74LVT244A-Q100; 74LVTH244A-Q100

3.3 V octal buffer/line driver; 3-state

Rev. 2 — 24 August 2020 Product data sheet

1. General description

The 74LVT244A-Q100; 74LVTH244A-Q100 is a high-performance BiCMOS product designed for V_{CC} operation at 3.3 V.

This device is an octal buffer that is ideal for driving bus lines. The device features two output enables ($1\overline{OE}$, $2\overline{OE}$), each controlling four of the 3-state outputs.

This product has been qualified to the Automotive Electronics Council (AEC) standard Q100 (Grade 3) and is suitable for use in automotive applications.

2. Features and benefits

- Automotive product qualification in accordance with AEC-Q100 (Grade 3)
  - Specified from -40 °C to +85 °C
- Octal bus interface
- 3-state buffers
- Output capability: +64 mA and -32 mA
- TTL input and output switching levels
- Input and output interface capability to systems at 5 V supply
- Bus hold data inputs eliminate need for external pull-up resistors to hold unused inputs
- Live insertion and extraction permitted
- Power-up 3-state
- No bus current loading when output is tied to 5 V bus
- Latch-up protection
  - JESD78 Class II exceeds 500 mA
- ESD protection:
  - MIL-STD-883, method 3015 exceeds 2000 V
  - HBM JESD22-A114F exceeds 2000 V
  - MM JESD22-A115-A exceeds 200 V (C = 200 pF, R = 0 Ω)
- DHVQFN package with Side-Wettable Flanks enabling Automatic Optical Inspection (AOI) of solder joints

3. Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
74LVT244AD-Q100	-40 °C to +85 °C	SO20	plastic small outline package; 20 leads; body width 7.5 mm	SOT163-1
74LVTH244AD-Q100				
74LVT244APW-Q100	-40 °C to +85 °C	TSSOP20	plastic thin shrink small outline package; 20 leads; body width 4.4 mm	SOT360-1
74LVTH244APW-Q100				
74LVT244ABQ-Q100	-40 °C to +85 °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
74LVTH244ABQ-Q100				

nexperia

4. Functional diagram

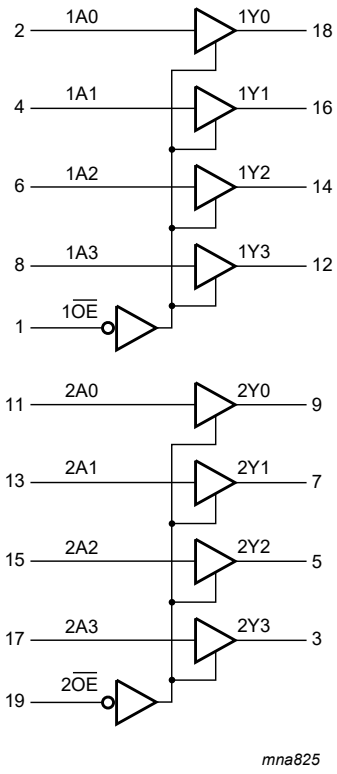


Fig. 1. Logic symbol

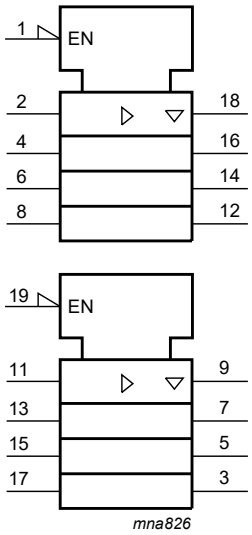


Fig. 2. IEC logic symbol

5. Pinning information

5.1. Pinning

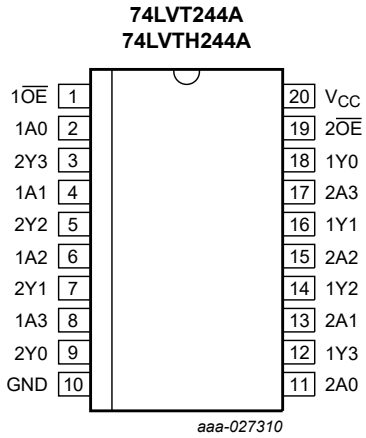


Fig. 3. Pin configuration SOT163-1 (SO20)

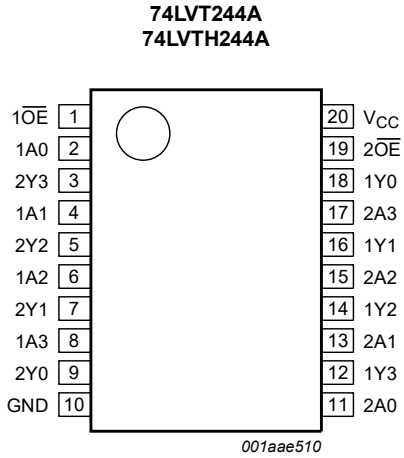
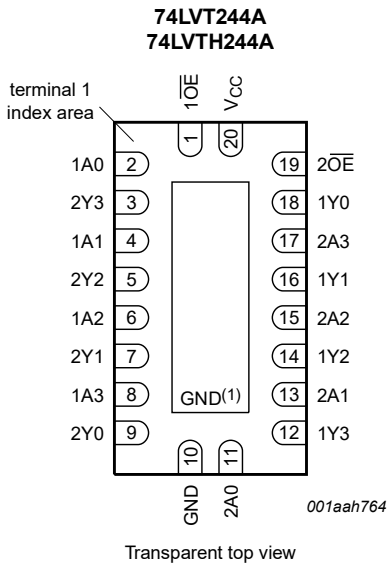


Fig. 4. Pin configuration SOT360-1 (TSSOP20)



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.

Fig. 5. Pin configuration SOT764-1 (DHVQFN20)

5.2. Pin description

Table 2. Pin description

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

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
$n\overline{OE}$	**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	+4.6	V
V_I	input voltage		[1]	-0.5	+7.0	V
V_O	output voltage	output in OFF-state or HIGH-state	[1]	-0.5	+7.0	V
I_{IK}	input clamping current	$V_I < 0$ V		-50	-	mA
I_{OK}	output clamping current	$V_O < 0$ V		-50	-	mA
I_O	output current	output in LOW-state		-	128	mA
		output in HIGH-state		-64	-	mA
T_{stg}	storage temperature			-65	+150	°C
T_j	junction temperature		[2]	-	150	°C
P_{tot}	total power dissipation	T_{amb} = -40 to +85 °C	[3]	-	500	mW

[1] The input and output negative voltage ratings may be exceeded if the input and output clamp current ratings are observed.
[2] The performance capability of a high-performance integrated circuit in conjunction with its thermal environment can create junction temperatures which are detrimental to reliability.
[3] For SOT163-1 (SO20) package: P_{tot} derates linearly with 12.3 mW/K above 109 °C.
For SOT360-1 (TSSOP20) package: P_{tot} derates linearly with 10.0 mW/K above 100 °C.
For SOT764-1 (DHVQFN20) package: P_{tot} derates linearly with 12.9 mW/K above 111 °C.

8. Recommended operating conditions

Table 5. Operating conditions

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{CC}	supply voltage		2.7	-	3.6	V
V_I	input voltage		0	-	5.5	V
I_{OH}	HIGH-level output current		-32	-	-	mA
I_{OL}	LOW-level output current	none	-	-	32	mA
		current duty cycle ≤ 50 %; $f_i \geq 1$ kHz	-	-	64	mA
T_{amb}	ambient temperature	in free-air	-40	-	+85	°C
$\Delta t/\Delta V$	input transition rise and fall rate	outputs enabled	-	-	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			Unit
			Min	Typ[1]	Max	
V_{IK}	input clamping voltage	V_{CC} = 2.7 V; I_{IK} = -18 mA	-1.2	-0.9	-	V
V_{IH}	HIGH-level input voltage		2.0	-	-	V
V_{IL}	LOW-level input voltage		-	-	0.8	V
V_{OH}	HIGH-level output voltage	V_{CC} = 2.7 V to 3.6 V; I_{OH} = -100 µA	V_{CC} - 0.2	V_{CC} - 0.1	-	V
		V_{CC} = 2.7 V to 3.6 V; I_{OH} = -8 mA	2.4	2.5	-	V
		V_{CC} = 3.0 V; I_{OH} = -32 mA	2.0	2.2	-	V
V_{OL}	LOW-level output voltage	V_{CC} = 2.7 V; I_{OL} = 100 µA	-	0.1	0.2	V
		V_{CC} = 2.7 V; I_{OL} = 24 mA	-	0.3	0.5	V
		V_{CC} = 3.0 V; I_{OL} = 16 mA	-	0.25	0.4	V
		V_{CC} = 3.0 V; I_{OL} = 32 mA	-	0.3	0.5	V
		V_{CC} = 3.0 V; I_{OL} = 64 mA	-	0.4	0.55	V
I_I	input leakage current	all input pins				
		V_{CC} = 0 V or 3.6 V; V_I = 5.5 V	-	0.1	10	µA
		control pins				
		V_{CC} = 3.6 V; V_I = V_{CC} or GND	-	±0.1	±1	µA
		data pins [2]				
		V_{CC} = 3.6 V; V_I = V_{CC}	-	0.1	1	µA
		V_{CC} = 3.6 V; V_I = 0 V	-5	-1	-	µA
I_{OFF}	power-off leakage current	V_{CC} = 0 V; V_I or V_O = 0 V to 4.5 V	-	1	±100	µA
I_{BHL}	bus hold LOW current	V_{CC} = 3 V; V_I = 0.8 V	75	150	-	µA
I_{BHH}	bus hold HIGH current	V_{CC} = 3 V; V_I = 2.0 V	-	-150	-75	µA
I_{BHLO}	bus hold LOW overdrive current	nAn input; V_{CC} = 3.6 V; V_I = 0 V to 3.6 V [3]	500	-	-	µA
I_{BHHO}	bus hold HIGH overdrive current	nAn input; V_{CC} = 3.6 V; V_I = 0 V to 3.6 V [3]	-	-	-500	µA
I_{EX}	external current	nYn output in HIGH-state when V_O > V_{CC}; V_O = 5.5 V; V_{CC} = 3.0 V	-	60	125	µA
$I_{O(pu/pd)}$	power-up/power-down output current	V_{CC} ≤ 1.2 V; V_O = 0.5 V to V_{CC}; V_I = GND or V_{CC}; $n\overline{OE}$ = don't care [4]	-	±1	±100	µA
I_{OZ}	OFF-state output current	V_{CC} = 3.6 V; V_I = V_{IH} or V_{IL}				
		V_O = 3.0 V	-	1	5	µA
		V_O = 0.5 V	-5	-1	-	µA
I_{CC}	supply current	V_{CC} = 3.6 V; V_I = GND or V_{CC}; I_O = 0 A				
		output HIGH	-	0.13	0.19	mA
		output LOW	-	3	12	mA
		outputs disabled [5]	-	0.13	0.19	mA
ΔI_{CC}	additional supply current	per input pin; V_{CC} = 3.0 V to 3.6 V; one input at V_{CC} - 0.6 V and other inputs at V_{CC} or GND [6]	-	0.1	0.2	mA
C_I	input capacitance	V_I = 0 V or 3.0 V	-	4	-	pF

Symbol	Parameter	Conditions	T_{amb} = -40 °C to +85 °C			Unit
			Min	Typ[1]	Max	
C_O	output capacitance	outputs disabled; V_O = 0 V or 3.0 V	-	8	-	pF

[1] All typical values are measured at T_{amb} = 25 °C.
[2] Unused pins at V_{CC} or GND.
[3] This is the bus hold overdrive current required to force the input to the opposite logic state.
[4] This parameter is valid for any V_{CC} between 0 V and 1.2 V with a transition time of up to 10 ms. From V_{CC} = 1.2 V to V_{CC} = 3.3 V ± 0.3 V a transition time of 100 µs is permitted. This parameter is valid for T_{amb} = 25 °C only.
[5] I_{CC} is measured with outputs pulled to V_{CC} or GND.
[6] This is the increase in supply current for each input at the specified voltage level other than V_{CC} or GND.

10. Dynamic characteristics

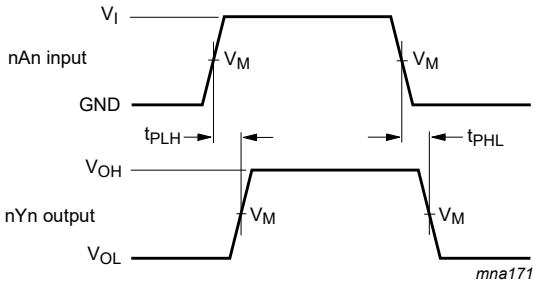
Table 7. Dynamic characteristics

Voltages are referenced to GND (ground = 0 V); for test circuit see Fig. 8.

Symbol	Parameter	Conditions	T_{amb} = -40 °C to +85 °C			Unit
			Min	Typ[1]	Max	
t_{PLH}	LOW to HIGH propagation delay	nAn to nYn; see Fig. 6				
		V_{CC} = 2.7 V	-	-	5.0	ns
		V_{CC} = 3.0 V to 3.6 V	1	2.5	4.1	ns
t_{PHL}	HIGH to LOW propagation delay	nAn to nYn; see Fig. 6				
		V_{CC} = 2.7 V	-	-	5.1	ns
		V_{CC} = 3.0 V to 3.6 V	1	2.6	4.1	ns
t_{PZH}	OFF-state to HIGH propagation delay	$n\overline{OE}$ to nYn; see Fig. 7				
		V_{CC} = 2.7 V	-	-	6.3	ns
		V_{CC} = 3.0 V to 3.6 V	1	3.2	5.2	ns
t_{PZL}	OFF-state to LOW propagation delay	$n\overline{OE}$ to nYn; see Fig. 7				
		V_{CC} = 2.7 V	-	-	6.7	ns
		V_{CC} = 3.0 V to 3.6 V	1.1	3.1	5.2	ns
t_{PHZ}	HIGH to OFF-state propagation delay	$n\overline{OE}$ to nYn; see Fig. 7				
		V_{CC} = 2.7 V	-	-	6.3	ns
		V_{CC} = 3.0 V to 3.6 V	1.9	3.3	5.6	ns
t_{PLZ}	LOW to OFF-state propagation delay	$n\overline{OE}$ to nYn; see Fig. 7				
		V_{CC} = 2.7 V	-	-	5.6	ns
		V_{CC} = 3.0 V to 3.6 V	1.8	3.3	5.1	ns

[1] All typical values are at V_{CC} = 3.3 V and T_{amb} = 25 °C.

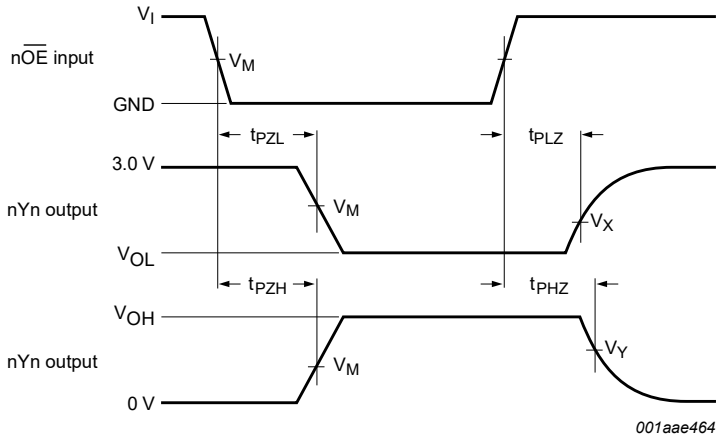
10.1. Waveforms and test circuit



Measurement points are given in Table 8.

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

Fig. 6. Input (nAn) to output (nYn) propagation delays



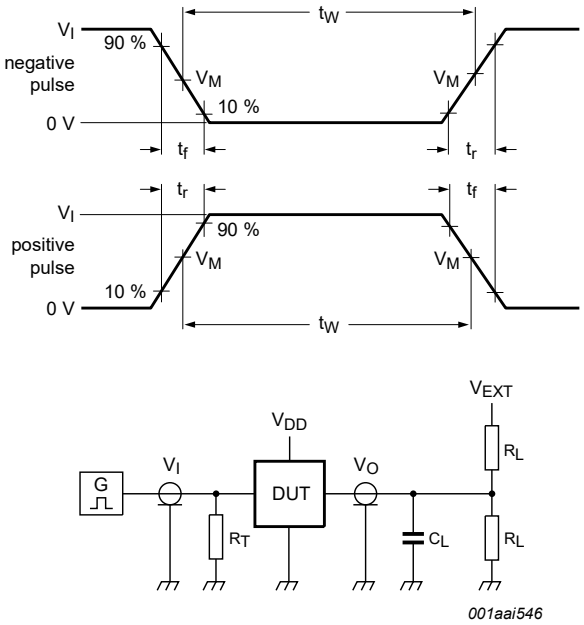
Measurement points are given in Table 8.

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

Fig. 7. 3-state output enable and disable times

Table 8. Measurement points

Input	Output		
V_M	V_M	V_X	V_Y
1.5 V	1.5 V	V_{OL} + 0.3 V	V_{OH} - 0.3 V



Test data is given in Table 9.

Definitions 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} = Test voltage for switching times.

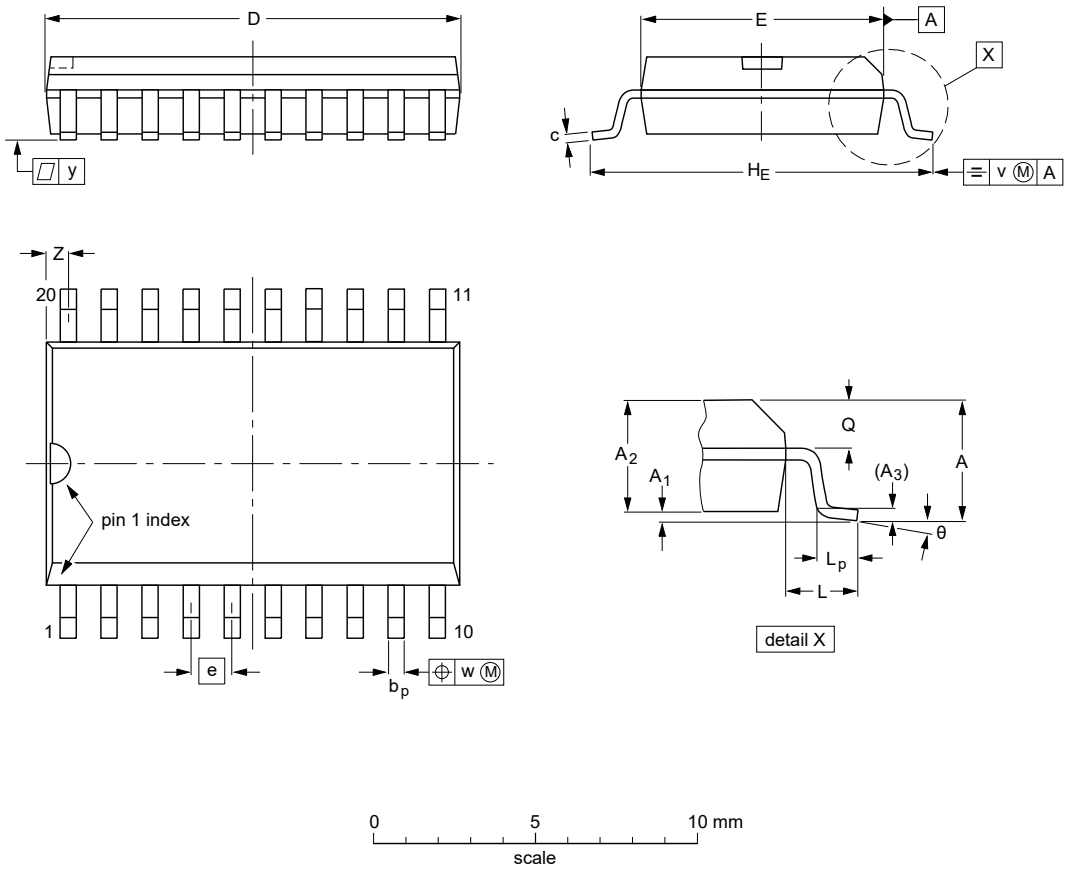
Fig. 8. Test circuit for measuring switching times

Table 9. Test data

Input				Load		V_{EXT}		
V_I	f_i	t_W	t_r, t_f	C_L	R_L	t_{PHZ}, t_{PZH}	t_{PLZ}, t_{PZL}	t_{PLH}, t_{PHL}
2.7 V	≤ 10 MHz	500 ns	≤ 2.5 ns	50 pF	500 Ω	GND	6 V	open

11. Package outline

SO20: plastic small outline package; 20 leads; body width 7.5 mm **SOT163-1**



DIMENSIONS (inch dimensions are derived from the original mm dimensions)

UNIT	A max.	A_1	A_2	A_3	b_p	c	$D^{(1)}$	$E^{(1)}$	e	H_E	L	L_p	Q	v	w	y	$Z^{(1)}$	θ
mm	2.65	0.3 0.1	2.45 2.25	0.25	0.49 0.36	0.32 0.23	13.0 12.6	7.6 7.4	1.27	10.65 10.00	1.4	1.1 0.4	1.1 1.0	0.25	0.25	0.1	0.9 0.4	8^o 0^o
inches	0.1	0.012 0.004	0.096 0.089	0.01	0.019 0.014	0.013 0.009	0.51 0.49	0.30 0.29	0.05	0.419 0.394	0.055	0.043 0.016	0.043 0.039	0.01	0.01	0.004	0.035 0.016	

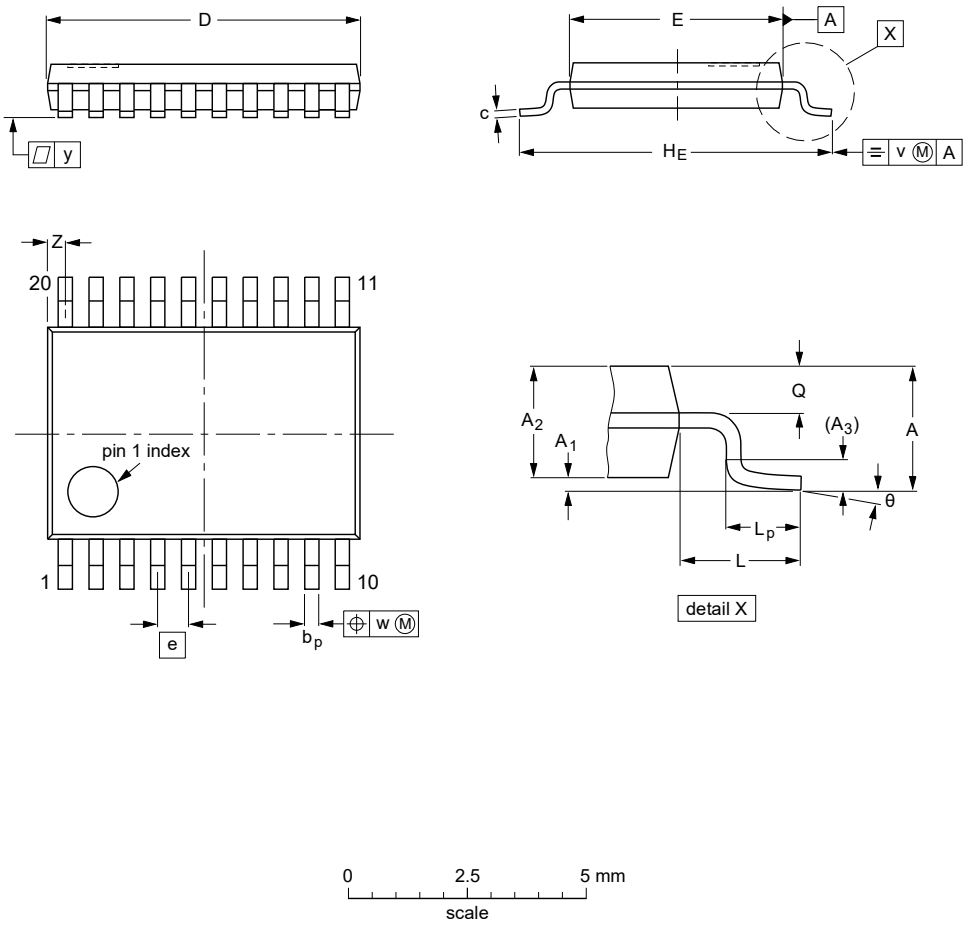
Note

1. Plastic or metal protrusions of 0.15 mm (0.006 inch) maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT163-1	075E04	MS-013				~~99-12-27~~ 03-02-19

Fig. 9. Package outline SOT163-1 (SO20)

TSSOP20: plastic thin shrink small outline package; 20 leads; body width 4.4 mm **SOT360-1**



DIMENSIONS (mm are the original dimensions)

UNIT	A max.	A_1	A_2	A_3	b_p	c	D (1)	E (2)	e	H_E	L	L_p	Q	v	w	y	Z (1)	θ
mm	1.1	0.15 0.05	0.95 0.80	0.25	0.30 0.19	0.2 0.1	6.6 6.4	4.5 4.3	0.65	6.6 6.2	1	0.75 0.50	0.4 0.3	0.2	0.13	0.1	0.5 0.2	8° 0°

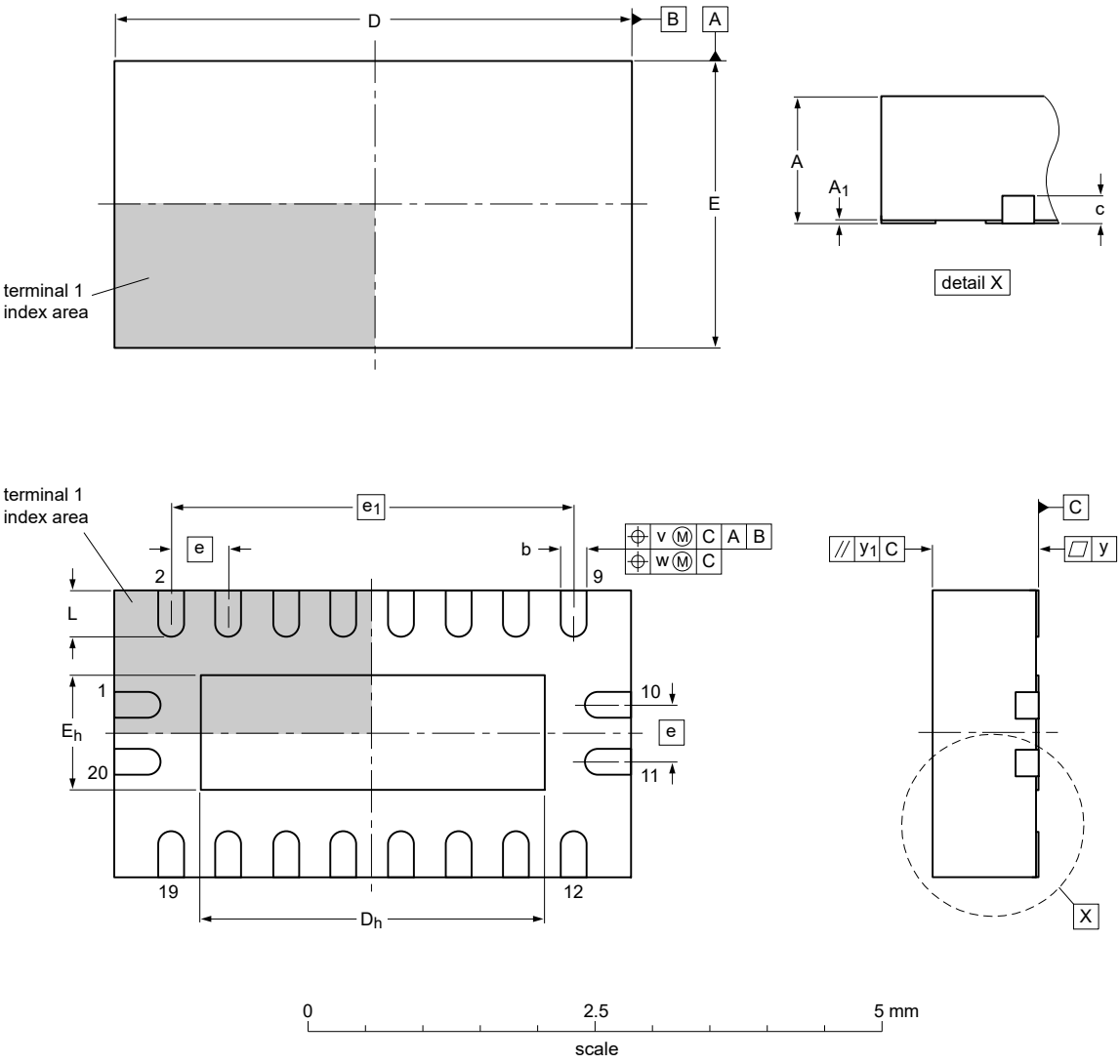
Notes

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.
2. Plastic interlead protrusions of 0.25 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT360-1		MO-153				~~99-12-27~~ 03-02-19

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**



Dimensions (mm are the original dimensions)

Unit		$A^{(1)}$	A_1	b	c	$D^{(1)}$	D_h	$E^{(1)}$	E_h	e	e_1	L	v	w	y	y_1
	max	1.00	0.05	0.30		4.6	3.15	2.6	1.15			0.5				
mm	nom	0.90	0.02	0.25	0.2	4.5	3.00	2.5	1.00	0.5	3.5	0.4	0.1	0.05	0.05	0.1
	min	0.80	0.00	0.18		4.4	2.85	2.4	0.85			0.3				

Note
1. Plastic or metal protrusions of 0.075 mm maximum per side are not included.

sot764-1_po

Outline version	References				European projection	Issue date
	IEC	JEDEC	JEITA			
SOT764-1	- - -	MO-241	- - -			~~03-01-27~~ 14-12-12

Fig. 11. Package outline SOT764-1 (DHVQFN20)

12. Abbreviations

Table 10. Abbreviations

Acronym	Description
BiCMOS	Bipolar Complementary Metal Oxide Semiconductor
DUT	Device Under Test
ESD	ElectroStatic Discharge
HBM	Human Body Model
MIL	Military
MM	Machine Model
TTL	Transistor-Transistor Logic

13. Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74LVT_LVTH244A_Q100 v.2	20200824	Product data sheet	-	74LVT_LVTH244A_Q100 v.1
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. • Section 2 updated. • Table 4: Derating values for P_{tot} total power dissipation have been updated. • Table 6: conditions for bushold overdrive current corrected. • Package outline drawing Fig. 11 (DHVQFN20) updated.			
74LVT_LVTH244A_Q100 v.1	20130422	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.

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