

# SN74LV1T125 単電源シングル・バッファ・ゲート、3 ステート出力 CMOS ロジック・レベル・シフト付き

## 1 特長

- 5V、3.3V、2.5V、1.8V  $V_{CC}$  の単一電源電圧トランスレータ
- 動作範囲: 1.8V~5.5V
- 昇圧変換:
  - 1.8V  $V_{CC}$  で 1.2V<sup>(1)</sup> から 1.8V
  - 2.5V  $V_{CC}$  で 1.5V<sup>(1)</sup> から 2.5V
  - 3.3V  $V_{CC}$  で 1.8V<sup>(1)</sup> から 3.3V
  - 5.0V  $V_{CC}$  で 3.3V から 5.0V
- 降圧変換:
  - 1.8V  $V_{CC}$  で 3.3V から 1.8V
  - 2.5V  $V_{CC}$  で 3.3V から 2.5V
  - 3.3V  $V_{CC}$  で 5.0V から 3.3V
- ロジック出力は  $V_{CC}$  を基準とする
- 出力駆動能力:
  - 5V で 8.0mA の出力駆動能力
  - 3.3V で 7.0mA の出力駆動能力
  - 1.8V で 3.0mA の出力駆動能力
- 3.3V の  $V_{CC}$  で最大 50MHz の動作を特性評価
- 入力ピンの許容電圧: 5.0V
- 40°C~125°Cの動作温度範囲
- JESD 17 準拠で 250mA 超のラッチアップ性能

- 標準ロジックピン配置をサポート
- CMOS 出力 B は AUP1G および LVC1G ファミリーと互換性あり。<sup>1</sup>

## 2 アプリケーション

- テレコム
- 携帯用アプリケーション
- サーバー
- PC とノート PC

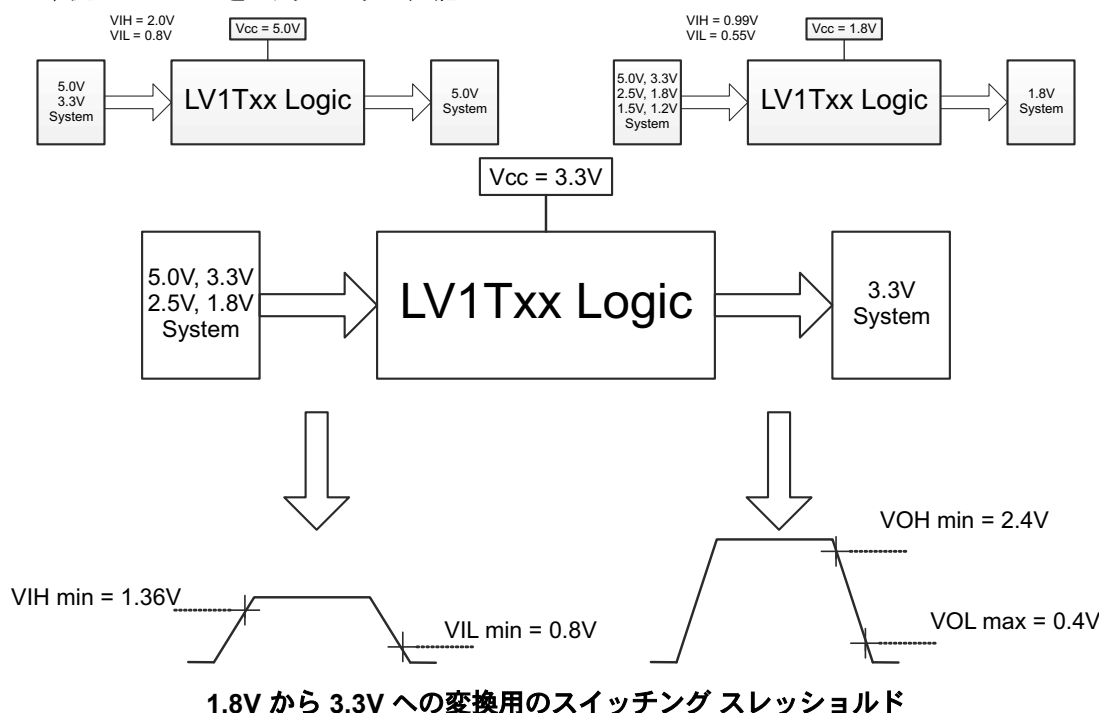
## 3 概要

SN74LV1T125 は、電圧レベル変換アプリケーションをサポートするために入力スレッショルドを低減した、シングルバッファゲートです。

### パッケージ情報

| 部品番号        | パッケージ (1)       | パッケージサイズ (2)   | 本体サイズ (3)     |
|-------------|-----------------|----------------|---------------|
| SN74LV1T125 | DBV (SOT-23, 5) | 2.90mm × 2.8mm | 2.9mm × 1.6mm |
|             | DCK (SC70, 5)   | 2.00mm × 2.1mm | 2mm × 1.25mm  |

- 詳細については、[セクション 12](#) を参照してください。
- パッケージサイズ (長さ × 幅) は公称値であり、該当する場合はピンも含まれます。
- 本体サイズ (長さ × 幅) は公称値であり、ピンは含まれません。



<sup>1</sup> より低い  $V_{CC}$  の条件については、 $V_{IH}/V_{IL}$  と出力駆動能力を参照。



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## 4 Related Products

| DEVICE      | PACKAGE  | DESCRIPTION                                    |
|-------------|----------|------------------------------------------------|
| SN74LV1T00  | DCK, DBV | 2-Input Positive-NAND Gate                     |
| SN74LV1T02  | DCK, DBV | 2-Input Positive-NOR Gate                      |
| SN74LV1T04  | DCK, DBV | Inverter Gate                                  |
| SN74LV1T08  | DCK, DBV | 2-Input Positive-AND Gate                      |
| SN74LV1T17  | DCK, DBV | Single Schmitt-Trigger Buffer Gate             |
| SN74LV1T14  | DCK, DBV | Single Schmitt-Trigger Inverter Gate           |
| SN74LV1T32  | DCK, DBV | 2-Input Positive-OR Gate                       |
| SN74LV1T34  | DCK, DBV | Single Buffer Gate                             |
| SN74LV1T86  | DCK, DBV | Single 2-Input Exclusive-Or Gate               |
| SN74LV1T125 | DCK, DBV | Single Buffer Gate with 3-state Output         |
| SN74LV1T126 | DCK, DBV | Single Buffer Gate with 3-state Output         |
| SN74LV4T125 | RGY, PW  | Quadruple Bus Buffer Gate With 3-State Outputs |

## 5 Pin Configuration and Functions

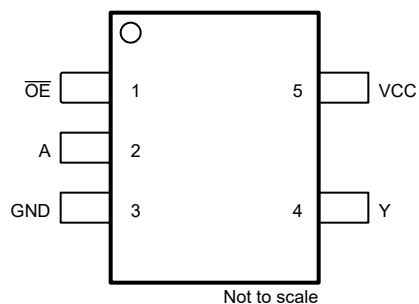


図 5-1. DCK or DBV Package, 5-Pin SC70 or SOT-23 (Top View)

表 5-1. Pin Functions

| PIN             |     | TYPE <sup>(1)</sup> | DESCRIPTION               |
|-----------------|-----|---------------------|---------------------------|
| NAME            | NO. |                     |                           |
| OE              | 1   | I                   | Output enable, active low |
| A               | 2   | I                   | Input A                   |
| GND             | 3   | G                   | Ground                    |
| Y               | 4   | O                   | Output Y                  |
| V <sub>CC</sub> | 5   | P                   | Positive supply           |

(1) I = Input, O = Output, I/O = Input or Output, G = Ground, P = Power.

## 6 Specifications

### 6.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted)<sup>(1)</sup>

|                  |                                                                             | MIN                                                    | MAX                   | UNIT   |
|------------------|-----------------------------------------------------------------------------|--------------------------------------------------------|-----------------------|--------|
| V <sub>CC</sub>  | Supply voltage range                                                        | −0.5                                                   | 7.0                   | V      |
| V <sub>I</sub>   | Input voltage range <sup>(2)</sup>                                          | −0.5                                                   | 7.0                   | V      |
| V <sub>O</sub>   | Voltage range applied to any output in the high or low state <sup>(2)</sup> | −0.5                                                   | V <sub>CC</sub> + 0.5 | V      |
| I <sub>IK</sub>  | Input clamp current                                                         | V <sub>I</sub> < 0                                     |                       | −20 mA |
| I <sub>OK</sub>  | Output clamp current                                                        | V <sub>O</sub> < 0 or V <sub>O</sub> > V <sub>CC</sub> |                       | ±20 mA |
| I <sub>O</sub>   | Continuous output current                                                   |                                                        |                       | ±25 mA |
|                  | Continuous current through V <sub>CC</sub> or GND                           |                                                        |                       | ±50 mA |
| T <sub>J</sub>   | Junction temperature                                                        |                                                        |                       | 150 °C |
| T <sub>stg</sub> | 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, and functional operation of the device at these or any other conditions beyond those indicated under *Recommended Operating Conditions* is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
- (2) The input negative-voltage and output voltage ratings may be exceeded if the input and output current ratings are observed.

### 6.2 ESD Ratings

|                    |                                                                       | VALUE | UNIT |
|--------------------|-----------------------------------------------------------------------|-------|------|
| V <sub>(ESD)</sub> | Electrostatic discharge                                               |       |      |
|                    | Human-body model (HBM), per ANSI/ESDA/JEDEC JS-001 <sup>(1)</sup>     | ±2000 | V    |
|                    | Machine Model (MM), per JEDEC specification                           | ±200  |      |
|                    | Charged-device model (CDM), per ANSI/ESDA/JEDEC JS-002 <sup>(2)</sup> | ±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)<sup>(1)</sup>

|                 |                                    | MIN                              | MAX             | UNIT |
|-----------------|------------------------------------|----------------------------------|-----------------|------|
| V <sub>CC</sub> | Supply voltage                     | 1.6                              | 5.5             | V    |
| V <sub>I</sub>  | Input voltage                      | 0                                | 5.5             | V    |
| V <sub>O</sub>  | Output voltage                     | 0                                | V <sub>CC</sub> | V    |
| I <sub>OH</sub> | High-level output current          | V <sub>CC</sub> = 1.8 V          | −3              | mA   |
|                 |                                    | V <sub>CC</sub> = 2.5 V          | −5              |      |
|                 |                                    | V <sub>CC</sub> = 3.3 V          | −7              |      |
|                 |                                    | V <sub>CC</sub> = 5.0 V          | −8              |      |
| I <sub>OL</sub> | Low-level output current           | V <sub>CC</sub> = 1.8 V          | 3               | mA   |
|                 |                                    | V <sub>CC</sub> = 2.5 V          | 5               |      |
|                 |                                    | V <sub>CC</sub> = 3.3 V          | 7               |      |
|                 |                                    | V <sub>CC</sub> = 5.0 V          | 8               |      |
| Δt/Δv           | Input transition rise or fall rate | V <sub>CC</sub> = 1.8 V          | 20              | ns/V |
|                 |                                    | V <sub>CC</sub> = 3.3 V or 2.5 V | 20              |      |
|                 |                                    | V <sub>CC</sub> = 5.0 V          | 20              |      |
| T <sub>A</sub>  | Operating free-air temperature     | −40                              | 125             | °C   |

- (1) All unused inputs of the device must be held at V<sub>CC</sub> or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number [SCBA004](#).

## 6.4 Thermal Information

| THERMAL METRIC <sup>(1)</sup> |                                        | DBV    | DCK    | UNIT |
|-------------------------------|----------------------------------------|--------|--------|------|
|                               |                                        | 5 PINS | 5 PINS |      |
| $R_{\theta JA}$               | Junction-to-ambient thermal resistance | 278    | 289.2  | °C/W |

(1) For more information about traditional and new thermal metrics, see the *IC Package Thermal Metrics* application report, [SPRA953](#).

## 6.5 Electrical Characteristics

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

| PARAMETER                                    | TEST CONDITIONS                                                                  | V <sub>CC</sub>                                  | T <sub>A</sub> = 25°C           |     |     | T <sub>A</sub> = −40°C to +125°C |     |     | UNIT |    |
|----------------------------------------------|----------------------------------------------------------------------------------|--------------------------------------------------|---------------------------------|-----|-----|----------------------------------|-----|-----|------|----|
|                                              |                                                                                  |                                                  | MIN                             | TYP | MAX | MIN                              | TYP | MAX |      |    |
| V <sub>IH</sub><br>High-level input voltage  |                                                                                  | V <sub>CC</sub> = 1.65 V to 1.8 V                | 0.95                            |     |     | 1                                |     |     | V    |    |
|                                              |                                                                                  | V <sub>CC</sub> = 2.0 V                          | 0.99                            |     |     | 1.03                             |     |     |      |    |
|                                              |                                                                                  | V <sub>CC</sub> = 2.25 V to 2.5 V                | 1.145                           |     |     | 1.18                             |     |     |      |    |
|                                              |                                                                                  | V <sub>CC</sub> = 2.75 V                         | 1.22                            |     |     | 1.25                             |     |     |      |    |
|                                              |                                                                                  | V <sub>CC</sub> = 3 V to 3.3 V                   | 1.37                            |     |     | 1.39                             |     |     |      |    |
|                                              |                                                                                  | V <sub>CC</sub> = 3.6 V                          | 1.47                            |     |     | 1.48                             |     |     |      |    |
|                                              |                                                                                  | V <sub>CC</sub> = 4.5 V to 5.0 V                 | 2.02                            |     |     | 2.03                             |     |     |      |    |
|                                              |                                                                                  | V <sub>CC</sub> = 5.5 V                          | 2.1                             |     |     | 2.11                             |     |     |      |    |
| V <sub>IL</sub><br>Low-level input voltage   |                                                                                  | V <sub>CC</sub> = 1.65 V to 2.0 V                |                                 |     |     | 0.57                             |     |     | V    |    |
|                                              |                                                                                  | V <sub>CC</sub> = 2.25 V to 2.75 V               |                                 |     |     | 0.75                             |     |     |      |    |
|                                              |                                                                                  | V <sub>CC</sub> = 3 V to 3.6 V                   |                                 |     |     | 0.8                              |     |     |      |    |
|                                              |                                                                                  | V <sub>CC</sub> = 4.5 V to 5.5 V                 |                                 |     |     | 0.8                              |     |     |      |    |
| V <sub>OH</sub><br>High-level output voltage | I <sub>OH</sub> = −20 μA                                                         | 1.65 V to 5.5 V                                  | V <sub>CC</sub> − 0.1           |     |     | V <sub>CC</sub> − 0.1            |     |     | V    |    |
|                                              | I <sub>OH</sub> = −2.0 mA                                                        | 1.65 V                                           | 1.28                            |     |     | 1.21                             |     |     |      |    |
|                                              |                                                                                  | 1.8 V                                            | 1.5                             |     |     | 1.45                             |     |     |      |    |
|                                              | I <sub>OH</sub> = −3 mA                                                          | 2.3 V                                            | 2                               |     |     | 1.93                             |     |     |      |    |
|                                              | I <sub>OH</sub> = −3 mA                                                          | 2.5 V                                            | 2.25                            |     |     | 2.15                             |     |     |      |    |
|                                              | I <sub>OH</sub> = −3.0 mA                                                        | 3.0 V                                            | 2.78                            |     |     | 2.7                              |     |     |      |    |
|                                              | I <sub>OH</sub> = −5.5 mA                                                        |                                                  | 2.6                             |     |     | 2.49                             |     |     |      |    |
|                                              | I <sub>OH</sub> = −5.5 mA                                                        | 3.3 V                                            | 2.9                             |     |     | 2.8                              |     |     |      |    |
|                                              | I <sub>OH</sub> = −4 mA                                                          | 4.5 V                                            | 4.2                             |     |     | 4.1                              |     |     |      |    |
|                                              | I <sub>OH</sub> = −8 mA                                                          |                                                  | 4.1                             |     |     | 3.95                             |     |     |      |    |
| V <sub>OL</sub><br>Low-level output voltage  | I <sub>OL</sub> = 20 μA                                                          | 1.65 V to 5.5 V                                  |                                 |     |     | 0.1                              |     |     | V    |    |
|                                              | I <sub>OL</sub> = 2 mA                                                           | 1.65 V                                           |                                 |     |     | 0.25                             |     |     |      |    |
|                                              | I <sub>OL</sub> = 3 mA                                                           | 2.3 V                                            |                                 |     |     | 0.2                              |     |     |      |    |
|                                              | I <sub>OL</sub> = 3 mA                                                           | 3.0 V                                            |                                 |     |     | 0.15                             |     |     |      |    |
|                                              | I <sub>OL</sub> = 5.5 mA                                                         |                                                  | 0.21                            |     |     | 0.252                            |     |     |      |    |
|                                              | I <sub>OL</sub> = 4 mA                                                           | 4.5 V                                            |                                 |     |     | 0.2                              |     |     |      |    |
|                                              | I <sub>OL</sub> = 8 mA                                                           |                                                  | 0.3                             |     |     | 0.35                             |     |     |      |    |
|                                              | I <sub>I</sub><br>Input leakage current                                          | A input; V <sub>I</sub> = 0 V or V <sub>CC</sub> | 0 V, 1.8 V, 2.5 V, 3.3 V, 5.5 V |     |     |                                  | 0.1 |     |      | ±1 |
| I <sub>CC</sub><br>Static supply current     | V <sub>I</sub> = 0 V or V <sub>CC</sub> ,<br>I <sub>O</sub> = 0; open on loading | 5.0 V                                            |                                 |     |     | 1                                |     |     | μA   |    |
|                                              |                                                                                  | 3.3 V                                            |                                 |     |     | 1                                |     |     |      |    |
|                                              |                                                                                  | 2.5 V                                            |                                 |     |     | 1                                |     |     |      |    |
|                                              |                                                                                  | 1.8 V                                            |                                 |     |     | 1                                |     |     |      |    |

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

| PARAMETER                                        | TEST CONDITIONS                                                                        | V <sub>CC</sub> | T <sub>A</sub> = 25°C |     |      | T <sub>A</sub> = –40°C to +125°C |     |     | UNIT |
|--------------------------------------------------|----------------------------------------------------------------------------------------|-----------------|-----------------------|-----|------|----------------------------------|-----|-----|------|
|                                                  |                                                                                        |                 | MIN                   | TYP | MAX  | MIN                              | TYP | MAX |      |
| $\Delta I_{CC}$ Additional static supply current | One input at 0.3 V or 3.4 V, Other inputs at 0 or V <sub>CC</sub> , I <sub>O</sub> = 0 | 5.5 V           |                       |     | 1.35 |                                  |     | 1.5 | mA   |
|                                                  | One input at 0.3 V or 1.1 V Other inputs at 0 or V <sub>CC</sub> , I <sub>O</sub> = 0  | 1.8 V           |                       |     | 10   |                                  |     | 10  | μA   |
| C <sub>i</sub> Input capacitance                 | V <sub>I</sub> = V <sub>CC</sub> or GND                                                | 3.3 V           |                       | 2   | 10   |                                  | 2   | 10  | pF   |
| C <sub>o</sub> Output capacitance                | V <sub>O</sub> = V <sub>CC</sub> or GND                                                | 3.3 V           |                       | 2.5 |      |                                  | 2.5 |     | pF   |

## 6.6 Switching Characteristics

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

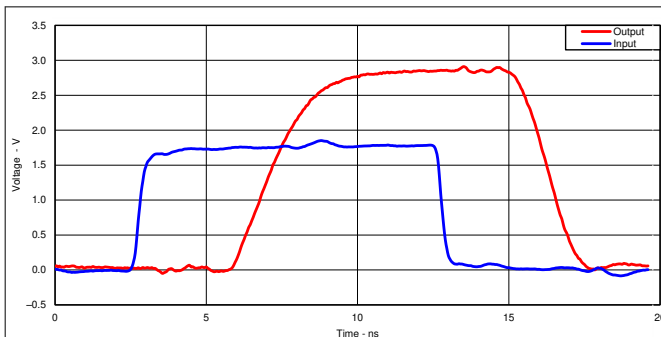
| PARAMETER                           | FROM (INPUT) | TO (OUTPUT) | FREQUENCY (TYP) | V <sub>CC</sub> | C <sub>L</sub> | T <sub>A</sub> = 25°C |     |      | T <sub>A</sub> = –65°C to 125°C |     |      | UNIT |
|-------------------------------------|--------------|-------------|-----------------|-----------------|----------------|-----------------------|-----|------|---------------------------------|-----|------|------|
|                                     |              |             |                 |                 |                | MIN                   | TYP | MAX  | MIN                             | TYP | MAX  |      |
| t <sub>pd</sub>                     | Any In       | Y           | DC to 50 MHz    | 5.0 V           | 15 pF          |                       | 2.7 | 5.5  |                                 | 3.4 | 6.5  | ns   |
|                                     |              |             |                 |                 | 30 pF          |                       | 3.0 | 6.5  |                                 | 4.1 | 7.5  |      |
|                                     |              |             |                 | 3.3 V           | 15 pF          |                       | 4.0 | 7.0  |                                 | 5.0 | 8.0  | ns   |
|                                     |              |             |                 |                 | 30 pF          |                       | 4.9 | 8.0  |                                 | 6.0 | 9.0  |      |
|                                     |              |             | DC to 25 MHz    | 2.5 V           | 15 pF          |                       | 5.8 | 8.5  |                                 | 6.8 | 9.5  | ns   |
|                                     |              |             |                 |                 | 30 pF          |                       | 6.5 | 9.5  |                                 | 7.5 | 10.5 |      |
| t <sub>pZH</sub> , t <sub>pZL</sub> | OE           | Y           | DC to 50 MHz    | 5.0 V           | 15 pF          |                       | 3.0 | 5.0  |                                 | 3.5 | 6.0  | ns   |
|                                     |              |             |                 |                 | 30 pF          |                       | 4.3 | 6.5  |                                 | 4.9 | 7.5  |      |
|                                     |              |             |                 | 3.3 V           | 15 pF          |                       | 4.0 | 6.5  |                                 | 4.5 | 7.5  | ns   |
|                                     |              |             |                 |                 | 30 pF          |                       | 5.0 | 8.0  |                                 | 6.5 | 9.0  |      |
|                                     |              |             | DC to 25 MHz    | 2.5 V           | 15 pF          |                       | 5.5 | 8.0  |                                 | 6.1 | 9.0  | ns   |
|                                     |              |             |                 |                 | 30 pF          |                       | 7.0 | 10.0 |                                 | 8.5 | 11.0 |      |
| t <sub>pHZ</sub> , t <sub>pLZ</sub> | OE           | Y           | DC to 50 MHz    | 5.0 V           | 15 pF          |                       | 4.2 | 6.5  |                                 | 4.5 | 7.0  | ns   |
|                                     |              |             |                 |                 | 30 pF          |                       | 4.8 | 8.0  |                                 | 5.0 | 8.5  |      |
|                                     |              |             |                 | 3.3 V           | 15 pF          |                       | 4.5 | 7.0  |                                 | 5.0 | 8.0  | ns   |
|                                     |              |             |                 |                 | 30 pF          |                       | 5.0 | 8.0  |                                 | 5.5 | 9.0  |      |
|                                     |              |             | DC to 25MHz     | 2.5 V           | 15 pF          |                       | 5.0 | 11.0 |                                 | 6.0 | 9.0  | ns   |
|                                     |              |             |                 |                 | 30 pF          |                       | 6.0 | 9.0  |                                 | 7.0 | 10.0 |      |
|                                     |              |             | DC to 15MHz     | 1.8 V           | 15 pF          |                       | 8.0 | 10.0 |                                 | 8.5 | 11.0 | ns   |
|                                     |              |             |                 |                 | 30 pF          |                       | 8.5 | 11.0 |                                 | 9.5 | 12.0 |      |

## 6.7 Operating Characteristics

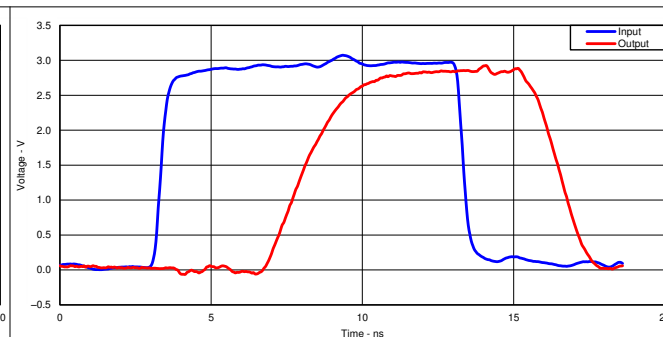
T<sub>A</sub> = 25°C

| PARAMETER                                     | TEST CONDITIONS      | V <sub>CC</sub> | TYP | UNIT |
|-----------------------------------------------|----------------------|-----------------|-----|------|
| C <sub>pd</sub> Power dissipation capacitance | f = 1 MHz and 10 MHz | 1.8 V ± 0.15 V  | 14  | pF   |
|                                               |                      | 2.5 V ± 0.2 V   | 14  |      |
|                                               |                      | 3.3 V ± 0.3 V   | 14  |      |
|                                               |                      | 5.5 V ± 0.5 V   | 14  |      |

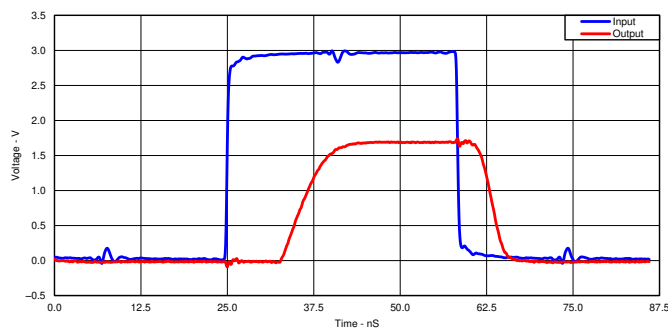
## 6.8 Typical Characteristics



**図 6-1. Switching Characteristics at 50 MHz**  
**Excellent Signal Integrity**  
**(1.8 V to 3.3 V at 3.3-V  $V_{CC}$ )**

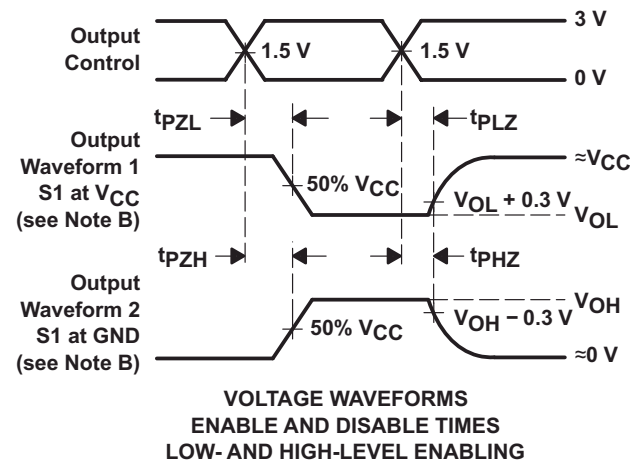
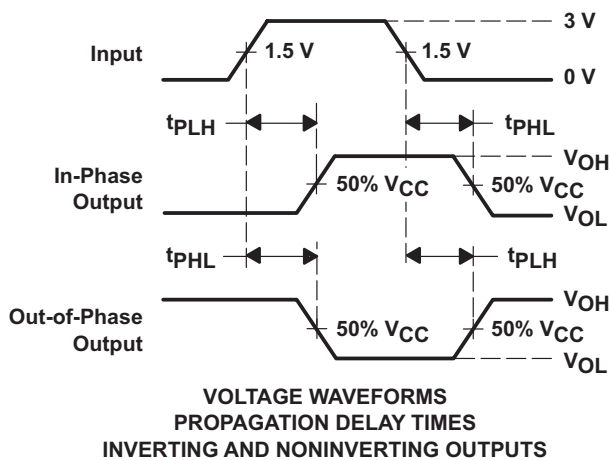
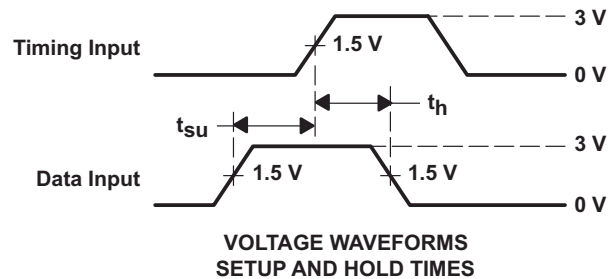
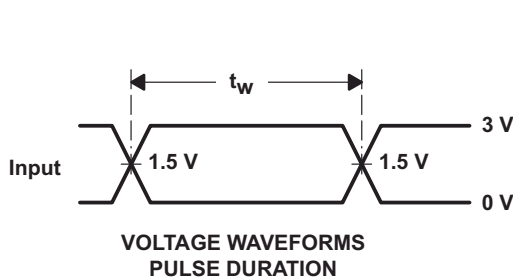
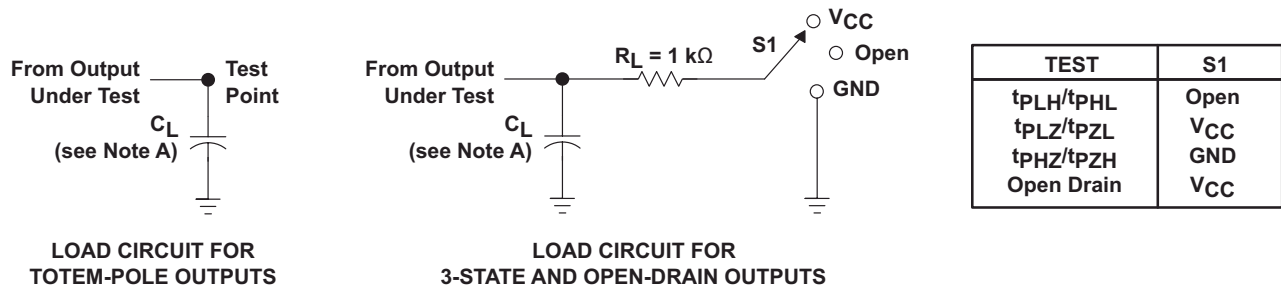


**図 6-2. Switching Characteristics at 50 MHz**  
**Excellent Signal Integrity**  
**(3.3 V to 3.3 V at 3.3-V  $V_{CC}$ )**



**図 6-3. Switching Characteristics at 15 MHz**  
**Excellent Signal Integrity**  
**(3.3 V to 1.8 V at 1.8-V  $V_{CC}$ )**

## 7 Parameter Measurement Information



- 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:  $PRR \leq 1$  MHz,  $Z_O = 50 \Omega$ ,  $t_r \leq 3$  ns,  $t_f \leq 3$  ns.  
 D. The outputs are measured one at a time, with one input transition per measurement.  
 E. All parameters and waveforms are not applicable to all devices.

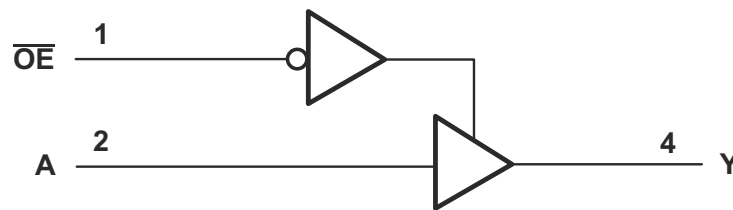
图 7-1. Load Circuit and Voltage Waveforms

## 8 Detailed Description

### 8.1 Overview

The SN74LV1T125 device is a low-voltage CMOS gate logic that operates at a wider voltage range for industrial, portable, telecom, and automotive applications. The output level is referenced to the supply voltage and is able to support 1.8-V, 2.5-V, 3.3-V, and 5-V CMOS levels. The input is designed with a lower threshold circuit to match 1.8 V input logic at  $V_{CC} = 3.3$  V and can be used in 1.8 V to 3.3 V level-up translation. In addition, the 5 V tolerant input pins enable down translation (that is, 3.3 V to 2.5 V output at  $V_{CC} = 2.5$  V). The wide  $V_{CC}$  range of 1.8 V to 5.5 V allows generation of desired output levels to connect to controllers or processors. The SN74LV1T125 device is designed with current-drive capability of 8 mA to reduce line reflections, overshoot, and undershoot caused by high-drive outputs.

### 8.2 Functional Block Diagram



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図 8-1. Logic Diagram

### 8.3 Feature Description

#### 8.3.1 Clamp Diode Structure

The outputs to this device have both positive and negative clamping diodes, and the inputs to this device have negative clamping diodes only as depicted in 図 8-2.

#### 注意

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

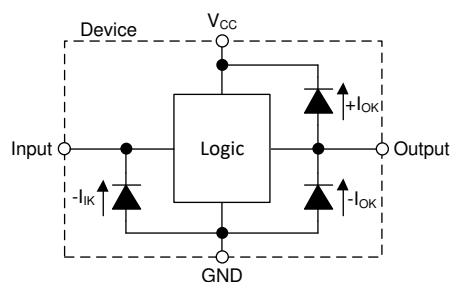


図 8-2. Electrical Placement of Clamping Diodes for Each Input and Output

#### 8.3.2 Balanced CMOS Push-Pull Outputs

This device includes balanced CMOS push-pull outputs. The term *balanced* indicates that the device can sink and source similar currents. The drive capability of this device may create 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. It is important for the output power of the device to be limited to avoid damage due to overcurrent. The electrical and thermal limits defined in the *Absolute Maximum Ratings* must be followed at all times.

Unused push-pull CMOS outputs should be left disconnected.

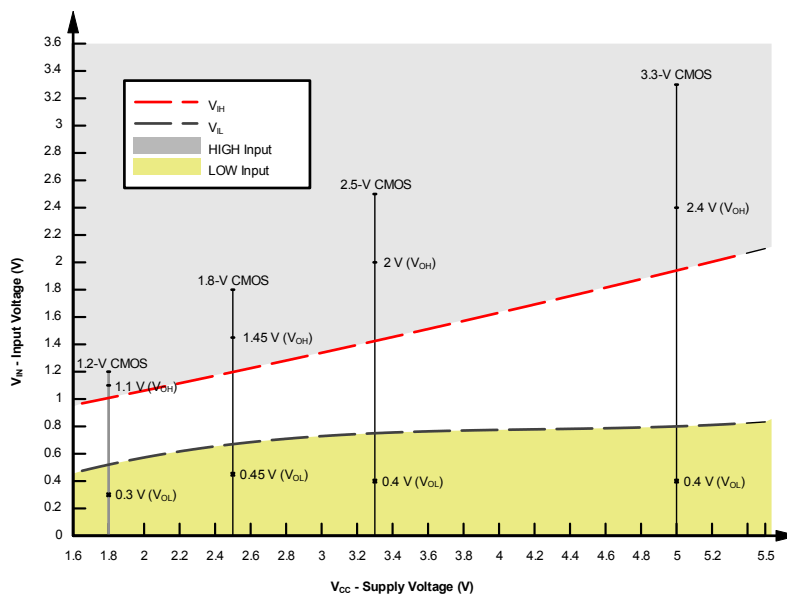
### 8.3.3 LVxT Enhanced Input Voltage

The SN74LV1T125 belongs to TI's LVxT family of Logic devices with integrated voltage level translation. This family of devices was designed with reduced input voltage thresholds to support up-translation, and inputs tolerant of signals with up to 5.5 V levels to support down-translation. The output voltage will always be referenced to the supply voltage ( $V_{CC}$ ), as described in the *Electrical Characteristics* table. To ensure proper functionality, input signals must remain at or below the specified  $V_{IH(MIN)}$  level for a HIGH input state, and at or below the specified  $V_{IL(MAX)}$  for a LOW input state. [Figure 8-3](#) shows the typical  $V_{IH}$  and  $V_{IL}$  levels for the LVxT family of devices, as well as the voltage levels for standard CMOS devices for comparison.

The 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 ( $R = V \div I$ ).

The inputs require that input signals transition between valid logic states quickly, as defined by the input transition time or rate in the *Recommended Operating Conditions* table. Failing to meet this specification will result in excessive power consumption and could cause oscillations. More details can be found in the [Implications of Slow or Floating CMOS Inputs](#) application report.

Do not leave inputs floating at any time during operation. Unused inputs must be terminated at  $V_{CC}$  or GND. If a system will not be actively driving an input at all times, a pull-up or pull-down resistor can be added to provide a valid input voltage during these times. The resistor value will depend on multiple factors; however, a 10-k $\Omega$  resistor is recommended and will typically meet all requirements.



**Figure 8-3. LVxT Input Voltage Levels**

#### 8.3.3.1 Down Translation

Signals can be translated down using the SN74LV1T125. The voltage applied at the  $V_{CC}$  will determine the output voltage and the input thresholds as described in the *Recommended Operating Conditions* and *Electrical Characteristics* tables.

When connected to a high-impedance input, the output voltage will be approximately  $V_{CC}$  in the HIGH state, and 0 V in the LOW state. Ensure that the input signals in the HIGH state are between  $V_{IH(MIN)}$  and 5.5 V, and input signals in the LOW state are lower than  $V_{IL(MAX)}$  as shown in [Figure 8-3](#).

For example, standard CMOS inputs for devices operating at 5.0 V, 3.3 V or 2.5 V can be down-translated to match 1.8 V CMOS signals when operating from 1.8-V  $V_{CC}$ . See [Figure 8-4](#).

#### Down Translation Combinations:

- 1.8-V  $V_{CC}$  – Inputs from 2.5 V, 3.3 V, and 5.0 V
- 2.5-V  $V_{CC}$  – Inputs from 3.3 V and 5.0 V
- 3.3-V  $V_{CC}$  – Inputs from 5.0 V

#### 8.3.3.2 Up Translation

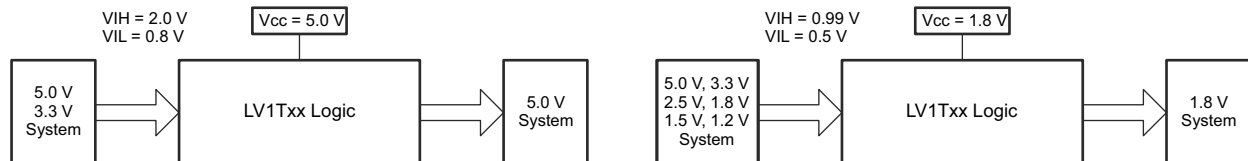
Input signals can be up translated using the SN74LV1T125. The voltage applied at  $V_{CC}$  will determine the output voltage and the input thresholds as described in the *Recommended Operating Conditions* and *Electrical Characteristics* tables. When connected to a high-impedance input, the output voltage will be approximately  $V_{CC}$  in the HIGH state, and 0 V in the LOW state.

The inputs have reduced thresholds that allow for input high-state levels which are much lower than standard values. For example, standard CMOS inputs for a device operating at a 5-V supply will have a  $V_{IH(MIN)}$  of 3.5 V. For the SN74LV1T125,  $V_{IH(MIN)}$  with a 5-V supply is only 2 V, which would allow for up-translation from a typical 2.5-V to 5-V signals.

Ensure that the input signals in the HIGH state are above  $V_{IH(MIN)}$  and input signals in the LOW state are lower than  $V_{IL(MAX)}$  as shown in [Figure 8-4](#).

#### Up Translation Combinations:

- 1.8-V  $V_{CC}$  – Inputs from 1.2 V
- 2.5-V  $V_{CC}$  – Inputs from 1.8 V
- 3.3-V  $V_{CC}$  – Inputs from 1.8 V and 2.5 V
- 5.0-V  $V_{CC}$  – Inputs from 2.5 V and 3.3 V



**Figure 8-4. LVxT Up and Down Translation Example**

## 8.4 Device Functional Modes

### Function Tables

| INPUT <sup>(1)</sup><br>(LOWER LEVEL INPUT) |   | OUTPUT <sup>(2)</sup><br>( $V_{CC}$ CMOS) |
|---------------------------------------------|---|-------------------------------------------|
| OE <sup>(3)</sup>                           | A | Y                                         |
| L                                           | H | H                                         |
| L                                           | L | L                                         |
| H                                           | X | Z                                         |

- (1) H = High Voltage Level, L = Low Voltage Level, X = Do not Care, Z = High Impedance  
 (2) H = Driving High, L = Driving Low, Z = High Impedance State  
 (3) Not recommend to float OE pin for signal oscillation.

| SUPPLY $V_{CC} = 3.3\text{ V}$ |   |                            |
|--------------------------------|---|----------------------------|
| INPUT<br>(LOWER LEVEL INPUT)   |   | OUTPUT<br>( $V_{CC}$ CMOS) |
| A                              | B | Y                          |

| SUPPLY $V_{CC} = 3.3\text{ V}$                                              |                                                                            |
|-----------------------------------------------------------------------------|----------------------------------------------------------------------------|
| INPUT<br>(LOWER LEVEL INPUT)                                                | OUTPUT<br>( $V_{CC}$ CMOS)                                                 |
| $V_{IH}(\text{min}) = 1.35\text{ V}$<br>$V_{IL}(\text{max}) = 0.8\text{ V}$ | $V_{OH}(\text{min}) = 2.9\text{ V}$<br>$V_{OL}(\text{max}) = 0.2\text{ V}$ |

## 9 アプリケーション情報に関する免責事項

### 注

以下のアプリケーション情報は、TI の製品仕様に含まれるものではなく、TI ではその正確性または完全性を保証いたしません。個々の目的に対する製品の適合性については、お客様の責任で判断していただくことになります。お客様は自身の設計実装を検証しテストすることで、システムの機能を確認する必要があります。

### 9.1 Layout

#### 9.1.1 Layout Guidelines

When using multiple-input and multiple-channel logic devices inputs must not ever be left floating. In many cases, functions or parts of functions of digital logic devices are unused; for example, when only two inputs of a triple-input AND gate are used or only 3 of the 4 buffer gates are used. Such unused input pins must not be left unconnected because the undefined voltages at the outside connections result in undefined operational states. All unused inputs of digital logic devices must be connected to a logic high or logic low voltage, as defined by the input voltage specifications, to prevent them from floating. The logic level that must be applied to any particular unused input depends on the function of the device. Generally, the inputs are tied to GND or  $V_{CC}$ , whichever makes more sense for the logic function or is more convenient.

### 9.2 Power Supply Recommendations

The power supply can be any voltage between the minimum and maximum supply voltage rating located in the *Recommended Operating Conditions*. Each  $V_{CC}$  terminal should have a good bypass capacitor to prevent power disturbance. A 0.1- $\mu$ F capacitor is recommended for this device. It is acceptable to parallel multiple bypass caps to reject different frequencies of noise. The 0.1- $\mu$ F and 1- $\mu$ F capacitors are commonly used in parallel. The bypass capacitor should be installed as close to the power terminal as possible for best results, as shown in the following layout example.

## 10 Device and Documentation Support

### 10.1 Documentation Support (Analog)

#### 10.1.1 Related Documentation

For related documentation, see the following:

- Texas Instruments, [CMOS Power Consumption and Cpd Calculation application note](#)
- Texas Instruments, [Designing With Logic application note](#)
- Texas Instruments, [Thermal Characteristics of Standard Linear and Logic \(SLL\) Packages and Devices application note](#)
- Texas Instruments, [Implications of Slow or Floating CMOS Inputs application note](#)

### 10.2 ドキュメントの更新通知を受け取る方法

ドキュメントの更新についての通知を受け取るには、[www.tij.co.jp](http://www.tij.co.jp) のデバイス製品フォルダを開いてください。[通知] をクリックして登録すると、変更されたすべての製品情報に関するダイジェストを毎週受け取ることができます。変更の詳細については、改訂されたドキュメントに含まれている改訂履歴をご覧ください。

### 10.3 サポート・リソース

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### 10.4 Trademarks

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### 10.5 静電気放電に関する注意事項



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### 10.6 用語集

[テキサス・インスツルメンツ用語集](#) この用語集には、用語や略語の一覧および定義が記載されています。

## 11 Revision History

資料番号末尾の英字は改訂を表しています。その改訂履歴は英語版に準じています。

| Changes from Revision C (October 2023) to Revision D (March 2024) | Page |
|-------------------------------------------------------------------|------|
| • Updated RθJA values: DBV = 206 to 278, all values in °C/W ..... | 6    |

| Changes from Revision B (June 2022) to Revision C (October 2023)    | Page |
|---------------------------------------------------------------------|------|
| • 「パッケージ情報」表を更新 .....                                               | 1    |
| • Updated RθJA values: DCK = 252 to 289.2, all values in °C/W ..... | 6    |

## 12 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<br>(1) | Package Type | Package<br>Drawing | Pins | Package<br>Qty | Eco Plan<br>(2) | Lead finish/<br>Ball material<br>(6) | MSL Peak Temp<br>(3) | Op Temp (°C) | Device Marking<br>(4/5)  | Samples                 |
|-------------------|---------------|--------------|--------------------|------|----------------|-----------------|--------------------------------------|----------------------|--------------|--------------------------|-------------------------|
| SN74LV1T125DBVR   | ACTIVE        | SOT-23       | DBV                | 5    | 3000           | RoHS & Green    | NIPDAU   SN                          | Level-1-260C-UNLIM   | -40 to 125   | (37RH, NEZ3, NEZJ, NEZS) | <a href="#">Samples</a> |
| SN74LV1T125DBVRG4 | ACTIVE        | SOT-23       | DBV                | 5    | 3000           | RoHS & Green    | NIPDAU                               | Level-1-260C-UNLIM   | -40 to 125   | NEZ3                     | <a href="#">Samples</a> |
| SN74LV1T125DCKR   | ACTIVE        | SC70         | DCK                | 5    | 3000           | RoHS & Green    | NIPDAU   SN                          | Level-1-260C-UNLIM   | -40 to 125   | (WZ3, WZJ, WZS)          | <a href="#">Samples</a> |
| SN74LV1T125DCKRG4 | ACTIVE        | SC70         | DCK                | 5    | 3000           | RoHS & Green    | NIPDAU                               | Level-1-260C-UNLIM   |              | WZ3                      | <a href="#">Samples</a> |

(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.

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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.

**OTHER QUALIFIED VERSIONS OF SN74LV1T125 :**

- Automotive : [SN74LV1T125-Q1](#)

NOTE: Qualified Version Definitions:

- Automotive - Q100 devices qualified for high-reliability automotive applications targeting zero defects

## 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 |
|-------------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| SN74LV1T125DBVR   | SOT-23       | DBV             | 5    | 3000 | 178.0              | 9.0                | 3.3     | 3.2     | 1.4     | 4.0     | 8.0    | Q3            |
| SN74LV1T125DBVRG4 | SOT-23       | DBV             | 5    | 3000 | 178.0              | 9.2                | 3.3     | 3.23    | 1.55    | 4.0     | 8.0    | Q3            |
| SN74LV1T125DCKR   | SC70         | DCK             | 5    | 3000 | 180.0              | 8.4                | 2.47    | 2.3     | 1.25    | 4.0     | 8.0    | Q3            |
| SN74LV1T125DCKR   | SC70         | DCK             | 5    | 3000 | 178.0              | 9.0                | 2.4     | 2.5     | 1.2     | 4.0     | 8.0    | Q3            |
| SN74LV1T125DCKRG4 | SC70         | DCK             | 5    | 3000 | 178.0              | 9.2                | 2.4     | 2.4     | 1.22    | 4.0     | 8.0    | Q3            |

## TAPE AND REEL BOX DIMENSIONS



\*All dimensions are nominal

| Device            | Package Type | Package Drawing | Pins | SPQ  | Length (mm) | Width (mm) | Height (mm) |
|-------------------|--------------|-----------------|------|------|-------------|------------|-------------|
| SN74LV1T125DBVR   | SOT-23       | DBV             | 5    | 3000 | 180.0       | 180.0      | 18.0        |
| SN74LV1T125DBVRG4 | SOT-23       | DBV             | 5    | 3000 | 180.0       | 180.0      | 18.0        |
| SN74LV1T125DCKR   | SC70         | DCK             | 5    | 3000 | 202.0       | 201.0      | 28.0        |
| SN74LV1T125DCKR   | SC70         | DCK             | 5    | 3000 | 180.0       | 180.0      | 18.0        |
| SN74LV1T125DCKRG4 | SC70         | DCK             | 5    | 3000 | 180.0       | 180.0      | 18.0        |

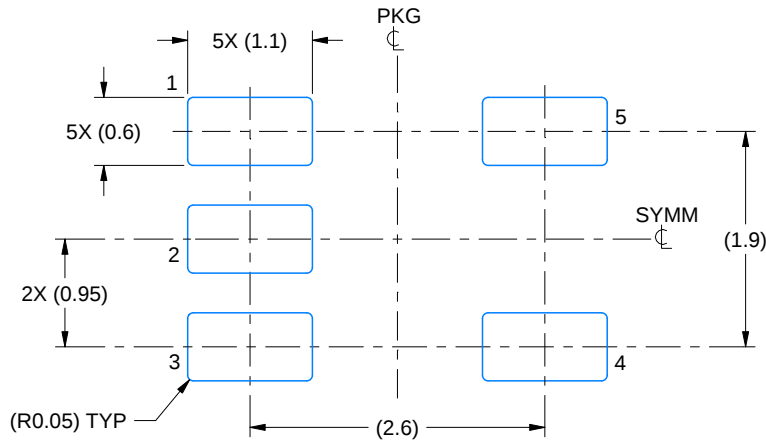


# EXAMPLE BOARD LAYOUT

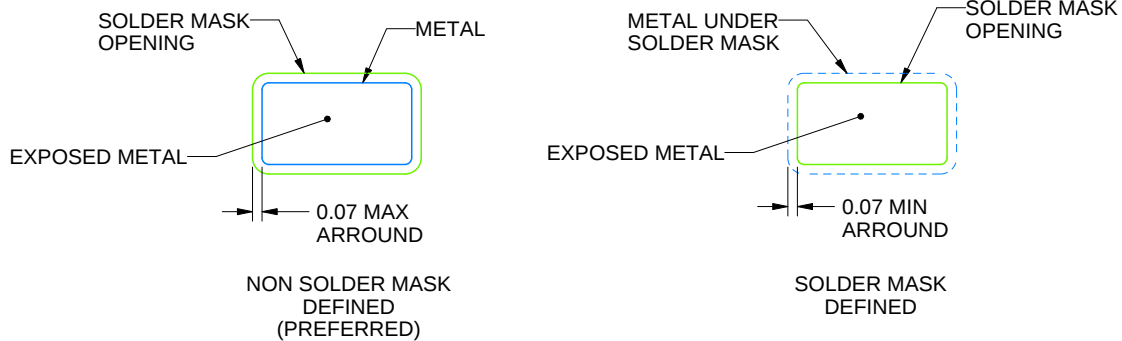
DBV0005A

SOT-23 - 1.45 mm max height

SMALL OUTLINE TRANSISTOR



LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE:15X



SOLDER MASK DETAILS

4214839/J 02/2024

NOTES: (continued)

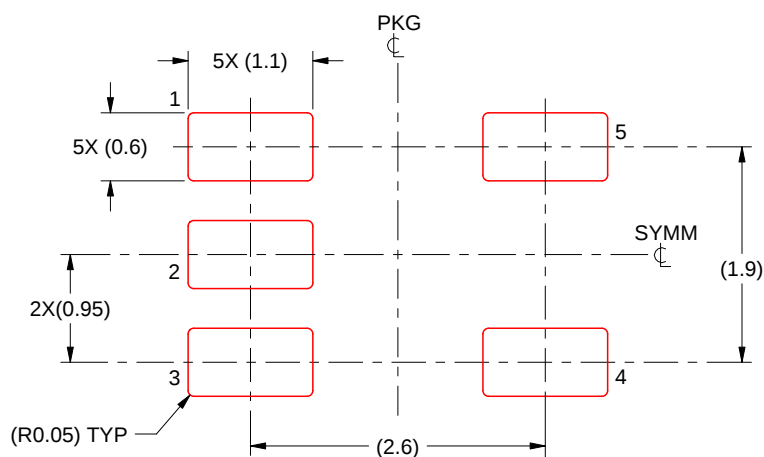
6. Publication IPC-7351 may have alternate designs.
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

## EXAMPLE STENCIL DESIGN

DBV0005A

SOT-23 - 1.45 mm max height

SMALL OUTLINE TRANSISTOR



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

4214839/J 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.

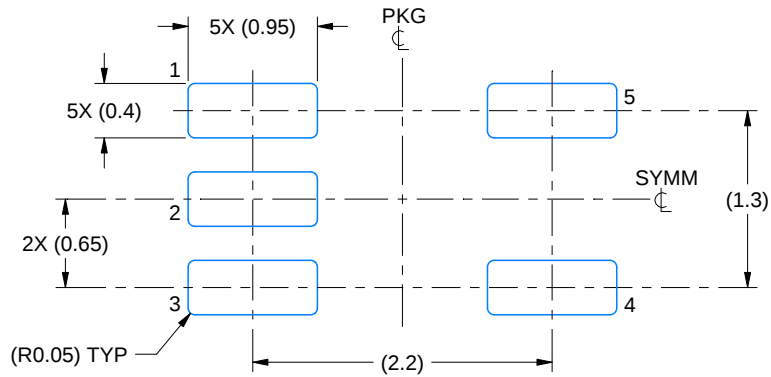


# EXAMPLE BOARD LAYOUT

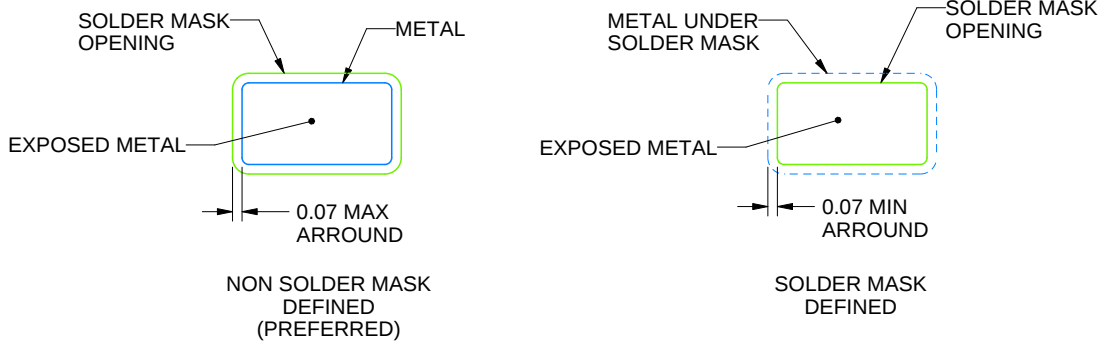
DCK0005A

SOT - 1.1 max height

SMALL OUTLINE TRANSISTOR



LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE:18X



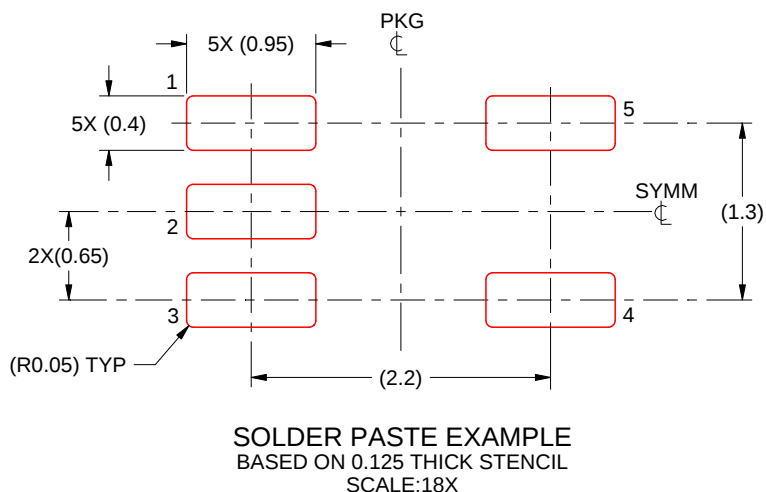
SOLDER MASK DETAILS

4214834/D 07/2023

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.



4214834/D 07/2023

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.

## 重要なお知らせと免責事項

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