

## 1. General description

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

## 2. Features and benefits

- Low thermal resistance
- Fast switching

## 3. Applications

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

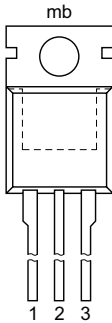
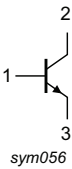
## 4. Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Values				Unit
Absolute maximum rating							
V <sub>CESM</sub>	peak collector-emitter voltage	V <sub>BE</sub> = 0 V	700				V
I <sub>C</sub>	collector current (DC)		4				A
P <sub>tot</sub>	total power dissipation	T <sub>mb</sub> ≤ 25 °C; <a href="#">Fig. 1</a>	80				W
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Static characteristics							
h <sub>FE</sub>	DC current gain	I <sub>C</sub> = 1 A; V <sub>CE</sub> = 5 V; T <sub>mb</sub> = 25 °C; <a href="#">Fig. 9</a>		10	17	32	
		I <sub>C</sub> = 500 mA; V <sub>CE</sub> = 5 V; T <sub>mb</sub> = 25 °C		13	22	32	

5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	B	base		
2	C	collector		
3	E	emitter		
mb	C	mounting base; connected to collector		

6. Ordering information

Table 3. Ordering information

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

7. Marking

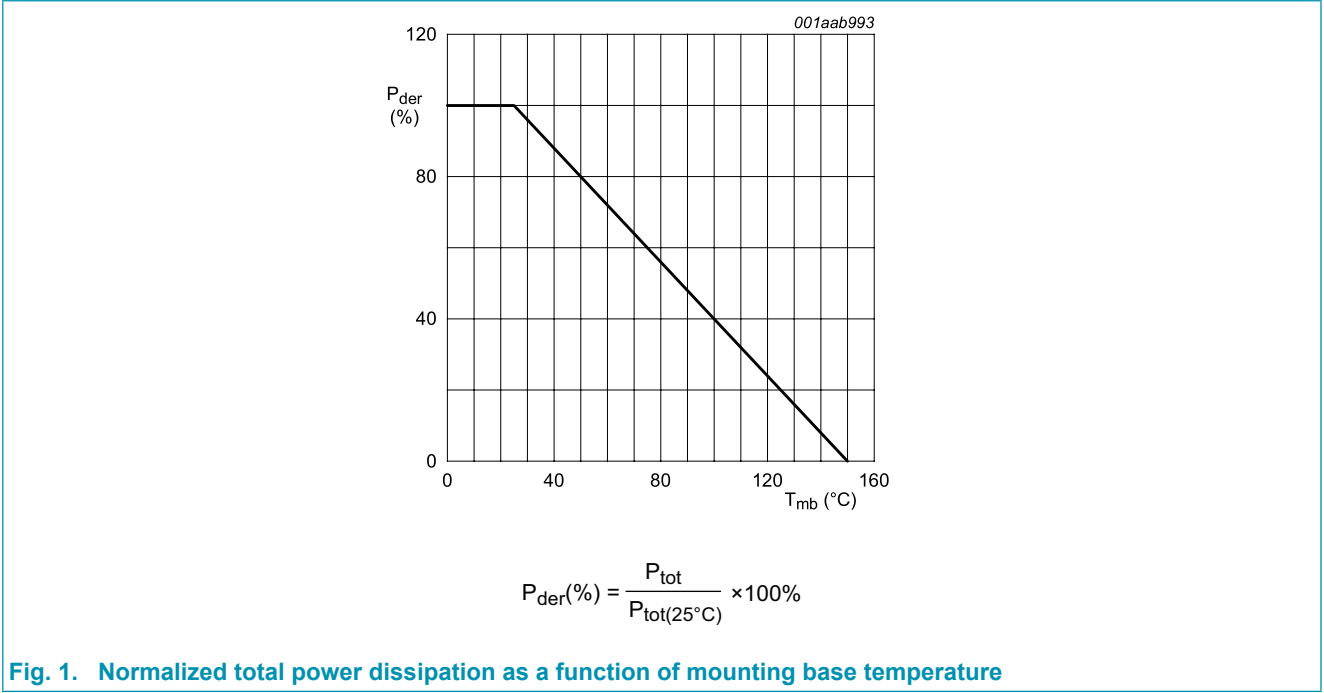
Table 4. Marking codes

Type number	Marking codes
BUJ103A	BUJ103A

8. Limiting values

Table 5. Limiting values  
In accordance with the Absolute Maximum Rating System (IEC 60134).

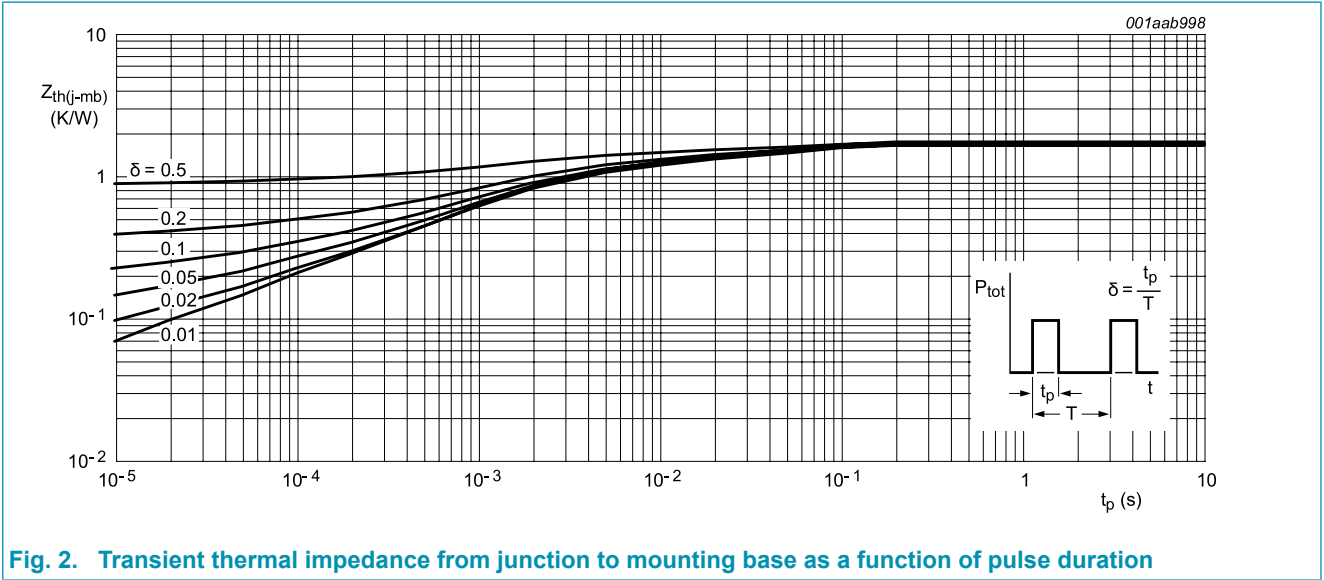
Symbol	Parameter	Conditions	Values	Unit
$V_{CESM}$	peak collector-emitter voltage	$V_{BE} = 0\text{ V}$	700	V
$V_{CBO}$	collector-base voltage	open emitter	700	V
$V_{CEO}$	collector-emitter voltage	open base	400	V
$I_C$	collector current (DC)		4	A
$I_{CM}$	peak collector current		8	A
$I_B$	base current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



9. Thermal characteristics

Table 6. Thermal characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-mb)}$	thermal resistance from junction to mounting base	<a href="#">Fig. 2</a>	-	-	1.56	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	-	60	-	K/W



## 10. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Static characteristics							
I <sub>CES</sub>	collector-emitter cut-off current	V <sub>BE</sub> = 0 V; V <sub>CE</sub> = V <sub>CESMmax</sub> ; T <sub>mb</sub> = 25 °C; [1]		-	-	1	mA
		V <sub>BE</sub> = 0 V; V <sub>CE</sub> = V <sub>CESMmax</sub> ; T <sub>j</sub> = 125 °C; [1]		-	-	2	mA
I <sub>CBO</sub>	collector-base cut-off current	V <sub>BE</sub> = 0 V; V <sub>CE</sub> = V <sub>CESMmax</sub> ; T <sub>mb</sub> = 25 °C; [1]		-	-	1	mA
I <sub>CEO</sub>	collector-emitter cut-off current	V <sub>CEO</sub> = V <sub>CEOMmax</sub> = 400 V; T <sub>mb</sub> = 25 °C; [1]		-	-	0.1	mA
I <sub>EBO</sub>	emitter-base cut-off current	V <sub>EB</sub> = 7 V; I <sub>C</sub> = 0 A; T <sub>mb</sub> = 25 °C		-	-	0.1	mA
V <sub>CEOsus</sub>	collector-emitter sustaining voltage	I <sub>B</sub> = 0 A; I <sub>C</sub> = 10 mA; L = 25 mH; T <sub>mb</sub> = 25 °C; Fig. 3; Fig. 4		400	-	-	V
V <sub>CEsat</sub>	collector-emitter saturation voltage	I <sub>C</sub> = 3.0 A; I <sub>B</sub> = 0.6 A; T <sub>mb</sub> = 25 °C; Fig. 10		-	0.25	1	V
V <sub>BEsat</sub>	base-emitter saturation voltage	I <sub>C</sub> = 3.0 A; I <sub>B</sub> = 0.6 A; T <sub>mb</sub> = 25 °C; Fig. 11		-	0.97	1.5	V
h <sub>FE</sub>	DC current gain	I <sub>C</sub> = 1 mA; V <sub>CE</sub> = 5 V; T <sub>mb</sub> = 25 °C; Fig. 9		10	17	32	
		I <sub>C</sub> = 500 mA; V <sub>CE</sub> = 5 V; T <sub>mb</sub> = 25 °C		13	22	32	
h <sub>FEsat</sub>	DC saturation current gain	I <sub>C</sub> = 2.0 A; V <sub>CE</sub> = 5 V; T <sub>mb</sub> = 25 °C		11	16	22	
		I <sub>C</sub> = 3.0 A; V <sub>CE</sub> = 5 V; T <sub>mb</sub> = 25 °C		-	12.5	-	
Dynamic characteristics							
Switching times (resistive load); Fig. 5; Fig. 6							
t <sub>on</sub>	turn-on time	I <sub>Con</sub> = 2.5 A; I <sub>Bon</sub> = -I <sub>Boff</sub> = 0.5 A; R <sub>L</sub> = 75 Ω; T <sub>mb</sub> = 25 °C		-	0.52	0.6	μs
t <sub>stg</sub>	storage time	I <sub>Con</sub> = 2.5 A; I <sub>Bon</sub> = -I <sub>Boff</sub> = 0.5 A; R <sub>L</sub> = 75 Ω; T <sub>mb</sub> = 25 °C		-	2.7	3.3	μs
t <sub>f</sub>	fall time	I <sub>Con</sub> = 2.5 A; I <sub>Bon</sub> = -I <sub>Boff</sub> = 0.5 A; R <sub>L</sub> = 75 Ω; T <sub>mb</sub> = 25 °C		-	0.3	0.35	μs
Switching times (inductive load); Fig. 7; Fig. 8							
t <sub>stg</sub>	storage time	I <sub>Con</sub> = 2 A; I <sub>Bon</sub> = 0.4 A; L <sub>B</sub> = 1 μH; V <sub>BB</sub> = -5 V; T <sub>mb</sub> = 25 °C		-	1.2	1.4	μs
t <sub>f</sub>	fall time	I <sub>Con</sub> = 2 A; I <sub>Bon</sub> = 0.4 A; L <sub>B</sub> = 1 μH; V <sub>BB</sub> = -5 V; T <sub>mb</sub> = 25 °C		-	30	60	ns
Switching times (inductive load); Fig. 7; Fig. 8							
t <sub>stg</sub>	storage time	I <sub>Con</sub> = 2 A; I <sub>Bon</sub> = 0.4 A; L <sub>B</sub> = 1 μH; V <sub>BB</sub> = -5 V; T <sub>j</sub> = 100 °C; T <sub>mb</sub> = 25 °C		-	-	1.8	μs
t <sub>f</sub>	fall time	I <sub>Con</sub> = 2 A; I <sub>Bon</sub> = 0.4 A; L <sub>B</sub> = 1 μH; V <sub>BB</sub> = -5 V; T <sub>i</sub> = 100 °C; T <sub>mb</sub> = 25 °C		-	-	120	ns

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

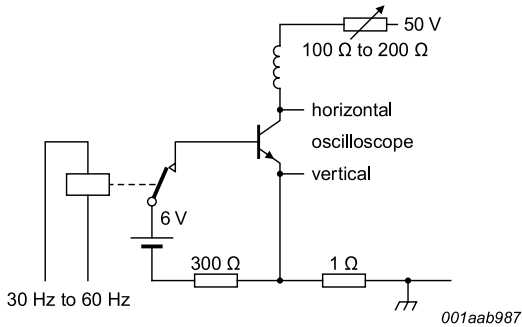


Fig. 3. Test circuit for collector-emitter sustaining voltage

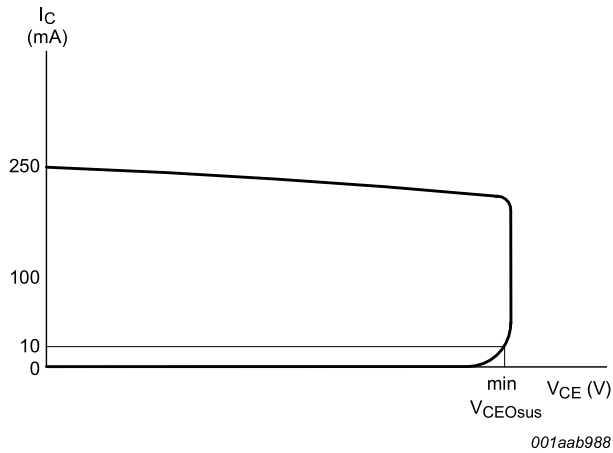
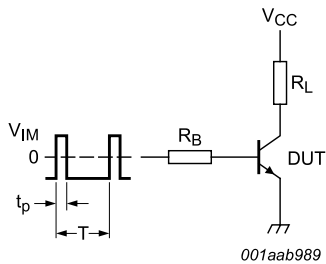


Fig. 4. Oscilloscope display for collector-emitter sustaining voltage test waveform



$V_{IM} = -6\text{ V to }+8\text{ V}$ ;  $V_{CC} = 250\text{ V}$ ;  $t_p = 20\text{ }\mu\text{s}$ ;  
 $\delta = t_p / T = 0.01$   
 $R_B$  and  $R_L$  calculated from  $I_{Con}$  and  $I_{Bon}$  requirements

Fig. 5. Test circuit for resistive load switching

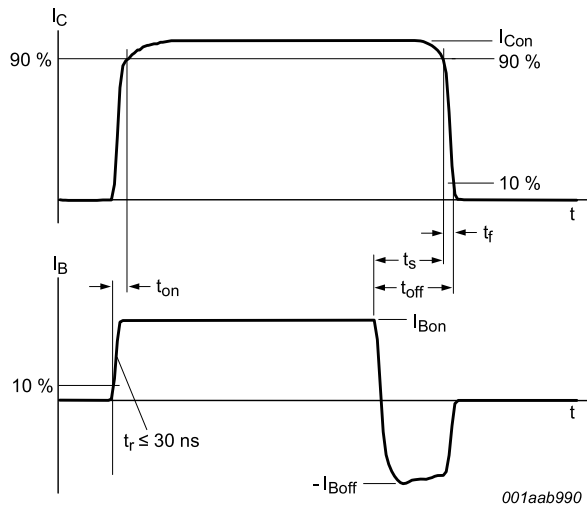
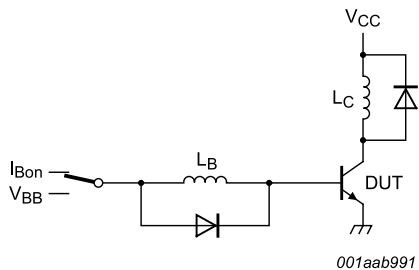


Fig. 6. Switching times waveforms for resistive load



$V_{CC} = 300\text{ V}$ ;  $V_{BB} = -5\text{ V}$ ;  $L_C = 200\text{ }\mu\text{H}$ ;  $L_B = 1\text{ }\mu\text{H}$ .

Fig. 7. Test circuit for inductive load switching

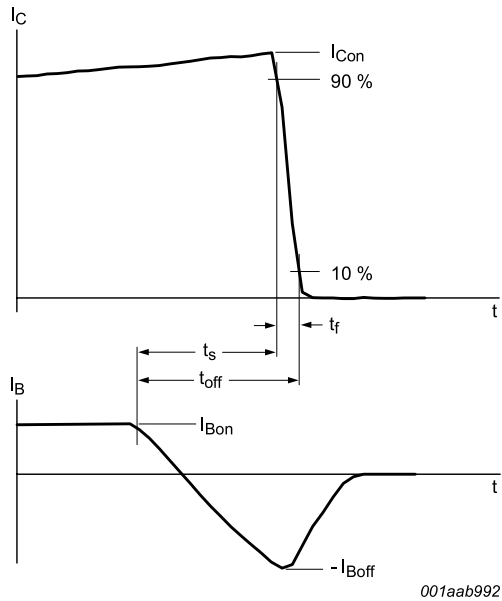


Fig. 8. Switching times waveforms for inductive load

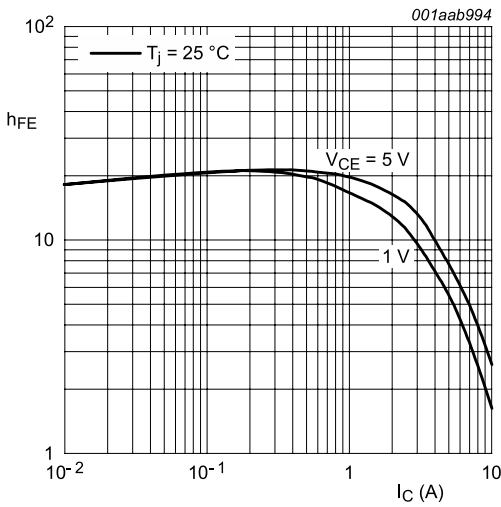


Fig. 9. DC current gain as a function of collector current; typical values

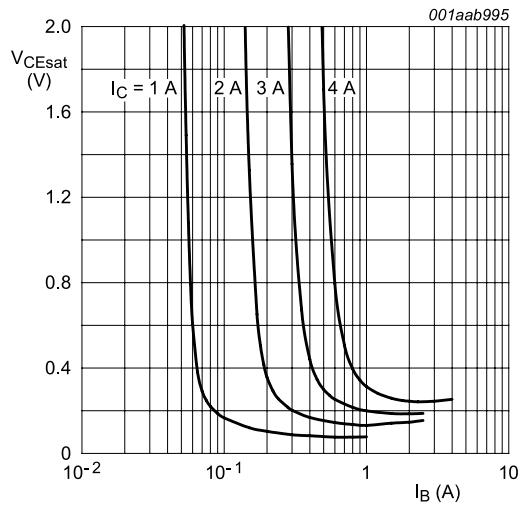


Fig. 10. Collector-emitter saturation voltage as a function of base current; typical values

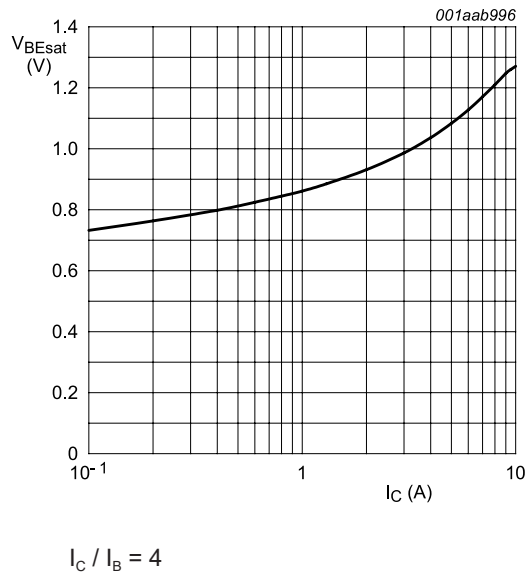


Fig. 11. Base-emitter saturation voltage as a function of collector current; typical values

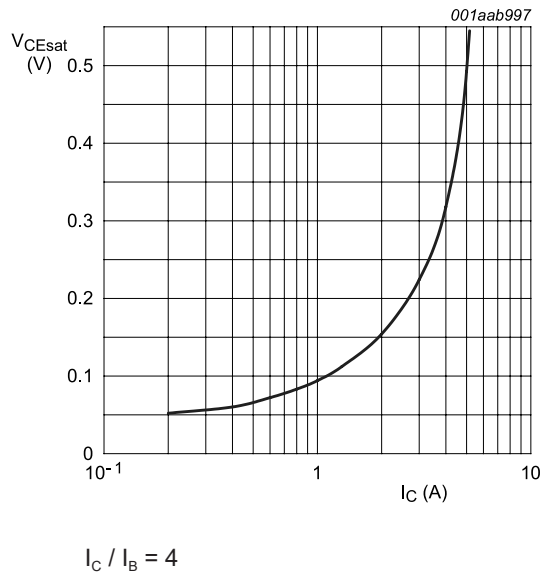
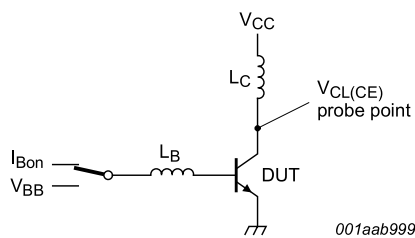
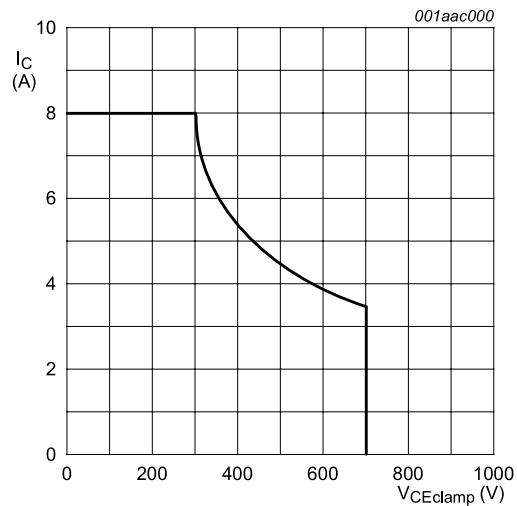


Fig. 12. Collector-emitter saturation voltage as a function of collector current; typical values



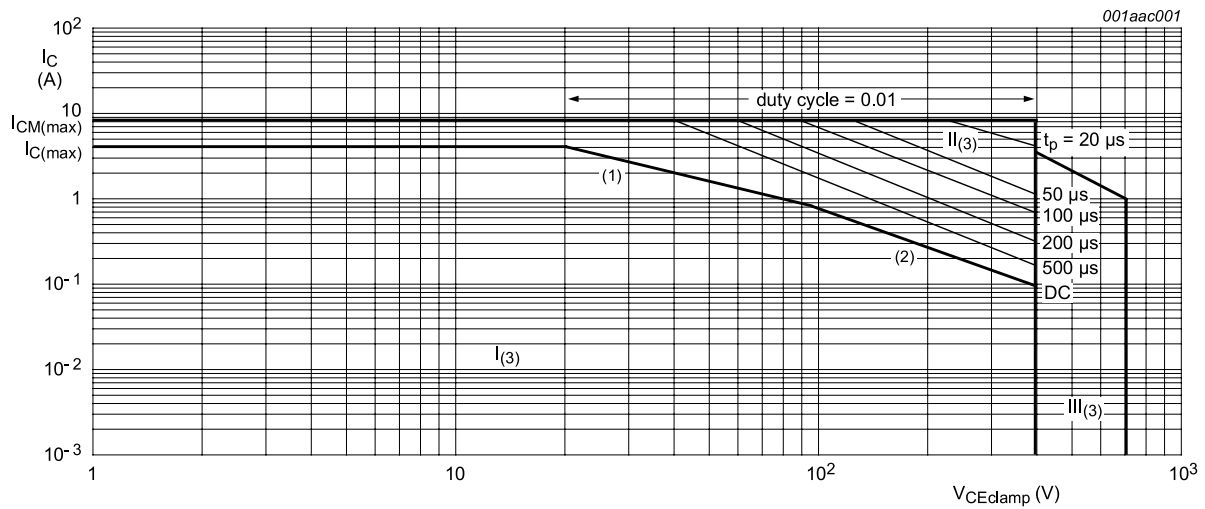
$V_{CEclamp} \leq 1000$  V;  $V_{CC} = 150$  V;  $V_{BB} = -5$  V;  
 $L_B = 1$   $\mu$ H;  $L_C = 200$   $\mu$ H

Fig. 13. Test circuit for reverse bias safe operating area



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

Fig. 14. Reverse bias safe operating area



$T_{mb} \leq 25^\circ C$ ; Mounted with heatsink compound and  $30 \pm 5$  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.

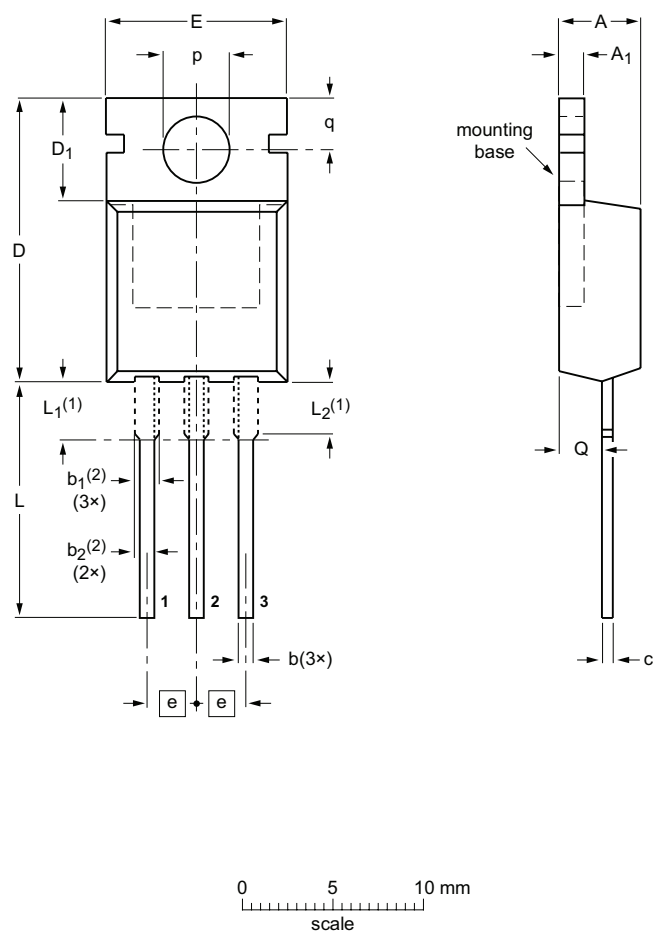
III = Extension during turn-on in single transistor converters provided that  $R_{BE} \leq 100 \Omega$  and  $t_p \leq 0.6 \mu s$ .

**Fig. 15. Forward bias safe operating area**

11. 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 <sub>1</sub>	b	b <sub>1</sub> (2)	b <sub>2</sub> (2)	c	D	D <sub>1</sub>	E	e	L	L <sub>1</sub> (1)	L <sub>2</sub> (1) max.	p	q	Q
mm	4.7 4.1	1.40 1.25	0.9 0.6	1.6 1.0	1.3 1.0	0.7 0.4	16.0 15.2	6.6 5.9	10.3 9.7	2.54	15.0 12.8	3.30 2.79	3.0	3.8 3.5	3.0 2.7	2.6 2.2

Notes

- 1. Lead shoulder designs may vary.
- 2. Dimension includes excess dambar.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT78		3-lead TO-220AB	SC-46			08-04-23 08-06-13

## 12. Revision history

Table 8. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BUJ103A v.5	20180329	Product data sheet	-	BUJ103A v.4
Modifications:	Change from NXP version to WeEn version			
BUJ103A v.4	20111108	Product data sheet	-	BUJ103A v.3
Modifications:	<ul style="list-style-type: none"><li>• The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors.</li><li>• Legal texts have been adapted to the new company name where appropriate.</li></ul>			
BUJ103A v.3	20050303	Product data sheet	-	BUJ103A_HG v.2
BUJ103A_HG v.2	19980918	Product data sheet	-	BUJ103A v.1
BUJ103A v.1	19980801	Product data sheet	-	-

## 13. Legal information

### Data sheet status

Document status [1][2]	Product status [3]	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

- [1] Please consult the most recently issued document before initiating or completing a design.
- [2] The term 'short data sheet' is explained in section "Definitions".
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