

# 74LVT16543A

3.3 V 16-bit registered transceiver; 3-state

Rev. 3 — 1 October 2018

Product data sheet

## 1. General description

The 74LVT16543A is a high-performance BiCMOS product designed for  $V_{CC}$  operation at 3.3 V. The device can be used as two 8-bit transceivers or one 16-bit transceiver.

The 74LVT16543A contains two sets of eight D-type latches, with separate control pins for each set. Using data flow from A to B as an example, when the A-to-B enable ( $n\overline{EAB}$ ) input and the A-to-B latch enable ( $n\overline{LEAB}$ ) input are LOW, the A-to-B path is transparent.

A subsequent LOW-to-HIGH transition of the  $n\overline{LEAB}$  signal puts the A data into the latches where it is stored and the B outputs no longer change with the A inputs. With  $n\overline{EAB}$  and  $n\overline{OEAB}$  both LOW, the 3-State B output buffers are active and display the data present at the outputs of the A latches.

Control of data flow from B to A is similar, but using the  $n\overline{EBA}$ ,  $n\overline{LEBA}$ , and  $n\overline{OEBA}$  inputs.

Active bus-hold circuitry is provided to hold unused or floating data inputs at a valid logic level.

## 2. Features and benefits

- 16-bit universal bus interface
- 3-state buffers
- Input and output interface capability to systems at 5 V supply
- TTL input and output switching levels
- Output capability: +64 mA/-32 mA
- Bus-hold data inputs eliminate the need for external pull-up resistors to hold unused inputs
- Live insertion/extraction permitted
- Power-up 3-state
- Power-up reset
- No bus current loading when output is tied to 5 V bus
- Latch-up protection:
  - JESD78B Class II exceeds 500 mA
- ESD protection:
  - HBM: JESD22-A114F exceeds 2000 V
  - MM: JESD22-A115-A exceeds 200 V

## 3. Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
74LVT16543ADL	-40 °C to +85 °C	SSOP56	plastic shrink small outline package; 56 leads; body width 7.5 mm	SOT371-1
74LVT16543ADGG	-40 °C to +85 °C	TSSOP56	plastic thin shrink small outline package; 56 leads; body width 6.1 mm	SOT364-1

### 4. Functional diagram

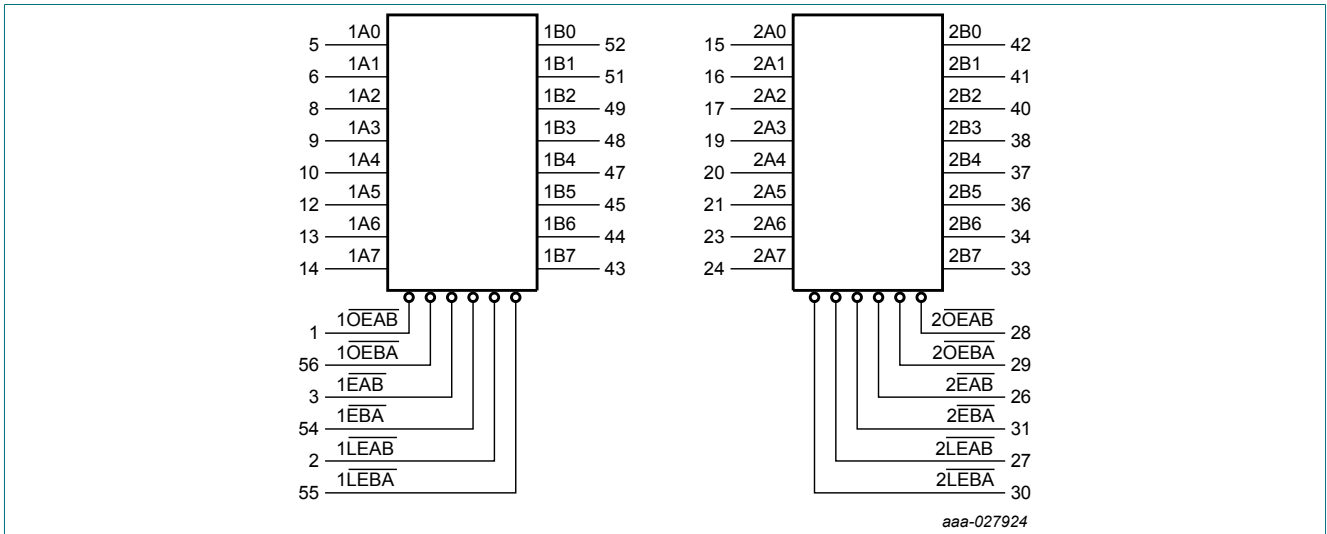


Fig. 1. Logic symbol

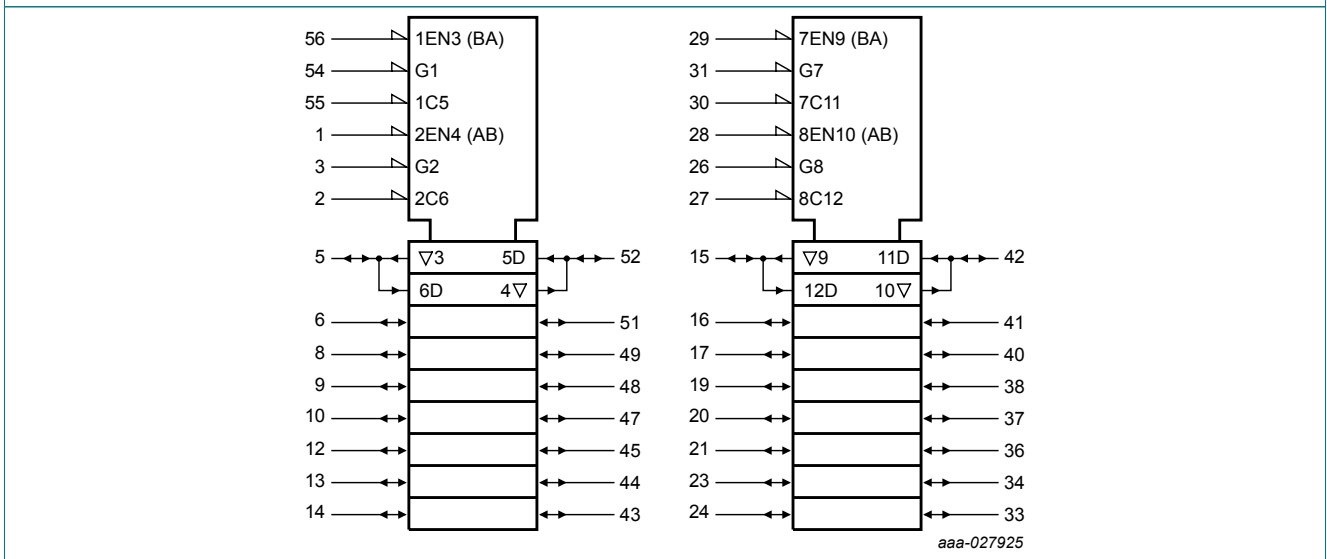


Fig. 2. IEC logic symbol

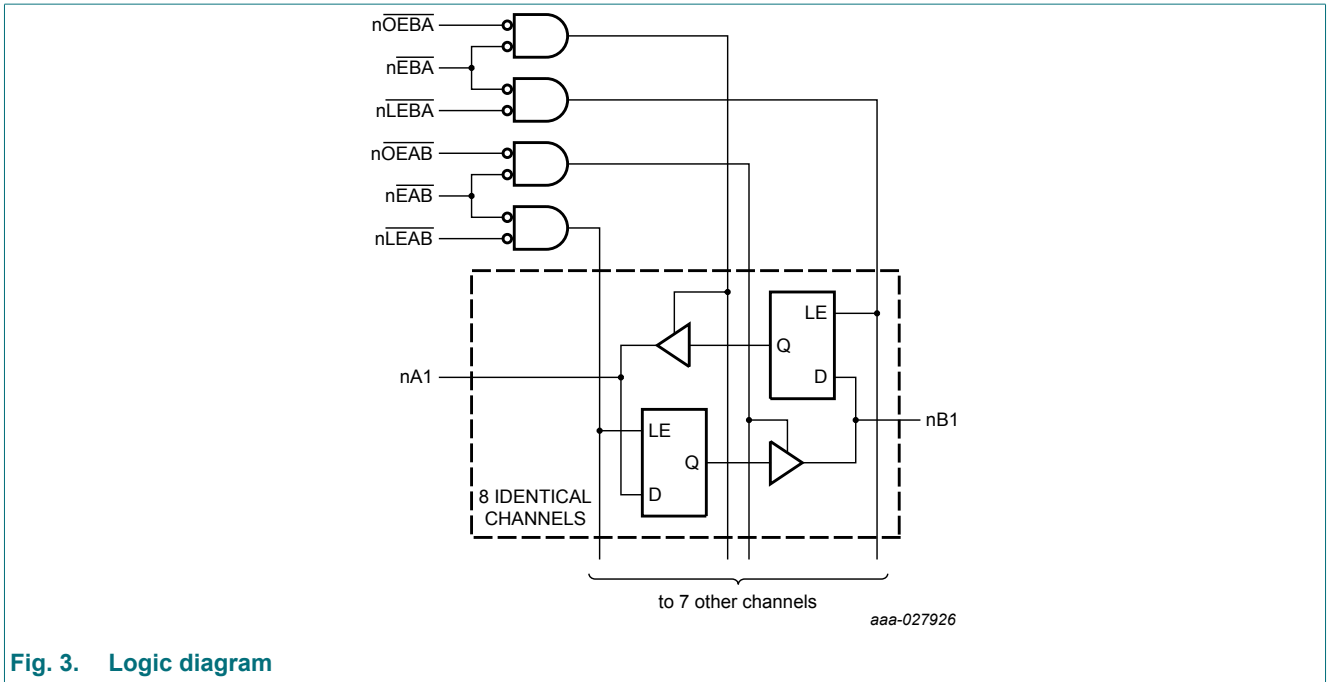


Fig. 3. Logic diagram

## 5. Pinning information

### 5.1. Pinning

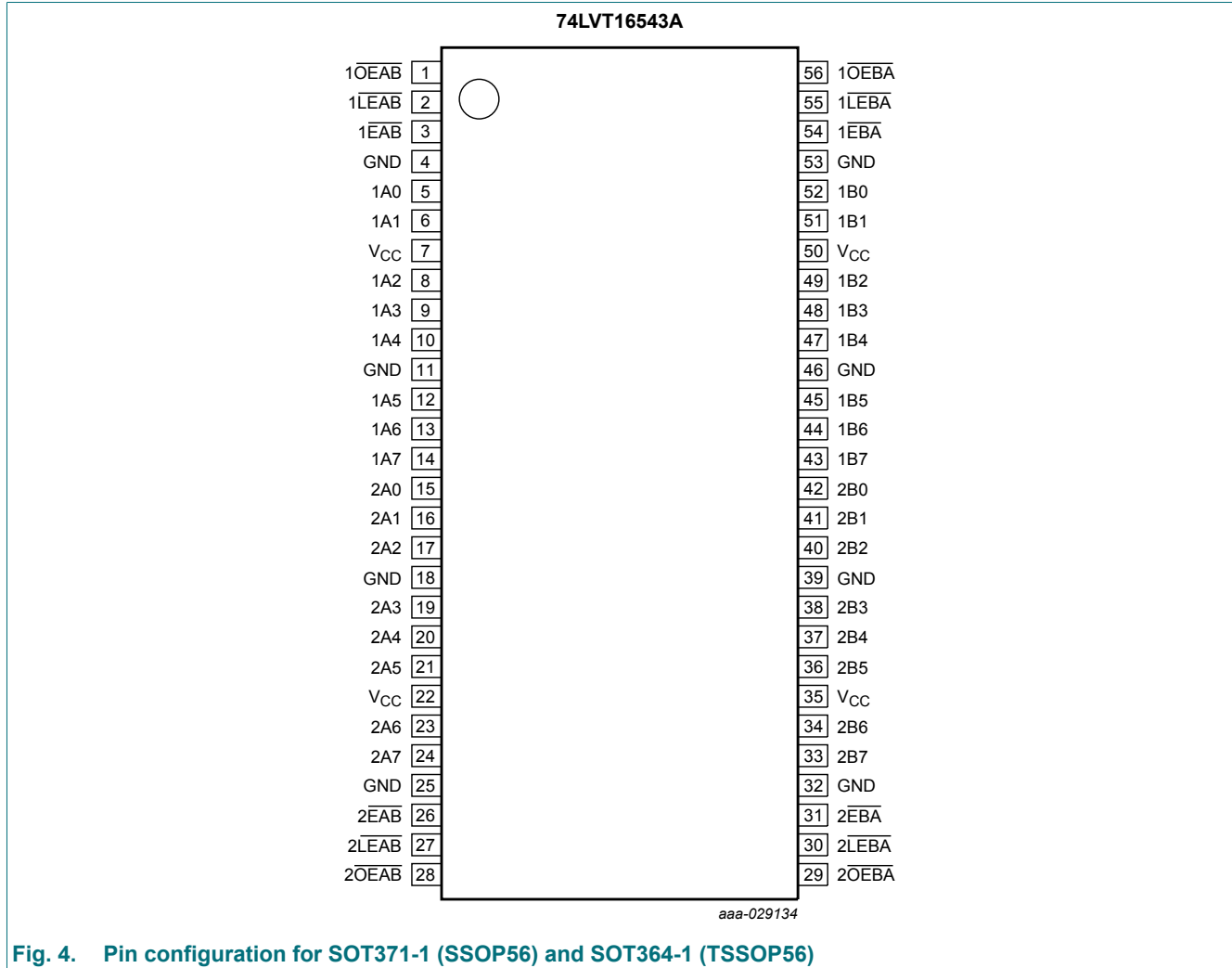


Fig. 4. Pin configuration for SOT371-1 (SSOP56) and SOT364-1 (TSSOP56)

## 5.2. Pin description

Table 2. Pin description

Symbol	Pin	Description
1A0, 1A1, 1A2, 1A3, 1A4, 1A5, 1A6, 1A7	5, 6, 8, 9, 10, 12, 13, 14	data inputs/outputs
2A0, 2A1, 2A2, 2A3, 2A4, 2A5, 2A6, 2A7	15, 16, 17, 19, 20, 21, 23, 24	data inputs/outputs
1B0, 1B1, 1B2, 1B3, 1B4, 1B5, 1B6, 1B7	52, 51, 49, 48, 47, 45, 44, 43	data inputs/outputs
2B0, 2B1, 2B2, 2B3, 2B4, 2B5, 2B6, 2B7	42, 41, 40, 38, 37, 36, 34, 33	data inputs/outputs
1OEAB, 1OEBA, 2OEAB, 2OEBA	1, 56, 28, 29	A to B / B to A output enable inputs (active LOW)
1EAB, 1EBA, 2EAB, 2EBA	3, 54, 26, 31	A to B / B to A enable inputs (active LOW)
1LEAB, 1LEBA, 2LEAB, 2LEBA	2, 55, 27, 30	A to B / B to A latch enable inputs (active LOW)
GND	4, 11, 18, 25, 32, 39, 46, 53	ground (0 V)
V <sub>CC</sub>	7, 22, 35, 50	supply voltage

## 6. Functional description

Table 3. Function selection [1]

Inputs				Outputs	Status
nOEAB or nOEBA	nEAB or nEBA	nLEAB or nLEBA	nAn or nBn	nBn or nAn	
H	X	X	X	Z	Disabled
X	H	X	X	Z	Disabled
L	↑	L	h	Z	Disabled + Latch
L	↑	L	l	Z	Disabled + Latch
L	L	↑	h	H	Latch + Display
L	L	↑	l	L	Latch + Display
L	L	L	H	H	Transparent
L	L	L	L	L	Transparent
L	L	H	X	NC	Hold

- [1] H = HIGH voltage level;  
h = HIGH voltage level one set-up time prior to the LOW-to-HIGH transition of nLEAB, nLEBA, nEAB and nEBA;  
L = LOW voltage level;  
l = LOW voltage level one set-up time prior to the LOW-to-HIGH transition of nLEAB, nLEBA, nEAB and nEBA;  
X = don't care;  
↑ = LOW-to-HIGH transition of nLEAB, nLEBA, nEAB or nEBA;  
NC = no change;  
Z = high-impedance OFF-state.

## 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 or HIGH state	[1] -0.5	+7.0	V
$I_{IK}$	input clamping current	$V_I < 0$	-50	-	mA
$I_{OK}$	output clamping current	$V_O < 0$	-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

[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	Max	Unit
$V_{CC}$	supply voltage		2.7	3.6	V
$V_I$	input voltage		0	5.5	V
$T_{amb}$	ambient temperature	in free air	-40	+85	°C
$\Delta t/\Delta V$	input transition rise and fall rate	outputs enabled	-	10	ns/V

## 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
$V_{IK}$	input clamping voltage	$V_{CC} = 2.7\text{ V}; I_{IK} = -18\text{ mA}$	-	-0.85	-1.2	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	$V_{CC} = 2.7\text{ V to }3.6\text{ V}; I_{OH} = -100\text{ }\mu\text{A}$	$V_{CC} - 0.2$	$V_{CC}$	-	V
		$V_{CC} = 2.7\text{ V}; I_{OH} = -8\text{ mA}$	2.4	2.54	-	V
		$V_{CC} = 3.0\text{ V}; I_{OH} = -32\text{ mA}$	2.0	2.36	-	V
$V_{OL}$	LOW-level output voltage	$V_{CC} = 2.7\text{ V}; I_{OL} = 100\text{ }\mu\text{A}$	-	0.07	0.2	V
		$V_{CC} = 2.7\text{ V}; I_{OL} = 24\text{ mA}$	-	0.3	0.5	V
		$V_{CC} = 3.0\text{ V}; I_{OL} = 16\text{ mA}$	-	0.2	0.4	V
		$V_{CC} = 3.0\text{ V}; I_{OL} = 32\text{ mA}$	-	0.3	0.5	V
		$V_{CC} = 3.0\text{ V}; I_{OL} = 64\text{ mA}$	-	0.35	0.55	V
$I_{OH}$	HIGH-level output current		-	-	-32	mA

## 3.3 V 16-bit registered transceiver; 3-state

Symbol	Parameter	Conditions	Min	Typ [1]	Max	Unit
$I_{OL}$	LOW-level output current		-	-	32	mA
		current duty cycle $\leq 50\%$ ; $f_i \geq 1$ kHz	-	-	64	mA
$V_{OL(pu)}$	power-up LOW-level output voltage	$V_{CC} = 3.6$ V; $I_O = 1$ mA; $V_I = V_{CC}$ or GND [2]	-	0.13	0.55	V
$I_I$	input leakage current	control pins				
		$V_{CC} = 0$ V or 3.6 V; $V_I = 5.5$ V	-	0.1	10	$\mu$ A
		$V_{CC} = 3.6$ V; $V_I = V_{CC}$ or GND	-	0.1	$\pm 1$	$\mu$ A
		I/O data pins [3]				
		$V_{CC} = 3.6$ V; $V_I = 5.5$ V	-	0.5	20	$\mu$ A
		$V_{CC} = 3.6$ V; $V_I = V_{CC}$	-	0.5	10	$\mu$ A
		$V_{CC} = 3.6$ V; $V_I = 0$ V	-	1	-5	$\mu$ A
$I_{OFF}$	power-off leakage current	$V_{CC} = 0$ V; $V_I$ or $V_O = 0$ V to 4.5 V	-	1	$\pm 100$	$\mu$ A
$I_{BHL}$	bus hold LOW current	$V_{CC} = 3.0$ V; $V_I = 0.8$ V	75	130	-	$\mu$ A
$I_{BHH}$	bus hold HIGH current	$V_{CC} = 3.0$ V; $V_I = 2.0$ V	-75	-140	-	$\mu$ A
$I_{BHLO}$	bus hold LOW overdrive current	$V_{CC} = 3.6$ V; $V_I = 0$ V to 3.6 V [4]	500	-	-	$\mu$ A
$I_{BHHO}$	bus hold HIGH overdrive current	$V_{CC} = 3.6$ V; $V_I = 0$ V to 3.6 V [4]	-	-	-500	$\mu$ A
$I_{CEX}$	output high leakage current	output in HIGH-state when $V_O > V_{CC}$ ; $V_O = 5.5$ V; $V_{CC} = 3.0$ V	-	45	125	$\mu$ A
$I_{O(pu/pd)}$	power-up/power-down output current	$V_{CC} \leq 1.2$ V; $V_O = 0.5$ V to $V_{CC}$ ; $V_I =$ GND or $V_{CC}$ ; $n\overline{OE} =$ don't care [5]	-	35	$\pm 100$	$\mu$ A
$I_{CC}$	supply current	$V_{CC} = 3.6$ V; $V_I = V_{CC}$ or GND; $I_O = 0$ A				
		outputs HIGH	-	0.07	0.12	mA
		outputs LOW	-	4.5	6	mA
		outputs disabled [6]	-	0.07	0.12	mA
$\Delta I_{CC}$	additional supply current	per input pin; $V_{CC} = 3.0$ V to 3.6 V; one input = $V_{CC} - 0.6$ V; other inputs at $V_{CC}$ or GND [7]	-	0.1	0.2	mA
$C_I$	input capacitance	at control pins; $V_I = 0$ V or 3.0 V	-	3	-	pF
$C_{I/O}$	input/output capacitance	at input/output data pins, outputs disabled; $V_{I/O} = 0$ V or 3.0 V	-	9	-	pF

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

[2] For valid test results, data must not be loaded into the latches after applying power.

[3] Unused pins at  $V_{CC}$  or GND.

[4] This is the bus hold overdrive current required to force the input to the opposite logic state.

[5] 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  $\mu$ s is permitted. This parameter is valid for  $T_{amb} = +25$  °C only.

[6]  $I_{CC}$  with the outputs disabled is measured with outputs pulled to  $V_{CC}$  or GND.

[7] 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**

At recommended operating conditions. Voltages are referenced to GND (ground = 0 V). For test circuit see Fig. 9.

Symbol	Parameter	Conditions	Min	Typ [1]	Max	Unit
$t_{pd}$	propagation delay	nAn to nBn or nBn to nAn; see Fig. 5 [2]				
		$V_{CC} = 2.7\text{ V}$	-	-	4.4	ns
		$V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$	1.0	2.2	3.7	ns
$t_{pd}$	propagation delay	$\overline{\text{nLEBA}}$ to nAn, $\overline{\text{nLEAB}}$ to nBn; see Fig. 6 [2]				
		$V_{CC} = 2.7\text{ V}$	-	-	6.2	ns
		$V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$	1.5	2.7	4.8	ns
$t_{PZH}$	OFF-state to HIGH propagation delay	$\overline{\text{nOEBA}}$ to nAn, $\overline{\text{nOEAB}}$ to nBn; see Fig. 7				
		$V_{CC} = 2.7\text{ V}$	-	-	6.1	ns
		$V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$	1.5	2.8	4.6	ns
$t_{PZL}$	OFF-state to LOW propagation delay	$\overline{\text{nOEBA}}$ to nAn, $\overline{\text{nOEAB}}$ to nBn; see Fig. 7				
		$V_{CC} = 2.7\text{ V}$	-	-	6.6	ns
		$V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$	1.5	2.6	5.0	ns
$t_{PHZ}$	HIGH to OFF-state propagation delay	$\overline{\text{nOEBA}}$ to nAn, $\overline{\text{nOEAB}}$ to nBn; see Fig. 7				
		$V_{CC} = 2.7\text{ V}$	-	-	5.7	ns
		$V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$	2.0	3.1	5.2	ns
$t_{PLZ}$	LOW to OFF-state propagation delay	$\overline{\text{nOEBA}}$ to nAn, $\overline{\text{nOEAB}}$ to nBn; see Fig. 7				
		$V_{CC} = 2.7\text{ V}$	-	-	4.7	ns
		$V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$	2.0	3.2	4.6	ns
$t_{PZH}$	OFF-state to HIGH propagation delay	$\overline{\text{nEBA}}$ to nAn, $\overline{\text{nEAB}}$ to nBn; see Fig. 7				
		$V_{CC} = 2.7\text{ V}$	-	-	6.1	ns
		$V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$	1.5	2.9	4.8	ns
$t_{PZL}$	OFF-state to LOW propagation delay	$\overline{\text{nEBA}}$ to nAn, $\overline{\text{nEAB}}$ to nBn; see Fig. 7				
		$V_{CC} = 2.7\text{ V}$	-	-	6.6	ns
		$V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$	1.5	2.6	5.1	ns
$t_{PHZ}$	HIGH to OFF-state propagation delay	$\overline{\text{nEBA}}$ to nAn, $\overline{\text{nEAB}}$ to nBn; see Fig. 7				
		$V_{CC} = 2.7\text{ V}$	-	-	5.7	ns
		$V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$	2.0	3.1	5.1	ns
$t_{PLZ}$	LOW to OFF-state propagation delay	$\overline{\text{nEBA}}$ to nAn, $\overline{\text{nEAB}}$ to nBn; see Fig. 7				
		$V_{CC} = 2.7\text{ V}$	-	-	4.5	ns
		$V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$	2.0	3.2	4.3	ns
$t_{su(H)}$	set-up time HIGH	nAn to $\overline{\text{nLEAB}}$ , nBn to $\overline{\text{nLEBA}}$ ; see Fig. 8				
		$V_{CC} = 2.7\text{ V}$	0.5	-	-	ns
		$V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$	0.8	0.4	-	ns
$t_{su(L)}$	set-up time LOW	nAn to $\overline{\text{nLEAB}}$ , nBn to $\overline{\text{nLEBA}}$ ; see Fig. 8				
		$V_{CC} = 2.7\text{ V}$	1.5	-	-	ns
		$V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$	1.0	0.1	-	ns
$t_{h(H)}$	hold time HIGH	nAn to $\overline{\text{nLEAB}}$ , nBn to $\overline{\text{nLEBA}}$ ; see Fig. 8				
		$V_{CC} = 2.7\text{ V}$	0.5	-	-	ns
		$V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$	1.0	0.2	-	ns

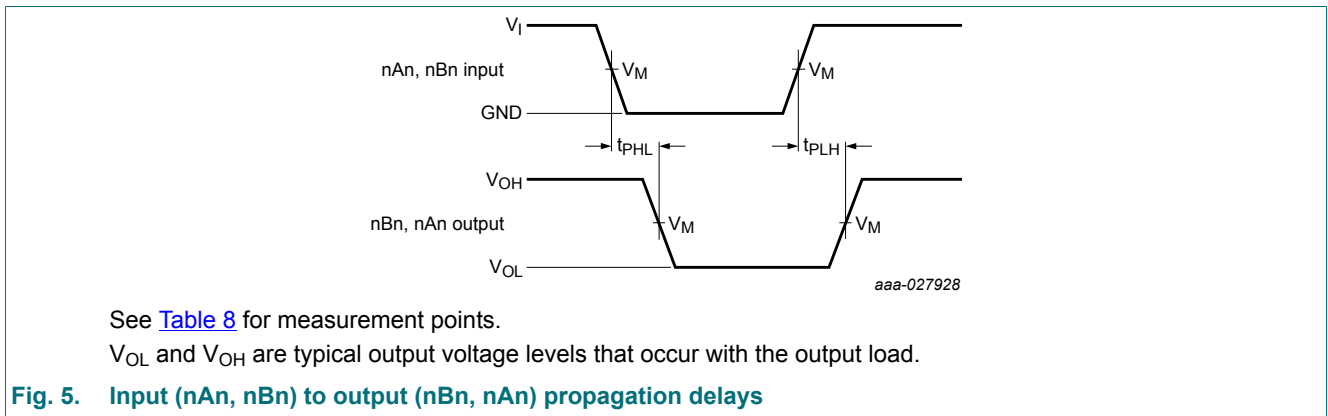


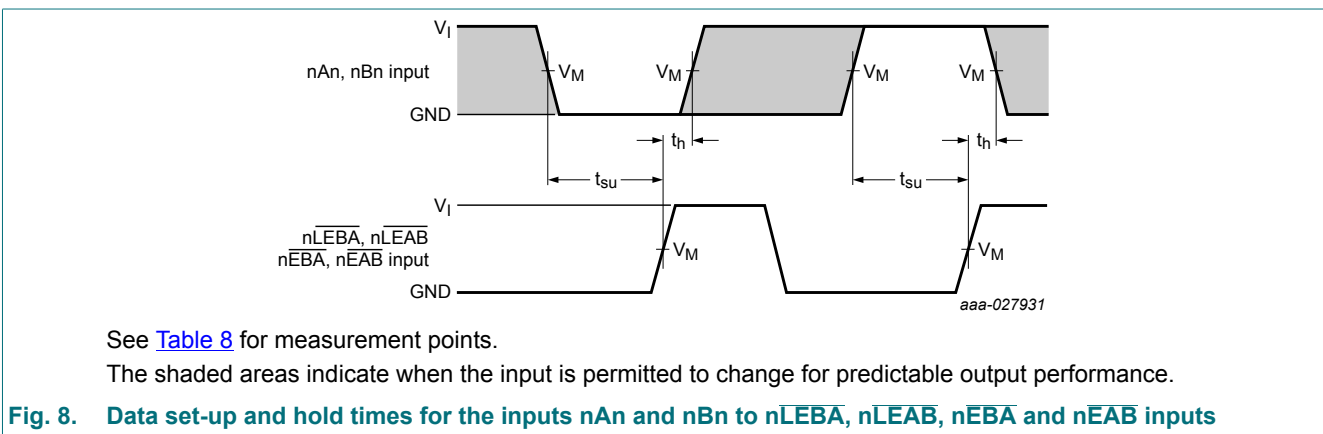
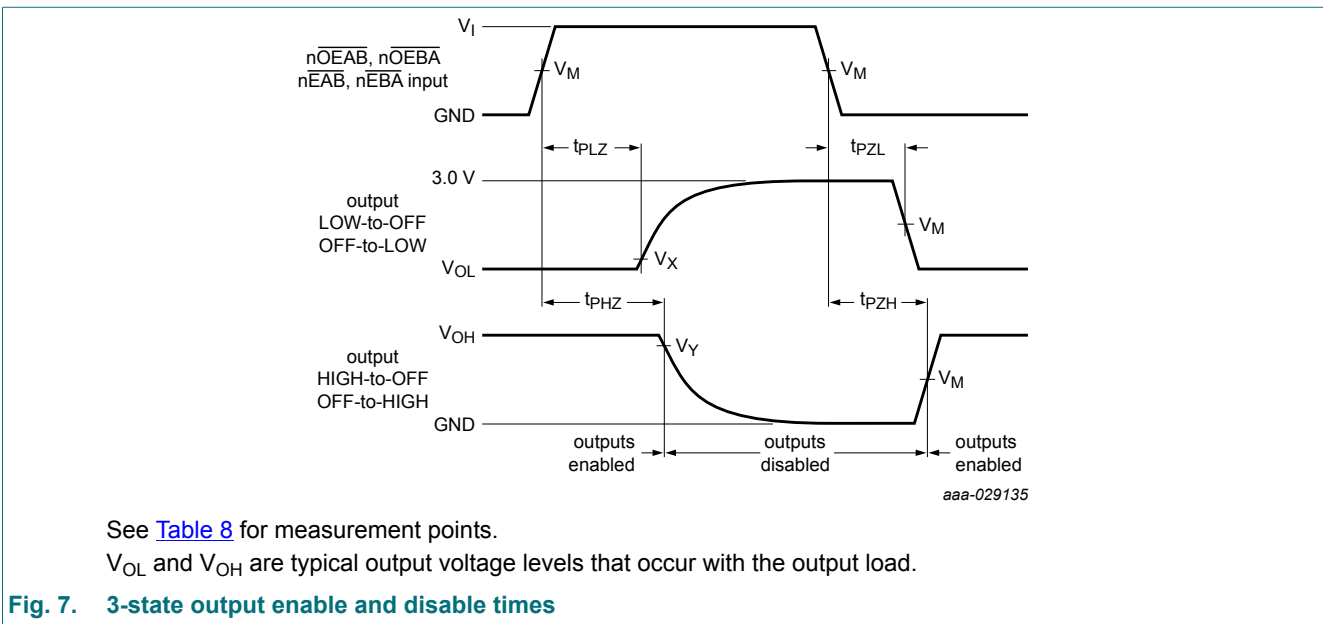
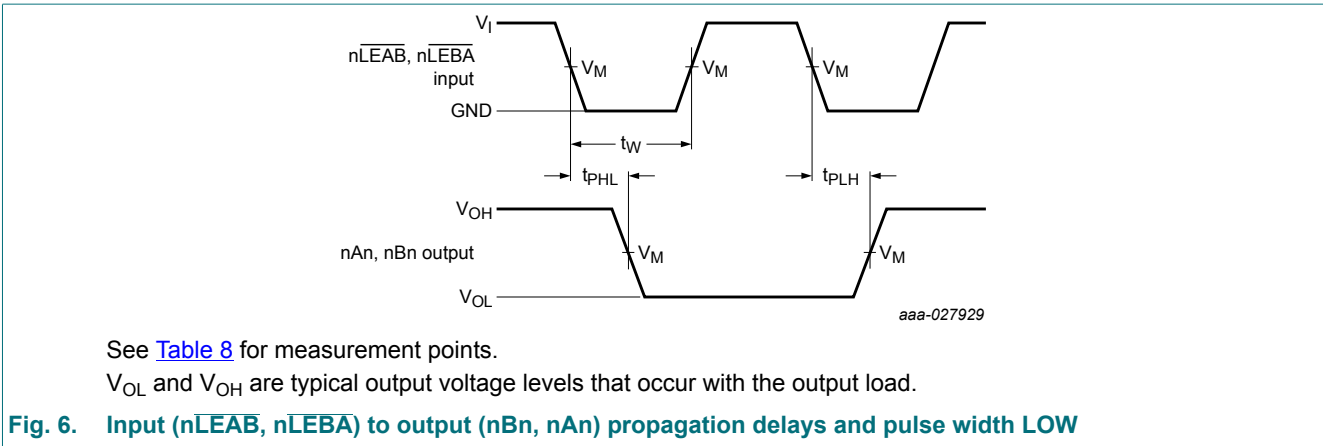
Symbol	Parameter	Conditions	Min	Typ [1]	Max	Unit
$t_{h(L)}$	hold time LOW	$nAn$ to $n\overline{LEAB}$ , $nBn$ to $n\overline{LEBA}$ ; see Fig. 8				
		$V_{CC} = 2.7\text{ V}$	1.3	-	-	ns
		$V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$	1.2	0.4	-	ns
$t_{su(H)}$	set-up time HIGH	$nAn$ to $n\overline{EAB}$ , $nBn$ to $n\overline{EBA}$ ; see Fig. 8				
		$V_{CC} = 2.7\text{ V}$	0.4	-	-	ns
		$V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$	0.7	0.1	-	ns
$t_{su(L)}$	set-up time LOW	$nAn$ to $n\overline{EAB}$ , $nBn$ to $n\overline{EBA}$ ; see Fig. 8				
		$V_{CC} = 2.7\text{ V}$	1.5	-	-	ns
		$V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$	1.3	0.1	-	ns
$t_{h(H)}$	hold time HIGH	$nAn$ to $n\overline{EAB}$ , $nBn$ to $n\overline{EBA}$ ; see Fig. 8				
		$V_{CC} = 2.7\text{ V}$	0.8	-	-	ns
		$V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$	1.2	0.2	-	ns
$t_{h(L)}$	hold time LOW	$nAn$ to $n\overline{EAB}$ , $nBn$ to $n\overline{EBA}$ ; see Fig. 8				
		$V_{CC} = 2.7\text{ V}$	1.4	-	-	ns
		$V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$	1.3	0.4	-	ns
$t_{WL}$	pulse width LOW	$n\overline{LEAB}$ and $n\overline{LEBA}$ ; see Fig. 6				
		$V_{CC} = 2.7\text{ V}$	1.8	-	-	ns
		$V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$	1.8	1.0	-	ns

[1] Typical values are measured at  $T_{amb} = 25\text{ }^\circ\text{C}$  and  $V_{CC} = 3.3\text{ V}$

[2]  $t_{pd}$  is the same as  $t_{PLH}$  and  $t_{PHL}$

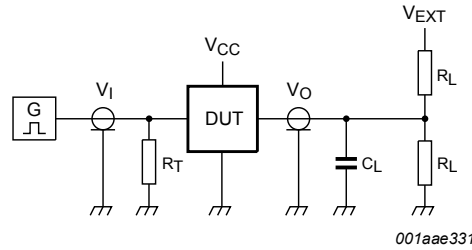
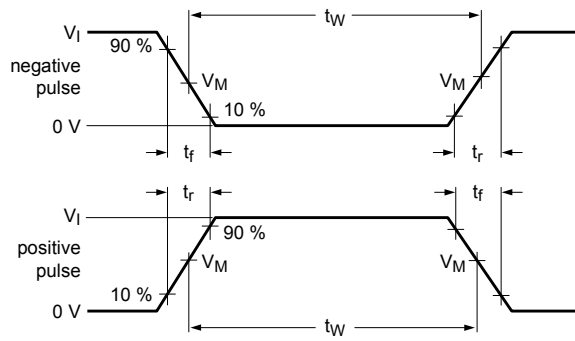
### 10.1. Waveforms and test circuit





**Table 8. Measurement points**

Input		Output		
$V_I$	$V_M$	$V_M$	$V_x$	$V_y$
2.7 V	1.5 V	1.5 V	$V_{OL} + 0.3 V$	$V_{OH} - 0.3 V$



001aee331

Test data is given in [Table 9](#).

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;

$V_{EXT}$  = External voltage for measuring switching times.

**Fig. 9. Test circuit for measuring switching times**

**Table 9. Test data**

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

### 11. Package outline

SSOP56: plastic shrink small outline package; 56 leads; body width 7.5 mm

SOT371-1

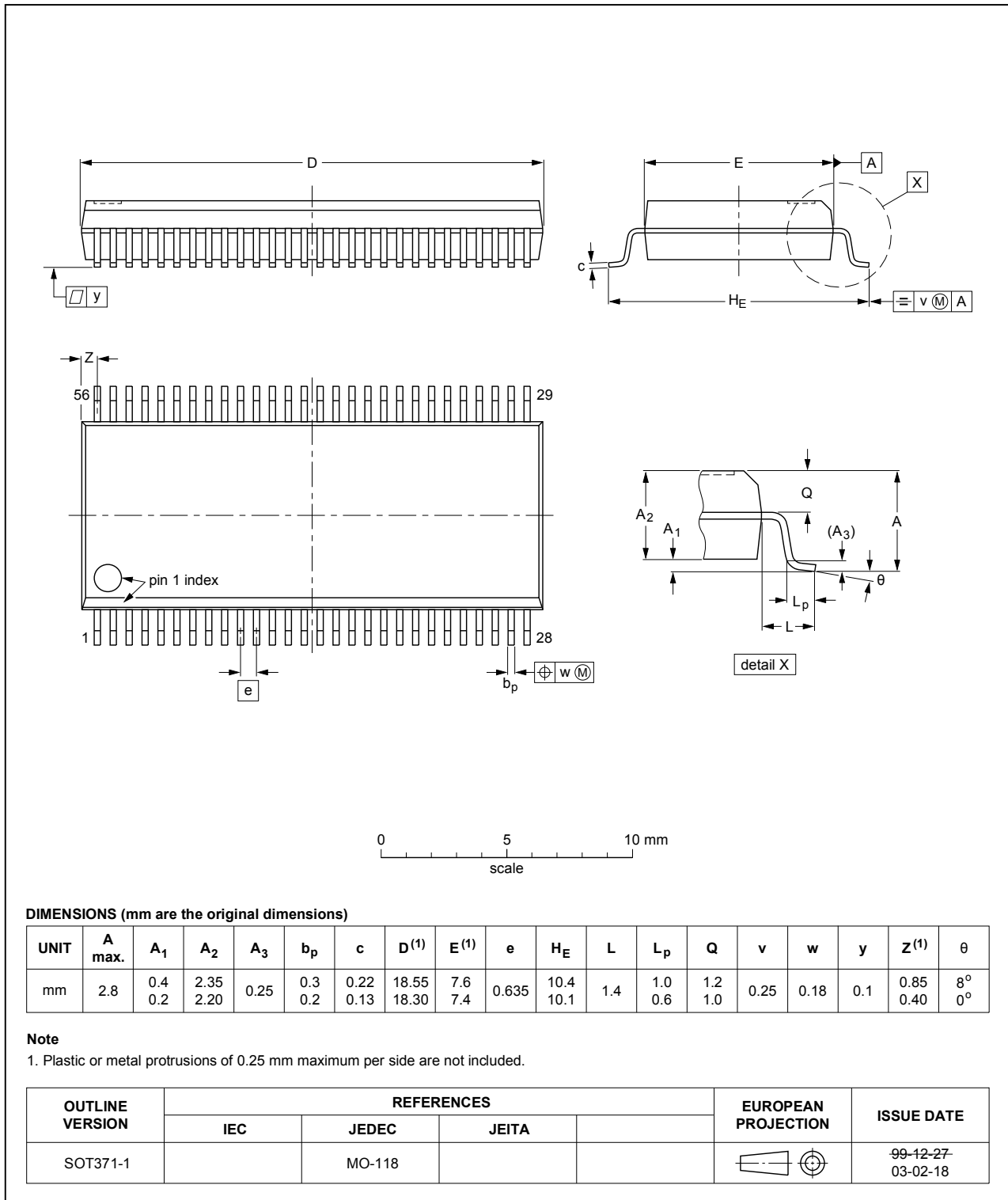


Fig. 10. Package outline SOT371-1 (SSOP56)

TSSOP56: plastic thin shrink small outline package; 56 leads; body width 6.1 mm

SOT364-1

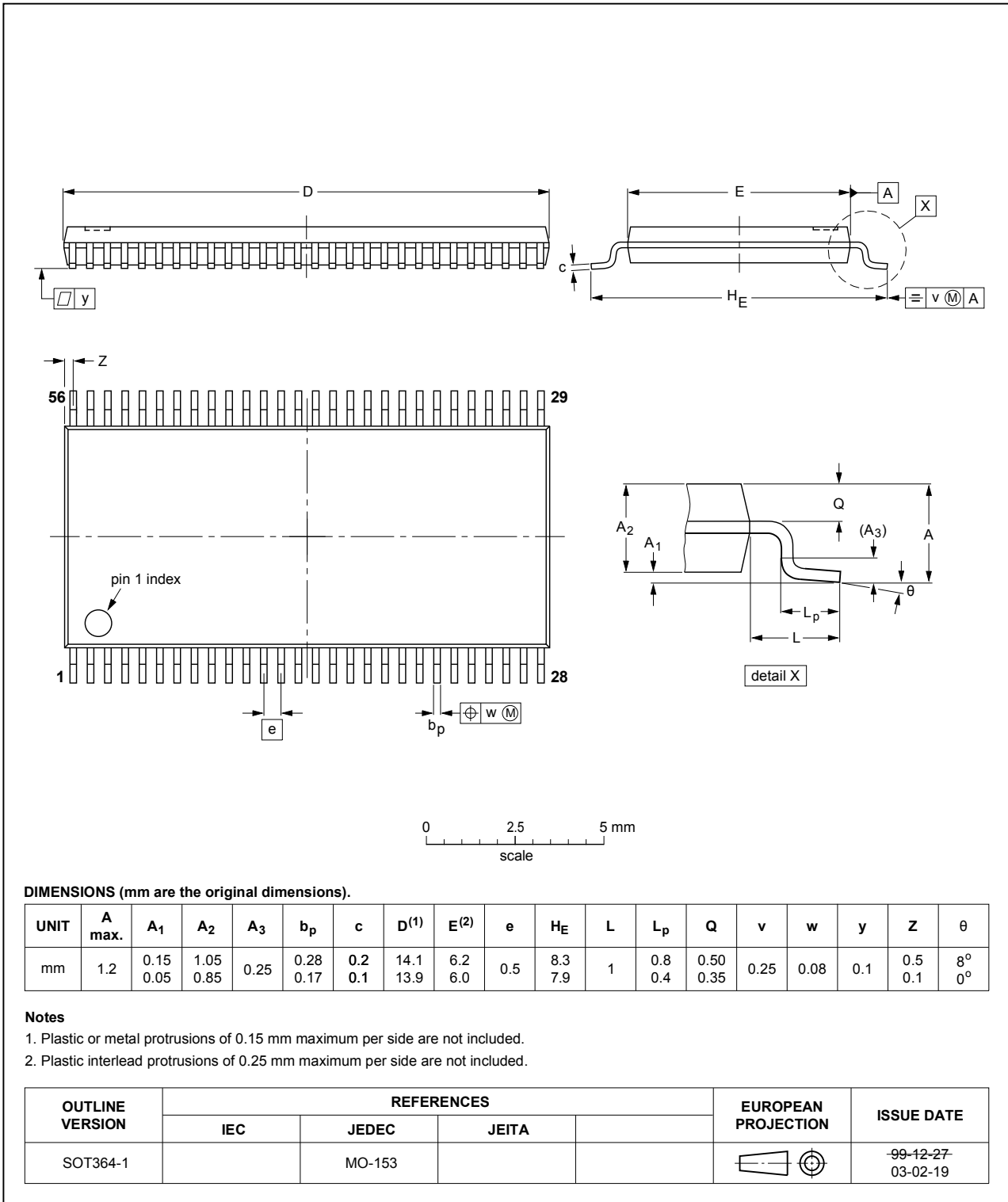


Fig. 11. Package outline SOT364-1 (TSSOP56)

## 12. Abbreviations

Table 10. 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 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74LVT16543A v.3	20181001	Product data sheet	-	74LVT16543A v.2
Modifications:	<ul style="list-style-type: none"> <li>The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia.</li> <li>Legal texts have been adapted to the new company name where appropriate.</li> </ul>			
74LVT16543A v.2	19980219	Product specification	-	74LVT16543A v.1
74LVT16543A v.1	-	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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