

DATA SHEET

74AC16245/74ACT16245 16-bit bus transceiver (3-State)

Product specification

1997 Jul 15

16-bit bus transceiver (3-State)

74AC16245
74ACT16245

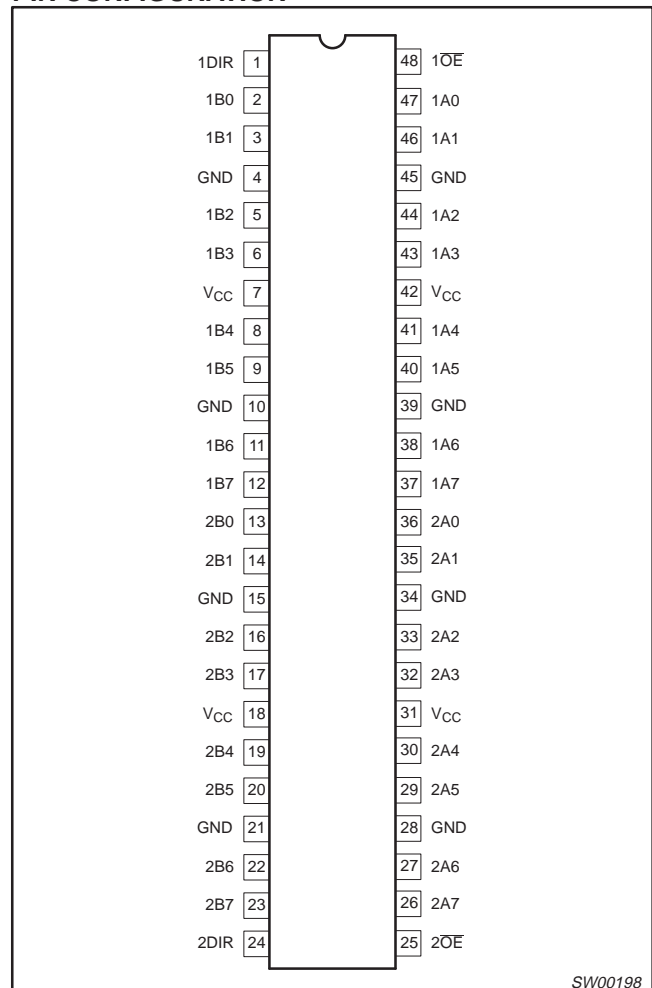
FEATURES

- 16-bit bidirectional bus interface
- 74ACT16245 has TTL-compatible inputs
- 74AC16245 has CMOS-compatible inputs
- 3-State outputs source/sink 24mA
- 3-State outputs drive bus lines or buffer memory address registers
- Distributed power and ground pins for minimum noise and ground bounce
- ESD protection in accordance with industry standards

DESCRIPTION

The 74AC16245/74ACT16245 is a 16-bit transceiver featuring non-inverting 3-State bus compatible outputs in both send and receive directions. The '16245' features two output enable ($1\overline{OE}$, $2\overline{OE}$) inputs for easy cascading and two send/receive (1DIR, 2DIR) 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.

PIN CONFIGURATION



SW00198

QUICK REFERENCE DATA

GND = 0V; $T_{amb} = 25^{\circ}\text{C}$; $t_r = t_f \leq 2.5\text{ns}$

SYMBOL	PARAMETER	CONDITIONS	TYPICAL			UNIT
			AC		ACT	
			$V_{CC} = 3.3\text{V}$	$V_{CC} = 5.0\text{V}$	$V_{CC} = 5.0\text{V}$	
t_{PHL}/t_{PLH}	Propagation delay An to Bn; Bn to An	$C_L = 50\text{pF}$	3.6	2.5	3.7	ns
C_I	Input capacitance		4.5			pF
C_{PD}	Power dissipation capacitance	$V_I = \text{GND to } V_{CC}^1$ outputs enabled outputs disabled	32 6		38 6	pF

NOTE:

- C_{PD} is used to determine the dynamic power dissipation (P_D in μW): $P_D = C_{PD} \times V_{CC}^2 \times f_i + \sum (C_L \times V_{CC}^2 \times f_o)$ 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;
 $\sum (C_L \times V_{CC}^2 \times f_o)$ = sum of the outputs.

ORDERING INFORMATION

PACKAGES	TEMPERATURE RANGE	OUTSIDE NORTH AMERICA	NORTH AMERICA	DWG NUMBER
48-Pin Plastic SSOP Type III	-40°C to $+85^{\circ}\text{C}$	74AC16245 DL 74ACT16245 DL	7AC16245 DL 7AT16245 DL	SOT370-1
48-Pin Plastic TSSOP Type II	-40°C to $+85^{\circ}\text{C}$	74AC16245 DGG 74ACT16245 DGG	7AC16245 DGG 7AT16245 DGG	SOT362-1

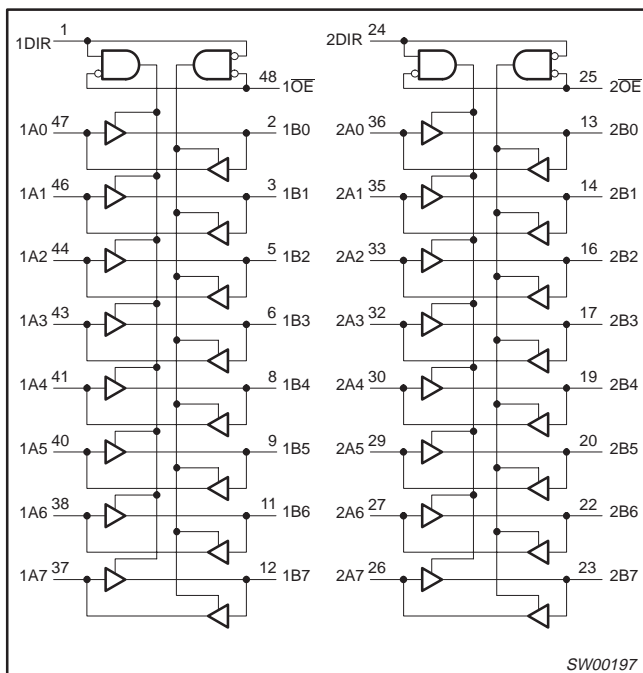
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PIN DESCRIPTION

PIN NUMBER	SYMBOL	NAME AND FUNCTION
1, 24	1DIR, 2DIR	Direction control input
47, 46, 44, 43, 41, 40, 38, 37, 36, 35, 33, 32, 30, 29, 27, 26	nA0 to nA7	Data inputs/outputs (A side)
2, 3, 5, 6, 8, 9, 11, 12, 13, 14, 16, 17, 19, 20, 22, 23	nB0 to nB7	Data inputs/outputs (B side)
48, 25	1OE, 2OE	Output enable input (active LOW)
4, 10, 15, 21, 28, 34, 39, 45	GND	Ground (0V)
7, 18, 31, 42	VCC	Positive supply voltage

LOGIC SYMBOL

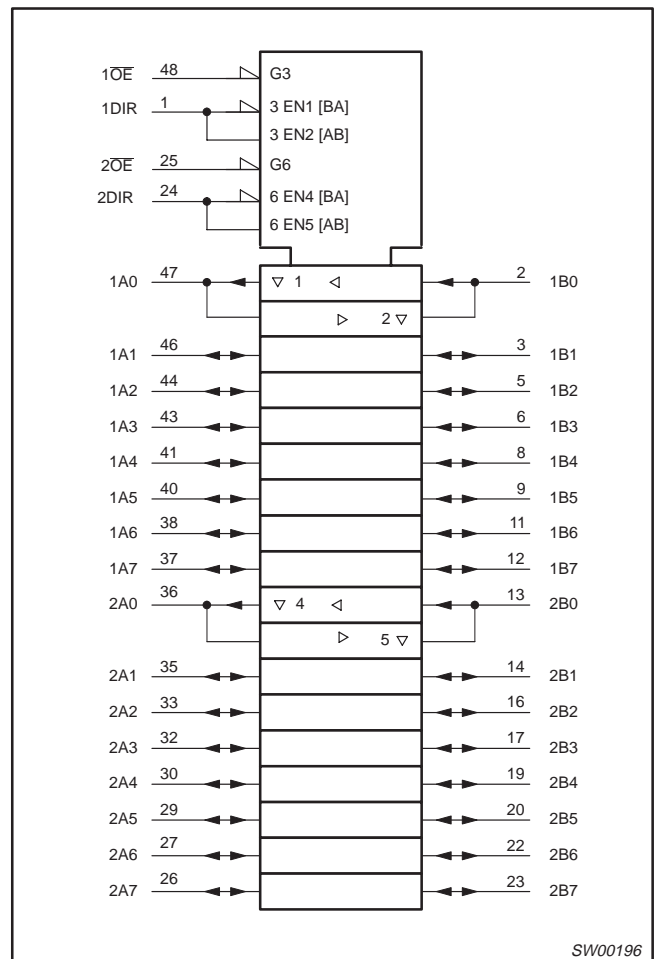


FUNCTION TABLE

INPUTS		INPUTS/OUTPUT	
nOE	nDIR	nAx	nBx
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)



16-bit bus transceiver (3-State)

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RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	LIMITS		UNIT
		MIN	MAX	
V_{CC}	DC supply voltage for 'AC	2.0	6.0	V
V_{CC}	DC supply voltage for 'ACT	4.5	5.5	V
V_{IN}	DC input voltage range	0	V_{CC}	V
V_O	DC output voltage range	0	V_{CC}	V
T_{amb}	Operating free-air temperature range	-40	+85	°C
$\Delta V/\Delta t$	Minimum input edge rate — AC devices V_{IN} from 30% to 70% of V_{CC} V_{CC} @ 3.3V, 4.5V, 5.5V	125		mV/ns
	— ACT devices V_{IN} from 0.8V to 2.0V V_{CC} @ 4.5V, 5.5V	125		

ABSOLUTE MAXIMUM RATINGS¹

in accordance with the Absolute Maximum Rating System (IEC134)
Voltages are referenced to GND (ground = 0V)

SYMBOL	PARAMETER	CONDITIONS	RATING	UNIT
V_{CC}	DC supply voltage		-0.5 to +7.0	V
I_{IK}	DC input diode current	$V_{IN} = -0.5V$	-20	mA
		$V_{IN} = V_{CC} + 0.5V$	+20	
V_{IN}	DC input voltage		-0.5 to $V_{CC} + 0.5$	V
I_{OK}	DC output diode current	$V_O = -0.5V$	-20	mA
		$V_O = V_{CC} + 0.5V$	+20	
V_O	DC output voltage		-0.5 to $V_{CC} + 0.5$	V
I_O	DC output source or sink current		± 50	mA
I_{CC}, I_{GND}	DC V_{CC} or GND current per output		± 50	mA
I_{CC}, I_{GND}	DC V_{CC} or GND current		± 200	mA
T_{stg}	Storage temperature range		-65 to 150	°C
P_{TOT}	Power dissipation per package — plastic mini-pack (SO) — plastic shrink mini-pack (SSOP and TSSOP)	above +70°C derate linearly with 8 mW/K	500	mW
		above +60°C derate linearly with 5.5 mW/K	500	

NOTES:

- 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.

16-bit bus transceiver (3-State)

74AC16245
74ACT16245**DC ELECTRICAL CHARACTERISTICS FOR 74AC16245**

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

SYMBOL	PARAMETER	TEST CONDITIONS	V _{CC} (V)	LIMITS			UNIT	
				Temp = -40°C to +85°C				
				MIN	TYP ¹	MAX		
V _{IH}	HIGH level Input voltage	V _{OUT} = 0.1V or (V _{CC} - 0.1V)	3.0	2.1	1.5		V	
			4.5	3.15	2.25			
			5.5	3.85	2.75			
V _{IL}	LOW level Input voltage	V _{OUT} = 0.1V or (V _{CC} - 0.1V)	3.0		1.5	0.9	V	
			4.5		2.25	1.35		
			5.5		2.75	1.65		
V _{OH}	HIGH level output voltage	I _{OUT} = -50 μA	3.0	2.9	2.99		V	
			4.5	4.4	4.49			
			5.5	5.4	5.49			
			V _{IN} = V _{IL} or V _{IH} , I _{OH} = -12mA ¹	3.0	2.46			V
			V _{IN} = V _{IL} or V _{IH} , I _{OH} = -24mA ¹	4.5	3.76			
			V _{IN} = V _{IL} or V _{IH} , I _{OH} = -24mA ¹	5.5	4.76			
V _{OL}	LOW level output voltage	I _{OUT} = 50 μA	3.0		0.01	0.1	V	
			4.5		0.01	0.1		
			5.5		0.01	0.1		
			V _{IN} = V _{IL} or V _{IH} , I _{OL} = 12mA ¹	3.0			0.44	V
			V _{IN} = V _{IL} or V _{IH} , I _{OL} = 24mA ¹	4.5			0.44	
			V _{IN} = V _{IL} or V _{IH} , I _{OL} = 24mA ¹	5.5			0.44	
I _{IN}	Input leakage current	V _{IN} = V _{CC} , GND	5.5			± 1.0	μA	
I _{OZ}	3-State output OFF-state current	V _{IN} (OE) = V _{IL} , V _{IH} V _{IN} = V _{CC} , GND V _{OUT} = V _{CC} , GND	5.5			± 2.5	μA	
I _{OLD} ²	Dynamic output current ²	V _{OLD} = 1.65V max	5.5	75			mA	
I _{OHD} ²	Dynamic output current ²	V _{OHD} = 3.85V min	5.5			-75	mA	
I _{CC}	Quiescent supply current	V _{IN} = V _{CC} or GND	5.5			80	μA	

NOTES:

- All outputs loaded
- Maximum test duration 2.0 ms; one output loaded at a time

16-bit bus transceiver (3-State)

74AC16245
74ACT16245**DC ELECTRICAL CHARACTERISTICS FOR 74ACT16245**

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

SYMBOL	PARAMETER	TEST CONDITIONS	V _{CC} (V)	LIMITS			UNIT
				Temp = -40°C to +85°C			
				MIN	TYP ¹	MAX	
V _{IH}	HIGH level Input voltage	V _{OUT} = 0.1V or (V _{CC} - 0.1V)	4.5	2.0	1.5		V
			5.5	2.0	1.5		
V _{IL}	LOW level Input voltage	V _{OUT} = 0.1V or (V _{CC} - 0.1V)	4.5		1.5	0.8	V
			5.5		1.5	0.8	
V _{OH}	HIGH level output voltage	I _{OUT} = -50 μA	4.5	4.4	4.49		V
			5.5	5.4	5.49		
		V _{IN} = V _{IL} or V _{IH} , I _{OH} = -24mA ¹	4.5	3.76	3.86		V
		V _{IN} = V _{IL} or V _{IH} , I _{OH} = -24mA ¹	5.5	4.76	4.86		
V _{OL}	LOW level output voltage	I _{OUT} = 50 μA	4.5		0.01	0.1	V
			5.5		0.01	0.1	
		V _{IN} = V _{IL} or V _{IH} , I _{OL} = 24mA ¹	4.5			0.44	V
		V _{IN} = V _{IL} or V _{IH} , I _{OL} = 24mA ¹	5.5			0.44	
I _{IN}	Input leakage current	V _{IN} = V _{CC} , GND	5.5			±1.0	μA
I _{OZ}	3-State output OFF-state current	V _{IN} (OE) = V _{IL} , V _{IH} V _{IN} = V _{CC} , GND V _{OUT} = V _{CC} , GND	5.5			±2.5	μA
ΔI _{CC}	Additional quiescent supply current per input pin	V _{IN} = V _{CC} - 2.1V Other inputs at V _{CC} or GND; I _{OUT} = 0	5.5			1.0	mA
I _{OLD} ²	Dynamic output current	V _{OLD} = 1.65V max	5.5	75			mA
I _{OHD} ²	Dynamic output current	V _{OHD} = 3.85V min	5.5			-75	mA
I _{CC}	Quiescent supply current	V _{IN} = V _{CC} or GND	5.5			80	μA

NOTES:

1. All outputs loaded
2. Maximum test duration 2.0ms, one output loaded at a time

16-bit bus transceiver (3-State)

74AC16245
74ACT16245**AC CHARACTERISTICS FOR 74AC16245**GND = 0V; $t_r = t_f = 2.5\text{ns}$; $C_L = 50\text{pF}$; $R_L = 500\Omega$; .

SYMBOL	PARAMETER	V_{CC}^1 (V)	LIMITS					UNIT	WAVEFORM
			$T_{amb} = +25^\circ\text{C}$			$T_{amb} = -40^\circ\text{C to } +85^\circ\text{C}$			
			MIN	TYP	MAX	MIN	MAX		
t_{PLH}	Propagation delay nAx to nBx; nBx to nAx	3.3	2.0	3.8	8	1.5	9	ns	1, 3
		5.0	1.5	2.6	6	1.0	7		
t_{PHL}	Propagation delay nAx to nBx; nBx to nAx	3.3	2.0	3.4	8	1.5	9	ns	1, 3
		5.0	1.5	2.4	6	1.0	7		
t_{PZH}	3-State output enable time \overline{OE} to nAx; \overline{OE} to nBx	3.3	2.0	5.1	10.5	1.5	12	ns	2, 3
		5.0	1.5	3.5	7	1.0	8		
t_{PZL}	3-State output enable time \overline{OE} to nAx; \overline{OE} to nBx	3.3	2.0	4.9	10.5	1.5	12	ns	2, 3
		5.0	1.5	3.3	7	1.0	8		
t_{PHZ}	3-State output disable time \overline{OE} to nAx; \overline{OE} to nBx	3.3	2.0	4.1	9.5	1.5	11	ns	2, 3
		5.0	1.5	2.9	6.5	1.0	7.5		
t_{PLZ}	3-State output disable time \overline{OE} to nAx; \overline{OE} to nBx	3.3	2.0	4.7	9.5	1.5	11	ns	2, 3
		5.0	1.5	3.4	6.5	1.0	7.5		

NOTE:

1. Voltage range 3.3V is $V_{CC} = 3.3\text{V} \pm 0.3\text{V}$
Voltage range 5.0V is $V_{CC} = 5.0\text{V} \pm 0.5\text{V}$

AC CHARACTERISTICS FOR 74ACT16245GND = 0V; $t_r = t_f = 2.5\text{ns}$; $C_L = 50\text{pF}$; $R_L = 500\Omega$; .

SYMBOL	PARAMETER	V_{CC}^1 (V)	LIMITS					UNIT	WAVEFORM
			$T_{amb} = +25^\circ\text{C}$			$T_{amb} = -40^\circ\text{C to } +85^\circ\text{C}$			
			MIN	TYP	MAX	MIN	MAX		
t_{PLH}	Propagation delay A_n to B_n ; B_n to A_n	5.0	1.5	3.9	8	1.0	9	ns	1, 3
t_{PHL}	Propagation delay A_n to B_n ; B_n to A_n	5.0	1.5	3.5	8	1.0	9	ns	1, 3
t_{PZH}	3-State output enable time \overline{OE} to A_n ; \overline{OE} to B_n	5.0	1.5	4.6	9	1.0	10	ns	2, 3
t_{PZL}	3-State output enable time \overline{OE} to A_n ; \overline{OE} to B_n	5.0	1.5	4.6	9	1.0	10	ns	2, 3
t_{PHZ}	3-State output disable time \overline{OE} to A_n ; \overline{OE} to B_n	5.0	1.5	4.5	8.5	1.0	9.5	ns	2, 3
t_{PLZ}	3-State output disable time \overline{OE} to A_n ; \overline{OE} to B_n	5.0	1.5	4.8	8.5	1.0	9.5	ns	2, 3

NOTE:

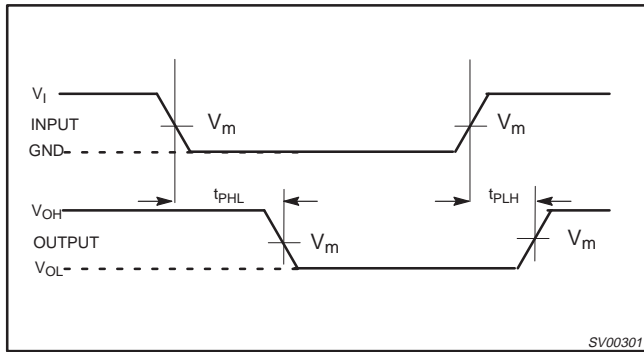
1. These values are at $V_{CC} = 5.0\text{V} \pm 0.5\text{V}$

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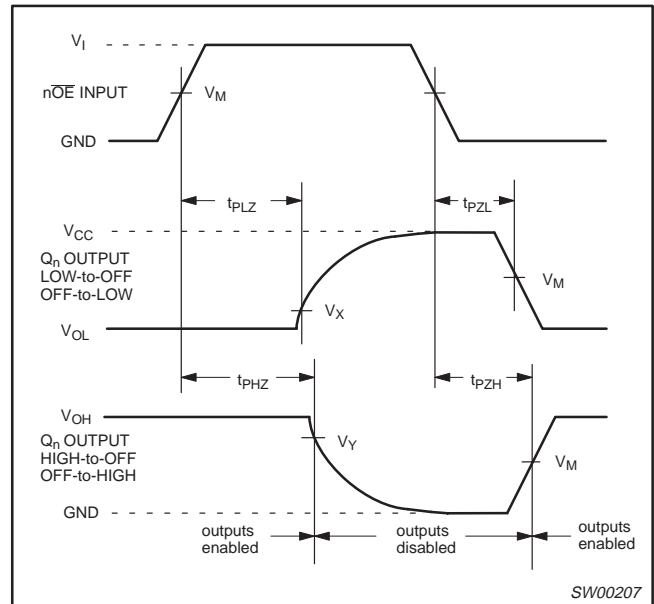
AC WAVEFORMS

$V_m = 50\% V_{CC}$ for 'AC' devices; 1.5V for 'ACT' devices
 $V_m = 50\% V_{CC}$ for 'AC'/'ACT' devices



Waveform 1. Input to output propagation delay

V_{OL} and V_{OH} are the typical output voltage drops that occur with the output load.
 $V_X = V_{OL} + 0.3V$
 $V_Y = V_{OH} - 0.3V$



Waveform 2. 3-State output enable and disable times

TEST CIRCUIT

Test Circuit for 3-State Outputs

SWITCH POSITION		FAMILY	V_{IN} Input Requirements	V_m Input	V_m Output
TEST	SWITCH				
t_{PLH}/t_{PHL}	Open	AC	GND to V_{CC}	50% V_{CC}	50% V_{CC}
t_{PLZ}/t_{PZL}	$2 \times V_{CC}$				
t_{PHZ}/t_{PZH}	GND	ACT	GND to 3.0V	1.5V	50% V_{CC}

DEFINITIONS

R_L = Load resistor; see AC CHARACTERISTICS for value.
 C_L = Load capacitance, see AC characteristics
 R_T = Termination resistance should be equal to Z_{OUT} of pulse generators.

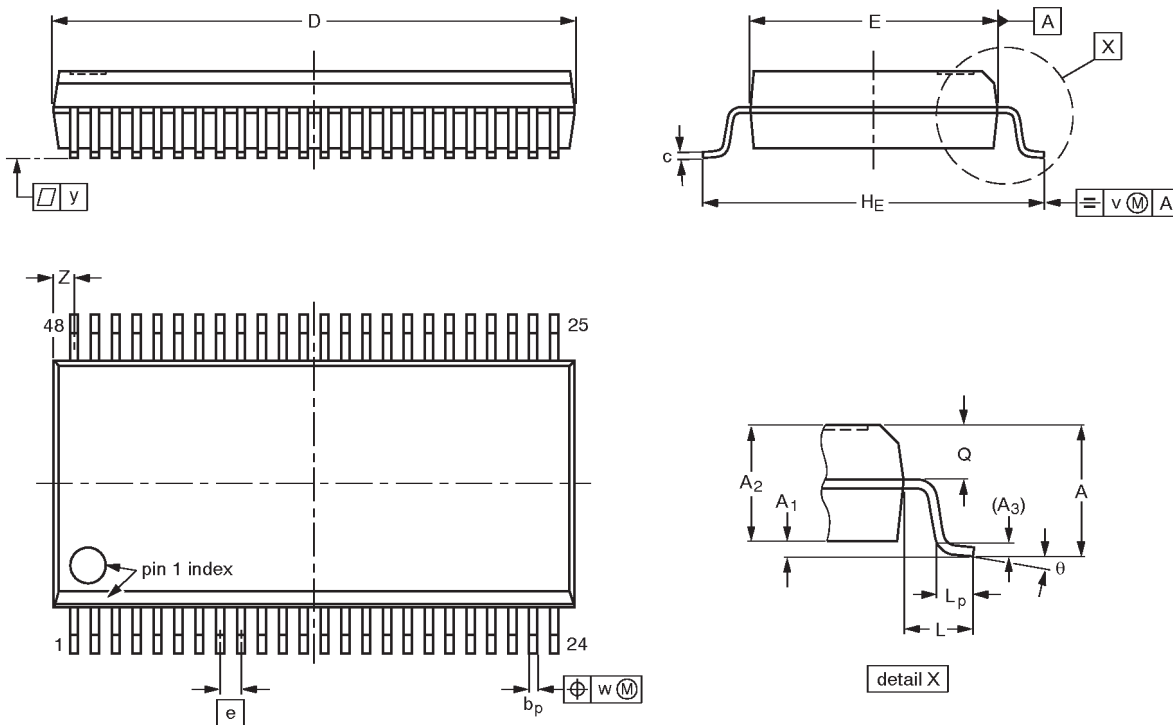
Waveform 3. Load circuitry for switching times.

16-bit bus transceiver (3-State)

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SSOP48: plastic shrink small outline package; 48 leads; body width 7.5 mm

SOT370-1



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	2.8	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.

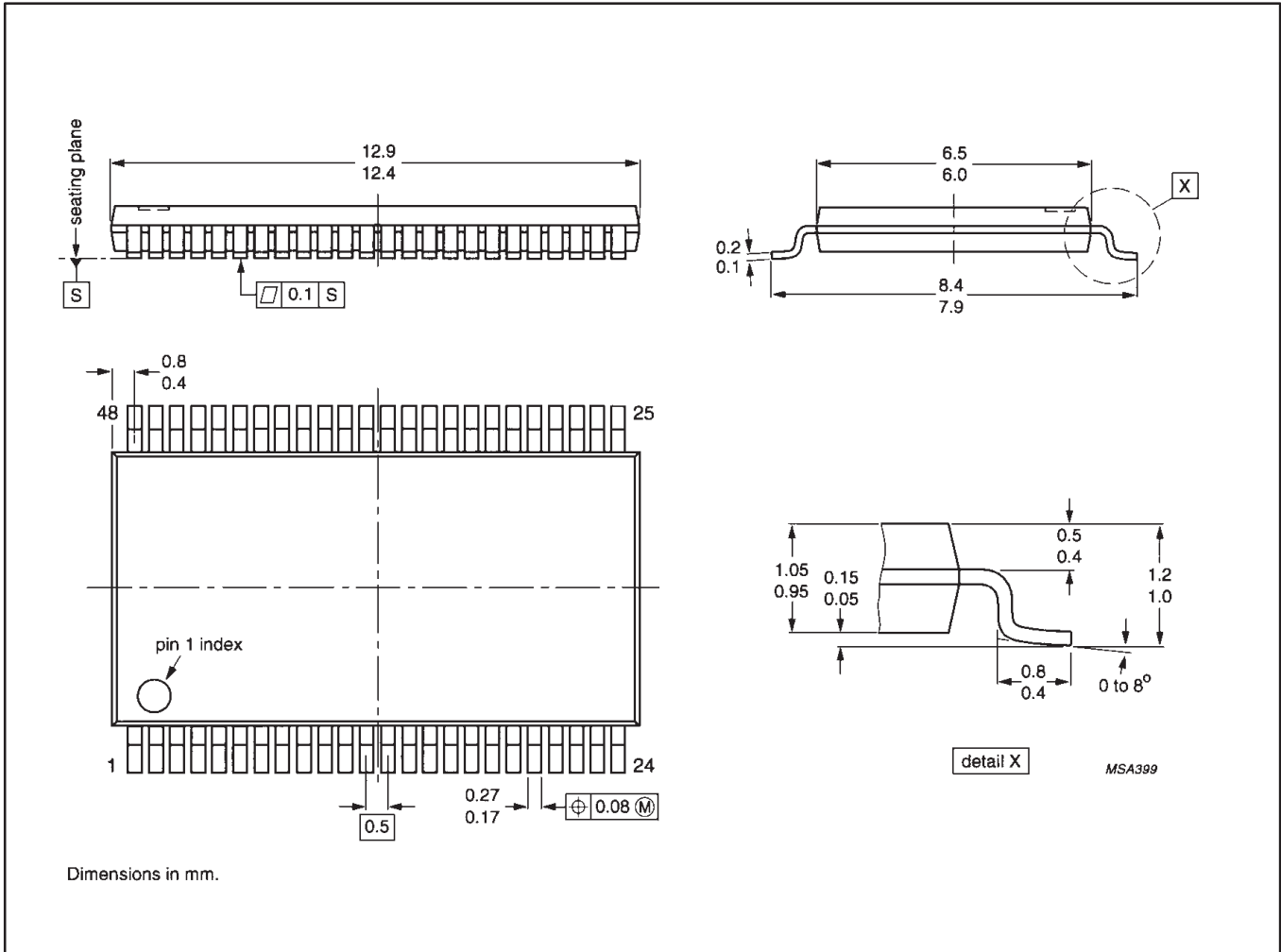
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT370-1		MO-118AA				93-11-02- 95-02-04

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

SOT362-1



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74ACT16245

NOTES

16-bit bus transceiver (3-State)

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DEFINITIONS

Data Sheet Identification	Product Status	Definition
<i>Objective Specification</i>	Formative or in Design	This data sheet contains the design target or goal specifications for product development. Specifications may change in any manner without notice.
<i>Preliminary Specification</i>	Preproduction Product	This data sheet contains preliminary data, and supplementary data will be published at a later date. Philips Semiconductors reserves the right to make changes at any time without notice in order to improve design and supply the best possible product.
<i>Product Specification</i>	Full 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.

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811 East Arques Avenue
P.O. Box 3409
Sunnyvale, California 94088-3409
Telephone 800-234-7381

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