

74LVC16244A-Q100; 74LVCH16244A-Q100

16-bit buffer/line driver; 5 V input/output tolerant; 3-state

Rev. 2 — 27 September 2013

Product data sheet

1. General description

The 74LVC16244A-Q100; 74LVCH16244A-Q100 are 16-bit non-inverting buffer/line drivers with 3-state bus compatible outputs. The device can be used as four 4-bit buffers, two 8-bit buffers or one 16-bit buffer. It features four output enable inputs ($\overline{1OE}$ to $\overline{4OE}$) each controlling four of the 3-state outputs. A HIGH on $\overline{nOE}$ causes the outputs to assume a high-impedance OFF-state.

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 in mixed 3.3 V and 5 V applications.

The 74LVCH16244A-Q100 bus hold on data inputs eliminates the need for external pull-up resistors to hold unused inputs.

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 $-40\text{ }^{\circ}\text{C}$ to $+85\text{ }^{\circ}\text{C}$ and from $-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$
- 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
- Multibyte flow-through standard pinout architecture
- Low inductance multiple power and ground pins for minimum noise and ground bounce
- Direct interface with TTL levels
- High-impedance when $V_{CC} = 0\text{ V}$
- All data inputs have bus hold. (74LVCH16244A-Q100 only)
- 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 ($C = 200\text{ pF}$, $R = 0\text{ }\Omega$)

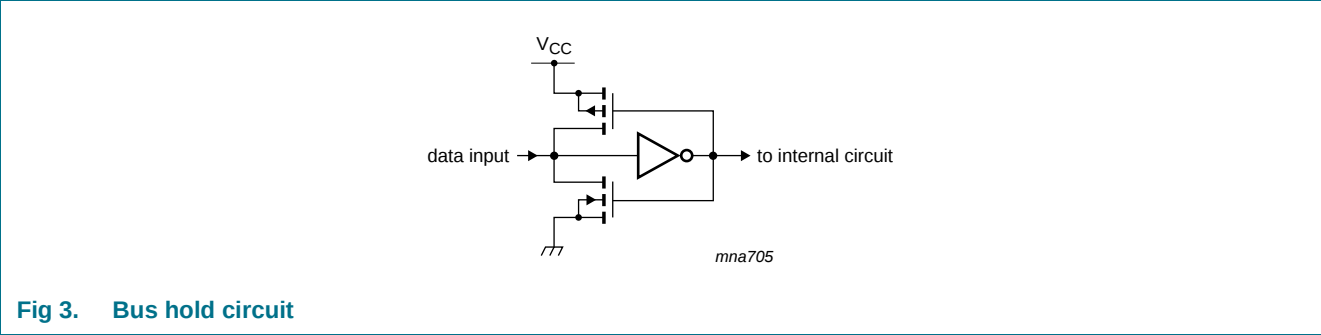
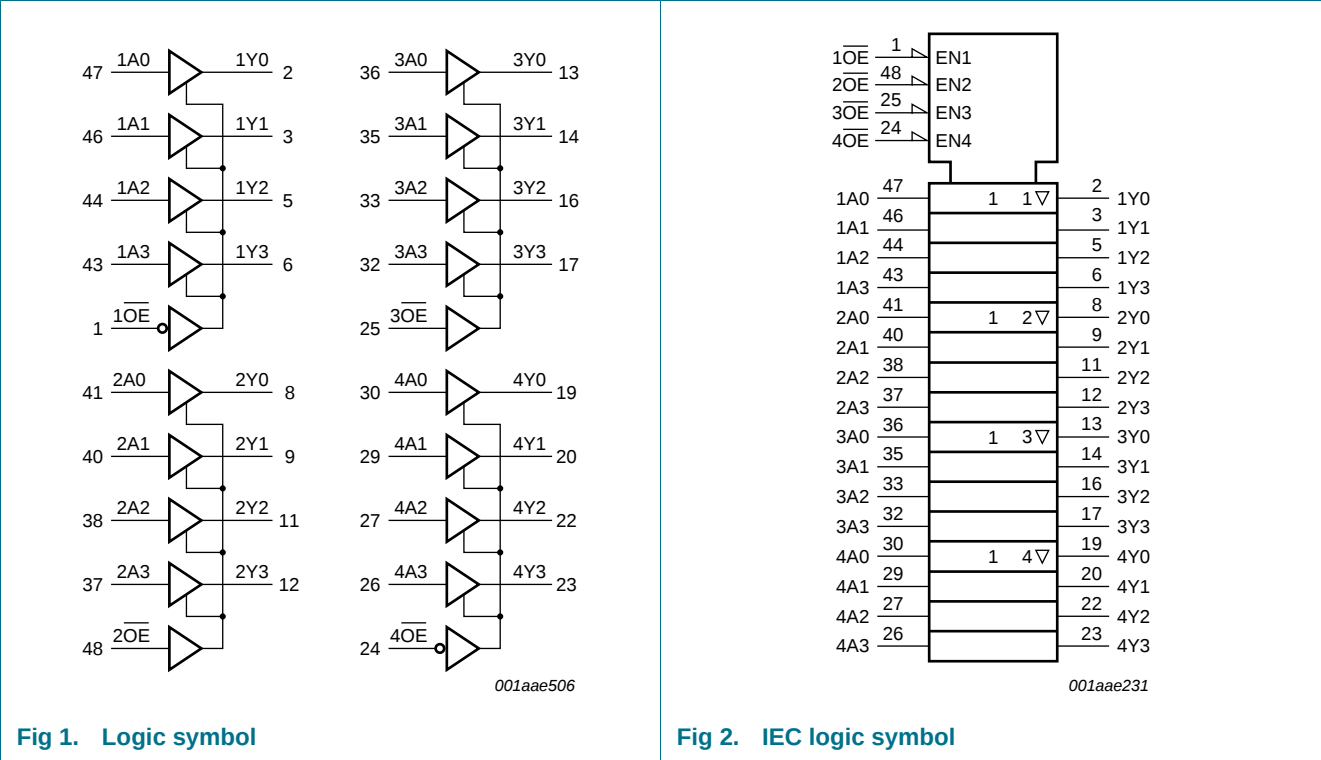


3. Ordering information

Table 1. Ordering information

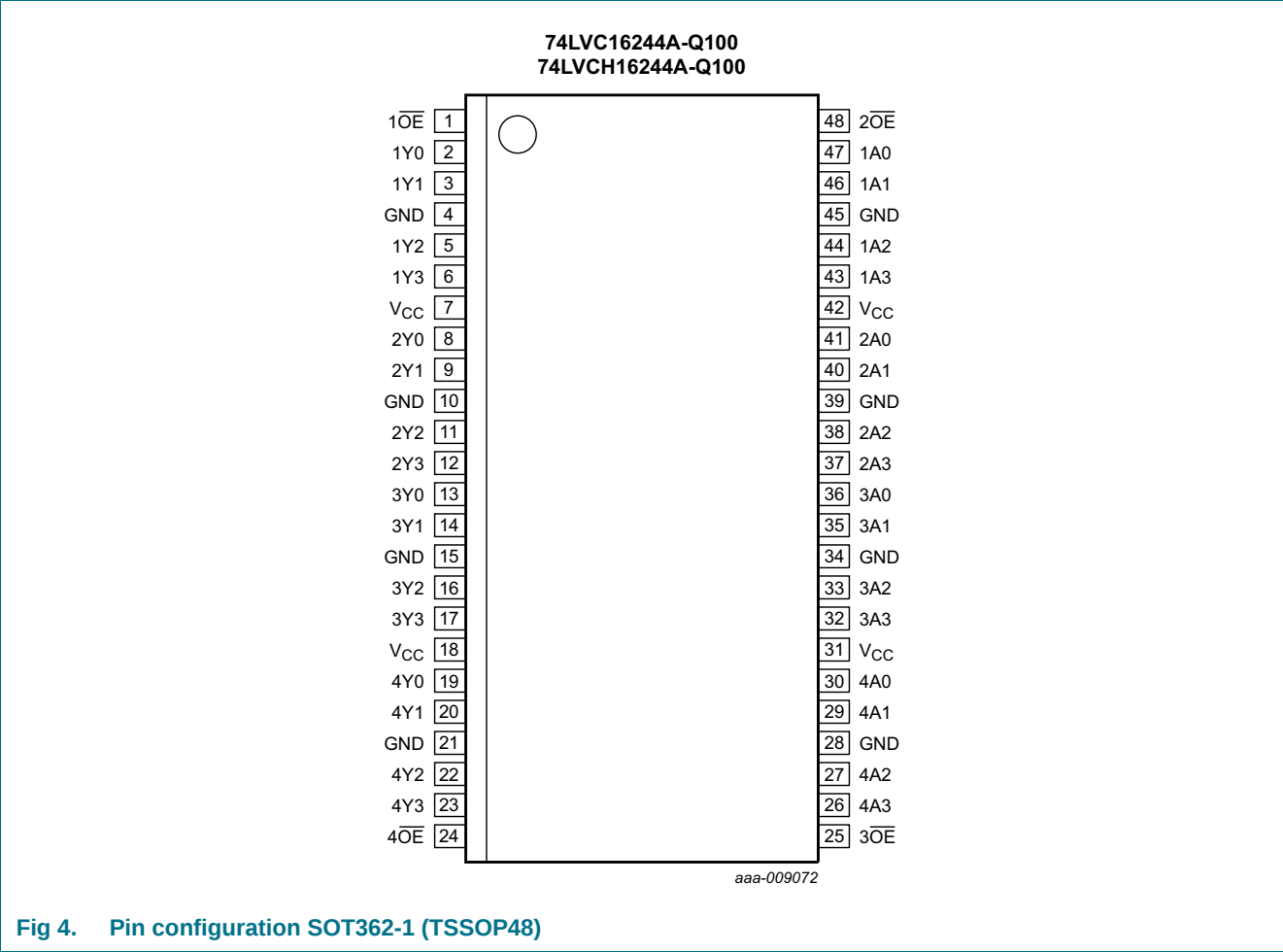
Type number	Temperature range	Package		
		Name	Description	Version
74LVC16244ADGG-Q100	−40 °C to +125 °C	TSSOP48	plastic thin shrink small outline package; 48 leads; body width 6.1 mm	SOT362-1
74LVCH16244ADGG-Q100				

4. Functional diagram



5. Pinning information

5.1 Pinning



5.2 Pin description

Table 2. Pin description

Symbol	Pin	Description
$\overline{1OE}$, $\overline{2OE}$, $\overline{3OE}$, $\overline{4OE}$	1, 48, 25, 24	output enable input (active LOW)
1Y0 to 1Y3	2, 3, 5, 6	data output
2Y0 to 2Y3	8, 9, 11, 12	data output
3Y0 to 3Y3	13, 14, 16, 17	data output
4Y0 to 4Y3	19, 20, 22, 23	data output
GND	4, 10, 15, 21, 28, 34, 39, 45	ground (0 V)
V _{CC}	7, 18, 31, 42	supply voltage
1A0 to 1A3	47, 46, 44, 43	data input
2A0 to 2A3	41, 40, 38, 37	data input
3A0 to 3A3	36, 35, 33, 32	data input
4A0 to 4A3	30, 29, 27, 26	data input
n.c.	-	not connected

6. Functional description

Table 3. Function table^[1]

Control	Input	Output
$\overline{nOE}$	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] Above 60 °C, the value of 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		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
$\Delta t/\Delta V$	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	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
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	20	-	80	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

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 _{BHL}	bus hold LOW current	V _{CC} = 1.65; V _I = 0.58 V	[3][4]	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	[3][4]	–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	[3][5]	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	[3][5]	–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 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] Valid for data inputs only. Control inputs do not have a bus hold circuit.

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

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

10. Dynamic characteristics

Table 7. Dynamic characteristics

Voltages are referenced to GND (ground = 0 V). For test circuit, see [Figure 7](#).

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 5	[1]						
		V _{CC} = 1.2 V		-	11.0	-	-	-	ns
		V _{CC} = 1.65 V to 1.95 V		1.5	4.8	10.7	1.5	11.3	ns
		V _{CC} = 2.3 V to 2.7 V		1.0	2.6	5.3	1.0	5.9	ns
		V _{CC} = 2.7 V		1.0	2.6	4.7	1.0	6.0	ns
		V _{CC} = 3.0 V to 3.6 V		1.1	2.2	4.1	1.1	5.5	ns
t _{en}	enable time	nOE to nYn; see Figure 6	[1]						
		V _{CC} = 1.2 V		-	15.0	-	-	-	ns
		V _{CC} = 1.65 V to 1.95 V		1.5	6.2	12.1	1.5	12.7	ns
		V _{CC} = 2.3 V to 2.7 V		1.0	3.5	6.4	1.0	7.1	ns
		V _{CC} = 2.7 V		1.0	3.3	5.8	1.0	7.5	ns
		V _{CC} = 3.0 V to 3.6 V		1.0	2.8	4.6	1.0	6.0	ns

Table 7. Dynamic characteristics ...continued

Voltages are referenced to GND (ground = 0 V). For test circuit, see [Figure 7](#).

Symbol	Parameter	Conditions	–40 °C to +85 °C			–40 °C to +125 °C		Unit
			Min	Typ ^[2]	Max	Min	Max	
t_{dis}	disable time	nOE to nYn; see Figure 6 ^[1]						
		$V_{CC} = 1.2\text{ V}$	-	10.0	-	-	-	ns
		$V_{CC} = 1.65\text{ V to }1.95\text{ V}$	2.5	4.4	8.7	2.5	9.4	ns
		$V_{CC} = 2.3\text{ V to }2.7\text{ V}$	1.0	2.4	4.9	1.0	5.3	ns
		$V_{CC} = 2.7\text{ V}$	1.0	3.2	6.2	1.0	8.0	ns
		$V_{CC} = 3.0\text{ V to }3.6\text{ V}$	1.8	3.1	5.2	1.8	6.5	ns
C_{PD}	power dissipation capacitance	per input; $V_I = \text{GND to } V_{CC}$ ^[3]						
		$V_{CC} = 1.65\text{ V to }1.95\text{ V}$	-	4.8	-	-	-	pF
		$V_{CC} = 2.3\text{ V to }2.7\text{ V}$	-	8.3	-	-	-	pF
		$V_{CC} = 3.0\text{ V to }3.6\text{ V}$	-	11.4	-	-	-	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 $T_{amb} = 25\text{ °C}$ and $V_{CC} = 1.2\text{ V}, 1.8\text{ V}, 2.5\text{ V}, 2.7\text{ V}$ and 3.3 V respectively.

[3] 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

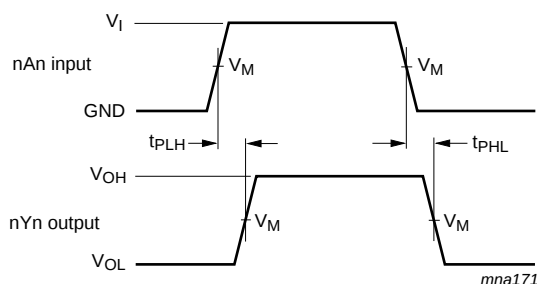
C_L = output load capacitance in pF

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



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 5. The input (nAn) to output (nYn) propagation delays

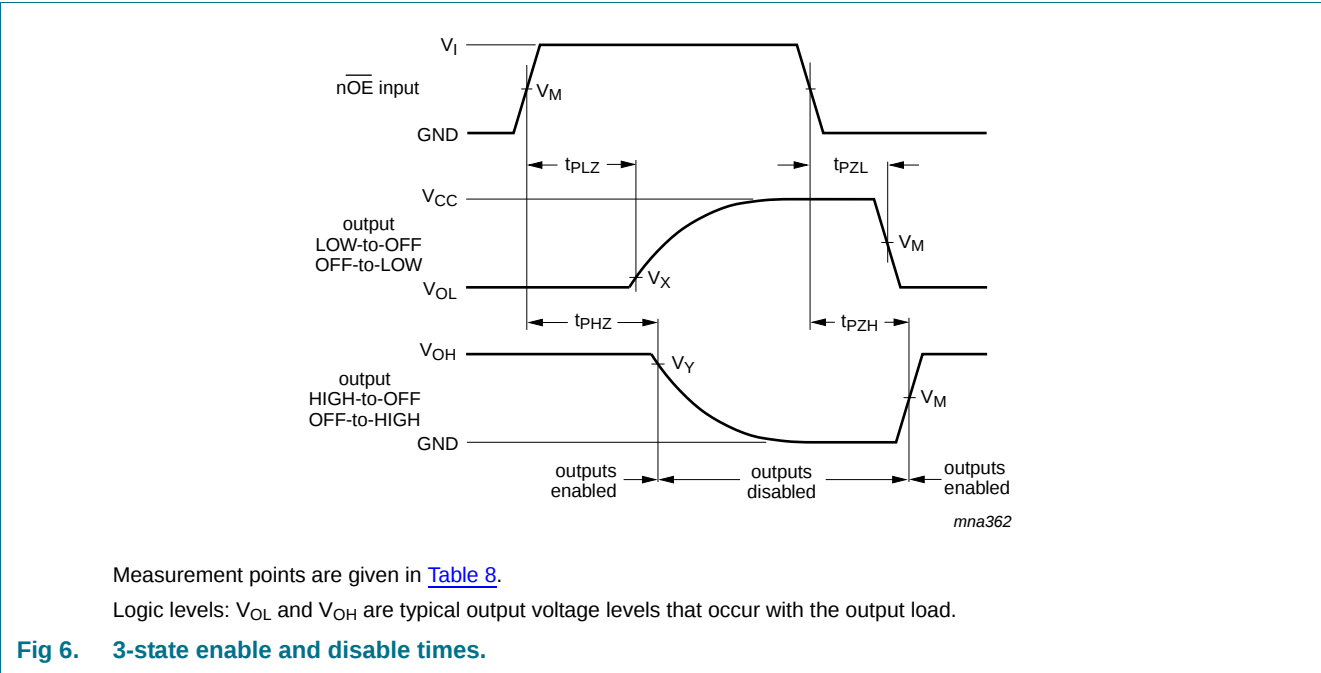


Table 8. Measurement points

Supply voltage	V_M	Input			
		V_I	$t_r = t_f$	V_X	V_Y
1.2 V	$0.5 \times V_{CC}$	V_{CC}	≤ 2.5 ns	$V_{OL} + 0.15$ V	$V_{OH} - 0.15$ V
1.65 V to 1.95 V	$0.5 \times V_{CC}$	V_{CC}	≤ 2.5 ns	$V_{OL} + 0.15$ V	$V_{OH} - 0.15$ V
2.3 V to 2.7 V	$0.5 \times V_{CC}$	V_{CC}	≤ 2.5 ns	$V_{OL} + 0.15$ V	$V_{OH} - 0.15$ V
2.7 V	1.5 V	2.7 V	≤ 2.5 ns	$V_{OL} + 0.3$ V	$V_{OH} - 0.3$ V
3.0 V to 3.6 V	1.5 V	2.7 V	≤ 2.5 ns	$V_{OL} + 0.3$ V	$V_{OH} - 0.3$ V

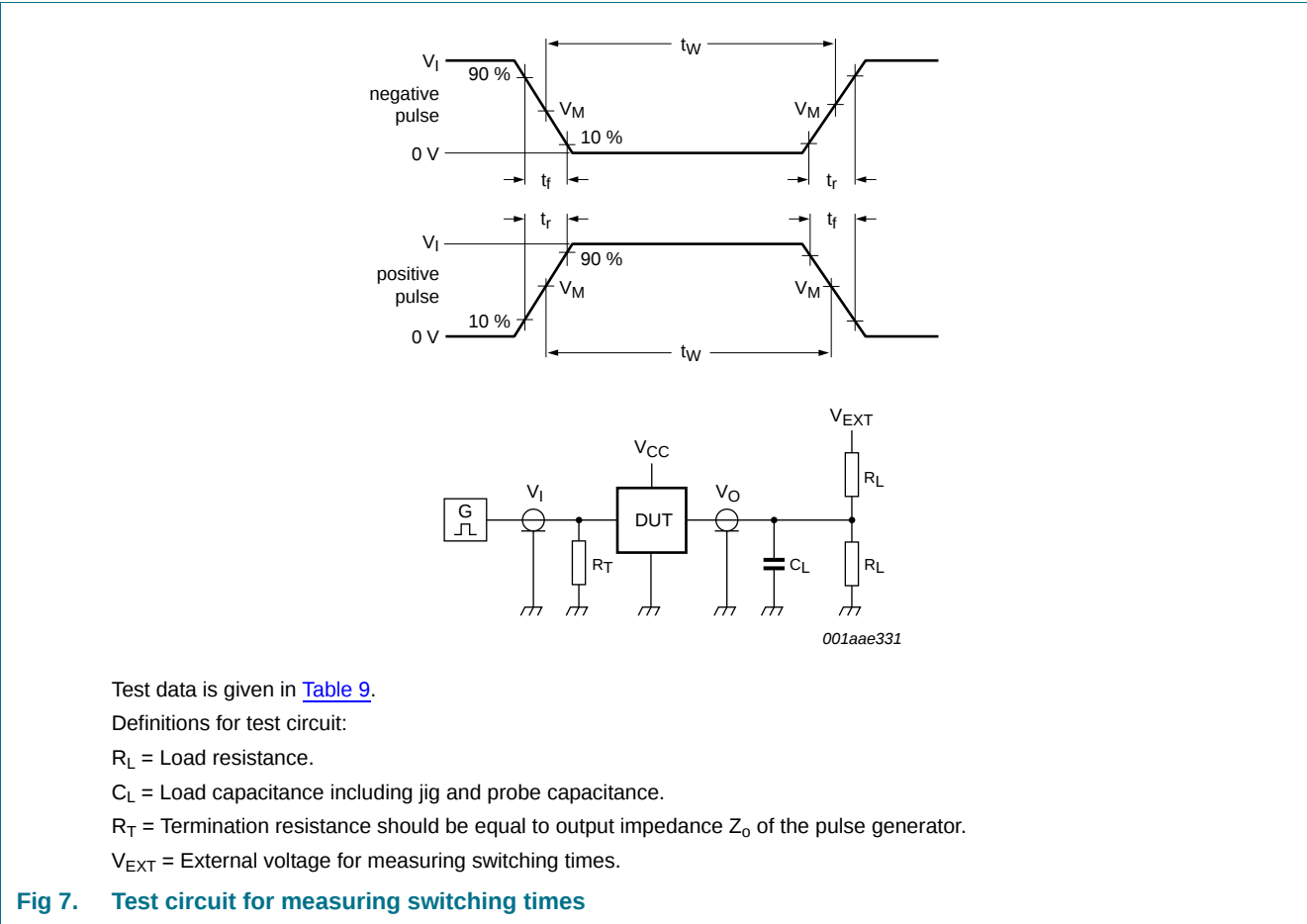


Table 9. Test data

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

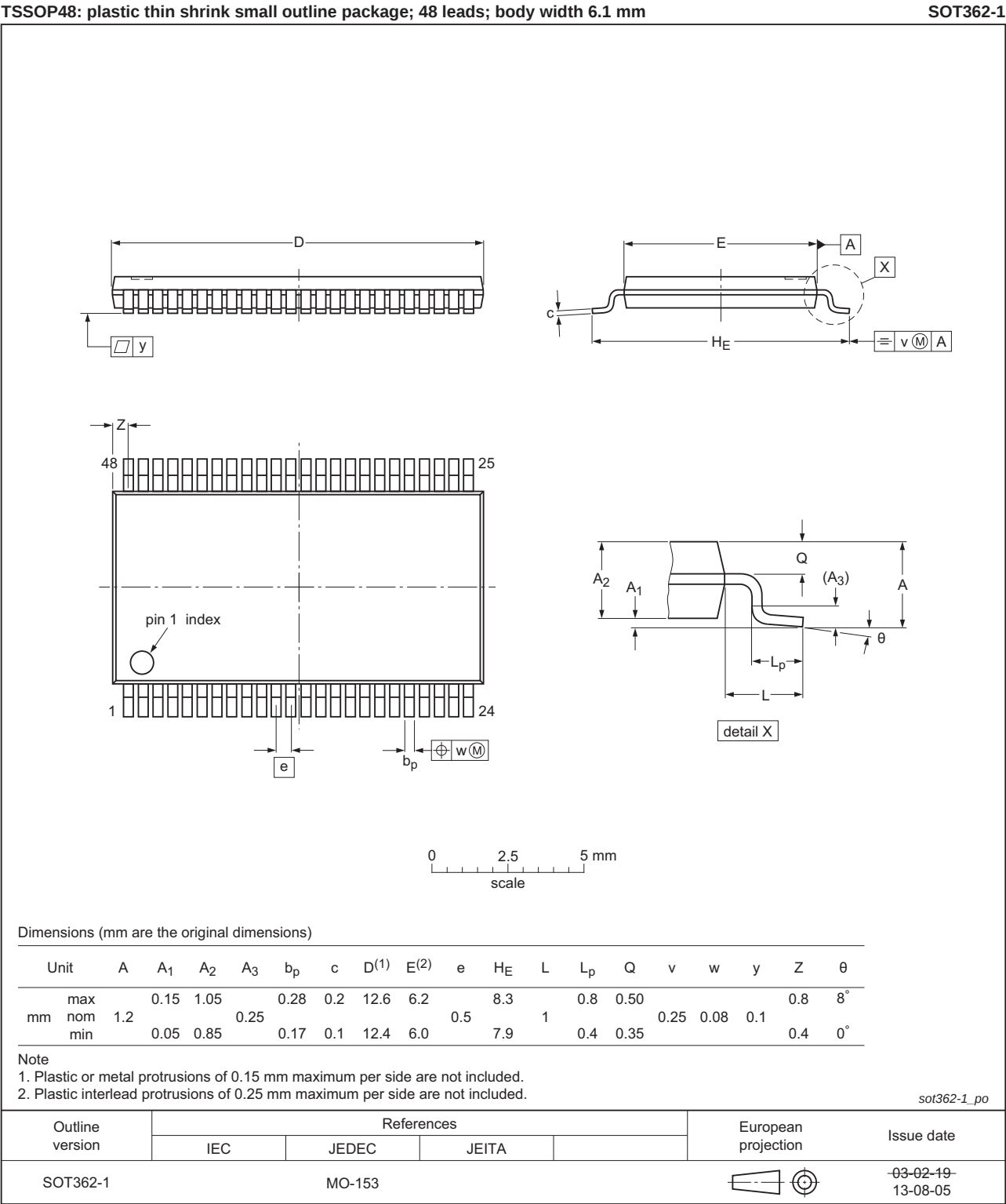


Fig 8. Package outline SOT362-1 (TSSOP48)

13. 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
MIL	Military
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_LVCH16244A_Q100 v.2	20130927	-	-	74LVC_LVCH16244A_Q100 v.1
Modifications:	• Typo removed from the title header.			
74LVC_LVCH16244A_Q100 v.1	20130923	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".

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17. Contents

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