

DATA SHEET

74AC245/74ACT245

Octal transceiver with direction pin
(3-State)

Product specification

1997 Apr 07

Octal transceiver with direction pin (3-State)

74AC245
74ACT245

FEATURES

- 74ACT245 has TTL-compatible inputs
- 74AC245 has CMOS-compatible inputs
- 3-State outputs source/sink 24mA
- Non-inverting buffers, bidirectional data path
- Meets or exceeds JEDEC standard for 74AC(T)XX family
- Superior ground bounce noise immunity

DESCRIPTION

The 74AC245/74ACT245 is an octal transceiver featuring non-inverting 3-State bus compatible outputs in both send and receive directions. The '245' features an output enable (\overline{OE}) input for easy cascading and a send/receive (DIR) input for direction control. \overline{OE} controls the outputs so that the buses are effectively isolated.

The '245' is functionally identical to the '640', but the '640' has true (non-inverting) outputs.

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	$C_L = 50\text{pF}$	4.4	3.3	4.3	ns
C_I	Input capacitance		4.5			pF
C_{PD}	Power dissipation capacitance per transceiver	$V_I = \text{GND to } V_{CC}^1$ outputs enabled outputs disabled	31	30		pF
			5.5	4		

NOTES:

1. C_{PD} is used to determine the dynamic power dissipation (P_D in μW)

$P_D = C_{PD} \times V_{CC}^2 \times f_i + \sum (C_L \times V_{CC}^2 \times f_o)$ 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.

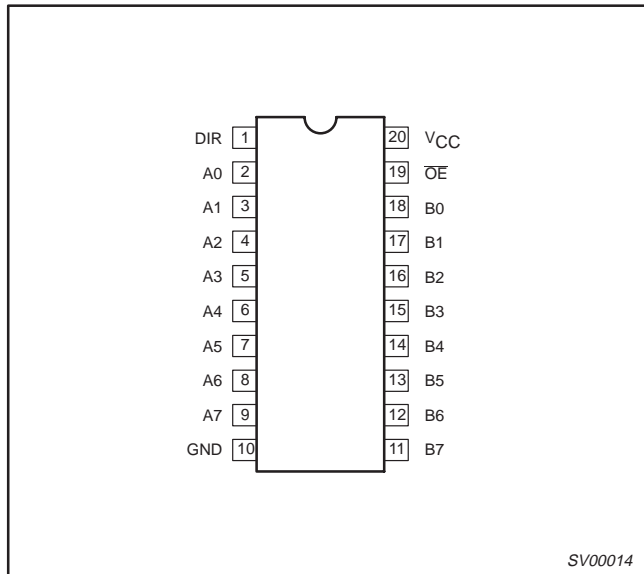
ORDERING INFORMATION

PACKAGES	TEMPERATURE RANGE	OUTSIDE NORTH AMERICA	NORTH AMERICA	DWG NUMBER
20-Pin Plastic SO	-40°C to $+85^{\circ}\text{C}$	74AC245 D 74ACT245 D	74AC245 D 74ACT245 D	SOT163-1
20-Pin Plastic SSOP Type II	-40°C to $+85^{\circ}\text{C}$	74AC245 DB 74ACT245 DB	74AC245 DB 74ACT245 DB	SOT339-1
20-Pin Plastic TSSOP Type I	-40°C to $+85^{\circ}\text{C}$	74AC245 PW 74ACT245 PW	74AC245PW DH 74ACT245PW DH	SOT360-1

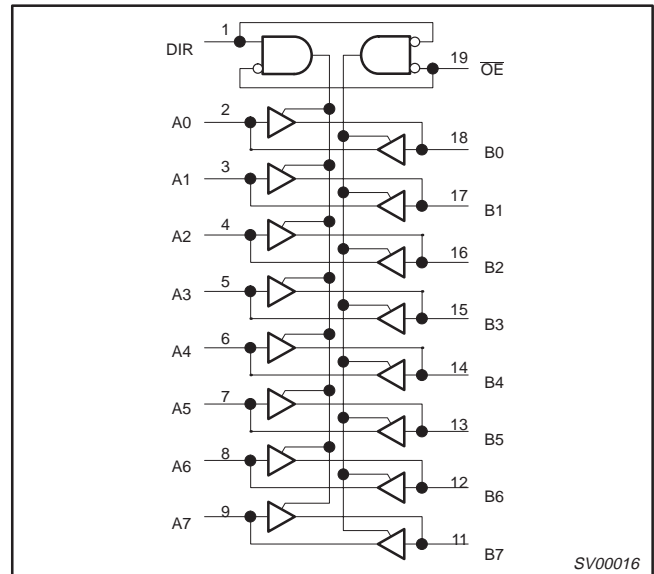
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PIN CONFIGURATION



LOGIC SYMBOL



PIN DESCRIPTION

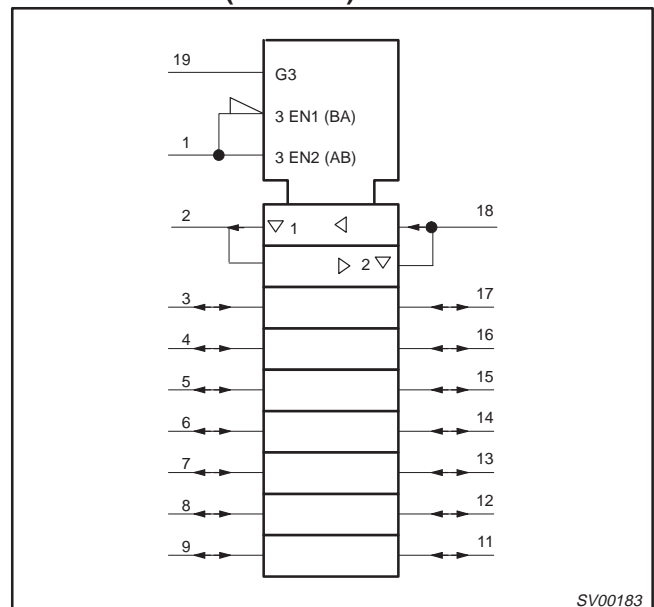
PIN NUMBER	SYMBOL	NAME AND FUNCTION
1	DIR	Direction control input
2, 3, 4, 5, 6, 7, 8, 9	A0 – A7	Data inputs/outputs (A side)
18, 17, 16, 15, 14, 13, 12, 11	B0 – B7	Data inputs/outputs (B side)
19	OE	Output enable input (active-Low)
10	GND	Ground (0V)
20	V _{CC}	Positive supply voltage

FUNCTION TABLE

INPUTS		INPUTS/OUTPUTS	
OE _n	DIR	A _n	B _n
L	L	A _n = B _n	Inputs
L	H	Inputs	B _n = A _n
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)



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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_I	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	$V_I = -0.5V$	-20	mA
		$V_I = V_{CC} + 0.5V$	+20	
V_I	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.

Octal transceiver with direction pin (3-State)

74AC245
74ACT245**DC ELECTRICAL CHARACTERISTICS (74AC245)**

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	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			40	μA

NOTES:

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

Octal transceiver with direction pin (3-State)

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74ACT245**DC ELECTRICAL CHARACTERISTICS (74ACT245)**

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			V
		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	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			1.5	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			40	μA

NOTES:

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

Octal transceiver with direction pin (3-State)

74AC245
74ACT245**AC CHARACTERISTICS FOR 74AC245**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
			$T_{\text{amb}} = +25^\circ\text{C}$			$T_{\text{amb}} = -40^\circ\text{C to } +85^\circ\text{C}$			
			MIN	TYP	MAX	MIN	MAX		
t_{PLH}	Propagation delay A_n to B_n ; B_n to A_n	3.3	2.0	4.3	8.0	1.5	9.0	ns	1
		5.0	1.5	3.2	6.0	1.0	7.0		
t_{PHL}	Propagation delay A_n to B_n ; B_n to A_n	3.3	2.0	4.4	8.0	1.5	9.0	ns	1
		5.0	1.5	3.4	6.0	1.0	7.0		
t_{PZH}	3-State output enable time $\overline{\text{OE}}$ to A_n ; $\overline{\text{OE}}$ to B_n ;	3.3	2.0	6.1	11.0	1.5	12.5	ns	2
		5.0	1.5	4.2	8.0	1.0	9.0		
t_{PZL}	3-State output enable time $\overline{\text{OE}}$ to A_n ; $\overline{\text{OE}}$ to B_n ;	3.3	2.0	6.7	11.0	1.5	12.5	ns	2
		5.0	1.5	4.6	8.0	1.0	9.0		
t_{PHZ}	3-State output disable time $\overline{\text{OE}}$ to A_n ; $\overline{\text{OE}}$ to B_n ;	3.3	2.0	5.7	10.0	1.5	11.5	ns	2
		5.0	1.5	4.0	7.5	1.0	8.5		
t_{PLZ}	3-State output disable time $\overline{\text{OE}}$ to A_n ; $\overline{\text{OE}}$ to B_n ;	3.3	2.0	5.1	10.0	1.5	11.5	ns	2
		5.0	1.5	3.7	7.5	1.0	8.5		

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 74ACT245GND = 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
			$T_{\text{amb}} = +25^\circ\text{C}$			$T_{\text{amb}} = -40^\circ\text{C to } +85^\circ\text{C}$			
			MIN	TYP	MAX	MIN	MAX		
t_{PLH}	Propagation delay A_n to B_n ; B_n to A_n	5.0	2.0	4.3	7.0	1.5	8.0	ns	1
t_{PHL}	Propagation delay A_n to B_n ; B_n to A_n	5.0	2.0	4.3	7.0	1.5	8.0	ns	1
t_{PZH}	3-State output enable time $\overline{\text{OE}}$ to A_n ; $\overline{\text{OE}}$ to B_n ;	5.0	2.0	6.7	9.5	1.5	11.0	ns	2
t_{PZL}	3-State output enable time $\overline{\text{OE}}$ to A_n ; $\overline{\text{OE}}$ to B_n ;	5.0	2.0	7.0	10.5	1.5	12.0	ns	2
t_{PHZ}	3-State output disable time $\overline{\text{OE}}$ to A_n ; $\overline{\text{OE}}$ to B_n ;	5.0	2.0	4.9	9.0	1.5	10.0	ns	2
t_{PLZ}	3-State output disable time $\overline{\text{OE}}$ to A_n ; $\overline{\text{OE}}$ to B_n ;	5.0	2.0	4.5	9.0	1.5	10.0	ns	2

NOTE:

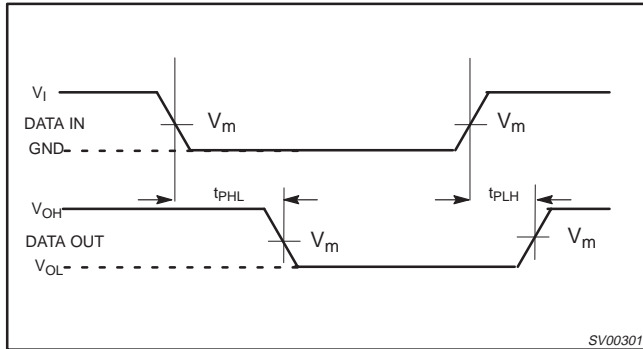
1. These values are at $V_{CC} = 5.0\text{V} \pm 0.5\text{V}$

Octal transceiver with direction pin (3-State)

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AC WAVEFORMS

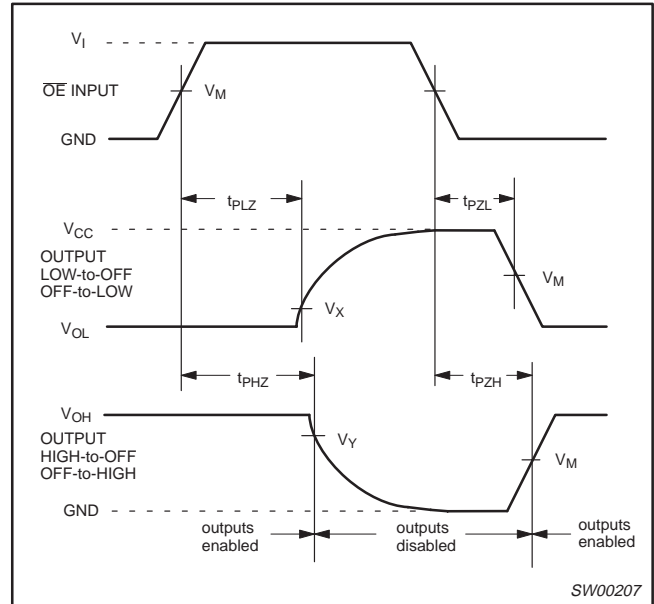
V_{OL} and V_{OH} are the typical output voltage drops that occur with the output load.



Waveform 1. Waveforms Showing the Input (An or Bn) to Output (Bn or An) Propagation Delays

$$V_X = V_{OL} + 0.3V$$

$$V_Y = V_{OH} - 0.3V$$



Waveform 2. Waveforms Showing the 3-State Output Enable and Disable Times

TEST CIRCUIT AND WAVEFORMS

Test Circuit for 3-State Outputs

SWITCH POSITION		FAMILY	V_I 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}	Open				
		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.

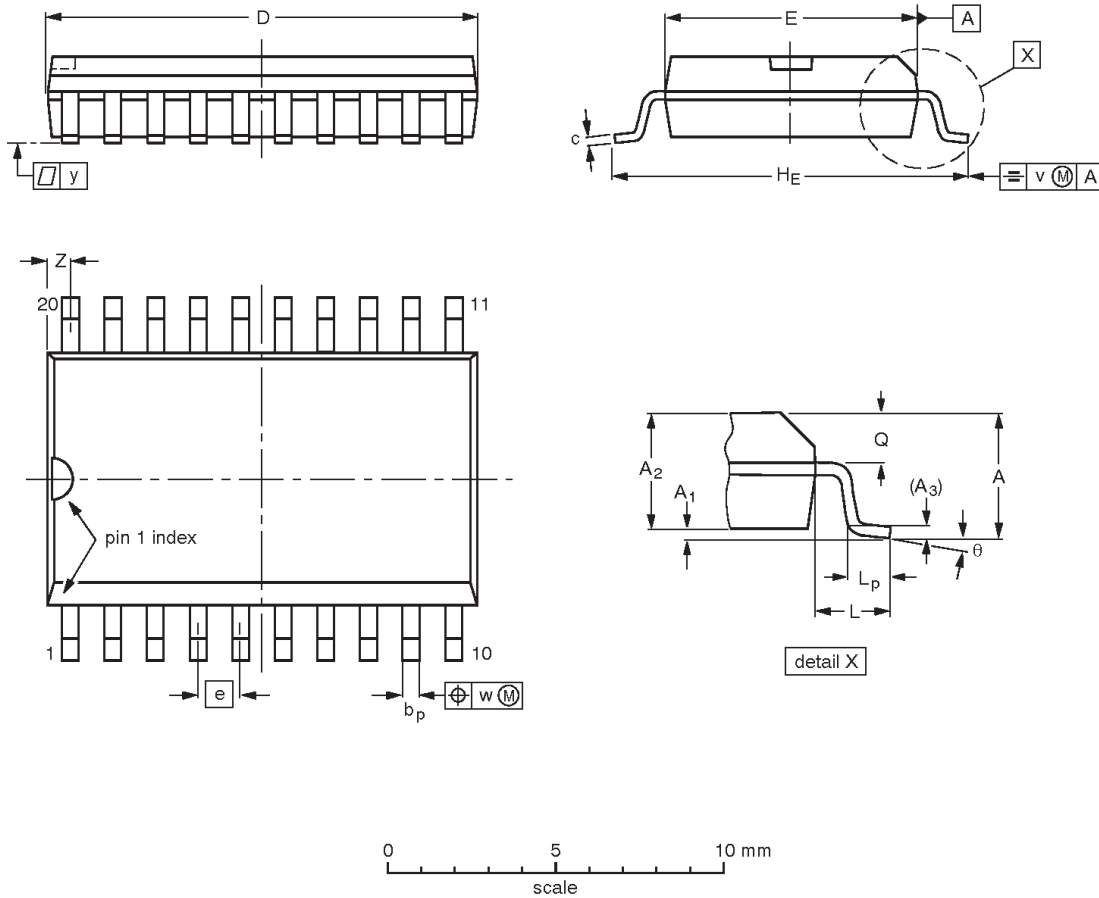
Waveform 3. Load circuitry for switching times.

Octal transceiver with direction pin (3-State)

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SO20: plastic small outline package; 20 leads; body width 7.5 mm

SOT163-1



DIMENSIONS (inch dimensions are derived from the original mm 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	2.65	0.30 0.10	2.45 2.25	0.25	0.49 0.36	0.32 0.23	13.0 12.6	7.6 7.4	1.27	10.65 10.00	1.4	1.1 0.4	1.1 1.0	0.25	0.25	0.1	0.9 0.4	8° 0°
inches	0.10	0.012 0.004	0.096 0.089	0.01	0.019 0.014	0.013 0.009	0.51 0.49	0.30 0.29	0.050	0.42 0.39	0.055	0.043 0.016	0.043 0.039	0.01	0.01	0.004	0.035 0.016	

Note

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.

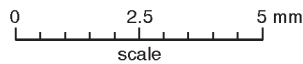
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT163-1	075E04	MS-013AC				92-11-17 95-01-24

Octal transceiver with direction pin (3-State)

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SSOP20: plastic shrink small outline package; 20 leads; body width 5.3 mm

SOT339-1



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	2.0	0.21 0.05	1.80 1.65	0.25	0.38 0.25	0.20 0.09	7.4 7.0	5.4 5.2	0.65	7.9 7.6	1.25	1.03 0.63	0.9 0.7	0.2	0.13	0.1	0.9 0.5	8° 0°

Note

1. Plastic or metal protrusions of 0.20 mm maximum per side are not included.

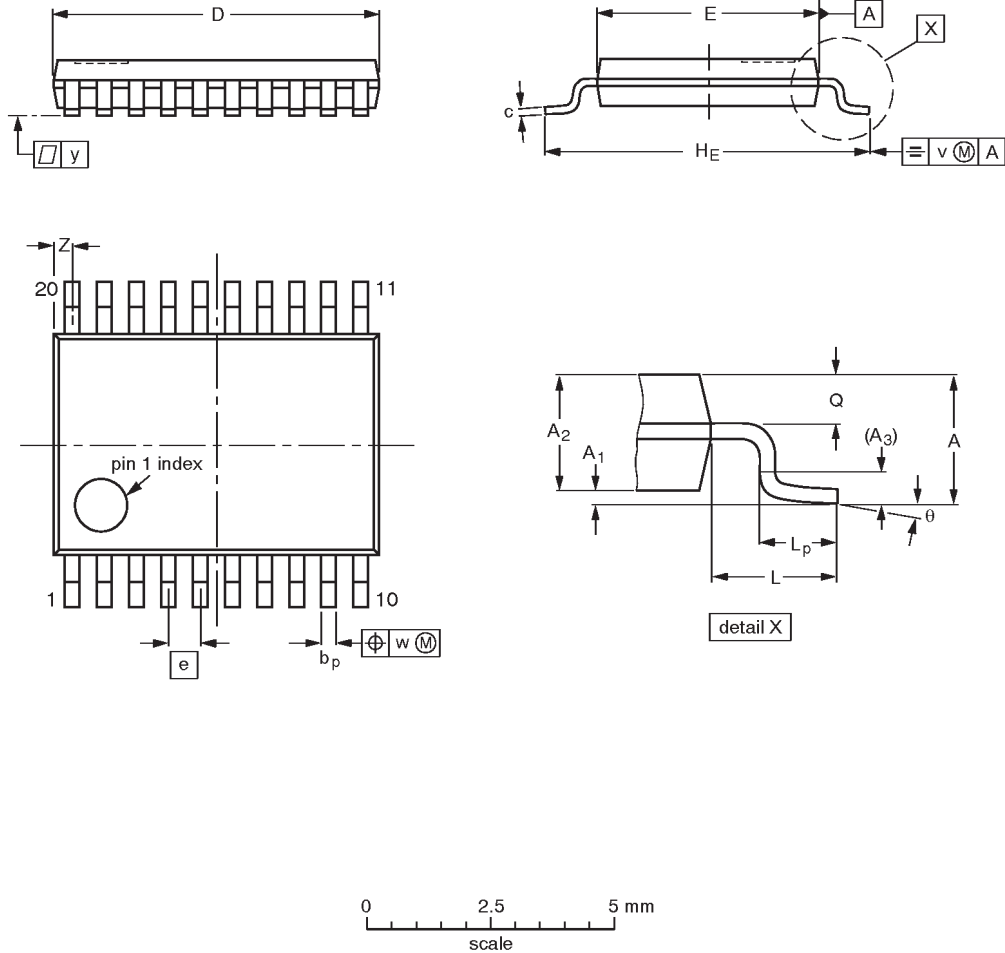
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT339-1		MO-150AE				93-09-08 95-02-04

Octal transceiver with direction pin (3-State)

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TSSOP20: plastic thin shrink small outline package; 20 leads; body width 4.4 mm

SOT360-1



DIMENSIONS (mm are the original dimensions)

UNIT	A max.	A ₁	A ₂	A ₃	b _p	c	D ⁽¹⁾	E ⁽²⁾	e	H _E	L	L _p	Q	v	w	y	Z ⁽¹⁾	θ
mm	1.10	0.15 0.05	0.95 0.80	0.25	0.30 0.19	0.2 0.1	6.6 6.4	4.5 4.3	0.65	6.6 6.2	1.0	0.75 0.50	0.4 0.3	0.2	0.13	0.1	0.5 0.2	8° 0°

Notes

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.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT360-1		MO-153AC				-93-06-16- 95-02-04

Octal transceiver with direction pin (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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