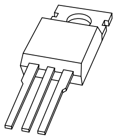


BUJ103A

Silicon diffused power transistor

Rev. 03 — 3 March 2005 **Product data sheet**

1. Product profile

1.1 General description

High-voltage, high-speed planar-passivated NPN power switching transistor in a SOT78 (TO-220AB) plastic package.

1.2 Features

- Low thermal resistance
- Fast switching

1.3 Applications

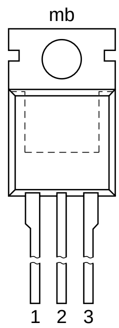
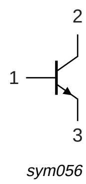
- Electronic lighting ballasts
- Inverters
- DC-to-DC converters
- Motor control systems

1.4 Quick reference data

- $V_{CESM} \leq 700$ V
- $P_{tot} \leq 80$ W
- $I_C \leq 4$ A
- $h_{FEsat} = 12.5$ (typ)

2. Pinning information

Table 1: Pinning

Pin	Description	Simplified outline	Symbol
1	base	 SOT78 (TO-220AB)	
2	collector		
3	emitter		
mb	mounting base; connected to collector		

3. Ordering information

Table 2: Ordering information

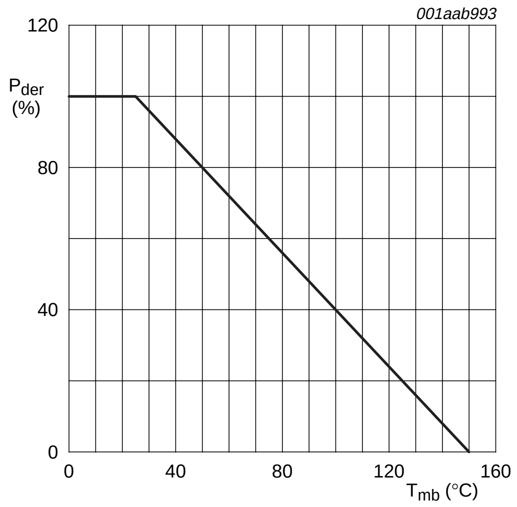
Type number	Package		
	Name	Description	Version
BUJ103A	TO-220AB	plastic single-ended package; heatsink mounted; 1 mounting hole; 3-leads	SOT78

4. Limiting values

Table 3: Limiting values

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

Symbol	Parameter	Conditions	Min	Max	Unit
V_{CESM}	peak collector-emitter voltage	V_{BE} = 0 V	-	700	V
V_{CBO}	collector-base voltage	open emitter	-	700	V
V_{CEO}	collector-emitter voltage	open base	-	400	V
I_C	collector current (DC)		-	4	A
I_{CM}	peak collector current		-	8	A
I_B	base current (DC)		-	2	A
I_{BM}	peak base current		-	4	A
P_{tot}	total power dissipation	$T_{mb} \leq 25$ °C; see Figure 1	-	80	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		-	150	°C



$$P_{der}(\%) = \frac{P_{tot}}{P_{tot(25\ °C)}} \times 100\%$$

Fig 1. Normalized total power dissipation as a function of mounting base temperature

5. Thermal characteristics

Table 4: Thermal characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-mb)}$	thermal resistance from junction to mounting base	see Figure 2	-	-	1.56	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	-	60	-	K/W

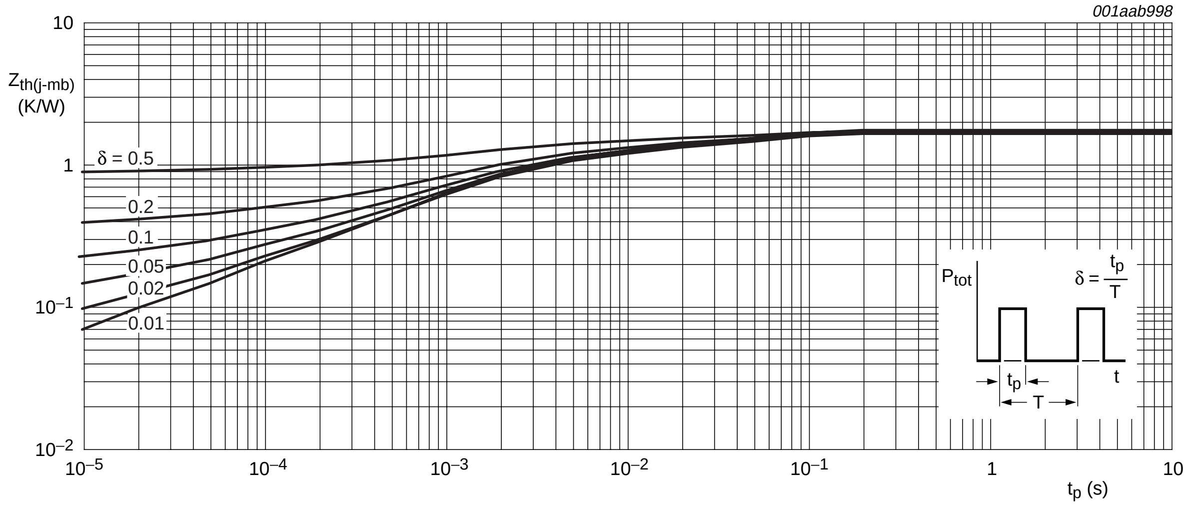


Fig 2. Transient thermal impedance from junction to mounting base as a function of pulse duration

6. Characteristics

Table 5: Characteristics

T_{mb} = 25 °C; unless otherwise specified.

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Static characteristics							
I_{CES}	collector-emitter cut-off current	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	[1]	-	-	1	mA
		V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$; T_j = 125 °C	[1]	-	-	2	mA
I_{CBO}	collector-base cut-off current	V_{BE} = 0 V; V_{CE} = $V_{CESMmax}$	[1]	-	-	1	mA
I_{CEO}	collector-emitter cut-off current	V_{CEO} = $V_{CEOMmax}$ = 400 V	[1]	-	-	0.1	mA
I_{EBO}	emitter-base cut-off current	V_{EB} = 7 V; I_C = 0 A		-	-	0.1	mA
V_{CEOsus}	collector-emitter sustaining voltage	I_B = 0 A; I_C = 10 mA; L = 25 mH; see Figure 3 and 4		400	-	-	V
V_{CEsat}	collector-emitter saturation voltage	I_C = 3.0 A; I_B = 0.6 A; see Figure 10		-	0.25	1	V
V_{BEsat}	base-emitter saturation voltage	I_C = 3.0 A; I_B = 0.6 A; see Figure 11		-	0.97	1.5	V
h_{FE}	DC current gain	I_C = 1 mA; V_{CE} = 5 V; see Figure 9		10	17	32	
		I_C = 500 mA; V_{CE} = 5 V		13	22	32	
h_{FEsat}	DC saturation current gain	I_C = 2.0 A; V_{CE} = 5 V		11	16	22	
		I_C = 3.0 A; V_{CE} = 5 V		-	12.5	-	
Dynamic characteristics							
Switching times (resistive load); see Figure 5 and 6							
t_{on}	turn-on time	I_{Con} = 2.5 A; I_{Bon} = $-I_{Boff}$ = 0.5 A; R_L = 75 Ω		-	0.52	0.6	µs
t_{stg}	storage time			-	2.7	3.3	µs
t_f	fall time			-	0.3	0.35	µs
Switching times (inductive load); see Figure 7 and 8							
t_{stg}	storage time	I_{Con} = 2 A; I_{Bon} = 0.4 A; L_B = 1 µH; V_{BB} = −5 V		-	1.2	1.4	µs
t_f	fall time			-	30	60	ns
Switching times (inductive load); see Figure 7 and 8							
t_{stg}	storage time	I_{Con} = 2 A; I_{Bon} = 0.4 A; L_B = 1 µH; V_{BB} = −5 V; T_j = 100 °C		-	-	1.8	µs
t_f	fall time			-	-	120	ns

[1] Measured with half sine-wave voltage (curve tracer).

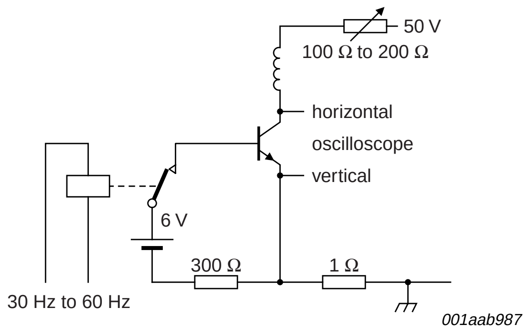


Fig 3. Test circuit for collector-emitter sustaining voltage

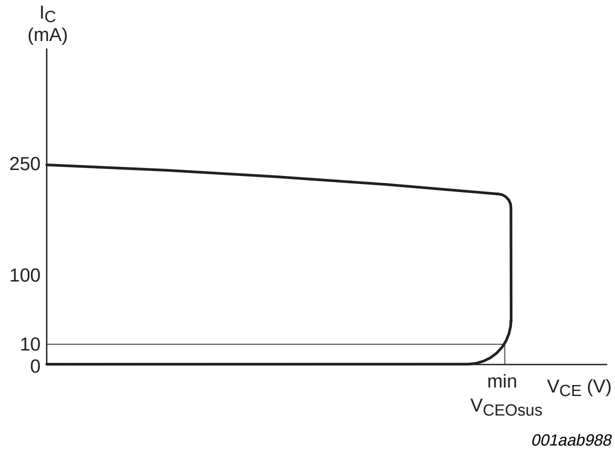
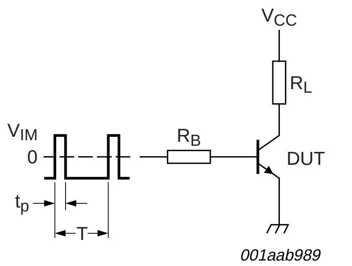


Fig 4. Oscilloscope display for collector-emitter sustaining voltage test waveform



V_{IM} = –6 V to +8 V; V_{CC} = 250 V; t_p = 20 µs;
$\delta = t_p/T = 0.01$.

R_B and R_L calculated from I_{Con} and I_{Bon} requirements.

Fig 5. Test circuit for resistive load switching

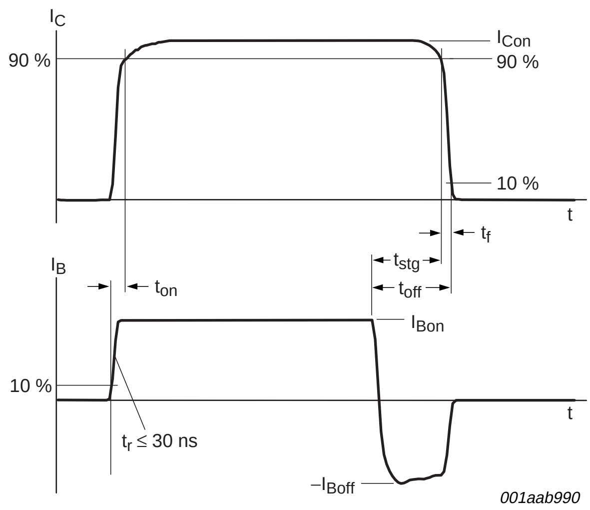
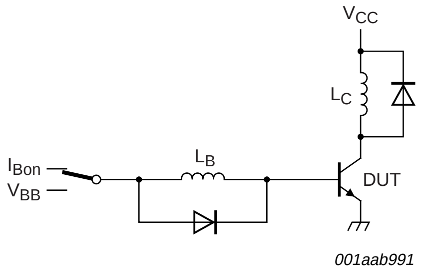


Fig 6. Switching times waveforms for resistive load



V_{CC} = 300 V; V_{BB} = –5 V; L_C = 200 µH; L_B = 1 µH.

Fig 7. Test circuit for inductive load switching

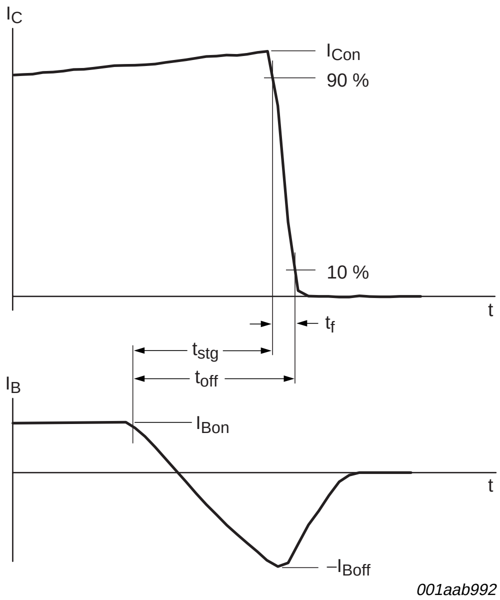


Fig 8. Switching times waveforms for inductive load

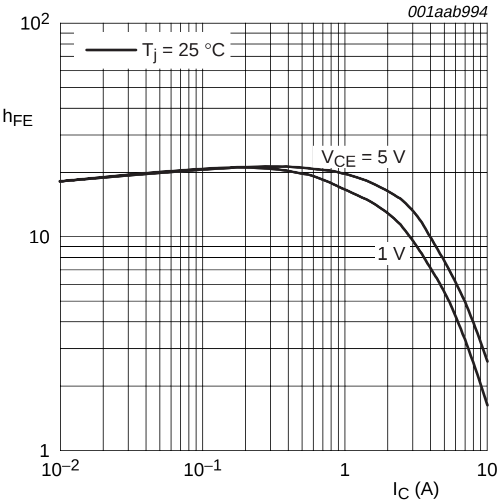
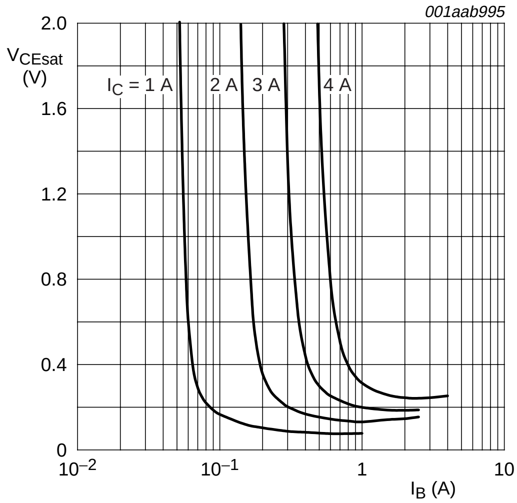
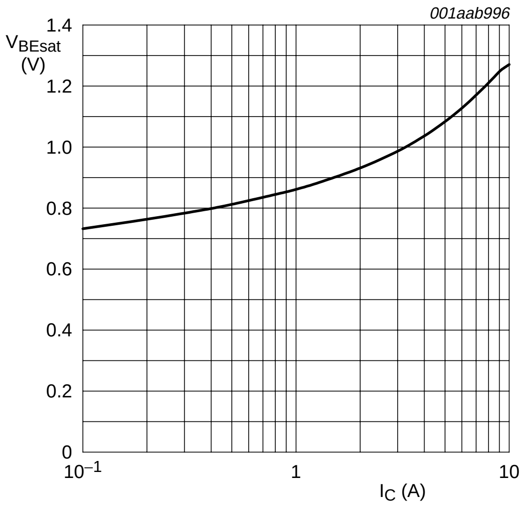


Fig 9. DC current gain as a function of collector current; typical values



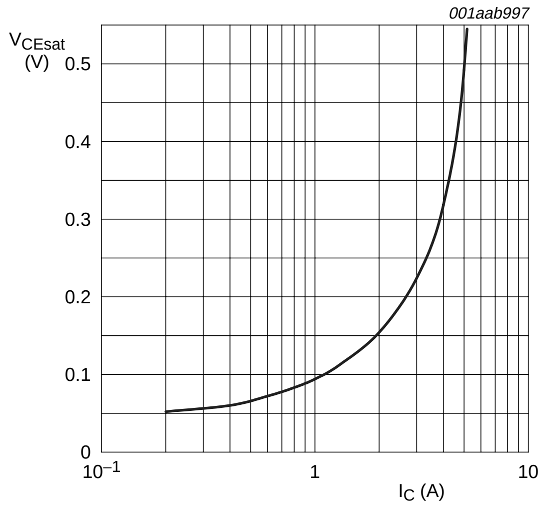
T_j = 25 °C.

Fig 10. Collector-emitter saturation voltage as a function of base current; typical values



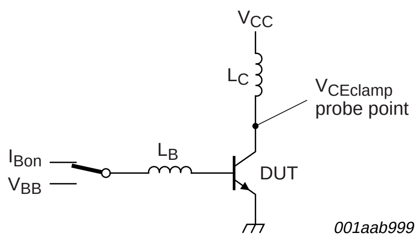
$I_C/I_B = 4$.

Fig 11. Base-emitter saturation voltage as a function of collector current; typical values



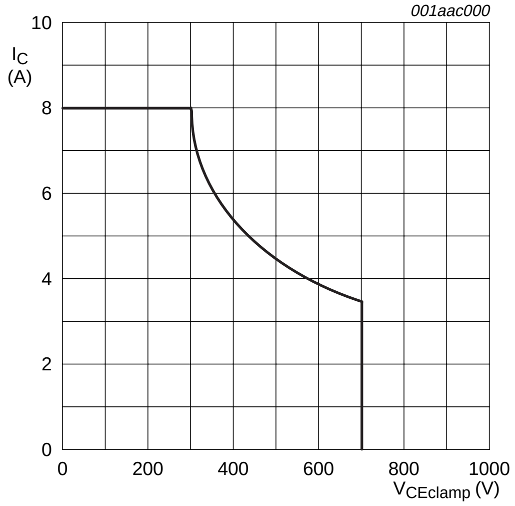
$I_C/I_B = 4$.

Fig 12. Collector-emitter saturation voltage as a function of collector current; typical values



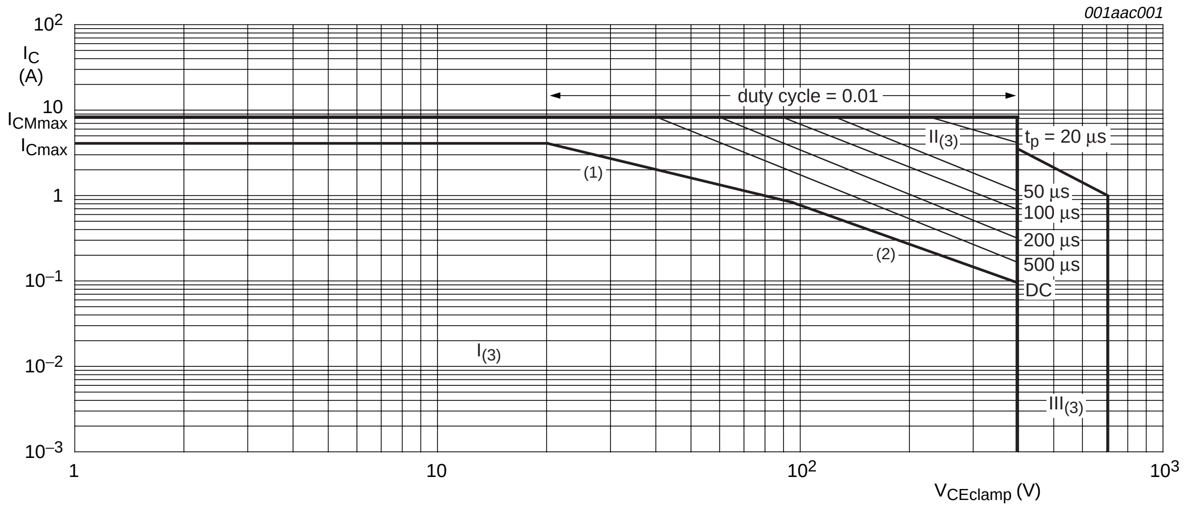
$V_{CEclamp} \leq 1000$ V; $V_{CC} = 150$ V; $V_{BB} = -5$ V;
$L_B = 1$ µH; $L_C = 200$ µH.

Fig 13. Test circuit for reverse bias safe operating area



$T_j \leq T_{j(max)}$.

Fig 14. Reverse bias safe operating area



$T_{mb} \leq 25$ °C; Mounted with heatsink compound and 30 ± 5 Newton force on the center of the envelope.

(1) P_{tot} maximum and P_{tot} peak maximum lines.

(2) Second breakdown limits.

(3) I = Region of permissible DC operation.

II = Extension for repetitive pulse operation.

III = Extension during turn-on in single transistor converters provided that $R_{BE} \leq 100\ \Omega$ and $t_p \leq 0.6$ µs.

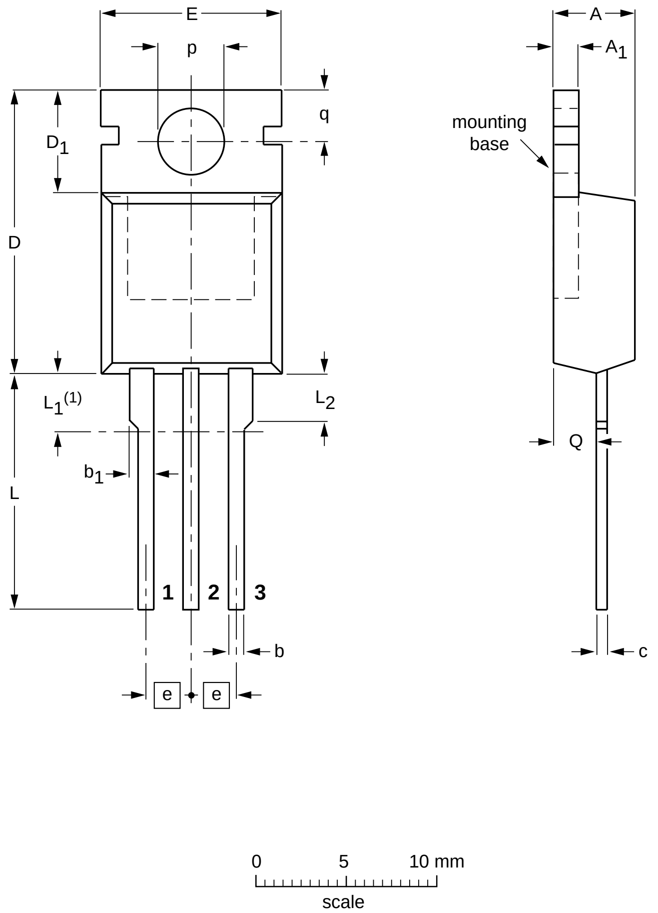
Fig 15. Forward bias safe operating area

7. Package information

Epoxy meets requirements of UL94 V-0 at ⅛ inch.

8. Package outline

Plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB **SOT78**



DIMENSIONS (mm are the original dimensions)

UNIT	A	A_1	b	b_1	c	D	D_1	E	e	L	$L_1^{(1)}$	L_2 max.	p	q	Q
mm	4.5 4.1	1.39 1.27	0.9 0.6	1.3 1.0	0.7 0.4	15.8 15.2	6.4 5.9	10.3 9.7	2.54	15.0 13.5	3.30 2.79	3.0	3.8 3.6	3.0 2.7	2.6 2.2

Note

1. Terminals in this zone are not tinned.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT78		3-lead TO-220AB	SC-46			~~01-02-16~~ 03-01-22

Fig 16. Package outline SOT78 (TO-220AB)

9. Revision history

Table 6: Revision history

Document ID	Release date	Data sheet status	Change notice	Doc. number	Supersedes
BUJ103A_3	20050303	Product data sheet	-	9397 750 14604	BUJ103A_HG_2
Modifications:	• The format of this data sheet has been redesigned to comply with the new presentation and information standard of Philips Semiconductors. • Section 1.4 "Quick reference data" t_f data revised. • Section 6 "Characteristics" h_{FE} data revised. • Section 6 "Characteristics" t_s and t_f data revised.				
BUJ103A_HG_2	19980918	Product data sheet	-	9397 750 04387	BUJ103A_1
BUJ103A_1	19980801	Product data sheet	-	-	-

10. 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.

11. 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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14. Contents

Date of release: 3 March 2005
Document number: 9397 750 14604

Published in The Netherlands