

74LVC2244A

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

Rev. 5 — 3 November 2011

Product data sheet

1. General description

The 74LVC2244A is an octal non-inverting buffer/line driver with 3-state outputs. The 3-state outputs are controlled by the output enable input pins $\overline{1OE}$ and $\overline{2OE}$. A HIGH on pin $\overline{nOE}$ causes the outputs to assume a high-impedance OFF-state. Schmitt trigger action at all inputs makes the circuit highly tolerant for slower input rise and fall times. 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 as translators in mixed 3.3 V and 5 V applications.

2. Features and benefits

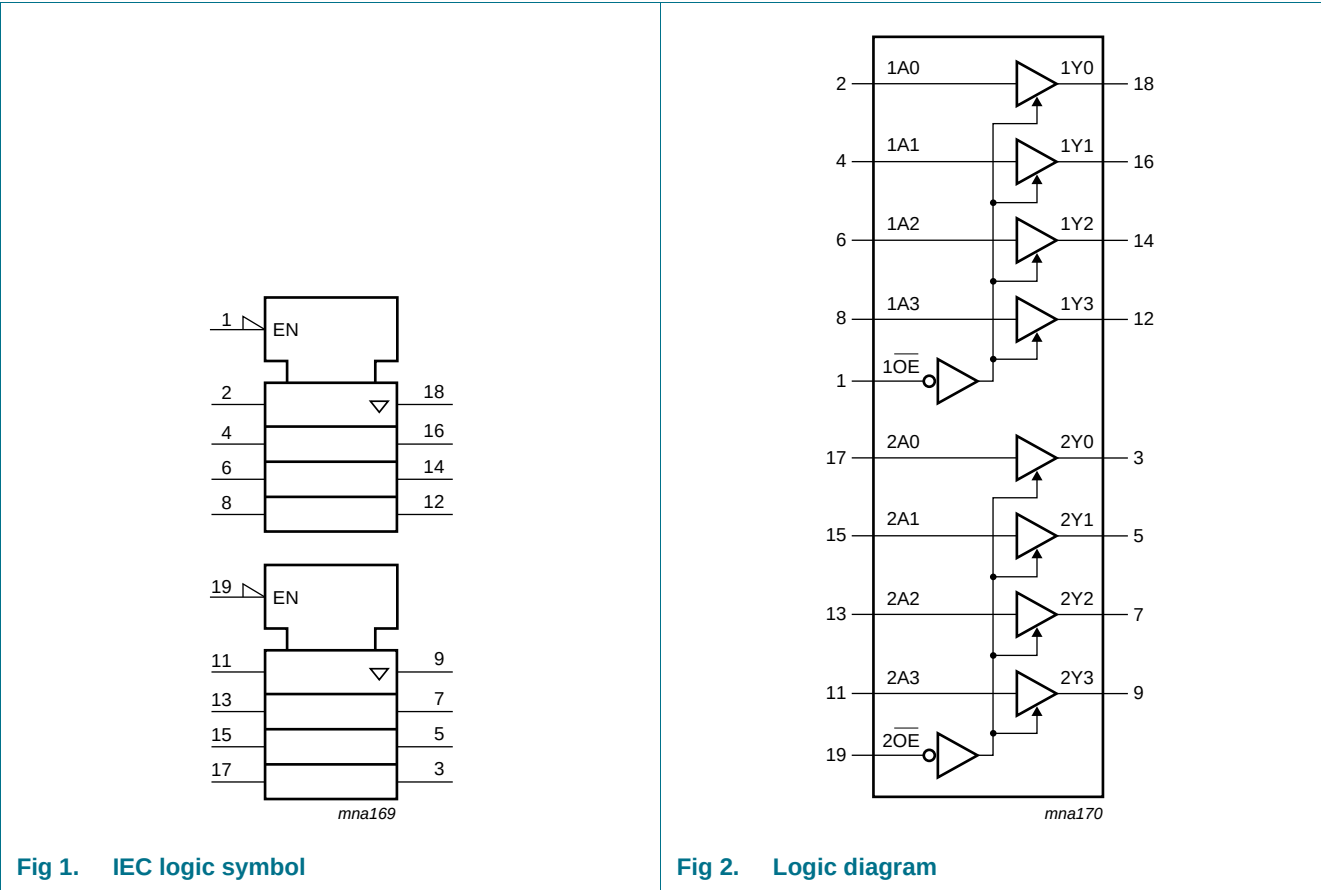
- 5 V tolerant inputs/outputs, for interfacing with 5 V logic
- Wide supply voltage range from 1.2 V to 3.6 V
- CMOS low-power consumption
- Direct interface with TTL levels
- Integrated 30 Ω termination resistors
- Complies with JEDEC standard:
 - ◆ JESD8-7A (1.65 V to 1.95 V)
 - ◆ JESD8-5A (2.3 V to 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

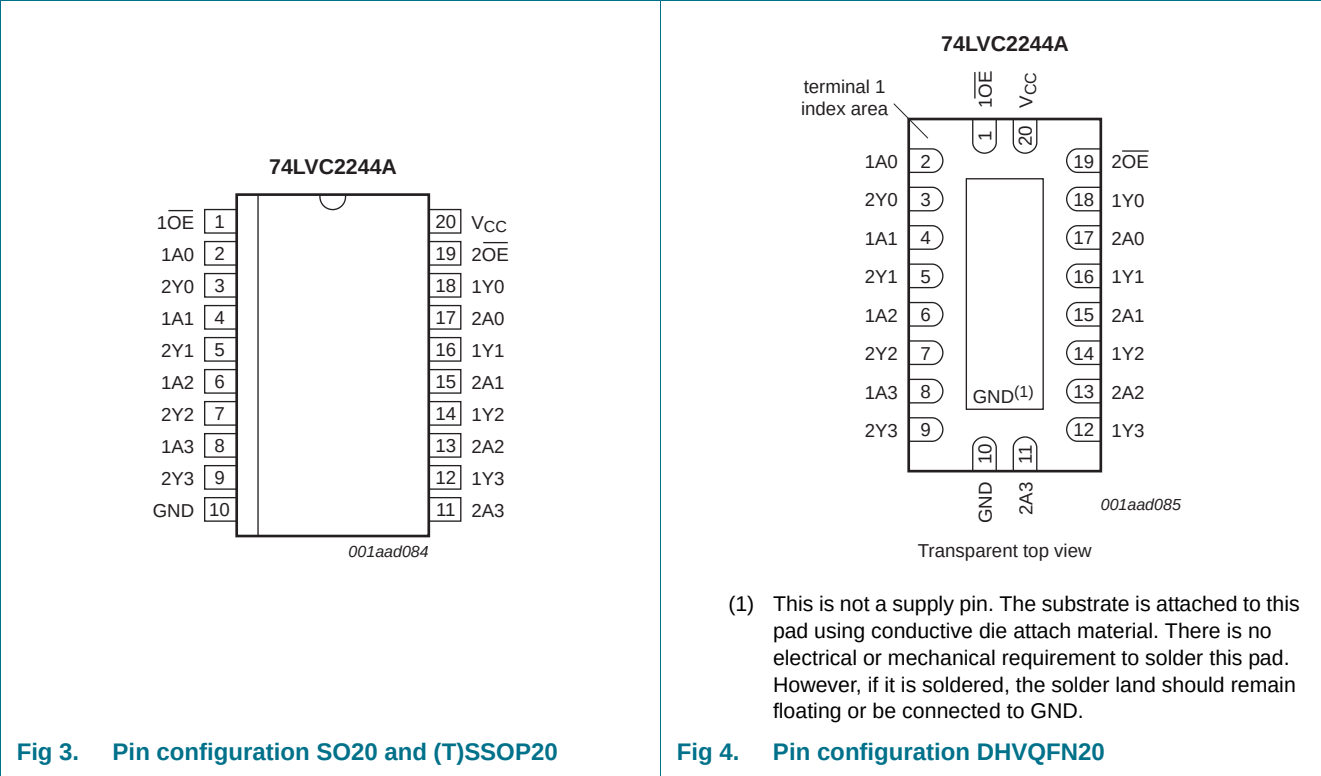
Type number	Package			
	Temperature range	Name	Description	Version
74LVC2244AD	−40 °C to +125 °C	SO20	plastic small outline package; 20 leads; body width 7.5 mm	SOT163-1
74LVC2244ADB	−40 °C to +125 °C	SSOP20	plastic shrink small outline package; 20 leads; body width 5.3 mm	SOT339-1
74LVC2244APW	−40 °C to +125 °C	TSSOP20	plastic thin shrink small outline package; 20 leads; body width 4.4 mm	SOT360-1
74LVC2244ABQ	−40 °C to +125 °C	DHVQFN20	plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 20 terminals; body 2.5 × 4.5 × 0.85 mm	SOT764-1

4. Functional diagram



5. Pinning information

5.1 Pinning



5.2 Pin description

Table 2. Pin description

Symbol	Pin	Description
1OE	1	output enable input (active LOW)
2OE	19	output enable input (active LOW)
1A[0:3]	2, 4, 6, 8	data input
2A[0:3]	17, 15, 13, 11	data input
1Y[0:3]	18, 16, 14, 12	data output
2Y[0:3]	3, 5, 7, 9	data output
GND	10	ground (0 V)
VCC	20	supply voltage

6. Functional description

Table 3. Functional table^[1]

Input		Output
nOE	nAn	nYn
L	L	L
L	H	H
H	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
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 state	^[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	°C
P_{tot}	total power dissipation	$T_{amb} = -40$ °C to +125 °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] For SO20 packages: above 70 °C derate linearly with 8 mW/K.
 For (T)SSOP20 packages: above 60 °C derate linearly with 5.5 mW/K.
 For DHVQFN20 packages: above 60 °C derate linearly with 4.5 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	-	-	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 ^[1]	Max	Min	Max	
V_{IH}	HIGH-level input voltage	$V_{CC} = 1.2 \text{ V}$	1.08	-	-	1.08	-	V
		$V_{CC} = 1.65 \text{ V to } 1.95 \text{ V}$	$0.65 \times V_{CC}$	-	-	$0.65 \times V_{CC}$	-	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	$V_I = V_{IH} \text{ or } V_{IL}$						
		$I_O = -100 \mu\text{A}; V_{CC} = 1.65 \text{ V to } 3.6 \text{ V}$	$V_{CC} - 0.2$	V_{CC}	-	$V_{CC} - 0.3$	-	V
		$I_O = -2 \text{ mA}; V_{CC} = 1.65 \text{ V}$	1.2	-	-	1.05	-	V
		$I_O = -4 \text{ mA}; V_{CC} = 2.3 \text{ V}$	1.8	-	-	1.65	-	V
		$I_O = -6 \text{ mA}; V_{CC} = 2.7 \text{ V}$	2.2	-	-	2.05	-	V
		$I_O = -9 \text{ mA}; V_{CC} = 2.7 \text{ V}$	2.4	-	-	2.25	-	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

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 ^[1]	Max	Min	Max	
I_{OZ}	OFF-state output current	$V_I = V_{IH}$ or V_{IL} ; $V_{CC} = 3.6$ V; $V_O = 5.5$ V or GND;	-	± 0.1	± 5	-	± 20	μA
I_{OFF}	power-off leakage current	$V_{CC} = 0$ V; V_I or $V_O = 5.5$ V	-	± 0.1	± 10	-	± 20	μA
I_{CC}	supply current	$V_{CC} = 3.6$ V; $V_I = V_{CC}$ or GND; $I_O = 0$ A	-	0.1	10	-	40	μA
ΔI_{CC}	additional supply current	per input pin; $V_{CC} = 2.7$ V to 3.6 V; $V_I = V_{CC} - 0.6$ V; $I_O = 0$ A	-	5	500	-	5000	μA
C_I	input capacitance	$V_{CC} = 0$ V to 3.6 V; $V_I = \text{GND to } V_{CC}$	-	4.0	-	-	-	pF

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

10. Dynamic characteristics

Table 7. Dynamic characteristics

Voltages are referenced to GND (ground = 0 V). For test circuit see [Figure 7](#).

Symbol	Parameter	Conditions	T _{amb} = –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 Figure 5 ^[2]						
		V _{CC} = 1.2 V	-	35	-	-	-	ns
		V _{CC} = 1.65 V to 1.95 V	1.9	7.8	17.7	1.9	18.6	ns
		V _{CC} = 2.3 V to 2.7 V	1.5	4.1	8.7	1.5	9.6	ns
		V _{CC} = 2.7 V	1.5	4.1	6.4	1.5	7.0	ns
		V _{CC} = 3.0 V to 3.6 V	1.5	3.5	5.5	1.5	8.0	ns
t _{en}	enable time	nOE to nYn; see Figure 6 ^[2]						
		V _{CC} = 1.2 V	-	38	-	-	-	ns
		V _{CC} = 1.65 V to 1.95 V	2.3	8.9	19.7	2.3	20.7	ns
		V _{CC} = 2.3 V to 2.7 V	1.9	5.0	10.3	1.9	11.4	ns
		V _{CC} = 2.7 V	1.5	5.1	8.1	1.5	9.0	ns
		V _{CC} = 3.0 V to 3.6 V	1.0	4.0	7.1	1.0	10.5	ns
t _{dis}	disable time	nOE to nYn; see Figure 6 ^[2]						
		V _{CC} = 1.2 V	-	9.0	-	-	-	ns
		V _{CC} = 1.65 V to 1.95 V	2.9	4.7	9.3	2.9	9.8	ns
		V _{CC} = 2.3 V to 2.7 V	1.0	2.6	5.0	1.0	5.6	ns
		V _{CC} = 2.7 V	1.5	3.4	6.4	1.5	7.0	ns
		V _{CC} = 3.0 V to 3.6 V	1.5	3.2	5.4	1.5	8.0	ns
t _{sk(o)}	output skew time	V _{CC} = 3.0 V to 3.6 V ^[3]	-	-	1.0	-	1.5	ns
C _{PD}	power dissipation capacitance	per input; V _I = GND to V _{CC} ^[4]						
		V _{CC} = 1.65 V to 1.95 V	-	1.8	-	-	-	pF
		V _{CC} = 2.3 V to 2.7 V	-	4.9	-	-	-	pF
		V _{CC} = 3.0 V to 3.6 V	-	7.7	-	-	-	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] Skew between any two outputs of the same package switching in the same direction. This parameter is guaranteed by design.

[4] C_{PD} is used to determine the dynamic power dissipation (P_D in μ W).

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

f_i = input frequency in MHz; f_o = output frequency in MHz

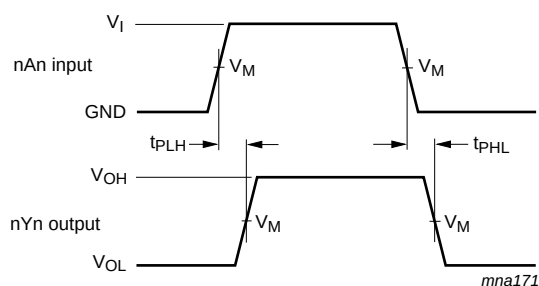
C_L = output load capacitance in pF

V_{CC} = supply voltage in Volts

N = number of inputs switching

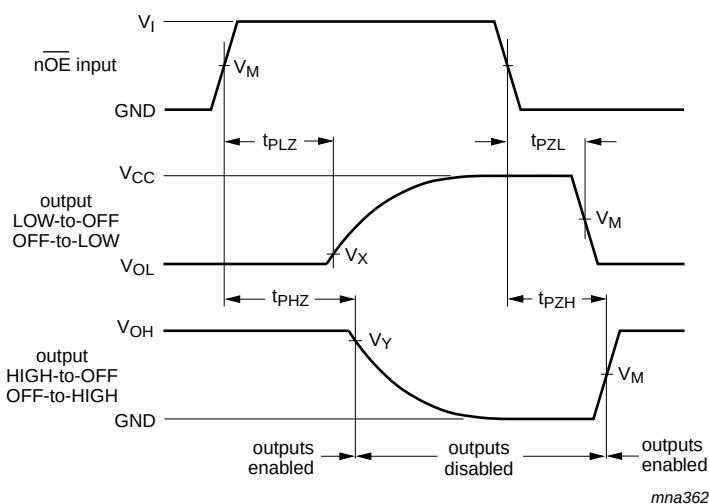
$\Sigma(C_L \times V_{CC}^2 \times f_o)$ = sum of the outputs

11. Waveforms


$$V_M = 1.5 \text{ V at } V_{CC} \geq 2.7 \text{ V.}$$
$$V_M = 0.5 \times V_{CC} \text{ at } V_{CC} < 2.7 \text{ V.}$$

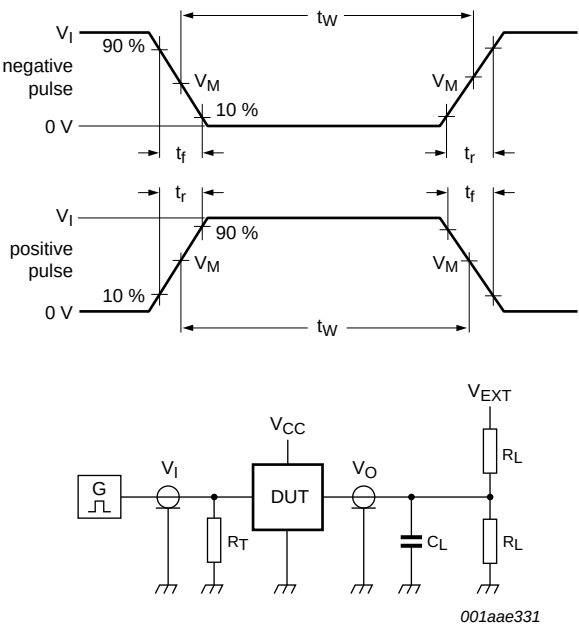
V_{OL} and V_{OH} are typical output voltage levels that occur with the output load.

Fig 5. The input (nAn) to output (nYn) propagation delays


$$V_M = 1.5 \text{ V at } V_{CC} \geq 2.7 \text{ V.}$$
$$V_M = 0.5 \times V_{CC} \text{ at } V_{CC} < 2.7 \text{ V.}$$
$$V_X = V_{OL} + 0.3 \text{ V at } V_{CC} \geq 2.7 \text{ V;}$$
$$V_X = V_{OL} + 0.15 \text{ V at } V_{CC} < 2.7 \text{ V.}$$
$$V_Y = V_{OH} - 0.3 \text{ V at } V_{CC} \geq 2.7 \text{ V;}$$
$$V_Y = V_{OH} - 0.15 \text{ V at } V_{CC} < 2.7 \text{ V.}$$

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

Fig 6. 3-state enable and disable times



Test data is given in [Table 8](#).
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 8. 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}	≤ 2 ns	30 pF	1 kΩ	open	2 × V _{CC}	GND
1.65 V to 1.95 V	V _{CC}	≤ 2 ns	30 pF	1 kΩ	open	2 × V _{CC}	GND
2.3 V to 2.7 V	V _{CC}	≤ 2 ns	30 pF	500 Ω	open	2 × V _{CC}	GND
2.7 V	2.7 V	≤ 2.5 ns	50 pF	500 Ω	open	2 × V _{CC}	GND
3.0 V to 3.6 V	2.7 V	≤ 2.5 ns	50 pF	500 Ω	open	2 × V _{CC}	GND

12. Package outline

SO20: plastic small outline package; 20 leads; body width 7.5 mm

SOT163-1

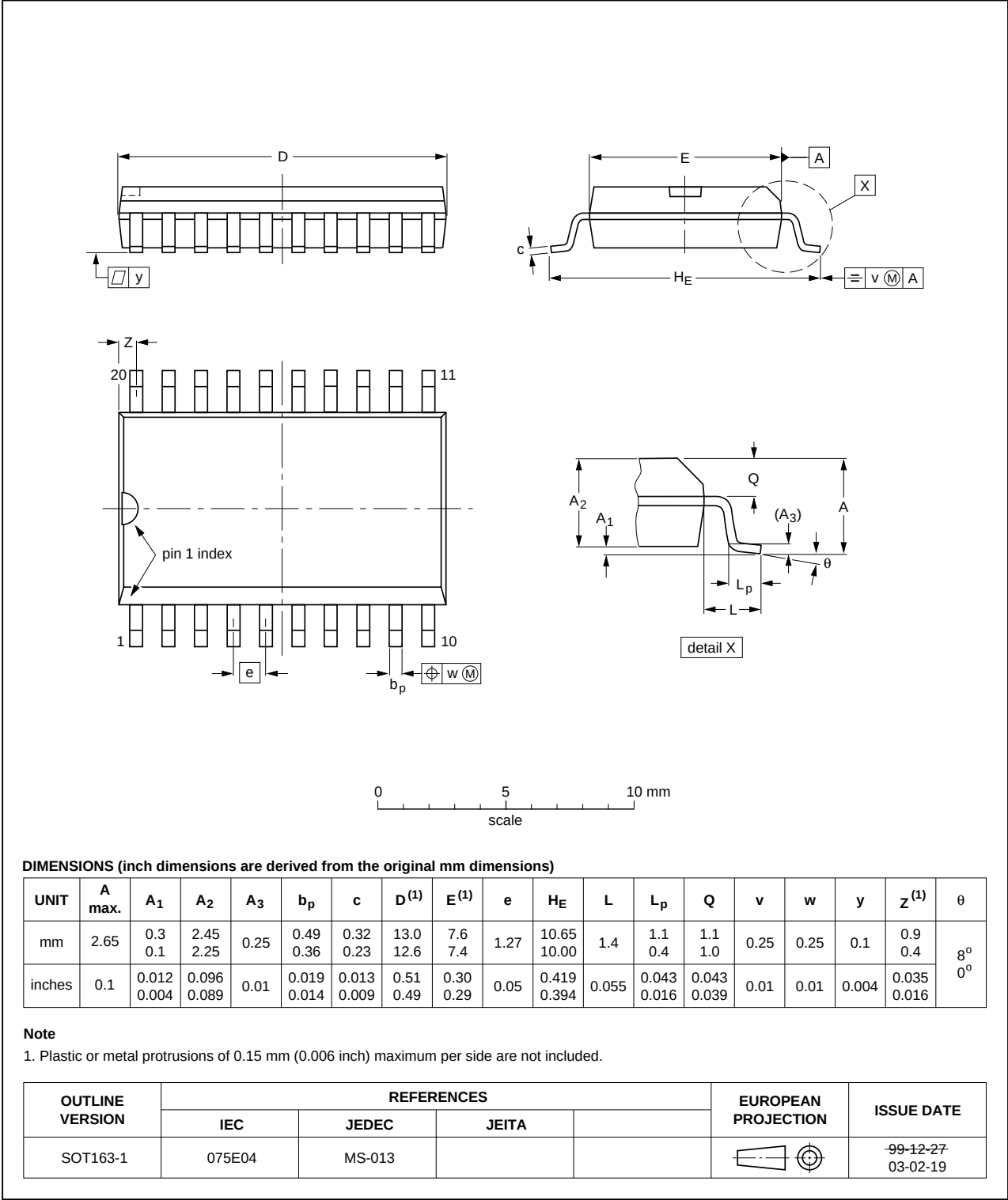


Fig 8. Package outline SOT163-1 (SO20)

SSOP20: plastic shrink small outline package; 20 leads; body width 5.3 mm

SOT339-1

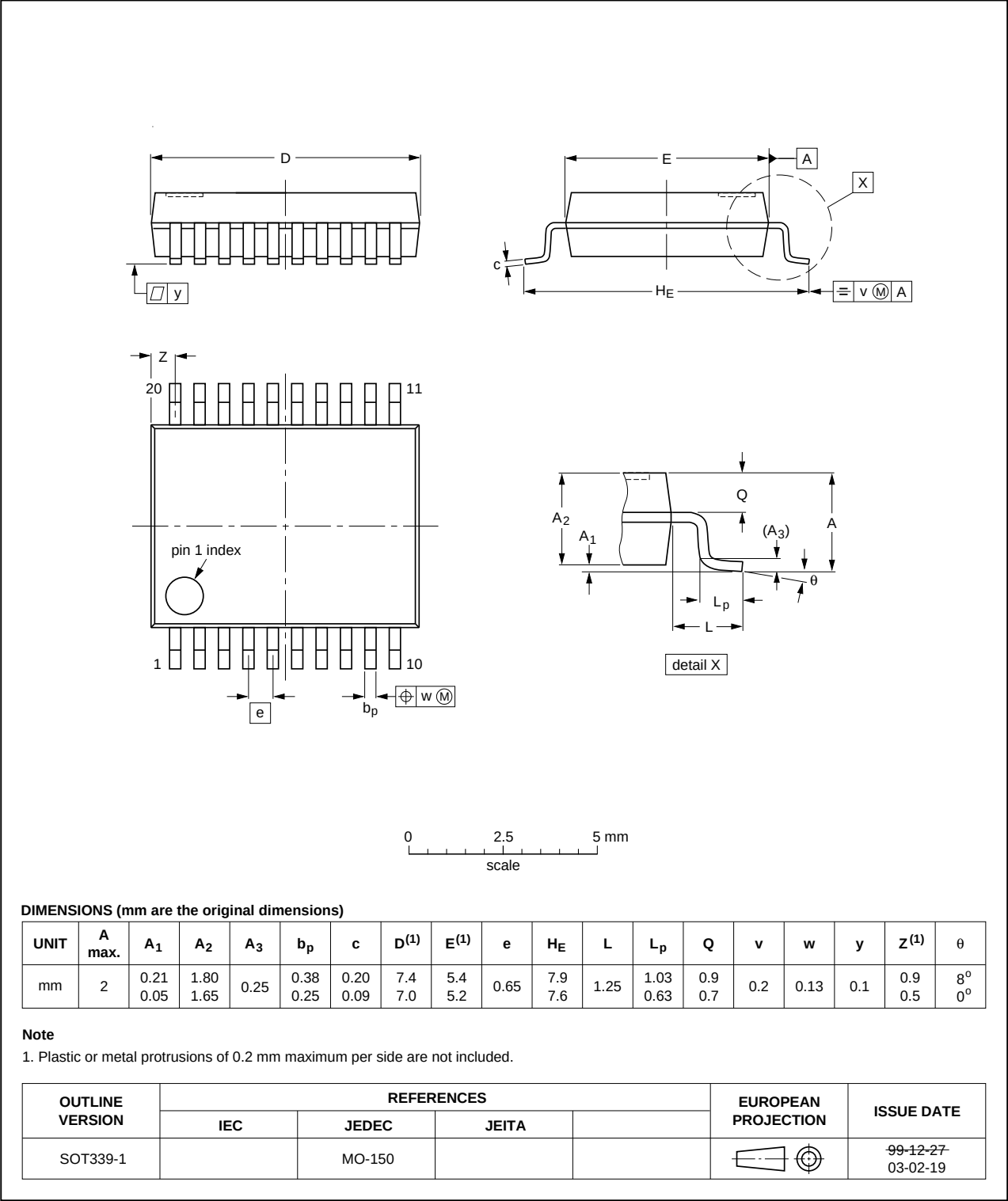


Fig 9. Package outline SOT339-1 (SSOP20)

TSSOP20: plastic thin shrink small outline package; 20 leads; body width 4.4 mm

SOT360-1

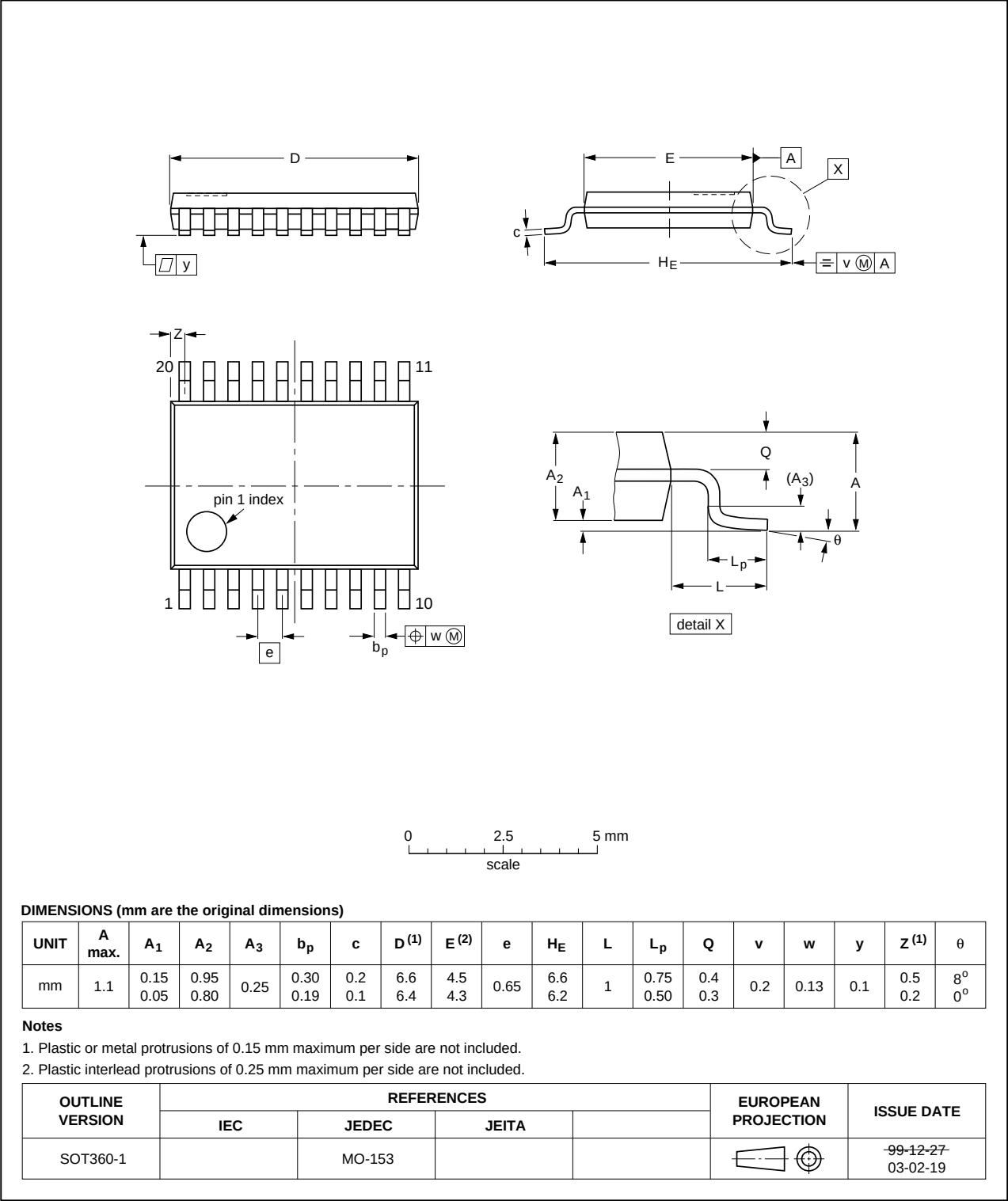


Fig 10. Package outline SOT360-1 (TSSOP20)

DHVQFN20: plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 20 terminals; body 2.5 x 4.5 x 0.85 mm

SOT764-1

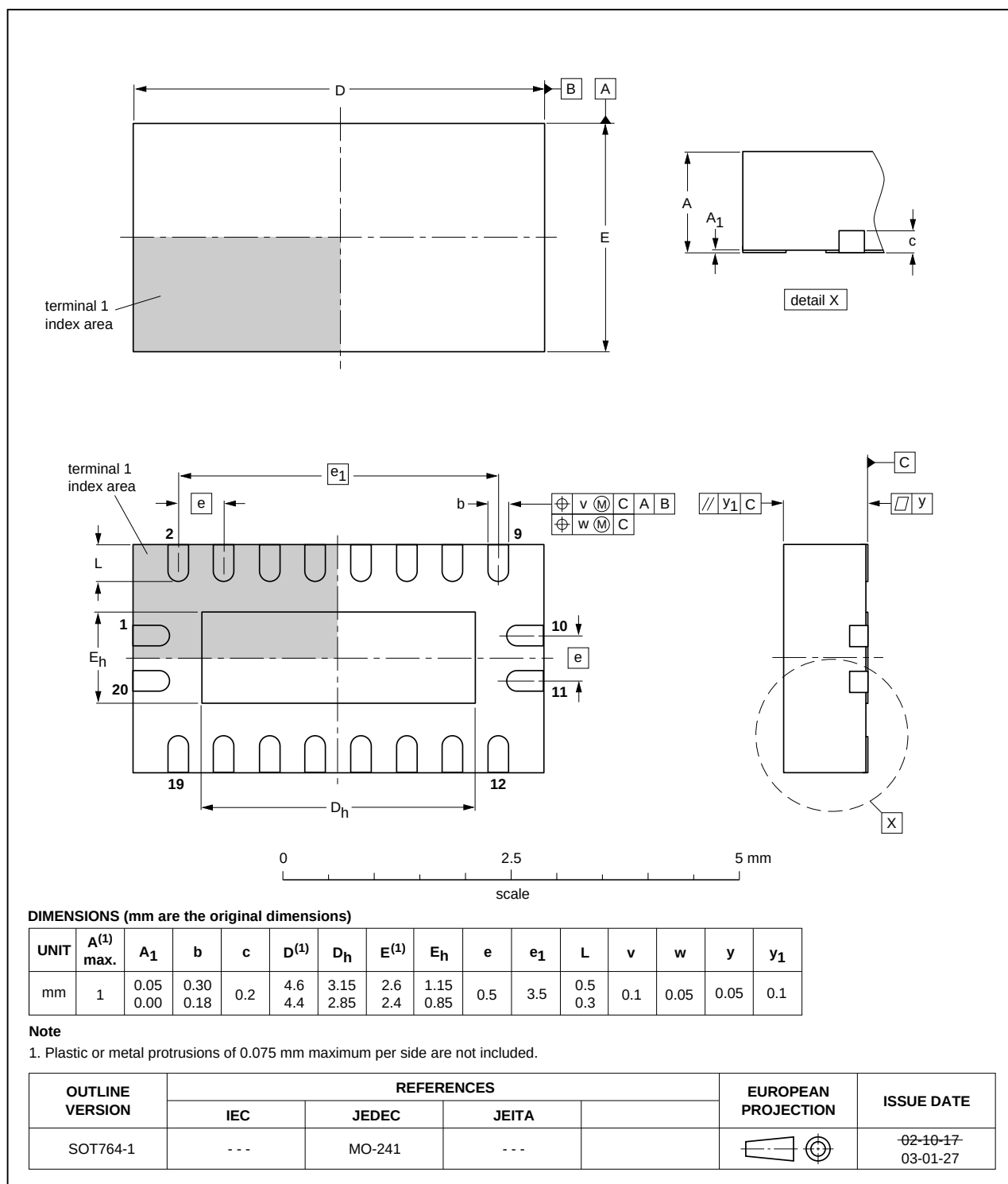


Fig 11. Package outline SOT764-1 (DHVQFN20)

13. Abbreviations

Table 9. 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 10. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74LVC2244A v.5	20111103	Product data sheet	-	74LVC2244A v.4
Modifications:	- 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 4, Table 5, Table 6, Table 7 and Table 8: values added for lower voltage ranges.			
74LVC2244A v.4	20040407	Product specification	-	74LVC2244A v.3
74LVC2244A v.3	20021213	Product specification	-	74LVC2244A v.2
74LVC2244A v.2	20020618	Product specification	-	74LVC2244A v.1
74LVC2244A v.1	19990930	Product specification	-	-

15. Legal information

15.1 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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17. Contents

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