# 74LVT2245; 74LVTH2245

## 3.3 V octal transceiver with 30 Ω termination resistors; 3-state

Rev. 7 — 17 August 2021 Product data sheet

## 1. General description

The 74LVT2245; 74LVTH2245 is an 8-bit transceiver with 30 Ω termination resistors and 3-state outputs. The device features an output enable ($\overline{OE}$) and send/receive (DIR) for direction control. A HIGH on $\overline{OE}$ causes the outputs to assume a high-impedance OFF-state. Bus hold data inputs eliminate the need for external pull-up resistors to define unused inputs

## 2. Features and benefits

- 30 Ω output termination resistors
- Octal bidirectional bus interface
- 3-state buffers
- Wide supply voltage range from 2.7 to 3.6 V
- BiCMOS high speed and output drive
- Output capability: +12 mA and -12 mA
- TTL input and output switching levels
- Overvoltage tolerant inputs to 5.5 V
- Bus hold data inputs eliminate need for external pull-up resistors to hold unused inputs
- Live insertion and extraction permitted
- Direct interface with TTL levels
- Power-up 3-state
- No bus current loading when output is tied to 5 V bus
- $I_{OFF}$ circuitry provides partial Power-down mode operation
- Latch-up performance exceeds 500 mA per JESD 78 Class II Level B
- Complies with JEDEC standards JESD8C (2.7 V to 3.6 V)
- ESD protection:
  - MIL STD 883 method 3015: exceeds 2000 V
  - MM JESD22-A115-A exceeds 200 V (C = 200 pF, R = 0 Ω)

## 3. Ordering information

**Table 1. Ordering information**

| Type number | Package | | | |
|---|---|---|---|---|
| | Temperature range | Name | Description | Version |
| 74LVT2245D | -40 °C to +85 °C | SO20 | plastic small outline package; 20 leads; body width 7.5 mm | SOT163-1 |
| 74LVTH2245D | | | | |
| 74LVT2245PW | -40 °C to +85 °C | TSSOP20 | plastic thin shrink small outline package; 20 leads; body width 4.4 mm | SOT360-1 |
| 74LVTH2245PW | | | | |

## 4. Functional diagram

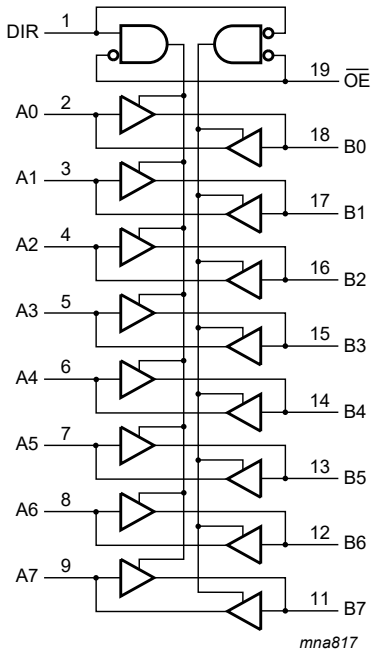



Fig. 1. Logic symbol

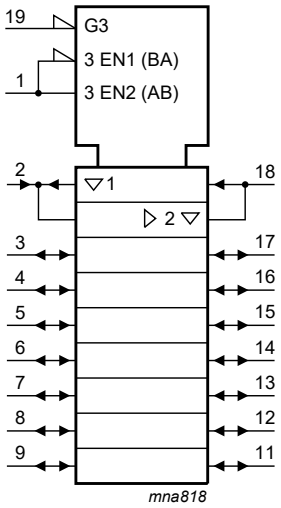



Fig. 2. IEC logic symbol

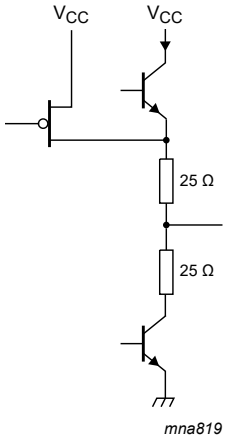



Fig. 3. Schematic of one output

## 5. Pinning information

### 5.1. Pinning

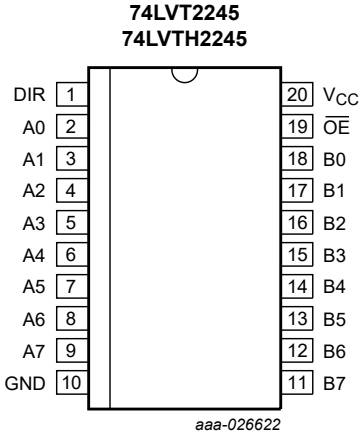



Fig. 4. Pin configuration SOT163-1 (SO20)

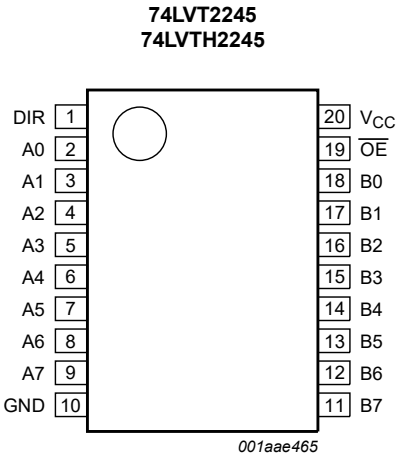



Fig. 5. Pin configuration SOT360-1 (TSSOP20)

### 5.2. Pin description

**Table 2. Pin description**

| Symbol | Pin | Description |
|---|---|---|
| DIR | 1 | direction control input |
| A0, A1, A2, A3, A4, A5, A6, A7 | 2, 3, 4, 5, 6, 7, 8, 9 | data input/output |
| GND | 10 | ground (0 V) |
| B7, B6, B5, B4, B3, B2, B1, B0 | 11, 12, 13, 14, 15, 16, 17, 18 | data input/output |
| $\overline{OE}$ | 19 | output enable input |
| $V_{CC}$ | 20 | supply voltage |

## 6. Functional description

**Table 3. Function table**

*H = HIGH voltage level; L = LOW voltage level; X = don't care; Z = high-impedance OFF-state.*

| Control | | Input/output | |
|---|---|---|---|
| $\overline{OE}$ | DIR | An | Bn |
| L | L | output An = Bn | input |
| L | H | input | output Bn = An |
| H | X | Z | Z |

## 7. Limiting values

**Table 4. Limiting values**

*In accordance with the Absolute Maximum Rating System (IEC 60134). Voltages are referenced to GND (ground = 0 V).*

| Symbol | Parameter | Conditions | Min | Max | Unit |
|---|---|---|---|---|---|
| $V_{CC}$ | supply voltage | | -0.5 | +4.6 | V |
| $V_I$ | input voltage | [1] | -0.5 | +7.0 | V |
| $V_O$ | output voltage | output in OFF-state or HIGH-state [1] | -0.5 | +7.0 | V |
| $I_{IK}$ | input clamping current | $V_I < 0$ V | -50 | - | mA |
| $I_{OK}$ | output clamping current | $V_O < 0$ V | -50 | - | mA |
| $I_O$ | output current | output in LOW-state | - | 128 | mA |
| | | output in HIGH-state | -64 | - | mA |
| $T_{stg}$ | storage temperature | | -65 | +150 | °C |
| $T_j$ | junction temperature | [2] | - | 150 | °C |
| $P_{tot}$ | total power dissipation | $T_{amb}$ = -40 to +85 °C | | 500 | mW |

[1] The input and output negative voltage ratings may be exceeded if the input and output clamp current ratings are observed.
[2] The performance capability of a high-performance integrated circuit in conjunction with its thermal environment can create junction temperatures which are detrimental to reliability.

# 8. Recommended operating conditions

**Table 5. Recommended operating conditions**

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{CC}$ | supply voltage | | 2.7 | - | 3.6 | V |
| $V_I$ | input voltage | | 0 | - | 5.5 | V |
| $I_{OH}$ | HIGH-level output current | | -12 | - | - | mA |
| $I_{OL}$ | LOW-level output current | | - | - | 12 | mA |
| Δt/ΔV | input transition rise and fall rate | outputs enabled | - | - | 10 | ns/V |
| $T_{amb}$ | ambient temperature | in free-air | -40 | +25 | +85 | °C |

# 9. Static characteristics

**Table 6. Static characteristics**

*At recommended operating conditions; voltages are referenced to GND (ground = 0 V).*

| Symbol | Parameter | Conditions | Min | Typ[1] | Max | Unit |
|---|---|---|---|---|---|---|
| **$T_{amb}$ = -40 °C to +85 °C** | | | | | | |
| $V_{IK}$ | input clamping voltage | $V_{CC}$ = 2.7 V; $I_{IK}$ = -18 mA | -1.2 | -0.9 | - | V |
| $V_{IH}$ | HIGH-level input voltage | | 2.0 | - | - | V |
| $V_{IL}$ | LOW-level input voltage | | - | - | 0.8 | V |
| $V_{OH}$ | HIGH-level output voltage | $V_{CC}$ = 3.0 V; $I_{OH}$ = -12 mA | 2.0 | 2.2 | - | V |
| $V_{OL}$ | LOW-level output voltage | $V_{CC}$ = 3.0 V; $I_{OL}$ = 12 mA | - | - | 0.8 | V |
| $I_I$ | input leakage current | control pins | | | | |
| | | $V_{CC}$ = 0 V or 3.6 V; $V_I$ = 5.5 V | - | 1 | 10 | μA |
| | | $V_{CC}$ = 3.6 V; $V_I$ = $V_{CC}$ or GND | - | ±0.1 | ±1 | μA |
| | | I/O data pins; $V_{CC}$ = 3.6 V [2] | | | | |
| | | $V_I$ = 5.5 V | - | 1 | 20 | μA |
| | | $V_I$ = $V_{CC}$ | - | 0.1 | 1 | μA |
| | | $V_I$ = 0 V | - | -1 | -5 | μA |
| $I_{OFF}$ | power-off leakage current | $V_{CC}$ = 0 V; $V_I$ or $V_O$ = 0 V to 4.5 V | - | 1 | ±100 | μA |
| $I_{BHL}$ | bus hold LOW current | $V_{CC}$ = 3 V; $V_I$ = 0.8 V | 75 | 150 | - | μA |
| $I_{BHH}$ | bus hold HIGH current | $V_{CC}$ = 3 V; $V_I$ = 2.0 V | - | -150 | -75 | μA |
| $I_{BHLO}$ | bus hold LOW overdrive current | $V_{CC}$ = 3.6 V; $V_I$ = 0 V to 3.6 V [3] | - | - | 500 | μA |
| $I_{BHHO}$ | bus hold HIGH overdrive current | $V_{CC}$ = 3.6 V; $V_I$ = 0 V to 3.6 V [3] | -500 | - | - | μA |
| $I_{CEX}$ | output high leakage current | output in HIGH-state when $V_O$ > $V_{CC}$; $V_O$ = 5.5 V; $V_{CC}$ = 3.0 V | - | 60 | 125 | μA |
| $I_{O(pu/pd)}$ | power-up/power-down output current | $V_{CC}$ ≤ 1.2 V; $V_O$ = 0.5 V to $V_{CC}$; $V_I$ = GND or $V_{CC}$; $\overline{OE}$ = don't care [4] | - | 15 | ±100 | μA |

| Symbol | Parameter | Conditions | Min | Typ[1] | Max | Unit |
|---|---|---|---|---|---|---|
| $I_{CC}$ | supply current | $V_{CC}$ = 3.6 V; $V_I$ = GND or $V_{CC}$; $I_O$ = 0 A | | | | |
| | | outputs HIGH | - | 0.13 | 0.19 | mA |
| | | outputs LOW | - | 3 | 12 | mA |
| | | outputs disabled [5] | - | 0.13 | 0.19 | mA |
| $\Delta I_{CC}$ | additional supply current | per input pin; $V_{CC}$ = 3 V to 3.6 V; one input at $V_{CC}$ - 0.6 V; other inputs at $V_{CC}$ or GND [6] | - | 0.1 | 0.2 | mA |
| $C_I$ | input capacitance | DIR and $\overline{OE}$; $V_I$ = 0 V or 3.0 V | - | 4 | - | pF |
| $C_{I/O}$ | input/output capacitance | An and Bn; outputs disabled; $V_{I/O}$ = 0 V or 3.0 V | - | 10 | - | pF |

[1] Typical values are measured at $V_{CC}$ = 3.3 V and $T_{amb}$ = 25 °C.
[2] Unused pins at $V_{CC}$ or GND.
[3] This is the bus hold overdrive current required to force the input to the opposite logic state.
[4] This parameter is valid for any $V_{CC}$ between 0 V and 1.2 V with a transition time of up to 10 ms. From $V_{CC}$ = 1.2 V to $V_{CC}$ = 3.0 V to 3.6 V a transition time of 100 µs is permitted.
[5] $I_{CC}$ is measured with outputs pulled to $V_{CC}$ or GND.
[6] This is the increase in supply current for each input at the specified voltage level other than $V_{CC}$ or GND.

## 10. Dynamic characteristics

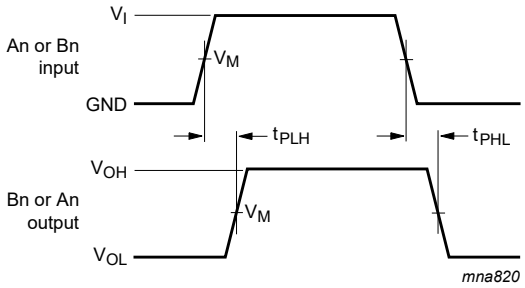
**Table 7. Dynamic characteristics**

*Voltages are referenced to GND (ground = 0 V); for test circuit see Fig. 8.*

| Symbol | Parameter | Conditions | Min | Typ[1] | Max | Unit |
|---|---|---|---|---|---|---|
| **$T_{amb}$ = -40 °C to +85 °C** | | | | | | |
| $t_{PLH}$ | LOW to HIGH propagation delay | An to Bn or Bn to An; see Fig. 6 | | | | |
| | | $V_{CC}$ = 2.7 V | - | - | 5.3 | ns |
| | | $V_{CC}$ = 3.0 V to 3.6 V | 1.0 | 3.2 | 4.6 | ns |
| $t_{PHL}$ | HIGH to LOW propagation delay | An to Bn or Bn to An; see Fig. 6 | | | | |
| | | $V_{CC}$ = 2.7 V | - | - | 4.9 | ns |
| | | $V_{CC}$ = 3.0 V to 3.6 V | 1.0 | 3.1 | 4.5 | ns |
| $t_{PZH}$ | OFF-state to HIGH propagation delay | see Fig. 7 | | | | |
| | | $V_{CC}$ = 2.7 V | - | - | 9.1 | ns |
| | | $V_{CC}$ = 3.0 V to 3.6 V | 1.1 | 4.5 | 7.0 | ns |
| $t_{PZL}$ | OFF-state to LOW propagation delay | see Fig. 7 | | | | |
| | | $V_{CC}$ = 2.7 V | - | - | 7.6 | ns |
| | | $V_{CC}$ = 3.0 V to 3.6 V | 1.5 | 4.3 | 6.5 | ns |
| $t_{PHZ}$ | HIGH to OFF-state propagation delay | see Fig. 7 | | | | |
| | | $V_{CC}$ = 2.7 V | - | - | 5.6 | ns |
| | | $V_{CC}$ = 3.0 V to 3.6 V | 2.2 | 3.7 | 5.2 | ns |
| $t_{PLZ}$ | LOW to OFF-state propagation delay | see Fig. 7 | | | | |
| | | $V_{CC}$ = 2.7 V | - | - | 5.0 | ns |
| | | $V_{CC}$ = 3.0 V to 3.6 V | 2.0 | 3.6 | 5.0 | ns |

[1] Typical values are measured at $V_{CC}$ = 3.3 V and $T_{amb}$ = 25 °C.

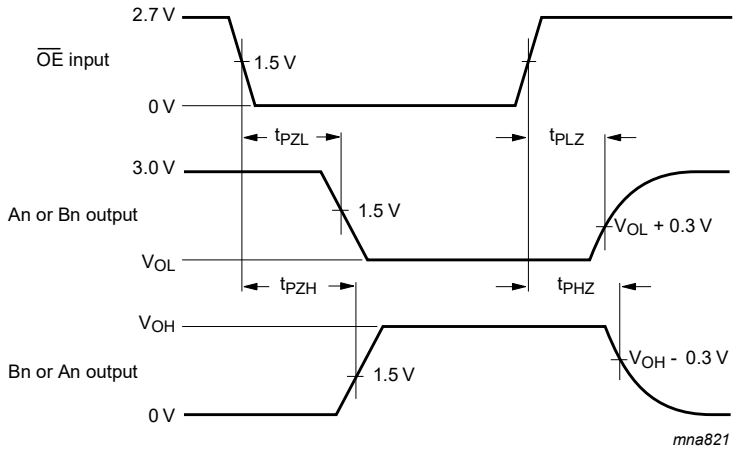
## 10.1. Waveforms and test circuit




$V_M$ = 1.5 V

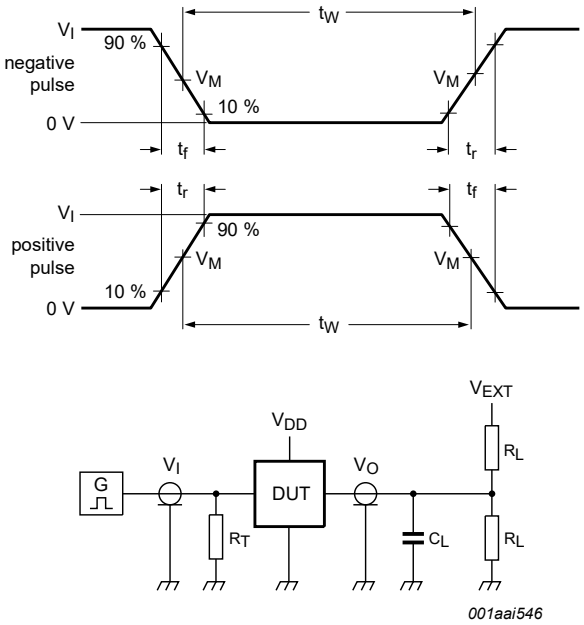
$V_{OL}$ and $V_{OH}$ are typical voltage output levels that occur with the output load.

**Fig. 6. Input (An or Bn) to output (Bn or An) propagation delays**




$V_{OL}$ and $V_{OH}$ are typical voltage output levels that occur with the output load.

**Fig. 7. 3-state output enable and disable times**




Test data is given in Table 8.

Definitions test circuit:

$R_L$ = Load resistance.

$C_L$ = Load capacitance including jig and probe capacitance.

$R_T$ = Termination resistance should be equal to output impedance $Z_o$ of the pulse generator.

$V_{EXT}$ = Test voltage for switching times.

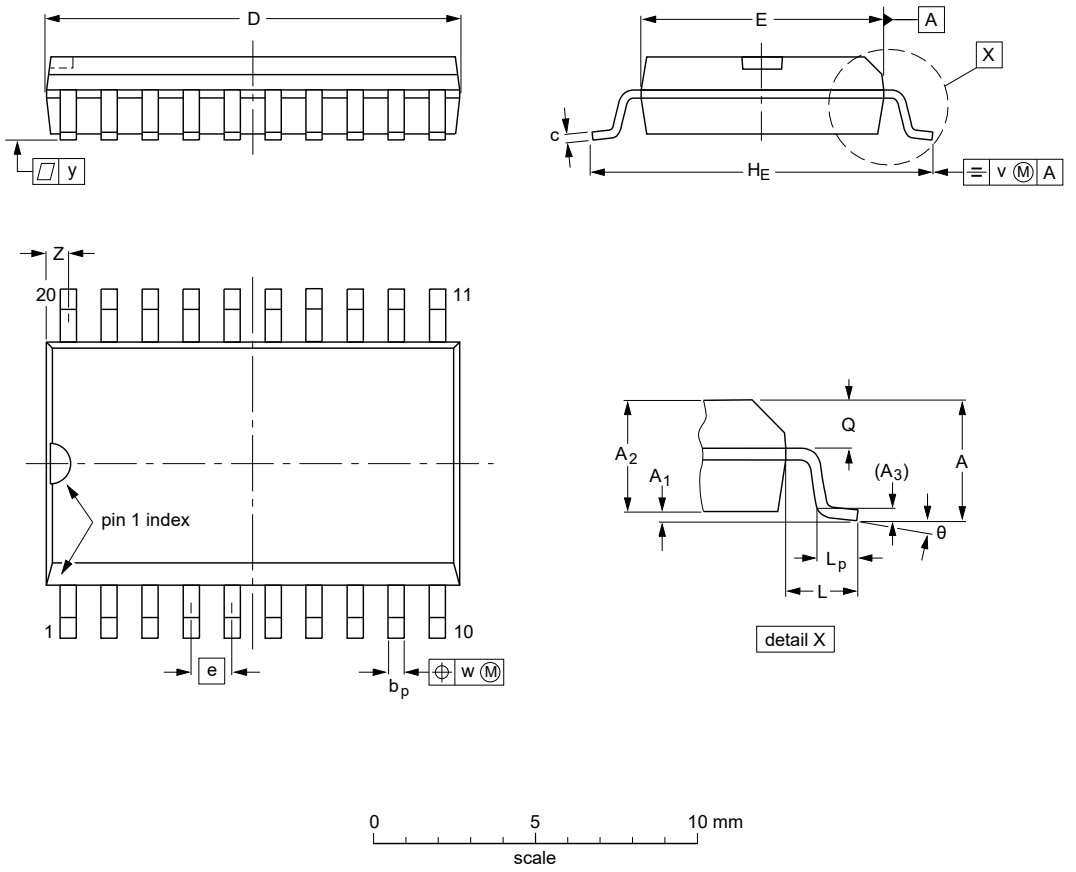
**Fig. 8. Test circuit for measuring switching times**

**Table 8. Test data**

| Input | | | | Load | | $V_{EXT}$ | | |
|---|---|---|---|---|---|---|---|---|
| $V_I$ | $f_i$ | $t_W$ | $t_r$, $t_f$ | $C_L$ | $R_L$ | $t_{PHZ}$, $t_{PZH}$ | $t_{PLZ}$, $t_{PZL}$ | $t_{PLH}$, $t_{PHL}$ |
| 2.7 V | ≤ 10 MHz | 500 ns | ≤ 2.5 ns | 50 pF | 500 Ω | GND | 6 V | open |

# 11. Package outline

**SO20: plastic small outline package; 20 leads; body width 7.5 mm** **SOT163-1**




**DIMENSIONS (inch dimensions are derived from the original mm dimensions)**

| UNIT | A max. | $A_1$ | $A_2$ | $A_3$ | $b_p$ | c | $D^{(1)}$ | $E^{(1)}$ | e | $H_E$ | L | $L_p$ | Q | v | w | y | $Z^{(1)}$ | θ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | 2.65 | 0.3<br>0.1 | 2.45<br>2.25 | 0.25 | 0.49<br>0.36 | 0.32<br>0.23 | 13.0<br>12.6 | 7.6<br>7.4 | 1.27 | 10.65<br>10.00 | 1.4 | 1.1<br>0.4 | 1.1<br>1.0 | 0.25 | 0.25 | 0.1 | 0.9<br>0.4 | $8^o$<br>$0^o$ |
| inches | 0.1 | 0.012<br>0.004 | 0.096<br>0.089 | 0.01 | 0.019<br>0.014 | 0.013<br>0.009 | 0.51<br>0.49 | 0.30<br>0.29 | 0.05 | 0.419<br>0.394 | 0.055 | 0.043<br>0.016 | 0.043<br>0.039 | 0.01 | 0.01 | 0.004 | 0.035<br>0.016 | |

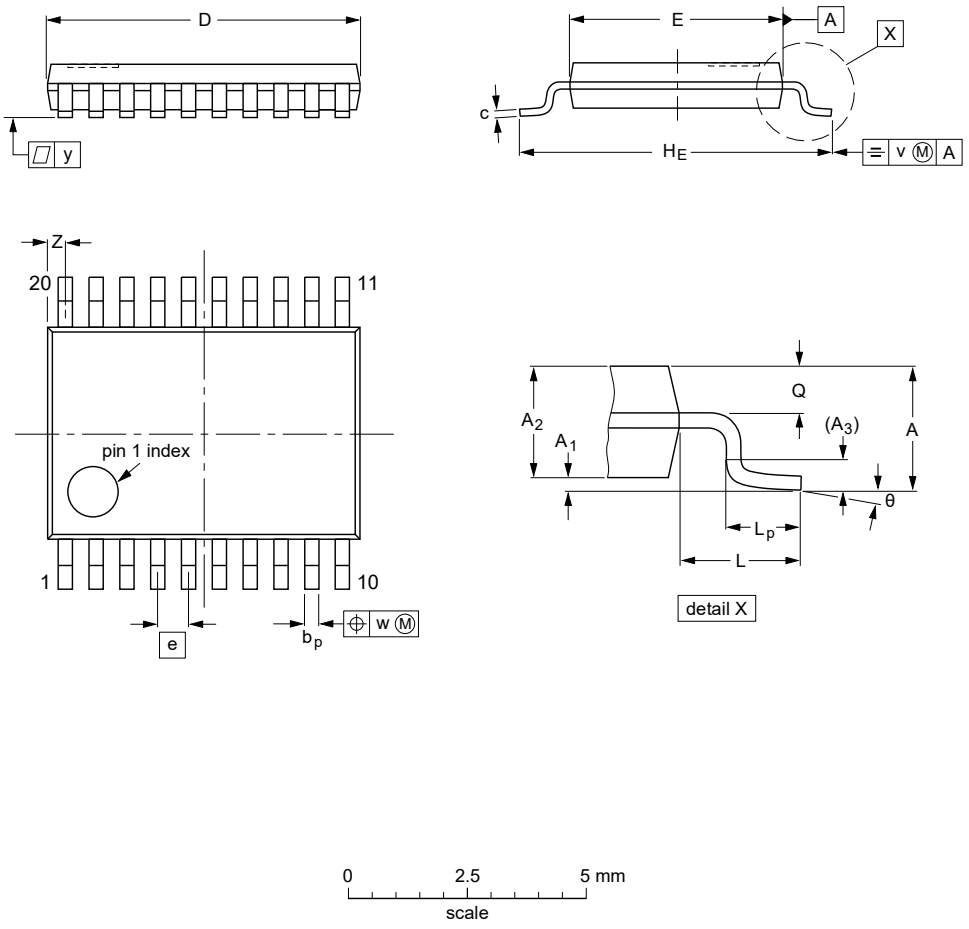
**Note**

1. Plastic or metal protrusions of 0.15 mm (0.006 inch) maximum per side are not included.

| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | JEITA | | | |
| SOT163-1 | 075E04 | MS-013 | | | | ~~99-12-27~~<br>03-02-19 |

**Fig. 9. Package outline SOT163-1 (SO20)**

**TSSOP20: plastic thin shrink small outline package; 20 leads; body width 4.4 mm** **SOT360-1**




**DIMENSIONS (mm are the original dimensions)**

| UNIT | A max. | $A_1$ | $A_2$ | $A_3$ | $b_p$ | c | D (1) | E (2) | e | $H_E$ | L | $L_p$ | Q | v | w | y | Z (1) | θ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | 1.1 | 0.15<br>0.05 | 0.95<br>0.80 | 0.25 | 0.30<br>0.19 | 0.2<br>0.1 | 6.6<br>6.4 | 4.5<br>4.3 | 0.65 | 6.6<br>6.2 | 1 | 0.75<br>0.50 | 0.4<br>0.3 | 0.2 | 0.13 | 0.1 | 0.5<br>0.2 | 8°<br>0° |

**Notes**

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.
2. Plastic interlead protrusions of 0.25 mm maximum per side are not included.

| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | JEITA | | | |
| SOT360-1 | | MO-153 | | | | ~~99-12-27~~<br>03-02-19 |

**Fig. 10. Package outline SOT360-1 (TSSOP20)**

## 12. Abbreviations

**Table 9. Abbreviations**

| Acronym | Description |
|---|---|
| BiCMOS | Bipolar Complementary Metal Oxide Semiconductor |
| DUT | Device Under Test |
| ESD | ElectroStatic Discharge |
| MIL | Military |
| MM | Machine Model |
| TTL | Transistor-Transistor Logic |

## 13. Revision history

**Table 10. Revision history**

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|---|---|---|---|---|
| 74LVT_LVTH2245 v.7 | 20210817 | Product data sheet | - | 74LVT_LVTH2245 v.6 |
| Modifications: | • Type number 74LVT2245DB (SOT339-1/SSOP20) removed. | | | |
| 74LVT_LVTH2245 v.6 | 20210215 | Product data sheet | - | 74LVT_LVTH2245 v.5 |
| Modifications: | • Type number 74LVTH2245DB (SOT339-1 / SSOP20) removed.<br>• Section 1 and Section 2 updated.<br>• Section 9: Conditions for $I_{BHLO}$ and $I_{BHHO}$ corrected. (errata) | | | |
| 74LVT_LVTH2245 v.5 | 20170410 | Product data sheet | - | 74LVT_LVTH2245 v.4 |
| Modifications: | • The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia.<br>• Legal texts have been adapted to the new company name where appropriate. | | | |
| 74LVT_LVTH2245 v.4 | 20060424 | Product data sheet | - | 74LVT_LVTH2245 v.3 |
| Modifications: | • Text changes have been made to the parameter descriptions of $t_{PLH}$ and $t_{PHL}$ in the Quick reference and Dynamic characteristics tables. | | | |
| 74LVT_LVTH2245 v.3 | 20060323 | Product data sheet | - | 74LVT2245 v.2 |
| 74LVT2245 v.2 | 19980219 | Product specification | - | 74LVT2245 v.1 |
| 74LVT2245 v.1 | 19960311 | Product specification | - | - |

# 14. Legal information

## Data sheet status

| Document status [1][2] | Product status [3] | Definition |
|---|---|---|
| Objective [short] data sheet | Development | This document contains data from the objective specification for product development. |
| Preliminary [short] data sheet | Qualification | This document contains data from the preliminary specification. |
| Product [short] data sheet | Production | This document contains the product specification. |

[1] Please consult the most recently issued document before initiating or completing a design.
[2] The term 'short data sheet' is explained in section "Definitions".
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