

# DATA SHEET

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**74LV541**

Octal buffer/line driver (3-State)

Product specification  
Supersedes data of 1997 Mar 04  
IC24 Data Handbook

1997 Jun 10

## Octal buffer/line driver (3-State)

## 74LV541

## FEATURES

- Optimized for Low Voltage applications: 1.0 to 3.6V
- Accepts TTL input levels between  $V_{CC} = 2.7V$  and  $V_{CC} = 3.6V$
- Typical  $V_{OLP}$  (output ground bounce)  $< 0.8V$  @  $V_{CC} = 3.3V$ ,  $T_{amb} = 25^{\circ}C$
- Typical  $V_{OHV}$  (output  $V_{OH}$  undershoot)  $> 2V$  @  $V_{CC} = 3.3V$ ,  $T_{amb} = 25^{\circ}C$
- Non-inverting outputs
- Output capability: bus driver
- $I_{CC}$  category: MSI

## DESCRIPTION

The 74LV541 is a low-voltage CMOS device and is pin and function compatible with 74HC/HCT541.

The 74LV541 is an octal non-inverting buffer/line driver with 3-State outputs. The 3-State outputs are controlled by the output enable inputs  $\overline{OE}_1$  and  $\overline{OE}_2$ .

A HIGH on  $\overline{OE}_n$  causes the outputs to assume a high impedance OFF-state.

## QUICK REFERENCE DATA

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

SYMBOL	PARAMETER	CONDITIONS	TYPICAL	UNIT
$t_{PHL}/t_{PLH}$	Propagation delay $A_n$ to $Y_n$	$C_L = 15pF$ $V_{CC} = 3.3V$	10	ns
$C_I$	Input capacitance		3.5	pF
$C_{PD}$	Power dissipation capacitance per buffer	$V_I = GND$ to $V_{CC}^1$	37	pF

## NOTES:

1.  $C_{PD}$  is used to determine the dynamic power dissipation ( $P_D$  in  $\mu W$ )  
 $P_D = C_{PD} \times V_{CC}^2 \times f_i + \sum (C_L \times V_{CC}^2 \times f_o)$  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	PKG. DWG. #
20-Pin Plastic DIL	$-40^{\circ}C$ to $+125^{\circ}C$	74LV541 N	74LV541 N	SOT146-1
20-Pin Plastic SO	$-40^{\circ}C$ to $+125^{\circ}C$	74LV541 D	74L541 D	SOT163-1
20-Pin Plastic SSOP Type II	$-40^{\circ}C$ to $+125^{\circ}C$	74LV541 DB	74LV541 DB	SOT339-1
20-Pin Plastic TSSOP Type I	$-40^{\circ}C$ to $+125^{\circ}C$	74LV541 PW	74LV541PW DH	SOT360-1

## PIN DESCRIPTION

PIN NUMBER	SYMBOL	FUNCTION
1, 19	$\overline{OE}_1, \overline{OE}_2$	Output enable input (active-LOW)
2, 3, 4, 5, 6, 7, 8, 9	$A_0$ to $A_7$	Data inputs
10	GND	Ground (0V)
18, 17, 16, 15, 14, 13, 12, 11	$Y_0$ to $Y_7$	Bus outputs
20	$V_{CC}$	Positive supply voltage

## FUNCTION TABLE

INPUTS			OUTPUT
$\overline{OE}_1$	$\overline{OE}_2$	nA	nY
L	L	L	L
L	L	H	H
X	H	X	Z
H	X	X	Z

H = HIGH voltage level

L = LOW voltage level

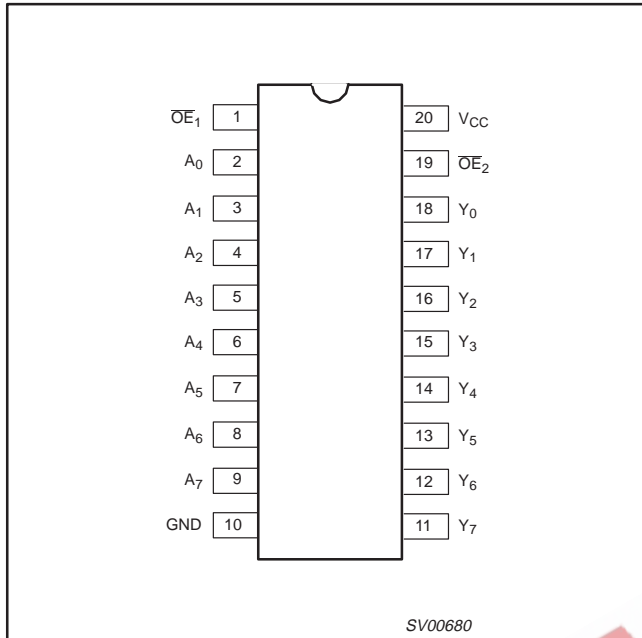
X = Don't care

Z = High impedance OFF-state

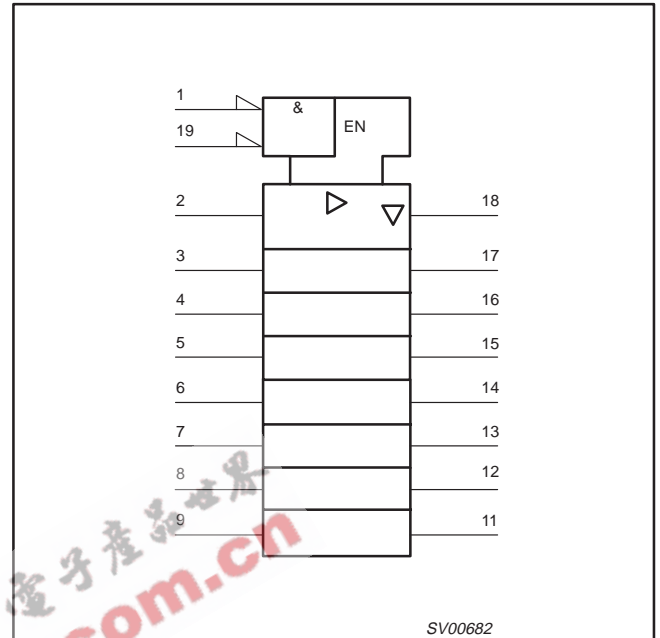
# Octal buffer/line driver (3-State)

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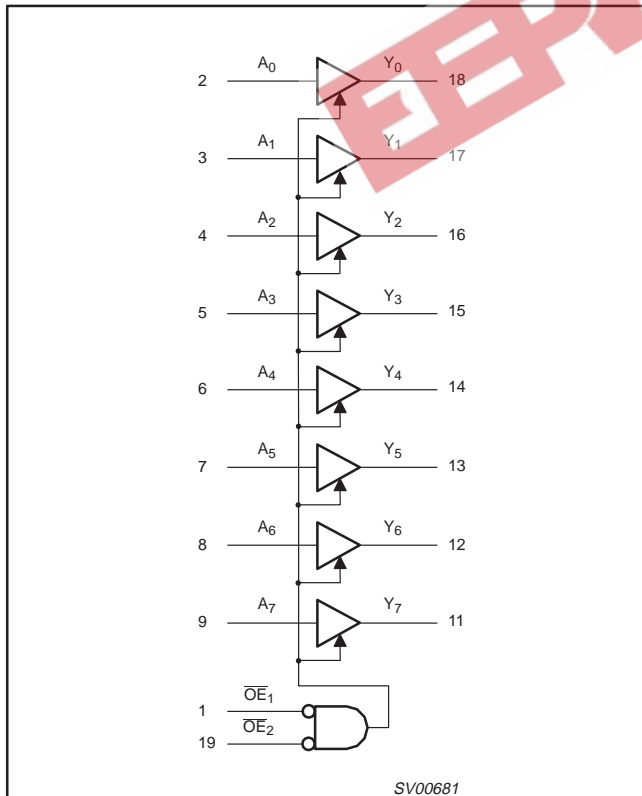
## PIN CONFIGURATION



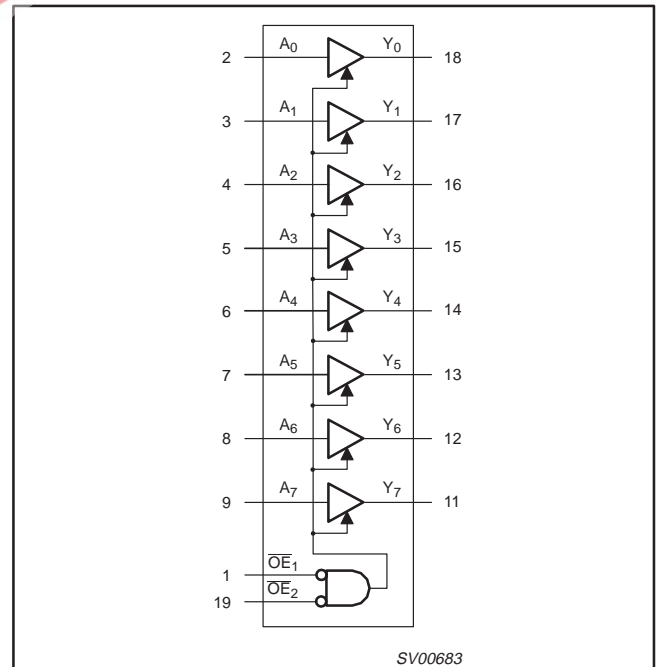
## LOGIC SYMBOL (IEEE/IEC)



## LOGIC SYMBOL



## FUNCTIONAL DIAGRAM



## Octal buffer/line driver (3-State)

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## RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
$V_{CC}$	DC supply voltage	See Note 1	1.0	3.3	3.6	V
$V_I$	Input voltage		0	–	$V_{CC}$	V
$V_O$	Output voltage		0	–	$V_{CC}$	V
$T_{amb}$	Operating ambient temperature range in free air	See DC and AC characteristics	–40 –40		+85 +125	°C
$t_r, t_f$	Input rise and fall times	$V_{CC} = 1.0V$ to $2.0V$ $V_{CC} = 2.0V$ to $2.7V$ $V_{CC} = 2.7V$ to $3.6V$	– – –	– – –	500 200 100	ns/V

## NOTE:

1. The LV is guaranteed to function down to  $V_{CC} = 1.0V$  (input levels GND or  $V_{CC}$ ); DC characteristics are guaranteed from  $V_{CC} = 1.2V$  to  $V_{CC} = 3.6V$ .

ABSOLUTE MAXIMUM RATINGS<sup>1, 2</sup>

In accordance with the Absolute Maximum Rating System (IEC 134).

Voltages are referenced to GND (ground = 0V).

SYMBOL	PARAMETER	CONDITIONS	RATING	UNIT
$V_{CC}$	DC supply voltage		–0.5 to +4.6	V
$\pm I_{IK}$	DC input diode current	$V_I < -0.5$ or $V_I > V_{CC} + 0.5V$	20	mA
$\pm I_{OK}$	DC output diode current	$V_O < -0.5$ or $V_O > V_{CC} + 0.5V$	50	mA
$\pm I_O$	DC output source or sink current – bus driver outputs	$-0.5V < V_O < V_{CC} + 0.5V$	35	mA
$\pm I_{GND},$ $\pm I_{CC}$	DC $V_{CC}$ or GND current for types with – bus driver outputs		70	mA
$T_{stg}$	Storage temperature range		–65 to +150	°C
$P_{tot}$	Power dissipation per package – plastic DIL – plastic mini-pack (SO) – plastic shrink mini-pack (SSOP and TSSOP)	for temperature range: –40 to +125°C above +70°C derate linearly with 12mW/K above +70°C derate linearly with 8 mW/K above +60°C derate linearly with 5.5 mW/K	750 500 400	mW

## 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.
- The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

## Octal buffer/line driver (3-State)

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**DC CHARACTERISTICS FOR THE LV FAMILY**

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

SYMBOL	PARAMETER	TEST CONDITIONS	LIMITS					UNIT
			-40°C to +85°C			-40°C to +125°C		
			MIN	TYP <sup>1</sup>	MAX	MIN	MAX	
V <sub>IH</sub>	HIGH level Input voltage	V <sub>CC</sub> = 1.2V	0.9			0.9		V
		V <sub>CC</sub> = 2.0V	1.4			1.4		
		V <sub>CC</sub> = 2.7 to 3.6V	2.0			2.0		
V <sub>IL</sub>	LOW level Input voltage	V <sub>CC</sub> = 1.2V			0.3		0.3	V
		V <sub>CC</sub> = 2.0V			0.6		0.6	
		V <sub>CC</sub> = 2.7 to 3.6V			0.8		0.8	
V <sub>OH</sub>	HIGH level output voltage; all outputs	V <sub>CC</sub> = 1.2V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; -I <sub>O</sub> = 100µA		1.2				V
		V <sub>CC</sub> = 2.0V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; -I <sub>O</sub> = 100µA	1.8	2.0		1.8		
		V <sub>CC</sub> = 2.7V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; -I <sub>O</sub> = 100µA	2.5	2.7		2.5		
		V <sub>CC</sub> = 3.0V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; -I <sub>O</sub> = 100µA	2.8	3.0		2.8		
	HIGH level output voltage; BUS driver outputs	V <sub>CC</sub> = 3.0V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; -I <sub>O</sub> = 8mA	2.40	2.82		2.20		
V <sub>OL</sub>	LOW level output voltage; all outputs	V <sub>CC</sub> = 1.2V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = 100µA		0				V
		V <sub>CC</sub> = 2.0V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = 100µA		0	0.2		0.2	
		V <sub>CC</sub> = 2.7V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = 100µA		0	0.2		0.2	
		V <sub>CC</sub> = 3.0V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = 100µA		0	0.2		0.2	
	LOW level output voltage; BUS driver outputs	V <sub>CC</sub> = 3.0V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = 8mA		0.20	0.40		0.50	
I <sub>I</sub>	Input leakage current	V <sub>CC</sub> = 3.6V; V <sub>I</sub> = V <sub>CC</sub> or GND			1.0		1.0	µA
I <sub>OZ</sub>	3-State output OFF-state current	V <sub>CC</sub> = 3.6V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; V <sub>O</sub> = V <sub>CC</sub> or GND			5		10	µA
I <sub>CC</sub>	Quiescent supply current; MSI	V <sub>CC</sub> = 3.6V; V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0			20.0		160	µA
ΔI <sub>CC</sub>	Additional quiescent supply current per input	V <sub>CC</sub> = 2.7V to 3.6V; V <sub>I</sub> = V <sub>CC</sub> - 0.6V			500		850	µA

**NOTE:**1. All typical values are measured at T<sub>amb</sub> = 25°C.

# Octal buffer/line driver (3-State)

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## AC CHARACTERISTICS

GND = 0V;  $t_r = t_f \leq 2.5\text{ns}$ ;  $C_L = 50\text{pF}$ ;  $R_L = 1\text{K}\Omega$

SYMBOL	PARAMETER	WAVEFORM	CONDITION	LIMITS					UNIT
				-40 to +85 °C			-40 to +125 °C		
				V <sub>CC</sub> (V)	MIN	TYP <sup>1</sup>	MAX	MIN	
t <sub>PHL</sub> /t <sub>PLH</sub>	Propagation delay A <sub>n</sub> to Y <sub>n</sub>	Figure 1	1.2	–	60	–	–	–	ns
			2.0	–	20	39	–	46	
			2.7	–	15	29	–	34	
			3.0 to 3.6	–	11 <sup>2</sup>	23	–	27	
t <sub>PZH</sub> /t <sub>PZL</sub>	3-State output enable time OE <sub>n</sub> to Y <sub>n</sub>	Figure 2	1.2	–	100	–	–	–	ns
			2.0	–	34	65	–	77	
			2.7	–	25	48	–	56	
			3.0 to 3.6	–	19 <sup>2</sup>	38	–	45	
t <sub>PHZ</sub> /t <sub>PLZ</sub>	3-State output disable time OE <sub>n</sub> to Y <sub>n</sub>	Figure 2	1.2	–	100	–	–	–	ns
			2.0	–	36	66	–	78	
			2.7	–	27	48	–	58	
			3.0 to 3.6	–	21 <sup>2</sup>	39	–	47	

**NOTES:**

1. Unless otherwise stated, all typical values are at T<sub>amb</sub> = 25°C.
2. Typical value measured at V<sub>CC</sub> = 3.3V.

## AC WAVEFORMS

V<sub>M</sub> = 1.5V at V<sub>CC</sub> ≥ 2.7V  
 V<sub>M</sub> = 0.5 \* V<sub>CC</sub> at V<sub>CC</sub> < 2.7V  
 V<sub>OL</sub> and V<sub>OH</sub> are the typical output voltage drop that occur with the output load.  
 V<sub>X</sub> = V<sub>OL</sub> + 0.3V at V<sub>CC</sub> ≥ 2.7V  
 V<sub>X</sub> = V<sub>OL</sub> + 0.1V<sub>CC</sub> at V<sub>CC</sub> < 2.7V  
 V<sub>Y</sub> = V<sub>OH</sub> - 0.3V at V<sub>CC</sub> ≥ 2.7V  
 V<sub>Y</sub> = V<sub>OH</sub> - 0.1 V<sub>CC</sub> at V<sub>CC</sub> < 2.7V

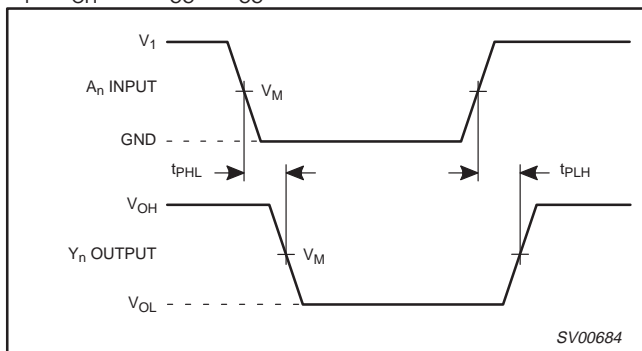


Figure 1. Input (A<sub>n</sub>) to output (Y<sub>n</sub>) propagation delays

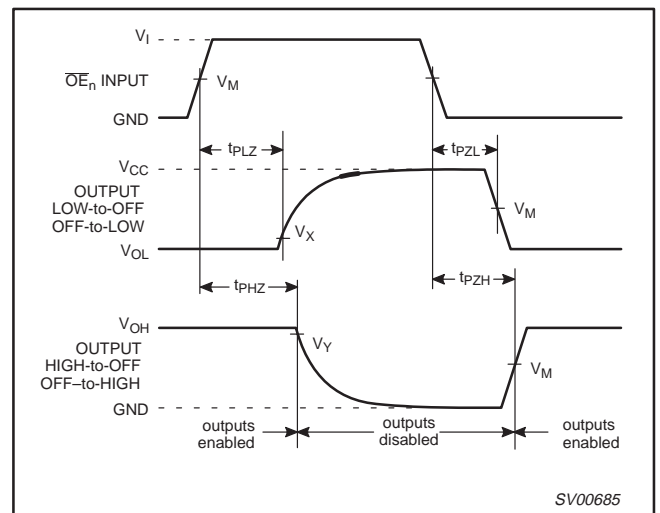


Figure 2. 3-State enable and disable times

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TEST CIRCUIT

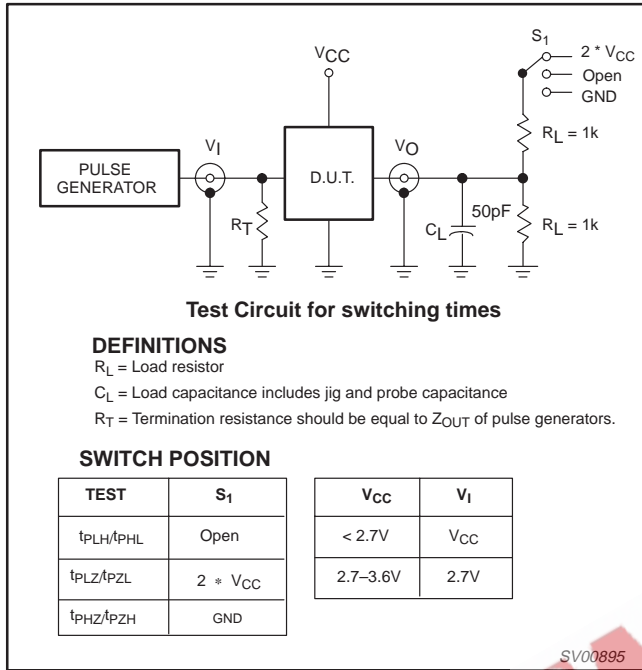
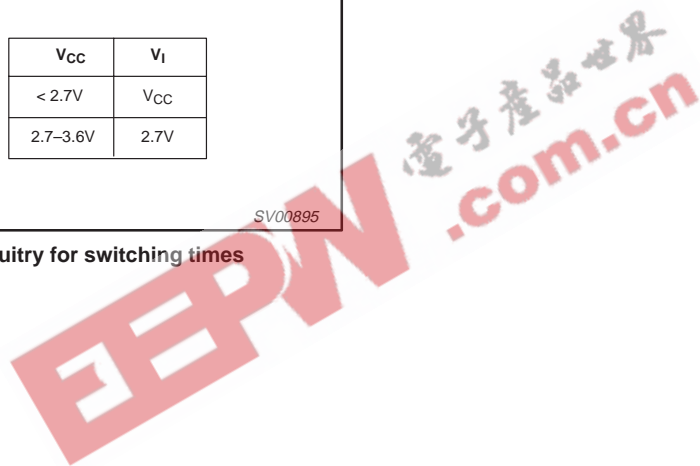


Figure 3. Load circuitry for switching times

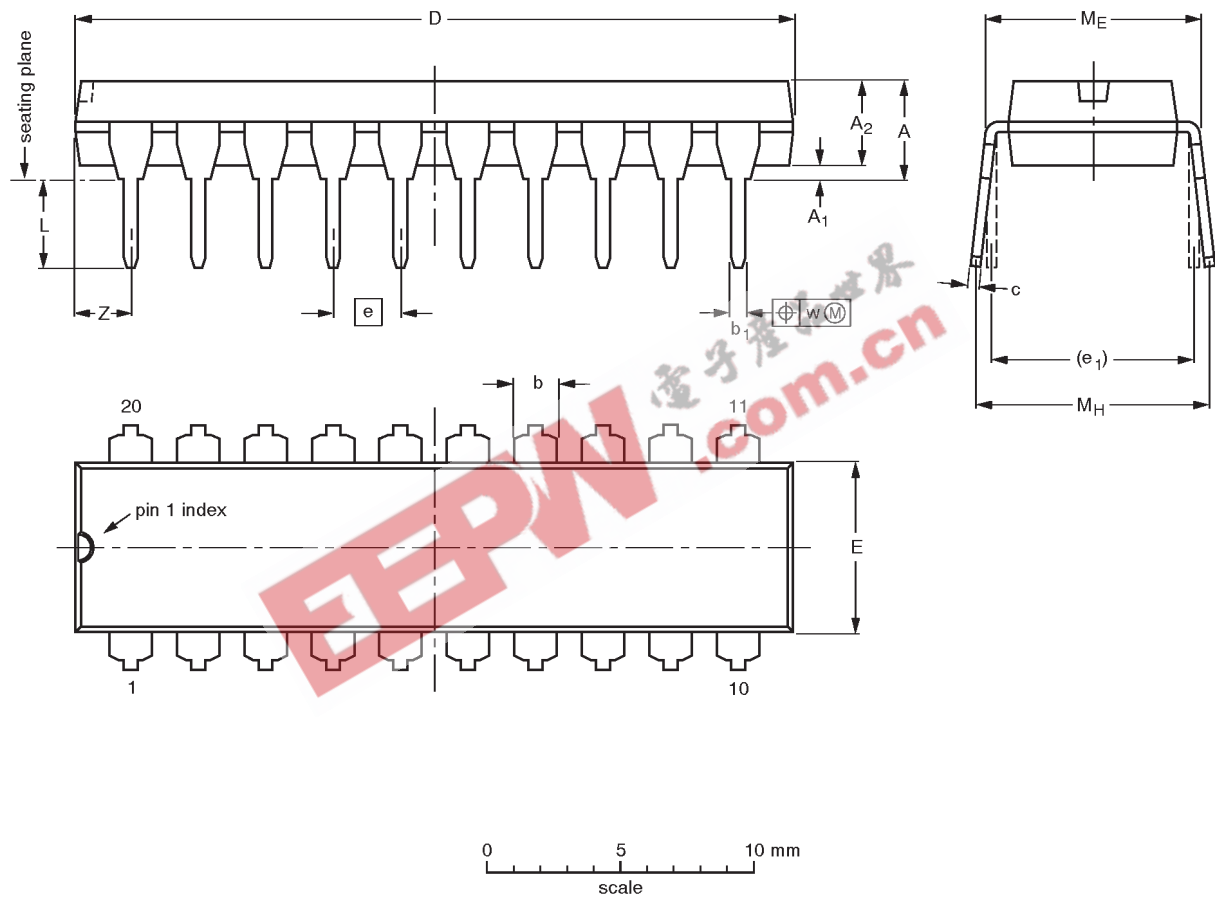


Octal buffer/line driver (3-State)

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DIP20: plastic dual in-line package; 20 leads (300 mil)

SOT146-1



DIMENSIONS (inch dimensions are derived from the original mm dimensions)

UNIT	A max.	A <sub>1</sub> min.	A <sub>2</sub> max.	b	b <sub>1</sub>	c	D <sup>(1)</sup>	E <sup>(1)</sup>	e	e <sub>1</sub>	L	M <sub>E</sub>	M <sub>H</sub>	w	Z <sup>(1)</sup> max.
mm	4.2	0.51	3.2	1.73 1.30	0.53 0.38	0.36 0.23	26.92 26.54	6.40 6.22	2.54	7.62	3.60 3.05	8.25 7.80	10.0 8.3	0.254	2.0
inches	0.17	0.020	0.13	0.068 0.051	0.021 0.015	0.014 0.009	1.060 1.045	0.25 0.24	0.10	0.30	0.14 0.12	0.32 0.31	0.39 0.33	0.01	0.078

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			
SOT146-1			SC603			92-11-17 95-05-24

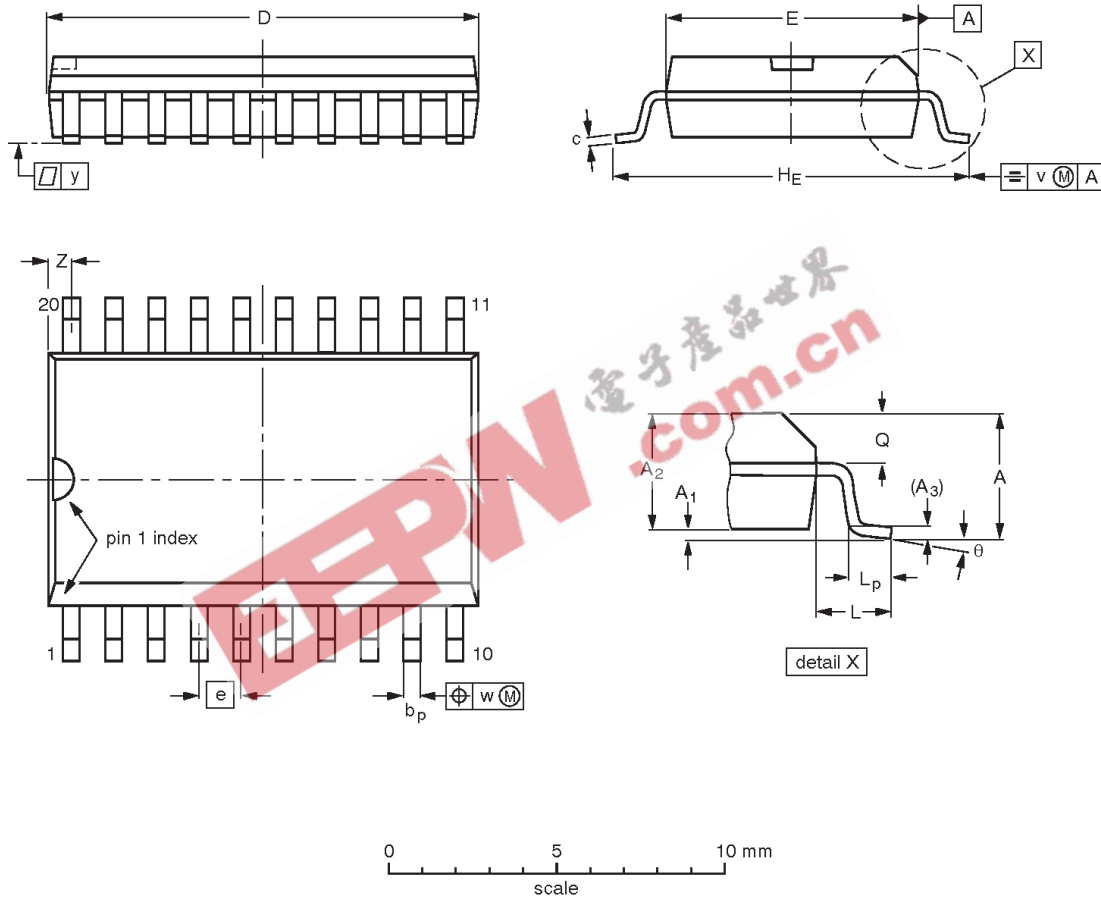


Octal buffer/line driver (3-State)

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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 <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	b <sub>p</sub>	c	D <sup>(1)</sup>	E <sup>(1)</sup>	e	H <sub>E</sub>	L	L <sub>p</sub>	Q	v	w	y	Z <sup>(1)</sup>	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.

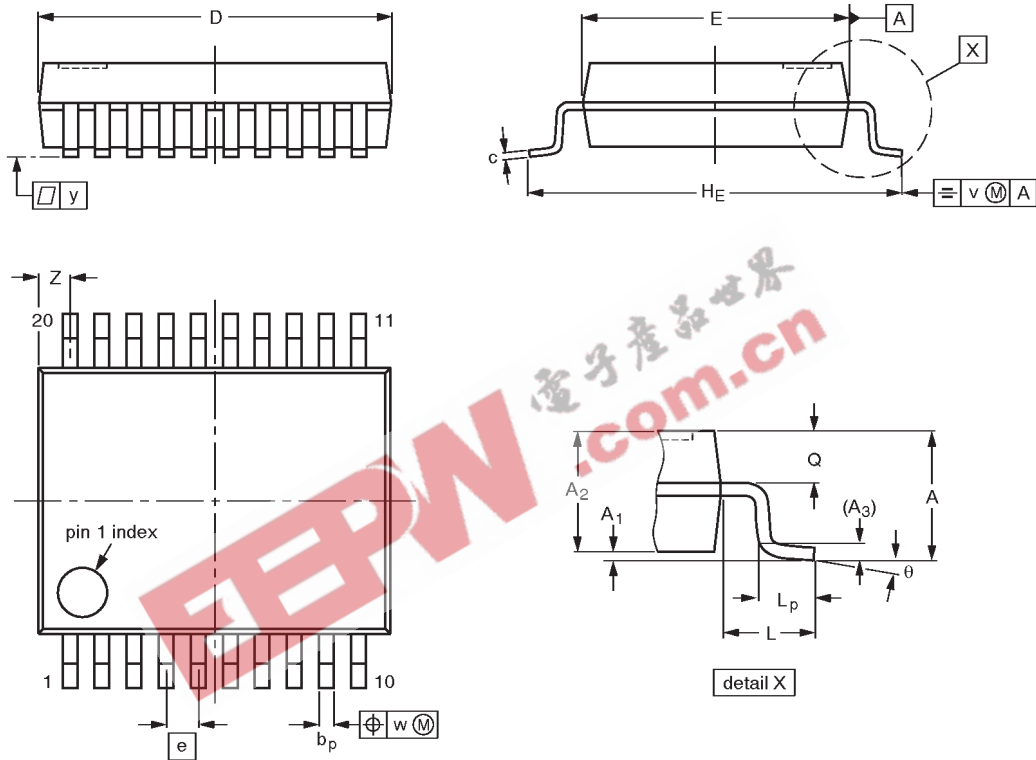
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT163-1	075E04	MS-013AC				92-11-17 95-01-24

Octal buffer/line driver (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 <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	b <sub>p</sub>	c	D <sup>(1)</sup>	E <sup>(1)</sup>	e	H <sub>E</sub>	L	L <sub>p</sub>	Q	v	w	y	z <sup>(1)</sup>	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.

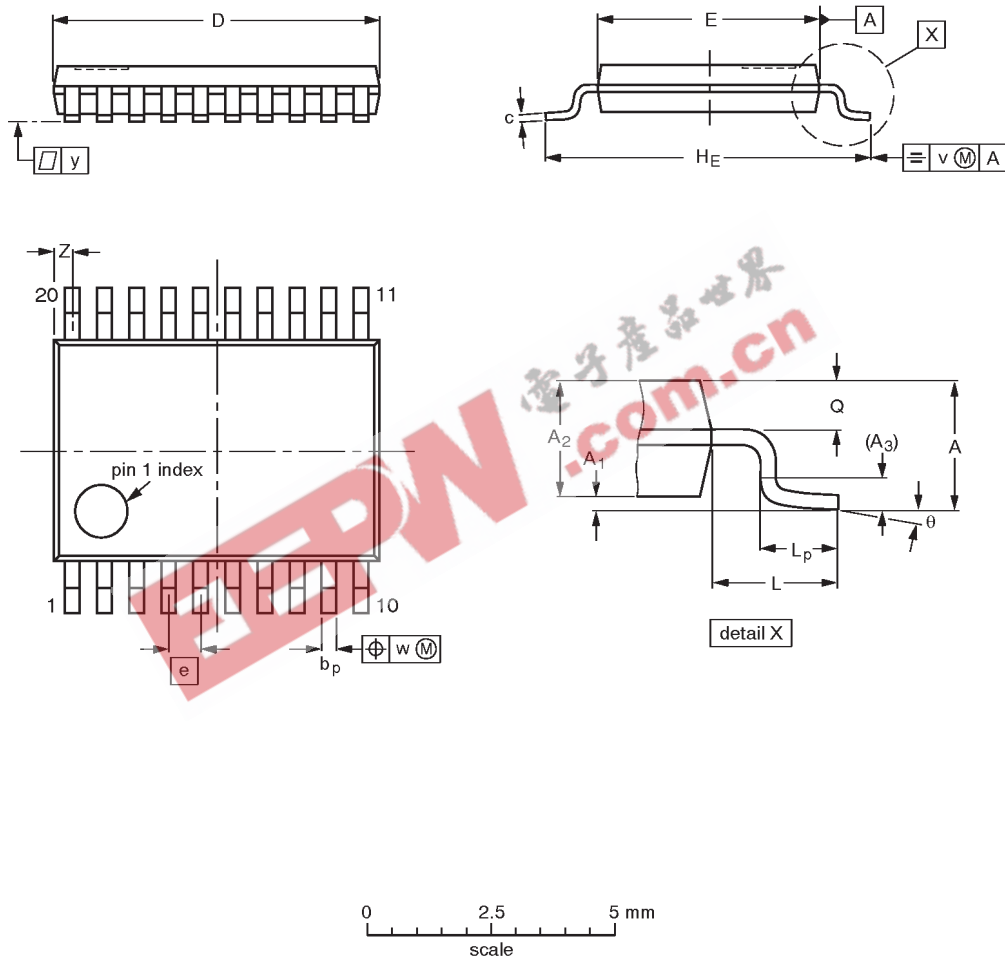
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT339-1		MO-150AE				93-09-08 95-02-04

Octal buffer/line driver (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 <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	b <sub>p</sub>	c	D <sup>(1)</sup>	E <sup>(2)</sup>	e	H <sub>E</sub>	L	L <sub>p</sub>	Q	v	w	y	Z <sup>(1)</sup>	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 buffer/line driver (3-State)

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## DEFINITIONS

Data Sheet Identification	Product Status	Definition
<i>Objective Specification</i>	<b>Formative or in Design</b>	This data sheet contains the design target or goal specifications for product development. Specifications may change in any manner without notice.
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print code

Date of release: 05-96

Document order number:

9397-750-04452

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