

74LVC162244A; LVCH162244A

16-bit buffer/line driver; 30 Ω series termination resistors;
5 V tolerant input/output; 3-state

Rev. 7 — 11 February 2019

Product data sheet

1. General description

The 74LVC162244A; 74LVCH162244A are 16-bit non-inverting buffer/line drivers with 3-state bus compatible outputs. The device can be used as four 4-bit buffers, two 8-bit buffers or one 16-bit buffer. It features four output enable inputs, (1OE to 4OE) each controlling four of the 3-state outputs. A HIGH on nOE causes the outputs to assume a high-impedance OFF-state. The device is designed with 30 Ω series termination resistors in both HIGH and LOW output stages to reduce line noise.

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 in mixed 3.3 V and 5 V applications.

The 74LVCH162244A bus hold on data inputs eliminates the need for external pull-up resistors to hold unused inputs.

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
- Multibyte flow-through standard pin-out architecture
- Low inductance multiple power and ground pins for minimum noise and ground bounce
- Direct interface with TTL levels
- High-impedance when $V_{CC} = 0$ V
- All data inputs have bus hold. (74LVCH162244A only)
- 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-A115-B exceeds 200 V
 - CDM ANSI/ESDA/Jedec JS-002 exceeds 1000 V
- Specified from -40 °C to +85 °C and -40 °C to +125 °C

16-bit buffer/line driver; 30 Ω series termination resistors; 5 V tolerant input/output; 3-state

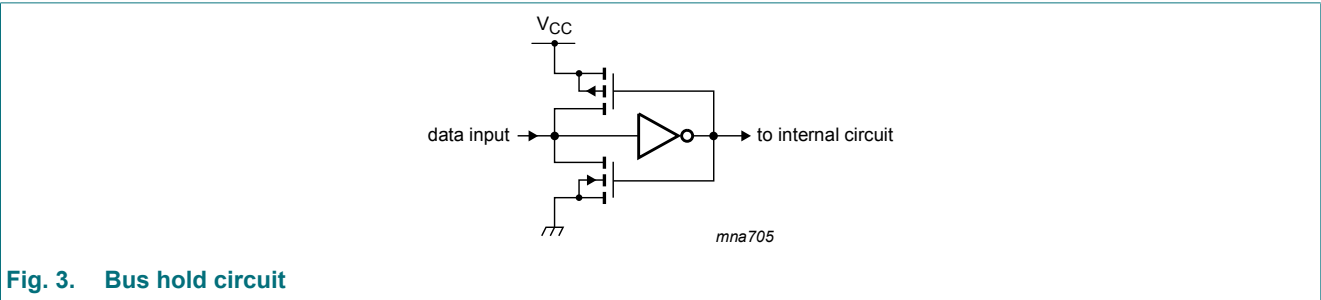
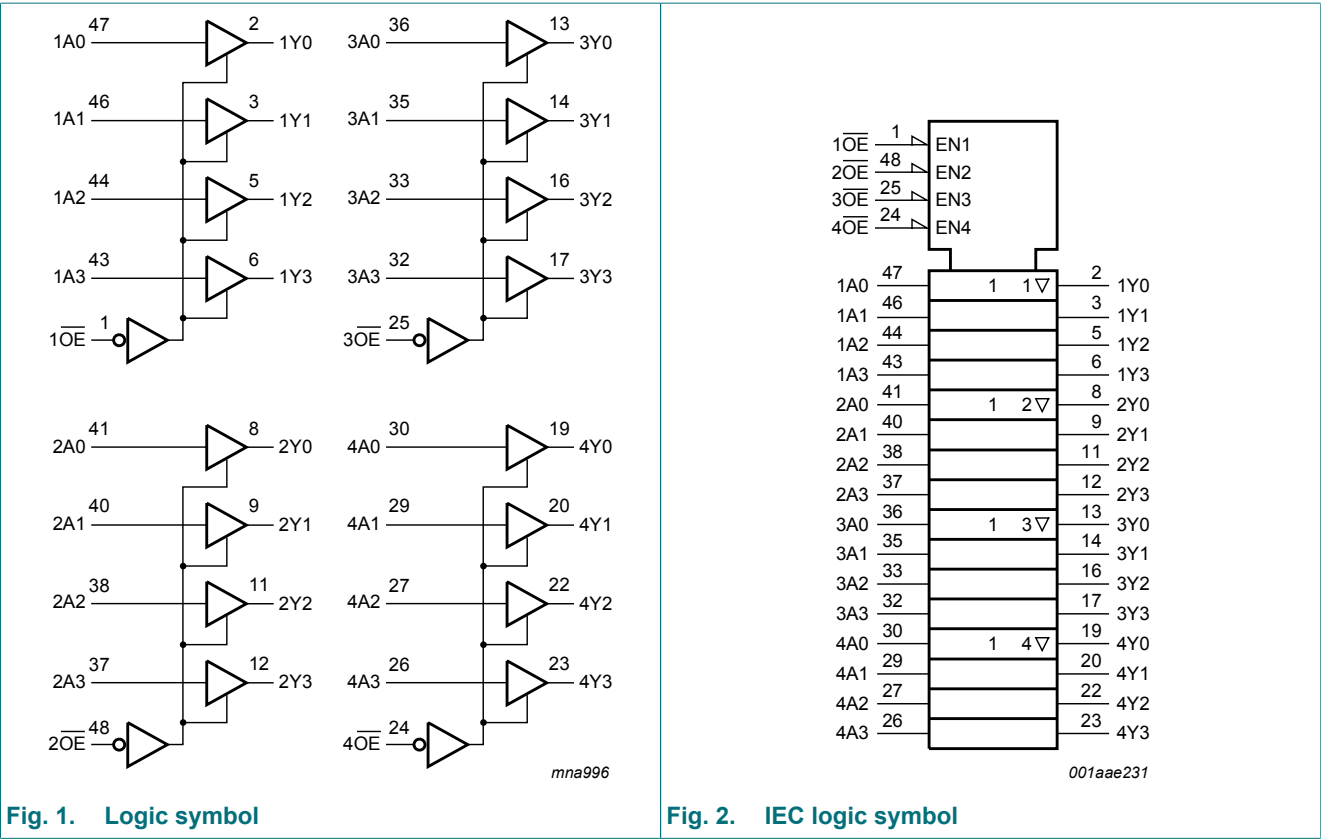
3. Ordering information

Table 1. Ordering information

Type number	Temperature range	Package		
		Name	Description	Version
74LVC162244ADL	-40 °C to +125 °C	SSOP48	plastic shrink small outline package; 48 leads; body width 7.5 mm	SOT370-1
74LVCH162244ADL				
74LVC162244ADGG	-40 °C to +125 °C	TSSOP48	plastic thin shrink small outline package; 48 leads; body width 6.1 mm	SOT362-1
74LVCH162244ADGG				
74LVC162244ADGV	-40 °C to +125 °C	TSSOP48 [1]	plastic thin shrink small outline package; 48 leads; body width 4.4 mm; lead pitch 0.4 mm	SOT480-1
74LVCH162244ADGV				

[1] Also known as TVSOP48.

4. Functional diagram



5. Pinning information

5.1. Pinning

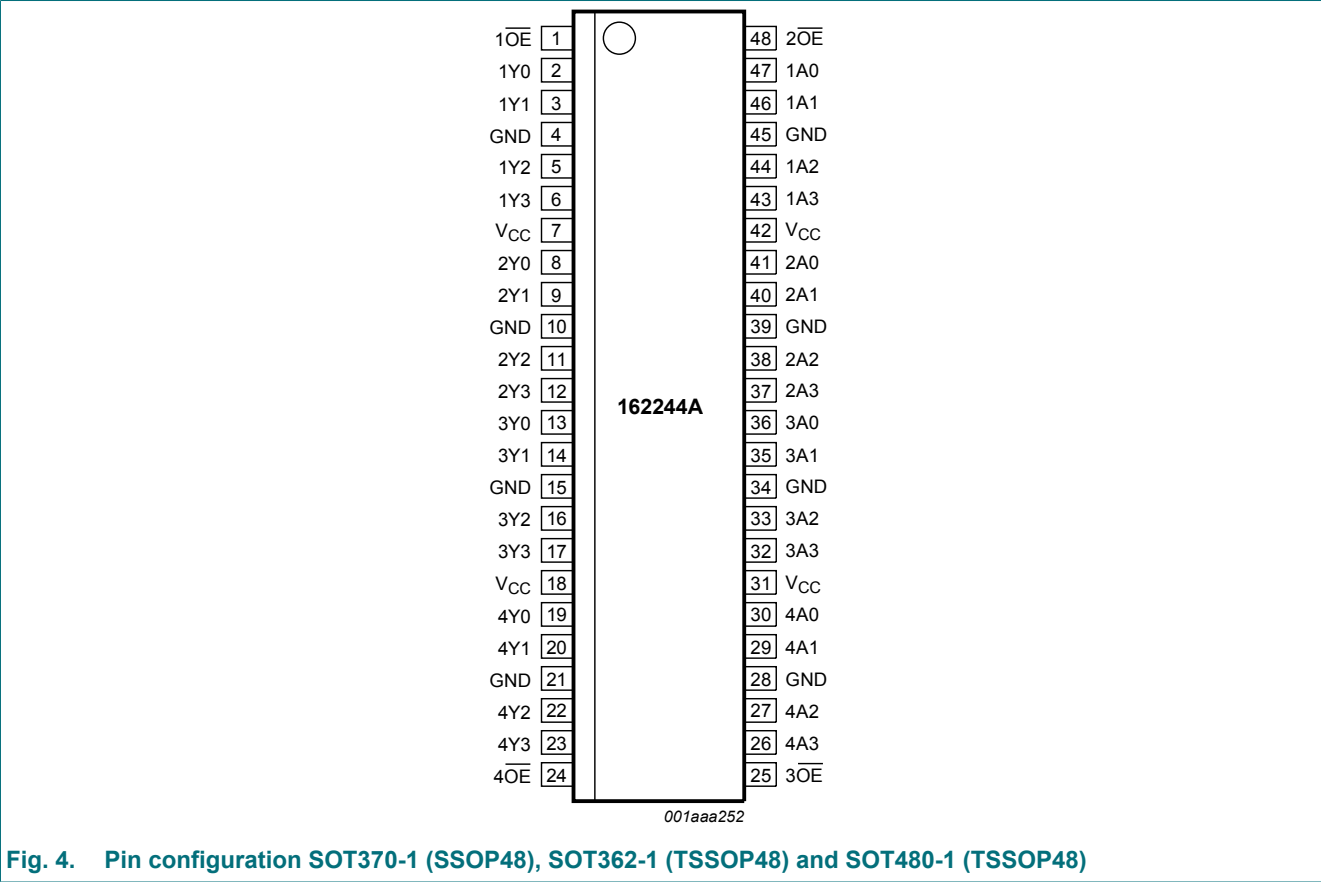


Fig. 4. Pin configuration SOT370-1 (SSOP48), SOT362-1 (TSSOP48) and SOT480-1 (TSSOP48)

5.2. Pin description

Table 2. Pin description

Symbol	Pin	Description
1OE, 2OE, 3OE, 4OE	1, 48, 25, 24	output enable input (active LOW)
1Y0 to 1Y3	2, 3, 5, 6	data output
2Y0 to 2Y3	8, 9, 11, 12	data output
3Y0 to 3Y3	13, 14, 16, 17	data output
4Y0 to 4Y3	19, 20, 22, 23	data output
GND	4, 10, 15, 21, 28, 34, 39, 45	ground (0 V)
V _{CC}	7, 18, 31, 42	supply voltage
1A0 to 1A3	47, 46, 44, 43	data input
2A0 to 2A3	41, 40, 38, 37	data input
3A0 to 3A3	36, 35, 33, 32	data input
4A0 to 4A3	30, 29, 27, 26	data input

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
nOE	nAn	nYn
L	L	L
L	H	H
H	X	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	+6.5	V
I_{IK}	input clamping current	$V_I < 0$ V	-50	-	mA
V_I	input voltage	[1]	-0.5	+6.5	V
I_{OK}	output clamping current	$V_O > V_{CC}$ or $V_O < 0$ V	-	± 50	mA
V_O	output voltage	output HIGH or LOW [2]	-0.5	$V_{CC} + 0.5$	V
		output 3-state [2]	-0.5	+6.5	V
I_O	output current	$V_O = 0$ V to V_{CC}	-	± 50	mA
I_{CC}	supply current		-	100	mA
I_{GND}	ground current		-100	-	mA
T_{stg}	storage temperature		-65	+150	$^{\circ}\text{C}$
P_{tot}	total power dissipation	$T_{amb} = -40$ $^{\circ}\text{C}$ to $+125$ $^{\circ}\text{C}$; [3]	-	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] Above 60 $^{\circ}\text{C}$ the value of P_{tot} derates linearly with 5.5 mW/K.

8. Recommended operating conditions

Table 5. Recommended operating conditions

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{CC}	supply voltage		1.65	-	3.6	V
		functional	1.2	-	3.6	V
V_I	input voltage		0	-	5.5	V
V_O	output voltage	output HIGH or LOW	0	-	V_{CC}	V
		output 3-state	0	-	5.5	V
T_{amb}	ambient temperature	in free air	-40	-	+125	$^{\circ}\text{C}$
$\Delta t/\Delta V$	input transition rise and fall rate	$V_{CC} = 1.2$ V to 2.7 V	0	-	20	ns/V
		$V_{CC} = 2.7$ V to 3.6 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 [1]	Max	Min	Max	
V_{IH}	HIGH-level input voltage	$V_{CC} = 1.2 \text{ V}$	1.08	-	-	1.08	-	V
		$V_{CC} = 1.65 \text{ V to } 1.95 \text{ V}$	$0.65V_{CC}$	-	-	$0.65V_{CC}$	-	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
		$V_{CC} = 1.65 \text{ V to } 1.95 \text{ V}$	-	-	$0.35V_{CC}$	-	$0.35V_{CC}$	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	$V_I = V_{IH} \text{ or } V_{IL}$						
		$I_O = -100 \mu\text{A}; V_{CC} = 1.65 \text{ V to } 3.6 \text{ V}$	$V_{CC} - 0.2$	-	-	$V_{CC} - 0.3$	-	V
		$I_O = -2 \text{ mA}; V_{CC} = 1.65 \text{ V}$	1.2	-	-	1.05	-	V
		$I_O = -4 \text{ mA}; V_{CC} = 2.3 \text{ V}$	1.7	-	-	1.55	-	V
		$I_O = -6 \text{ mA}; V_{CC} = 2.7 \text{ V}$	2.2	-	-	2.05	-	V
		$I_O = -12 \text{ mA}; V_{CC} = 3.0 \text{ V}$	2.2	-	-	2.0	-	V
V_{OL}	LOW-level output voltage	$V_I = V_{IH} \text{ or } V_{IL}$						
		$I_O = 100 \mu\text{A}; V_{CC} = 1.65 \text{ V to } 3.6 \text{ V}$	-	-	0.2	-	0.3	V
		$I_O = 2 \text{ mA}; V_{CC} = 1.65 \text{ V}$	-	-	0.45	-	0.65	V
		$I_O = 4 \text{ mA}; V_{CC} = 2.3 \text{ V}$	-	-	0.6	-	0.8	V
		$I_O = 6 \text{ mA}; V_{CC} = 2.7 \text{ V}$	-	-	0.4	-	0.6	V
		$I_O = 12 \text{ mA}; V_{CC} = 3.0 \text{ V}$	-	-	0.55	-	0.8	V
I_I	input leakage current	$V_{CC} = 3.6 \text{ V}; V_I = 5.5 \text{ V or GND}$	-	± 0.1	± 5	-	± 20	μA
I_{OZ}	OFF-state output current	$V_I = V_{IH} \text{ or } V_{IL}; V_{CC} = 3.6 \text{ V}; V_O = 5.5 \text{ V or GND}$ [2]	-	± 0.1	± 5	-	± 20	μA
I_{OFF}	power-off leakage current	$V_{CC} = 0 \text{ V}; V_I \text{ or } V_O = 5.5 \text{ V}$	-	± 0.1	± 10	-	± 20	μA
I_{CC}	supply current	$V_{CC} = 3.6 \text{ V}; V_I = V_{CC} \text{ or GND}; I_O = 0 \text{ A}$	-	0.1	20	-	80	μA
ΔI_{CC}	additional supply current	per input pin; $V_{CC} = 2.7 \text{ V to } 3.6 \text{ V}; V_I = V_{CC} - 0.6 \text{ V}; I_O = 0 \text{ A}$	-	5	500	-	5000	μA
C_I	input capacitance	$V_{CC} = 0 \text{ V to } 3.6 \text{ V}; V_I = \text{GND to } V_{CC}$	-	5.0	-	-	-	pF
I_{BHL}	bus hold LOW current	$V_{CC} = 1.65; V_I = 0.58 \text{ V}$ [3] [4]	10	-	-	10	-	μA
		$V_{CC} = 2.3; V_I = 0.7 \text{ V}$	30	-	-	25	-	μA
		$V_{CC} = 3.0; V_I = 0.8 \text{ V}$	75	-	-	60	-	μA

16-bit buffer/line driver; 30 Ω series termination resistors; 5 V tolerant input/output; 3-state

Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ [1]	Max	Min	Max	
I_{BHH}	bus hold HIGH current	$V_{CC} = 1.65$; $V_I = 1.07$ V [3] [4]	-10	-	-	-10	-	μ A
		$V_{CC} = 2.3$; $V_I = 1.7$ V	-30	-	-	-25	-	μ A
		$V_{CC} = 3.0$; $V_I = 2.0$ V	-75	-	-	-60	-	μ A
I_{BHLO}	bus hold LOW overdrive current	$V_{CC} = 1.95$ V [3] [5]	200	-	-	200	-	μ A
		$V_{CC} = 2.7$ V	300	-	-	300	-	μ A
		$V_{CC} = 3.6$ V	500	-	-	500	-	μ A
I_{BHHO}	bus hold HIGH overdrive current	$V_{CC} = 1.95$ V [3] [5]	-200	-	-	-200	-	μ A
		$V_{CC} = 2.7$ V	-300	-	-	-300	-	μ A
		$V_{CC} = 3.6$ V	-500	-	-	-500	-	μ A

[1] All typical values are measured at $V_{CC} = 3.3$ V and $T_{amb} = 25$ °C.[2] The bus hold circuit is switched off when $V_I > V_{CC}$ allowing 5.5 V on the input terminal.

[3] Valid for data inputs only. Control inputs do not have a bus hold circuit.

[4] The specified sustaining current at the data input holds the input below the specified V_I level.

[5] The specified overdrive current at the data input forces the data input to the opposite logic input state.

10. Dynamic characteristics

Table 7. Dynamic characteristics

Voltages are referenced to GND (ground = 0 V). For test circuit see Fig. 7.

Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ [1]	Max	Min	Max	
t_{pd}	propagation delay	nAn to nYn; see Fig. 5 [2]						
		$V_{CC} = 1.2$ V	-	11.0	-	-	-	ns
		$V_{CC} = 1.65$ V to 1.95 V	1.5	6.0	15.0	1.5	17.2	ns
		$V_{CC} = 2.3$ V to 2.7 V	1.0	3.2	7.4	1.0	8.2	ns
		$V_{CC} = 2.7$ V	1.0	3.3	6.7	1.0	8.5	ns
		$V_{CC} = 3.0$ V to 3.6 V	1.0	2.7	5.8	1.0	7.5	ns
t_{en}	enable time	nOE to nYn; see Fig. 6 [2]						
		$V_{CC} = 1.2$ V	-	15.0	-	-	-	ns
		$V_{CC} = 1.65$ V to 1.95 V	1.7	6.8	15.3	1.7	17.7	ns
		$V_{CC} = 2.3$ V to 2.7 V	1.5	3.8	8.0	1.5	8.9	ns
		$V_{CC} = 2.7$ V	1.5	4.2	7.6	1.5	9.5	ns
		$V_{CC} = 3.0$ V to 3.6 V	1.0	3.1	6.0	1.0	7.5	ns
t_{dis}	disable time	nOE to nYn; see Fig. 6 [2]						
		$V_{CC} = 1.2$ V	-	10.0	-	-	-	ns
		$V_{CC} = 1.65$ V to 1.95 V	2.2	3.9	8.2	2.2	9.5	ns
		$V_{CC} = 2.3$ V to 2.7 V	0.5	2.1	4.4	0.5	5.0	ns
		$V_{CC} = 2.7$ V	1.5	3.1	4.7	1.5	6.0	ns
		$V_{CC} = 3.0$ V to 3.6 V	1.5	2.8	4.5	1.5	6.0	ns

16-bit buffer/line driver; 30 Ω series termination resistors; 5 V tolerant input/output; 3-state

Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ [1]	Max	Min	Max	
C _{PD}	power dissipation capacitance	per input; V _I = GND to V _{CC} [3]						
		V _{CC} = 1.65 V to 1.95 V	-	4.8	-	-	-	pF
		V _{CC} = 2.3 V to 2.7 V	-	8.3	-	-	-	pF
		V _{CC} = 3.0 V to 3.6 V	-	11.4	-	-	-	pF

- [1] Typical values are measured at T_{amb} = 25 °C and V_{CC} = 1.2 V, 1.8 V, 2.5 V, 2.7 V and 3.3 V respectively.
- [2] t_{pd} is the same as t_{PLH} and t_{PHL}.
t_{en} is the same as t_{PZL} and t_{PZH}.
t_{dis} is the same as t_{PLZ} and t_{PHZ}.
- [3] C_{PD} is used to determine the dynamic power dissipation (P_D 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_i = input frequency in MHz; f_o = output frequency in MHz
C_L = output load capacitance in pF
V_{CC} = supply voltage in Volts
N = number of inputs switching
Σ(C_L × V_{CC}² × f_o) = sum of the outputs.

10.1. Waveforms and test circuit

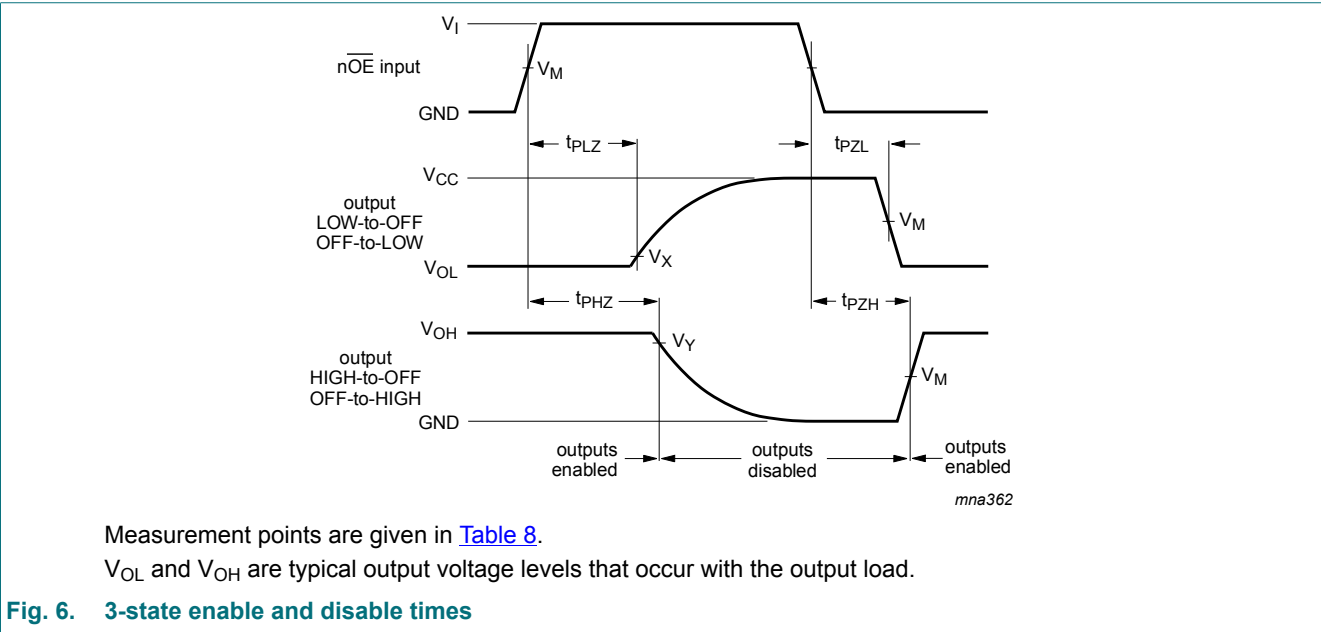
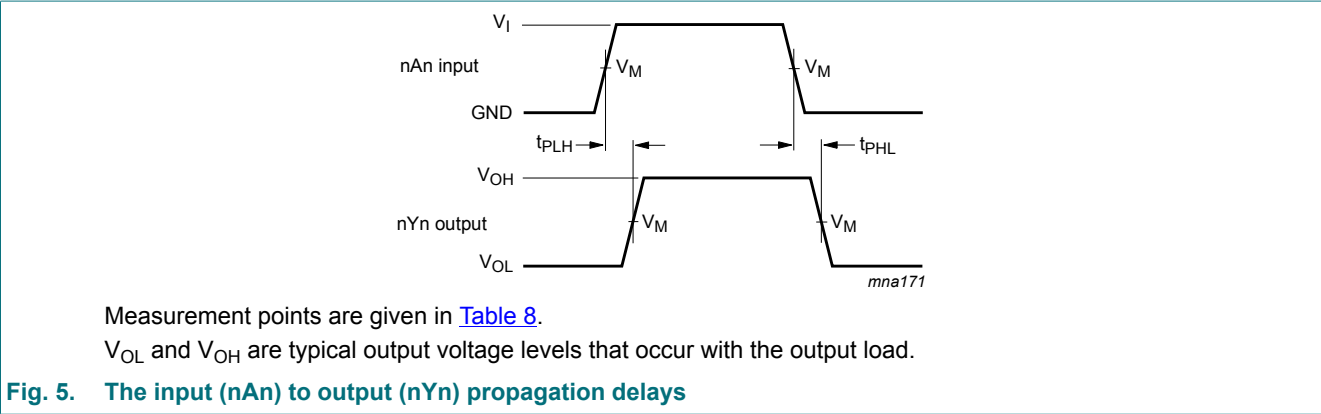
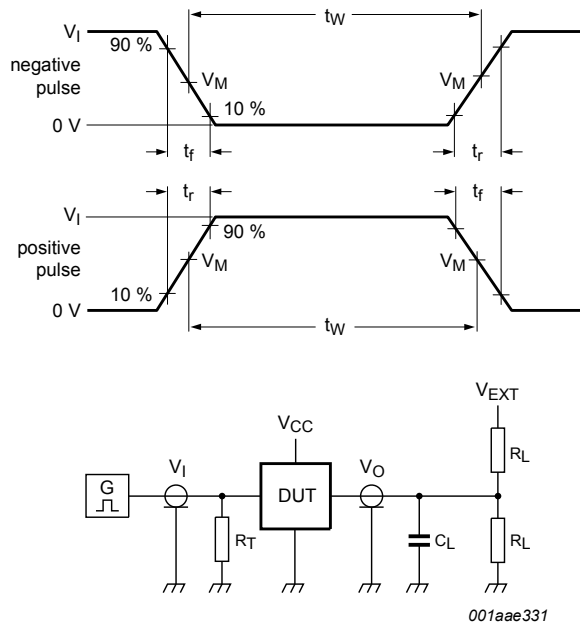


Table 8. Measurement points

Supply voltage	Input		Output		
V_{CC}	V_M	V_I	V_M	V_X	V_Y
1.2 V	$0.5 \times V_{CC}$	V_{CC}	$0.5 \times V_{CC}$	$V_{OL} + 0.15 \text{ V}$	$V_{OH} - 0.15 \text{ V}$
1.65 V to 1.95 V	$0.5 \times V_{CC}$	V_{CC}	$0.5 \times V_{CC}$	$V_{OL} + 0.15 \text{ V}$	$V_{OH} - 0.15 \text{ V}$
2.3 V to 2.7 V	$0.5 \times V_{CC}$	V_{CC}	$0.5 \times V_{CC}$	$V_{OL} + 0.15 \text{ V}$	$V_{OH} - 0.15 \text{ V}$
2.7 V	1.5 V	2.7 V	1.5 V	$V_{OL} + 0.3 \text{ V}$	$V_{OH} - 0.3 \text{ V}$
3.0 V to 3.6 V	1.5 V	2.7 V	1.5 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. 7. 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}	$\leq 2 \text{ ns}$	30 pF	1 k Ω	open	$2 \times V_{CC}$	GND
1.65 V to 1.95 V	V_{CC}	$\leq 2 \text{ ns}$	30 pF	1 k Ω	open	$2 \times V_{CC}$	GND
2.3 V to 2.7 V	V_{CC}	$\leq 2 \text{ ns}$	30 pF	500 Ω	open	$2 \times V_{CC}$	GND
2.7 V	2.7 V	$\leq 2.5 \text{ ns}$	50 pF	500 Ω	open	$2 \times V_{CC}$	GND
3.0 V to 3.6 V	2.7 V	$\leq 2.5 \text{ ns}$	50 pF	500 Ω	open	$2 \times V_{CC}$	GND

11. Package outline

SSOP48: plastic shrink small outline package; 48 leads; body width 7.5 mm

SOT370-1

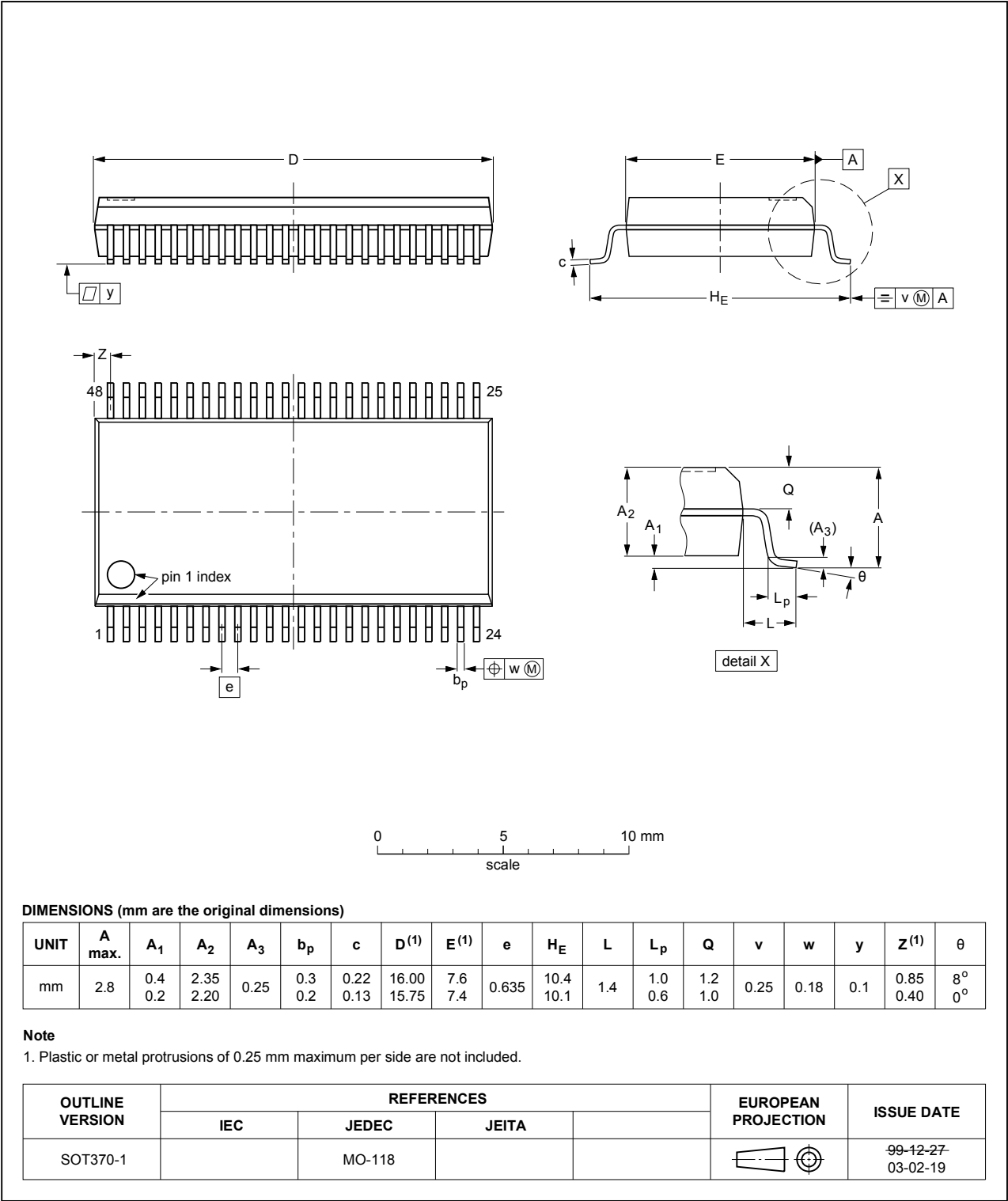


Fig. 8. Package outline SOT370-1 (SSOP48)

16-bit buffer/line driver; 30 Ω series termination resistors; 5 V tolerant input/output; 3-state

TSSOP48: plastic thin shrink small outline package; 48 leads; body width 6.1 mm

SOT362-1

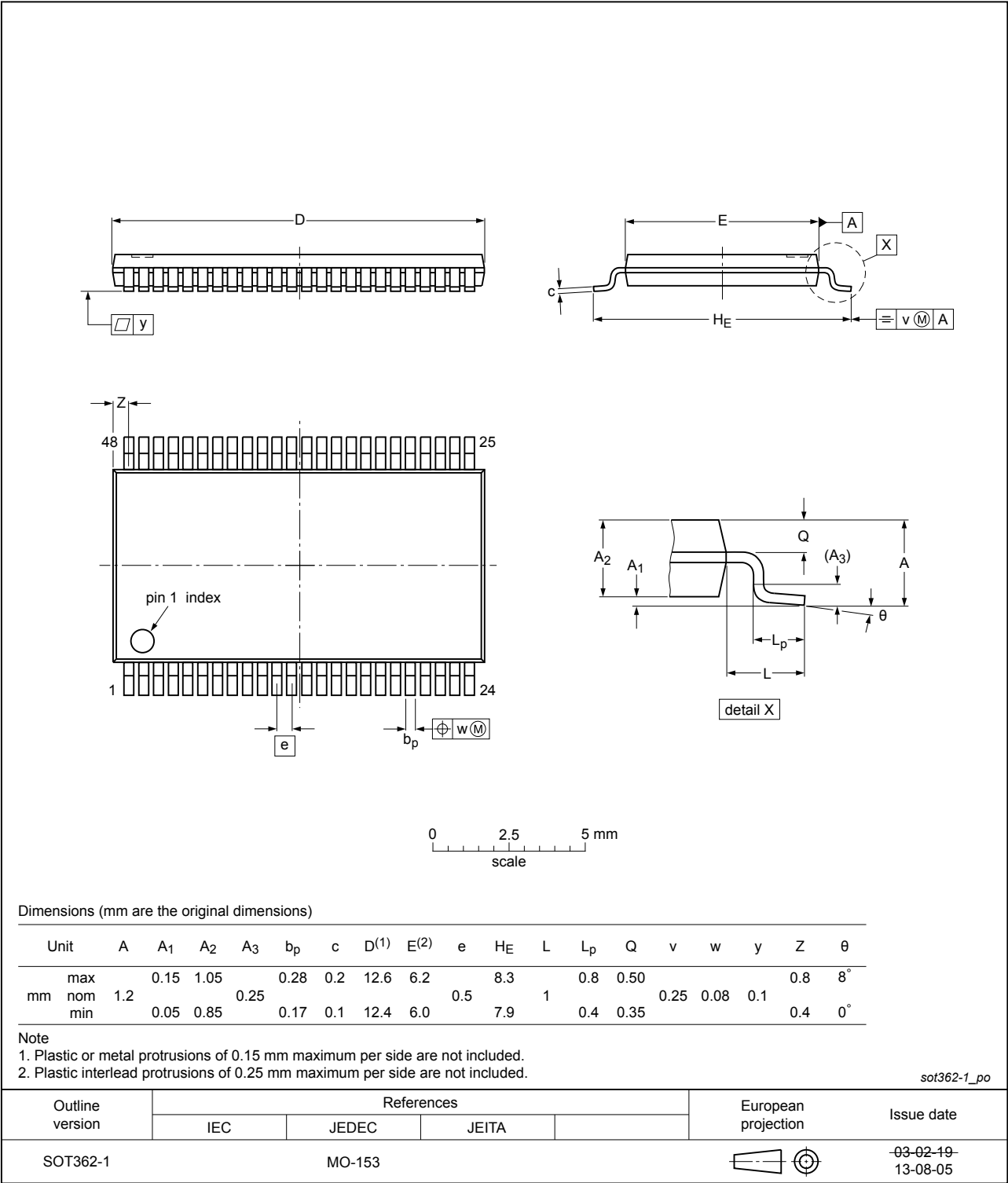


Fig. 9. Package outline SOT362-1 (TSSOP48)

TSSOP48: plastic thin shrink small outline package; 48 leads; body width 4.4 mm; lead pitch 0.4 mm

SOT480-1

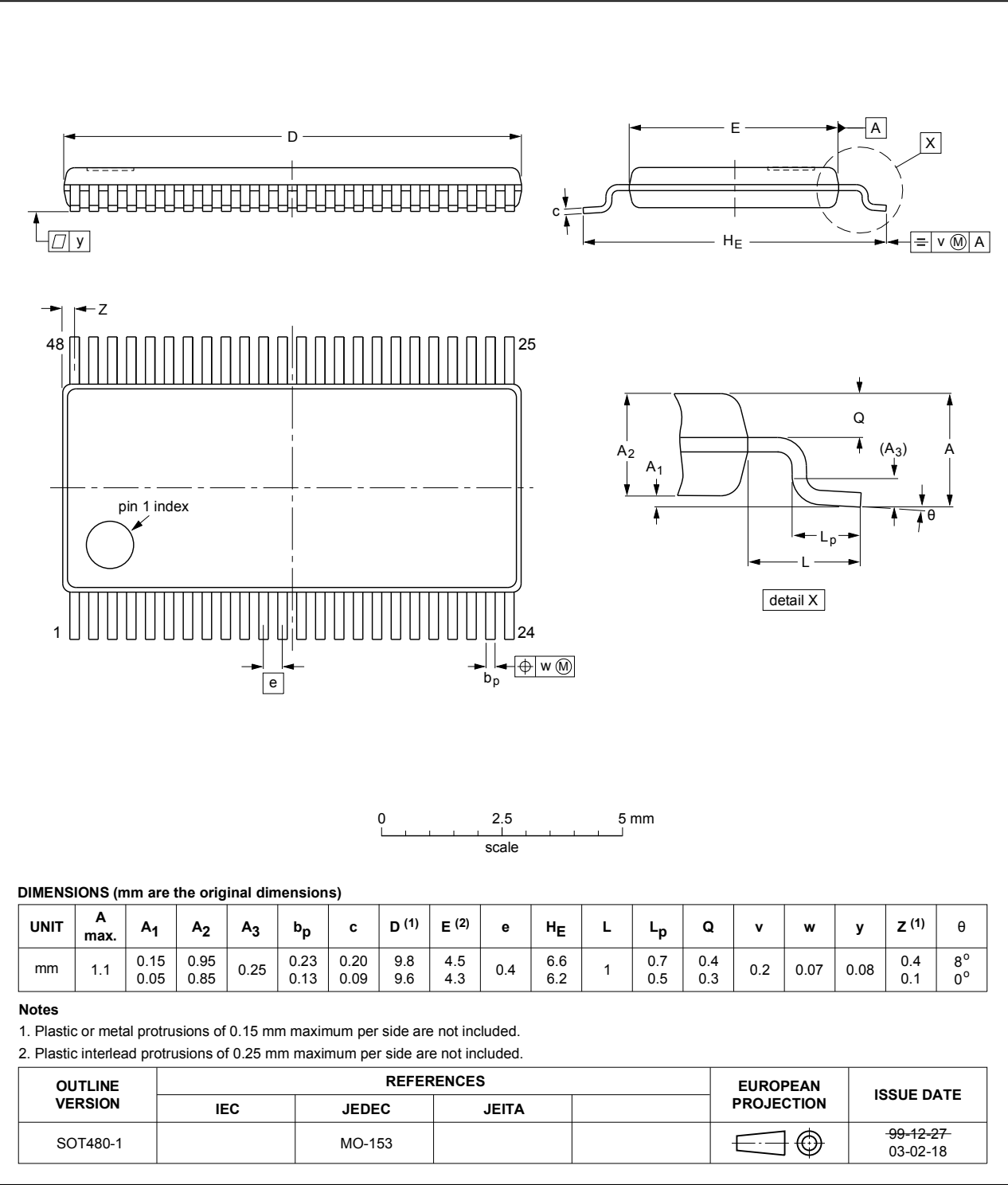


Fig. 10. Package outline SOT480-1 (TSSOP48)

12. Abbreviations

Table 10. Abbreviations

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

13. Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74LVC_LVCH162244A v.7	20190211	Product data sheet	-	74LVC_LVCH162244A v.6
Modifications:	<ul style="list-style-type: none"> The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia. Legal texts have been adapted to the new company name where appropriate. Type numbers 74LVC162244ADGV and 74LVCH162244ADGV (SOT480-1) added. Fig. 1: Logic symbol updated Package outline drawing SOT362-1 (TSSOP48) updated. 			
74LVC_LVCH162244A v.6	20111216	Product data sheet	-	74LVC_LVCH162244A v.5
Modifications:	<ul style="list-style-type: none"> Maximum propagation delay value for $V_{CC} = 1.65\text{ V}$ to 1.95 V at $+125\text{ }^{\circ}\text{C}$ changed from 15.7 ns to 17.2 ns Maximum enable time value for $V_{CC} = 1.65\text{ V}$ to 1.95 V at $+125\text{ }^{\circ}\text{C}$ changed from 16.1 ns to 17.7 ns Maximum disable time value for $V_{CC} = 1.65\text{ V}$ to 1.95 V at $+125\text{ }^{\circ}\text{C}$ changed from 8.7 ns to 9.5 ns 			
74LVC_LVCH162244A v.5	20111108	Product data sheet	-	74LVC_LVCH162244A v.4
Modifications:	<ul style="list-style-type: none"> The format of this document has been redesigned to comply with the new identity guidelines of NXP Semiconductors. Legal texts have been adapted to the new company name where appropriate. Table 5, Table 6, Table 7 and Table 9: values added for lower voltage ranges. 			
74LVC_LVCH162244A v.4	20031212	Product specification	-	74LVC_H162244A v.3
74LVC_H162244A v.3	19980217	Product specification	-	74LVC162244A_LVCH162244A v.3
74LVC162244A_LVCH162244A v.3	19980217	Product specification	-	74LVC162244A v.2
74LVC162244A v.2	19970801	Product specification	-	74LVC162244A v.1

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".
- [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 <https://www.nexperia.com>.

Definitions

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