

DATA SHEET

74LVC541A

Octal buffer/line driver with 5-volt tolerant
inputs/outputs (3-State)

Product specification
Supersedes data of 1997 Oct 27
IC24 Data Handbook

1998 Jul 29

Octal buffer/line driver with 5-volt tolerant inputs/outputs (3-State)

74LVC541A

FEATURES

- 5-volt tolerant inputs/outputs, for interfacing with 5-volt logic
- Wide supply voltage range of 2.7V to 3.6V
- Complies with JEDEC standard no. 8-1A
- CMOS low power consumption
- Direct interface with TTL levels
- 5 Volt tolerant inputs/outputs, for interfacing with 5 Volt logic

DESCRIPTION

The 74LVC541A is a high performance, low-power, low-voltage Si-gate CMOS device and superior to most advanced CMOS compatible TTL families.

Inputs can be driven from either 3.3V or 5.0V devices. In 3-State operation, outputs can handle 5V. This feature allows the use of these devices as translators in a mixed 3.3V/5V environment.

The 74LVC541A is an octal non-inverting buffer/line driver with 5-volt tolerant inputs/outputs. The 3-State outputs are controlled by the output enable inputs $\overline{OE}1$ and $\overline{OE}2$.

QUICK REFERENCE DATA

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

SYMBOL	PARAMETER	CONDITIONS	TYPICAL	UNIT
t_{PHL}/t_{PLH}	Propagation delay An to Yn	$C_L = 50 \text{ pF}$; $V_{CC} = 3.3 \text{ V}$	3.3	ns
C_i	Input capacitance		5.0	pF
C_{PD}	Power dissipation capacitance per buffer	Notes 1 and 2	20	pF

NOTES:

1. C_{PD} is used to determine the dynamic power dissipation (P_D in μW)
 $P_D = C_{PD} \times V_{CC}^2 \times f_i + \sum (C_L \times V_{CC}^2 \times f_o)$ where:
 f_i = input frequency in MHz; C_L = output load capacitance 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.
2. The condition is $V_i = \text{GND to } V_{CC}$

ORDERING INFORMATION

PACKAGES	TEMPERATURE RANGE	OUTSIDE NORTH AMERICA	NORTH AMERICA	PKG. DWG. #
20-Pin Plastic SO	-40°C to $+85^{\circ}\text{C}$	74LVC541A D	74LVC541A D	SOT163-1
20-Pin Plastic SSOP Type II	-40°C to $+85^{\circ}\text{C}$	74LVC541A DB	74LVC541A DB	SOT339-1
20-Pin Plastic TSSOP Type I	-40°C to $+85^{\circ}\text{C}$	74LVC541A PW	7LVC541APW DH	SOT360-1

PIN DESCRIPTION

PIN NUMBER	SYMBOL	NAME AND FUNCTION
1, 19	$\overline{OE}1, \overline{OE}2$	Output enable inputs (active LOW)
2, 3, 4, 5, 6, 7, 8, 9	A0 to A7	Data inputs
10	GND	Ground (0 V)
18, 17, 16, 15, 14, 13, 12, 11	Y0 to Y7	Bus outputs
20	V_{CC}	Positive supply voltage

FUNCTION TABLE

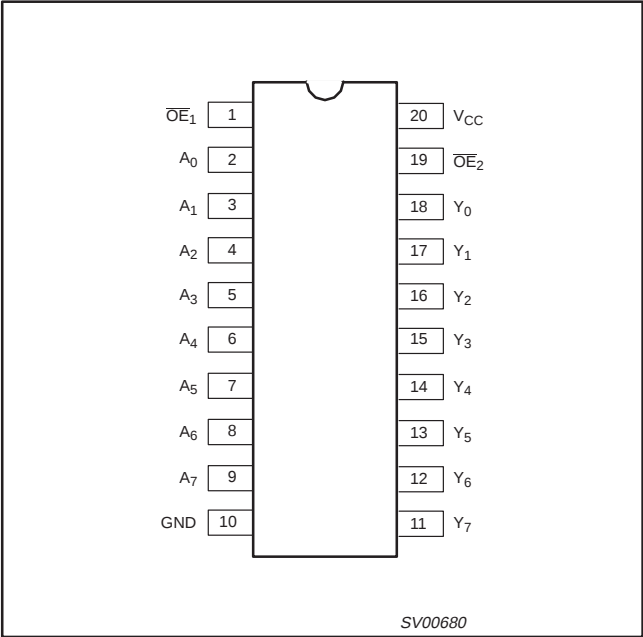
INPUTS	INPUTS		OUTPUT
$\overline{OE}1$	$\overline{OE}2$	An	Yn
L	L	L	L
L	L	H	H
X	H	X	Z
H	X	X	Z

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

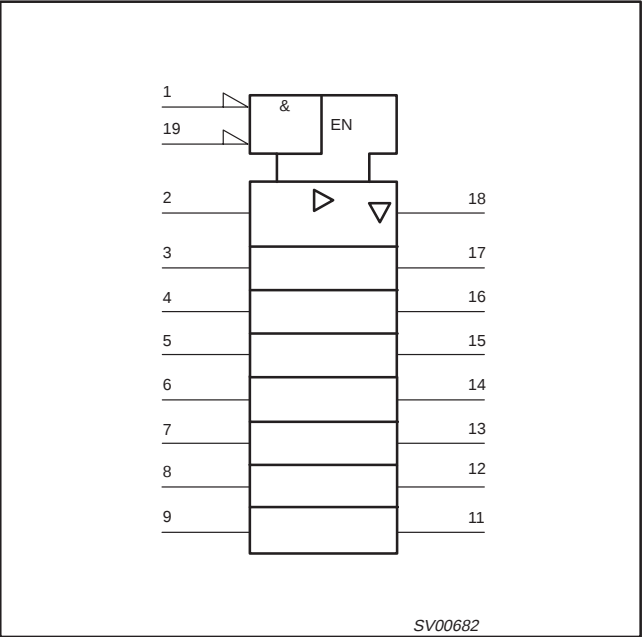
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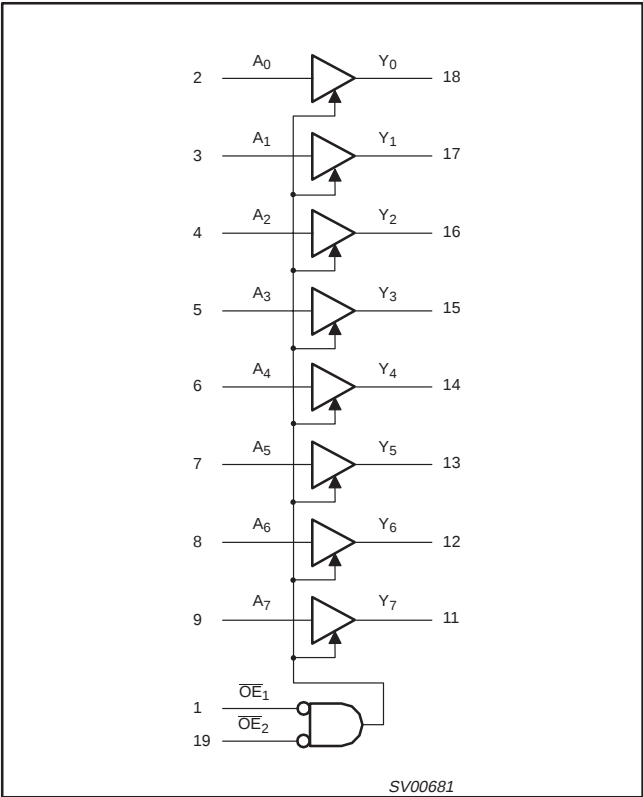
PIN CONFIGURATION



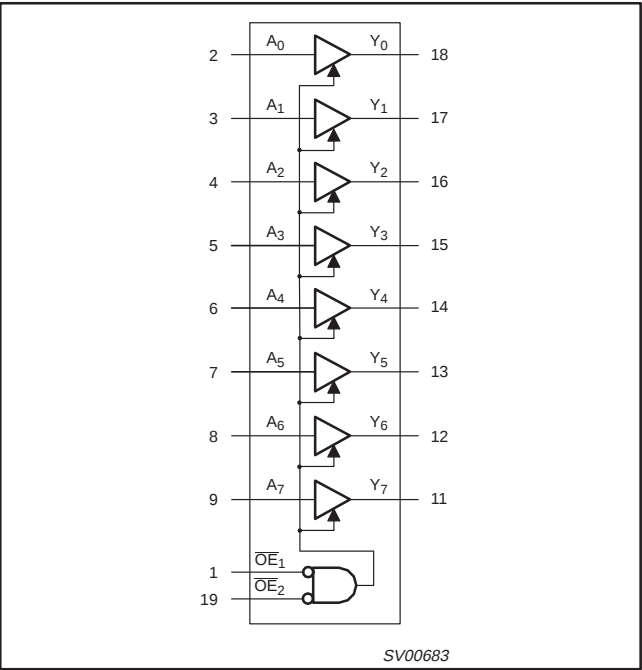
LOGIC SYMBOL (IEEE/IEC)



LOGIC SYMBOL



FUNCTIONAL DIAGRAM



Octal buffer/line driver with 5-volt tolerant inputs/outputs (3-State)

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RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	CONDITIONS	LIMITS		UNIT
			MIN	MAX	
V_{CC}	DC supply voltage (for max. speed performance)		2.7	3.6	V
	DC supply voltage (for low-voltage applications)		1.2	3.6	
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
	DC output voltage range; output 3-State		0	5.5	
T_{amb}	Operating free-air temperature range		-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 RATINGS¹

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 +6.5	V
I_{IK}	DC input diode current	$V_I < 0$	-50	mA
V_I	DC input voltage	Note 2	-0.5 to +5.5	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	Note 2	-0.5 to $V_{CC} + 0.5$	V
	DC output voltage; output 3-State	Note 2	-0.5 to +6.5	
I_O	DC output diode 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		-60 to +150	°C
P_{TOT}	Power dissipation per package – plastic mini-pack (SO)	above +70°C derate linearly with 8 mW/K	500	mW
	– plastic shrink mini-pack (SSOP and TSSOP)	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.
- The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

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DC ELECTRICAL CHARACTERISTICS

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

SYMBOL	PARAMETER	TEST CONDITIONS	LIMITS			UNIT
			Temp = -40°C to +85°C			
			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 = -12mA	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 = -18mA	V _{CC} - 0.6			
		V _{CC} = 3.0V; V _I = V _{IH} or V _{IL} ; I _O = -24mA	V _{CC} - 0.8			
V _{OL}	LOW level output voltage	V _{CC} = 2.7V; V _I = V _{IH} or V _{IL} ; I _O = 12mA			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 = 24mA			0.55	
I _I	Input leakage current	V _{CC} = 3.6V; V _I = 5.5V or GND		± 0.1	± 5	μA
I _{OZ}	3-State output OFF-state current	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			± 10	μA
I _{CC}	Quiescent supply current	V _{CC} = 3.6V; V _I = V _{CC} or GND; I _O = 0		0.1	10	μA
ΔI _{CC}	Additional quiescent supply current per input pin	V _{CC} = 2.7V to 3.6V; V _I = V _{CC} - 0.6V; I _O = 0		5	500	μA

NOTES:

1. All typical values are at V_{CC} = 3.3V and T_{amb} = 25°C.
2. The specified overdrive current at the data input forces the data input to the opposite logic input state.

AC CHARACTERISTICS

GND = 0 V; t_r = t_f ≤ 2.5 ns; C_L = 50 pF

SYMBOL	PARAMETER	WAVEFORM	LIMITS							UNIT
			V _{CC} = 3.3V ±0.3V			V _{CC} = 2.7V			V _{CC} = 1.2V	
			MIN	TYP ¹	MAX	MIN	TYP	MAX	TYP	
t _{PHL} /t _{PLH}	Propagation delay An to Yn	Figures 1, 3	1.5	3.3	5.6	1.5	3.9	6.6	14	ns
t _{PZH} /t _{PZL}	3-State output enable time OEn to Yn	Figures 2, 3	1.5	4.4	7.4	1.5	5.2	8.4	2.2	ns
t _{PHZ} /t _{PLZ}	3-State output disable time OEn to Yn	Figures 2, 3	1.5	3.8	6.0	1.5	4.3	7.0	11	ns

NOTE:

1. Unless otherwise stated, all typical values are at V_{CC} = 3.3V and T_{amb} = 25°C.

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AC WAVEFORMS

$V_M = 1.5\text{ V}$ at $V_{CC} \geq 2.7\text{ V}$
 $V_M = 0.5 \cdot V_{CC}$ at $V_{CC} < 2.7\text{ V}$
 $V_X = V_{OL} + 0.3\text{ V}$ at $V_{CC} \geq 2.7\text{ V}$
 $V_X = V_{OL} + 0.1 \cdot V_{CC}$ at $V_{CC} < 2.7\text{ V}$
 $V_Y = V_{OH} - 0.3\text{ V}$ at $V_{CC} \geq 2.7\text{ V}$
 $V_Y = V_{OH} - 0.1 \cdot V_{CC}$ at $V_{CC} < 2.7\text{ V}$
 V_{OL} and V_{OH} are the typical output voltage drop that occur with the output load.

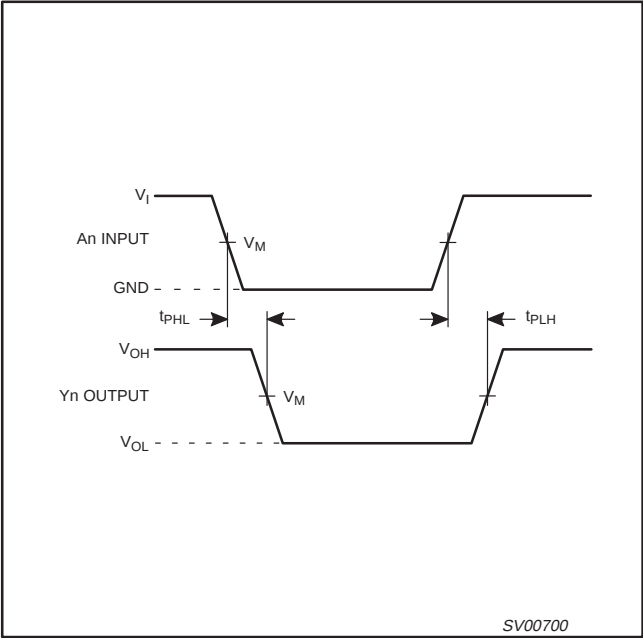


Figure 1. Input (A_n) to output (Y_n) propagation delays.

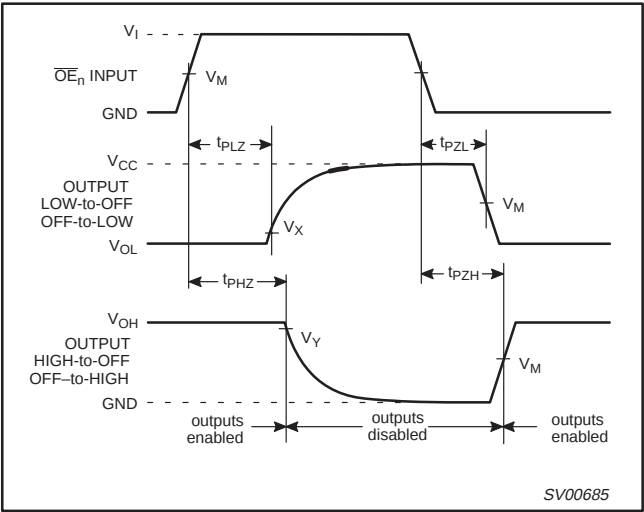


Figure 2. 3-state enable and disable times.

TEST CIRCUIT

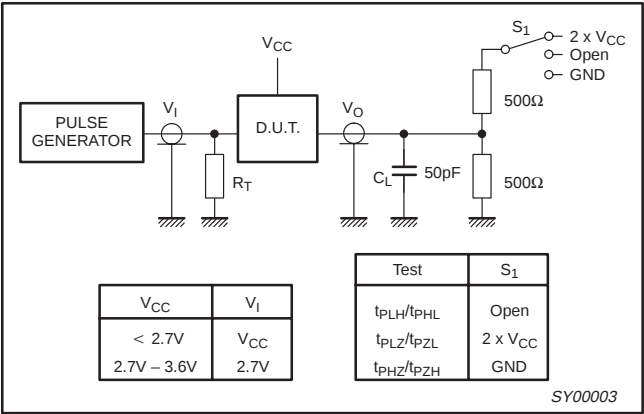


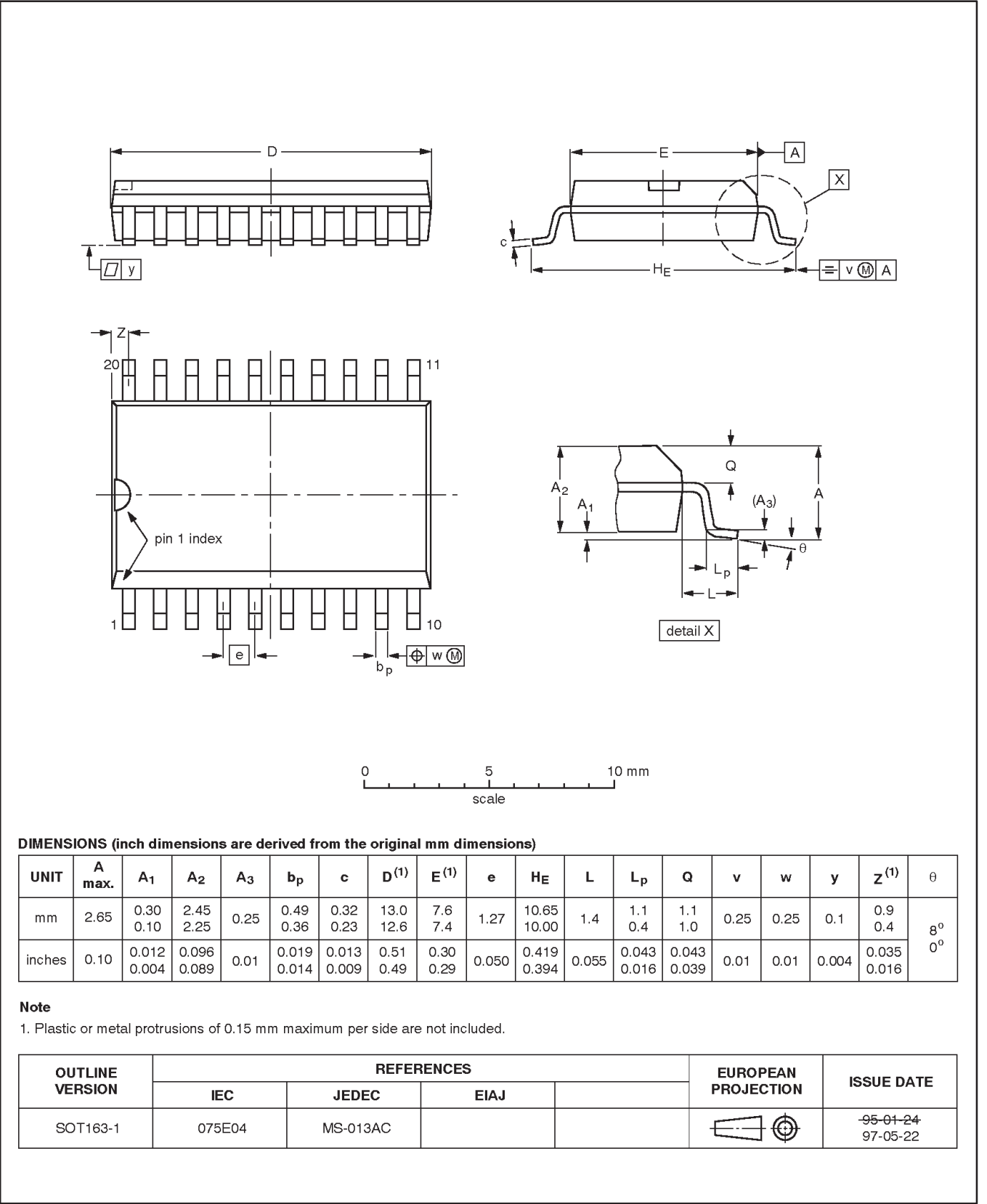
Figure 3. Load circuitry for switching times.

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

SOT163-1

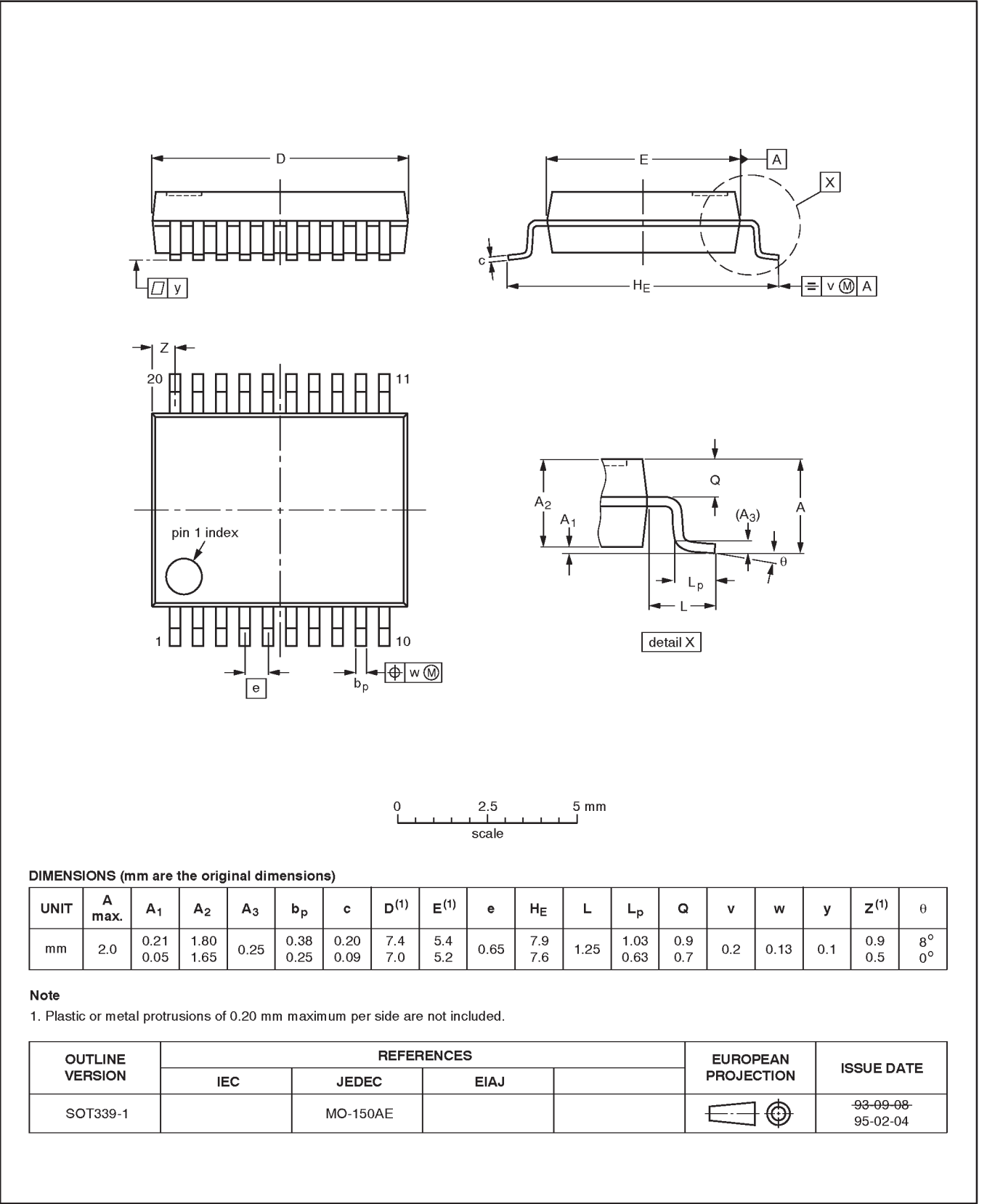


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SSOP20: plastic shrink small outline package; 20 leads; body width 5.3 mm

SOT339-1



Octal buffer/line driver with 5-volt tolerant inputs/outputs (3-State)

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

SOT360-1



Octal buffer/line driver with 5-volt tolerant inputs/outputs (3-State)

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

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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.

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