

74LVC573A

Octal D-type transparent latch with 5 V tolerant inputs/outputs; 3-state

Rev. 5 — 19 February 2013

Product data sheet

1. General description

The 74LVC573A consists of eight D-type transparent latches, featuring separate D-type inputs for each latch and 3-state true outputs for bus-oriented applications. A Latch Enable (LE) input and an Output Enable (\overline{OE}) input are common to all internal latches.

When LE is HIGH, data at the Dn inputs enters the latches. In this condition, the latches are transparent, that is, a latch output changes each time its corresponding D-input changes. When LE is LOW, the latches store the information that was present at the D-inputs one set-up time preceding the HIGH-to-LOW transition of LE.

When \overline{OE} is LOW, the contents of the eight latches are available at the outputs. When \overline{OE} is HIGH, the outputs go to the high impedance OFF-state. Operation of the \overline{OE} input does not affect the state of the latches.

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 or 5 V applications.

The 74LVC573A is functionally identical to the 74LVC373A, but has a different pin arrangement.

2. Features and benefits

- 5 V tolerant inputs/outputs, for interfacing with 5 V logic
- Supply voltage range from 1.2 V to 3.6 V
- CMOS low power consumption
- Direct interface with TTL levels
- High-impedance when $V_{CC} = 0$ V
- Flow-through pinout architecture
- 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 JESD22-C101E exceeds 1000 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	
74LVC573AD	-40 °C to +125 °C	SO20	plastic small outline package; 20 leads; body width 7.5 mm	SOT163-1
74LVC573ADB	-40 °C to +125 °C	SSOP20	plastic shrink small outline package; 20 leads; body width 5.3 mm	SOT339-1
74LVC573APW	-40 °C to +125 °C	TSSOP20	plastic thin shrink small outline package; 20 leads; body width 4.4 mm	SOT360-1
74LVC573ABQ	-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
74LVC573ABX	-40 °C to +125 °C	DHXQFN20	plastic dual in-line compatible thermal enhanced extremely thin quad flat package; no leads; 20 terminals; body 4.5 × 2.5 × 0.5 mm	SOT1045-2

4. Functional diagram

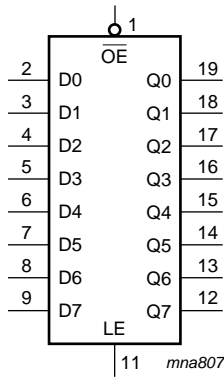


Fig 1. Logic symbol

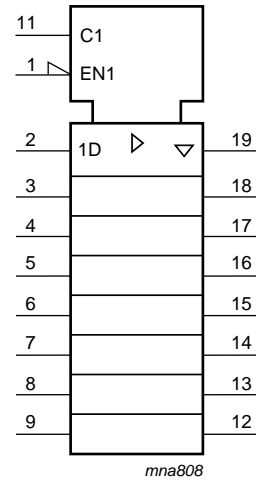


Fig 2. IEC logic symbol

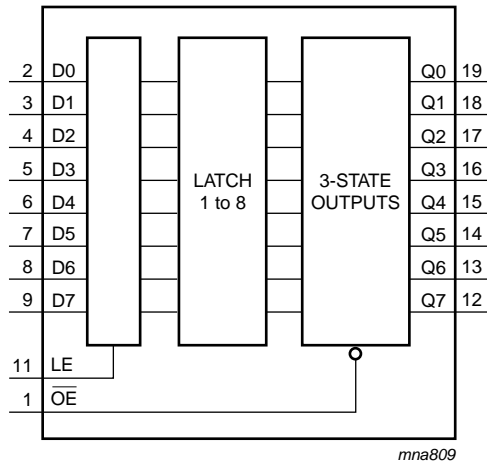


Fig 3. Functional diagram

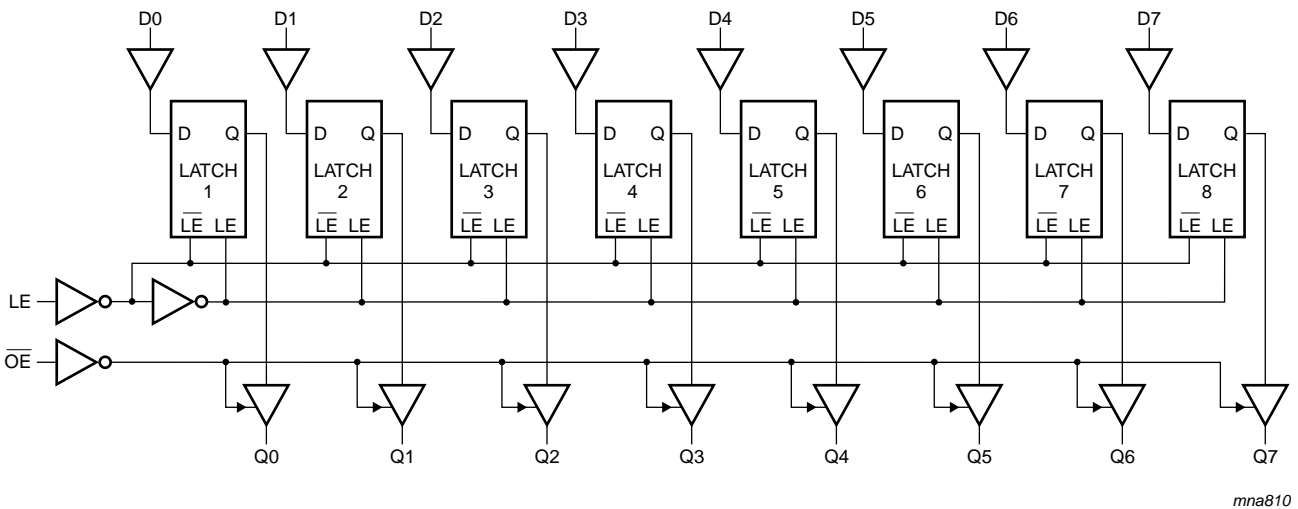


Fig 4. Logic diagram

5. Pinning information

5.1 Pinning

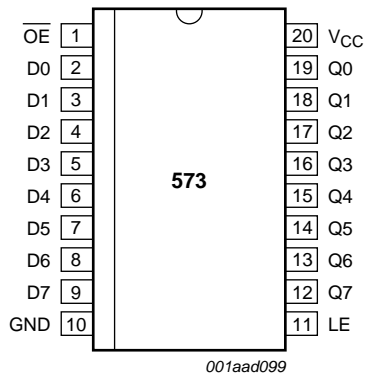


Fig 5. Pin configuration for SO20 and (T)SSOP20

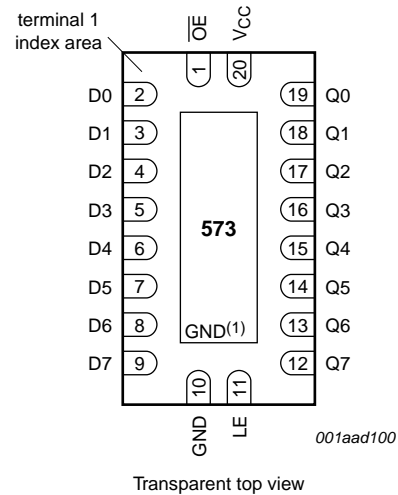


Fig 6. Pin configuration for DHVQFN20 and DHXQFN20

- (1) This is not a supply pin. The substrate is attached to this pad using conductive die attach material. There is no electrical or mechanical requirement to solder this pad. However, if it is soldered, the solder land should remain floating or be connected to GND.

5.2 Pin description

Table 2. Pin description

Symbol	Pin	Description
\overline{OE}	1	output enable input (active LOW)
LE	11	latch enable input (active HIGH)
D[0:7]	2, 3, 4, 5, 6, 7, 8, 9	data input
Q[0:7]	19, 18, 17, 16, 15, 14, 13, 12	data output
GND	10	ground (0 V)
V _{CC}	20	supply voltage

6. Functional description

Table 3. Functional table^[1]

Operating modes	Input			Internal latch	Output Qn
	$\overline{\text{OE}}$	LE	Dn		
Enable and read register (transparent mode)	L	H	L	L	L
	L	H	H	H	H
Latch and read register	L	L	l	L	L
	L	L	h	H	H
Latch register and disable outputs	H	L	l	L	Z
	H	L	h	H	Z

- [1] H = HIGH voltage level
 h = HIGH voltage level one set-up time prior to the HIGH-to-LOW LE transition
 L = LOW voltage level
 l = LOW voltage level one set-up time prior to the HIGH-to-LOW LE transition
 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	$V_I < 0$	-50	-	mA
V_I	input voltage		^[1] -0.5	+6.5	V
I_{OK}	output clamping current	$V_O > V_{CC}$ or $V_O < 0$	-	± 50	mA
V_O	output voltage		^[2] -0.5	$V_{CC} + 0.5$	V
I_O	output current	$V_O = 0 \text{ V to } V_{CC}$	-	± 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	$T_{amb} = -40 \text{ °C to } +125 \text{ °C}$	^[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] For SO20 packages: above 70 °C the value of P_{tot} derates linearly with 8 mW/K.
 For (T)SSOP20 packages: above 60 °C the value of P_{tot} derates linearly with 5.5 mW/K.
 For DHVQFN20 and DHXQFN20 packages: above 60 °C the value of P_{tot} derates 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	in free air	-40	-	+125	°C
Δt/ΔV	input transition rise and fall rate	V _{CC} = 1.65 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	1.08	-	-	1.08	-	V
		V _{CC} = 1.65 V to 1.95 V	0.65 × V _{CC}	-	-	0.65 × V _{CC}	-	V
		V _{CC} = 2.3 V to 2.7 V	1.7	-	-	1.7	-	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	-	-	0.12	-	0.12	V
		V _{CC} = 1.65 V to 1.95 V	-	-	0.35 × V _{CC}	-	0.35 × V _{CC}	V
		V _{CC} = 2.3 V to 2.7 V	-	-	0.7	-	0.7	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} = 1.65 V to 3.6 V	V _{CC} - 0.2	-	-	V _{CC} - 0.3	-	V
		I _O = -4 mA; V _{CC} = 1.65 V	1.2	-	-	1.05	-	V
		I _O = -8 mA; V _{CC} = 2.3 V	1.8	-	-	1.65	-	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} = 1.65 V to 3.6 V	-	-	0.2	-	0.3	V
		I _O = 4 mA; V _{CC} = 1.65 V	-	-	0.45	-	0.65	V
		I _O = 8 mA; V _{CC} = 2.3 V	-	-	0.6	-	0.8	V
		I _O = 12 mA; V _{CC} = 2.7 V	-	-	0.4	-	0.6	V
I _I	input leakage current	I _O = 24 mA; V _{CC} = 3.0 V	-	-	0.55	-	0.8	V
		V _{CC} = 3.6 V; V _I = 5.5 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 = GND to V _{CC}	-	5.0	-	-	-	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 11](#).

Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit		
			Min	Typ ^[1]	Max	Min	Max			
t _{pd}	propagation delay	Dn to Qn; see Figure 7 ^[2]								
		V _{CC} = 1.2 V	-	16.0	-	-	-	ns		
		V _{CC} = 1.65 V to 1.95 V	2.1	7.8	16.3	2.1	18.8	ns		
		V _{CC} = 2.3 V to 2.7 V	1.5	4.1	8.0	1.5	9.2	ns		
		V _{CC} = 2.7 V	1.5	4.1	7.2	1.5	9.0	ns		
		V _{CC} = 3.0 V to 3.6 V	1.5	3.4	6.2	1.5	8.0	ns		
		LE to Qn; see Figure 8 ^[2]								
		V _{CC} = 1.2 V	-	16.0	-	-	-	ns		
		V _{CC} = 1.65 V to 1.95 V	2.0	7.7	16.0	2.0	18.4	ns		
		V _{CC} = 2.3 V to 2.7 V	1.5	4.1	7.8	1.5	9.1	ns		
		V _{CC} = 2.7 V	1.5	3.7	7.5	1.5	9.5	ns		
		V _{CC} = 3.0 V to 3.6 V	1.5	3.4	6.5	1.5	8.5	ns		
		t _{en}	enable time	OE to Qn; see Figure 9 ^[2]						
				V _{CC} = 1.2 V	-	18.0	-	-	-	ns
V _{CC} = 1.65 V to 1.95 V	1.7			7.5	17.5	1.7	20.2	ns		
V _{CC} = 2.3 V to 2.7 V	1.5			4.2	9.2	1.5	10.6	ns		
V _{CC} = 2.7 V	1.5			4.2	8.5	1.5	11.0	ns		
V _{CC} = 3.0 V to 3.6 V	1.5			3.4	7.5	1.5	9.5	ns		

Table 7. Dynamic characteristics ...continued

Voltages are referenced to GND (ground = 0 V). For test circuit see [Figure 11](#).

Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ ^[1]	Max	Min	Max	
t _{dis}	disable time	OE to Qn; see Figure 9 ^[2]						
		V _{CC} = 1.2 V	-	8.0	-	-	-	ns
		V _{CC} = 1.65 V to 1.95 V	1.0	3.3	10.1	1.0	11.6	ns
		V _{CC} = 2.3 V to 2.7 V	0.3	1.8	5.7	0.3	6.6	ns
		V _{CC} = 2.7 V	1.5	3.0	6.5	1.5	8.5	ns
		V _{CC} = 3.0 V to 3.6 V	1.5	2.5	6.0	1.5	7.5	ns
t _w	pulse width	LE HIGH; see Figure 8						
		V _{CC} = 1.65 V to 1.95 V	5.0	-	-	5.0	-	ns
		V _{CC} = 2.3 V to 2.7 V	4.0	-	-	4.0	-	ns
		V _{CC} = 2.7 V	3.2	-	-	3.2	-	ns
		V _{CC} = 3.0 V to 3.6 V	3.2	1.6	-	3.2	-	ns
t _{su}	set-up time	nD to nCP; see Figure 10						
		V _{CC} = 1.65 V to 1.95 V	4.0	-	-	4.0	-	ns
		V _{CC} = 2.3 V to 2.7 V	2.5	-	-	2.5	-	ns
		V _{CC} = 2.7 V	1.7	-	-	1.7	-	ns
		V _{CC} = 3.0 V to 3.6 V	1.7	-	-	1.7	-	ns
t _h	hold time	Dn to LE; see Figure 10						
		V _{CC} = 1.65 V to 1.95 V	3.0	-	-	3.0	-	ns
		V _{CC} = 2.3 V to 2.7 V	1.9	-	-	1.9	-	ns
		V _{CC} = 2.7 V	1.5	-	-	1.5	-	ns
		V _{CC} = 3.0 V to 3.6 V	1.4	-	-	1.4	-	ns
t _{sk(0)}	output skew time	V _{CC} = 3.0 V to 3.6 V ^[3]	-	-	1.0	-	1.5	ns
C _{PD}	power dissipation capacitance	per latch; V _I = GND to V _{CC} ^[4]						
		V _{CC} = 1.65 V to 1.95 V	-	7.1	-	-	-	pF
		V _{CC} = 2.3 V to 2.7 V	-	10.3	-	-	-	pF
		V _{CC} = 3.0 V to 3.6 V	-	13.2	-	-	-	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 μW).

P_D = C_{PD} × V_{CC}² × f_i × N + Σ(C_L × V_{CC}² × f_o) where:

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

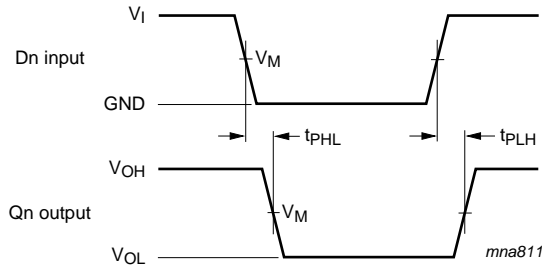
C_L = output load capacitance in pF

V_{CC} = supply voltage in Volts

N = number of inputs switching

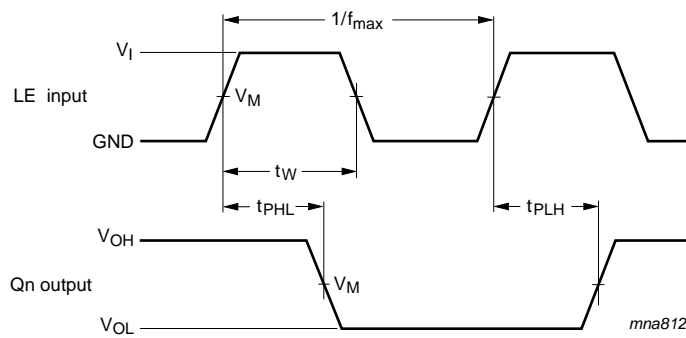
Σ(C_L × V_{CC}² × f_o) = sum of the outputs

11. AC waveforms



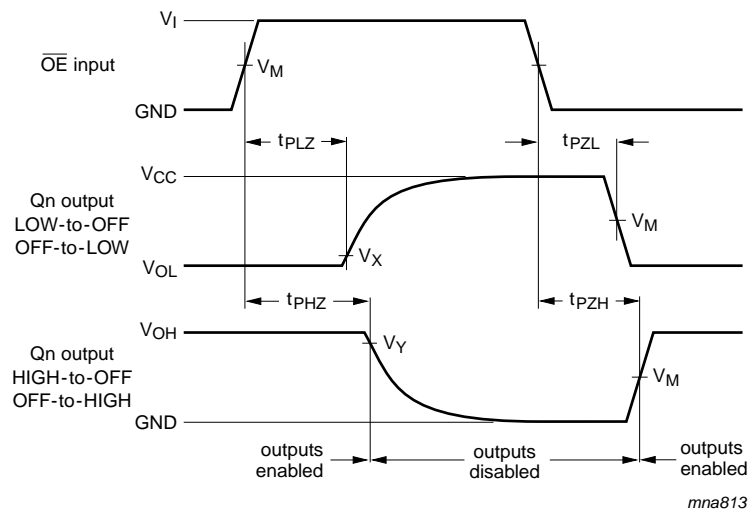
Measurement points are given in [Table 8](#).
 V_{OL} and V_{OH} are typical output voltage levels that occur with the output load.

Fig 7. Input (Dn) to output (Qn) propagation delays



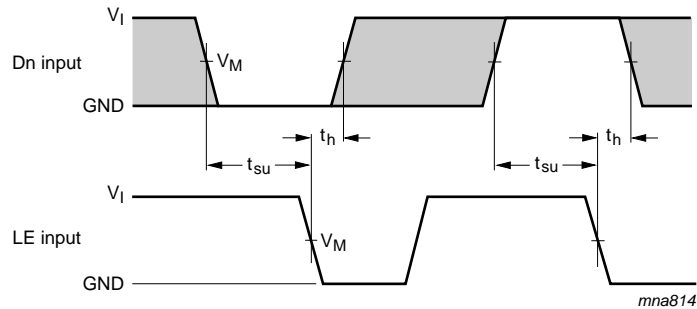
Measurement points are given in [Table 8](#).
 V_{OL} and V_{OH} are typical output voltage levels that occur with the output load.

Fig 8. Latch Enable input (LE) pulse width, the latch enable input to output (Qn) propagation delays



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

Fig 9. 3-state enable and disable times

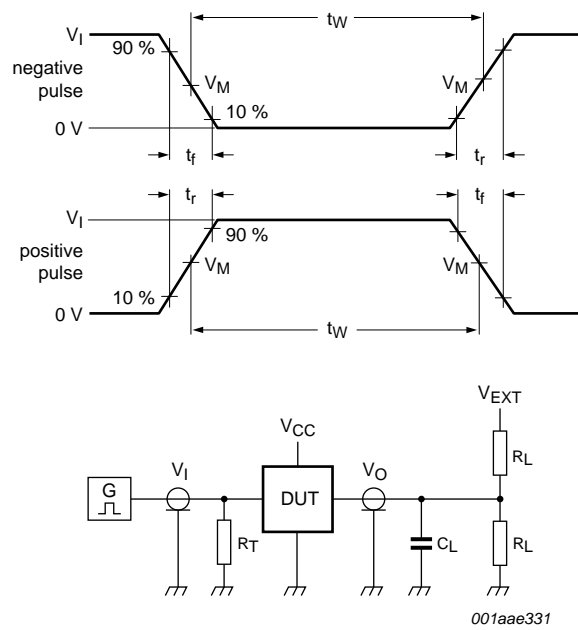


Measurement points are given in [Table 8](#).
 The shaded areas indicate when the input is permitted to change for predictable output performance.

Fig 10. Data set-up and hold times for the Dn input to the LE input

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}	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$	$V_{OL} + 0.15 \text{ V}$	$V_{OH} - 0.15 \text{ V}$
1.65 V to 1.95 V	V_{CC}	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$	$V_{OL} + 0.15 \text{ V}$	$V_{OH} - 0.15 \text{ V}$
2.3 V to 2.7 V	V_{CC}	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$	$V_{OL} + 0.15 \text{ V}$	$V_{OH} - 0.15 \text{ V}$
2.7 V	2.7 V	1.5 V	1.5 V	$V_{OL} + 0.3 \text{ V}$	$V_{OH} - 0.3 \text{ V}$
3.0 V to 3.6 V	2.7 V	1.5 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 11. 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 ns	30 pF	1 k Ω	open	$2 \times V_{CC}$	GND
1.65 V to 1.95 V	V_{CC}	≤ 2 ns	30 pF	1 k Ω	open	$2 \times V_{CC}$	GND
2.3 V to 2.7 V	V_{CC}	≤ 2 ns	30 pF	500 Ω	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

12. Package outline

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

SOT163-1

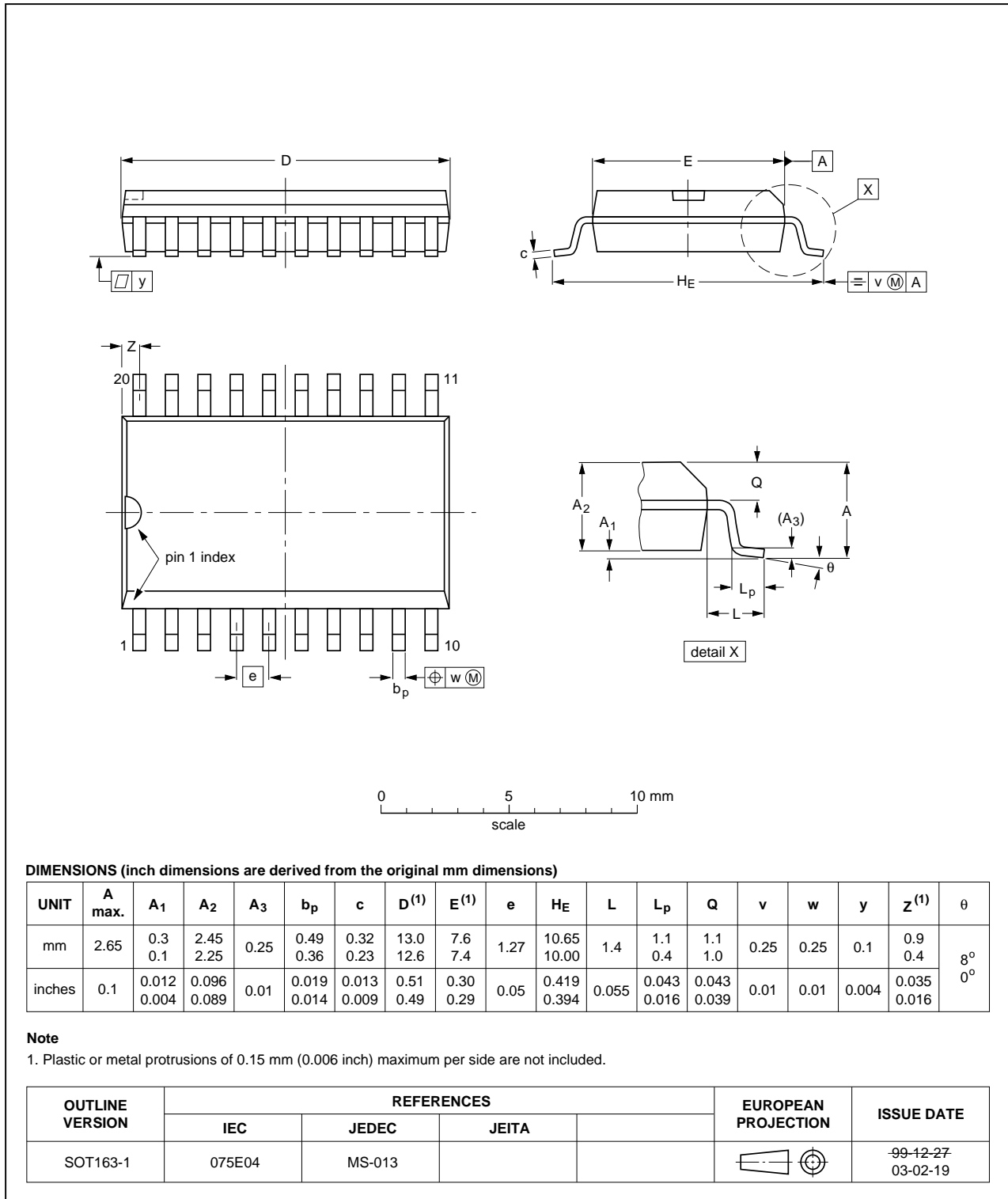


Fig 12. Package outline SOT163-1 (SO20)

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

SOT339-1

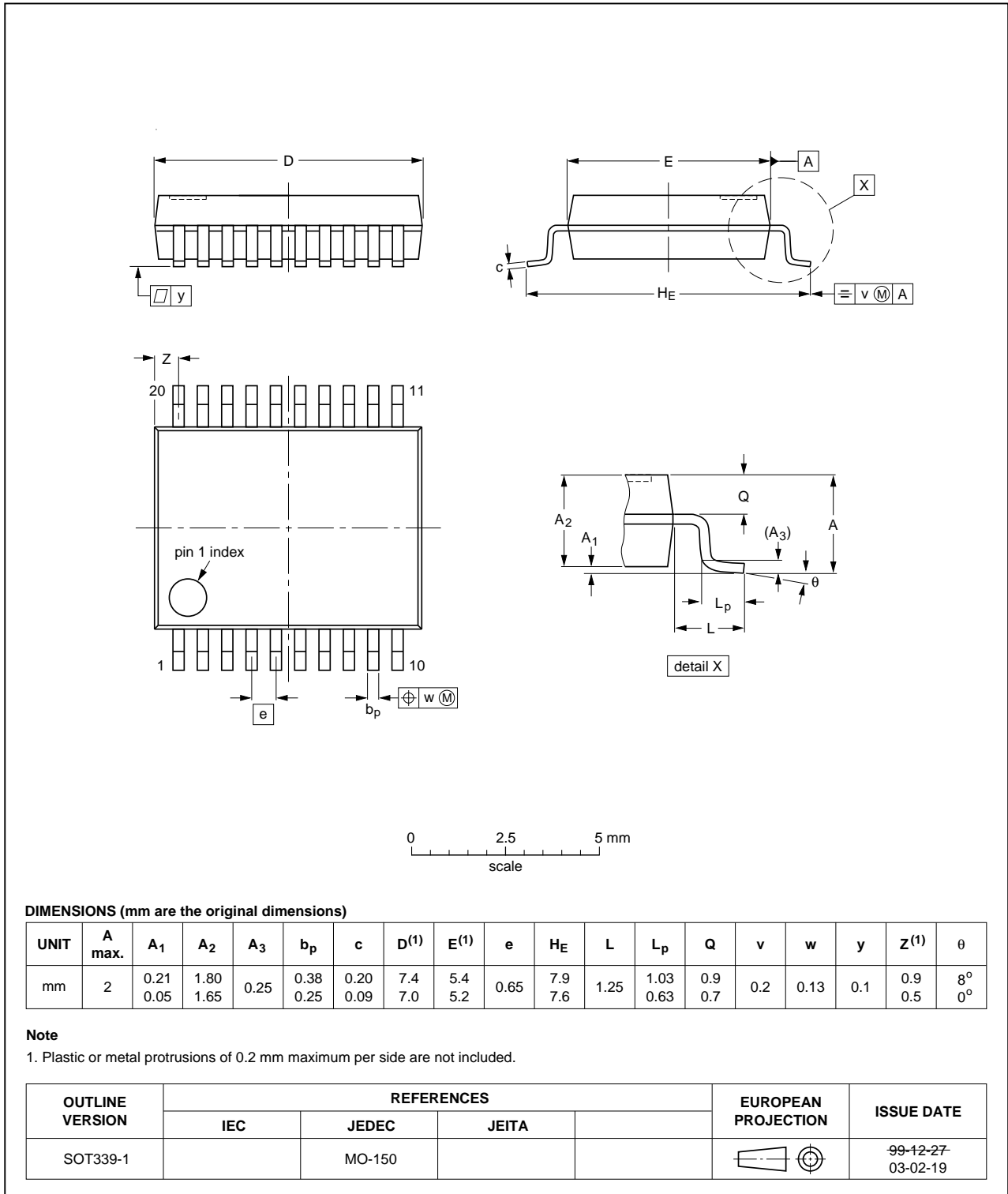


Fig 13. Package outline SOT339-1 (SSOP20)

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

SOT360-1

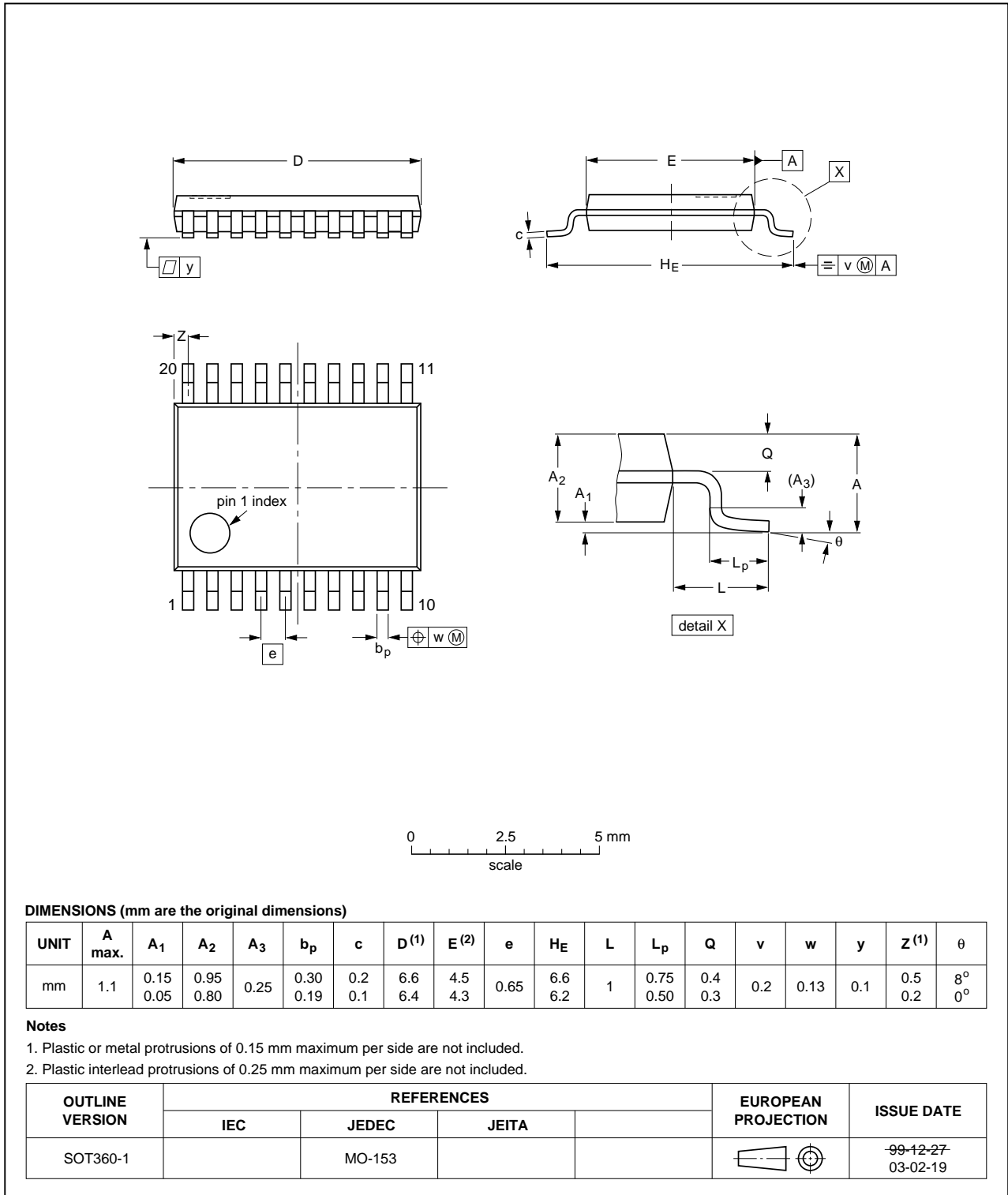


Fig 14. Package outline SOT360-1 (TSSOP20)

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

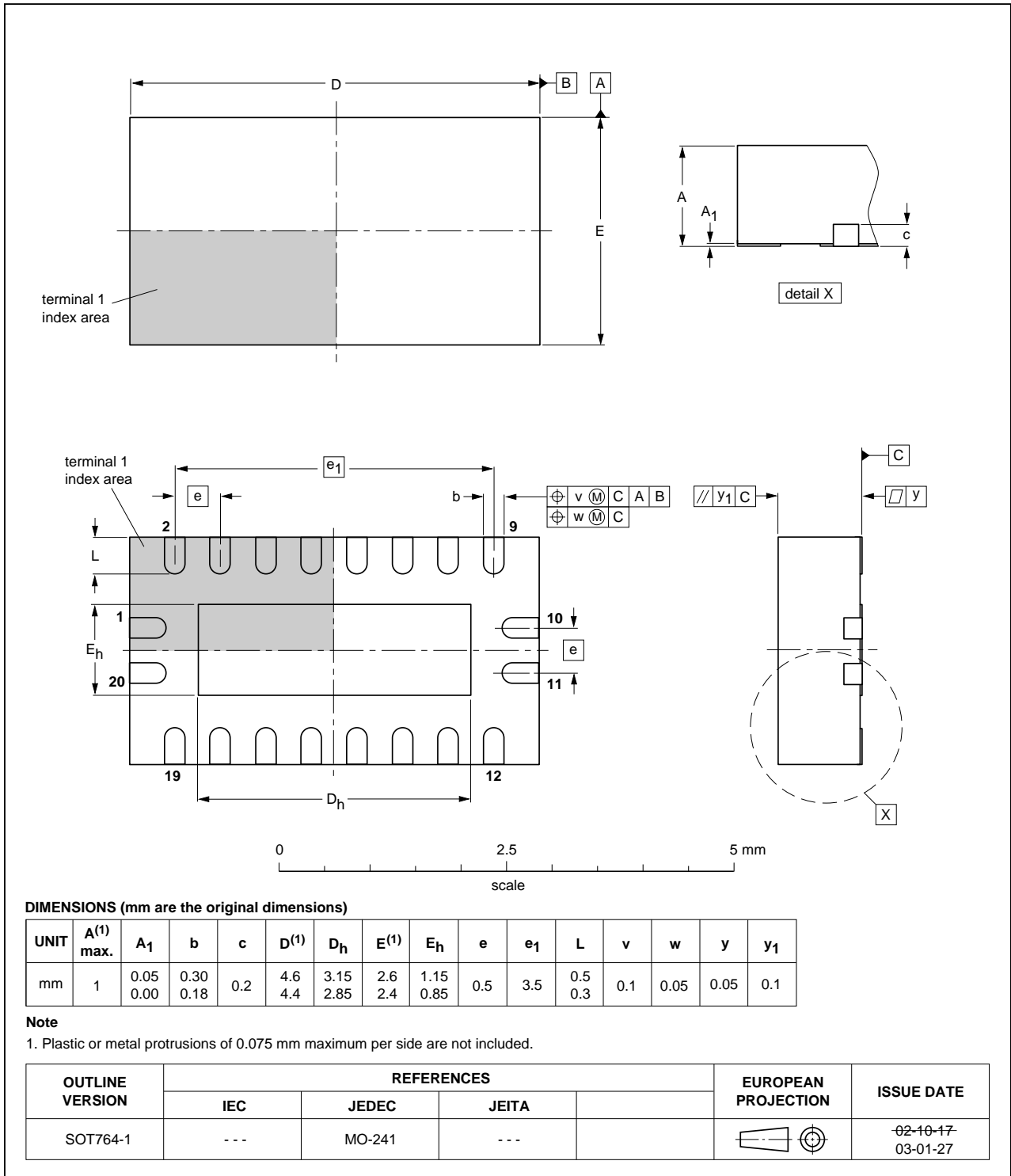


Fig 15. Package outline SOT764-1 (DHVQFN20)

DHXQFN20: plastic dual in-line compatible thermal enhanced extremely thin quad flat package; no leads; 20 terminals; body 4.5 x 2.5 x 0.5 mm

SOT1045-2

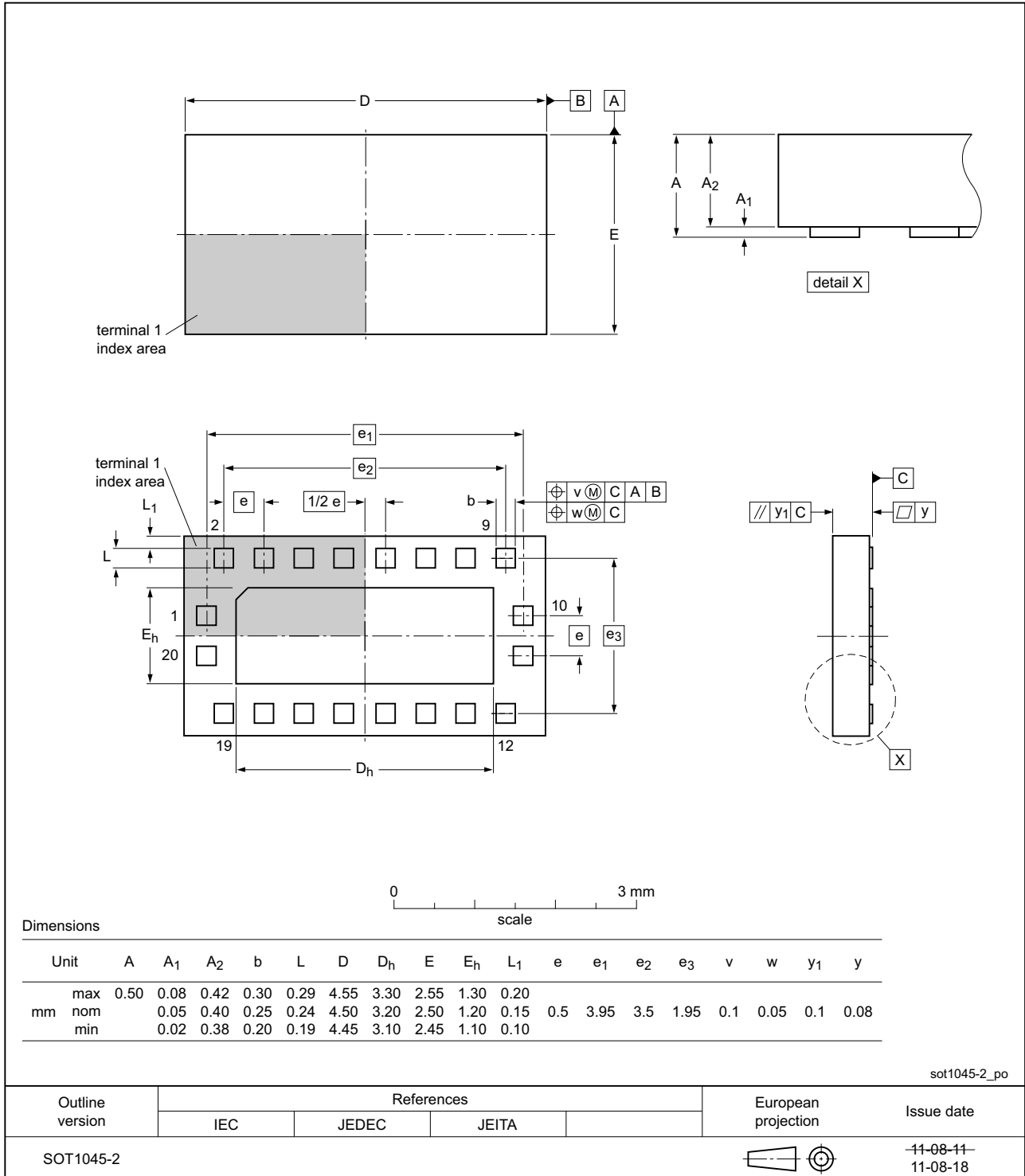


Fig 16. Package outline SOT1045-2 (DHXQFN20)

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
74LVC573A v.5	20130219	Product data sheet	-	74LVC573A v.4
Modifications:	<ul style="list-style-type: none"> 74LVC573ABX added. 			
74LVC573A v.4	20121129	Product data sheet	-	74LVC573A v.3
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. Table 4, Table 5, Table 6, Table 7, Table 8 and Table 9: values added for lower voltage ranges. 			
74LVC573A v.3	20031003	Product specification	-	74LVC573A v.2
74LVC573A v.2	20030526	Product specification	-	74LVC573A v.1
74LVC573A v.1	19980729	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".

[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.nxp.com>.

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