

74LVC244A; 74LVCH244A

Octal buffer/line driver; 3-state

Rev. 06 — 13 August 2009

Product data sheet

1. General description

The 74LVC244A; 74LVCH244A is an octal non-inverting buffer/line driver with 3-state outputs. The 3-state outputs are controlled by the output enable inputs $1\overline{OE}$ and $2\overline{OE}$. A HIGH on $n\overline{OE}$ 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.

Inputs can be driven from either 3.3 V or 5.0 V devices. In 3-state operation, outputs can handle 5 V. These features allow the use of these devices as translators in a mixed 3.3 V and 5 V environment.

The 74LVCH244A bus hold on data inputs eliminates the need for external pull-up resistors to hold unused inputs.

2. Features

- 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
- Inputs accept voltages up to 5.5 V
- High-impedance when $V_{CC} = 0$ V
- Bus hold on all data inputs (74LVCH244A only)
- Complies with JEDEC standard no. 8-1A
- ESD protection:
 - ◆ HBM JESD22-A114E exceeds 2000 V
 - ◆ MM JESD22-A115-A exceeds 200 V
- Specified from -40 °C to $+85$ °C and -40 °C to $+125$ °C

3. Ordering information

Table 1. Ordering information

Type number	Package			Version
	Temperature range	Name	Description	
74LVC244AD 74LVCH244AD	-40 °C to +125 °C	SO20	plastic small outline package; 20 leads; body width 7.5 mm	SOT163-1
74LVC244ADB 74LVCH244ADB	-40 °C to +125 °C	SSOP20	plastic shrink small outline package; 20 leads; body width 5.3 mm	SOT339-1
74LVC244APW 74LVCH244APW	-40 °C to +125 °C	TSSOP20	plastic thin shrink small outline package; 20 leads; body width 4.4 mm	SOT360-1
74LVC244ABQ 74LVCH244ABQ	-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
74LVC244ABX 74LVCH244ABX	-40 °C to +125 °C	DHXQFN20U	plastic dual in-line compatible thermal enhanced extremely thin quad flat package; no leads; 20 terminals; UTLP based; body 2.5 × 4.5 × 0.5 mm	SOT1045-1

4. Functional diagram

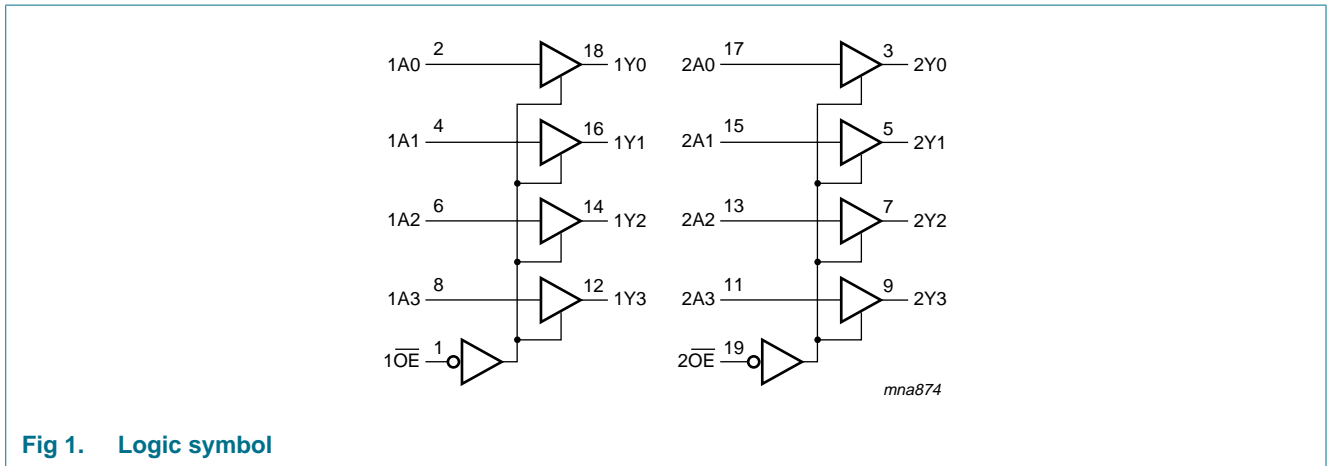


Fig 1. Logic symbol

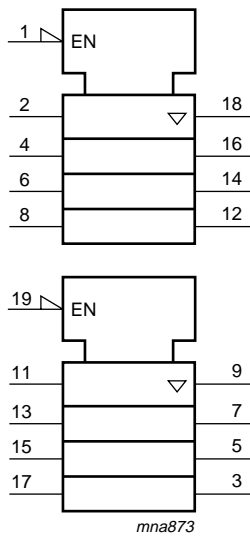


Fig 2. IEC logic diagram

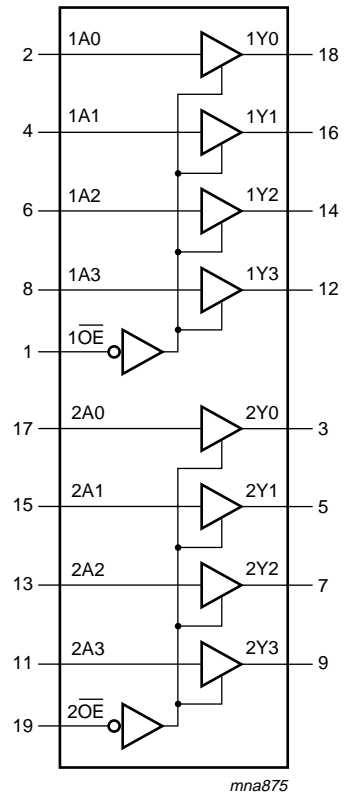
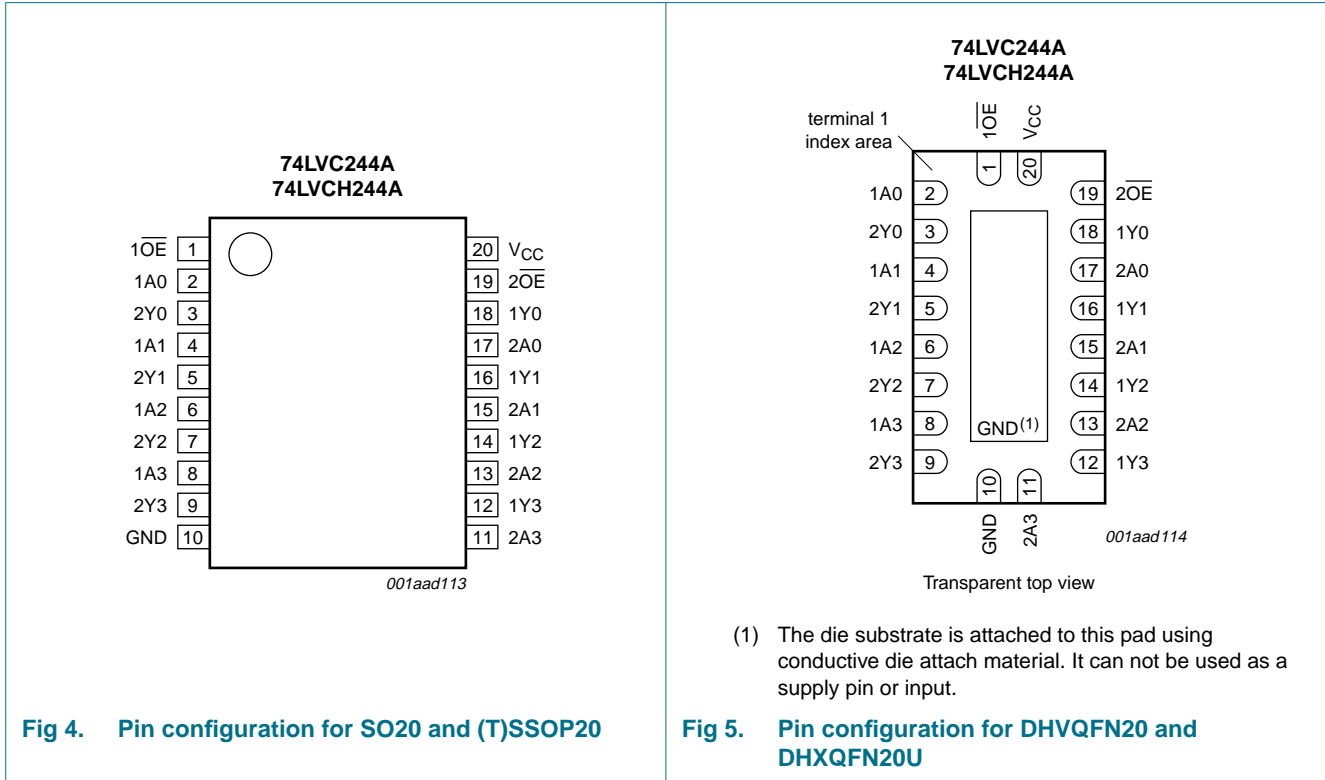


Fig 3. Functional diagram

5. Pinning information

5.1 Pinning



5.2 Pin description

Table 2. Pin description

Symbol	Pin	Description
10 \overline{OE} , 20 \overline{OE}	1, 19	output enable input (active low)
1A0, 1A1, 1A2, 1A3	2, 4, 6, 8	data input
2Y0, 2Y1, 2Y2, 2Y3	3, 5, 7, 9	data output
GND	10	ground (0 V)
2A0, 2A1, 2A2, 2A3	17, 15, 13, 11	data input
1Y0, 1Y1, 1Y2, 1Y3	18, 16, 14, 12	data output
V _{CC}	20	supply voltage

6. Functional description

Table 3. Function table [1]

Control	Input	Output
$\overline{\text{nOE}}$	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	[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 and DHXQFN20U 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	maximum speed performance	2.7	-	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	°C
Δt/ΔV	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 V	V _{CC}	-	-	V _{CC}	-	V
		V _{CC} = 2.7 V to 3.6 V	2.0	-	-	2.0	-	V
V _{IL}	LOW-level input voltage	V _{CC} = 1.2 V	-	-	0	-	0	V
		V _{CC} = 2.7 V to 3.6 V	-	-	0.8	-	0.8	V
V _{OH}	HIGH-level output voltage	V _I = V _{IH} or V _{IL}						
		I _O = -100 μA; V _{CC} = 2.7 V to 3.6 V	V _{CC} - 0.2	V _{CC}	-	V _{CC} - 0.3	-	V
		I _O = -12 mA; V _{CC} = 2.7 V	2.2	-	-	2.05	-	V
		I _O = -18 mA; V _{CC} = 3.0 V	2.4	-	-	2.25	-	V
V _{OL}	LOW-level output voltage	I _O = -24 mA; V _{CC} = 3.0 V	2.2	-	-	2.0	-	V
		V _I = V _{IH} or V _{IL}						
		I _O = 100 μA; V _{CC} = 2.7 V to 3.6 V	-	0	0.20	-	0.3	V
I _{OFF}	power-off leakage current	I _O = 12 mA; V _{CC} = 2.7 V	-	-	0.40	-	0.6	V
		I _O = 24 mA; V _{CC} = 3.0 V	-	-	0.55	-	0.8	V
		V _I = V _{IH} or V _{IL} ; V _O = 5.5 V or GND; V _{CC} = 3.6 V	-	±0.1	±5	-	±20	μA
I _I	input leakage current	V _I = 5.5 V or GND; V _{CC} = 3.6 V ^[2]	-	±0.1	±5	-	±20	μA
I _{OZ}	OFF-state output current	V _I = V _{IH} or V _{IL} ; V _O = 5.5 V or GND; V _{CC} = 3.6 V ^{[2][3]}	-	±0.1	±5	-	±20	μA
I _{CC}	supply current	V _I = V _{CC} or GND; I _O = 0 A; V _{CC} = 3.6 V	-	0.1	10	-	40	μA
ΔI _{CC}	additional supply current	per input pin; V _I = V _{CC} - 0.6 V; I _O = 0 A; V _{CC} = 2.7 V to 3.6 V	-	5	500	-	5000	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	
C _I	input capacitance		-	4.0	-	-	-	pF
I _{BHL}	bus hold LOW current	V _{CC} = 3.0 V; V _I = 0.8 V [4][5]	75	-	-	60	-	μA
I _{BHH}	bus hold HIGH current	V _{CC} = 3.0 V; V _I = 2.0 V [4][5]	-75	-	-	-60	-	μA
I _{BHLO}	bus hold LOW overdrive current	V _{CC} = 3.6 V [4][6]	500	-	-	500	-	μA
I _{BHHO}	bus hold HIGH overdrive current	V _{CC} = 3.6 V [4][6]	-500	-	-	-500	-	μA

[1] All typical values are measured at V_{CC} = 3.3 V (unless stated otherwise) 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] For I/O ports the parameter I_{OZ} includes the input leakage current.

[4] Valid for data inputs of bus hold parts only (74LVCH244A). Note that control inputs do not have a bus hold circuit.

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

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

10. Dynamic characteristics

Table 7. Dynamic characteristics

Voltages are referenced to GND (ground = 0 V). For test circuit see [Figure 8](#).

Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ ^[2]	Max	Min	Max	
t _{pd}	propagation delay	nAn to nYn; see Figure 6 [1]						
		V _{CC} = 1.2 V	-	17.0	-	-	-	ns
		V _{CC} = 2.7 V	1.5	3.3	6.9	1.5	9.0	ns
		V _{CC} = 3.0 V to 3.6 V [3]	1.5	2.8	5.9	1.5	7.5	ns
t _{en}	enable time	nOE to nYn; see Figure 7 [1]						
		V _{CC} = 1.2 V	-	24.0	-	-	-	ns
		V _{CC} = 2.7 V	1.5	3.3	8.6	1.5	11	ns
		V _{CC} = 3.0 V to 3.6 V [3]	1.0	3.4	7.6	1.0	9.5	ns
t _{dis}	disable time	nOE to nYn; see Figure 7 [1]						
		V _{CC} = 1.2 V	-	9.0	-	-	-	ns
		V _{CC} = 2.7 V	1.5	3.2	6.8	1.5	8.5	ns
		V _{CC} = 3.0 V to 3.6 V [3]	1.5	2.9	5.8	1.5	7.5	ns
t _{sk(o)}	output skew time	[4]	-	-	1.0	-	1.5	ns

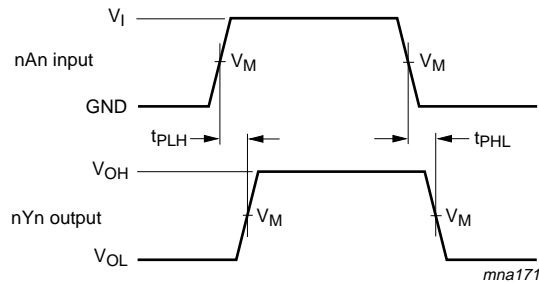
Table 7. Dynamic characteristics ...continued

Voltages are referenced to GND (ground = 0 V). For test circuit see [Figure 8](#).

Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ ^[2]	Max	Min	Max	
C _{PD}	power dissipation capacitance	per buffer; V _I = GND to V _{CC} ; V _{CC} = 3.3 V ^[5]	-	10	-	-	-	pF

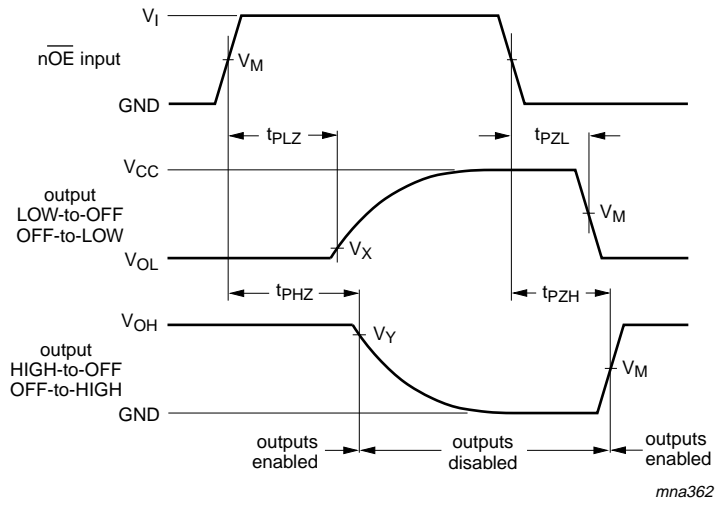
- [1] t_{pd} is the same as t_{PLH} and t_{PHL}.
t_{en} is the same as t_{PZL} and t_{PZH}.
t_{dis} is the same as t_{PLZ} and t_{PHZ}.
- [2] Typical values are measured at T_{amb} = 25 °C.
- [3] Typical values are measured at T_{amb} = 25 °C and V_{CC} = 3.3 V.
- [4] Skew between any two outputs of the same package switching in the same direction. This parameter is guaranteed by design.
- [5] 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.

11. AC waveforms



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

Fig 6. The input (nAn) to output (nYn) propagation delays



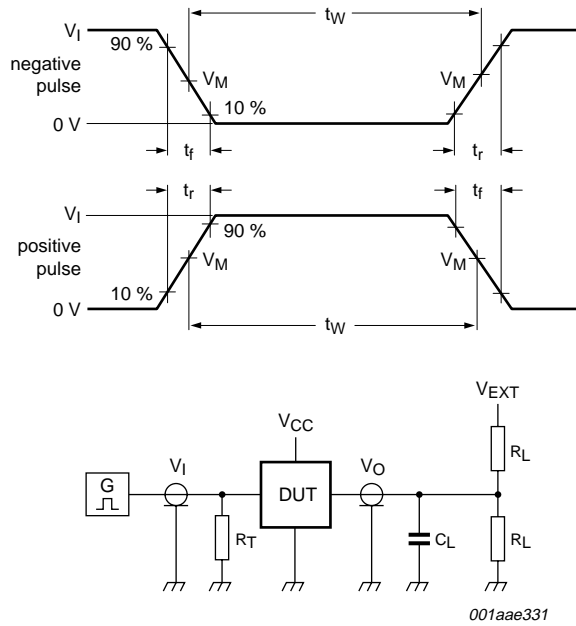
Measurement points are given in [Table 8](#).

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

Fig 7. 3-state enable and disable times.

Table 8. Measurement points

Supply voltage	Input		Output		
V_{CC}	V_I	V_M	V_M	V_X	V_Y
1.2 V	V_{CC}	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$	$V_{OL} + 0.1 V$	$V_{OH} - 0.1 V$
2.7 V	2.7 V	1.5 V	1.5 V	$V_{OL} + 0.3 V$	$V_{OH} - 0.3 V$
3.0 V to 3.6 V	2.7 V	1.5 V	1.5 V	$V_{OL} + 0.3 V$	$V_{OH} - 0.3 V$



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 8. 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}	≤ 2.5 ns	50 pF	500 Ω [1]	open	$2 \times V_{CC}$	GND
2.7 V	2.7 V	≤ 2.5 ns	50 pF	500 Ω	open	$2 \times V_{CC}$	GND
3.0 V to 3.6 V	2.7 V	≤ 2.5 ns	50 pF	500 Ω	open	$2 \times V_{CC}$	GND

[1] The circuit performs better when $R_L = 1$ k Ω .

12. Package outline

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

SOT163-1

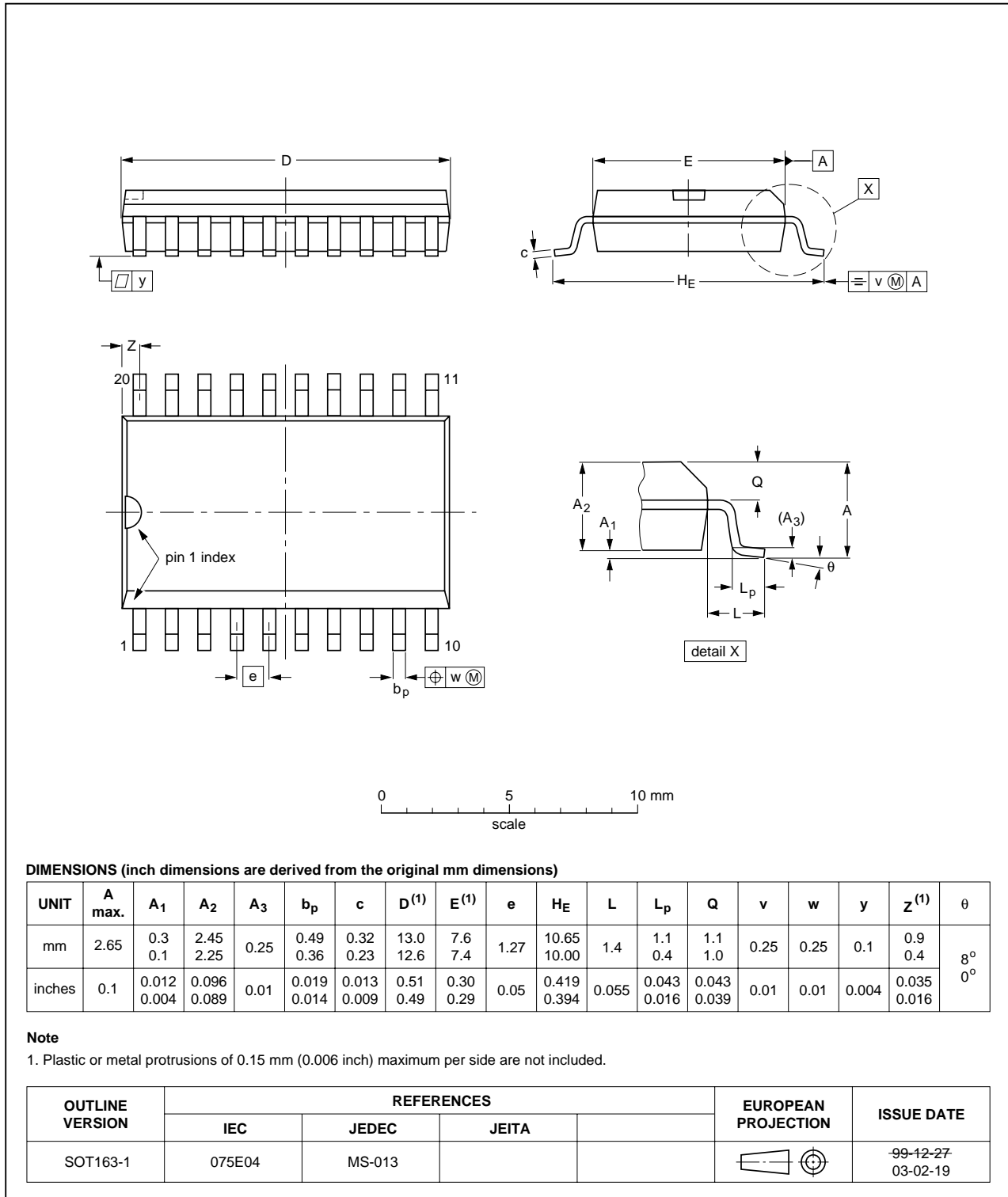


Fig 9. Package outline SOT163-1 (SO20)

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

SOT339-1

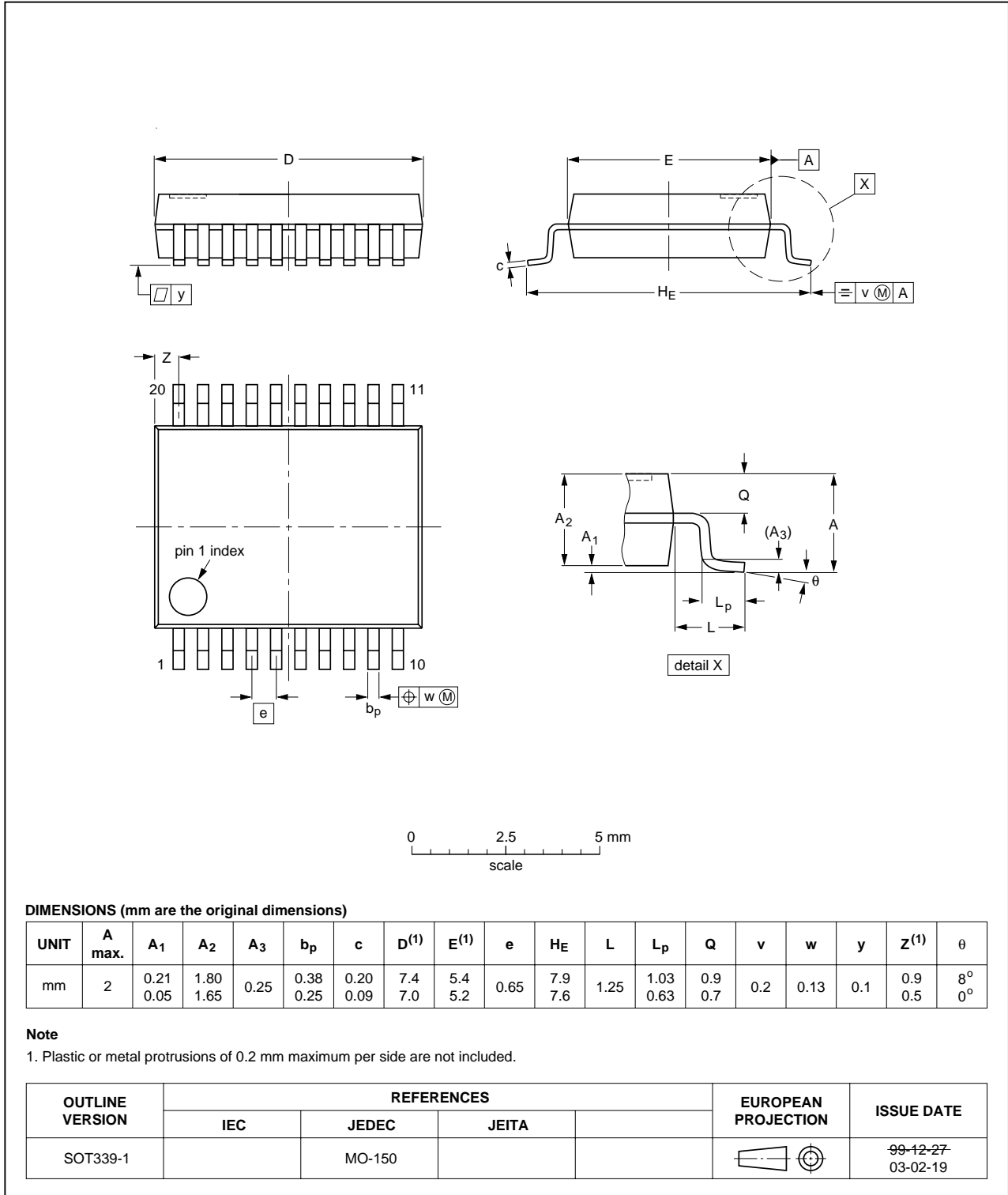


Fig 10. Package outline SOT339-1 (SSOP20)

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

SOT360-1

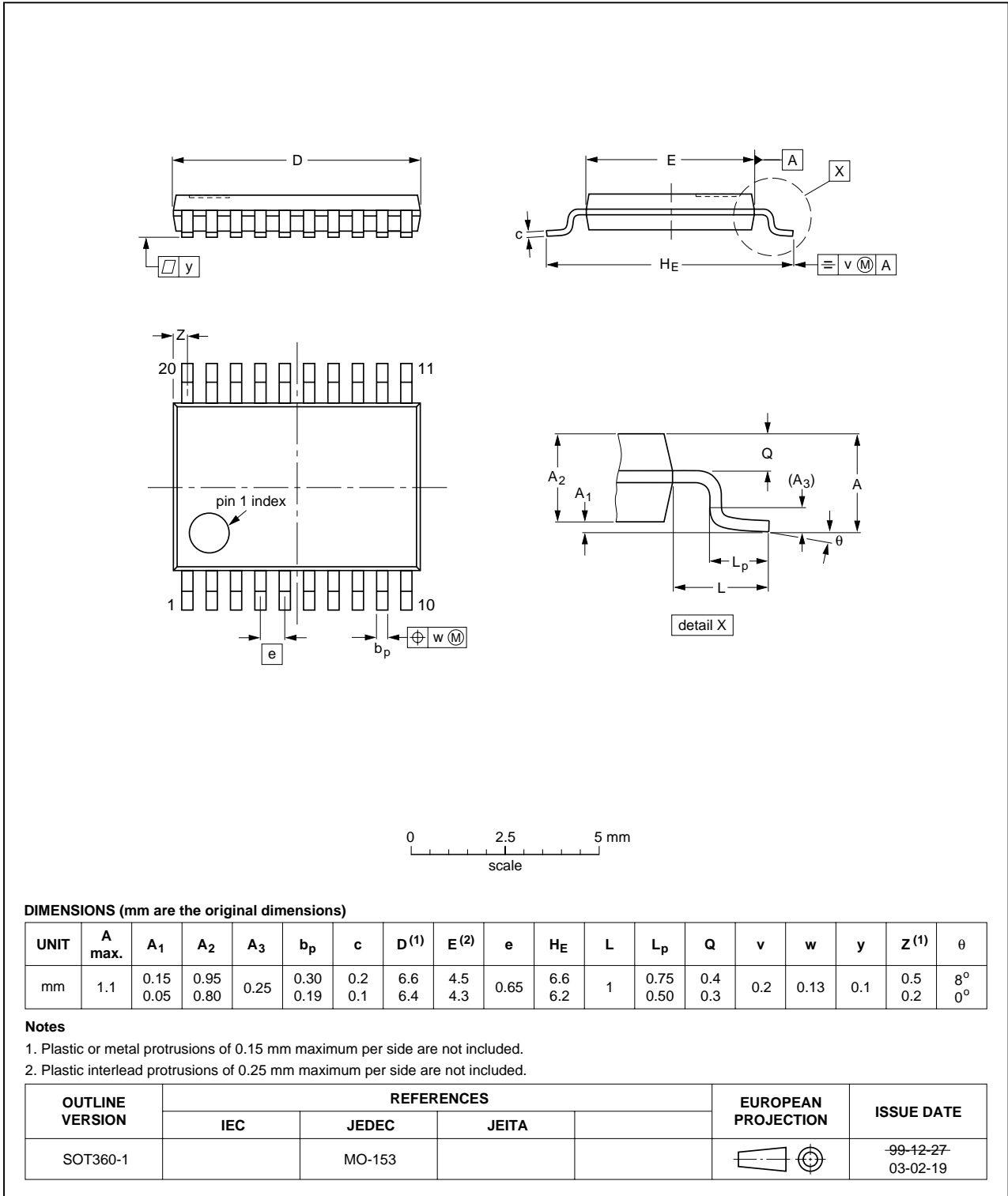


Fig 11. Package outline SOT360-1 (TSSOP20)

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

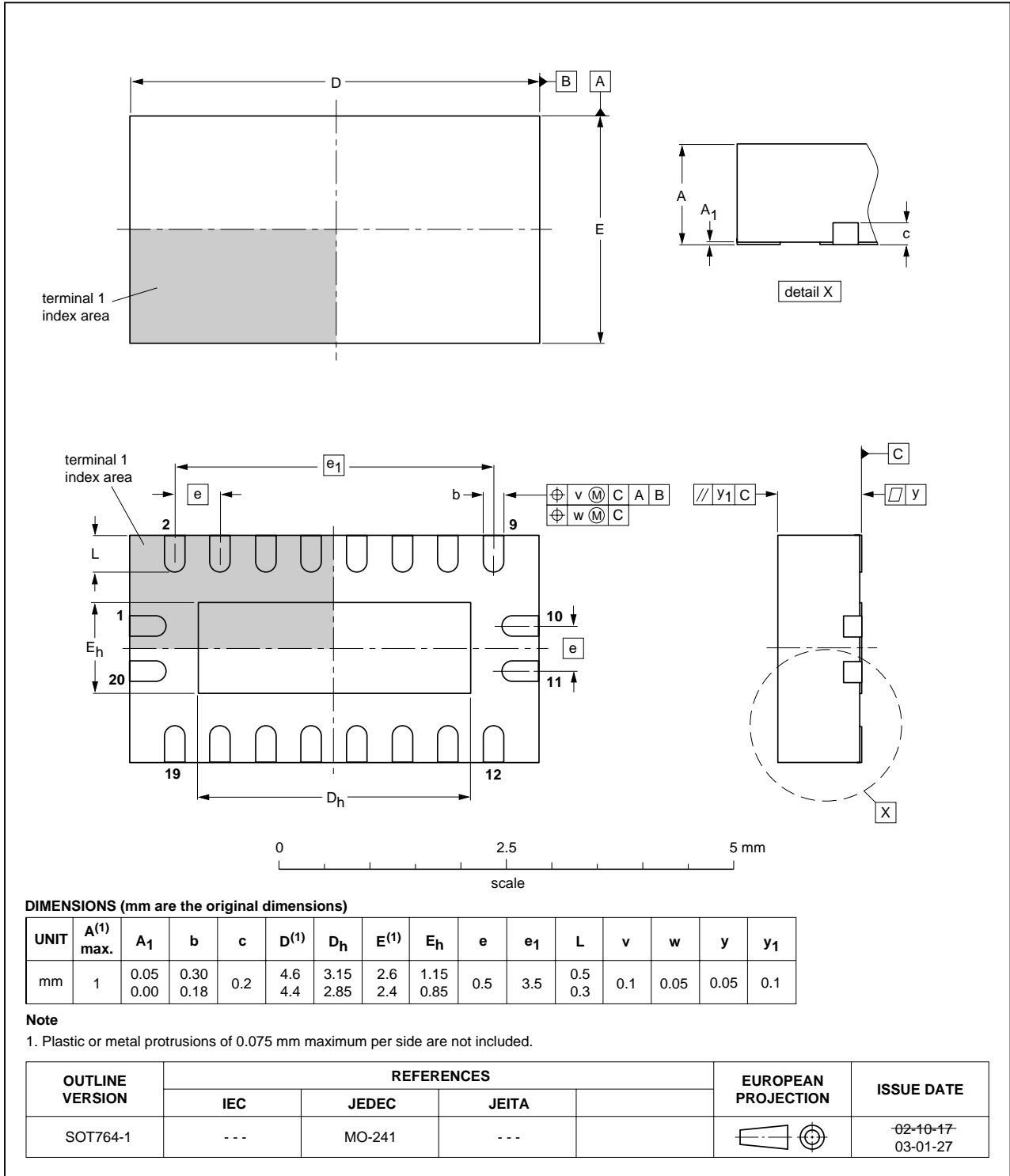


Fig 12. Package outline SOT764-1 (DHVQFN20)

DHXQFN20U: plastic dual in-line compatible thermal enhanced extremely thin quad flat package; no leads; 20 terminals; UTLP based; body 2.5 x 4.5 x 0.5 mm

SOT1045-1

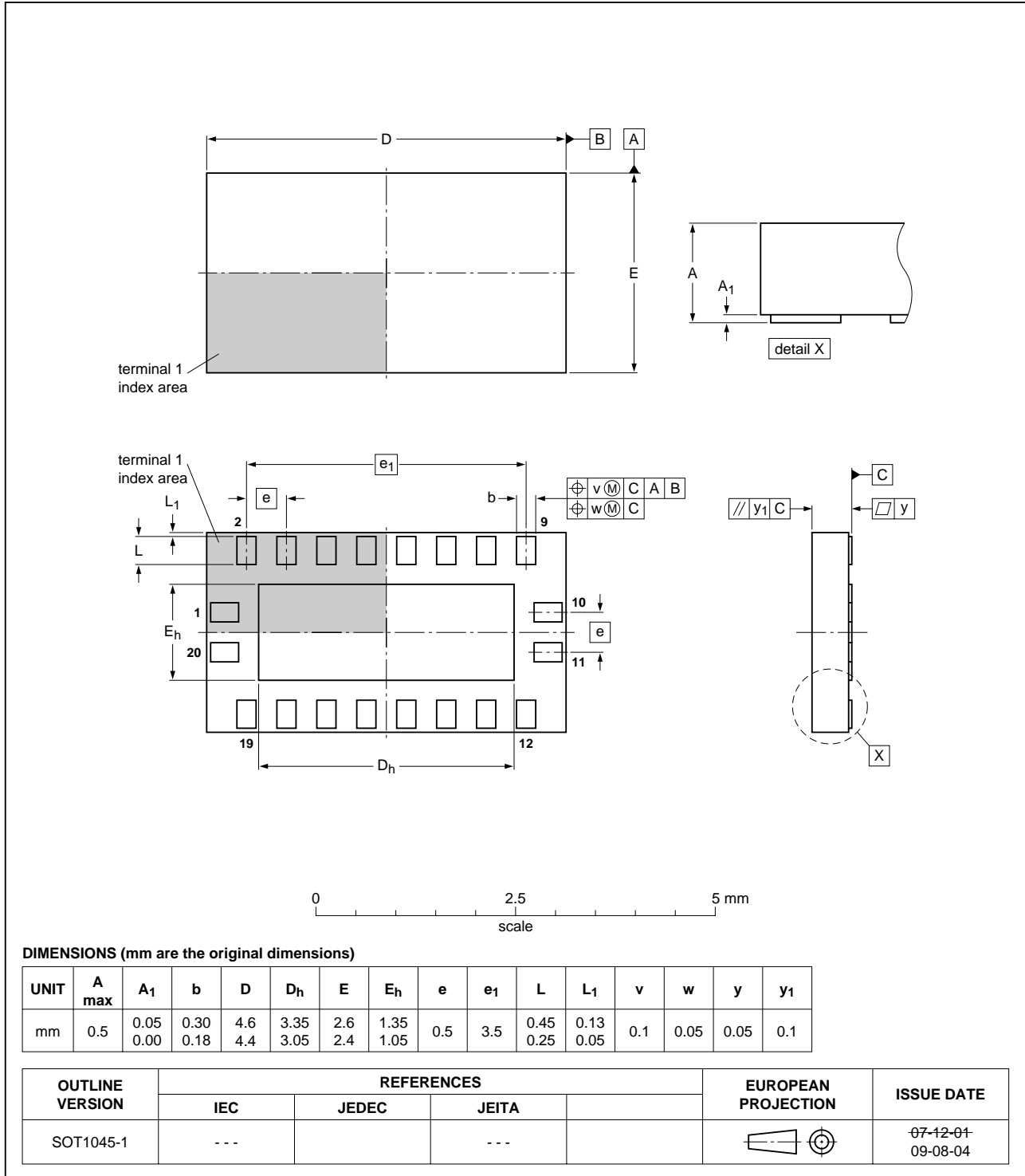


Fig 13. Package outline SOT1045-1 (DHXQFN20U)

13. Abbreviations

Table 10. Abbreviations

Acronym	Description
CMOS	Complementary Metal Oxide Semiconductor
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
74LVC_LVCH244A_6	20090813	Product data sheet	-	74LVC_LVCH244A_5
Modifications:	<ul style="list-style-type: none"> New SOT1045-1 package outline drawing (DHXQFN20U package). 			
74LVC_LVCH244A_5	20090709	Product data sheet	-	74LVC_LVCH244A_4
Modifications:	<ul style="list-style-type: none"> The format of this data sheet 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. Added type numbers 74LVC244ABX and 74LVCH244ABX (DHXQFN20U package). 			
74LVC_LVCH244A_4	20031030	Product specification	-	74LVC_LVCH244A_3
74LVC_LVCH244A_3	20030520	Product specification	-	74LVC_H244A_2
74LVC_H244A_2	19980520	Product specification	-	74LVC244A_74LVCH244A_1
74LVC244A_74LVCH244A_1	19960906	Product specification	-	-

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15.1 Data sheet status

Document status ^{[1][2]}	Product status ^[3]	Definition
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[2] The term 'short data sheet' is explained in section "Definitions".

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