74ALVCH162245

16-bit bus transceiver with direction pin and 30 Ω termination resistor; 3-state

Rev. 3 — 16 January 2018 Product data sheet

1 General description

The 74ALVCH162245 is a 16-bit transceiver featuring non-inverting 3-state bus compatible outputs in both send and receive directions.

The 74ALVCH162245 features two output enable ($n\overline{OE}$) inputs for easy cascading and two send/receive (nDIR) inputs for direction control. $n\overline{OE}$ controls the outputs so that the buses are effectively isolated. This device can be used as two 8-bit transceivers or one 16-bit transceiver.

The 74ALVCH162245 is designed with 30 Ω series resistors in both HIGH and LOW output states.

The 74ALVCH162245 has active bus hold circuitry which is provided to hold unused or floating data inputs at a valid logic level. This feature eliminates the need for external pull-up or pull-down resistors.

2 Features and benefits

- Wide supply voltage range from 1.2 V to 3.6 V
- CMOS low power consumption
- MultiByte flow-through standard pin-out architecture
- Low inductance multiple V_{CC} and GND pins for minimum noise and ground bounce
- Direct interface with TTL levels (2.7 V to 3.6 V)
- Bus hold on all data inputs
- Integrated 30 Ω termination resistor
- Complies with JEDEC standards:
  - JESD8-5 (2.3 V to 2.7 V)
  - JESD8B/JESD36 (2.7 V to 3.6 V)
- ESD protection:
  - HBM ANSI/ESDA/JEDEC JS-001 exceeds 2000 V
  - CDM JESD22-C101E exceeds 1000 V

3 Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
74ALVCH162245DGG	−40 °C to +85 °C	TSSOP48	plastic thin shrink small outline package; 48 leads; body width 6.1 mm	SOT362-1

4 Functional diagram

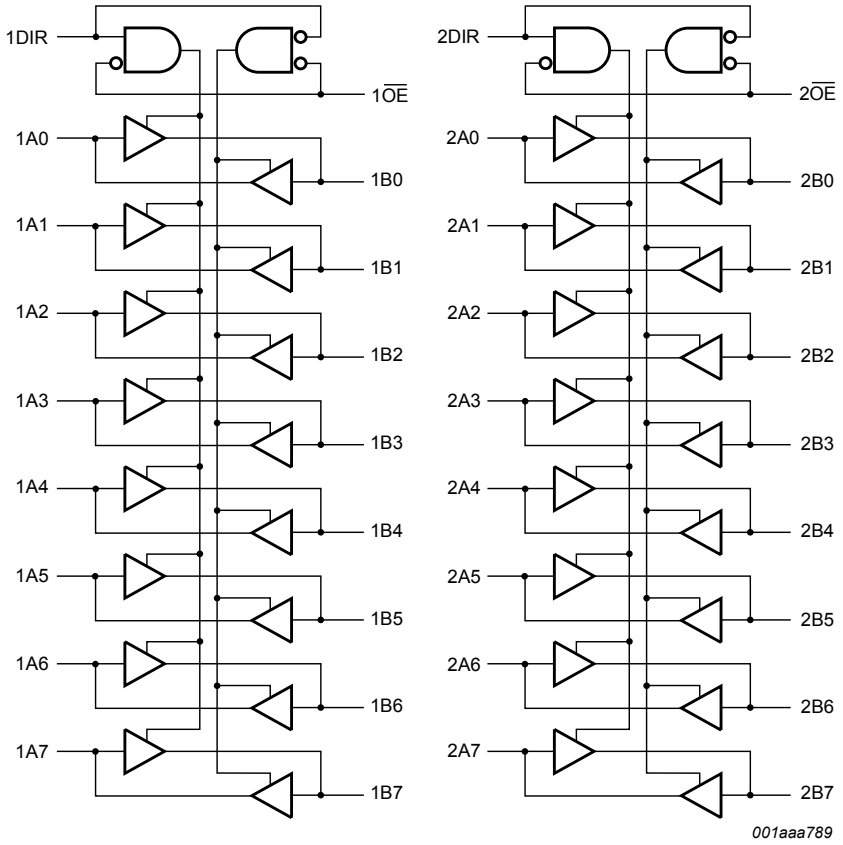


Figure 1. Logic symbol

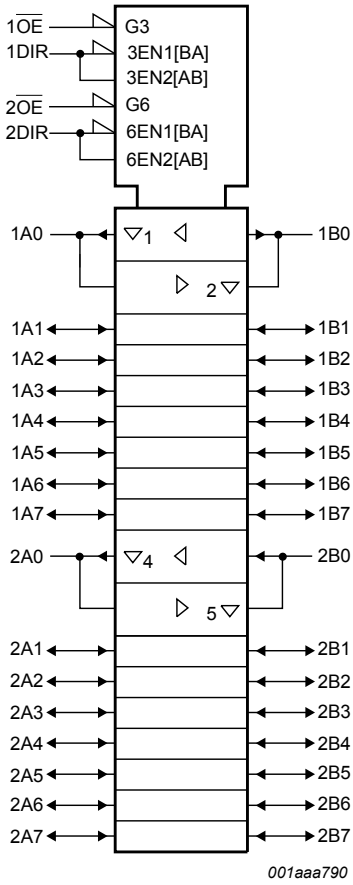


Figure 2. IEC logic symbol

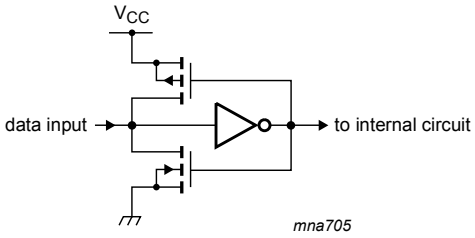


Figure 3. Bus hold circuit

5 Pinning information

5.1 Pinning

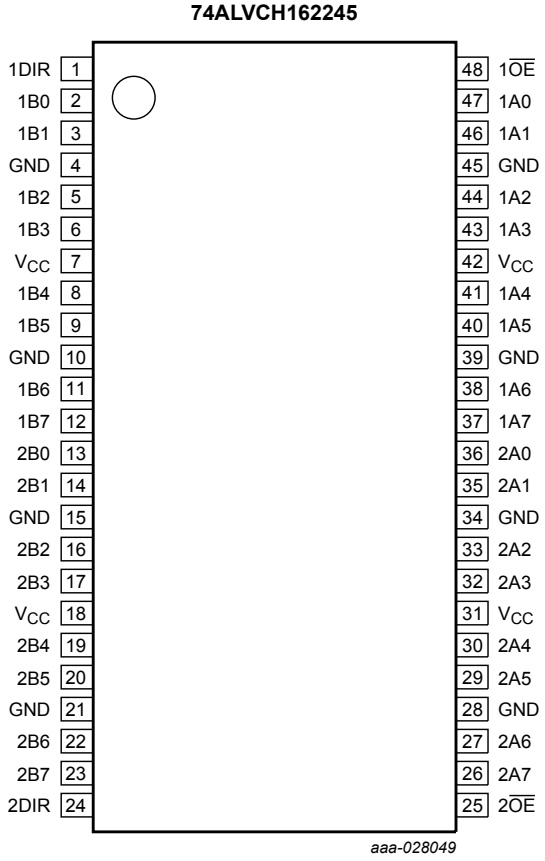


Figure 4. Pin configuration SOT362-1 (TSSOP48)

5.2 Pin description

Table 2. Pin description

Symbol	Pin	Description
1DIR, 2DIR	1, 24	direction control input
1A0, 1A1, 1A2, 1A3, 1A4, 1A5, 1A6, 1A7	47, 46, 44, 43, 41, 40, 38, 37	data input/output
2A0, 2A1, 2A2, 2A3, 2A4, 2A5, 2A6, 2A7	36, 35, 33, 32, 30, 29, 27, 26	data input/output
GND	4, 10, 15, 21, 28, 34, 39, 45	ground (0 V)
1B0, 1B1, 1B2, 1B3, 1B4, 1B5, 1B6, 1B7	2, 3, 5, 6, 8, 9, 11, 12	data input/output
2B0, 2B1, 2B2, 2B3, 2B4, 2B5, 2B6, 2B7	13, 14, 16, 17, 19, 20, 22, 23	data input/output
$1\overline{OE}$, $2\overline{OE}$	48, 25	output enable input (active-LOW)
V_{CC}	7, 18, 31, 42	supply voltage

6 Functional description

Table 3. Function table [1]

Control		Input/output	
n$\overline{OE}$	**nDIR**	**nAn**	**nBn**
L	L	output nAn = nBn	input
L	H	input	output nBn = nAn
H	X	Z	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	+4.6	V
V_I	input voltage	data inputs	[1]	−0.5	V_{CC} + 0.5	V
		control inputs	[1]	−0.5	+4.6	V
V_O	output voltage		[1]	−0.5	V_{CC} + 0.5	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 +85 °C				
		TSSOP48 package	[2]	-	600	mW

[1] The input and output voltage ratings may be exceeded if the input and output current ratings are observed.
[2] For TSSOP48 packages: above 55 °C derate linearly with 8 mW/K.

8 Recommended operating conditions

Table 5. Recommended operating conditions

Symbol	Parameter	Conditions	Min	Max	Unit
V_{CC}	supply voltage	V_{CC} = 2.5 V: for maximum speed performance at C_L = 30 pF	2.3	2.7	V
		V_{CC} = 3.3 V: for maximum speed performance at C_L = 50 pF	3.0	3.6	V
V_I	input voltage		0	V_{CC}	V
V_O	output voltage		0	V_{CC}	V
T_{amb}	ambient temperature	in free air	−40	+85	°C
Δt/ΔV	input transition rise and fall rate	V_{CC} = 2.3 V to 3.0 V	0	20	ns/V
		V_{CC} = 3.0 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	Min	Typ [1]	Max	Unit
V_{IH}	HIGH-level input voltage	V_{CC} = 2.3 to 2.7 V	1.7	1.2	-	V
		V_{CC} = 2.7 to 3.6 V	2.0	1.5	-	V
V_{IL}	LOW-level input voltage	V_{CC} = 2.3 to 2.7 V	-	1.2	0.7	V
		V_{CC} = 2.7 to 3.6 V	-	1.5	0.8	V
V_{OH}	HIGH-level output voltage	V_I = V_{IH} or V_{IL}				
		I_O = −100 µA; V_{CC} = 2.3 V to 3.6 V	V_{CC} - 0.2	V_{CC}	-	V
		I_O = −4 mA; V_{CC} = 2.3 V	V_{CC} - 0.4	V_{CC} - 0.11	-	V
		I_O = −6 mA; V_{CC} = 2.3 V	V_{CC} - 0.6	V_{CC} - 0.17	-	V
		I_O = −4 mA; V_{CC} = 2.7 V	V_{CC} - 0.5	V_{CC} - 0.09	-	V
		I_O = −8 mA; V_{CC} = 2.7 V	V_{CC} - 0.7	V_{CC} - 0.19	-	V
		I_O = −6 mA; V_{CC} = 3.0 V	V_{CC} - 0.6	V_{CC} - 0.13	-	V
		I_O = −12 mA; V_{CC} = 3.0 V	V_{CC} - 1.0	V_{CC} - 0.27	-	V
V_{OL}	LOW-level output voltage	V_I = V_{IH} or V_{IL}				
		I_O = 100 µA; V_{CC} = 2.3 V to 3.6 V	-	GND	0.20	V
		I_O = 4 mA; V_{CC} = 2.3 V	-	0.07	0.40	V
		I_O = 6 mA; V_{CC} = 2.3 V	-	0.11	0.55	V
		I_O = 4 mA; V_{CC} = 2.7 V	-	0.06	0.40	V
		I_O = 8 mA; V_{CC} = 2.7 V	-	0.13	0.60	V
		I_O = 6 mA; V_{CC} = 3.0 V	-	0.09	0.55	V
		I_O = 12 mA; V_{CC} = 3.0 V	-	0.19	0.80	V

Symbol	Parameter	Conditions	Min	Typ [1]	Max	Unit
I_I	input leakage current	per data input; $V_I = V_{CC}$ or GND; V_{CC} = 2.3 V to 3.6 V	-	0.1	5	µA
I_{BHL}	bus hold LOW current	V_{CC} = 2.3 V; V_I = 0.7 V	45	-	-	µA
		V_{CC} = 3.0 V; V_I = 0.8 V	75	150	-	µA
I_{BHH}	bus hold HIGH current	V_{CC} = 2.3 V; V_I = 1.7 V	−45	-	-	µA
		V_{CC} = 3.0 V; V_I = 2.0 V	−75	−175	-	µA
I_{BHLO}	bus hold LOW overdrive current	V_{CC} = 3.6 V	500	-	-	µA
I_{BHHO}	bus hold HIGH overdrive current	V_{CC} = 3.6 V	-500	-	-	µA
I_{OZ}	OFF-state output current	V_{CC} = 2.3 V to 3.6 V; $V_I = V_{IH}$ or V_{IL}; $V_O = V_{CC}$ or GND	-	0.1	10	µA
I_{CC}	supply current	V_{CC} = 2.3 V to 3.6 V; $V_I = V_{CC}$ or GND; I_O = 0 A	-	0.2	40	µA
ΔI_{CC}	additional supply current	V_{CC} = 2.3 V to 3.6 V; $V_I = V_{CC}$ - 0.6 V; I_O = 0 A	-	150	750	µA
C_I	input capacitance		-	4.0	-	pF
$C_{I/O}$	input/output capacitance		-	8.0	-	pF

[1] All typical values are measured at T_{amb} = 25 °C.

10 Dynamic characteristics

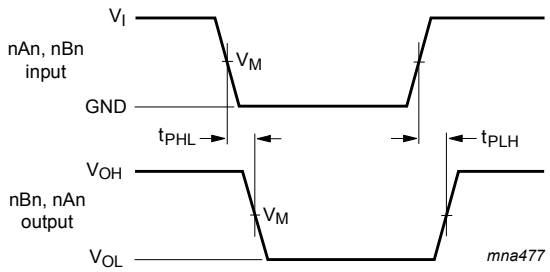
Table 7. Dynamic characteristics

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

Symbol	Parameter	Conditions		T_{amb} = −40 °C to +85 °C			Unit
				Min	Typ [1]	Max	
t_{pd}	propagation delay	nAn to nBn or nBn to nAn; see Figure 5	[2]				
		V_{CC} = 2.3 V to 2.7 V		1.0	2.5	4.9	ns
		V_{CC} = 2.7 V		1.0	2.7	4.7	ns
		V_{CC} = 3.0 V to 3.6 V		1.0	2.4	4.2	ns
t_{en}	enable time	$n\overline{OE}$ to nAn or $n\overline{OE}$ to nBn; see Figure 6	[3]				
		V_{CC} = 2.3 V to 2.7 V		1.0	2.9	6.8	ns
		V_{CC} = 2.7 V		1.0	3.9	6.7	ns
		V_{CC} = 3.0 V to 3.6 V		1.0	3.0	5.6	ns
t_{dis}	disable time	$n\overline{OE}$ to nAn or $n\overline{OE}$ to nBn; see Figure 6	[4]				
		V_{CC} = 2.3 V to 2.7 V		1.0	3.0	6.3	ns
		V_{CC} = 2.7 V		1.0	2.9	5.7	ns
		V_{CC} = 3.0 V to 3.6 V		1.0	2.6	5.5	ns
C_{PD}	power dissipation capacitance	per buffer; V_I = GND to V_{CC}	[5]				
		outputs enabled		-	27	-	pF
		outputs disabled		-	4	-	pF

[1] Typical values are measured at T_{amb} = 25 °C
Typical values for V_{CC} = 2.3 V to 2.7 V are measured at V_{CC} = 2.5 V
Typical values for V_{CC} = 3.0 V to 3.6 V are measured at V_{CC} = 3.3 V
[2] t_{pd} is the same as t_{PHL} and t_{PLH}.
[3] t_{en} is the same as t_{PZH} and t_{PZL}.
[4] t_{dis} is the same as t_{PHZ} and t_{PLZ}.
[5] 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

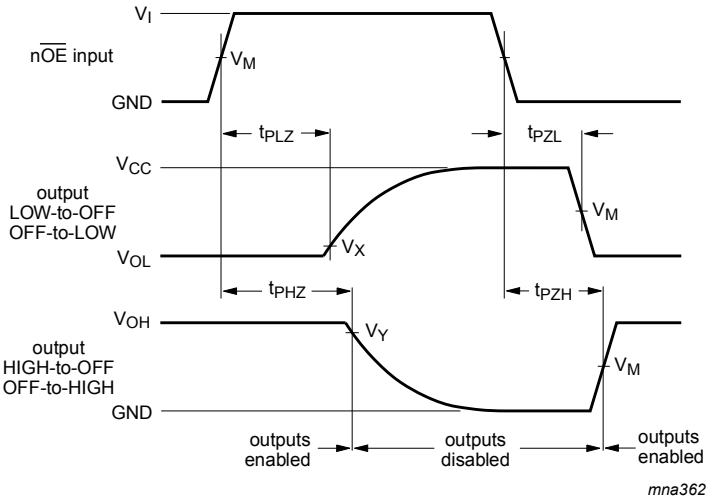
10.1 Waveforms and test circuit



Measurement points are given in Table 8.

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

Figure 5. Input (nAn or nBn) to output (nBn or nAn) propagation delays



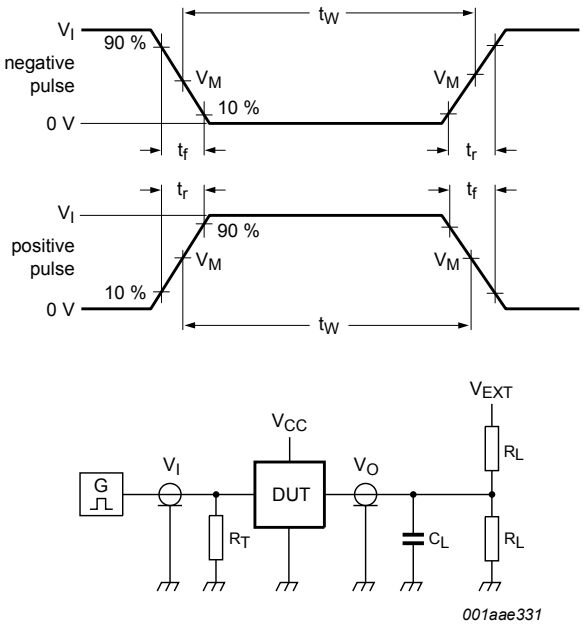
Measurement points are given in Table 8.

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

Figure 6. 3-state enable and disable times

Table 8. Measurement points

Supply voltage	Input		Output		
V_{CC}	V_I	V_M	V_M	V_X	V_Y
2.3 V to 2.7 V	V_{CC}	0.5 x V_{CC}	0.5V_{CC}	V_{OL} + 0.15 V	V_{OH} - 0.15 V
2.7 V	2.7 V	1.5 V	1.5 V	V_{OL} + 0.3 V	V_{OH} - 0.3 V
3.0 V to 3.6 V	2.7 V	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 includes jig and probe capacitance.

R_T = Termination resistance should be equal to Z_o of pulse generator.

V_{EXT} = Test voltage for switching times.

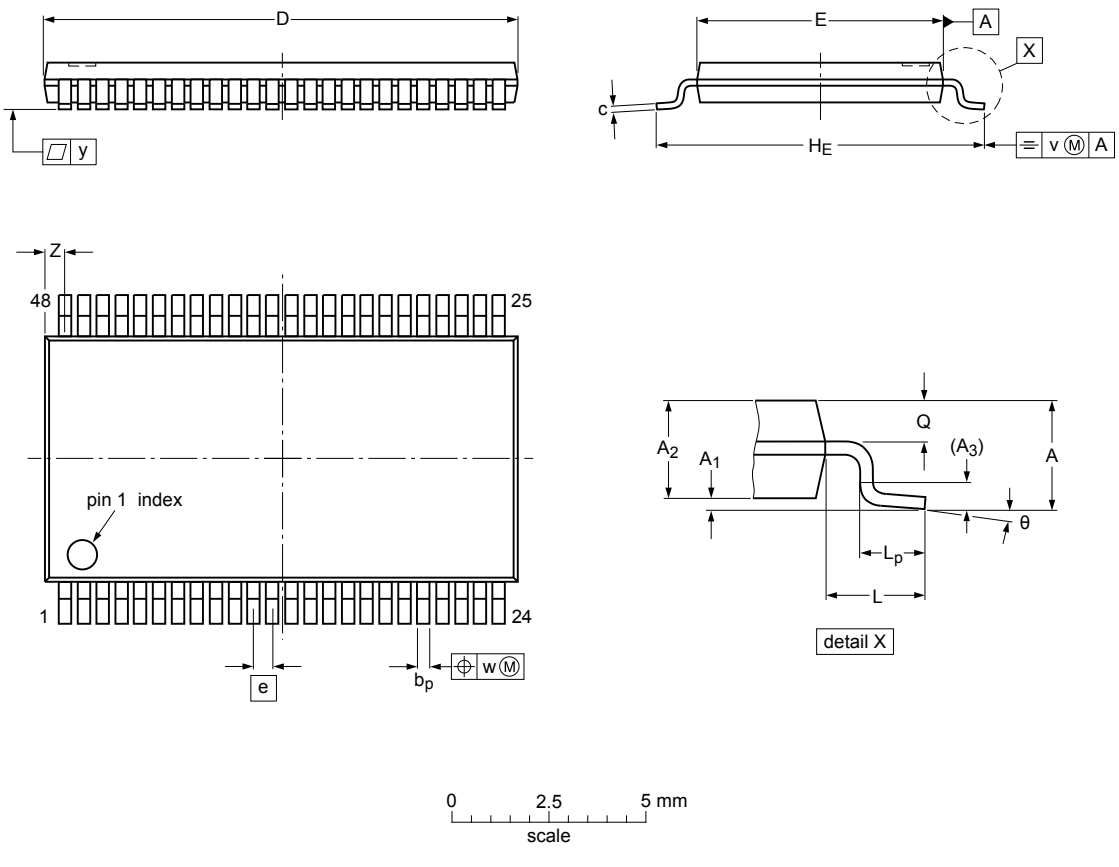
Figure 7. Test circuit for measuring switching times

Table 9. Test data

Supply voltage	Input		Load		V_{EXT}		
V_{CC}	V_I	t_r, t_f	C_L	R_L	t_{PLH}, t_{PHL}	t_{PLZ}, t_{PZL}	t_{PHZ}, t_{PZH}
2.3 V to 2.7 V	V_{CC}	≤ 2.0 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

TSSOP48: plastic thin shrink small outline package; 48 leads; body width 6.1 mm **SOT362-1**



Dimensions (mm are the original dimensions)

Unit		A	A_1	A_2	A_3	b_p	c	$D^{(1)}$	$E^{(2)}$	e	H_E	L	L_p	Q	v	w	y	Z	θ
mm	max	1.2	0.15	1.05	0.25	0.28	0.2	12.6	6.2	0.5	8.3	1	0.8	0.50	0.25	0.08	0.1	0.8	8°
	nom																		
	min		0.05	0.85		0.17	0.1	12.4	6.0		7.9		0.4	0.35				0.4	0°

Note
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.

sot362-1_po

Outline version	References				European projection	Issue date
	IEC	JEDEC	JEITA			
SOT362-1		MO-153				~~03-02-19~~ 13-08-05

Figure 8. Package outline SOT362-1 (TSSOP48)

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
74ALVCH162245 v.3	20180116	Product data sheet	-	74ALVCH162245 v.2
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 number 74ALVCH162245DL (SOT370-1 / SSOP48) removed.			
74ALVCH162245 v.2	19980629	Product specification	-	74ALVCH162245 v.1
74ALVCH162245 v.1	19980504	Product specification	-	-

14 Legal information

14.1 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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