### INTEGRATED CIRCUITS

## DATA SHEET

# **74LVC1G125**Bus buffer/line driver; 3-state

Product specification Supersedes data of 2002 May 28 2002 Nov 18





### Bus buffer/line driver; 3-state

### 74LVC1G125

#### **FEATURES**

- Wide supply voltage range from 1.65 to 5.5 V
- · High noise immunity
- Complies with JEDEC standard:
  - JESD8-7 (1.65 to 1.95 V)
  - JESD8-5 (2.3 to 2.7 V)
  - JESD8B/JESD36 (2.7 to 3.6 V).
- ±24 mA output drive (V<sub>CC</sub> = 3.0 V)
- CMOS low power consumption
- Latch-up performance exceeds 250 mA
- · Direct interface with TTL levels
- Inputs accept voltages up to 5 V
- · Multiple package options
- ESD protection: HBM EIA/JESD22-A114-A exceeds 2000 V MM EIA/JESD22-A115-A exceeds 200 V.
- Specified from -40 to +125 °C.

#### **DESCRIPTION**

The 74LVC1G125 is a high-performance, low-power, low-voltage, Si-gate CMOS device, superior to most advanced CMOS compatible TTL families.

The input can be driven from either 3.3 or 5 V devices. This feature allows the use of this device in a mixed 3.3 and 5 V environment.

This device is fully specified for partial power-down applications using  $I_{\text{off}}$ . The  $I_{\text{off}}$  circuitry disables the output, preventing the damaging backflow current through the device when it is powered down.

The 74LVC1G125 provides one non-inverting buffer/line driver with 3-state output. The 3-state output is controlled by the output enable input ( $\overline{\text{OE}}$ ). A HIGH level at pin  $\overline{\text{OE}}$  causes the output to assume a high-impedance OFF-state.

#### **QUICK REFERENCE DATA**

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

SYMBOL	PARAMETER	CONDITIONS	TYPICAL	UNIT
t <sub>PHL</sub> /t <sub>PLH</sub>	propagation delay input A to output Y	$V_{CC} = 1.8 \text{ V}; C_L = 30 \text{ pF}; R_L = 1 \text{ k}\Omega$	3.3	ns
		$V_{CC} = 2.5 \text{ V}; C_L = 30 \text{ pF}; R_L = 500 \Omega$	2.2	ns
		$V_{CC} = 2.7 \text{ V}; C_L = 50 \text{ pF}; R_L = 500 \Omega$	2.5	ns
		$V_{CC} = 3.3 \text{ V}; C_L = 50 \text{ pF}; R_L = 500 \Omega$	2.1	ns
		$V_{CC} = 5.0 \text{ V}; C_L = 50 \text{ pF}; R_L = 500 \Omega$	1.7	ns
C <sub>I</sub>	input capacitance		5	pF
C <sub>PD</sub>	power dissipation capacitance per buffer	output enabled; notes 1 and 2	25	pF
		output disabled; notes 1 and 2	6	pF

#### Notes

1.  $C_{PD}$  is used to determine the dynamic power dissipation ( $P_D$  in  $\mu W$ ).

 $P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \Sigma (C_L \times V_{CC}^2 \times f_o)$  where:

f<sub>i</sub> = input frequency in MHz;

f<sub>o</sub> = output frequency in MHz;

C<sub>L</sub> = output load capacitance in pF;

V<sub>CC</sub> = supply voltage in Volts;

N = total switching outputs;

 $\Sigma(C_1 \times V_{CC}^2 \times f_0) = \text{sum of the outputs.}$ 

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

### Bus buffer/line driver; 3-state

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### **FUNCTION TABLE**

See note 1.

INF	OUTPUT	
ŌĒ	Α	Y
L	L	L
L	Н	Н
Н	X	Z

#### Note

1. H = HIGH voltage level;

L = LOW voltage level;

X = don't care;

Z = high-impedance OFF-state.

### **ORDERING INFORMATION**

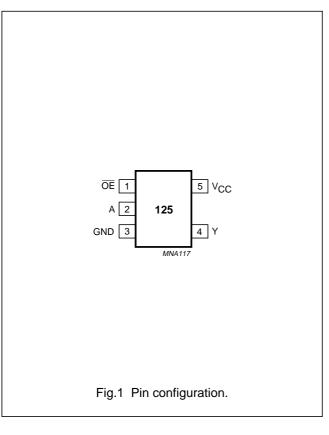
	PACKAGE							
TYPE NUMBER	TEMPERATURE RANGE	PINS	PACKAGE	MATERIAL	CODE	MARKING		
74LVC1G125GW	-40 to +125 °C	5	SC-88A	plastic	SOT353	VM		
74LVC1G125GV	–40 to +125 °C	5	SC-74A	plastic	SOT753	V25		

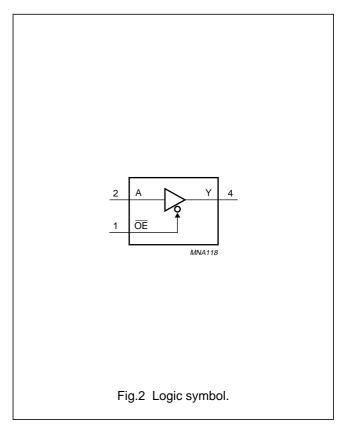
### **PINNING**

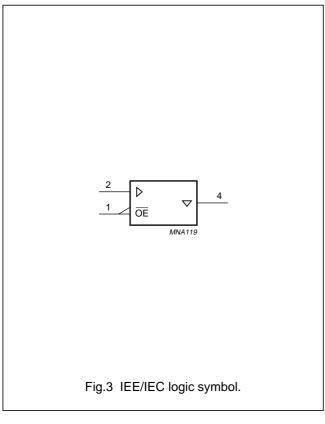
PIN	SYMBOL	DESCRIPTION
1	ŌĒ	output enable input
2	A	data input A
3	GND	ground (0 V)
4	Υ	data output Y
5	V <sub>CC</sub>	supply voltage

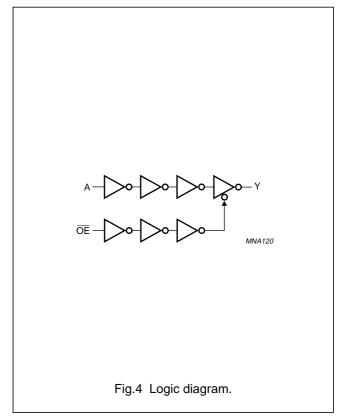
### Bus buffer/line driver; 3-state

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### Bus buffer/line driver; 3-state

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#### RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V <sub>CC</sub>	supply voltage		1.65	5.5	V
VI	input voltage		0	5.5	V
Vo	output voltage	V <sub>CC</sub> = 1.65 to 5.5 V; enable mode	0	V <sub>CC</sub>	V
		V <sub>CC</sub> = 1.65 to 5.5 V; disable mode	0	5.5	V
		V <sub>CC</sub> = 0 V; Power-down mode	0	5.5	V
T <sub>amb</sub>	operating ambient temperature		-40	+125	°C
t <sub>r</sub> , t <sub>f</sub>	input rise and fall times	V <sub>CC</sub> = 1.65 to 2.7 V	0	20	ns/V
		V <sub>CC</sub> = 2.7 to 5.5 V	0	10	ns/V

### **LIMITING VALUES**

In accordance with the Absolute Maximum Rating System (IEC 60134); voltages are referenced to GND (ground = 0 V).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V <sub>CC</sub>	supply voltage		-0.5	+6.5	V
I <sub>IK</sub>	input diode current	V <sub>I</sub> < 0	_	-50	mA
VI	input voltage	note 1	-0.5	+6.5	V
I <sub>OK</sub>	output diode current	$V_O > V_{CC}$ or $V_O < 0$	_	±50	mA
Vo	output voltage	enable mode; notes 1 and 2	-0.5	V <sub>CC</sub> + 0.5	V
		disable mode; notes 1 and 2	-0.5	+6.5	V
		Power-down mode; notes 1 and 2	-0.5	+6.5	V
Io	output source or sink current	$V_O = 0$ to $V_{CC}$	_	±50	mA
I <sub>CC</sub> , I <sub>GND</sub>	V <sub>CC</sub> or GND current		_	±100	mA
T <sub>stg</sub>	storage temperature		-65	+150	°C
P <sub>D</sub>	power dissipation per package	for temperature range from -40 to +125 °C	_	250	mW

#### **Notes**

- 1. The input and output voltage ratings may be exceeded if the input and output current ratings are observed.
- 2. When  $V_{CC} = 0 \text{ V}$  (Power-down mode), the output voltage can be 5.5 V in normal operation.

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### **DC CHARACTERISTICS**

At recommended operating conditions; voltages are referenced to GND (ground = 0 V).

SYMBOL	PARAMETER	TEST CONDITIONS		MAINI	TYP. <sup>(1)</sup>	MAY	LINIT	
STWIBUL	PARAMETER	OTHER	V <sub>CC</sub> (V)	MIN.	I YP.(1)	MAX.	UNIT	
T <sub>amb</sub> = -40	to +85 °C				•			
V <sub>IH</sub>	HIGH-level input		1.65 to 1.95	0.65 × V <sub>CC</sub>	_	_	V	
	voltage		2.3 to 2.7	1.7	_	_	V	
			2.7 to 3.6	2.0	_	_	V	
			4.5 to 5.5	$0.7 \times V_{CC}$	_	_	V	
V <sub>IL</sub>	LOW-level input		1.65 to 1.95	_	_	$0.35 \times V_{CC}$	V	
	voltage		2.3 to 2.7	_	_	0.7	V	
			2.7 to 3.6	_	_	0.8	V	
			4.5 to 5.5	_	_	$0.3 \times V_{CC}$	V	
V <sub>OL</sub>	LOW-level	$V_I = V_{IH}$ or $V_{IL}$						
	output voltage	I <sub>O</sub> = 100 μA	1.65 to 5.5	_	_	0.1	V	
		I <sub>O</sub> = 4 mA	1.65	_	_	0.45	V	
		I <sub>O</sub> = 8 mA	2.3	_	_	0.3	V	
		I <sub>O</sub> = 12 mA	2.7	_	_	0.4	V	
		I <sub>O</sub> = 24 mA	3.0	_	_	0.55	V	
		I <sub>O</sub> = 32 mA	4.5	_	_	0.55	V	
V <sub>OH</sub>	HIGH-level	$V_I = V_{IH}$ or $V_{IL}$						
	output voltage	$I_{O} = -100  \mu A$	1.65 to 5.5	V <sub>CC</sub> – 0.1	_	_	V	
		$I_O = -4 \text{ mA}$	1.65	1.2	_	_	V	
		$I_O = -8 \text{ mA}$	2.3	1.9	_	_	V	
		$I_0 = -12 \text{ mA}$	2.7	2.2	_	_	V	
		I <sub>O</sub> = -24 mA	3.0	2.7	_	_	V	
		$I_{O} = -32 \text{ mA}$	4.5	3.8	_	_	V	
I <sub>LI</sub>	input leakage current	$V_I = 5.5 \text{ V or GND}$	5.5	-	±0.1	±5	μΑ	
l <sub>OZ</sub>	3-state output OFF-state current	$V_I = V_{IH} \text{ or } V_{IL};$ $V_O = 5.5 \text{ V or GND}$	5.5	_	±0.1	±10	μΑ	
l <sub>off</sub>	power OFF leakage current	$V_I$ or $V_O = 5.5 \text{ V}$	0	-	±0.1	±10	μΑ	
lcc	quiescent supply current	$V_I = V_{CC}$ or GND; $I_O = 0$	5.5	-	0.1	10	μΑ	
Δl <sub>CC</sub>	additional quiescent supply current per pin	$V_I = V_{CC} - 0.6 \text{ V};$ $I_O = 0$	2.3 to 5.5	-	5	500	μА	

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SYMBOL	DADAMETER	TEST CONDITIONS			T)(D (1)		LINUT	
STWIBUL	PARAMETER	OTHER	V <sub>CC</sub> (V)	MIN.	TYP. <sup>(1)</sup>	MAX.	UNIT	
T <sub>amb</sub> = -40	to +125 °C		1		1	1		
V <sub>IH</sub>	HIGH-level input		1.65 to 1.95	0.65 × V <sub>CC</sub>	_	_	V	
	voltage		2.3 to 2.7	1.7	_	_	V	
			2.7 to 3.6	2.0	_	_	V	
			4.5 to 5.5	$0.7 \times V_{CC}$	_	_	V	
V <sub>IL</sub>	LOW-level input		1.65 to 1.95	_	_	$0.35 \times V_{CC}$	V	
	voltage		2.3 to 2.7	_	_	0.7	V	
			2.7 to 3.6	_	_	0.8	V	
			4.5 to 5.5	_	_	$0.3 \times V_{CC}$	V	
V <sub>OL</sub>	LOW-level	$V_I = V_{IH}$ or $V_{IL}$						
	output voltage	I <sub>O</sub> = 100 μA	1.65 to 5.5	_	_	0.1	V	
		$I_O = 4 \text{ mA}$	1.65	_	_	0.70	V	
		$I_O = 8 \text{ mA}$	2.3	_	_	0.45	V	
		I <sub>O</sub> = 12 mA	2.7	_	_	0.60	V	
		I <sub>O</sub> = 24 mA	3.0	_	_	0.80	V	
		I <sub>O</sub> = 32 mA	4.5	_	_	0.80	V	
V <sub>OH</sub>	HIGH-level	$V_I = V_{IH}$ or $V_{IL}$						
	output voltage	$I_{O} = -100  \mu A$	1.65 to 5.5	V <sub>CC</sub> – 0.1	_	_	V	
		$I_O = -4 \text{ mA}$	1.65	0.95	_	_	V	
		$I_O = -8 \text{ mA}$	2.3	1.7	_	_	V	
		I <sub>O</sub> = -12 mA	2.7	1.9	_	_	V	
		$I_{O} = -24 \text{ mA}$	3.0	2.0	_	_	V	
		$I_{O} = -32 \text{ mA}$	4.5	3.4	_	_	V	
l <sub>LI</sub>	input leakage current	$V_I = 5.5 \text{ V or GND}$	5.5	_	_	±100	μΑ	
l <sub>OZ</sub>	3-state output OFF-state current	$V_I = V_{IH} \text{ or } V_{IL};$ $V_O = 5.5 \text{ V or GND}$	5.5	_	_	±200	μΑ	
l <sub>off</sub>	power OFF leakage current	$V_I$ or $V_O = 5.5 \text{ V}$	0	-	_	±200	μΑ	
I <sub>CC</sub>	quiescent supply current	$V_I = V_{CC}$ or GND; $I_O = 0$	5.5	-	_	200	μΑ	
$\Delta I_{CC}$	additional quiescent supply current per pin	$V_I = V_{CC} - 0.6 \text{ V};$ $I_O = 0$	2.3 to 5.5	-	_	5000	μΑ	

### Note

1. All typical values are measured at  $V_{CC}$  = 3.3 V and  $T_{amb}$  = 25  $^{\circ}C.$ 

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### **AC CHARACTERISTICS**

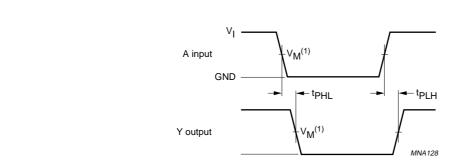
GND = 0 V;  $t_r = t_f \le 2.0$  ns.

OVMDOL	DADAMETED	TEST CONDITIONS		NAIN!	TVD	MAY	
SYMBOL	PARAMETER	WAVEFORMS	V <sub>CC</sub> (V)	MIN.	TYP.	MAX.	UNIT
T <sub>amb</sub> = -40	0 to +85 °C		1	-1	-1	-1	
t <sub>PHL</sub> /t <sub>PLH</sub>	propagation delay	see Figs 5 and 7	1.65 to 1.95	1.0	3.3	8.0	ns
	A, B to Y		2.3 to 2.7	0.5	2.2	5.5	ns
			2.7	0.5	2.5	5.5	ns
			3.0 to 3.6	0.5	2.1	4.5	ns
			4.5 to 5.5	0.5	1.7	4.0	ns
t <sub>PZH</sub> /t <sub>PZL</sub>	3-state output enable	see Figs 6 and 7	1.65 to 1.95	1.0	4.1	9.4	ns
	time input OE to Y		2.3 to 2.7	0.5	2.8	6.6	ns
			2.7	0.5	3.3	6.6	ns
			3.0 to 3.6	0.5	2.4	5.3	ns
			4.5 to 5.5	0.5	2.1	5.0	ns
t <sub>PHZ</sub> /t <sub>PLZ</sub>	3-state output disable	see Figs 6 and 7	1.65 to 1.95	1.0	4.3	9.2	ns
	time input OE to Y		2.3 to 2.7	0.5	2.7	5.0	ns
			2.7	0.5	3.0	5.0	ns
			3.0 to 3.6	0.5	3.1	5.0	ns
			4.5 to 5.5	0.5	2.2	4.2	ns
T <sub>amb</sub> = -40	0 to +125 °C		•	•		•	
t <sub>PHL</sub> /t <sub>PLH</sub>	propagation delay	see Figs 5 and 7	1.65 to 1.95	1.0	_	10.5	ns
	A, B to Y		2.3 to 2.7	0.5	_	7	ns
			2.7	0.5	_	7	ns
			3.0 to 3.6	0.5	_	6	ns
			4.5 to 5.5	0.5	_	5.5	ns
t <sub>PZH</sub> /t <sub>PZL</sub>	3-state output enable	see Figs 6 and 7	1.65 to 1.95	1.0	_	12	ns
	time input OE to Y		2.3 to 2.7	0.5	_	8.5	ns
			2.7	0.5	_	8.5	ns
			3.0 to 3.6	0.5	_	7	ns
			4.5 to 5.5	0.5	_	6.5	ns
t <sub>PHZ</sub> /t <sub>PLZ</sub>	3-state output disable	see Figs 6 and 7	1.65 to 1.95	1.0	_	12	ns
	time input OE to Y		2.3 to 2.7	0.5	_	6.5	ns
			2.7	0.5	_	6.5	ns
			3.0 to 3.6	0.5	_	6.5	ns
			4.5 to 5.5	0.5	_	5.5	ns

### Bus buffer/line driver; 3-state

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### **AC WAVEFORMS**



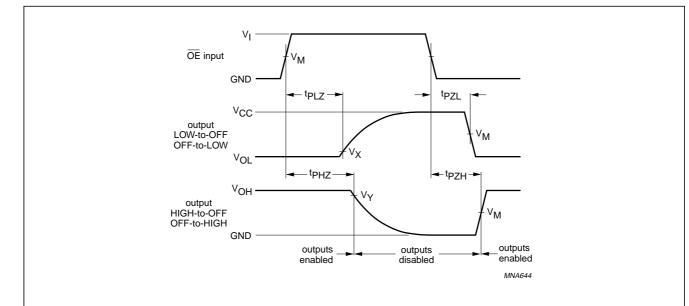
V <sub>CC</sub>	V <sub>M</sub>	INF	PUT	
▼CC	V M	VI	$t_r = t_f$	
1.65 to 1.95 V	$0.5 \times V_{CC}$	V <sub>CC</sub>	≤ 2.0 ns	
2.3 to 2.7 V	$0.5 \times V_{CC}$	V <sub>CC</sub>	≤ 2.0 ns	
2.7 V	1.5 V	2.7 V	≤ 2.5 ns	
3.0 to 3.6 V	1.5 V	2.7 V	≤ 2.5 ns	
4.5 to 5.5 V	$0.5 \times V_{CC}$	V <sub>CC</sub>	≤ 2.5 ns	

 $\rm V_{OL}$  and  $\rm V_{OH}$  are typical output voltage drop that occur with the output load.

Fig.5 Input A to output Y propagation delay times.

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V	V	INF	PUT
V <sub>CC</sub>	V <sub>M</sub>	VI	$t_r = t_f$
1.65 to 1.95 V	$0.5 \times V_{CC}$	V <sub>CC</sub>	≤ 2.0 ns
2.3 to 2.7 V	$0.5 \times V_{CC}$	$V_{CC}$	≤ 2.0 ns
2.7 V	1.5 V	2.7 V	≤ 2.5 ns
3.0 to 3.6 V	1.5 V	2.7 V	≤ 2.5 ns
4.5 to 5.5 V	$0.5 \times V_{CC}$	V <sub>CC</sub>	≤ 2.5 ns

 $V_X = V_{OL} + 0.3 \text{ V at } V_{CC} \ge 2.7 \text{ V};$ 

 $V_X = V_{OL} + 0.15 \text{ V at } V_{CC} < 2.7 \text{ V};$ 

 $V_Y = V_{OH} - 0.3 \text{ V at } V_{CC} \ge 2.7 \text{ V};$ 

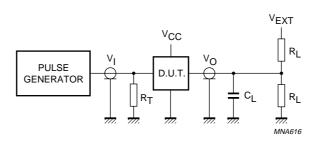
 $V_{Y}$  =  $V_{OH} - 0.15 \ V$  at  $V_{CC} < 2.7 \ V.$ 

 $\ensuremath{V_{\text{OL}}}$  and  $\ensuremath{V_{\text{OH}}}$  are typical output voltage drop that occur with the output load.

Fig.6 3-state enable and disable times.

### Bus buffer/line driver; 3-state

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V	V.	C.	C. B.		V <sub>EXT</sub>		
V <sub>CC</sub>	V <sub>I</sub>	CL	$R_L$	t <sub>PLH</sub> /t <sub>PHL</sub>	t <sub>PZH</sub> /t <sub>PHZ</sub>	t <sub>PZL</sub> /t <sub>PLZ</sub>	
1.65 to 1.95 V	V <sub>CC</sub>	30 pF	1 kΩ	open	GND	$2 \times V_{CC}$	
2.3 to 2.7 V	V <sub>CC</sub>	30 pF	500 Ω	open	GND	$2 \times V_{CC}$	
2.7 V	2.7 V	50 pF	500 Ω	open	GND	6 V	
3.0 to 3.6 V	2.7 V	50 pF	500 Ω	open	GND	6 V	
4.5 to 5.5 V	V <sub>CC</sub>	50 pF	500 Ω	open	GND	$2 \times V_{CC}$	

Definitions for test circuits:

R<sub>L</sub> = Load resistor.

 $C_L$  = Load capacitance including jig and probe capacitance.

 $R_{T}\!=\!Termination$  resistance should be equal to the output impedance  $Z_{o}$  of the pulse generator.

Fig.7 Load circuitry for switching times.

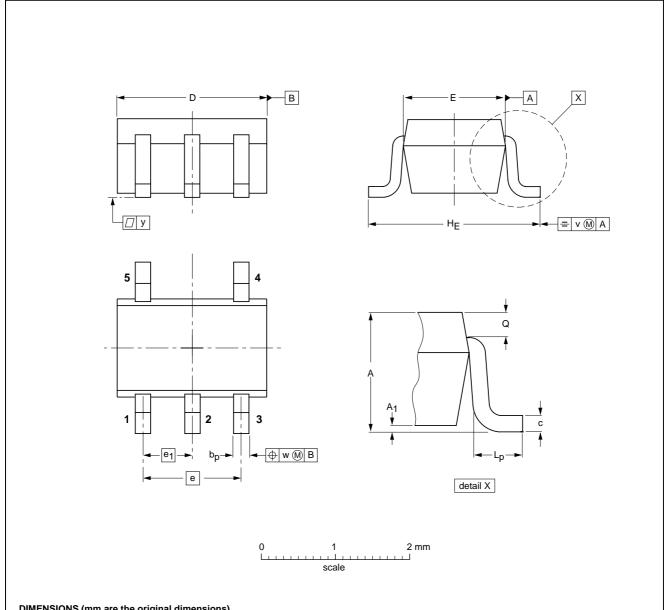
### Bus buffer/line driver; 3-state

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### **PACKAGE OUTLINES**

### Plastic surface mounted package; 5 leads

**SOT353** 



### **DIMENSIONS (mm are the original dimensions)**

UNIT	Α	A <sub>1</sub> max	bp	С	D	E <sup>(2)</sup>	е	e <sub>1</sub>	HE	Lp	Q	v	w	у
mm	1.1 0.8	0.1	0.30 0.20	0.25 0.10	2.2 1.8	1.35 1.15	1.3	0.65	2.2 2.0	0.45 0.15	0.25 0.15	0.2	0.2	0.1

OUTLINE		REFER	EUROPEAN	ISSUE DATE		
VERSION	IEC	JEDEC	EIAJ		PROJECTION	ISSUE DATE
SOT353			SC-88A			97-02-28

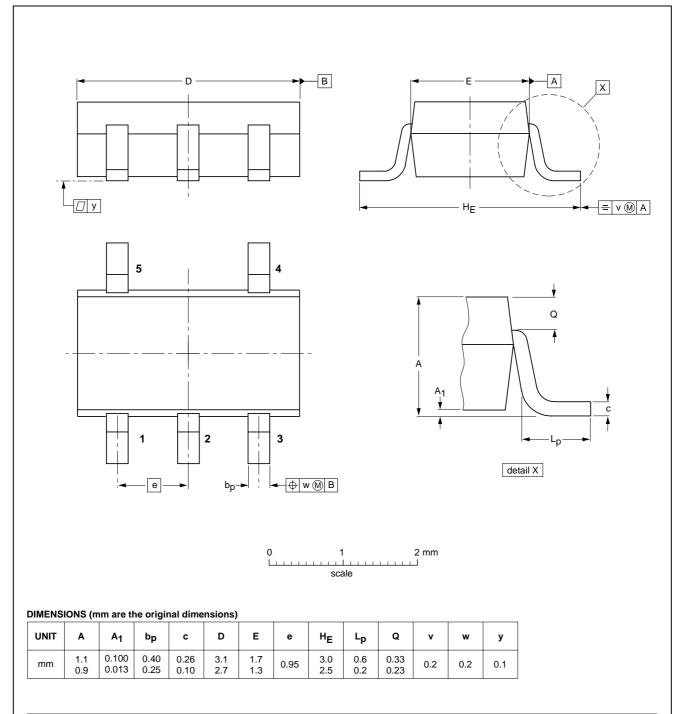
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### Bus buffer/line driver; 3-state

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### Plastic surface mounted package; 5 leads

**SOT753** 



OUTLINE		REFER	EUROPEAN	ISSUE DATE		
VERSION	IEC	JEDEC	JEITA		PROJECTION	ISSUE DATE
SOT753			SC-74A			02-04-16

### Bus buffer/line driver; 3-state

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#### **SOLDERING**

#### Introduction to soldering surface mount packages

This text gives a very brief insight to a complex technology. A more in-depth account of soldering ICs can be found in our "Data Handbook IC26; Integrated Circuit Packages" (document order number 9398 652 90011).

There is no soldering method that is ideal for all surface mount IC packages. Wave soldering can still be used for certain surface mount ICs, but it is not suitable for fine pitch SMDs. In these situations reflow soldering is recommended.

#### Reflow soldering

Reflow soldering requires solder paste (a suspension of fine solder particles, flux and binding agent) to be applied to the printed-circuit board by screen printing, stencilling or pressure-syringe dispensing before package placement.

Several methods exist for reflowing; for example, convection or convection/infrared heating in a conveyor type oven. Throughput times (preheating, soldering and cooling) vary between 100 and 200 seconds depending on heating method.

Typical reflow peak temperatures range from 215 to 250 °C. The top-surface temperature of the packages should preferable be kept below 220 °C for thick/large packages, and below 235 °C for small/thin packages.

#### Wave soldering

Conventional single wave soldering is not recommended for surface mount devices (SMDs) or printed-circuit boards with a high component density, as solder bridging and non-wetting can present major problems.

To overcome these problems the double-wave soldering method was specifically developed.

If wave soldering is used the following conditions must be observed for optimal results:

- Use a double-wave soldering method comprising a turbulent wave with high upward pressure followed by a smooth laminar wave.
- For packages with leads on two sides and a pitch (e):
  - larger than or equal to 1.27 mm, the footprint longitudinal axis is preferred to be parallel to the transport direction of the printed-circuit board;
  - smaller than 1.27 mm, the footprint longitudinal axis must be parallel to the transport direction of the printed-circuit board.

The footprint must incorporate solder thieves at the downstream end.

 For packages with leads on four sides, the footprint must be placed at a 45° angle to the transport direction of the printed-circuit board. The footprint must incorporate solder thieves downstream and at the side corners.

During placement and before soldering, the package must be fixed with a droplet of adhesive. The adhesive can be applied by screen printing, pin transfer or syringe dispensing. The package can be soldered after the adhesive is cured.

Typical dwell time is 4 seconds at 250 °C. A mildly-activated flux will eliminate the need for removal of corrosive residues in most applications.

#### Manual soldering

Fix the component by first soldering two diagonally-opposite end leads. Use a low voltage (24 V or less) soldering iron applied to the flat part of the lead. Contact time must be limited to 10 seconds at up to  $300\ ^{\circ}$ C.

When using a dedicated tool, all other leads can be soldered in one operation within 2 to 5 seconds between 270 and 320  $^{\circ}$ C.

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#### Suitability of surface mount IC packages for wave and reflow soldering methods

PACKAGE <sup>(1)</sup>	SOLDERING METHOD			
PACKAGE	WAVE	REFLOW <sup>(2)</sup>		
BGA, LBGA, LFBGA, SQFP, TFBGA, VFBGA	not suitable	suitable		
DHVQFN, HBCC, HBGA, HLQFP, HSQFP, HSOP, HTQFP, HTSSOP, HVQFN, HVSON, SMS	not suitable <sup>(3)</sup>	suitable		
PLCC <sup>(4)</sup> , SO, SOJ	suitable	suitable		
LQFP, QFP, TQFP	not recommended <sup>(4)(5)</sup>	suitable		
SSOP, TSSOP, VSO	not recommended <sup>(6)</sup>	suitable		

#### **Notes**

- 1. For more detailed information on the BGA packages refer to the "(LF)BGA Application Note" (AN01026); order a copy from your Philips Semiconductors sales office.
- 2. All surface mount (SMD) packages are moisture sensitive. Depending upon the moisture content, the maximum temperature (with respect to time) and body size of the package, there is a risk that internal or external package cracks may occur due to vaporization of the moisture in them (the so called popcorn effect). For details, refer to the Drypack information in the "Data Handbook IC26; Integrated Circuit Packages; Section: Packing Methods".
- 3. These packages are not suitable for wave soldering. On versions with the heatsink on the bottom side, the solder cannot penetrate between the printed-circuit board and the heatsink. On versions with the heatsink on the top side, the solder might be deposited on the heatsink surface.
- 4. If wave soldering is considered, then the package must be placed at a 45° angle to the solder wave direction. The package footprint must incorporate solder thieves downstream and at the side corners.
- 5. Wave soldering is suitable for LQFP, TQFP and QFP packages with a pitch (e) larger than 0.8 mm; it is definitely not suitable for packages with a pitch (e) equal to or smaller than 0.65 mm.
- 6. Wave soldering is suitable for SSOP and TSSOP packages with a pitch (e) equal to or larger than 0.65 mm; it is definitely not suitable for packages with a pitch (e) equal to or smaller than 0.5 mm.

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#### **DATA SHEET STATUS**

LEVEL	DATA SHEET STATUS <sup>(1)</sup>	PRODUCT STATUS <sup>(2)(3)</sup>	DEFINITION
I	Objective data	Development	This data sheet contains data from the objective specification for product development. Philips Semiconductors reserves the right to change the specification in any manner without notice.
II	Preliminary data	Qualification	This data sheet contains data from the preliminary specification. Supplementary data will be published at a later date. Philips Semiconductors reserves the right to change the specification without notice, in order to improve the design and supply the best possible product.
III	Product data	Production	This data sheet contains data from the product specification. Philips Semiconductors reserves the right to make changes at any time in order to improve the design, manufacturing and supply. Relevant changes will be communicated via a Customer Product/Process Change Notification (CPCN).

#### **Notes**

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- 2. The product status of the device(s) described in this data sheet may have changed since this data sheet was published. The latest information is available on the Internet at URL http://www.semiconductors.philips.com.
- 3. For data sheets describing multiple type numbers, the highest-level product status determines the data sheet status.

#### **DEFINITIONS**

**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 60134). 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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