

DATA SHEET

74LVC240A

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

Product specification
IC24 Data Handbook

1998 May 20

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

74LVC240A

FEATURES

- 5-volt tolerant inputs/outputs, for interfacing with 5-volt logic
- Supply voltage range of 1.2V to 3.6V
- Complies with JEDEC standard no. 8-1A
- CMOS low power consumption
- Direct interface with TTL levels
- High impedance when $V_{CC} = 0V$

DESCRIPTION

The 74LVC240A 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 as translators in a mixed 3.3V/5V environment.

The '240A is an octal non-inverting buffer/line driver with 3-State outputs. The 3-State outputs are controlled by the output enable inputs 1OE and 2OE. A HIGH on nOE causes the outputs to assume a high impedance OFF-state. Schmitt-trigger action at all inputs makes the circuit highly tolerant for slower input rise and fall times.

The '240' is functionally identical to the '244', but the '244' has inverting outputs.

QUICK REFERENCE DATA

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

SYMBOL	PARAMETER	CONDITIONS	TYPICAL	UNIT
t_{PHL}/t_{PLH}	Propagation delay 1A _n to 1Y _n ; 2A _n to 2Y _n	$C_L = 50pF$ $V_{CC} = 3.3V$	3.5	ns
C_I	Input capacitance		5.0	pF
C_{PD}	Power dissipation capacitance per buffer	Notes 1 and 2	20	pF

NOTE:

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 outputs.
2. The condition is $V_I = GND$ to V_{CC}

ORDERING INFORMATION

PACKAGES	TEMPERATURE RANGE	OUTSIDE NORTH AMERICA	NORTH AMERICA	PKG. DWG. #
20-Pin Plastic Small Outline (SO)	-40°C to +85°C	74LVC240A D	74LVC240A D	SOT163-1
20-Pin Plastic Shrink Small Outline (SSOP) Type II	-40°C to +85°C	74LVC240A DB	74LVC240A DB	SOT339-1
20-Pin Plastic Thin Shrink Small Outline (TSSOP) Type I	-40°C to +85°C	74LVC240A PW	7LVC240APW DH	SOT360-1

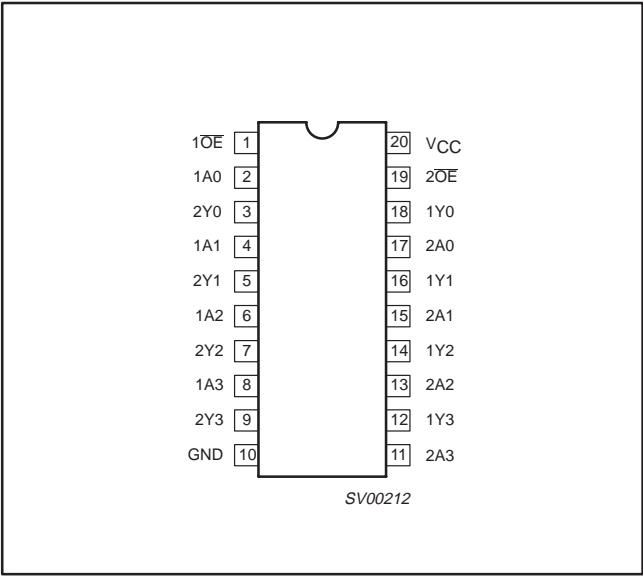
Octal buffer/line driver with 5-volt tolerant inputs/outputs; inverting (3-State)

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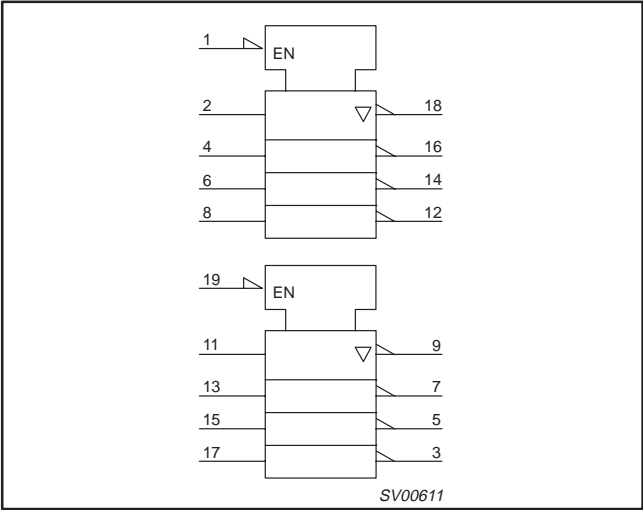
PIN DESCRIPTION

PIN NUMBER	SYMBOL	FUNCTION
1	1OE	Output enable input (active LOW)
2, 4, 6, 8	1A ₀ to 1A ₃	Data inputs
3, 5, 7, 9	2Y ₀ to 2Y ₃	Bus outputs
10	GND	Ground (0V)
17, 15, 13, 11	2A ₀ to 2A ₃	Bus inputs
18, 16, 14, 12	1Y ₀ to 1Y ₃	Bus outputs
19	2OE	Output enable input (active-LOW)
20	V _{CC}	Positive power supply

PIN CONFIGURATION



LOGIC SYMBOL (IEEE/IEC)

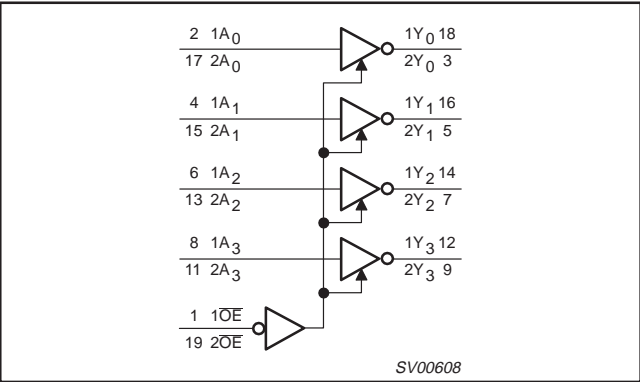


FUNCTION TABLE

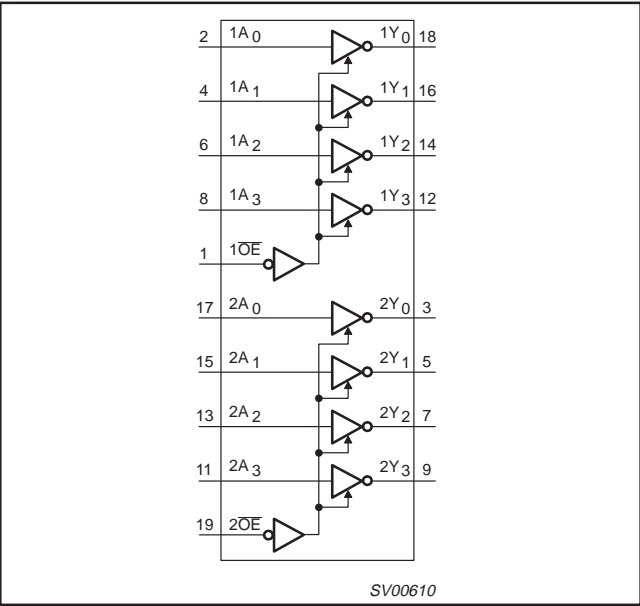
INPUTS		OUTPUT
nOE	nA _n	nY _n
L	L	H
L	H	L
H	X	Z

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

LOGIC SYMBOL



FUNCTIONAL DIAGRAM



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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
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
	DC output voltage range; output 3-State		0	5.5	
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 2.7 V $V_{CC} = 2.7$ to 3.6 V	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 +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 to $V_{CC} + 0.5$	V
	DC output voltage; output 3-State	Note 2	-0.5 to 6.5	
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 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 above +60°C derate linearly with 5.5 mW/K	500 500	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.

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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		GND	0.20	
		V _{CC} = 3.0V; V _I = V _{IH} or V _{IL} ; I _O = 24mA			0.55	
I _I	Input leakage current ²	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	± 10	μA
I _{off}	Power off leakage current	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	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 $T_{amb} = 25^\circ C$.
2. The specified overdrive current at the data input forces the data input to the opposite logic input state.

AC CHARACTERISTICS

GND = 0V; $t_r = t_f \leq 2.5ns$; $C_L = 50pF$; $R_L = 500\Omega$; $T_{amb} = -40^\circ C$ to $+85^\circ C$.

SYMBOL	PARAMETER	WAVEFORM	LIMITS						UNIT
			$V_{CC} = 3.3V \pm 0.3V$			$V_{CC} = 2.7V$		$V_{CC} = 1.2V$	
			MIN	TYP ¹	MAX	MIN	MAX	TYP	
t_{PLH} t_{PHL}	Propagation delay $1A_n$ to $1Y_n$; $2A_n$ to $2Y_n$	1, 3	1.5	3.5	6.5	1.5	7.5	16.0	ns
t_{PZH} t_{PZL}	3-State output enable time $\overline{1OE}$ to $1Y_n$; $\overline{2OE}$ to $2Y_n$	2, 3	1.5	4.3	8.0	1.5	9.0	19.0	ns
t_{PHZ} t_{PLZ}	3-State output disable time $\overline{1OE}$ to $1Y_n$; $\overline{2OE}$ to $2Y_n$	2, 3	1.5	3.7	7.0	1.5	8.0	17.0	ns

NOTE:

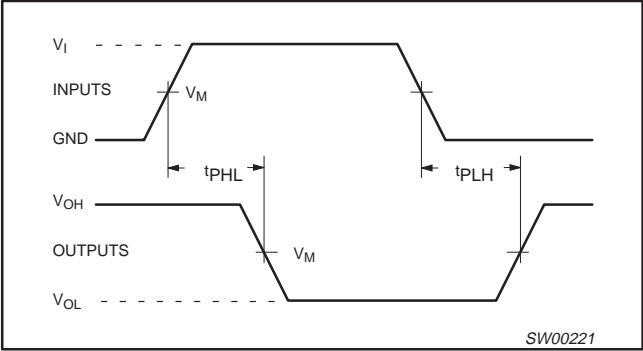
1. Unless otherwise stated, all typical values are at $V_{CC} = 3.3V$ and $T_{amb} = 25^\circ C$.

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

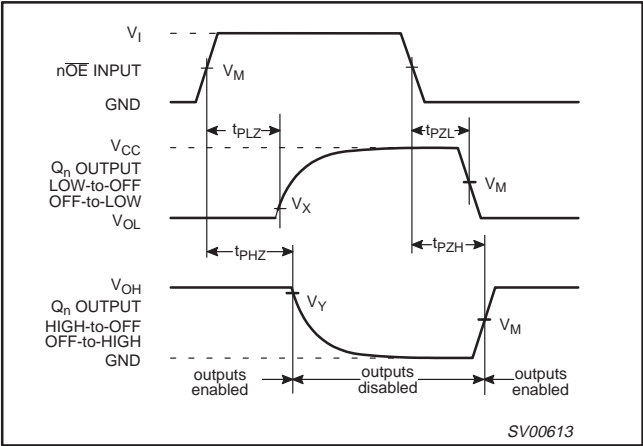
74LVC240A

AC WAVEFORMS

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

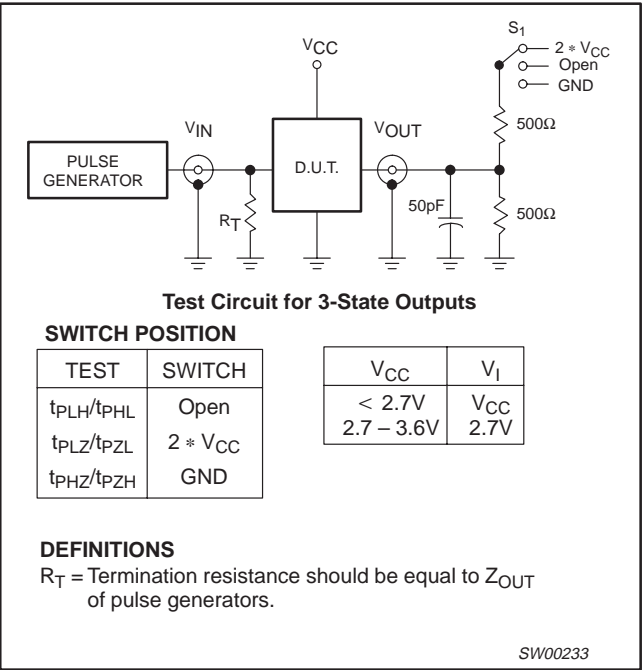


Waveform 1. Inputs (1A_n, 2A_n) to outputs (1Y_n, 2Y_n) propagation delays.



Waveform 2. 3-State enable and disable times.

TEST CIRCUIT



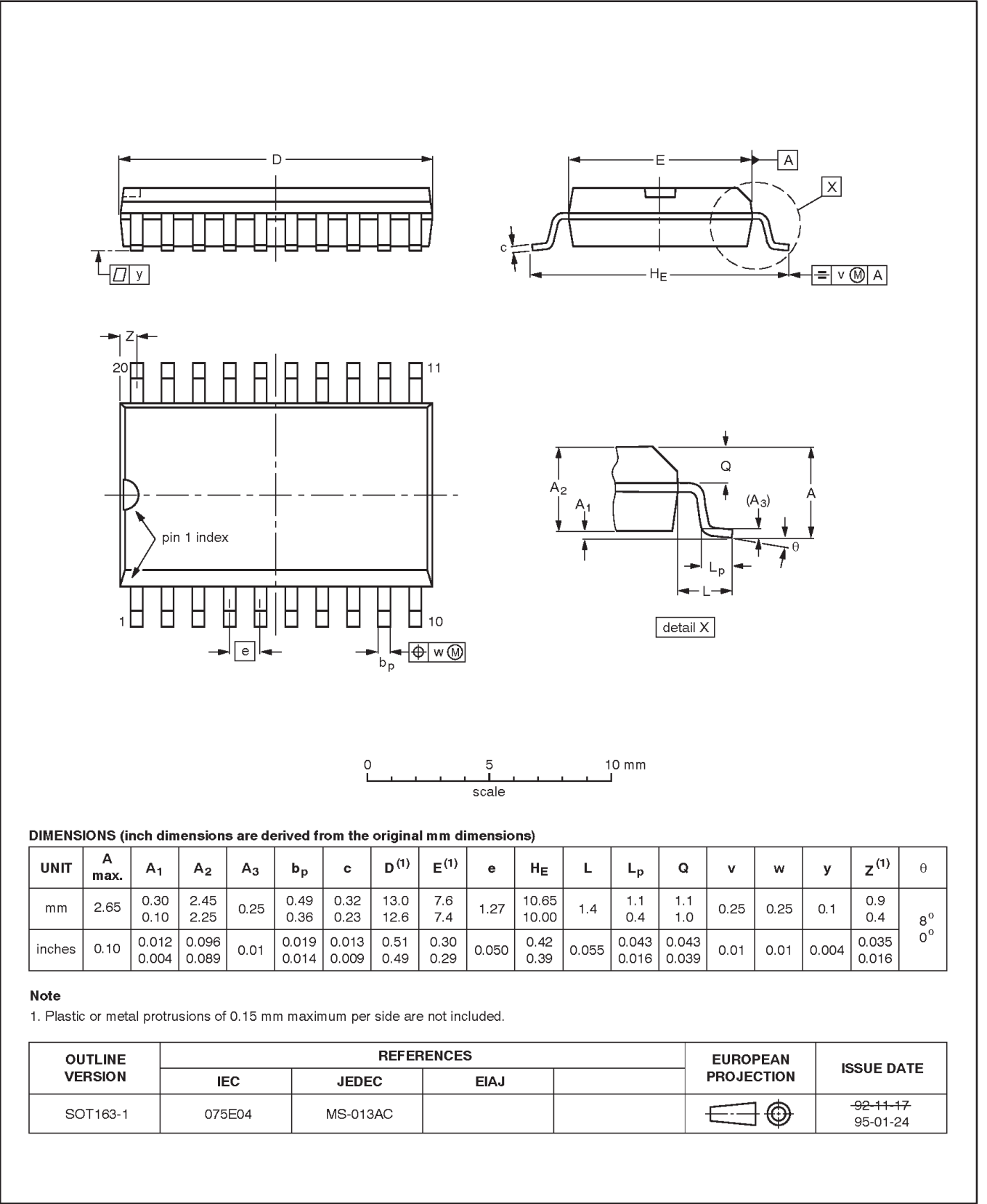
Waveform 3. Load circuitry for switching times.

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

SOT163-1

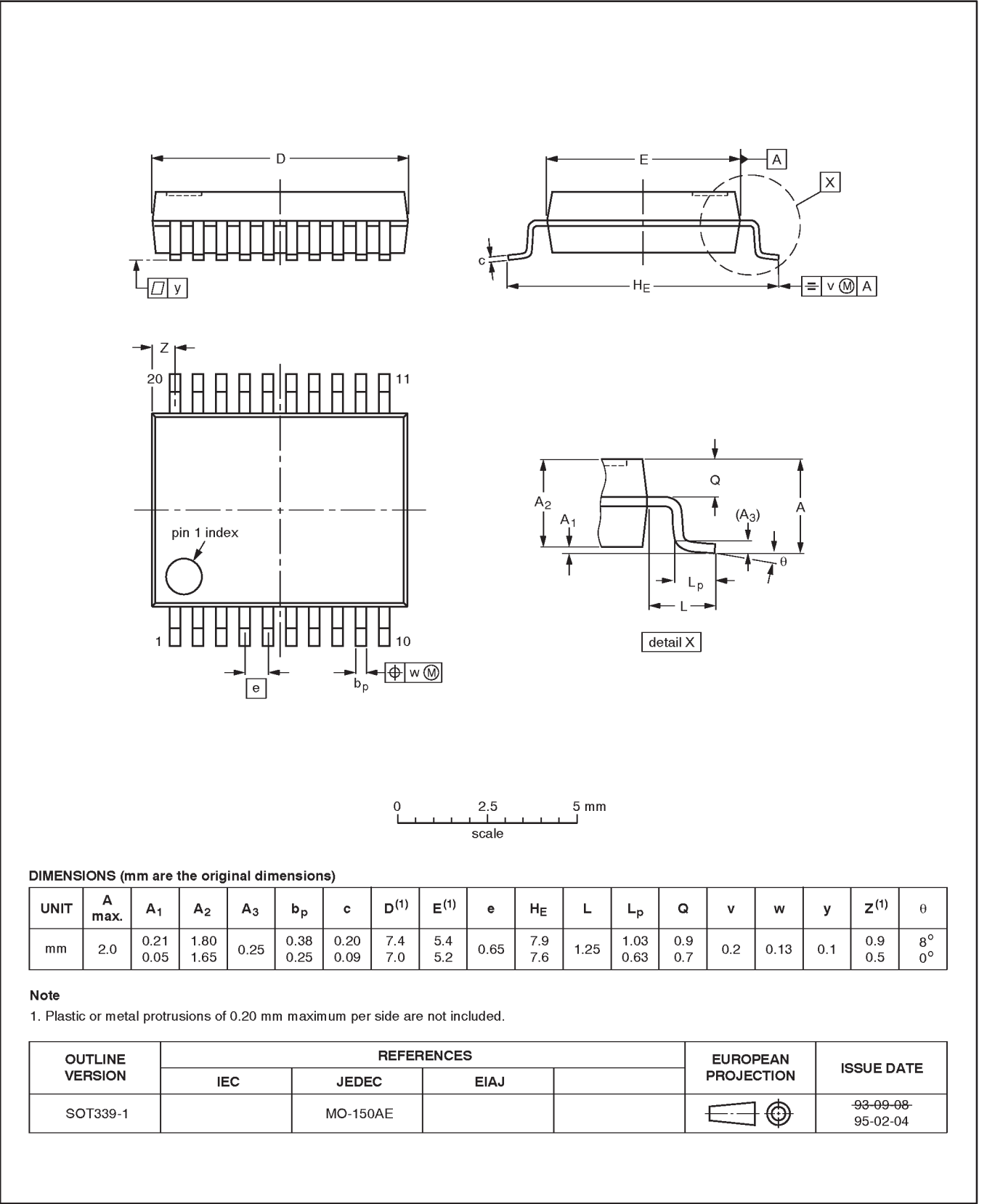


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SSOP20: plastic shrink small outline package; 20 leads; body width 5.3 mm

SOT339-1

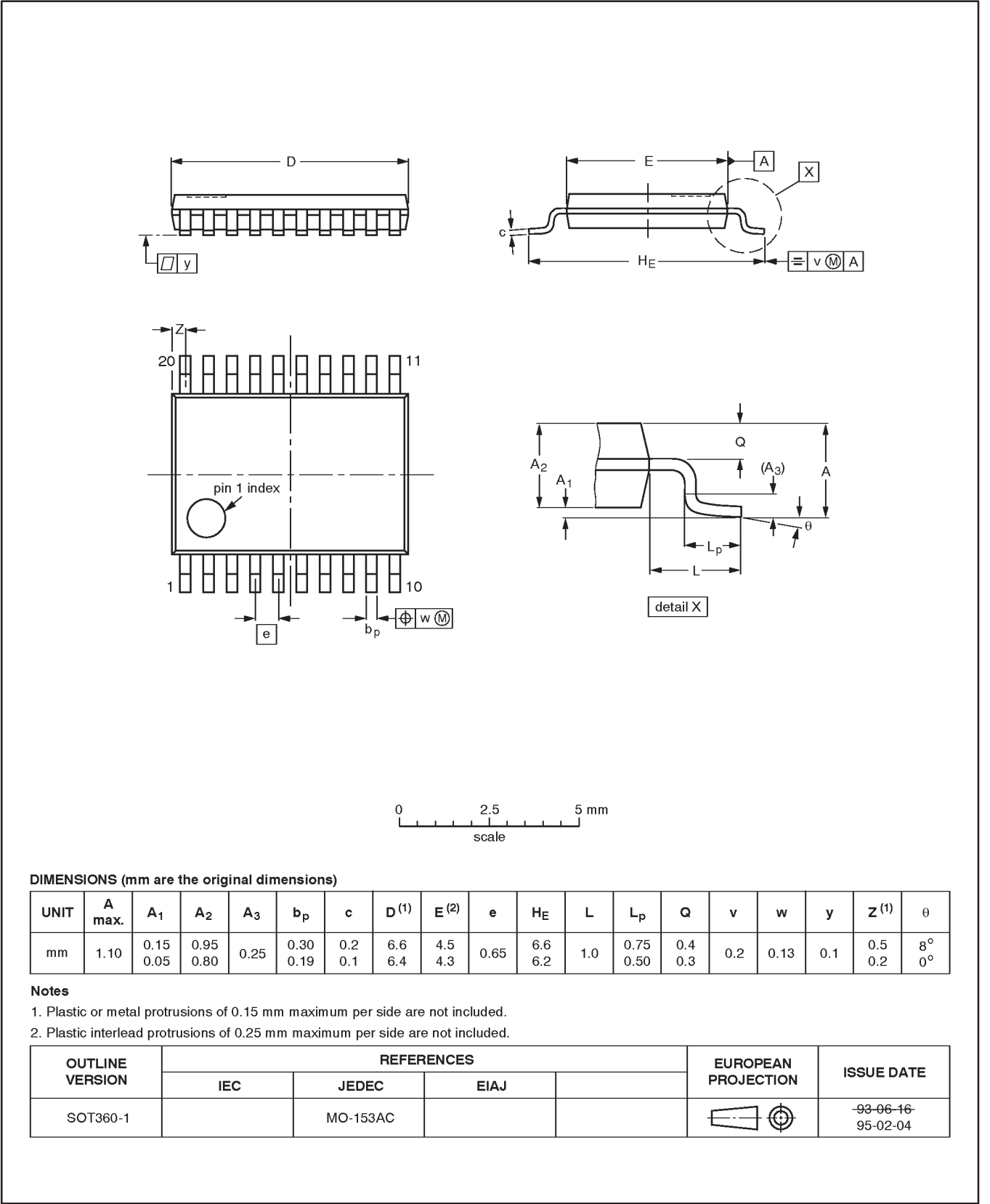


Octal buffer/line driver with 5-volt tolerant inputs/outputs; inverting (3-State);

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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; inverting (3-State);

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NOTES

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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.
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 changes at any time without notice in order to improve design and supply the best possible product.
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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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