

# DATA SHEET

## **74LVC827A**

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

Product specification

1998 Sep 04

# 10-bit buffer/line driver with 5-volt tolerant inputs/outputs (3-State)

## 74LVC827A

### FEATURES

- 5-volt tolerant inputs/outputs, for interfacing with 5-volt logic
- 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
- High impedance when  $V_{CC} = 0V$

### DESCRIPTION

The 74LVC827A 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 74LVC827A is a 10-bit 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 = 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 $A_n$ to $Y_n$	$C_L = 50$ pF; $V_{CC} = 3.3$ V	4	ns
$C_I$	Input capacitance		5.0	pF
$C_{PD}$	Power dissipation capacitance per buffer	Notes 1 and 2	24	pF

#### NOTES:

- $C_{PD}$  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.
- The condition is  $V_I = GND$  to  $V_{CC}$

### ORDERING INFORMATION

PACKAGES	TEMPERATURE RANGE	OUTSIDE NORTH AMERICA	NORTH AMERICA	PKG. DWG. #
24-Pin Plastic SO	$-40^\circ C$ to $+85^\circ C$	74LVC827A D	74LVC827A D	SOT137-1
24-Pin Plastic SSOP Type II	$-40^\circ C$ to $+85^\circ C$	74LVC827A DB	74LVC827A DB	SOT340-1
24-Pin Plastic TSSOP Type I	$-40^\circ C$ to $+85^\circ C$	74LVC827A PW	74LVC827A PW DH	SOT355-1

### PIN DESCRIPTION

PIN NUMBER	SYMBOL	NAME AND FUNCTION
1, 13	$\overline{OE}_1, \overline{OE}_2$	Output enable input (active LOW)
2, 3, 4, 5, 6, 7, 8, 9, 10, 11	$A_0$ to $A_9$	Data inputs
12	GND	Ground (0 V)
23, 22, 21, 20, 19, 18, 17, 16, 15, 14	$Y_0$ to $Y_9$	Bus outputs
24	$V_{CC}$	Positive supply voltage

### FUNCTION TABLE

INPUTS			OUTPUTS
$\overline{OE}_1$	$\overline{OE}_2$	$A_n$	$Y_n$
L	L	L	L
L	L	H	H
X	H	X	Z
H	X	X	Z

H = HIGH voltage level

L = LOW voltage level

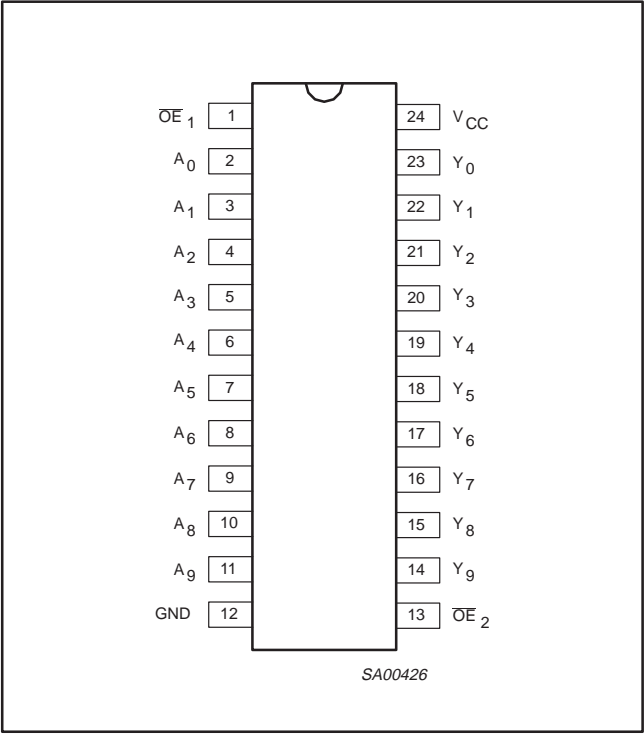
X = Don't care

Z = high impedance OFF-state

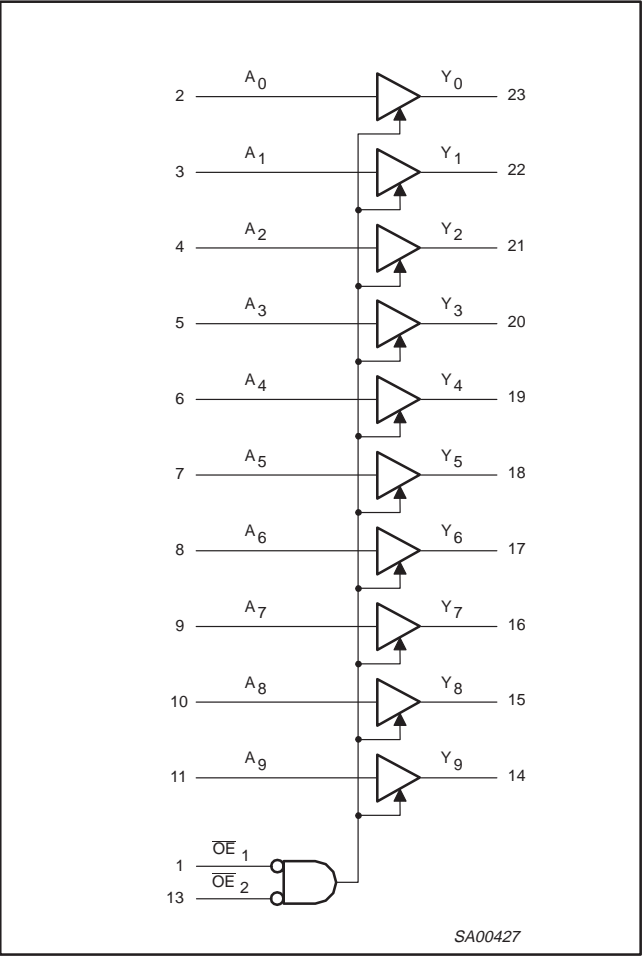
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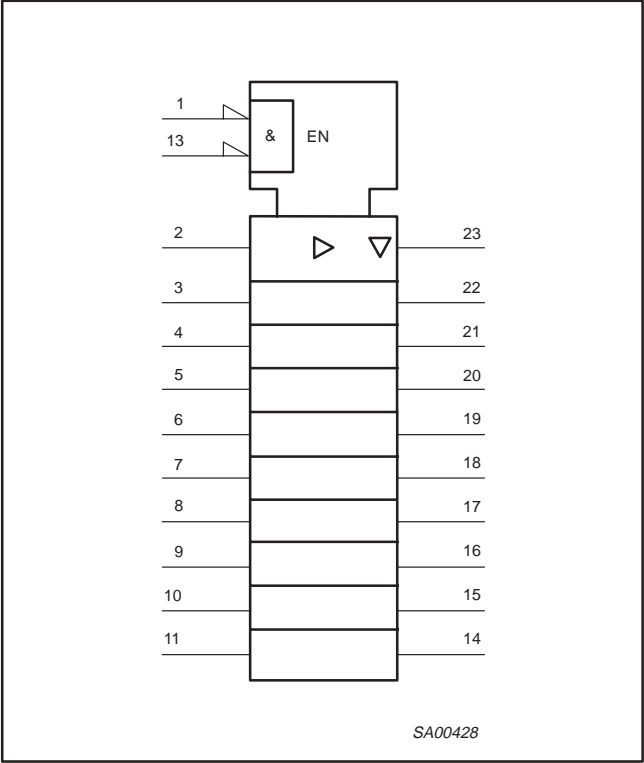
PIN CONFIGURATION



LOGIC SYMBOL



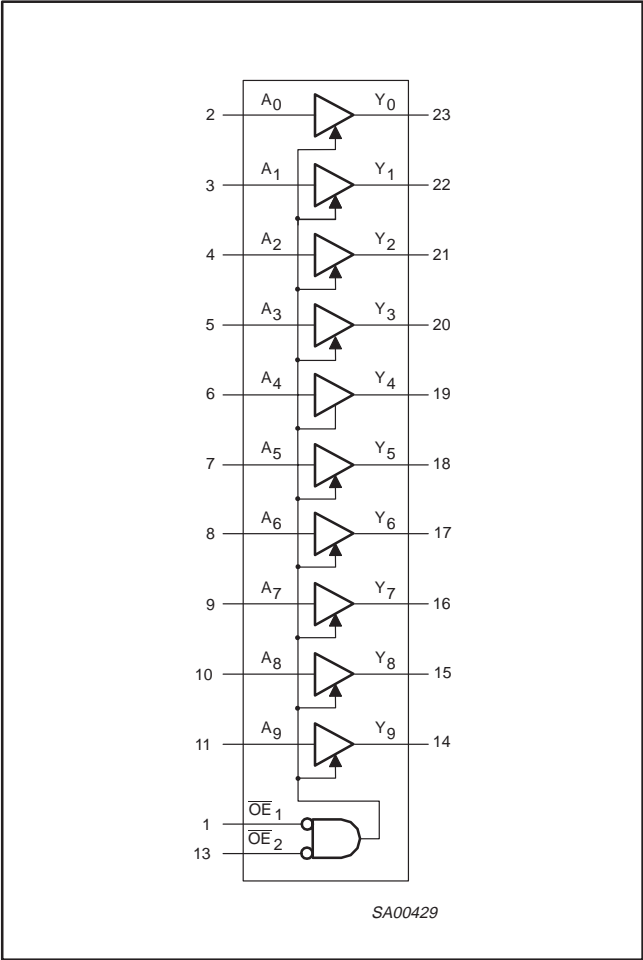
LOGIC SYMBOL (IEEE/IEC)



10-bit buffer/line driver with 5-volt tolerant  
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FUNCTIONAL DIAGRAM



RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	CONDITIONS	LIMITS		UNIT
			MIN	MAX	
V <sub>CC</sub>	DC supply voltage (for max. speed performance)		2.7	3.6	V
	DC supply voltage (for low-voltage applications)		1.2	3.6	
V <sub>I</sub>	DC Input voltage range		0	5.5	V
V <sub>O</sub>	DC output voltage range; output HIGH or LOW state		0	V <sub>CC</sub>	V
	DC output voltage range; output 3-State		0	5.5	
T <sub>amb</sub>	Operating ambient temperature range in free-air		−40	+85	°C
t <sub>r</sub> , t <sub>f</sub>	Input rise and fall times	V <sub>CC</sub> = 1.2 to 2.7V	0	20	ns/V
		V <sub>CC</sub> = 2.7 to 3.6V	0	10	

# 10-bit buffer/line driver with 5-volt tolerant inputs/outputs (3-State)

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## ABSOLUTE MAXIMUM RATINGS<sup>1</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 +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 $V_O < 0$	$\pm 50$	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 $V_{CC}$	$\pm 50$	mA
$I_{GND}, I_{CC}$	DC $V_{CC}$ or GND current		$\pm 100$	mA
$T_{stg}$	Storage temperature range		-65 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.

## 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 <sup>1</sup>	MAX	
V <sub>IH</sub>	HIGH level Input voltage	V <sub>CC</sub> = 1.2V	V <sub>CC</sub>			V
		V <sub>CC</sub> = 2.7 to 3.6V	2.0			
V <sub>IL</sub>	LOW level Input voltage	V <sub>CC</sub> = 1.2V			GND	V
		V <sub>CC</sub> = 2.7 to 3.6V			0.8	
V <sub>OH</sub>	HIGH level output voltage	V <sub>CC</sub> = 2.7V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = -12mA	V <sub>CC</sub> - 0.5			V
		V <sub>CC</sub> = 3.0V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = -100μA	V <sub>CC</sub> - 0.2	V <sub>CC</sub>		
		V <sub>CC</sub> = 3.0V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = -18mA	V <sub>CC</sub> - 0.6			
		V <sub>CC</sub> = 3.0V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = -24mA	V <sub>CC</sub> - 0.8			
V <sub>OL</sub>	LOW level output voltage	V <sub>CC</sub> = 2.7V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = 12mA			0.40	V
		V <sub>CC</sub> = 3.0V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = 100μA			0.20	
		V <sub>CC</sub> = 3.0V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = 24mA			0.55	

### NOTES:

- All typical values are at  $V_{CC} = 3.3V$  and  $T_{amb} = 25^\circ C$ .
- The specified overdrive current at the data input forces the data input to the opposite logic input state.

# 10-bit buffer/line driver with 5-volt tolerant inputs/outputs (3-State)

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## DC ELECTRICAL CHARACTERISTICS (Continued)

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 <sup>1</sup>	MAX	
I <sub>I</sub>	Input leakage current	V <sub>CC</sub> = 3.6V; V <sub>I</sub> = 5.5V or GND	Not for I/O pins		± 0.1	± 5	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> = 5.5V or GND			0.1	± 5	μA
I <sub>off</sub>	Power off leakage supply	V <sub>CC</sub> = 0.0V; V <sub>I</sub> or V <sub>O</sub> = 5.5V			0.1	± 10	μA
I <sub>CC</sub>	Quiescent supply current	V <sub>CC</sub> = 3.6V; V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0			0.1	10	μA
ΔI <sub>CC</sub>	Additional quiescent supply current per input pin	V <sub>CC</sub> = 2.7V to 3.6V; V <sub>I</sub> = V <sub>CC</sub> - 0.6V; I <sub>O</sub> = 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 <sup>1</sup>	MAX	MIN	MAX	TYP	
$t_{PHL}$ $t_{PLH}$	Propagation delay $1A_n$ to $1Y_n$ ; $2A_n$ to $2Y_n$	Figures 1, 3	1.5	4.0	6.7	1.5	7.1	15	ns
$t_{PZH}$ $t_{PZL}$	3-State output enable time $\overline{OE}_1$ to $1Y_n$ ; $\overline{OE}_2$ to $2Y_n$	Figures 2, 3	1.5	5.4	8.5	1.5	9.5	25	ns
$t_{PHZ}$ $t_{PLZ}$	3-State output disable time $\overline{OE}_1$ to $1Y_n$ ; $\overline{OE}_2$ to $2Y_n$	Figures 2, 3	1.5	4.0	6.7	1.5	7.3	11	ns

### NOTE:

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

## AC WAVEFORMS

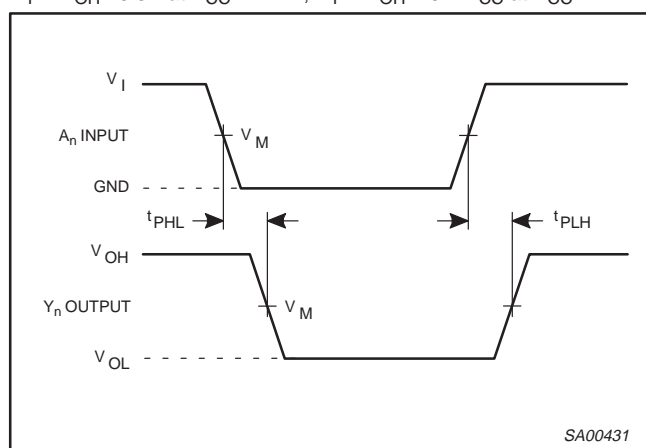
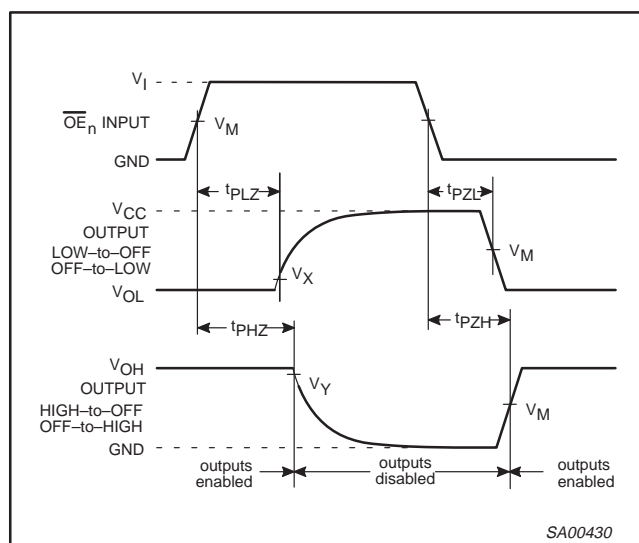
 $V_M = 1.5V$  at  $V_{CC} \geq 2.7V$ ;  $V_M = 0.5 V_{CC}$  at  $V_{CC} < 2.7V$ . $V_{OL}$  and  $V_{OH}$  are the typical output voltage drop that occur with the output load. $V_X = V_{OL} + 0.3V$  at  $V_{CC} \geq 2.7V$ ;  $V_X = V_{OL} + 0.1 V_{CC}$  at  $V_{CC} < 2.7V$  $V_Y = V_{OH} - 0.3V$  at  $V_{CC} \geq 2.7V$ ;  $V_Y = V_{OH} - 0.1 V_{CC}$  at  $V_{CC} < 2.7V$ Figure 1. The input (A<sub>n</sub>) to output (Y<sub>n</sub>) propagation delays.

Figure 2. 3-State enable and disable times.

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

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TEST CIRCUIT

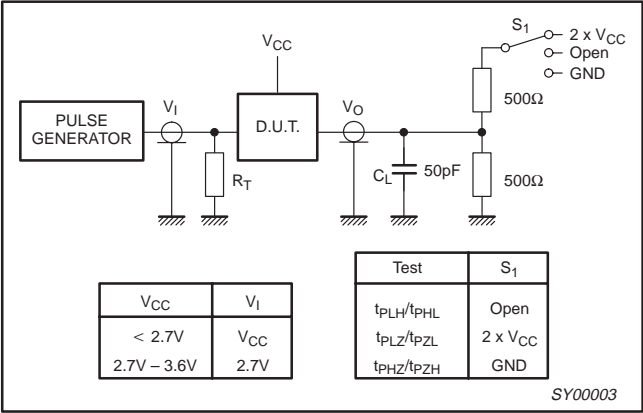


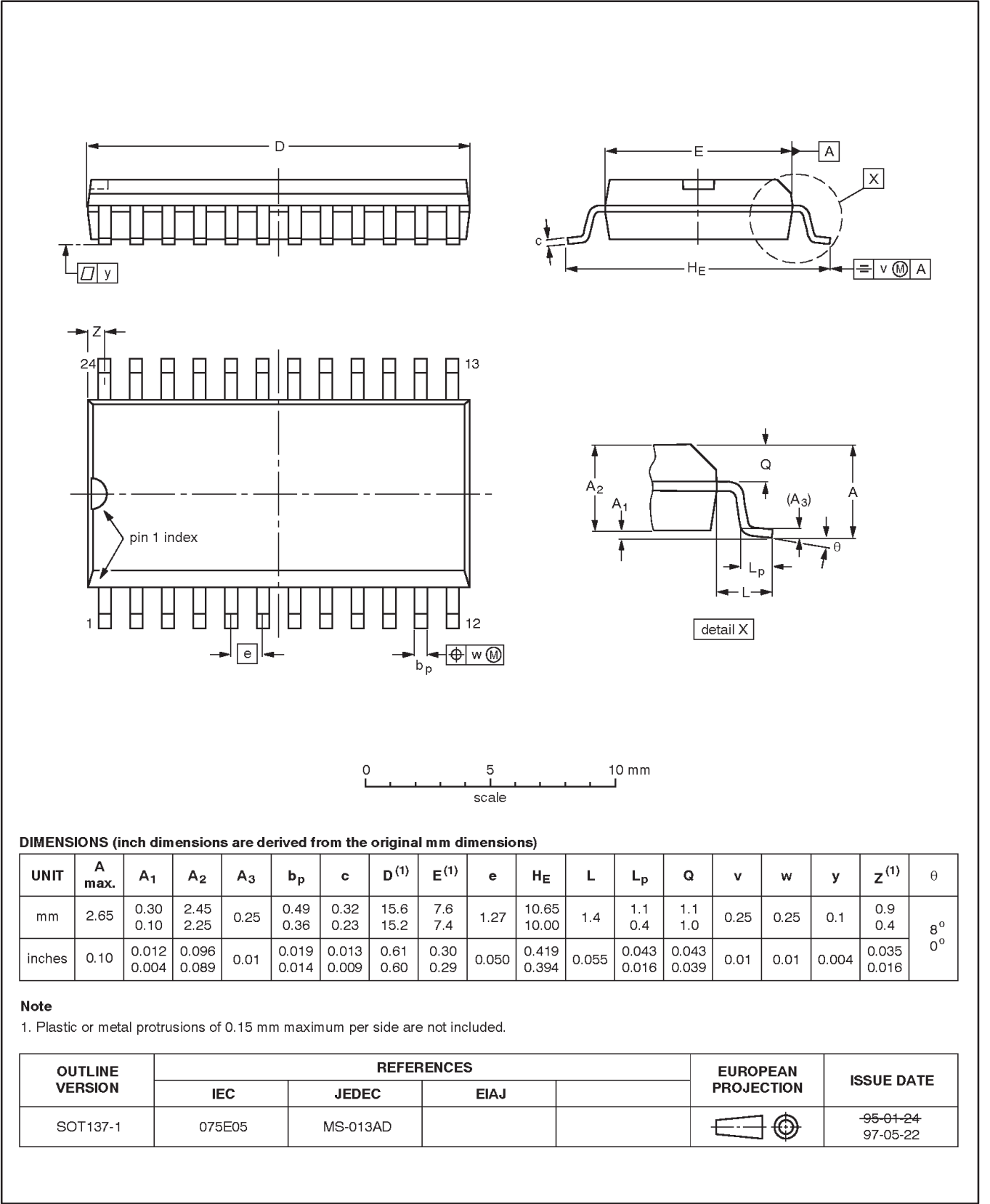
Figure 3. Load circuitry for switching times.

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SO24: plastic small outline package; 24 leads; body width 7.5 mm

SOT137-1



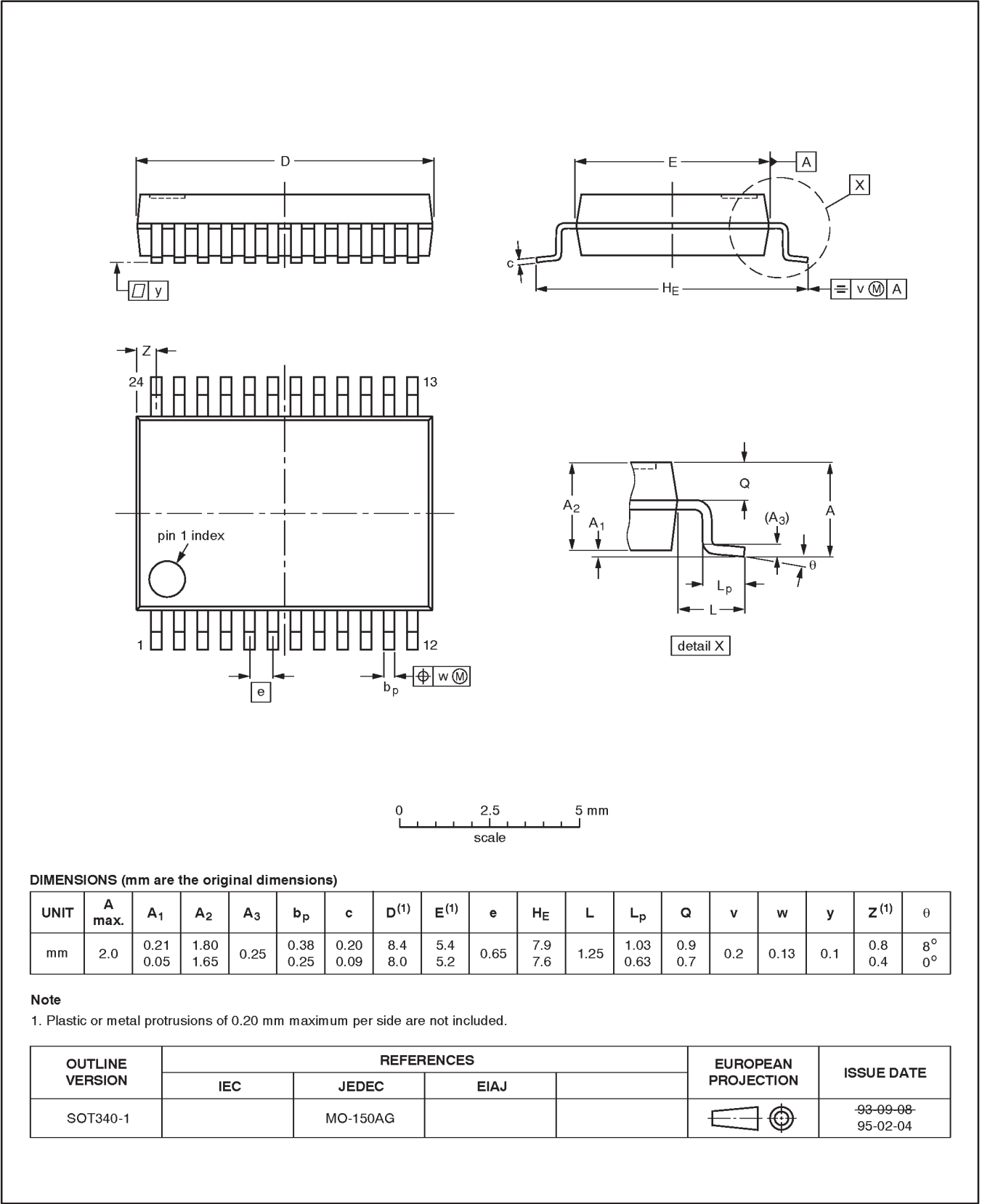


10-bit buffer/line driver with 5-volt tolerant inputs/outputs (3-State)

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SSOP24: plastic shrink small outline package; 24 leads; body width 5.3 mm

SOT340-1

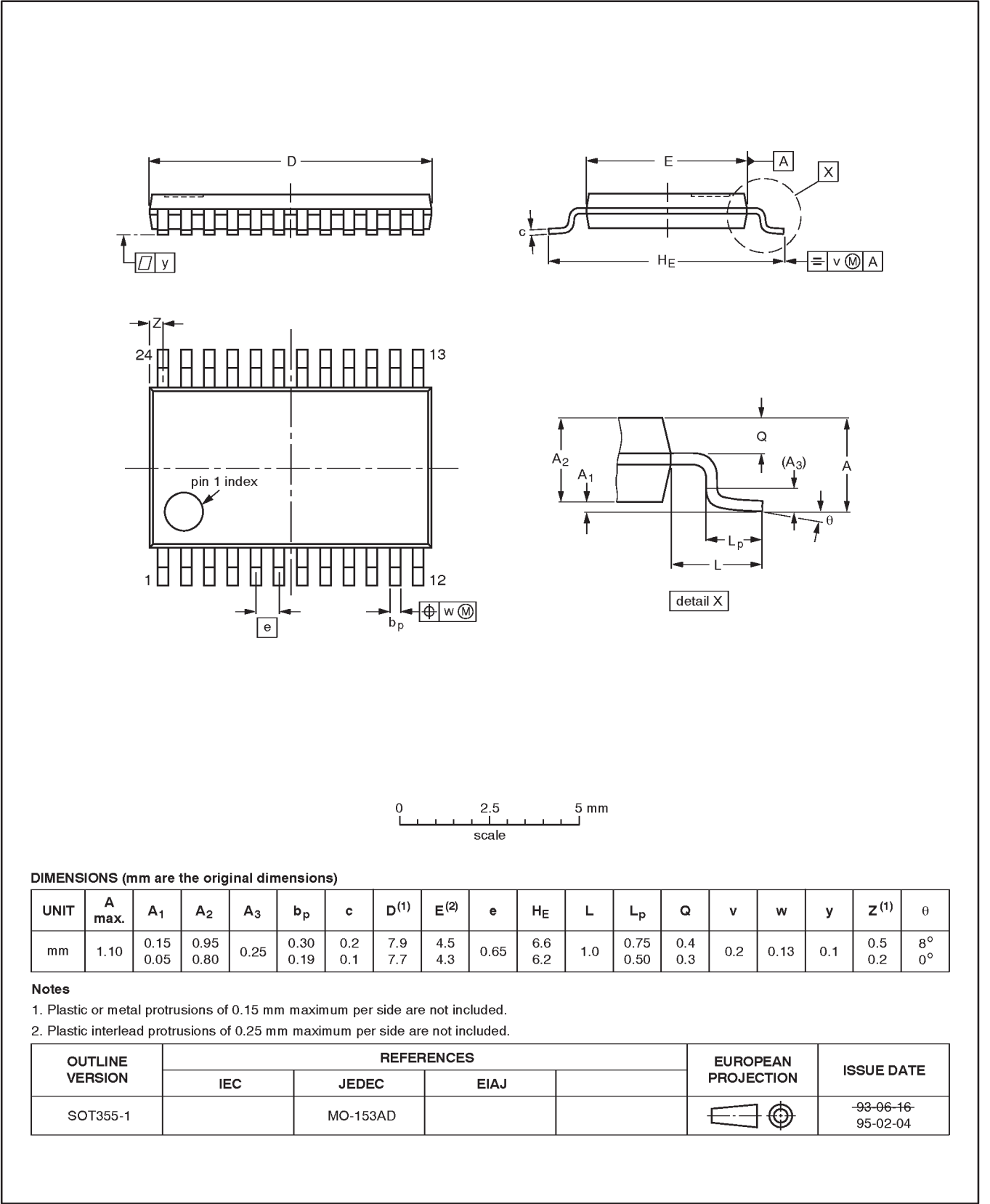


10-bit buffer/line driver with 5-volt tolerant inputs/outputs (3-State)

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TSSOP24: plastic thin shrink small outline package; 24 leads; body width 4.4 mm

SOT355-1



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10-bit buffer/line driver with 5-volt tolerant  
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## NOTES

# 10-bit 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.
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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**Short-form specification** — The data in a short-form specification is extracted from a full data sheet with the same type number and title. For detailed information see the relevant data sheet or data handbook.

**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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