

74LVC16240A-Q100

16-bit buffer/line driver with 5 V tolerant inputs/outputs;
inverting; 3-state

Rev. 1 — 19 May 2014

Product data sheet

1. General description

The 74LVC16240A-Q100 is a 16-bit inverting buffer/line driver with 3-state outputs. The device can be used as four 4-bit buffers, two 8-bit buffers or one 16-bit buffer. The device features four output enables ($\overline{1OE}$, $\overline{2OE}$, $\overline{3OE}$ and $\overline{4OE}$), 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.

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

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
- 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	Package			Version
	Temperature range	Name	Description	
74LVC16240ADGG-Q100	-40 °C to +125 °C	TSSOP48	plastic thin shrink small outline package; 48 leads; body width 6.1 mm	SOT362-1

4. Functional diagram

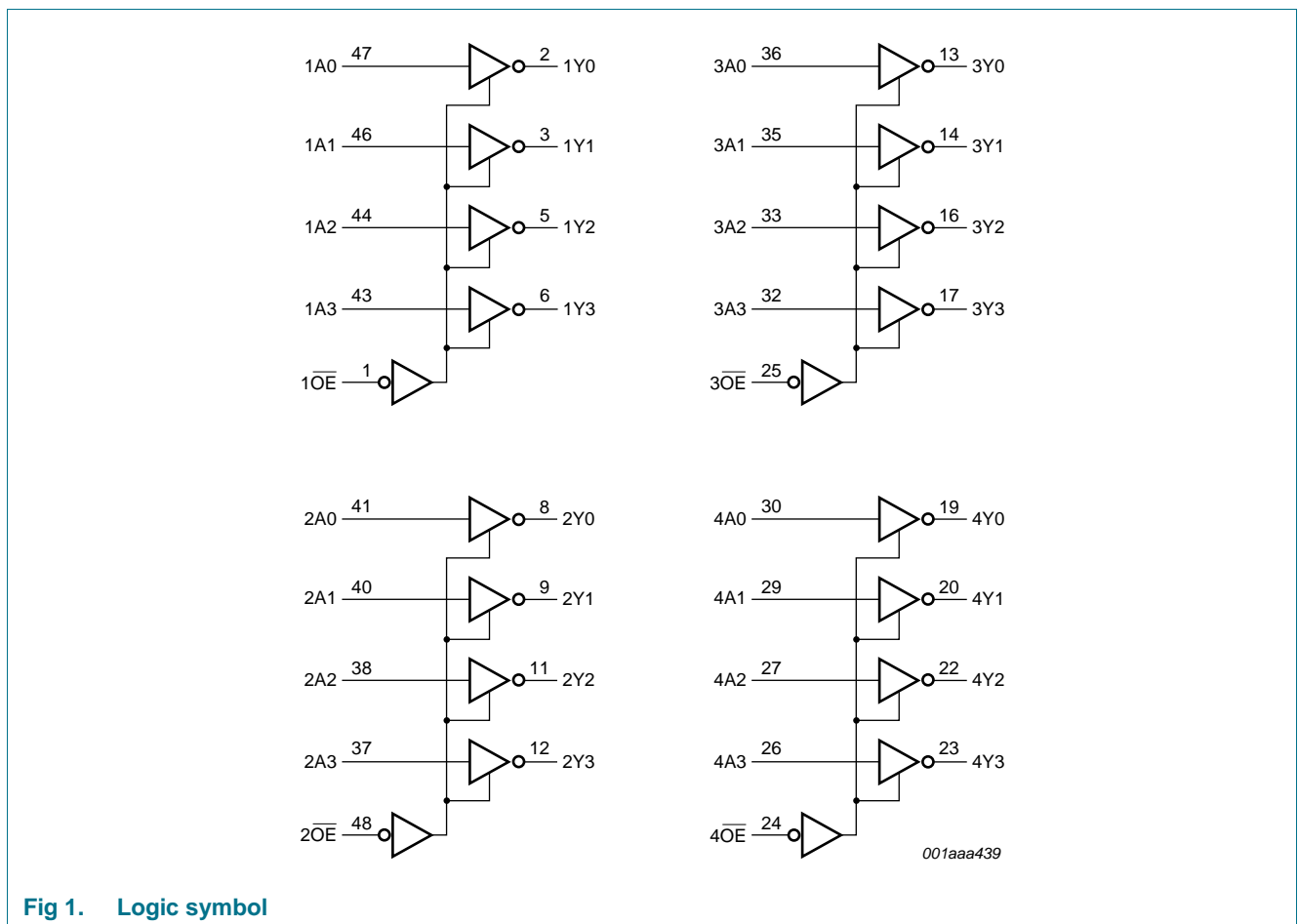


Fig 1. Logic symbol

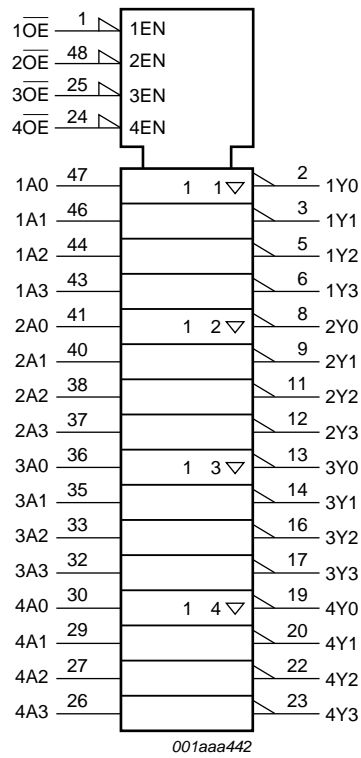


Fig 2. IEC logic symbol

5. Pinning information

5.1 Pinning

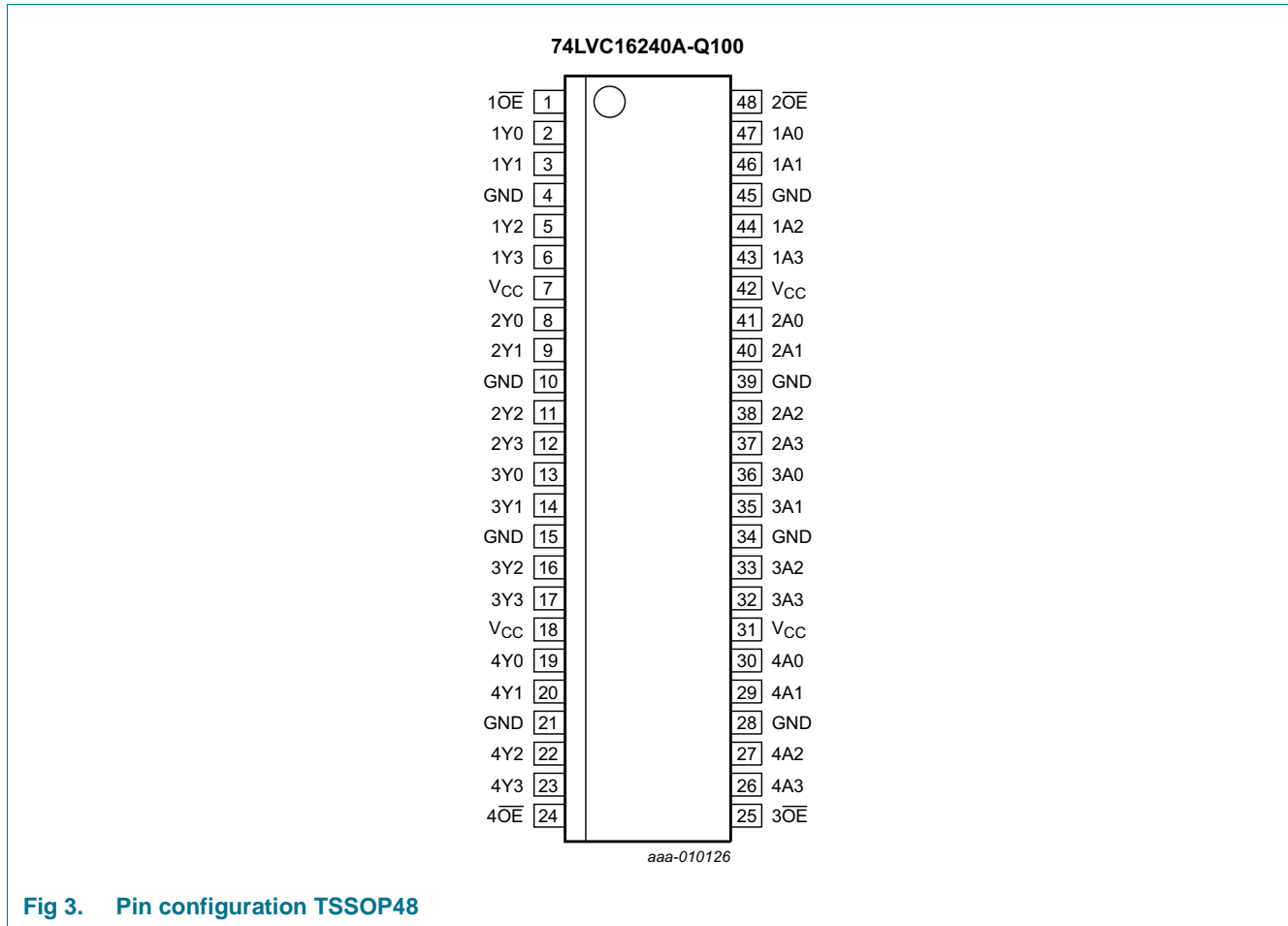


Fig 3. Pin configuration TSSOP48

5.2 Pin description

Table 2. Pin description

Name	Pin	Description
1OE	1	output enable input (active LOW)
2OE	48	output enable input (active HIGH)
3OE	25	output enable input (active HIGH)
4OE	24	output enable input (active LOW)
GND	4, 10, 15, 21, 28, 34, 39, 45	ground (0 V)
V _{CC}	7, 18, 31, 42	supply voltage
1Y[0:3]	2, 3, 5, 6	data output
2Y[0:3]	8, 9, 11, 12	data output
3Y[0:3]	13, 14, 16, 17	data output
4Y[0:3]	19, 20, 22, 23	data output

Table 2. Pin description ...continued

Name	Pin	Description
1A[0:3]	47, 46, 44, 43	data input
2A[0:3]	41, 40, 38, 37	data input
3A[0:3]	36, 35, 33, 32	data input
4A[0:3]	30, 29, 27, 26	data input

6. Functional description

Table 3. Function table^[1]

Input		Output
nOE	nAn	nYn
L	L	H
L	H	L
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 state	^[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		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	-	-	20	ns/V
		V _{CC} = 2.7 V to 3.6 V	-	-	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	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;	-	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

[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 6](#).

Symbol	Parameter	Conditions	T _{amb} = -40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ ^[1]	Max	Min	Max	
t _{pd}	propagation delay	nAn to nYn; see Figure 4 ^[2]	-	12.0	-	-	-	ns
		V _{CC} = 1.2 V	-	12.0	-	-	-	ns
		V _{CC} = 1.65 V to 1.95 V	1.0	5.1	11.0	1.0	11.7	ns
		V _{CC} = 2.3 V to 2.7 V	0.5	2.7	5.5	0.5	6.1	ns
		V _{CC} = 2.7 V	1.0	2.7	5.2	1.0	6.5	ns
t _{en}	enable time	n $\overline{O}E$ to nYn; see Figure 5 ^[2]	-	18.0	-	-	-	ns
		V _{CC} = 1.2 V	-	18.0	-	-	-	ns
		V _{CC} = 1.65 V to 1.95 V	1.5	6.6	12.8	1.5	13.5	ns
		V _{CC} = 2.3 V to 2.7 V	1.0	3.8	6.8	1.0	7.5	ns
		V _{CC} = 2.7 V	1.5	3.5	5.8	1.5	7.5	ns
t _{dis}	disable time	n $\overline{O}E$ to nYn; see Figure 5 ^[2]	-	11.0	-	-	-	ns
		V _{CC} = 1.2 V	-	11.0	-	-	-	ns
		V _{CC} = 1.65 V to 1.95 V	2.9	4.7	9.2	2.9	9.7	ns
		V _{CC} = 2.3 V to 2.7 V	1.0	2.6	5.0	1.0	5.6	ns
		V _{CC} = 2.7 V	1.5	3.5	5.1	1.5	6.5	ns
t _{sk(o)}	output skew time	V _{CC} = 3.0 V to 3.6 V ^[3]	-	-	1.0	-	1.5	ns

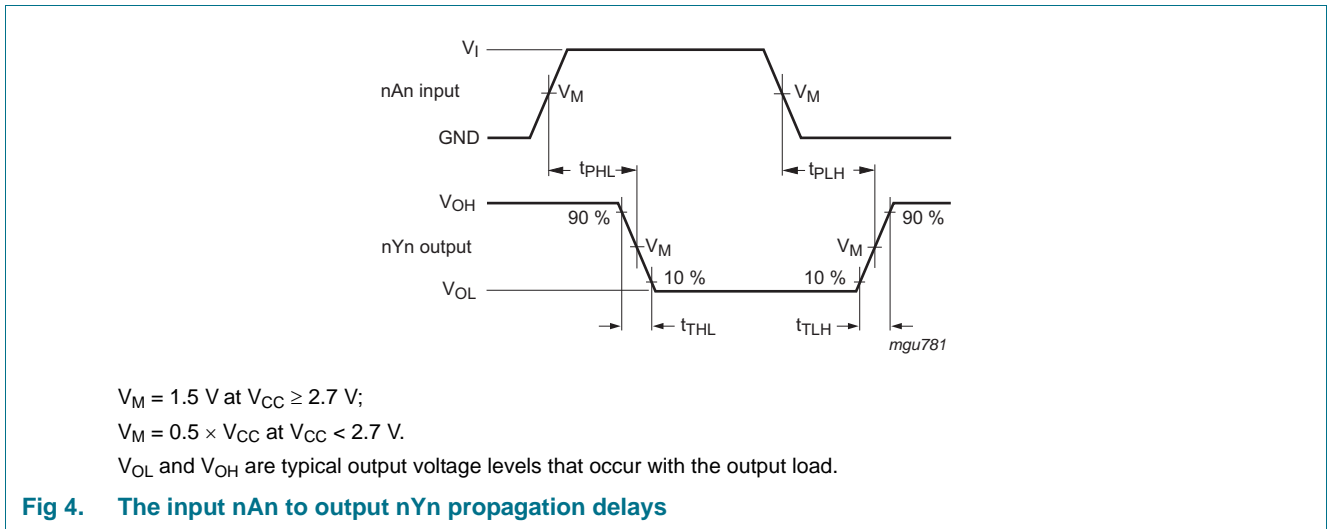
Table 7. Dynamic characteristics ...continued

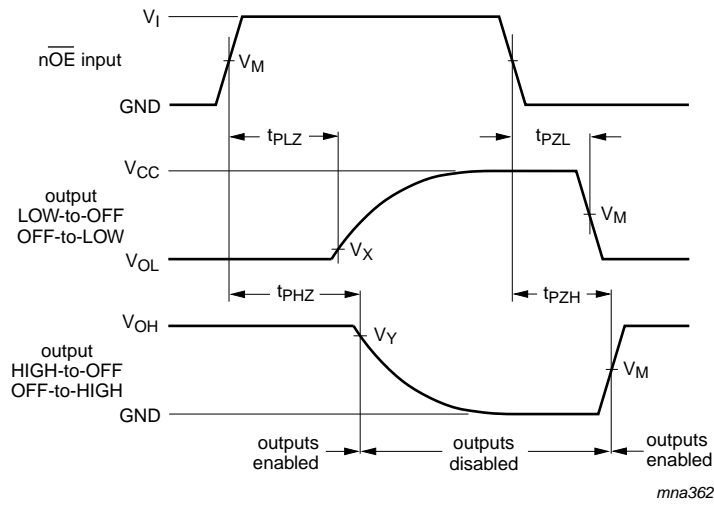
Voltages are referenced to GND (ground = 0 V). For test circuit, see [Figure 6](#).

Symbol	Parameter	Conditions	T _{amb} = -40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ ^[1]	Max	Min	Max	
C _{PD}	power dissipation capacitance	per input; V _I = GND to V _{CC} ^[4]						
		V _{CC} = 1.65 V to 1.95 V	-	4.8	-	-	-	pF
		V _{CC} = 2.3 V to 2.7 V	-	8.3	-	-	-	pF
		V _{CC} = 3.0 V to 3.6 V	-	11.4	-	-	-	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} × 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. Waveforms



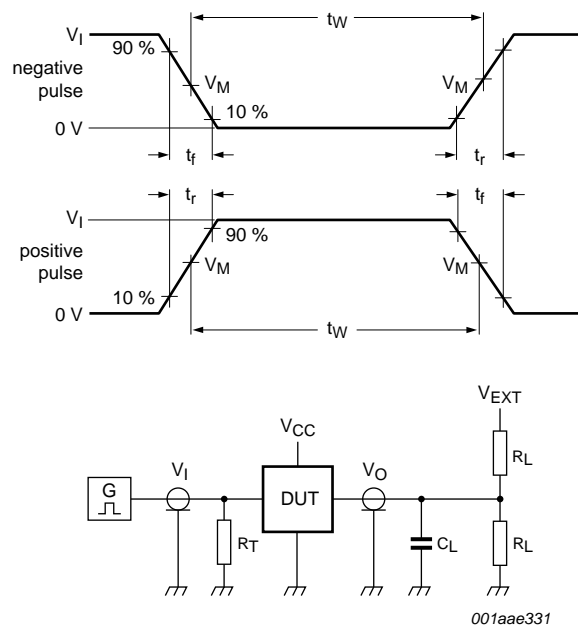


Measurement points are given in [Table 8](#).
 V_{OL} and V_{OH} are typical output voltage levels that occur with the output load.

Fig 5. 3-state enable and disable times

Table 8. Measurement points

Supply voltage	Input	Output		
		V_M	V_X	V_Y
1.2 V	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$	$V_{OL} + 0.1 \text{ V}$	$V_{OH} - 0.1 \text{ V}$
1.65 V to 1.95 V	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$	$V_{OL} + 0.1 \text{ V}$	$V_{OH} - 0.1 \text{ V}$
2.3 V to 2.7 V	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$	$V_{OL} + 0.1 \text{ V}$	$V_{OH} - 0.1 \text{ V}$
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	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 6. 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

TSSOP48: plastic thin shrink small outline package; 48 leads; body width 6.1 mm

SOT362-1

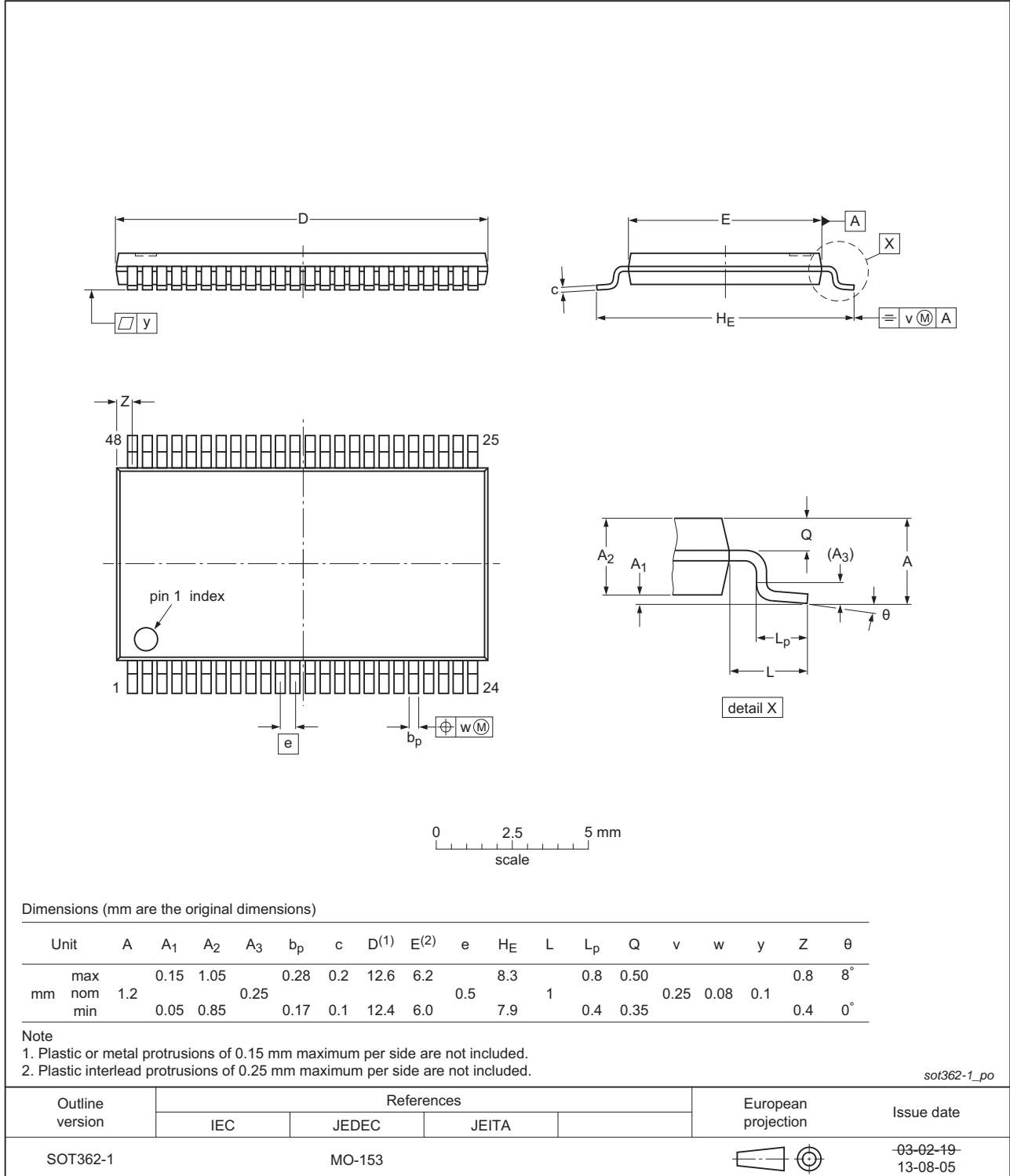


Fig 7. Package outline SOT362-1 (TSSOP48)

13. Abbreviations

Table 10. Abbreviations

Acronym	Description
CDM	Charged Device Model
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
74LVC16240A_Q100 v.1	20140519	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.
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