DATA SHEET

74ALVC244
Octal buffer/line driver; 3-state

Preliminary specification
File under Integrated Circuits, IC24

2001 Oct 30

Philips
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FEATURES

- Wide supply voltage range of 1.65 to 3.6 V
- 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).
- 3.6 V tolerant inputs/outputs
- CMOS LOW power consumption
- Direct interface with TTL levels (2.7 to 3.6 V)
- Power-down mode
- Latch-up performance exceeds ≤ 250 mA
- ESD protection:
  - Human Body Model (HBM) (A 114-A) exceeds 2000 V
  - Machine Model (MM) (A 115-A) exceeds 200 V.

DESCRIPTION

The 74ALVC244 is a high-performance, low-power, low-voltage, Si-gate CMOS device and superior to most advanced CMOS compatible TTL families.

The 74ALVC244 is an octal non-inverting buffer/line driver with 3-state outputs. The 3-state outputs are controlled by the output enable inputs $1\overline{OE}$ and $2\overline{OE}$. A HIGH on $n\overline{OE}$ 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.

QUICK REFERENCE DATA

GND = 0 V; T_{amb} = 25 °C.

SYMBOL	PARAMETER	CONDITIONS	TYPICAL	UNIT
t_{PHL}/t_{PLH}	propagation delay inputs nA_n to output nY_n	V_{CC} = 1.8 V; C_L = 30 pF; R_L = 1 kΩ	–	ns
		V_{CC} = 2.5 V; C_L = 30 pF; R_L = 500 Ω	–	ns
		V_{CC} = 2.7 V; C_L = 50 pF; R_L = 500 Ω	–	ns
		V_{CC} = 3.3 V; C_L = 50 pF; R_L = 500 Ω	–	ns
C_I	input capacitance		3.5	pF
C_{PD}	power dissipation capacitance per buffer	V_{CC} = 3.3 V; notes 1 and 2	20	pF

Notes

1. C_{PD} is used to determine the dynamic power dissipation (P_D in μW).

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

   f_i = input frequency in MHz;

   f_o = output frequency in MHz;

   C_L = output load capacitance in pF;

   V_{CC} = supply voltage in Volts.
2. The condition is V_I = GND to V_{CC}.

FUNCTION TABLE

See note 1.

INPUT		OUTPUT
$n\overline{OE}$	nA_n	nY_n
L	L	L
L	H	H
H	X	Z

Note

1. H = HIGH voltage level;
   L = LOW voltage level;
   X = don’t care;
   Z = HIGH-impedance OFF-state.

ORDERING INFORMATION

TYPE NUMBER	PACKAGES			
	PINS	PACKAGE	MATERIAL	CODE
74ALVC244D	20	SO	plastic	SOT163-1
74ALVC244PW	20	TSSOP	plastic	SOT360-1

PINNING

PIN	SYMBOL	DESCRIPTION
1	$1\overline{OE}$	output enable input (active LOW)
2, 4, 6 and 8	$1A_0$ to $1A_3$	data inputs
3, 5, 7 and 9	$2Y_0$ to $2Y_3$	bus outputs
10	GND	ground (0 V)
11, 13, 15 and 17	$2A_3$ to $2A_0$	data inputs
12, 14, 16 and 18	$1Y_3$ to $1Y_0$	bus outputs
19	$2\overline{OE}$	output enable input (active LOW)
20	V_{CC}	supply voltage

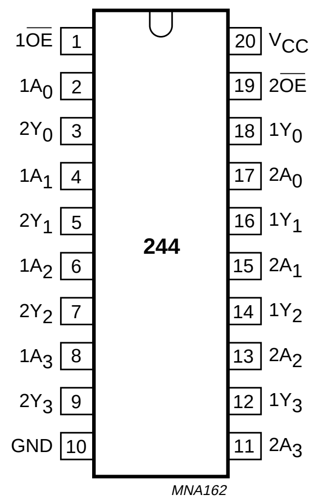


Fig.1 Pin configuration.

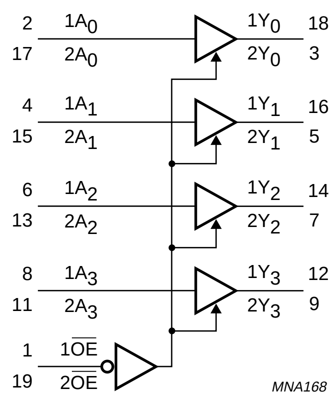


Fig.2 Logic symbol.

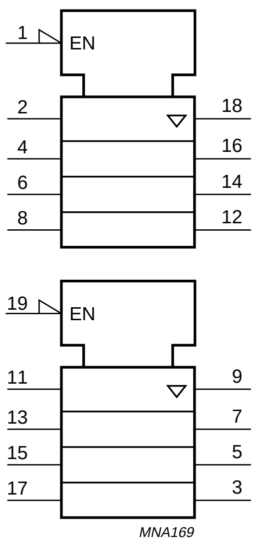


Fig.3 IEE/IEC logic symbol.

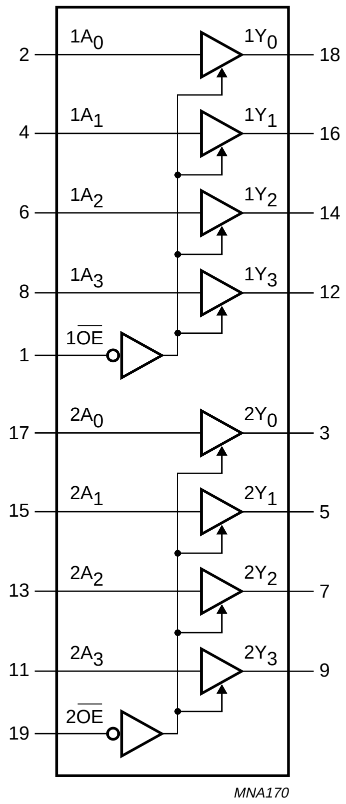


Fig.4 Logic diagram.

RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CC}	supply voltage		1.65	3.6	V
V_I	input voltage		0	3.6	V
V_O	output voltage	V_{CC} = 1.65 to 3.6 V; enable mode	0	V_{CC}	V
		V_{CC} = 1.65 to 3.6 V; disable mode	0	3.6	V
		V_{CC} = 0 V; Power-down mode	0	3.6	V
T_{amb}	operating ambient temperature		–40	+85	°C
t_r, t_f	input rise and fall times	V_{CC} = 1.65 to 2.7 V	0	20	ns/V
		V_{CC} = 2.7 to 3.6 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_{CC}	supply voltage		–0.5	+4.6	V
I_{IK}	input diode current	$V_I < 0$	–	–50	mA
V_I	input voltage		–0.5	+4.6	V
I_{OK}	output diode current	$V_O > V_{CC}$ or $V_O < 0$	–	±50	mA
V_O	output voltage	enable mode; notes 1 and 2	–0.5	V_{CC} + 0.5	V
		disable mode	–0.5	+4.6	V
		Power-down mode; note 2	–0.5	+4.6	V
I_O	output diode current	V_O = 0 to V_{CC}	–	±50	mA
I_{GND}, I_{CC}	V_{CC} or GND current		–	±100	mA
T_{stg}	storage temperature		–65	+150	°C
P_{tot}	power dissipation per package				
	SO package	above 70 °C derate linearly with 8 mW/K	–	500	mW
	TSSOP package	above 60 °C derate linearly with 5.5 mW/K	–	500	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 V (Power-down mode), the output voltage can be 3.6 V in normal operation.

DC CHARACTERISTICS

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

SYMBOL	PARAMETER	TEST CONDITIONS		T_{amb} (°C)			UNIT
		OTHER	V_{CC} (V)	–40 to +85			
				MIN.	TYP.[1]	MAX.	
V_{IH}	HIGH-level input voltage		1.65 to 1.95	$0.65 \times V_{CC}$	–	–	V
			2.3 to 2.7	1.7	–	–	V
			2.7 to 3.6	2	–	–	V
V_{IL}	LOW-level input voltage		1.65 to 1.95	–	–	$0.35 \times V_{CC}$	V
			2.3 to 2.7	–	–	0.7	V
			2.7 to 3.6	–	–	0.8	V
V_{OL}	LOW-level output voltage	$V_I = V_{IH}$ or V_{IL}; $I_O = 100\ \mu A$	1.65 to 3.6	–	–	0.2	V
		$V_I = V_{IH}$ or V_{IL}; $I_O = 6$ mA	1.65	–	–	0.3	V
		$V_I = V_{IH}$ or V_{IL}; $I_O = 12$ mA	2.3	–	–	0.4	V
		$V_I = V_{IH}$ or V_{IL}; $I_O = 18$ mA	2.3	–	–	0.6	V
		$V_I = V_{IH}$ or V_{IL}; $I_O = 12$ mA	2.7	–	–	0.4	V
		$V_I = V_{IH}$ or V_{IL}; $I_O = 18$ mA	3.0	–	–	0.4	V
		$V_I = V_{IH}$ or V_{IL}; $I_O = 24$ mA	3.0	–	–	0.55	V
V_{OH}	HIGH-level output voltage	$V_I = V_{IH}$ or V_{IL}; $I_O = -100\ \mu A$	1.65 to 3.6	$V_{CC} - 0.2$	–	–	V
		$V_I = V_{IH}$ or V_{IL}; $I_O = -6$ mA	1.65	1.25	–	–	V
		$V_I = V_{IH}$ or V_{IL}; $I_O = -12$ mA	2.3	1.8	–	–	V
		$V_I = V_{IH}$ or V_{IL}; $I_O = -18$ mA	2.3	1.7	–	–	V
		$V_I = V_{IH}$ or V_{IL}; $I_O = -12$ mA	2.7	2.2	–	–	V
		$V_I = V_{IH}$ or V_{IL}; $I_O = -18$ mA	3.0	2.4	–	–	V
		$V_I = V_{IH}$ or V_{IL}; $I_O = -24$ mA	3.0	2.2	–	–	V
I_I	input leakage current	$V_I = 3.6$ V or GND	3.6	–	±0.1	±5	μA
I_{OZ}	3-state output OFF-state current	$V_I = V_{IH}$ or V_{IL}; $V_O = 3.6$ V or GND; note 2	3.6	–	0.1	±10	μA
I_{off}	power OFF leakage current	V_I or $V_O = 3.6$ V	0.0	–	±0.1	±10	μA
I_{CC}	quiescent supply current	$V_I = V_{CC}$ or GND; $I_O = 0$	3.6	–	0.2	20	μA
ΔI_{CC}	additional quiescent supply current per input pin	$V_I = V_{CC} - 0.6$ V; $I_O = 0$	3.0 to 3.6	–	5	750	μA

Notes

1. All typical values are measured at $V_{CC} = 3.3$ V and $T_{amb} = 25$ °C.
2. For transceivers, the parameters I_{OZ} includes the input leakage current.

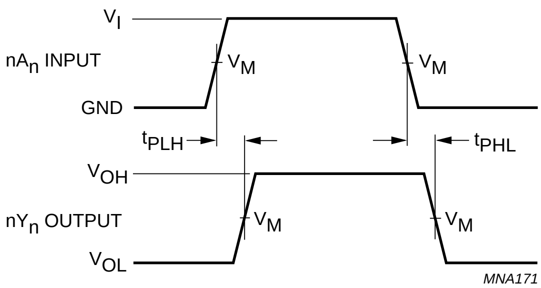
AC CHARACTERISTICS

SYMBOL	PARAMETER	TEST CONDITIONS		T_{amb} (°C)			UNIT
				–40 to +85			
		WAVEFORMS	V_{CC} (V)	MIN.	TYP.[1]	MAX.	
t_{PHL}/t_{PLH}	propagation delay input nA_n to output nY_n	see Figs 5 and 7	1.65 to 1.95	1.0	–	4.4	ns
			2.3 to 2.7	1.0	–	3.1	ns
			2.7	1.0	–	3.1	ns
			3.0 to 3.6	1.0	–	2.8	ns
t_{PZH}/t_{PZL}	3-state output enable time input $n\overline{OE}$ to output nY_n	see Figs 6 and 7	1.65 to 1.95	1.0	–	6.9	ns
			2.3 to 2.7	1.0	–	5.4	ns
			2.7	1.0	–	5.3	ns
			3.0 to 3.6	1.0	–	4.5	ns
t_{PHZ}/t_{PLZ}	3-state output disable time input $n\overline{OE}$ to output nY_n	see Figs 6 and 7	1.65 to 1.95	1.0	–	5.9	ns
			2.3 to 2.7	1.0	–	4.1	ns
			2.7	1.0	–	4.4	ns
			3.0 to 3.6	1.0	–	4.2	ns

Note

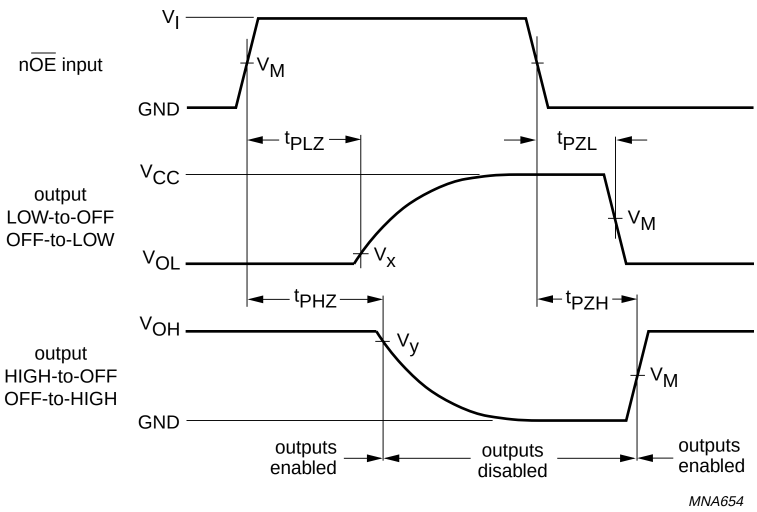
1. All typical values are measured at T_{amb} = 25 °C.

AC WAVEFORMS



V_{CC}	V_M	INPUT	
		V_I	$t_r = t_f$
1.65 to 1.95 V	0.5 × V_{CC}	V_{CC}	≤ 2.0 ns
2.3 to 2.7 V	0.5 × 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

Fig.5 Input nA_n to output nY_n propagation delay times.

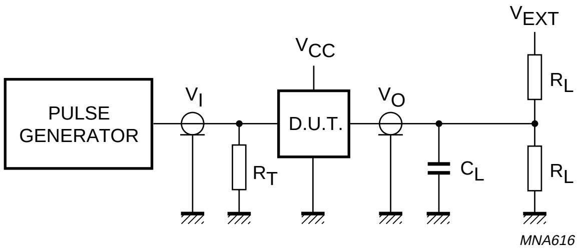


V_{CC}	V_M	INPUT	
		V_I	$t_r = t_f$
1.65 to 1.95 V	$0.5 \times V_{CC}$	V_{CC}	≤ 2.0 ns
2.3 to 2.7 V	$0.5 \times V_{CC}$	V_{CC}	≤ 2.0 ns
2.7 V	1.5 V	2.7 V	≤ 2.5 ns
3.0 to 3.6 V	1.5 V	2.7 V	≤ 2.5 ns

$V_X = V_{OL} + 0.3$ V at $V_{CC} \geq 2.7$ V;
$V_X = V_{OL} + 0.15$ V at $V_{CC} < 2.7$ V;
$V_Y = V_{OH} - 0.3$ V at $V_{CC} \geq 2.7$ V;
$V_Y = V_{OH} - 0.15$ V at $V_{CC} < 2.7$ V.

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

Fig.6 3-state enable and disable times.



V_{CC}	**V_I**	**C_L**	**R_L**	**V_{EXT}**		
				t_{PLH}/t_{PHL}	**t_{PZH}/t_{PHZ}**	**t_{PZL}/t_{PLZ}**
1.65 to 1.95 V	V_{CC}	30 pF	1 kΩ	open	GND	$2 \times V_{CC}$
2.3 to 2.7 V	V_{CC}	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

R_L = Load resistor.

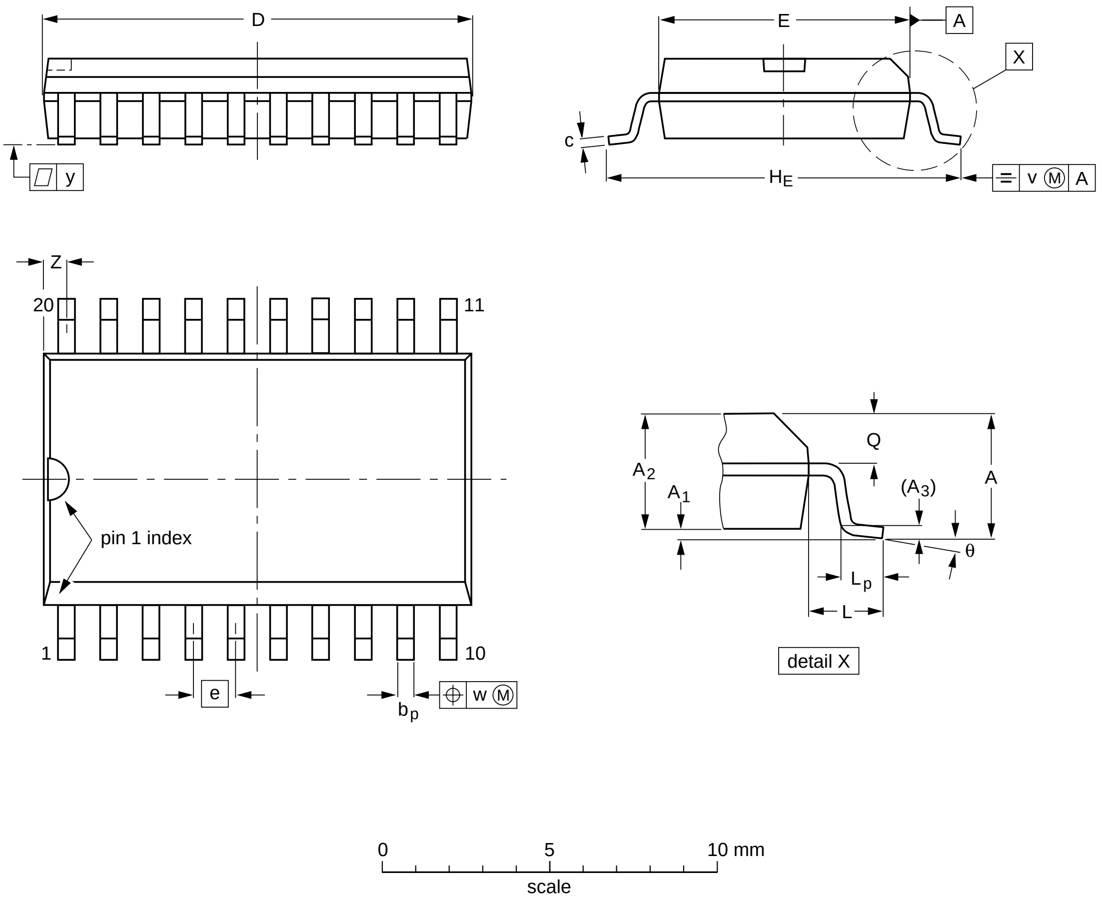
C_L = Load capacitance including jig and probe capacitance.

R_T = Termination resistance should be equal to the output impedance Z_o of the pulse generator.

Fig.7 Load circuitry for switching times.

PACKAGE OUTLINES

SO20: plastic small outline package; 20 leads; body width 7.5 mm SOT163-1



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

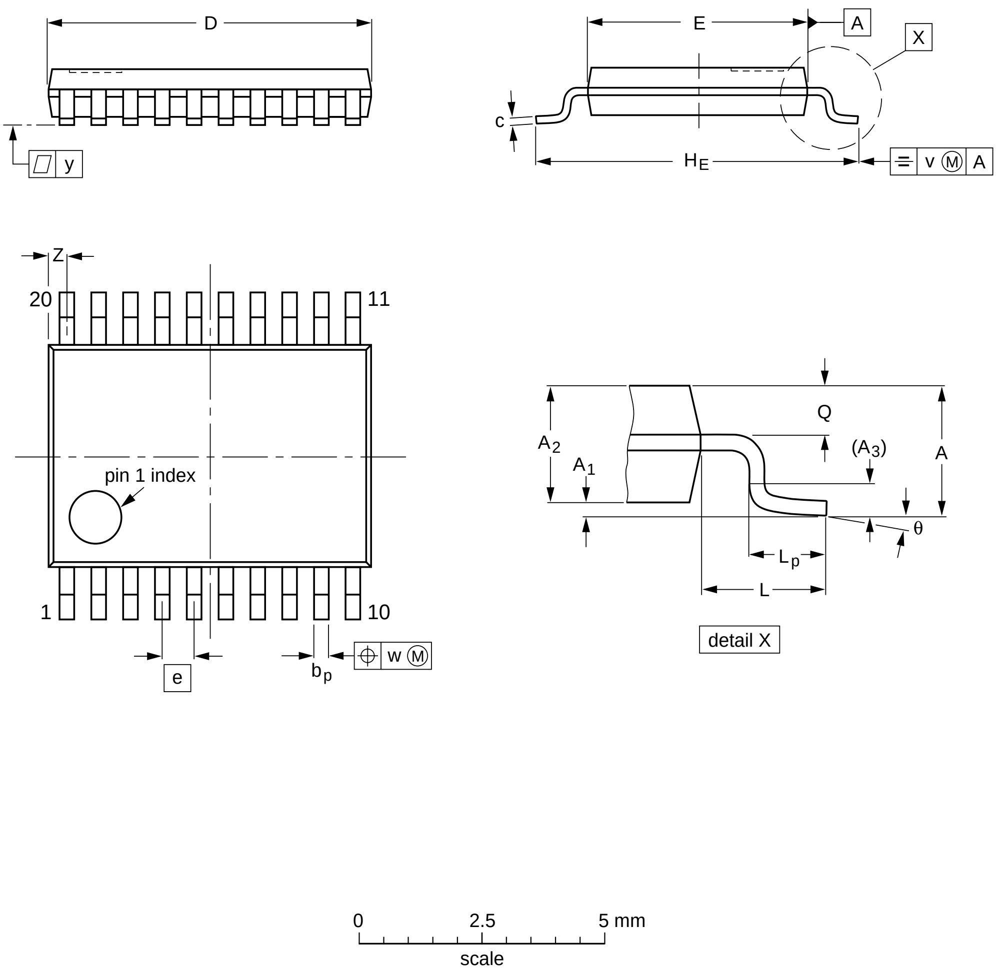
UNIT	A max.	A_1	A_2	A_3	b_p	c	D (1)	E (1)	e	H_E	L	L_p	Q	v	w	y	Z (1)	θ
mm	2.65	0.30 0.10	2.45 2.25	0.25	0.49 0.36	0.32 0.23	13.0 12.6	7.6 7.4	1.27	10.65 10.00	1.4	1.1 0.4	1.1 1.0	0.25	0.25	0.1	0.9 0.4	8° 0°
inches	0.10	0.012 0.004	0.096 0.089	0.01	0.019 0.014	0.013 0.009	0.51 0.49	0.30 0.29	0.050	0.419 0.394	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-013				~~97-05-22~~ 99-12-27

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_1	A_2	A_3	b_p	c	D (1)	E (2)	e	H_E	L	L_p	Q	v	w	y	Z (1)	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-153				~~95-02-04~~ 99-12-27

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 °C.

When using a dedicated tool, all other leads can be soldered in one operation within 2 to 5 seconds between 270 and 320 °C.

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

PACKAGE	SOLDERING METHOD	
	WAVE	REFLOW[1]
BGA, LFBGA, SQFP, TFBGA	not suitable	suitable
HBCC, HLQFP, HSQFP, HSOP, HTQFP, HTSSOP, SMS	not suitable[2]	suitable
PLCC[3], SO, SOJ	suitable	suitable
LQFP, QFP, TQFP	not recommended[3][4]	suitable
SSOP, TSSOP, VSO	not recommended[5]	suitable

Notes

1. 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"*.
2. These packages are not suitable for wave soldering as a solder joint between the printed-circuit board and heatsink (at bottom version) can not be achieved, and as solder may stick to the heatsink (on top version).
3. 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.
4. Wave soldering is only suitable for LQFP, TQFP and QFP packages with a pitch (e) equal to or larger than 0.8 mm; it is definitely not suitable for packages with a pitch (e) equal to or smaller than 0.65 mm.
5. Wave soldering is only 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.

DATA SHEET STATUS

DATA SHEET STATUS[(1)]	PRODUCT STATUS[(2)]	DEFINITIONS
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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.
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Notes

1. Please consult the most recently issued data sheet before initiating or completing a design.
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.

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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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