CBT3257A

Quad 1-of-2 multiplexer/demultiplexer

Rev. 01 — 27 October 2005 Product data sheet

1. General description

The CBT3257A is a quad 1-of-2 high-speed TTL-compatible multiplexer/demultiplexer. The low ON-state resistance of the switch allows inputs to be connected to outputs without adding propagation delay or generating additional ground bounce noise.

Output enable ($\overline{OE}$) and select-control (S) inputs select the appropriate nB1 and nB2 outputs for the nA input data.

The CBT3257A is characterized for operation from –40 °C to +85 °C.

2. Features

- 5 Ω switch connection between two ports
- TTL-compatible input levels
- Minimal propagation delay through the switch
- ESD protection exceeds 2000 V HBM per JESD22-A114, 200 V MM per JESD22-A115 and 1000 V CDM per JESD22-C101
- Latch-up testing is done to JEDEC standard JESD78 which exceeds 100 mA

3. Ordering information

Table 1: Ordering information

T_{amb} = –40 °C to +85 °C

Type number	Topside mark	Package		
		Name	Description	Version
CBT3257AD	CBT3257AD	SO16	plastic small outline package; 16 leads; body width 3.9 mm	SOT109-1
CBT3257ADB	C3257A	SSOP16	plastic shrink small outline package; 16 leads; body width 5.3 mm	SOT338-1
CBT3257ADS	CT3257A	SSOP16 [1]	plastic shrink small outline package; 16 leads; body width 3.9 mm; lead pitch 0.635 mm	SOT519-1
CBT3257APW	CBT3257A	TSSOP16	plastic thin shrink small outline package; 16 leads; body width 4.4 mm	SOT403-1

[1] Also known as QSOP16.

PHILIPS

4. Functional diagram

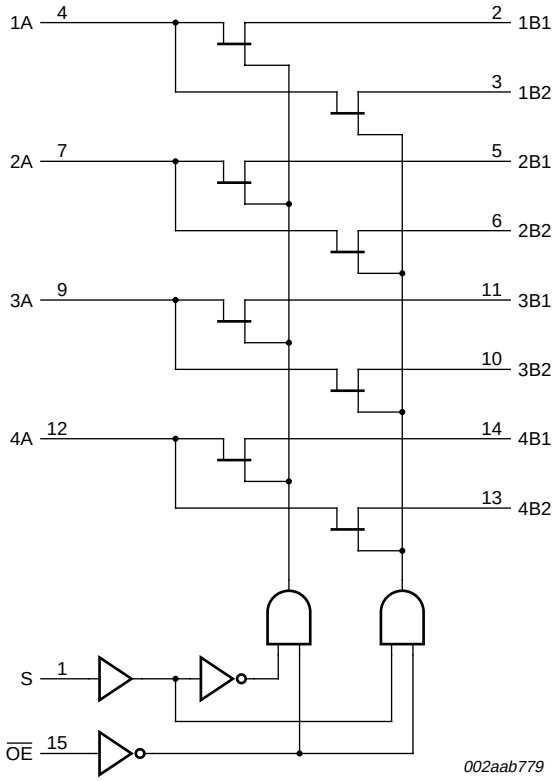


Fig 1. Logic diagram of CBT3257A (positive logic)

5. Pinning information

5.1 Pinning

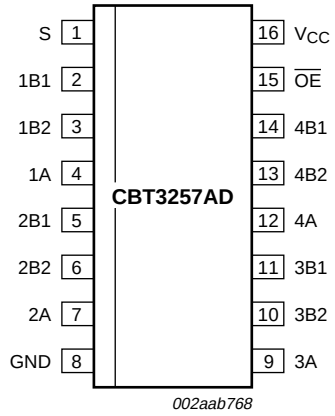


Fig 2. Pin configuration for SO16

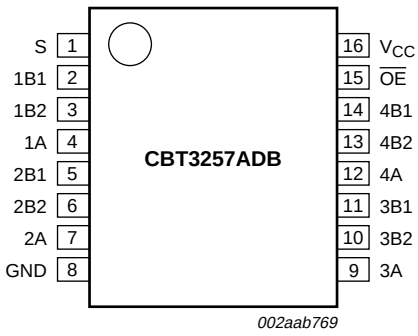


Fig 3. Pin configuration for SSOP16

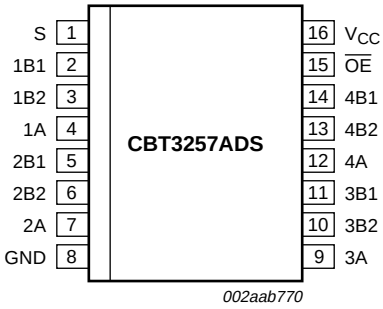


Fig 4. Pin configuration for SSOP16 (QSOP16)

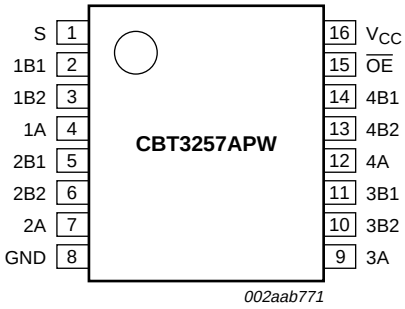


Fig 5. Pin configuration for TSSOP16

5.2 Pin description

Table 2: Pin description

Symbol	Pin	Description
S	1	select control input
1B1, 1B2, 2B1, 2B2, 3B1, 3B2, 4B1, 4B2	2, 3, 5, 6, 10, 11, 13, 14	B outputs [1]
1A, 2A, 3A, 4A	4, 7, 9, 12	A inputs
GND	8	ground (0 V)
$\overline{OE}$	15	output enable (active LOW)
V_{CC}	16	positive supply voltage

[1] B outputs are inputs if A inputs are outputs.

6. Functional description

Refer to Figure 1 “Logic diagram of CBT3257A (positive logic)”.

6.1 Function table

Table 3: Function selection

H = HIGH voltage level; L = LOW voltage level; X = Don’t care

Inputs		Function
$\overline{OE}$	S	
L	L	A port = B1 port
L	H	A port = B2 port
H	X	disconnect

7. Limiting values

Table 4: Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions		Min	Max	Unit
V_{CC}	supply voltage			–0.5	+7.0	V
V_I	input voltage		[1]	–0.5	+7.0	V
I_{CCC}	continuous current through each V_{CC} or GND pin			-	128	mA
I_{IK}	input clamping current	$V_I < 0$ V		-	–50	mA
T_{stg}	storage temperature			–65	+150	°C

[1] The input and output negative voltage ratings may be exceeded if the input and output clamp current ratings are observed.

8. Recommended operating conditions

Table 5: Operating conditions

All unused control inputs of the device must be held at V_{CC} or GND to ensure proper device operation.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{CC}	supply voltage		4.5	-	5.5	V
V_{IH}	HIGH-state input voltage		2.0	-	-	V
V_{IL}	LOW-state input voltage		-	-	0.8	V
T_{amb}	ambient temperature	operating in free-air	–40	-	+85	°C

9. Static characteristics

Table 6: Static characteristics

T_{amb} = –40 °C to +85 °C

Symbol	Parameter	Conditions		Min	Typ [1]	Max	Unit
V_{IK}	input clamping voltage	V_{CC} = 4.5 V; I_I = –18 mA		-	-	–1.2	V
V_{pass}	pass voltage	$V_I = V_{CC}$ = 5.0 V; I_O = –100 µA		3.4	3.6	3.9	V
I_{LI}	input leakage current	V_{CC} = 5.5 V; V_I = GND or 5.5 V		-	-	±1	µA
I_{CC}	quiescent supply current	V_{CC} = 5.5 V; I_O = 0 mA; $V_I = V_{CC}$ or GND		-	-	3	µA
ΔI_{CC}	additional quiescent supply current	per input; V_{CC} = 5.5 V; one input at 3.4 V, other inputs at V_{CC} or GND	[2]	-	-	2.5	mA
C_i	input capacitance (control pins)	V_I = 3 V or 0 V		-	3.3	-	pF
$C_{io(off)}$	off-state input/output capacitance	A port; V_O = 3 V or 0 V; $\overline{OE} = V_{CC}$		-	9.9	-	pF
		B port; V_O = 3 V or 0 V; $\overline{OE} = V_{CC}$		-	6.4	-	pF
R_{on}	ON-state resistance	V_{CC} = 4.5 V	[3]				
		V_I = 0 V; I_I = 64 mA		-	5	7	Ω
		V_I = 0 V; I_I = 30 mA		-	5	7	Ω
		V_I = 2.4 V; I_I = 15 mA		-	10	15	Ω

[1] All typical values are at V_{CC} = 5 V; T_{amb} = 25 °C.

[2] This is the increase in supply current for each input that is at the specified TTL voltage level rather than V_{CC} or GND.

[3] Measured by the voltage drop between the A and the B terminals at the indicated current through the switch. ON-state resistance is determined by the lowest voltage of the two (A or B) terminals.

10. Dynamic characteristics

Table 7: Dynamic characteristics

T_{amb} = –40 °C to +85 °C; V_{CC} = 5.0 V ± 0.5 V; C_L = 50 pF; unless otherwise specified.

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
t_{PD}	propagation delay	from nA input to nBn output, or from nBn input to nA output	[1]	-	-	0.25	ns
		from S input to nA output	[1]	1.6	-	5.0	ns
t_{en}	enable time	from $\overline{OE}$ input to nA or nBn output	[2]	1.8	-	5.1	ns
		from S input to nBn output	[2]	1.6	-	5.2	ns
t_{dis}	disable time	from $\overline{OE}$ input to nA or nBn output	[3]	2.2	-	5.5	ns
		from S input to nBn output	[3]	1.0	-	5.0	ns

[1] This parameter is warranted but not production tested. The propagation delay is based on the RC time constant of the typical ON-state resistance of the switch and a load capacitance, when driven by an ideal voltage source (zero output impedance).

[2] Output enable time to HIGH and LOW level.

[3] Output disable time from HIGH and LOW level.

10.1 AC waveforms

V_I = GND to 3.0 V.

t_{PLZ} and t_{PHZ} are the same as t_{dis}.

t_{PZL} and t_{PZH} are the same as t_{en}.

t_{PLH} and t_{PHL} are the same as t_{PD}.

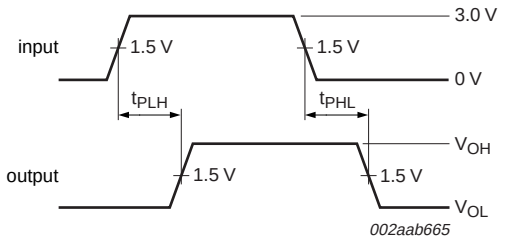
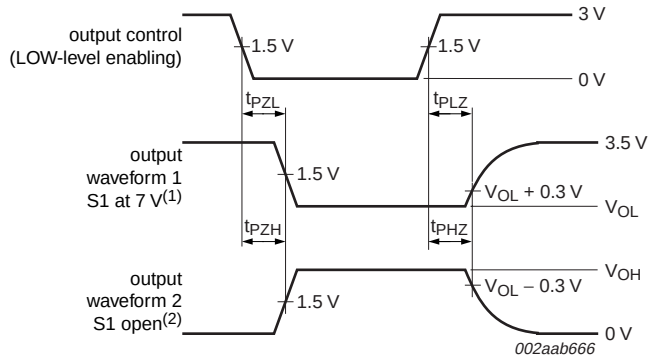


Fig 6. Input to output propagation delays

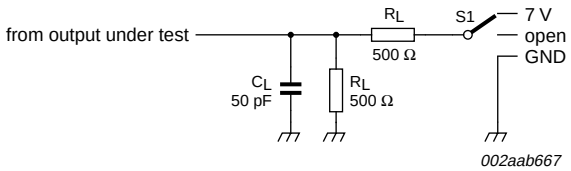


(1) Waveform 1 is for an output with internal conditions such that the output is LOW except when disabled by the output control.

(2) Waveform 2 is for an output with internal conditions such that the output is HIGH except when disabled by the output control.

Fig 7. 3-state output enable and disable times

11. Test information



Test data are given in Table 8.

All input pulses are supplied by generators having the following characteristics: PRR ≤ 10 MHz; Z_o = 50 Ω; t_r ≤ 2.5 ns; t_f ≤ 2.5 ns.

The outputs are measured one at a time with one transition per measurement.

C_L = load capacitance includes jig and probe capacitance.

R_L = load resistance.

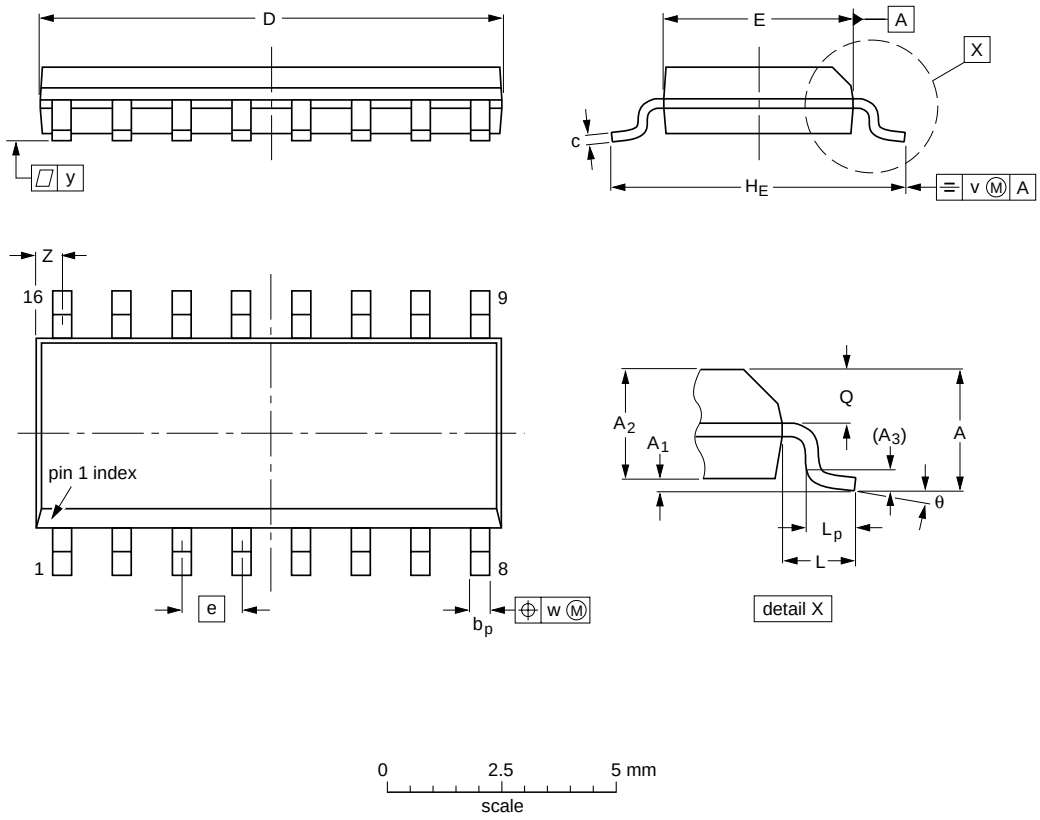
Fig 8. Test circuit

Table 8: Test data

Test	Load		Switch
	C_L	R_L	
t_{PD}	50 pF	500 Ω	open
t_{PLZ}, t_{PZL}	50 pF	500 Ω	7 V
t_{PHZ}, t_{PZH}	50 pF	500 Ω	open

12. Package outline

SO16: plastic small outline package; 16 leads; body width 3.9 mm **SOT109-1**



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	1.75	0.25 0.10	1.45 1.25	0.25	0.49 0.36	0.25 0.19	10.0 9.8	4.0 3.8	1.27	6.2 5.8	1.05	1.0 0.4	0.7 0.6	0.25	0.25	0.1	0.7 0.3	8^o 0^o
inches	0.069	0.010 0.004	0.057 0.049	0.01	0.019 0.014	0.0100 0.0075	0.39 0.38	0.16 0.15	0.05	0.244 0.228	0.041	0.039 0.016	0.028 0.020	0.01	0.01	0.004	0.028 0.012	

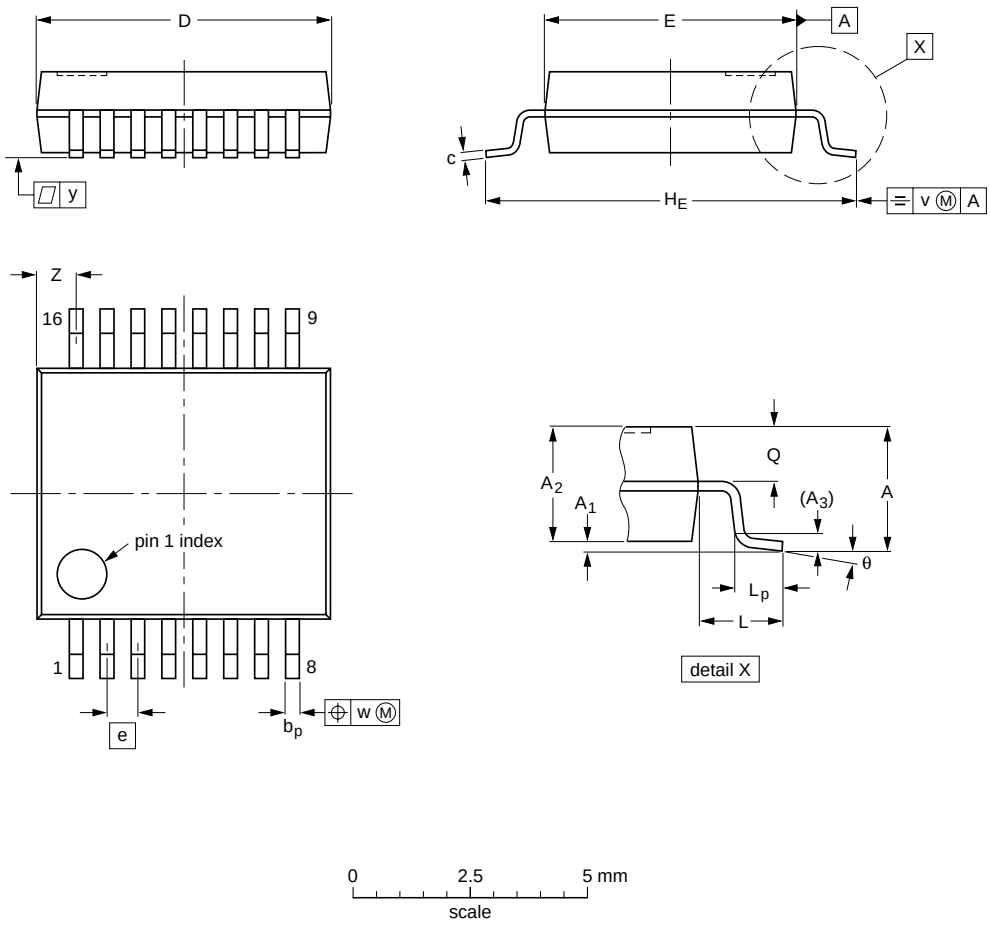
Note

1. Plastic or metal protrusions of 0.15 mm (0.006 inch) maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT109-1	076E07	MS-012				~~99-12-27~~ 03-02-19

Fig 9. Package outline SOT109-1 (SO16)

SSOP16: plastic shrink small outline package; 16 leads; body width 5.3 mm **SOT338-1**



DIMENSIONS (mm are the original 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	0.21 0.05	1.80 1.65	0.25	0.38 0.25	0.20 0.09	6.4 6.0	5.4 5.2	0.65	7.9 7.6	1.25	1.03 0.63	0.9 0.7	0.2	0.13	0.1	1.00 0.55	8^o 0^o

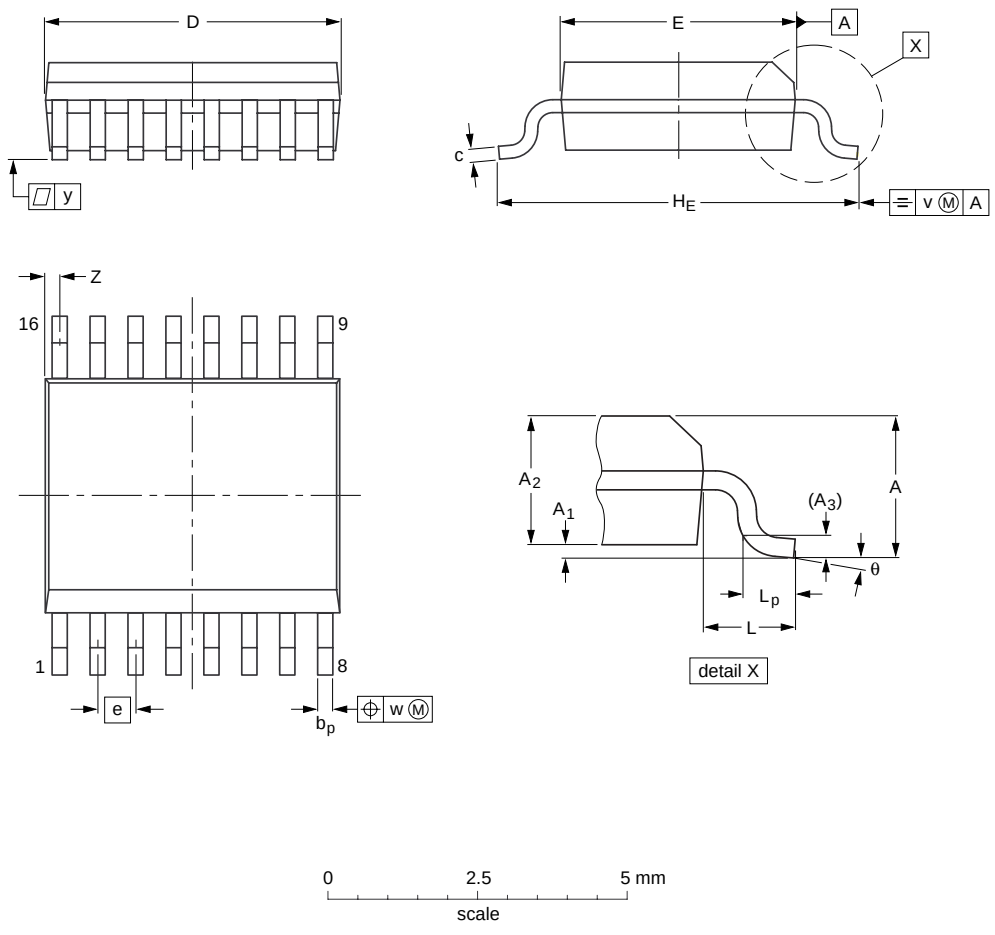
Note

1. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT338-1		MO-150				~~99-12-27~~ 03-02-19

Fig 10. Package outline SOT338-1 (SSOP16)

SSOP16: plastic shrink small outline package; 16 leads; body width 3.9 mm; lead pitch 0.635 mm **SOT519-1**



DIMENSIONS (mm are the original dimensions)

UNIT	A max.	A_1	A_2	A_3	b_p	c	D (1)	E (1)	e	H_E	L	L_p	v	w	y	Z (1)	θ
mm	1.73	0.25 0.10	1.55 1.40	0.25	0.31 0.20	0.25 0.18	5.0 4.8	4.0 3.8	0.635	6.2 5.8	1	0.89 0.41	0.2	0.18	0.09	0.18 0.05	8^o 0^o

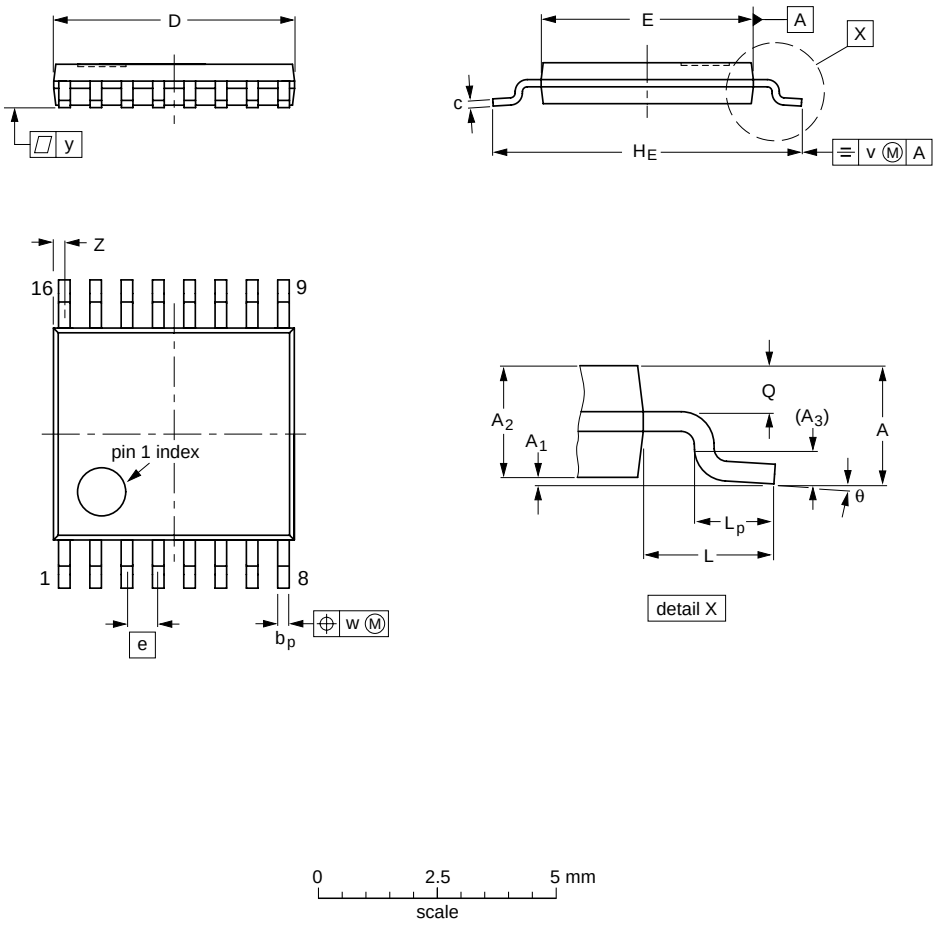
Note

1. Plastic or metal protrusions of 0.2 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT519-1						~~99-05-04~~ 03-02-18

Fig 11. Package outline SOT519-1 (SSOP16)

TSSOP16: plastic thin shrink small outline package; 16 leads; body width 4.4 mm **SOT403-1**



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	1.1	0.15 0.05	0.95 0.80	0.25	0.30 0.19	0.2 0.1	5.1 4.9	4.5 4.3	0.65	6.6 6.2	1	0.75 0.50	0.4 0.3	0.2	0.13	0.1	0.40 0.06	8^o 0^o

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	JEITA			
SOT403-1		MO-153				~~99-12-27~~ 03-02-18

Fig 12. Package outline SOT403-1 (TSSOP16)

13. Soldering

13.1 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.

13.2 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. Driven by legislation and environmental forces the worldwide use of lead-free solder pastes is increasing.

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 seconds and 200 seconds depending on heating method.

Typical reflow peak temperatures range from 215 °C to 270 °C depending on solder paste material. The top-surface temperature of the packages should preferably be kept:

- below 225 °C (SnPb process) or below 245 °C (Pb-free process)
  - for all BGA, HTSSON..T and SSOP..T packages
  - for packages with a thickness ≥ 2.5 mm
  - for packages with a thickness < 2.5 mm and a volume ≥ 350 mm^3 so called thick/large packages.
- below 240 °C (SnPb process) or below 260 °C (Pb-free process) for packages with a thickness < 2.5 mm and a volume < 350 mm^3 so called small/thin packages.

Moisture sensitivity precautions, as indicated on packing, must be respected at all times.

13.3 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 of the leads in the wave ranges from 3 seconds to 4 seconds at 250 °C or 265 °C, depending on solder material applied, SnPb or Pb-free respectively.

A mildly-activated flux will eliminate the need for removal of corrosive residues in most applications.

13.4 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 seconds to 5 seconds between 270 °C and 320 °C.

13.5 Package related soldering information

Table 9: Suitability of surface mount IC packages for wave and reflow soldering methods

Package [1]	Soldering method	
	Wave	Reflow [2]
BGA, HTSSON..T [3], LBGA, LFBGA, SQFP, SSOP..T [3], TFBGA, VFBGA, XSON	not suitable	suitable
DHVQFN, HBCC, HBGA, HLQFP, HSO, HSOP, HSQFP, HSSON, HTQFP, HTSSOP, HVQFN, HVSON, SMS	not suitable [4]	suitable
PLCC [5], SO, SOJ	suitable	suitable
LQFP, QFP, TQFP	not recommended [5] [6]	suitable
SSOP, TSSOP, VSO, VSSOP	not recommended [7]	suitable
CWQCCN..L [8], PMFP [9], WQCCN..L [8]	not suitable	not suitable

[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 transparent plastic packages are extremely sensitive to reflow soldering conditions and must on no account be processed through more than one soldering cycle or subjected to infrared reflow soldering with peak temperature exceeding 217 °C ± 10 °C measured in the atmosphere of the reflow oven. The package body peak temperature must be kept as low as possible.

[4] 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.

[5] 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.

[6] Wave soldering is suitable for LQFP, QFP and TQFP 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.

[7] Wave soldering is suitable for SSOP, TSSOP, VSO and VSSOP 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.

[8] Image sensor packages in principle should not be soldered. They are mounted in sockets or delivered pre-mounted on flex foil. However, the image sensor package can be mounted by the client on a flex foil by using a hot bar soldering process. The appropriate soldering profile can be provided on request.

[9] Hot bar soldering or manual soldering is suitable for PMFP packages.

14. Abbreviations

Table 10: Abbreviations

Acronym	Description
CDM	Charged Device Model
ESD	ElectroStatic Discharge
HBM	Human Body Model
MM	Machine Model
PRR	Pulse Rate Repetition
TTL	Transistor-Transistor Logic

15. Revision history

Table 11: Revision history

Document ID	Release date	Data sheet status	Change notice	Doc. number	Supersedes
CBT3257A_1	20051027	Product data sheet	-	9397 750 12921	-

16. Data sheet status

Level	Data sheet status [1]	Product status [2] [3]	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).

[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.

[3] For data sheets describing multiple type numbers, the highest-level product status determines the data sheet status.

17. 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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