74LVC623A-Q100

Octal transceiver with dual enable; 3-state

Rev. 1 — 17 April 2013 Product data sheet

1. General description

The 74LVC623A-Q100 is an octal transceiver featuring non-inverting 3-state bus compatible outputs in both send and receive directions. This octal bus transceiver is designed for asynchronous two-way communication between data buses.

The control function implementation allows maximum flexibility in timing. This device allows data transmission from the An bus to the Bn bus or from the Bn bus to the An bus. The data flow direction depends on the logic levels at the enable inputs (pins OEAB and $\overline{\text{OEBA}}$). The enable inputs can be used to disable the device so that the buses are effectively isolated. The dual enable function configuration gives this transceiver the capability to store data by simultaneous enabling of pins OEAB and $\overline{\text{OEBA}}$. Each output reinforces its input in this transceiver configuration. Thus, when both control inputs are enabled and all other data sources to the two sets of the bus lines are at high-impedance OFF-state, both sets of the bus lines remain at their last states. The 8-bit codes on the two sets of buses are identical.

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.

This product has been qualified to the Automotive Electronics Council (AEC) standard Q100 (Grade 1) and is suitable for use in automotive applications.

2. Features and benefits

- Automotive product qualification in accordance with AEC-Q100 (Grade 1)
  - Specified from −40 °C to +85 °C and from −40 °C to +125 °C
- 5 V tolerant inputs and 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
- High-impedance when V_{CC} = 0 V
- 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:
  - 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)

3. Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
74LVC623AD-Q100	−40 °C to +125 °C	SO20	plastic small outline package; 20 leads; body width 7.5 mm	SOT163-1
74LVC623ADB-Q100	−40 °C to +125 °C	SSOP20	plastic shrink small outline package; 20 leads; body width 5.3 mm	SOT339-1
74LVC623APW-Q100	−40 °C to +125 °C	TSSOP20	plastic thin shrink small outline package; 20 leads; body width 4.4 mm	SOT360-1

4. Functional diagram

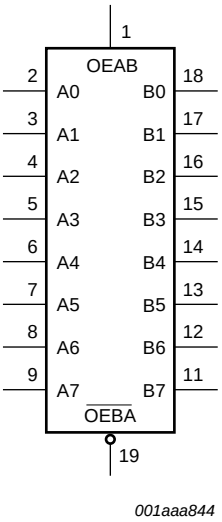


Fig 1. Logic symbol

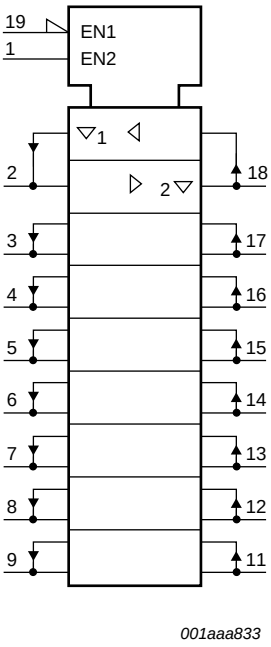


Fig 2. IEC logic symbol

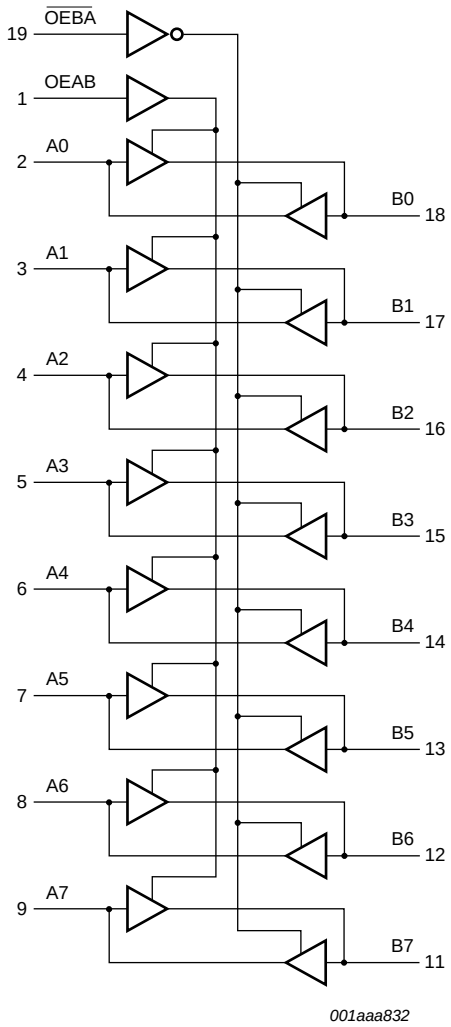


Fig 3. Logic diagram

5. Pinning information

5.1 Pinning

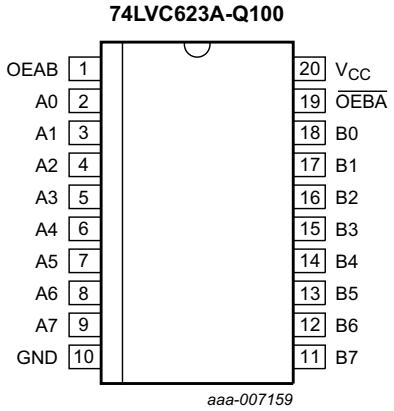


Fig 4. Pin configuration SO20 and (T)SSOP20

5.2 Pin description

Table 2. Pin description

Pin	Symbol	Description
1	OEAB	output enable input
19	$\overline{\text{OEBA}}$	output enable input (active LOW)
A[0:7]	2, 3, 4, 5, 6, 7, 8, 9	data input or output
B[0:7]	18, 17, 16, 15, 14, 13, 12, 11	data output or input
10	GND	ground (0 V)
20	V_{CC}	supply voltage

6. Functional description

Table 3. Function table[1]

Input		Input or output	
OEAB	**$\overline{OEBA}$**	**An**	**Bn**
L	L	An = Bn	input
H	H	input	Bn = An
L	H	Z	Z
H	L	An = Bn	input
		input	Bn = An

[1] H = HIGH voltage level; L = LOW voltage level; 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
V_I	input voltage		[1]	−0.5	+6.5	V
V_O	output voltage	HIGH or LOW state	[2]	−0.5	V_{CC} + 0.5	V
		3-state	[2]	−0.5	+6.5	V
I_{IK}	input clamping current	V_I < 0 V		−50	-	mA
I_{OK}	output clamping current	V_O > V_{CC} or V_O < 0 V		-	±50	mA
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 package: above 70 °C P_{tot} derates linearly with 8 mW/K.
For (T)SSOP20 packages: above 60 °C P_{tot} derates linearly with 5.5 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	HIGH or LOW state	0	-	V_{CC}	V
		3-state or V_{CC} = 0 V	0	-	5.5	V
T_{amb}	ambient temperature	in free air	−40	-	+125	°C
$\Delta t/\Delta V$	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
		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
I_I	input leakage current	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; [2]	-	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}	-	4.0	-	-	-	pF
$C_{I/O}$	input/output capacitance	V_{CC} = 0 V to 3.6 V; V_I = GND to V_{CC}	-	10.0	-	-	-	pF

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

[2] For transceivers, the parameter I_{OZ} includes the input leakage current.

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[1]	Max	Min	Max	
t_{pd}	propagation delay	An to Bn; Bn to An; see Figure 5 [2]						
		V_{CC} = 1.2 V	-	19	-	-	-	ns
		V_{CC} = 1.65 V to 1.95 V	1.7	6.4	13.5	1.7	14.2	ns
		V_{CC} = 2.3 V to 2.7 V	1.5	3.4	6.7	1.5	7.4	ns
		V_{CC} = 2.7 V	1.5	3.4	5.7	1.5	7.5	ns
		V_{CC} = 3.0 V to 3.6 V	1.0	2.9	5.2	1.0	6.5	ns
t_{en}	enable time	OEAB to Bn; see Figure 6 [2]						
		V_{CC} = 1.2 V	-	26	-	-	-	ns
		V_{CC} = 1.65 V to 1.95 V	2.7	8.7	17.0	2.7	17.9	ns
		V_{CC} = 2.3 V to 2.7 V	2.2	4.8	8.9	2.2	9.8	ns
		V_{CC} = 2.7 V	1.5	4.2	6.9	1.5	9.0	ns
		V_{CC} = 3.0 V to 3.6 V	1.0	3.9	6.6	1.0	8.5	ns
		$\overline{OEBA}$ to An; see Figure 7 [2]						
		V_{CC} = 1.2 V	-	26	-	-	-	ns
		V_{CC} = 1.65 V to 1.95 V	2.6	8.1	17.0	2.6	17.9	ns
		V_{CC} = 2.3 V to 2.7 V	2.2	4.5	8.9	2.2	9.8	ns
		V_{CC} = 2.7 V	1.5	4.6	7.5	1.5	9.5	ns
		V_{CC} = 3.0 V to 3.6 V	1.0	3.6	6.6	1.0	8.5	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[1]	Max	Min	Max	
t_{dis}	disable time	OEAB to Bn; see Figure 6 [2]						
		V_{CC} = 1.2 V	-	12	-	-	-	ns
		V_{CC} = 1.65 V to 1.95 V	2.3	4.7	10.5	2.3	11.1	ns
		V_{CC} = 2.3 V to 2.7 V	1.0	2.6	5.7	1.0	6.4	ns
		V_{CC} = 2.7 V	1.5	4.2	6.2	1.5	8.0	ns
		V_{CC} = 3.0 V to 3.6 V	1.0	3.2	5.5	1.0	7.0	ns
		$\overline{OEBA}$ to An; see Figure 7 [2]						
		V_{CC} = 1.2 V	-	11	-	-	-	ns
		V_{CC} = 1.65 V to 1.95 V	3.6	5.2	10.1	3.6	10.7	ns
		V_{CC} = 2.3 V to 2.7 V	1.0	2.9	5.5	1.0	6.1	ns
		V_{CC} = 2.7 V	1.5	3.7	5.5	1.5	7.0	ns
		V_{CC} = 3.0 V to 3.6 V	1.0	3.4	5.3	1.0	7.0	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	-	11.9	-	-	-	pF
		V_{CC} = 2.3 V to 2.7 V	-	15.5	-	-	-	pF
		V_{CC} = 3.0 V to 3.6 V	-	18.8	-	-	-	pF

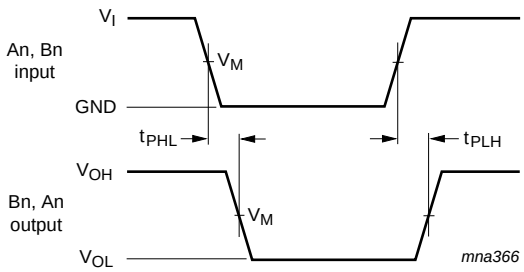
[1] Typical values are measured at T_{amb} = 25 °C and V_{CC} = 1.2 V, 1.8 V, 2.5 V, 2.7 V, and 3.3 V respectively.

[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

11. Waveforms

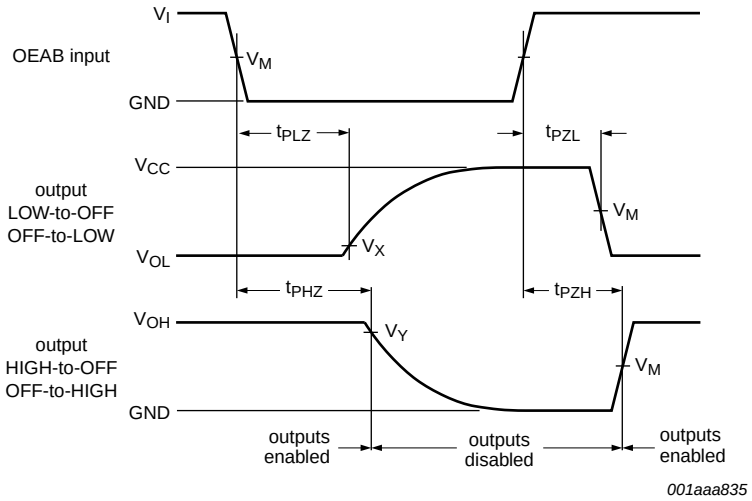


V_M = 1.5 V at $V_{CC} \geq$ 2.7 V;

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

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

Fig 5. The inputs An, Bn to outputs Bn, An propagation delays



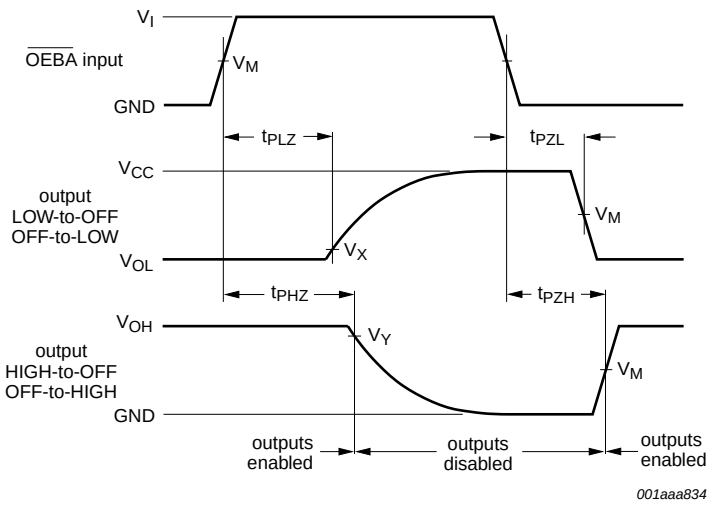
Measurement points are given in Table 8.

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

Fig 6. 3-state enable and disable times for OEAB input

Table 8. Measurement points

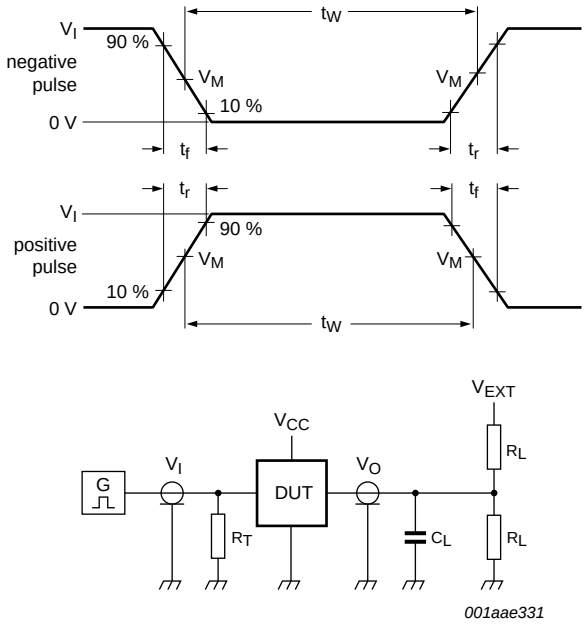
Supply voltage	Input	Output		
V_{CC}	V_M	V_M	V_X	V_Y
< 2.7 V	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$	V_{OL} + 0.15 V	V_{OH} − 0.15 V
≥ 2.7 V	1.5 V	1.5 V	V_{OL} + 0.3 V	V_{OH} − 0.3 V



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. 3-state enable and disable times for $\overline{OEBA}$ input



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.

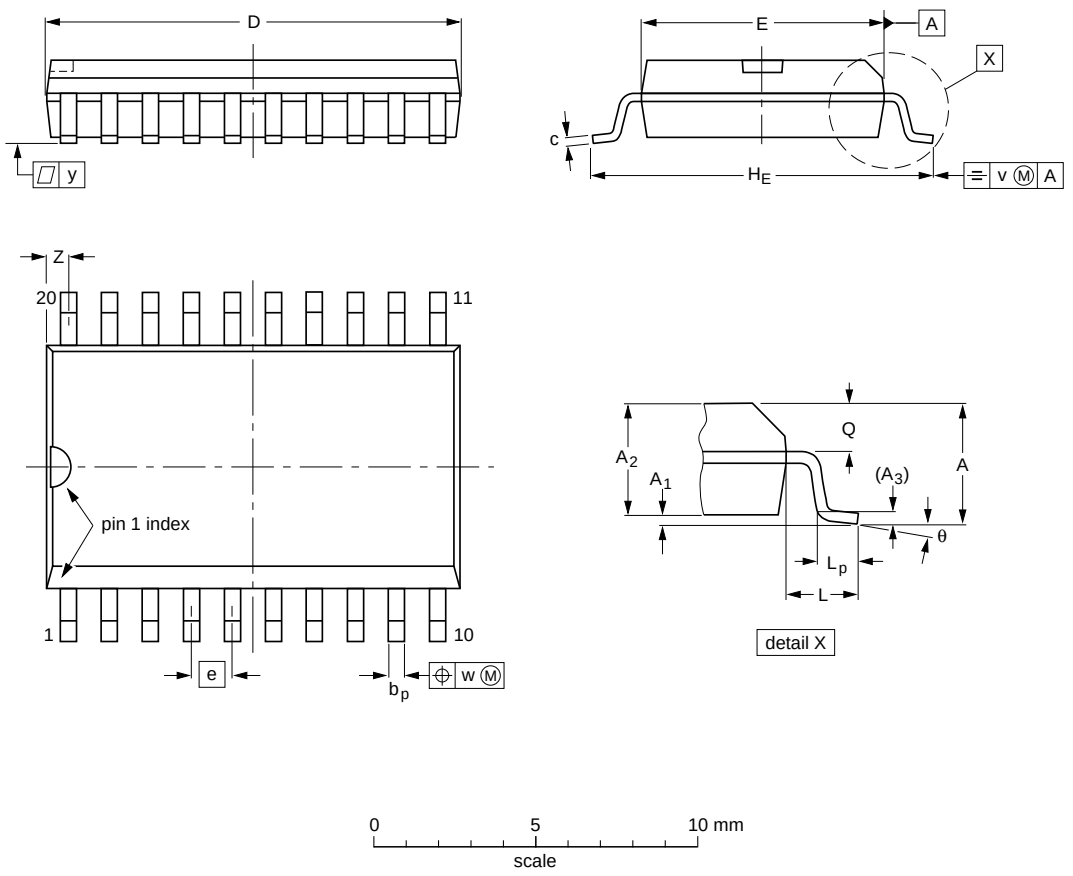
Fig 8. Test circuit for measuring switching times

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 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**



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	

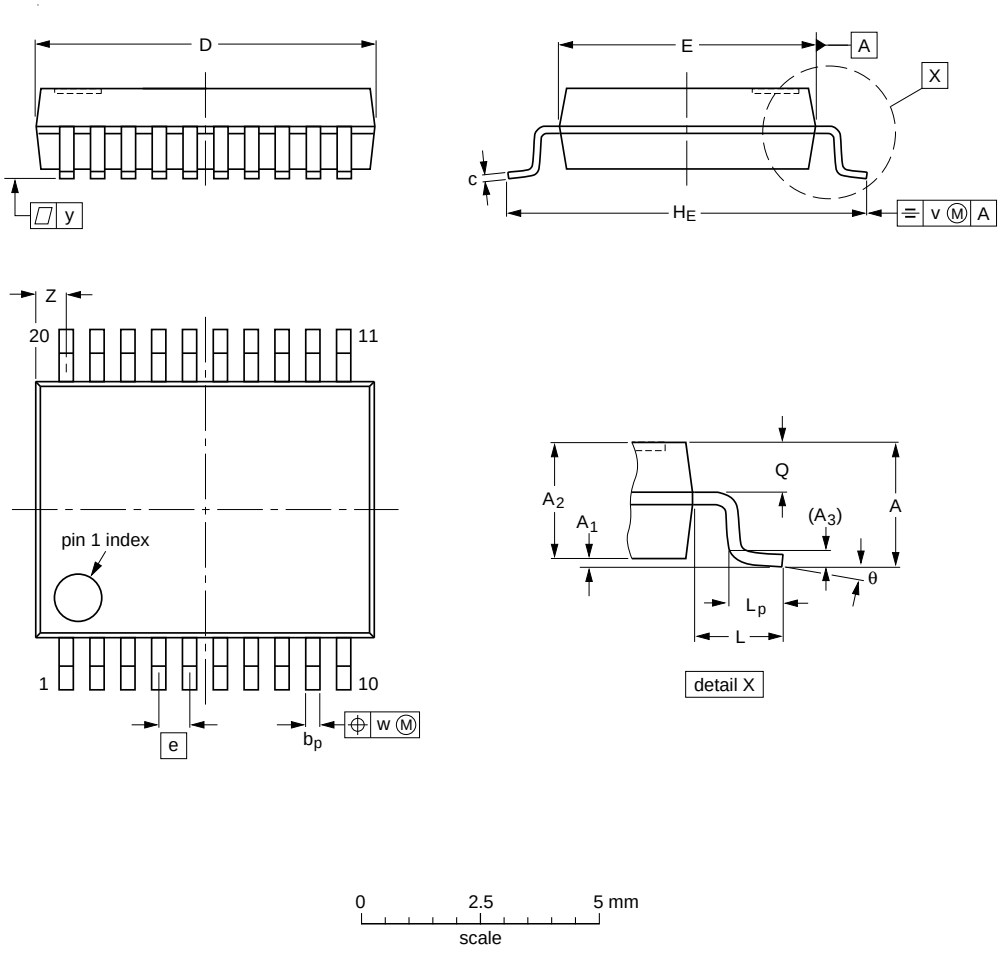
Note

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)

SSOP20: plastic shrink small outline package; 20 leads; body width 5.3 mm **SOT339-1**



DIMENSIONS (mm are the original 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	0.21 0.05	1.80 1.65	0.25	0.38 0.25	0.20 0.09	7.4 7.0	5.4 5.2	0.65	7.9 7.6	1.25	1.03 0.63	0.9 0.7	0.2	0.13	0.1	0.9 0.5	8^o 0^o

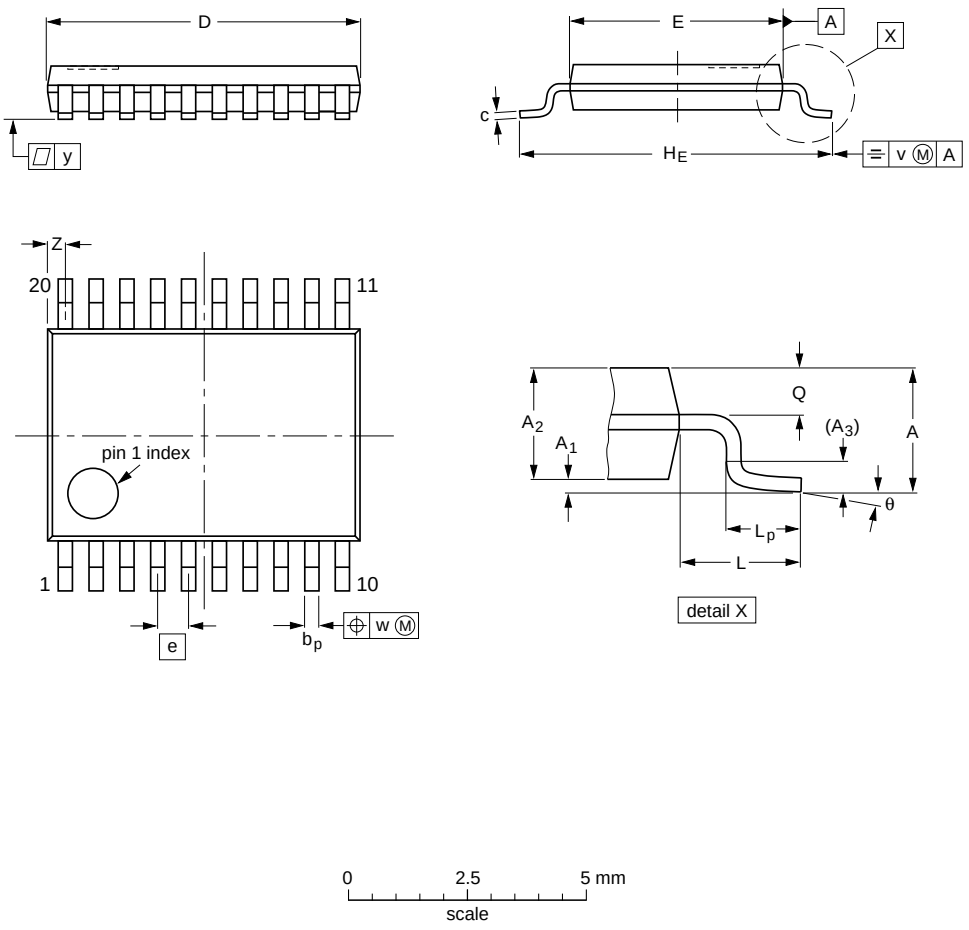
Note

1. Plastic or metal protrusions of 0.2 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT339-1		MO-150				~~99-12-27~~ 03-02-19

Fig 10. Package outline SOT339-1 (SSOP20)

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^o 0^o

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 11. Package outline SOT 360-1 (TSSOP20)

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
74LVC623A_Q100 v.1	20130417	Product data sheet	-	-

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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17. Contents

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