

# 74LVC827A

10-bit buffer/line driver with 5 V tolerant inputs/outputs;  
3-state

Rev. 4 — 25 November 2011

Product data sheet

## 1. General description

The 74LVC827A is a 10-bit buffer/line driver with 3-state outputs. The 3-state outputs are controlled by the output enable pins  $\overline{OE}1$  and  $\overline{OE}2$ . A HIGH on pin  $\overline{OE}n$  causes the outputs to assume a high-impedance OFF-state.

Inputs can be driven from either 3.3 V or 5 V devices. When disabled, up to 5.5 V can be applied to the outputs. These features allow the use of these devices as translators in mixed 3.3 V and 5 V applications.

## 2. Features and benefits

- 5 V tolerant inputs/outputs for interfacing with 5 V logic
- Wide supply voltage range from 1.2 V to 3.6 V
- CMOS low power consumption
- Direct interface with TTL levels
- Complies with JEDEC standard:
  - ◆ JESD8-7A (1.65 V to 1.95 V)
  - ◆ JESD8-5A (2.3 V to 2.7 V)
  - ◆ JESD8-C/JESD36 (2.7 V to 3.6 V)
- ESD protection:
  - ◆ HBM JESD22-A114F exceeds 2000 V
  - ◆ MM JESD22-A115B exceeds 200 V
  - ◆ CDM JESD22-C101E exceeds 1000 V
- Specified from  $-40\text{ }^{\circ}\text{C}$  to  $+85\text{ }^{\circ}\text{C}$  and  $-40\text{ }^{\circ}\text{C}$  to  $+125\text{ }^{\circ}\text{C}$

## 3. Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
74LVC827AD	$-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$	SO24	plastic small outline package; 24 leads; body width 7.5 mm	SOT137-1
74LVC827ADB	$-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$	SSOP24	plastic shrink small outline package; 24 leads; body width 5.3 mm	SOT340-1
74LVC827APW	$-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$	TSSOP24	plastic thin shrink small package outline package; 24 leads; body width 4.4 mm	SOT355-1

### 4. Functional diagram

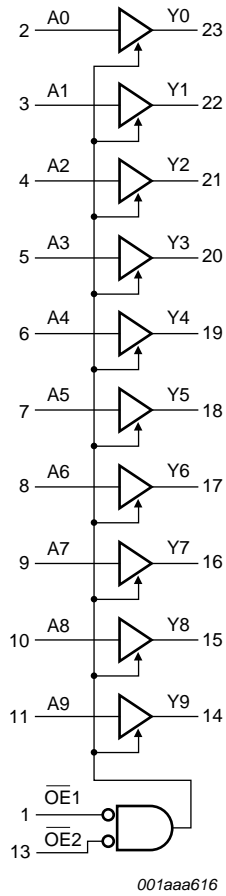


Fig 1. Logic diagram

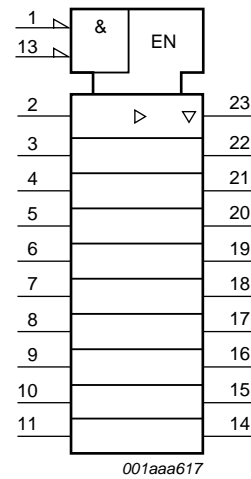


Fig 2. IEC logic symbol

## 5. Pinning information

### 5.1 Pinning

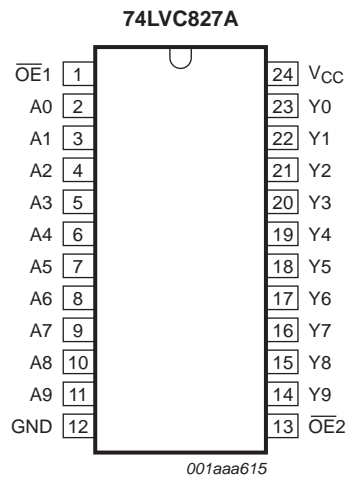


Fig 3. Pin configuration SO24 and (T)SSOP24

### 5.2 Pin description

Table 2. Pin description

Symbol	Pin	Description
$\overline{OE}1$	1	output enable input 1 (active LOW)
$\overline{OE}2$	13	output enable input 2 (active LOW)
A[0:9]	2, 3, 4, 5, 6, 7, 8, 9, 10, 11	data input
Y[0:9]	23, 22, 21, 20, 19, 18, 17, 16, 15, 14	data output
GND	12	ground (0 V)
V <sub>CC</sub>	24	supply voltage

## 6. Functional description

Table 3. Function table<sup>[1]</sup>

Control		Input		Output
OE1	OE2	An		Yn
L	L	L		L
L	L	H		H
X	H	X		Z
H	X	X		Z

- [1] H = HIGH voltage level  
 L = LOW voltage level  
 X = don't care  
 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	+6.5	V
$V_I$	input voltage		<sup>[1]</sup> -0.5	+6.5	V
$V_O$	output voltage	output HIGH or LOW state	<sup>[2]</sup> -0.5	$V_{CC} + 0.5$	V
		output 3-state	<sup>[2]</sup> -0.5	+6.5	V
$I_{IK}$	input clamping current	$V_I < 0$ V	-50	-	mA
$I_{OK}$	output clamping current	$V_O > V_{CC}$ or $V_O < 0$ V	-	$\pm 50$	mA
$I_O$	output current	$V_O = 0$ V to $V_{CC}$	-	$\pm 50$	mA
$I_{CC}$	supply current		-	100	mA
$I_{GND}$	ground current		-100	-	mA
$T_{stg}$	storage temperature		-65	+150	°C
$P_{tot}$	total power dissipation	$T_{amb} = -40$ °C to +125 °C	<sup>[3]</sup>	500	mW

- [1] The minimum input voltage ratings may be exceeded if the input current ratings are observed.  
 [2] The output voltage ratings may be exceeded if the output current ratings are observed.  
 [3] SO24 package:  $P_{tot}$  derates linearly with 8 mW/K above 70 °C.  
 (T)SSOP24 package:  $P_{tot}$  derates linearly with 5.5 mW/K above 60 °C.

## 8. Recommended operating conditions

**Table 5. Recommended operating conditions**

Symbol	Parameter	Conditions	Min	Max	Unit
$V_{CC}$	supply voltage		1.65	3.6	V
		functional	1.2		V
$V_I$	input voltage		0	5.5	V
$V_O$	output voltage	output HIGH or LOW state	0	$V_{CC}$	V
		output 3-state	0	5.5	V
$T_{amb}$	ambient temperature		-40	+125	°C
$\Delta t/\Delta V$	input transition rise and fall rate	$V_{CC} = 1.65\text{ V to }2.7\text{ V}$	0	20	ns/V
		$V_{CC} = 2.7\text{ V to }3.6\text{ V}$	0	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	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ <sup>(1)</sup>	Max	Min	Max	
$V_{IH}$	HIGH-level input voltage	$V_{CC} = 1.2\text{ V}$	1.08	-	-	1.08	-	V
		$V_{CC} = 1.65\text{ V to }1.95\text{ V}$	$0.65 \times V_{CC}$	-	-	$0.65 \times V_{CC}$	-	V
		$V_{CC} = 2.3\text{ V to }2.7\text{ V}$	1.7	-	-	1.7	-	V
		$V_{CC} = 2.7\text{ V to }3.6\text{ V}$	2.0	-	-	2.0	-	V
$V_{IL}$	LOW-level input voltage	$V_{CC} = 1.2\text{ V}$	-	-	0.12	-	0.12	V
		$V_{CC} = 1.65\text{ V to }1.95\text{ V}$	-	-	$0.35 \times V_{CC}$	-	$0.35 \times V_{CC}$	V
		$V_{CC} = 2.3\text{ V to }2.7\text{ V}$	-	-	0.7	-	0.7	V
		$V_{CC} = 2.7\text{ V to }3.6\text{ V}$	-	-	0.8	-	0.8	V
$V_{OH}$	HIGH-level output voltage	$V_I = V_{IH}$ or $V_{IL}$						
		$I_O = -100\ \mu\text{A}$ ; $V_{CC} = 1.65\text{ V to }3.6\text{ V}$	$V_{CC} - 0.2$	-	-	$V_{CC} - 0.3$	-	V
		$I_O = -4\text{ mA}$ ; $V_{CC} = 1.65\text{ V}$	1.2	-	-	1.05	-	V
		$I_O = -8\text{ mA}$ ; $V_{CC} = 2.3\text{ V}$	1.8	-	-	1.65	-	V
		$I_O = -12\text{ mA}$ ; $V_{CC} = 2.7\text{ V}$	2.2	-	-	2.05	-	V
		$I_O = -18\text{ mA}$ ; $V_{CC} = 3.0\text{ V}$	2.4	-	-	2.25	-	V
$V_{OL}$	LOW-level output voltage	$V_I = V_{IH}$ or $V_{IL}$						
		$I_O = 100\ \mu\text{A}$ ; $V_{CC} = 1.65\text{ V to }3.6\text{ V}$	-	-	0.2	-	0.3	V
		$I_O = 4\text{ mA}$ ; $V_{CC} = 1.65\text{ V}$	-	-	0.45	-	0.65	V
		$I_O = 8\text{ mA}$ ; $V_{CC} = 2.3\text{ V}$	-	-	0.6	-	0.8	V
		$I_O = 12\text{ mA}$ ; $V_{CC} = 2.7\text{ V}$	-	-	0.4	-	0.6	V
		$I_O = 24\text{ mA}$ ; $V_{CC} = 3.0\text{ V}$	-	-	0.55	-	0.8	V
$I_I$	input leakage current	$V_{CC} = 3.6\text{ V}$ ; $V_I = 5.5\text{ V}$ or GND	-	$\pm 0.1$	$\pm 5$	-	$\pm 20$	$\mu\text{A}$

**Table 6.** Static characteristics ...continued

At recommended operating conditions. Voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ <sup>[1]</sup>	Max	Min	Max	
I <sub>OZ</sub>	OFF-state output current	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; V <sub>CC</sub> = 3.6 V; V <sub>O</sub> = 5.5 V or GND;	-	0.1	±5	-	±20	μA
I <sub>OFF</sub>	power-off leakage current	V <sub>CC</sub> = 0 V; V <sub>I</sub> or V <sub>O</sub> = 5.5 V	-	0.1	±10	-	±20	μA
I <sub>CC</sub>	supply current	V <sub>CC</sub> = 3.6 V; V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A	-	0.1	10	-	40	μA
ΔI <sub>CC</sub>	additional supply current	per input pin; V <sub>CC</sub> = 2.7 V to 3.6 V; V <sub>I</sub> = V <sub>CC</sub> - 0.6 V; I <sub>O</sub> = 0 A	-	5	500	-	5000	μA
C <sub>I</sub>	input capacitance	V <sub>CC</sub> = 0 V to 3.6 V; V <sub>I</sub> = GND to V <sub>CC</sub>	-	5.0	-	-	-	pF

[1] All typical values are measured at V<sub>CC</sub> = 3.3 V (unless stated otherwise) and T<sub>amb</sub> = 25 °C.

## 10. Dynamic characteristics

**Table 7.** Dynamic characteristicsVoltages are referenced to GND (ground = 0 V). For test circuit see [Figure 6](#).

Symbol	Parameter	Conditions	T <sub>amb</sub> = -40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ <sup>[1]</sup>	Max	Min	Max	
t <sub>pd</sub>	propagation delay	An to Y <sub>n</sub> ; see <a href="#">Figure 4</a> <sup>[2]</sup>	-	15	-	-	-	ns
		V <sub>CC</sub> = 1.2 V	-	15	-	-	-	ns
		V <sub>CC</sub> = 1.65 V to 1.95 V	1.5	6.4	15.5	1.5	17.9	ns
		V <sub>CC</sub> = 2.3 V to 2.7 V	1.0	3.4	8.0	1.0	9.3	ns
		V <sub>CC</sub> = 2.7 V	1.5	3.4	7.1	1.5	9.0	ns
t <sub>en</sub>	enable time	$\overline{\text{OEn}}$ to Y <sub>n</sub> ; see <a href="#">Figure 5</a> <sup>[2]</sup>	-	20	-	-	-	ns
		V <sub>CC</sub> = 1.2 V	-	20	-	-	-	ns
		V <sub>CC</sub> = 1.65 V to 1.95 V	1.8	7.9	16.7	1.8	19.3	ns
		V <sub>CC</sub> = 2.3 V to 2.7 V	1.5	4.4	9.2	1.5	10.6	ns
		V <sub>CC</sub> = 2.7 V	1.5	4.5	8.5	1.5	11.0	ns
t <sub>dis</sub>	disable time	$\overline{\text{OEn}}$ to Y <sub>n</sub> ; see <a href="#">Figure 5</a> <sup>[2]</sup>	-	10.0	-	-	-	ns
		V <sub>CC</sub> = 1.2 V	-	10.0	-	-	-	ns
		V <sub>CC</sub> = 1.65 V to 1.95 V	2.5	4.3	11.3	2.5	13.0	ns
		V <sub>CC</sub> = 2.3 V to 2.7 V	1.0	2.4	6.4	1.0	7.4	ns
		V <sub>CC</sub> = 2.7 V	1.5	3.2	7.3	1.5	9.5	ns
t <sub>sk(o)</sub>	output skew time	V <sub>CC</sub> = 3.0 V to 3.6 V <sup>[3]</sup>	-	-	1.0	-	1.5	ns

**Table 7. Dynamic characteristics ...continued**

Voltages are referenced to GND (ground = 0 V). For test circuit see [Figure 6](#).

Symbol	Parameter	Conditions	T <sub>amb</sub> = -40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ <sup>[1]</sup>	Max	Min	Max	
C <sub>PD</sub>	power dissipation capacitance	per input; V <sub>I</sub> = GND to V <sub>CC</sub> <sup>[4]</sup>						
		V <sub>CC</sub> = 1.65 V to 1.95 V	-	5.5	-	-	-	pF
		V <sub>CC</sub> = 2.3 V to 2.7 V	-	8.8	-	-	-	pF
		V <sub>CC</sub> = 3.0 V to 3.6 V	-	11.7	-	-	-	pF

[1] Typical values are measured at T<sub>amb</sub> = 25 °C and V<sub>CC</sub> = 1.2 V, 1.8 V, 2.5 V, 2.7 V, and 3.3 V respectively.

[2] t<sub>pd</sub> is the same as t<sub>PLH</sub> and t<sub>PHL</sub>.

t<sub>en</sub> is the same as t<sub>PZL</sub> and t<sub>PZH</sub>.

t<sub>dis</sub> is the same as t<sub>PLZ</sub> and t<sub>PHZ</sub>.

[3] Skew between any two outputs of the same package switching in the same direction. This parameter is guaranteed by design.

[4] C<sub>PD</sub> is used to determine the dynamic power dissipation (P<sub>D</sub> in μW).

$P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \Sigma(C_L \times V_{CC}^2 \times f_o)$  where:

f<sub>i</sub> = input frequency in MHz; f<sub>o</sub> = output frequency in MHz

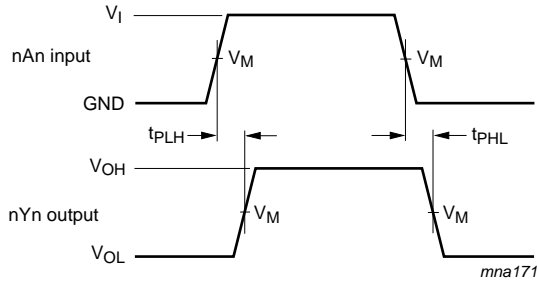
C<sub>L</sub> = output load capacitance in pF

V<sub>CC</sub> = supply voltage in Volts

N = number of inputs switching

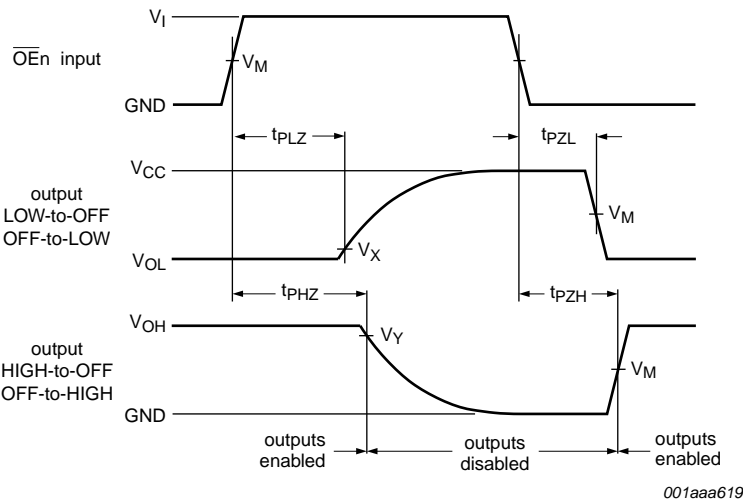
$\Sigma(C_L \times V_{CC}^2 \times f_o)$  = sum of the outputs

11. Waveforms



$V_M = 1.5\text{ V}$  at  $V_{CC} \geq 2.7\text{ V}$ .  
 $V_M = 0.5 \times V_{CC}$  at  $V_{CC} < 2.7\text{ V}$ .  
 $V_{OL}$  and  $V_{OH}$  are typical output voltage levels that occur with the output load.

Fig 4. Propagation delay input (An) to output (Yn)



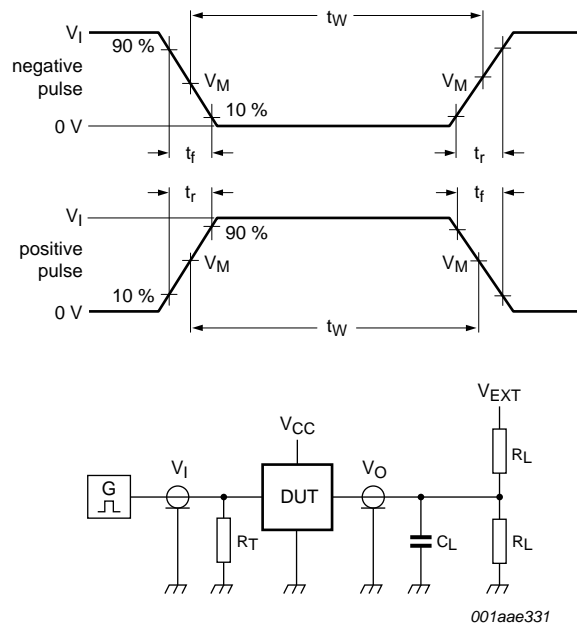
Measurement points are given in [Table 8](#).  
 $V_{OL}$  and  $V_{OH}$  are typical output voltage levels that occur with the output load.

Fig 5. 3-state enable and disable times

Table 8. Measurement points

Supply voltage	Input	Output		
$V_{CC}$	$V_M$	$V_M$	$V_X$	$V_Y$
$< 2.7\text{ V}$	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$	$V_{OL} + 0.1\text{ V}$	$V_{OH} - 0.1\text{ V}$
$\geq 2.7\text{ V}$	$1.5\text{ V}$	$1.5\text{ V}$	$V_{OL} + 0.3\text{ V}$	$V_{OH} - 0.3\text{ V}$





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

Definitions for 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 6. Test circuit for measuring switching times**

**Table 9. Test data**

Supply voltage	Input		Load		$V_{EXT}$		
	$V_I$	$t_r, t_f$	$C_L$	$R_L$	$t_{PLH}, t_{PHL}$	$t_{PLZ}, t_{PZL}$	$t_{PHZ}, t_{PZH}$
1.2 V	$V_{CC}$	$\leq 2$ ns	30 pF	1 k $\Omega$	open	$2 \times V_{CC}$	GND
1.65 V to 1.95 V	$V_{CC}$	$\leq 2$ ns	30 pF	1 k $\Omega$	open	$2 \times V_{CC}$	GND
2.3 V to 2.7 V	$V_{CC}$	$\leq 2$ ns	30 pF	500 $\Omega$	open	$2 \times V_{CC}$	GND
2.7 V	2.7 V	$\leq 2.5$ ns	50 pF	500 $\Omega$	open	$2 \times V_{CC}$	GND
3.0 V to 3.6 V	2.7 V	$\leq 2.5$ ns	50 pF	500 $\Omega$	open	$2 \times V_{CC}$	GND

12. Package outline

SO24: plastic small outline package; 24 leads; body width 7.5 mm

SOT137-1

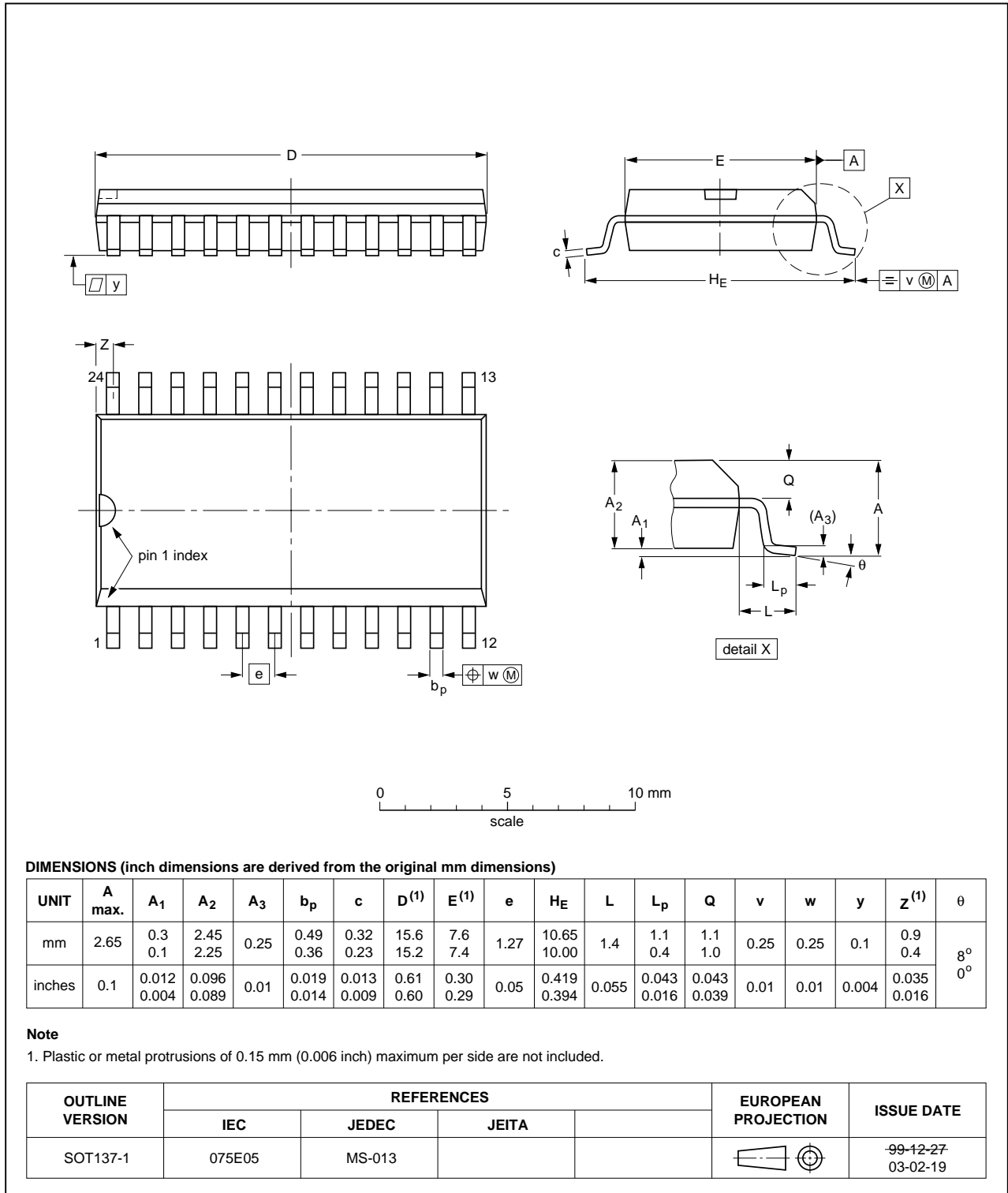


Fig 7. Package outline SOT137-1 (SO24)

SSOP24: plastic shrink small outline package; 24 leads; body width 5.3 mm

SOT340-1

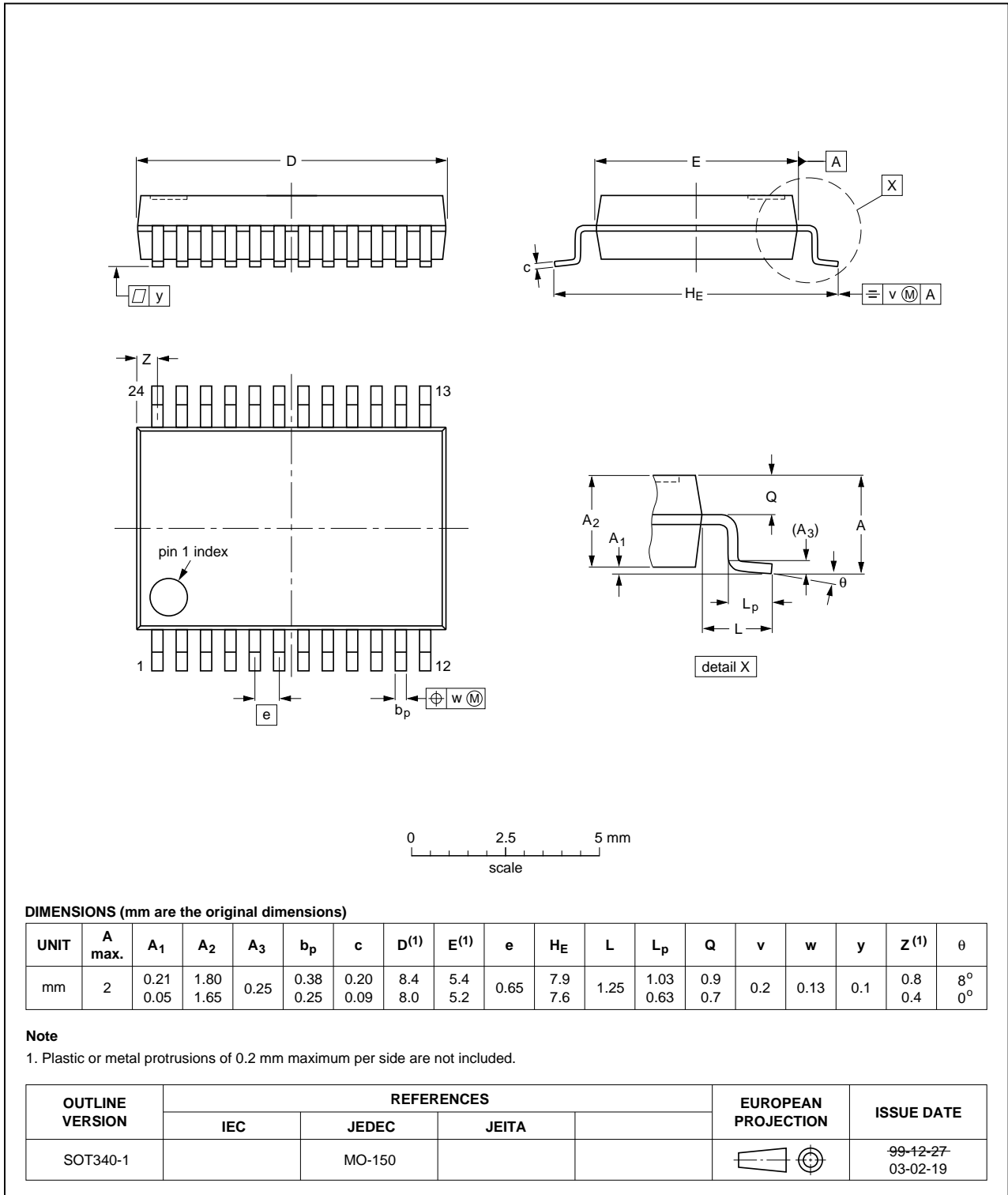


Fig 8. Package outline SOT340-1 (SSOP24)

TSSOP24: plastic thin shrink small outline package; 24 leads; body width 4.4 mm

SOT355-1

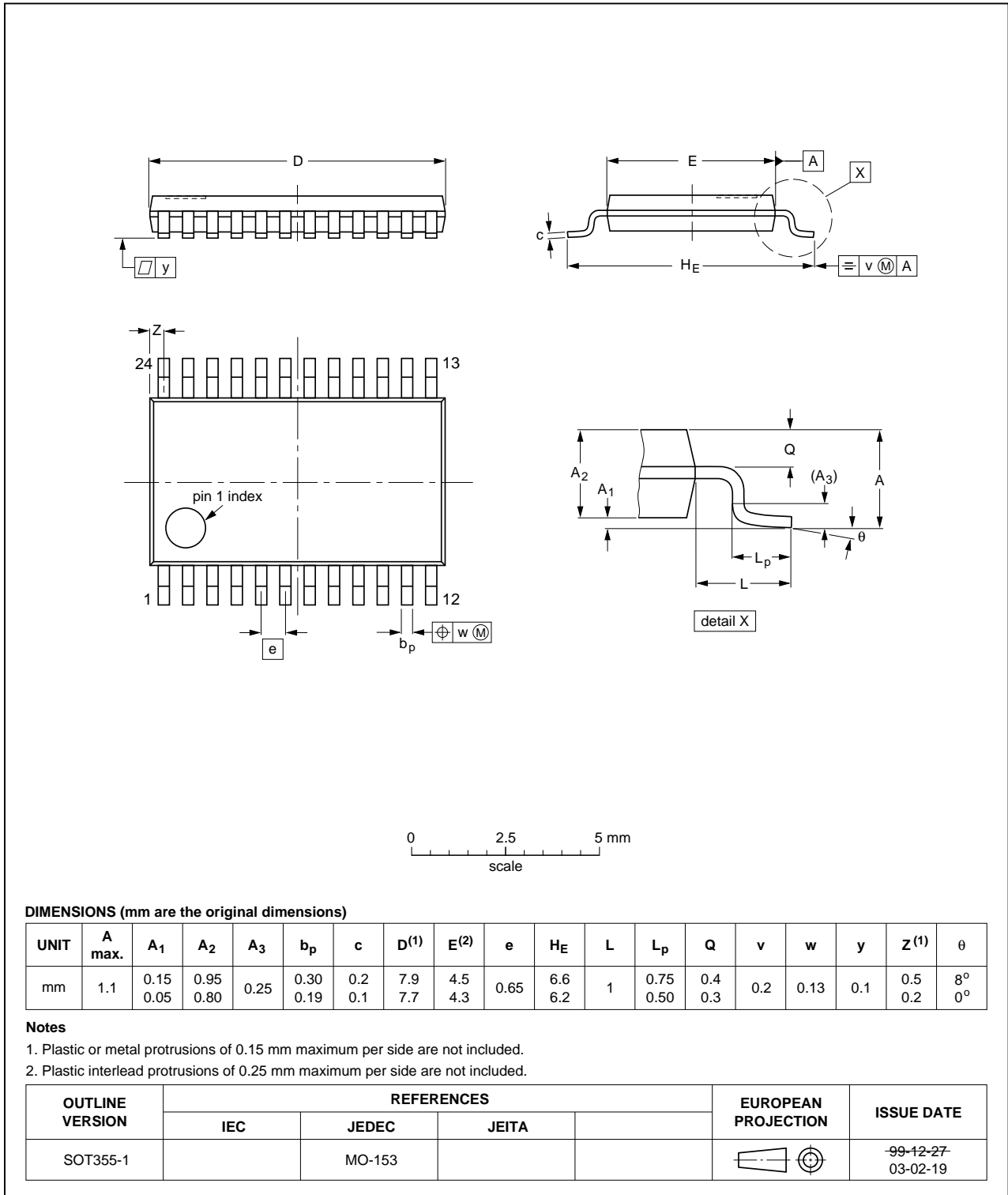


Fig 9. Package outline SOT355-1 (TSSOP24)

## 13. Abbreviations

Table 10. Abbreviations

Acronym	Description
CDM	Charged Device Model
DUT	Device Under Test
ESD	ElectroStatic Discharge
HBM	Human Body Model
MM	Machine Model
TTL	Transistor-Transistor Logic

## 14. Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74LVC827A v.4	20111125	Product data sheet	-	74LVC827A v.3
Modifications:	<ul style="list-style-type: none"> <li>Value changes for <math>t_{pd}</math>, <math>t_{en}</math> and <math>t_{dis}</math> in <a href="#">Table 7 "Dynamic characteristics"</a></li> <li>Corrected typographical errors</li> </ul>			
74LVC827A v.3	20111103	Product data sheet	-	74LVC827A v.2
Modifications:	<ul style="list-style-type: none"> <li>The format of this document has been redesigned to comply with the new identity guidelines of NXP Semiconductors.</li> <li>Legal texts have been adapted to the new company name where appropriate.</li> <li><a href="#">Table 4</a>, <a href="#">Table 5</a>, <a href="#">Table 6</a>, <a href="#">Table 7</a>, and <a href="#">Table 9</a>: values added for lower voltage ranges.</li> <li>Added: type number 74LVC827ABQ (DHVQFN24 package)</li> </ul>			
74LVC827A v.2	20040408	Product specification	-	74LVC827A v.1
74LVC827A v.1	19980904	Product specification	-	-

## 15. Legal information

### 15.1 Data sheet status

Document status <sup>[1][2]</sup>	Product status <sup>[3]</sup>	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".

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL <http://www.nexperia.com>.

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