

74LVC245A; 74LVCH245A

Octal bus transceiver; 3-state

Rev. 13 — 8 August 2023

Product data sheet

1. General description

The 74LVC245A; 74LVCH245A is an 8-bit transceiver with 3-state outputs. The device features an output enable ($\overline{OE}$) and send/receive (DIR) for direction control. A HIGH on $\overline{OE}$ causes the outputs to assume a high-impedance OFF-state. Inputs can be driven from either 3.3 V or 5 V devices. This feature allows the use of these devices as translators in mixed 3.3 V and 5 V environments.

Schmitt-trigger action at all inputs makes the circuit tolerant of slower input rise and fall times.

This device is fully specified for partial power down applications using I_{OFF} . The I_{OFF} circuitry disables the output, preventing the potentially damaging backflow current through the device when it is powered down.

2. Features and benefits

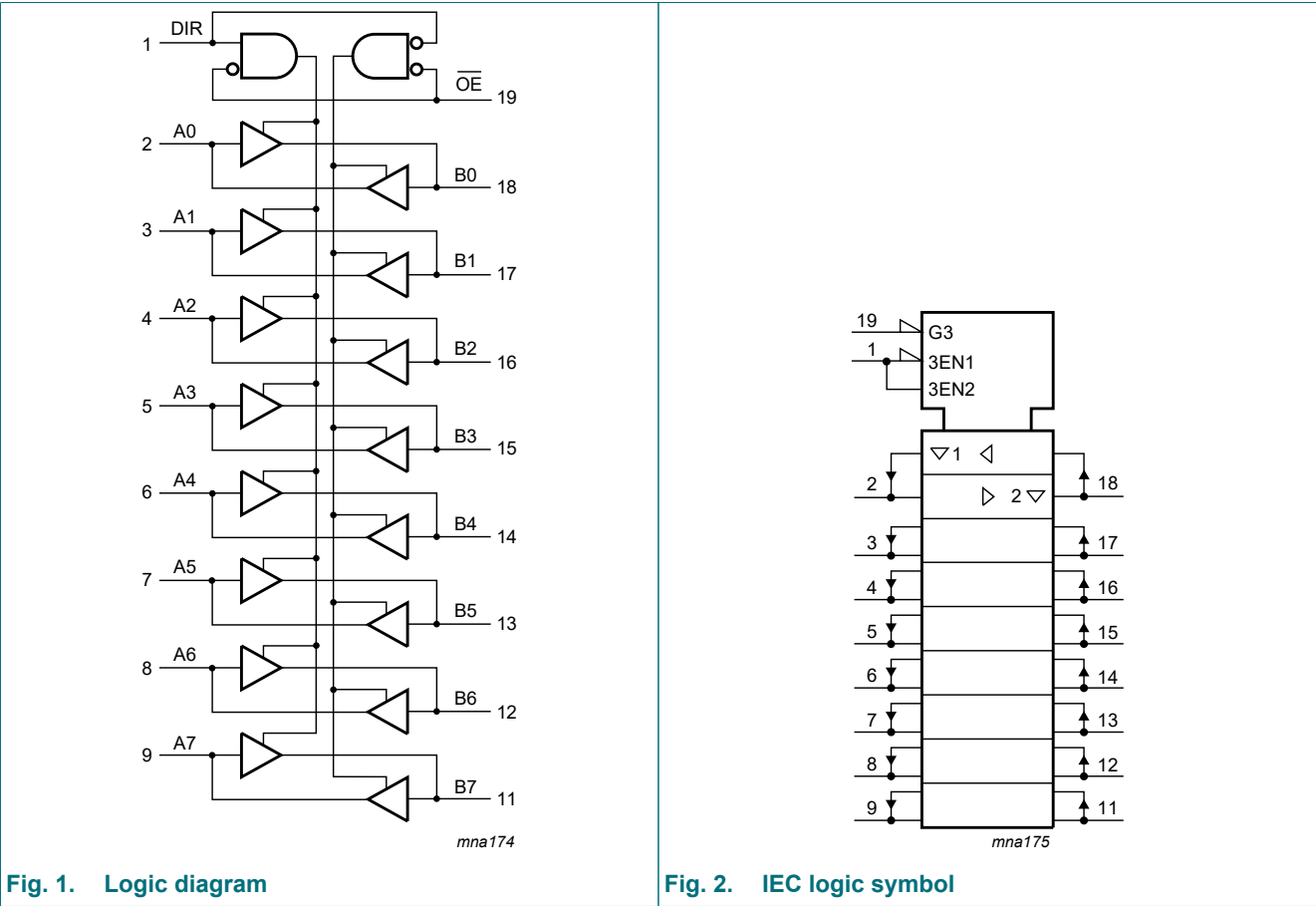
- Wide supply voltage range from 1.2 V to 3.6 V
- CMOS low-power consumption
- Direct interface with TTL levels
- Overvoltage tolerant inputs to 5.5 V
- Bus hold on all data inputs (74LVCH245A only)
- I_{OFF} circuitry provides partial Power-down mode operation
- Complies with JEDEC standard:
 - JESD8-7A (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: ANSI/ESDA/JEDEC JS-001 class 2 exceeds 2000 V
 - CDM: ANSI/ESDA/JEDEC JS-002 class C3 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			
	Temperature range	Name	Description	Version
74LVC245AD 74LVCH245AD	-40 °C to +125 °C	SO20	plastic small outline package; 20 leads; body width 7.5 mm	SOT163-1
74LVC245APW 74LVCH245APW	-40 °C to +125 °C	TSSOP20	plastic thin shrink small outline package; 20 leads; body width 4.4 mm	SOT360-1
74LVC245ABQ 74LVCH245ABQ	-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
74LVC245ABZ	-40 °C to +125 °C	DHXQFN20	plastic, leadless dual in-line compatible thermal enhanced extreme thin quad flat package; no leads; 20 terminals; 0.4 mm pitch; body 2 mm × 3.2 mm × 0.48 mm	SOT8020-1

4. Functional diagram



5. Pinning information

5.1. Pinning

D package
SOT163-1 (SO20)

DIR 1, A0 2, A1 3, A2 4, A3 5, A4 6, A5 7, A6 8, A7 9, GND 10, 20 VCC, 19 OE, 18 B0, 17 B1, 16 B2, 15 B3, 14 B4, 13 B5, 12 B6, 11 B7

aaa-035026

PW package
SOT360-1 (TSSOP20)

DIR 1, A0 2, A1 3, A2 4, A3 5, A4 6, A5 7, A6 8, A7 9, GND 10, 20 VCC, 19 OE, 18 B0, 17 B1, 16 B2, 15 B3, 14 B4, 13 B5, 12 B6, 11 B7

aaa-035027

BQ package
SOT764-1 (DHVQFN20)

terminal 1 index area, DIR 1, 20 VCC, A0 2, 19 OE, A1 3, 18 B0, A2 4, 17 B1, A3 5, 16 B2, A4 6, 15 B3, A5 7, 14 B4, A6 8, 13 B5, A7 9, 12 B6, GND(1) 10, B7 11

aaa-035029

Transparent top view

BZ package
SOT8020-1 (DHXQFN20)

pin 1 index area, DIR 1, 20 VCC, A0 2, 19 OE, A1 3, 18 B0, A2 4, 17 B1, A3 5, 16 B2, A4 6, 15 B3, A5 7, 14 B4, A6 8, 13 B5, A7 9, 12 B6, GND(1) 10, B7 11

aaa-035355

Transparent top view

(1) This is not a ground pin. There is no electrical or mechanical requirement to solder the pad. In case soldered, the solder land should remain floating or connected to GND.

5.2. Pin description

Table 2. Pin description

Symbol	Pin	Description
DIR	1	direction control
A0, A1, A2, A3, A4, A5, A6, A7	2, 3, 4, 5, 6, 7, 8, 9	data input/output
GND	10	ground (0 V)
B0, B1, B2, B3, B4, B5, B6, B7	18, 17, 16, 15, 14, 13, 12, 11	data input/output
OE	19	output enable input (active LOW)
VCC	20	supply voltage

6. Functional description

Table 3. Function selection

H = HIGH voltage level; L = LOW voltage level; X = don't care; Z = high impedance OFF-state.

Inputs		Inputs/outputs	
OE	DIR	An	Bn
L	L	An = Bn	inputs
L	H	inputs	Bn = An
H	X	Z	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	°C
P _{tot}	total power dissipation	T _{amb} = -40 °C to +125 °C			
		SOT163-1 (SO20) [3]	-	500	mW
		SOT360-1 (TSSOP20) [4]			
		SOT764-1 (DHVQFN20) [5]			
		SOT8020-1 (DHXQFN20)	-	250	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 SOT163-1 (SO20) package: P_{tot} derates linearly with 12.3 mW/K above 109 °C.

[4] For SOT360-1 (TSSOP20) package: P_{tot} derates linearly with 10.0 mW/K above 100 °C.

[5] For SOT764-1 (DHVQFN20) package: P_{tot} derates linearly with 12.9 mW/K above 111 °C.

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	°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	T _{amb} = -40 °C to +85 °C			T _{amb} = -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	0.65V _{CC}	-	-	0.65V _{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	-	-	0.35V _{CC}	-	0.35V _{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
		I _O = -24 mA; V _{CC} = 3.0 V	2.2	-	-	2.0	-	V
V _{OL}	LOW-level output voltage	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 _O = 24 mA; V _{CC} = 3.0 V	-	-	0.55	-	0.8	V

Symbol	Parameter	Conditions	T _{amb} = -40 °C to +85 °C			T _{amb} = -40 °C to +125 °C		Unit
			Min	Typ [1]	Max	Min	Max	
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 [3]	-	±0.1	±5	-	±20	µA
I _{OFF}	power-off leakage current	V _I or V _O = 5.5 V; V _{CC} = 0.0 V	-	±0.1	±10	-	±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
C _I	input capacitance	V _{CC} = 0 V to 3.6 V; V _I = GND to V _{CC}	-	4.0	-	-	-	pF
C _{I/O}	input/output capacitance	V _{CC} = 0 V to 3.6 V; V _I = GND to V _{CC}	-	10	-	-	-	pF
I _{BHL}	bus hold LOW current	V _{CC} = 1.65; V _I = 0.58 V [4] [5]	10	-	-	10	-	µA
		V _{CC} = 2.3; V _I = 0.7 V	30	-	-	25	-	µA
		V _{CC} = 3.0; V _I = 0.8 V	75	-	-	60	-	µA
I _{BHH}	bus hold HIGH current	V _{CC} = 1.65; V _I = 1.07 V [4] [5]	-10	-	-	-10	-	µA
		V _{CC} = 2.3; V _I = 1.7 V	-30	-	-	-25	-	µA
		V _{CC} = 3.0; V _I = 2.0 V	-75	-	-	-60	-	µA
I _{BHLO}	bus hold LOW overdrive current	V _{CC} = 1.95 V [4] [6]	200	-	-	200	-	µA
		V _{CC} = 2.7 V	300	-	-	300	-	µA
		V _{CC} = 3.6 V	500	-	-	500	-	µA
I _{BHHO}	bus hold HIGH overdrive current	V _{CC} = 1.95 V [4] [6]	-200	-	-	-200	-	µA
		V _{CC} = 2.7 V	-300	-	-	-300	-	µA
		V _{CC} = 3.6 V	-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 (74LVCH245A). 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 Fig. 5.

Symbol	Parameter	Conditions	T _{amb} = -40 °C to +85 °C			T _{amb} = -40 °C to +125 °C		Unit
			Min	Typ [1]	Max	Min	Max	
t _{pd}	propagation delay	nAn to nBn; nBn to nAn; see Fig. 3 [2]						
		V _{CC} = 1.2 V	-	17.0	-	-	-	ns
		V _{CC} = 1.65 V to 1.95 V	1.5	6.5	14.6	1.5	16.9	ns
		V _{CC} = 2.3 V to 2.7 V	1.0	3.4	7.6	1.0	8.7	ns
		V _{CC} = 2.7 V	1.5	3.4	7.3	1.5	9.5	ns
		V _{CC} = 3.0 V to 3.6 V	1.5	2.9	6.3	1.5	8.0	ns
t _{en}	enable time	n $\overline{\text{OE}}$ to nAn, nBn; see Fig. 4 [2]						
		V _{CC} = 1.2 V	-	22.0	-	-	-	ns
		V _{CC} = 1.65 V to 1.95 V	1.9	8.3	19.5	1.9	22.5	ns
		V _{CC} = 2.3 V to 2.7 V	1.5	4.6	10.7	1.5	12.4	ns
		V _{CC} = 2.7 V	1.5	4.8	9.5	1.5	12.0	ns
		V _{CC} = 3.0 V to 3.6 V	1.5	3.7	8.5	1.5	11.0	ns
t _{dis}	disable time	n $\overline{\text{OE}}$ to nAn, nBn; see Fig. 4 [2]						
		V _{CC} = 1.2 V	-	12.0	-	-	-	ns
		V _{CC} = 1.65 V to 1.95 V	2.9	5.5	12.3	2.9	14.2	ns
		V _{CC} = 2.3 V to 2.7 V	1.0	3.1	7.1	1.0	8.2	ns
		V _{CC} = 2.7 V	1.5	3.9	8.0	1.5	10.0	ns
		V _{CC} = 3.0 V to 3.6 V	1.7	3.6	7.0	1.7	9.0	ns
t _{sk(o)}	output skew time	[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	-	7.7	-	-	-	pF
		V _{CC} = 2.3 V to 2.7 V	-	11.3	-	-	-	pF
		V _{CC} = 3.0 V to 3.6 V	-	14.4	-	-	-	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] 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).

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

10.1. Waveforms and test circuit

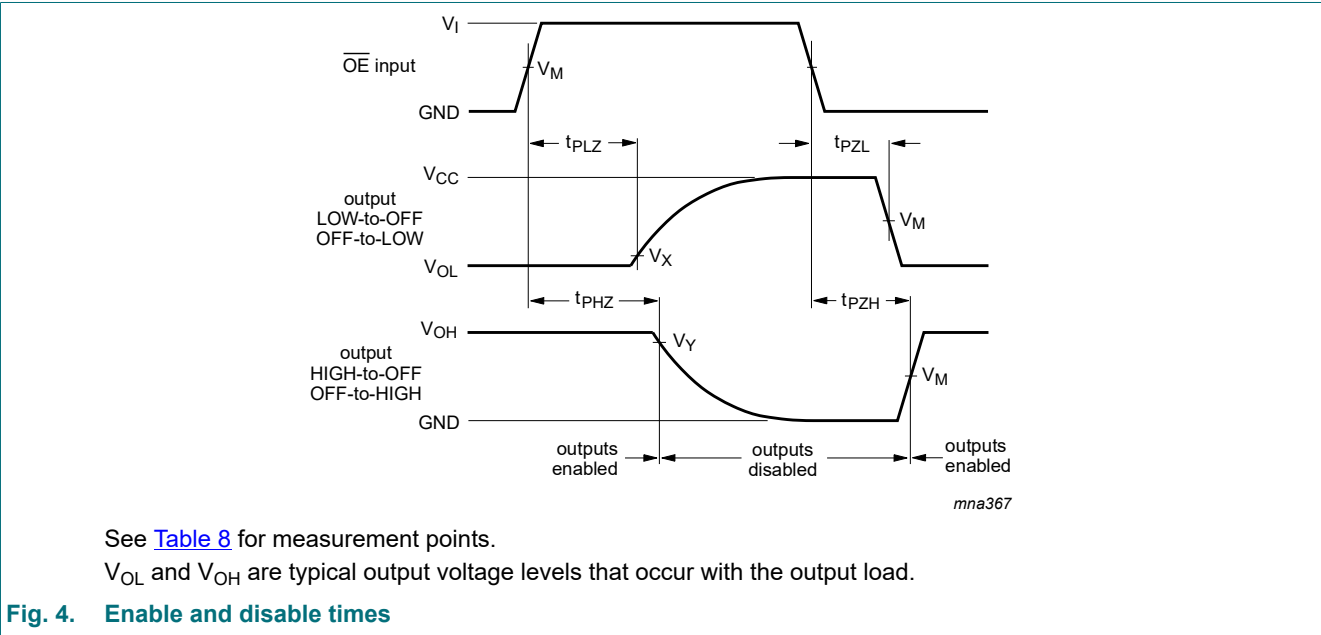
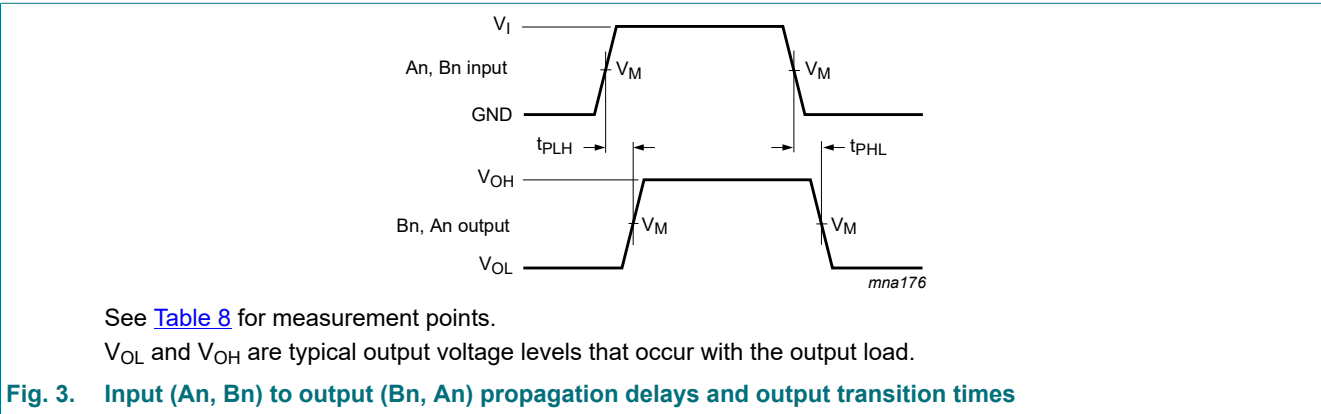
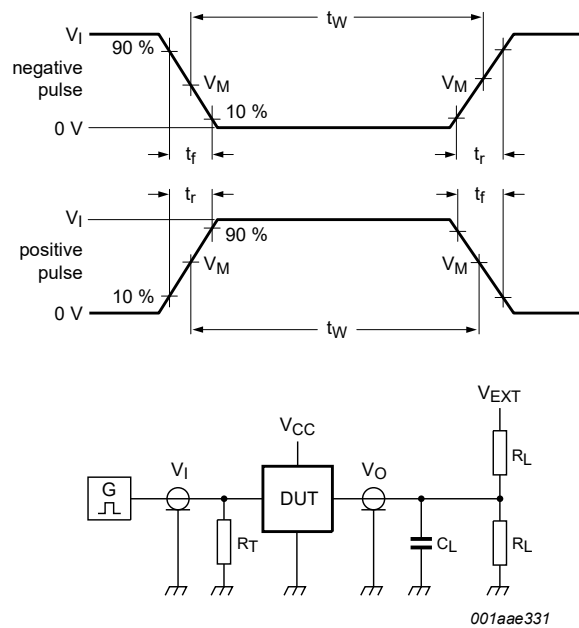


Table 8. Measurement points

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. 5. 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 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

11. Package outline

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

SOT163-1

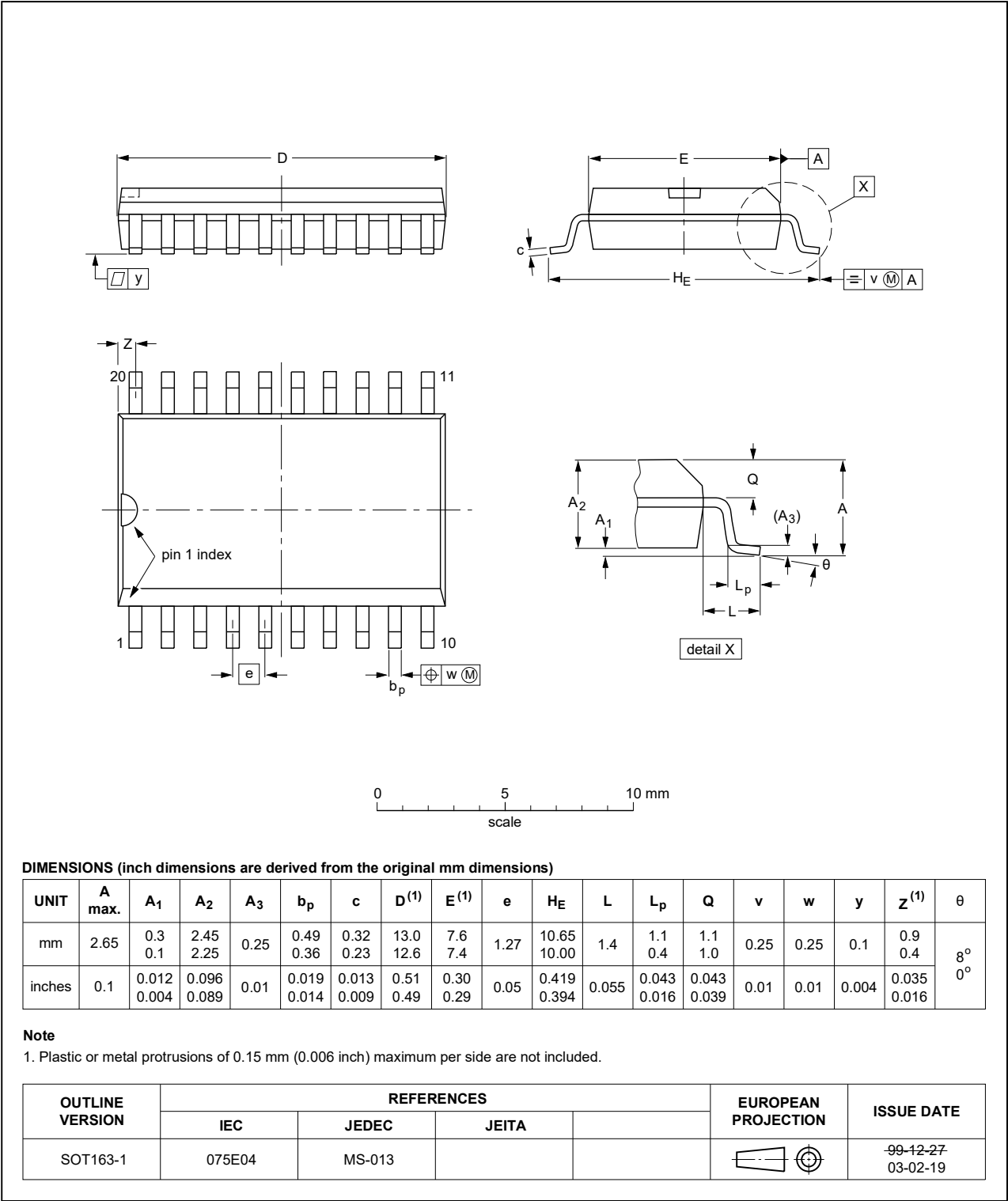


Fig. 6. Package outline SOT163-1 (SO20)

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

SOT360-1

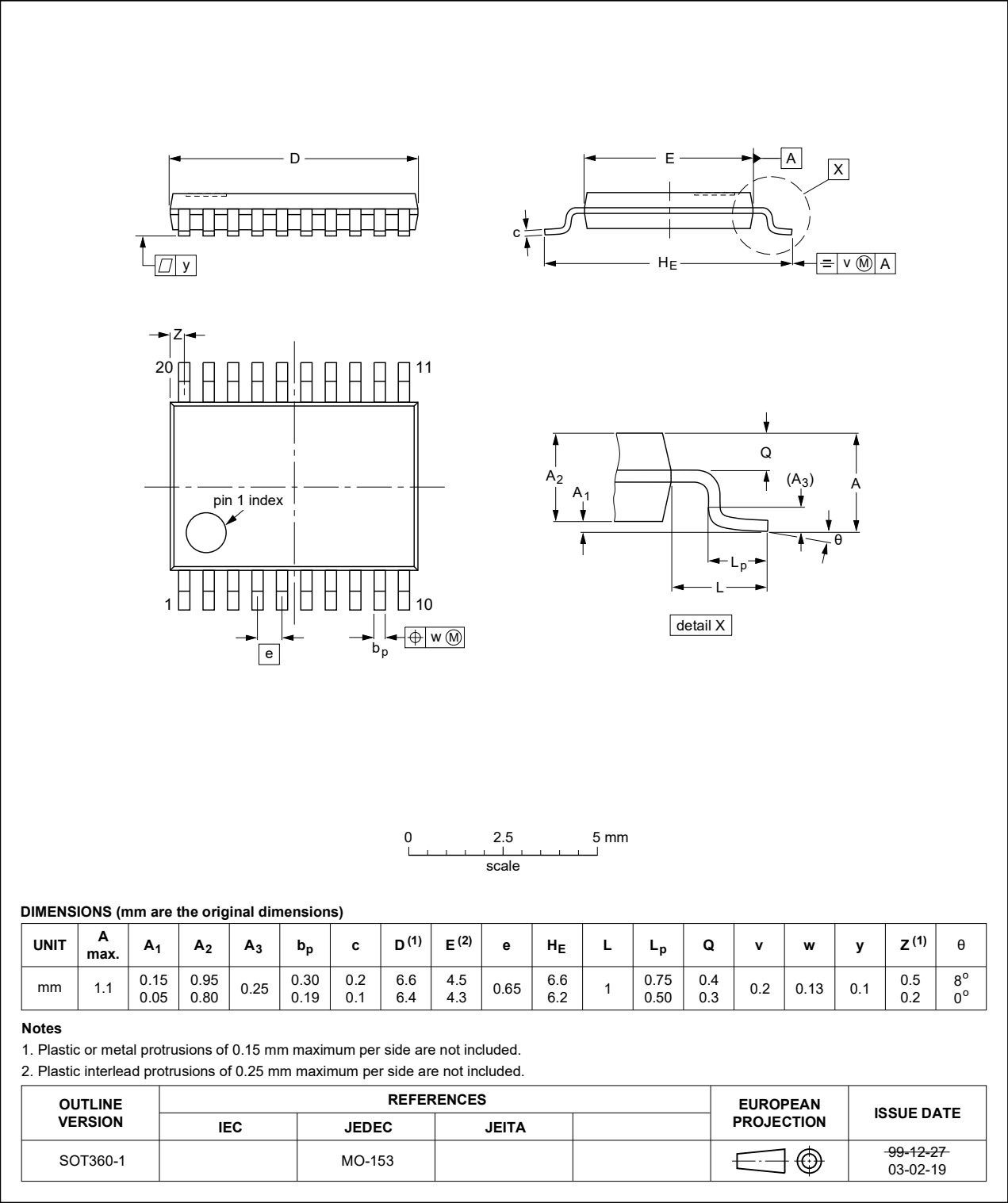


Fig. 7. Package outline SOT360-1 (TSSOP20)

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

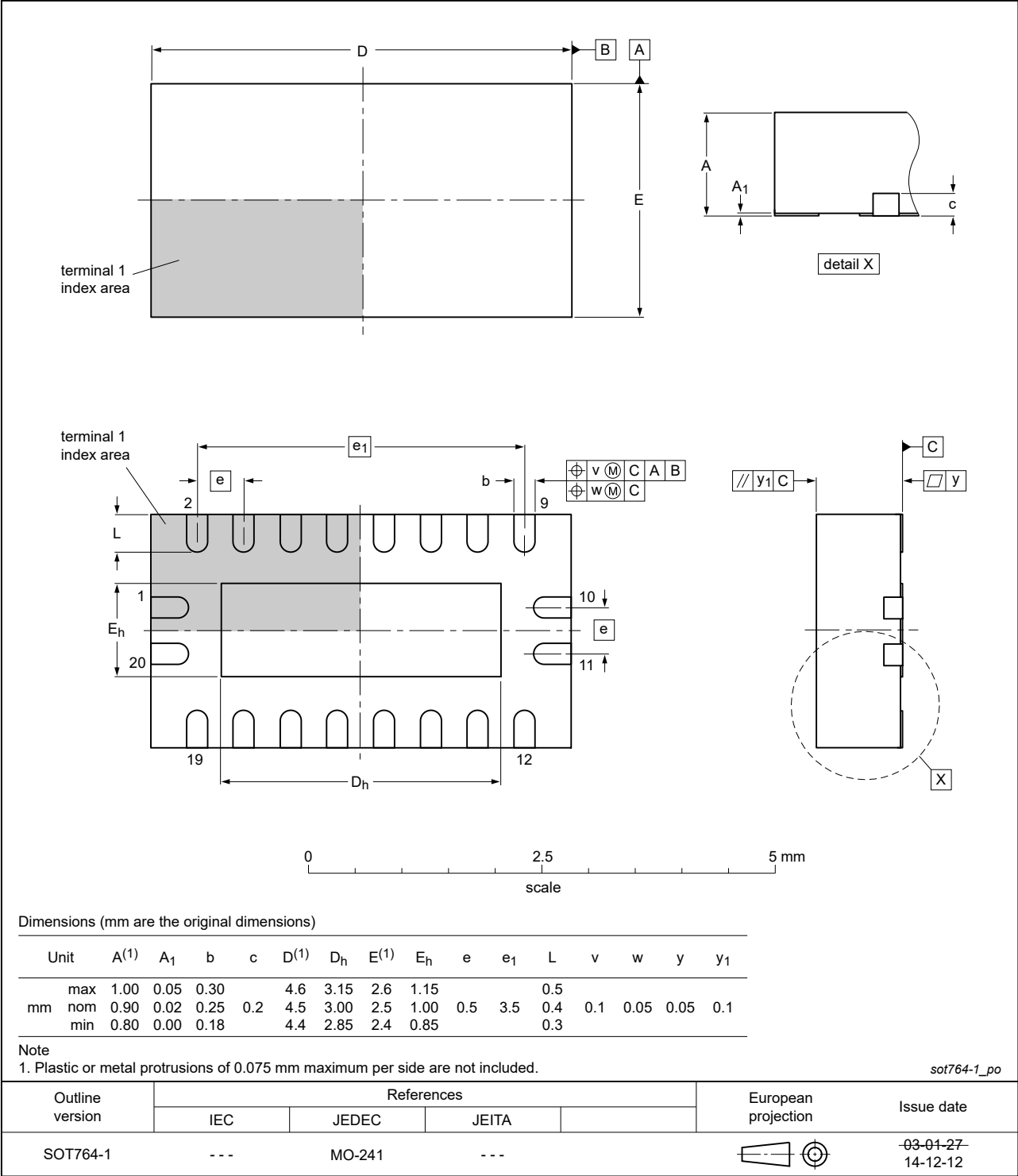


Fig. 8. Package outline SOT764-1 (DHVQFN20)

DHXQFN20: plastic, leadless dual in-line compatible thermal enhanced extreme thin quad flat package;
no leads; 20 terminals; 0.4 mm pitch; body 2 mm x 3.2 mm x 0.48 mm

SOT8020-1

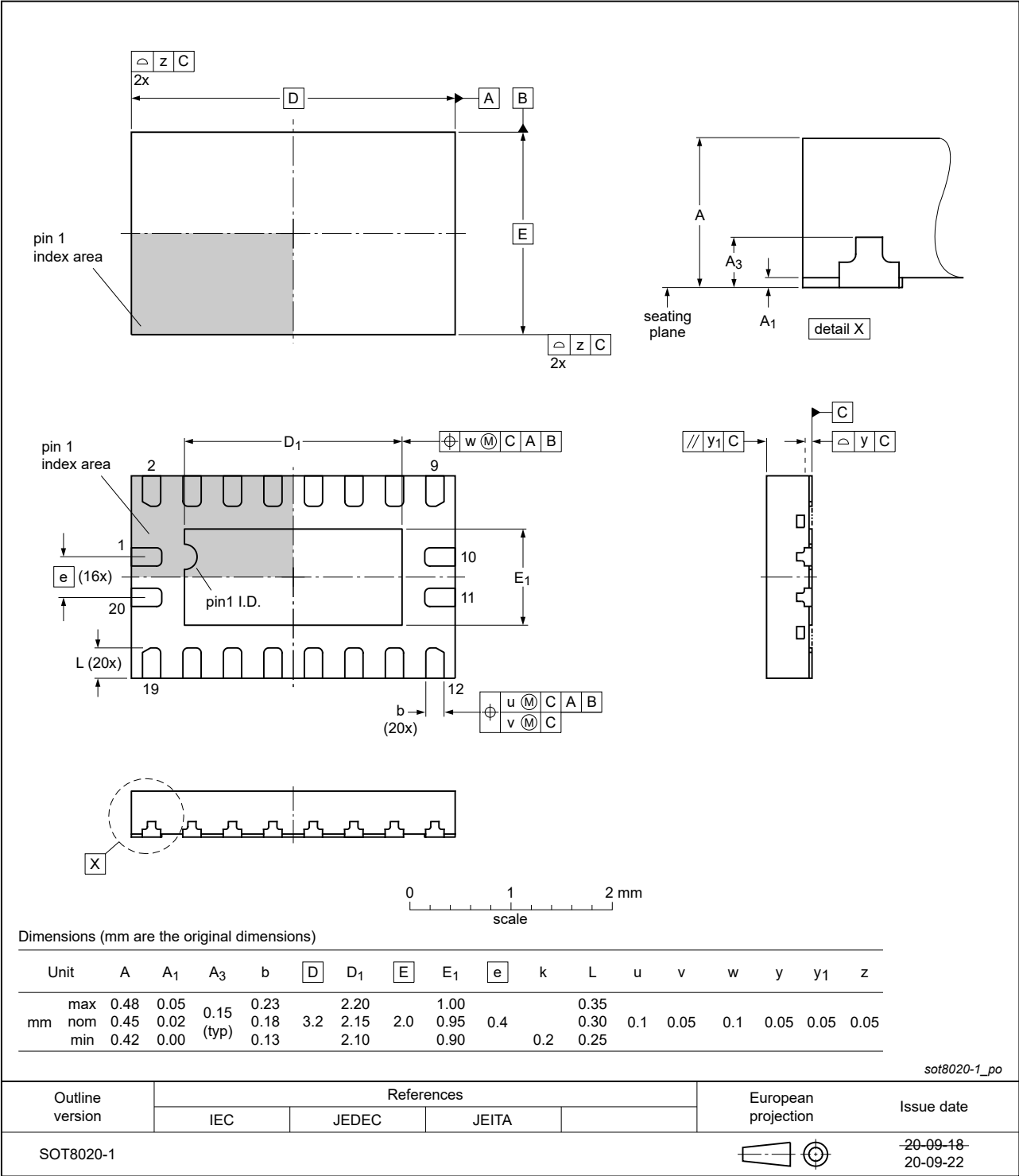


Fig. 9. Package outline SOT8020-1 (DHXQFN20)

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
TTL	Transistor-Transistor Logic

13. Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74LVC_LVCH245A v.13	20230808	Product data sheet	-	74LVC_LVCH245A v.12
Modifications:	Section 2: ESD specification updated according to the latest JEDEC standard.			
74LVC_LVCH245A v.12	20210916	Product data sheet	-	74LVC_LVCH245A v.11
Modifications:	Type numbers 74LVC245ADB and 74LVCH245ADB (SOT339-1/SSOP20) removed.			
74LVC_LVCH245A v.11	20210429	Product data sheet	-	74LVC_LVCH245A v.10
Modifications:	Type number 74LVC245ABZ (SOT8020-1 / DHXQFN20) added.			
74LVC_LVCH245A v.10	20200805	Product data sheet	-	74LVC_LVCH245A v.9
Modifications:	Section 1 updated. Table 4: Derating values for P_{tot} total power dissipation updated. Table 8 corrected (Errata).			
74LVC_LVCH245A v.9	20180911	Product data sheet	-	74LVC_LVCH245A v.8
Modifications:	- 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 74LVC245ABX and 74LVCH245ABX (SOT1045-2) removed. Fig. 8: Package outline drawing of SOT764-1 updated.			
74LVC_LVCH245A v.8	20130628	Product data sheet	-	74LVC_LVCH245A v.7
Modifications:	For type numbers 74LVC245ABX and 74LVCH245ABX DHXQFN20U (SOT1045-1) has changed to DHXQFN20 (SOT1045-2).			
74LVC_LVCH245A v.7	20120405	Product data sheet	-	74LVC_LVCH245A v.6
Modifications:	Table note 4 of Table 6: corrected (errata)			
74LVC_LVCH245A v.6	20111125	Product data sheet	-	74LVC_LVCH245A v.5
Modifications:	Table 4, Table 5, Table 6, Table 7, and Table 9: values added for lower voltage ranges.			
74LVC_LVCH245A v.5	20090825	Product data sheet	-	74LVC_LVCH245A v.4
74LVC_LVCH245A v.4	20090703	Product data sheet	-	74LVC_LVCH245A v.3
74LVC_LVCH245A v.3	20030507	Product specification	-	74LVC245A_74LVCH245A v.2
74LVC245A_74LVCH245A v.2	20020620	Product specification	-	74LVC245A_74LVCH245A v.1
74LVC245A_74LVCH245A v.1	19971219	Product specification	-	-

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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