DATA SHEET

74LVC162245A/
74LVCH162245A

16-bit bus transceiver with direction pin;
30Ω series termination resistors;
5V Input/Outputs tolerant (3-State)

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FEATURES

- 5 volt tolerant inputs/outputs for interfacing with 5V logic
- Wide supply voltage range of 1.2V to 3.6V
- Complies with JEDEC standard no. 8-1A
- CMOS low power consumption
- MULTIBYTE[TM] flow-through standard pin-out architecture
- Low inductance multiple power and ground pins for minimum noise and ground bounce
- Direct interface with TTL levels
- Bus hold on data inputs (74LVCH162245A only)
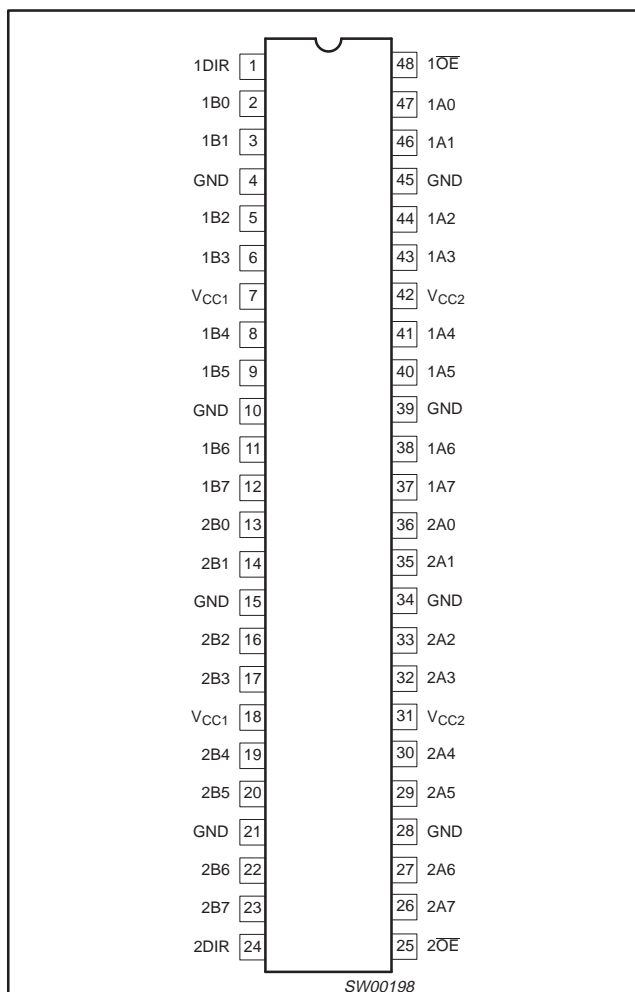- Integrated 30Ω termination resistors

DESCRIPTION

The 74LVC(H)162245A is a high-performance, low-power, low-voltage, Si-gate CMOS device, superior to most advanced CMOS compatible TTL families. Inputs can be driven from either 3.3V or 5V devices. In 3-State operation, outputs can handle 5V. These features allow the use of these devices in a mixed 3.3V/5V environment.

The 74LVC(H)162245A is a 16-bit transceiver featuring non-inverting 3-State bus compatible outputs in both send and receive directions. The 74LVC(H)162245A features two output enable (n$\overline{OE}$) inputs for easy cascading and two send/receive (n$\overline{DIR}$) inputs for direction control. n$\overline{OE}$ controls the outputs so that the buses are effectively isolated. The 74LVC(H)162245A is design with 30Ω series termination resistors in both HIGH and LOW output stages to reduce line noise. This device can be used as two 8-bit transceivers or one 16-bit transceiver.

The 74LVCH162245A bus hold data inputs eliminates the need for extreme pull up resistors to hold unused inputs.

PIN CONFIGURATION

Pin	Name		Pin	Name
1	1DIR		48	1$\overline{OE}$
2	1B0		47	1A0
3	1B1		46	1A1
4	GND		45	GND
5	1B2		44	1A2
6	1B3		43	1A3
7	V_{CC1}		42	V_{CC2}
8	1B4		41	1A4
9	1B5		40	1A5
10	GND		39	GND
11	1B6		38	1A6
12	1B7		37	1A7
13	2B0		36	2A0
14	2B1		35	2A1
15	GND		34	GND
16	2B2		33	2A2
17	2B3		32	2A3
18	V_{CC1}		31	V_{CC2}
19	2B4		30	2A4
20	2B5		29	2A5
21	GND		28	GND
22	2B6		27	2A6
23	2B7		26	2A7
24	2DIR		25	2$\overline{OE}$

SW00198

ORDERING INFORMATION

PACKAGES	TEMPERATURE RANGE	OUTSIDE NORTH AMERICA	NORTH AMERICA	DWG NUMBER
48-Pin Plastic SSOP Type III	−40°C to +85°C	74LVC162245A DL	VC162245A DL	SOT370-1
48-Pin Plastic TSSOP Type II	−40°C to +85°C	74LVC162245A DGG	VC162245A DGG	SOT362-1
48-Pin Plastic SSOP Type III	−40°C to +85°C	74LVCH162245A DL	VCH162245A DL	SOT370-1
48-Pin Plastic TSSOP Type II	−40°C to +85°C	74LVCH162245A DGG	VCH162245A DGG	SOT362-1

QUICK REFERENCE DATA

GND = 0V; T_{amb} = 25°C; t_r = t_f ≤ 2.5ns

SYMBOL	PARAMETER	CONDITIONS	TYPICAL	UNIT
t_{PHL}/t_{PLH}	Propagation delay An to Bn; Bn to An	C_L = 50pF V_{CC} = 3.3V	3.3	ns
C_I	Input capacitance		5.0	pF
$C_{I/O}$	Input/output capacitance		10	pF
C_{PD}	Power dissipation capacitance per buffer	V_I = GND to V_{CC}[1]	28	pF

NOTES:

1. C_{PD} is used to determine the dynamic power dissipation (P_D in μW):
   $P_D = C_{PD} \times V_{CC}^2 \times f_i + \Sigma (C_L \times V_{CC}^2 \times f_o)$ where:
   f_i = input frequency in MHz; C_L = output load capacity in pF;
   f_o = output frequency in MHz; V_{CC} = supply voltage in V;
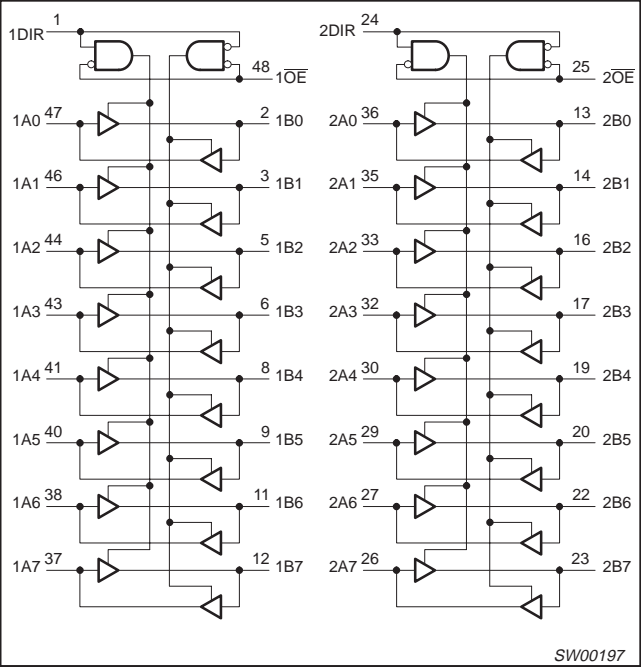 $\Sigma (C_L \times V_{CC}^2 \times f_o)$ = sum of the outputs.

16-bit bus transceiver with direction pin; 30Ω series termination resistors; 5V Input/Outputs tolerant (3-State)

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PIN DESCRIPTION

PIN NUMBER	SYMBOL	NAME AND FUNCTION
1	1DIR	Direction control
2, 3, 5, 6, 8, 9, 11, 12	1B0 to 1B7	Data inputs/outputs
4, 10, 15, 21, 28, 34, 39, 45	GND	Ground (0V)
7, 18, 31, 42	V_{CC}	Positive supply voltage
13, 14, 16, 17, 19, 20, 22, 23	2B0 to 2B7	Data inputs/outputs
24	2DIR	Direction control
25	2$\overline{OE}$	Output enable input (active LOW)
36, 35, 33, 32, 30, 29, 27, 26	2A0 to 2A7	Data inputs/outputs
47, 46, 44, 43, 41, 40, 38, 37	1A0 to 1A7	Data inputs/outputs
48	1$\overline{OE}$	Output enable input (active LOW)

LOGIC SYMBOL

SW00197

FUNCTION TABLE

INPUTS		INPUTS/OUTPUT	
n$\overline{OE}$	nDIR	nAn	nBn
L	L	A = B	inputs
L	H	inputs	B = A
H	X	Z	Z

H = HIGH voltage level
L = LOW voltage level
X = don't care
Z = high impedance OFF-state

LOGIC SYMBOL (IEEE/IEC)
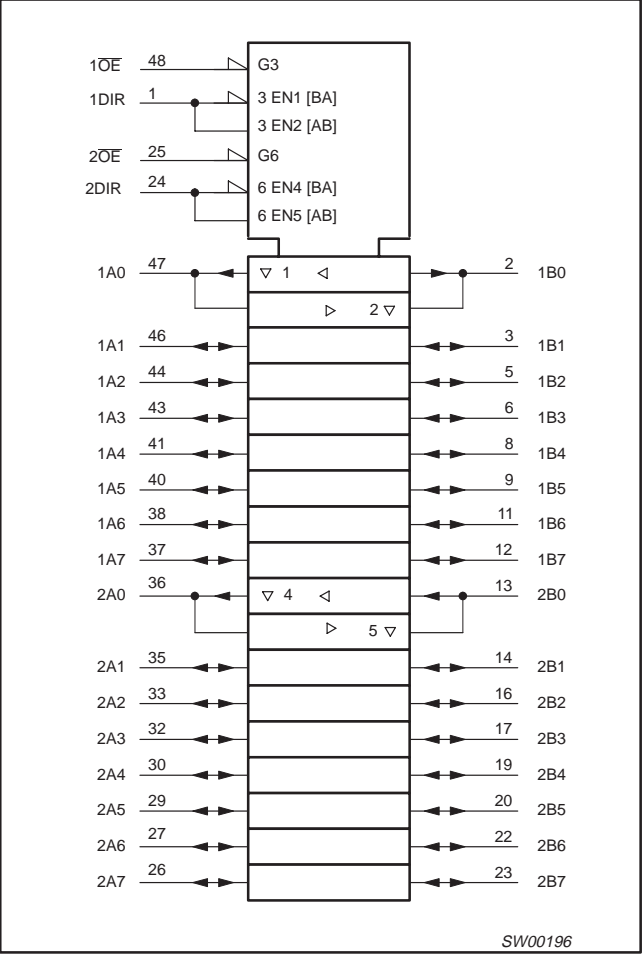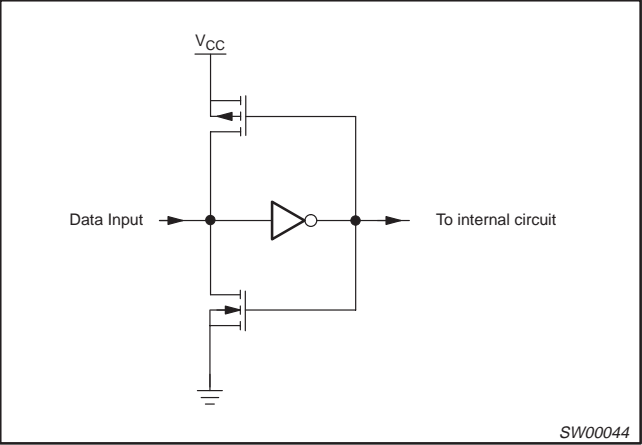
SW00196

BUSHOLD CIRCUIT

SW00044

16-bit bus transceiver with direction pin; 30Ω series termination resistors; 5V Input/Outputs tolerant (3-State)

74LVC162245A/ 74LVCH162245A

RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	CONDITIONS	LIMITS		UNIT
			MIN.	MAX.	
V_{CC}	DC supply voltage (for max. speed performance)		2.7	3.6	V
V_{CC}	DC supply voltage (for low-voltage applications)		1.2	3.6	V
V_I	DC Input voltage range		0	5.5	V
V_O	DC output voltage range; output HIGH or LOW state		0	V_{CC}	V
V_O	DC output voltage range; output 3-State		0	5.5	V
T_{amb}	Operating ambient temperature range in free air		−40	+85	°C
t_r, t_f	Input rise and fall times	V_{CC} = 1.2 to 2.7V V_{CC} = 2.7 to 3.6V	0 0	20 10	ns/V

ABSOLUTE MAXIMUM RATINGS[1]

In accordance with the Absolute Maximum Rating System (IEC 134) Voltages are referenced to GND (ground = 0V)

SYMBOL	PARAMETER	CONDITIONS	LIMITS		UNIT
			MIN	MAX	
V_{CC}	DC supply voltage		−0.5	+6.5	V
I_{IK}	DC input diode current	V_I < 0	–	−50	mA
V_I	DC input voltage	Note 2	−0.5	+6.5	V
I_{OK}	DC output diode current	V_O > V_{CC} or V_O < 0	–	± 50	mA
V_O	DC output voltage; output HIGH or LOW state	Note 2	−0.5	V_{CC} + 0.5	V
V_O	DC output voltage; output 3-State	Note 2	−0.5	6.5	V
I_O	DC output source or sink current	V_O = 0 to V_{CC}	–	± 50	mA
I_{GND}, I_{CC}	DC V_{CC} or GND current		–	± 100	mA
T_{stg}	Storage temperature range		−65	+150	°C
P_{tot}	Power dissipation per package – SSOP and TSSOP package	Above +60°C derate linearly 5.5mW/K		500	

NOTES:
1. Stresses beyond those listed may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
2. The input and output voltage ratings may be exceeded if the input and output clamp current ratings are observed.

DC ELECTRICAL CHARACTERISTICS

Over recommended operating conditions. Voltages are referenced to GND (ground = 0V)

SYMBOL	PARAMETER	TEST CONDITIONS	LIMITS Temp = -40°C to +85°C			UNIT
			MIN	TYP[1]	MAX	
V_{IH}	HIGH level Input voltage	V_{CC} = 1.2V	V_{CC}			V
		V_{CC} = 2.7 to 3.6V	2.0			
V_{IL}	LOW level Input voltage	V_{CC} = 1.2V			GND	V
		V_{CC} = 2.7 to 3.6V			0.8	
V_{OH}	HIGH level output voltage	V_{CC} = 2.7V; $V_I = V_{IH}$ or V_{IL}; I_O = –6mA	$V_{CC} - 0.5$			V
		V_{CC} = 3.0V; $V_I = V_{IH}$ or V_{IL}; I_O = –100µA	$V_{CC} - 0.2$	V_{CC}		
		V_{CC} = 3.0V; $V_I = V_{IH}$ or V_{IL}; I_O = –12mA	$V_{CC} - 0.8$			
V_{OL}	LOW level output voltage	V_{CC} = 2.7V; $V_I = V_{IH}$ or V_{IL}; I_O = 6mA			0.40	V
		V_{CC} = 3.0V; $V_I = V_{IH}$ or V_{IL}; I_O = 100µA			0.20	
		V_{CC} = 3.0V; $V_I = V_{IH}$ or V_{IL}; I_O = 12mA			0.55	
I_I	Input leakage current	V_{CC} = 3.6V; V_I = 5.5V or GND[6]		± 0.1	± 5	µA
I_{OZ}	3-State output OFF-state current[7]	V_{CC} = 3.6V; $V_I = V_{IH}$ or V_{IL}; V_O = 5.5V or GND		0.1	± 5	µA
I_{off}	Power off leakage supply	V_{CC} = 0.0V; V_I or V_O = 5.5V		0.1	± 10	µA
I_{CC}	Quiescent supply current	V_{CC} = 3.6V; $V_I = V_{CC}$ or GND; I_O = 0		0.1	20	µA
ΔI_{CC}	Additional quiescent supply current per control pin	V_{CC} = 2.7V to 3.6V; $V_I = V_{CC} - 0.6V$; I_O = 0		5	500	µA
ΔI_{CC}	Additional quiescent supply current per data input pin	V_{CC} = 2.7V to 3.6V; $V_I = V_{CC} - 0.6V$; I_O = 0		150	750	µA
I_{BHL}	Bus hold LOW sustaining current	V_{CC} = 3.0V; V_I = 0.8V, [2, 3, 4]	75			µA
I_{BHH}	Bus hold HIGH sustaining current	V_{CC} = 3.0V; V_I = 2.0V, [2, 3, 4]	–75			µA
I_{BHLO}	Bus hold LOW overdrive current	V_{CC} = 3.6V[2, 3, 5]	450			µA
I_{BHHO}	Bus hold HIGH overdrive current	V_{CC} = 3.6V[2, 3, 5]	–450			µA

NOTES:
1. All typical values are at V_{CC} = 3.3V and T_{amb} = 25°C.
2. Valid for data inputs of bus hold parts (LVCH16-A) only.
3. 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.
6. For bus hold parts, the bus hold circuit is switched off when V_i exceeds V_{CC} allowing 5.5V on the input terminal.
7. For I/O ports the parameter I_{OZ} includes the input leakage current.

AC CHARACTERISTICS

GND = 0V; $t_R = t_F$ = 2.5ns; C_L = 50pF; R_L = 500Ω; T_{amb} = –40°C to +85°C.

| SYMBOL	PARAMETER	WAVEFORM	LIMITS					UNIT
			V_{CC} = 3.3V ±0.3V			V_{CC} = 2.7V		
			MIN	TYP[1]	MAX	MIN	MAX	
t_{PHL} t_{PLH}	Propagation delay nAn to nBn; nBn to nAn	1	1.5	3.3	5.7	1.5	6.7	ns
t_{PZH} t_{PZL}	3-State output enable time n$\overline{OE}$ to nAn; n$\overline{OE}$ to nBn	2, 3	1.5	4.3	7.5	1.5	8.5	ns
t_{PHZ} t_{PLZ}	3-State output disable time n$\overline{OE}$ to nAn; n$\overline{OE}$ to nBn	2, 3	1.5	4.0	6.5	1.5	7.5	ns

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

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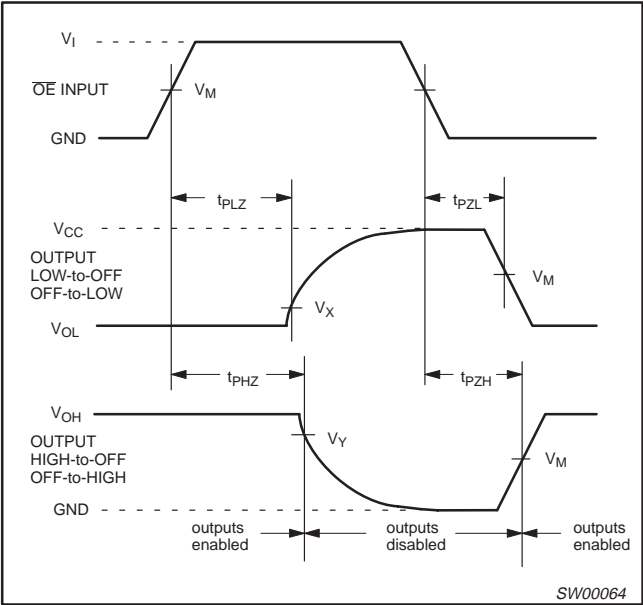
74LVC162245A/ 74LVCH162245A

AC WAVEFORMS

$V_M = 1.5V$ at $V_{CC} \geq 2.7V$; $V_M = 0.5\, V_{CC}$ at $V_{CC} < 2.7V$.
V_{OL} and V_{OH} are the typical output voltage drop that occur with the output load.
$V_X = V_{OL} + 0.3V$ at $V_{CC} \geq 2.7V$; $V_X = V_{OL} + 0.1\, V_{CC}$ at $V_{CC} < 2.7V$
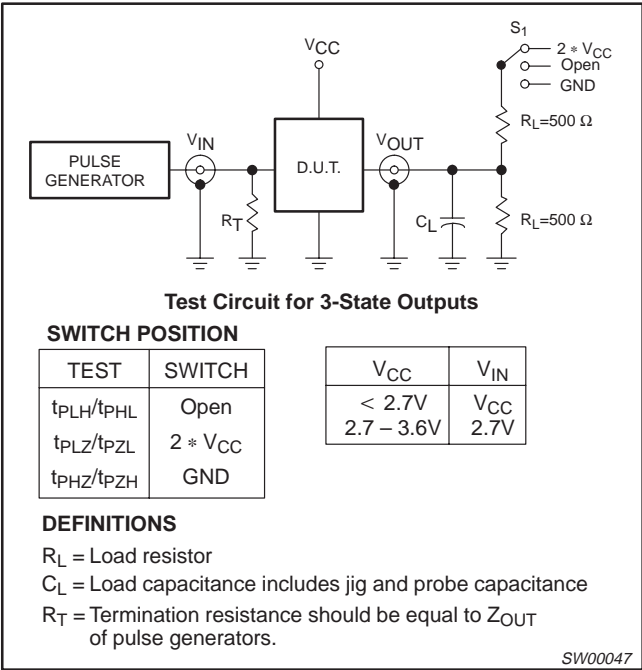$V_Y = V_{OH} - 0.3V$ at $V_{CC} \geq 2.7V$; $V_Y = V_{OH} - 0.1\, V_{CC}$ at $V_{CC} < 2.7V$
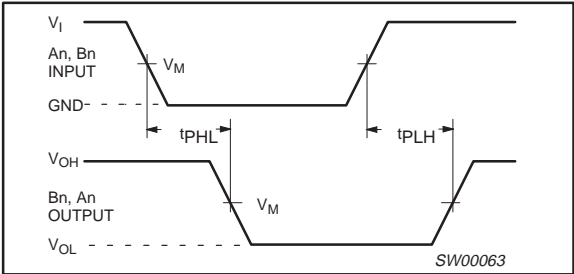
Waveform 1.   Input (nAn, nBn) to output (nBn, nAn) propagation delay times

Waveform 2.   3-State enable and disable times

TEST CIRCUIT

Test Circuit for 3-State Outputs

SWITCH POSITION

TEST	SWITCH
t_{PLH}/t_{PHL}	Open
t_{PLZ}/t_{PZL}	$2 * V_{CC}$
t_{PHZ}/t_{PZH}	GND

V_{CC}	V_{IN}
$< 2.7V$	V_{CC}
$2.7 - 3.6V$	$2.7V$

DEFINITIONS

R_L = Load resistor

C_L = Load capacitance includes jig and probe capacitance

R_T = Termination resistance should be equal to Z_{OUT} of pulse generators.
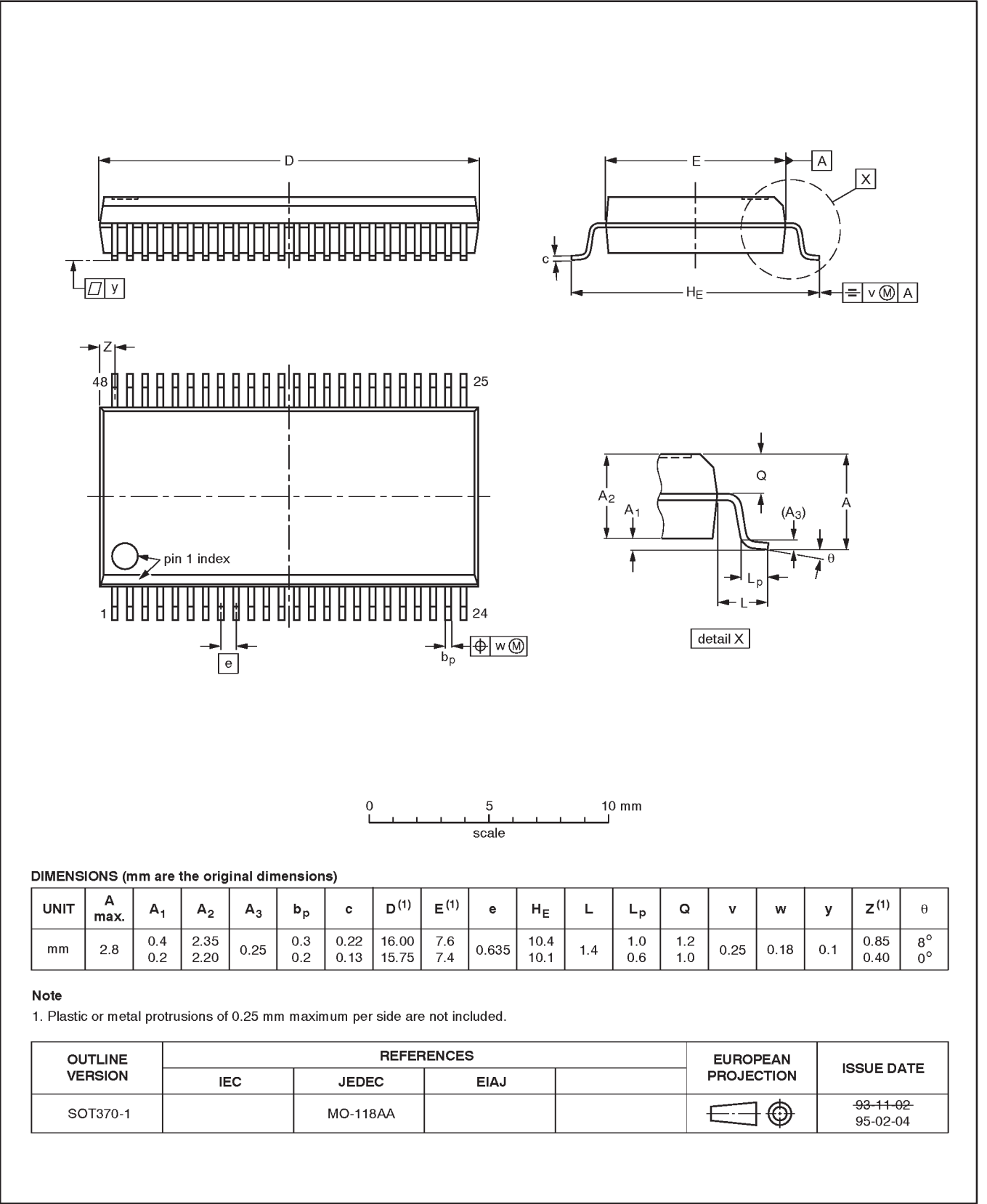
Waveform 3.   Load circuitry for switching times

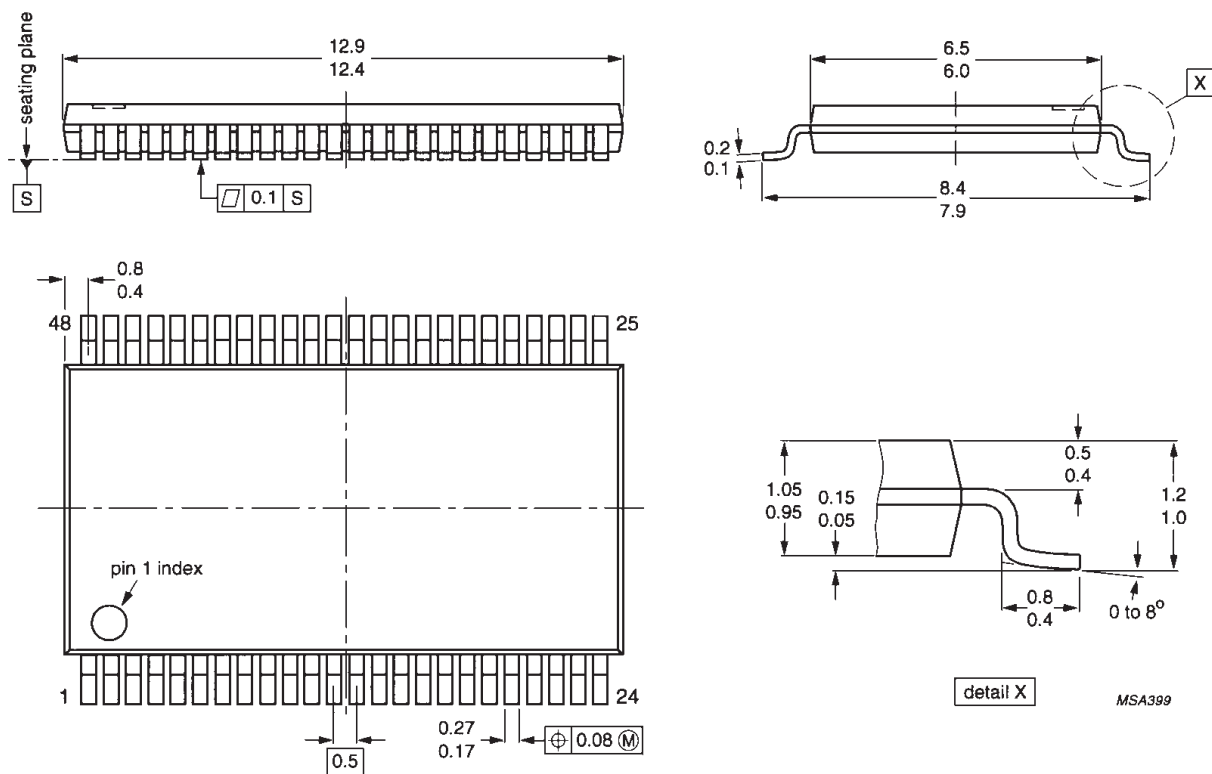16-bit bus transceiver with direction pin; 30Ω series
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74LVC162245A/
74LVCH162245A

SSOP48:   plastic shrink small outline package; 48 leads; body width 7.5 mm   **SOT370-1**

pin 1 index

detail X

```
0        5        10 mm
|_|_|_|_|_|_|_|_|_|_|_|
         scale
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DIMENSIONS (mm are the original dimensions)

UNIT	A max.	A₁	A₂	A₃	b_p	c	D(1)	E(1)	e	H_E	L	L_p	Q	v	w	y	Z(1)	θ
mm	2.8	0.4 0.2	2.35 2.20	0.25	0.3 0.2	0.22 0.13	16.00 15.75	7.6 7.4	0.635	10.4 10.1	1.4	1.0 0.6	1.2 1.0	0.25	0.18	0.1	0.85 0.40	8° 0°

Note

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

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT370-1		MO-118AA				~~93-11-02~~ 95-02-04

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

Dimensions in mm.

Philips Semiconductors

Product specification

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74LVC162245A/
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NOTES

Philips Semiconductors   Product specification

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termination resistors; 5V Input/Outputs tolerant (3-State)   74LVCH162245A

Data sheet status

Data sheet status	Product status	Definition [1]
Objective specification	Development	This data sheet contains the design target or goal specifications for product development. Specification may change in any manner without notice.
Preliminary specification	Qualification	This data sheet contains preliminary data, and supplementary data will be published at a later date. Philips Semiconductors reserves the right to make chages at any time without notice in order to improve design and supply the best possible product.
Product specification	Production	This data sheet contains final specifications. Philips Semiconductors reserves the right to make changes at any time without notice in order to improve design and supply the best possible product.

[1]   Please consult the most recently issued datasheet before initiating or completing a design.

Definitions

Short-form specification — The data in a short-form specification is extracted from a full data sheet with the same type number and title. For detailed information see the relevant data sheet or data handbook.

Limiting values definition — Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.

Application information — Applications that are described herein for any of these products are for illustrative purposes only. Philips Semiconductors make no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

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