

## 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

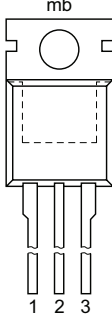
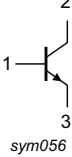
## 4. Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Values			Unit
<b>Absolute maximum rating</b>						
$V_{CESM}$	peak collector-emitter voltage	$V_{BE} = 0\text{ V}$	700			V
$I_C$	collector current (DC)		4			A
$P_{tot}$	total power dissipation	$T_{mb} \leq 25\text{ °C}$ ; <a href="#">Fig. 1</a>	80			W
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Static characteristics</b>						
$h_{FE}$	DC current gain	$I_C = 1\text{ A}$ ; $V_{CE} = 5\text{ V}$ ; $T_{mb} = 25\text{ °C}$ ; <a href="#">Fig. 9</a>	10	17	32	
		$I_C = 500\text{ mA}$ ; $V_{CE} = 5\text{ V}$ ; $T_{mb} = 25\text{ °C}$	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**

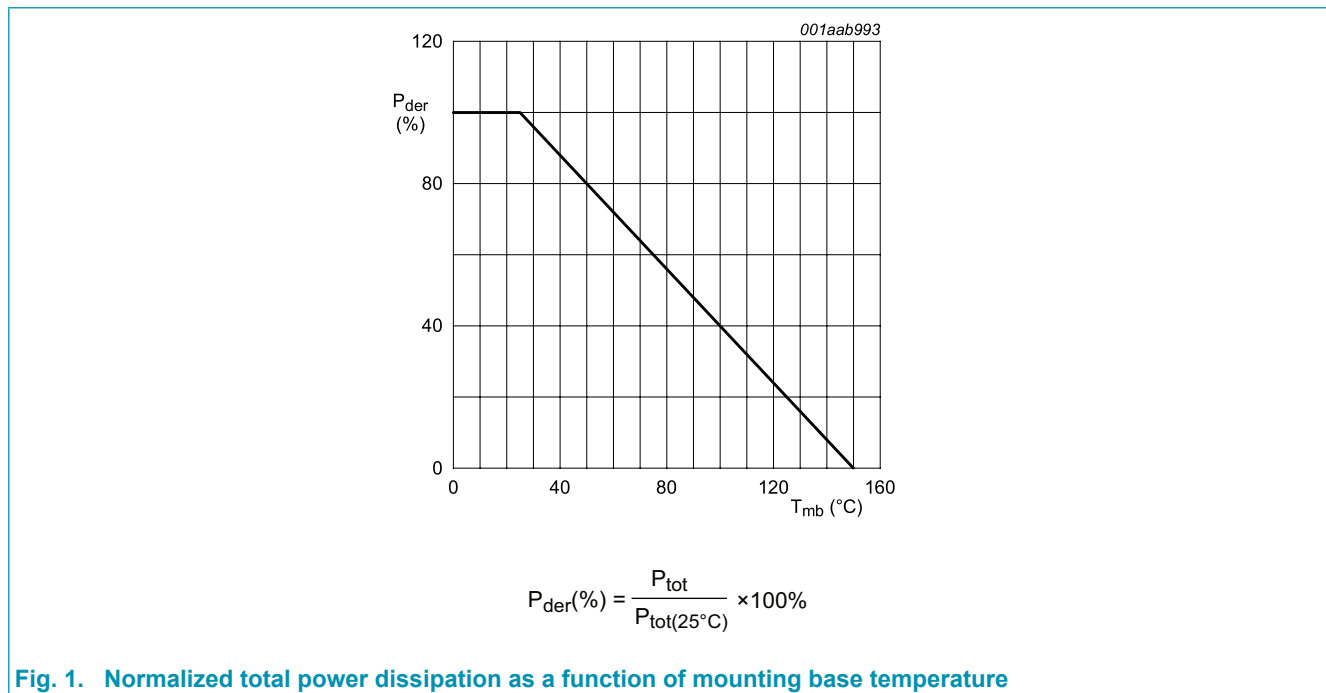
Type number	Marking codes
BUJ103A	BUJ103A

## 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	$T_{mb} \leq 25\text{ °C}$ ; <a href="#">Fig. 1</a>	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

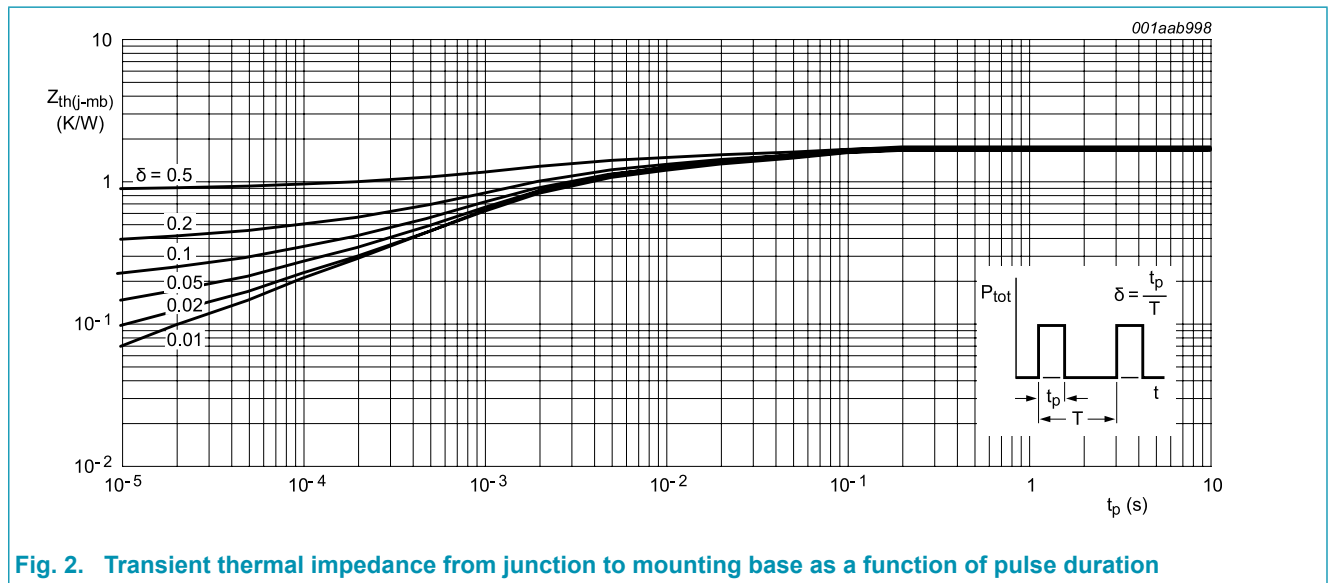


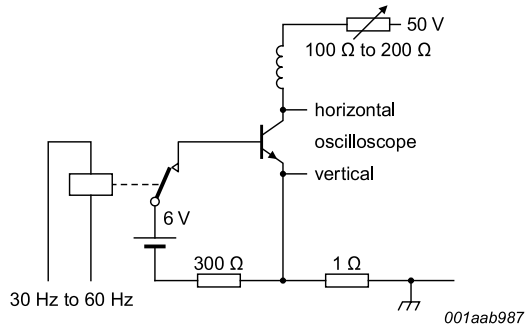
Fig. 2. Transient thermal impedance from junction to mounting base as a function of pulse duration

## 10. Characteristics

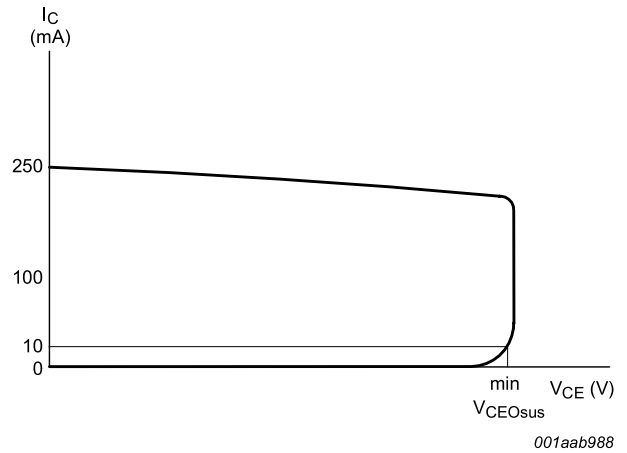
Table 7. Characteristics

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

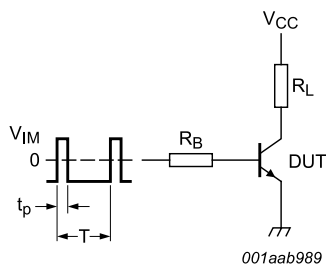
[1] Measured with half sine-wave voltage (curve tracer).



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

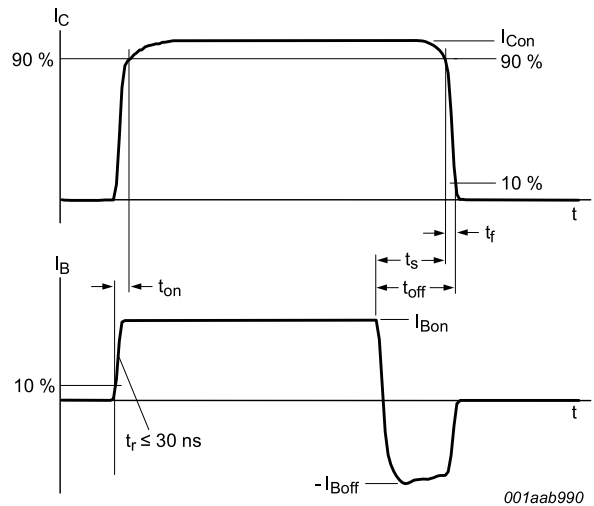


**Fig. 4. Oscilloscope display for collector-emitter sustaining voltage test waveform**

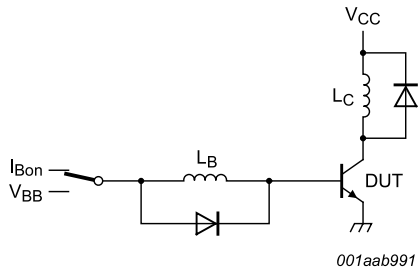


$V_{IM} = -6\text{ V to }+8\text{ V}; V_{CC} = 250\text{ V}; t_p = 20\text{ }\mu\text{s};$   
 $\delta = t_p / T = 0.01$   
 $R_B$  and  $R_L$  calculated from  $I_{Con}$  and  $I_{Bon}$  requirements

**Fig. 5. Test circuit for resistive load switching**



**Fig. 6. Switching times waveforms for resistive load**



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

Fig. 7. Test circuit for inductive load switching

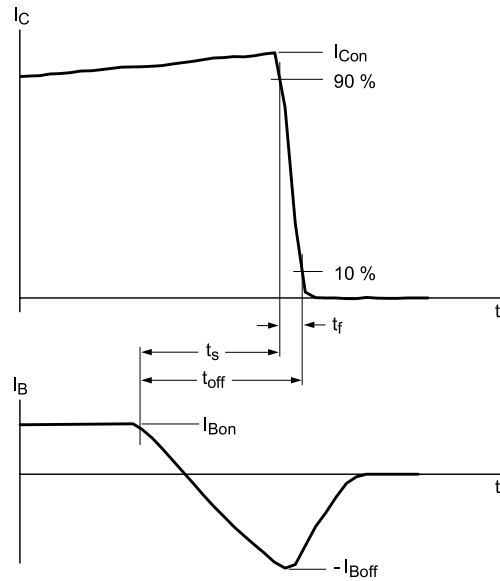


Fig. 8. Switching times waveforms for inductive load

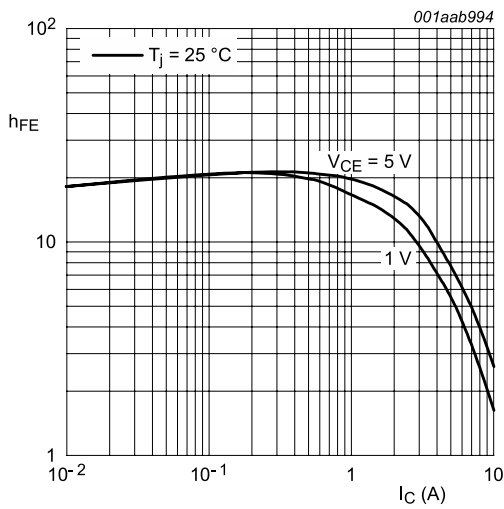
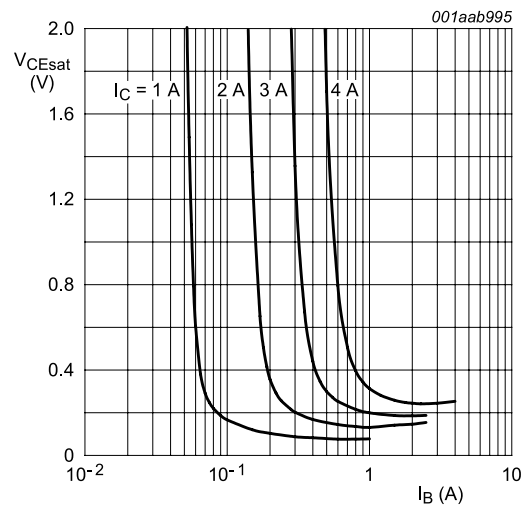
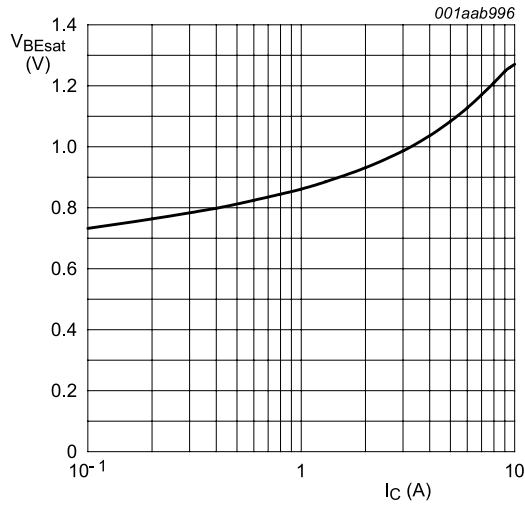


Fig. 9. DC current gain as a function of collector current; typical values

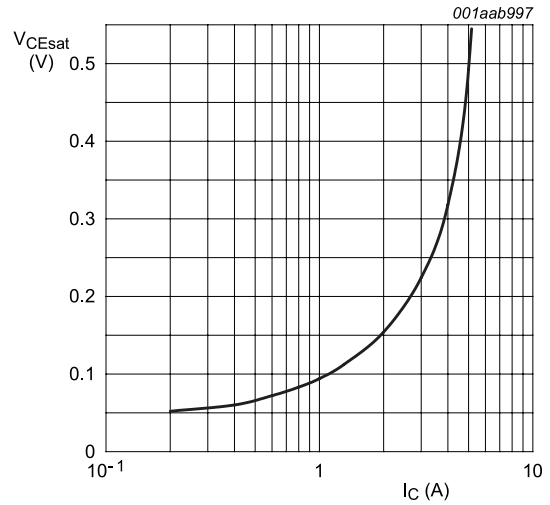


$T_j = 25\text{ }^\circ\text{C}$   
Fig. 10. Collector-emitter saturation voltage as a function of base current; typical values



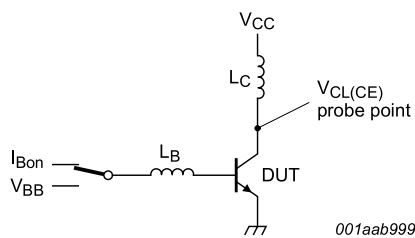
$I_C / I_B = 4$

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



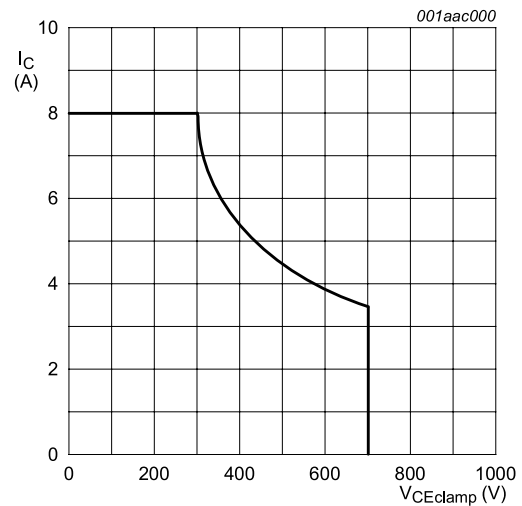
$I_C / I_B = 4$

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



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

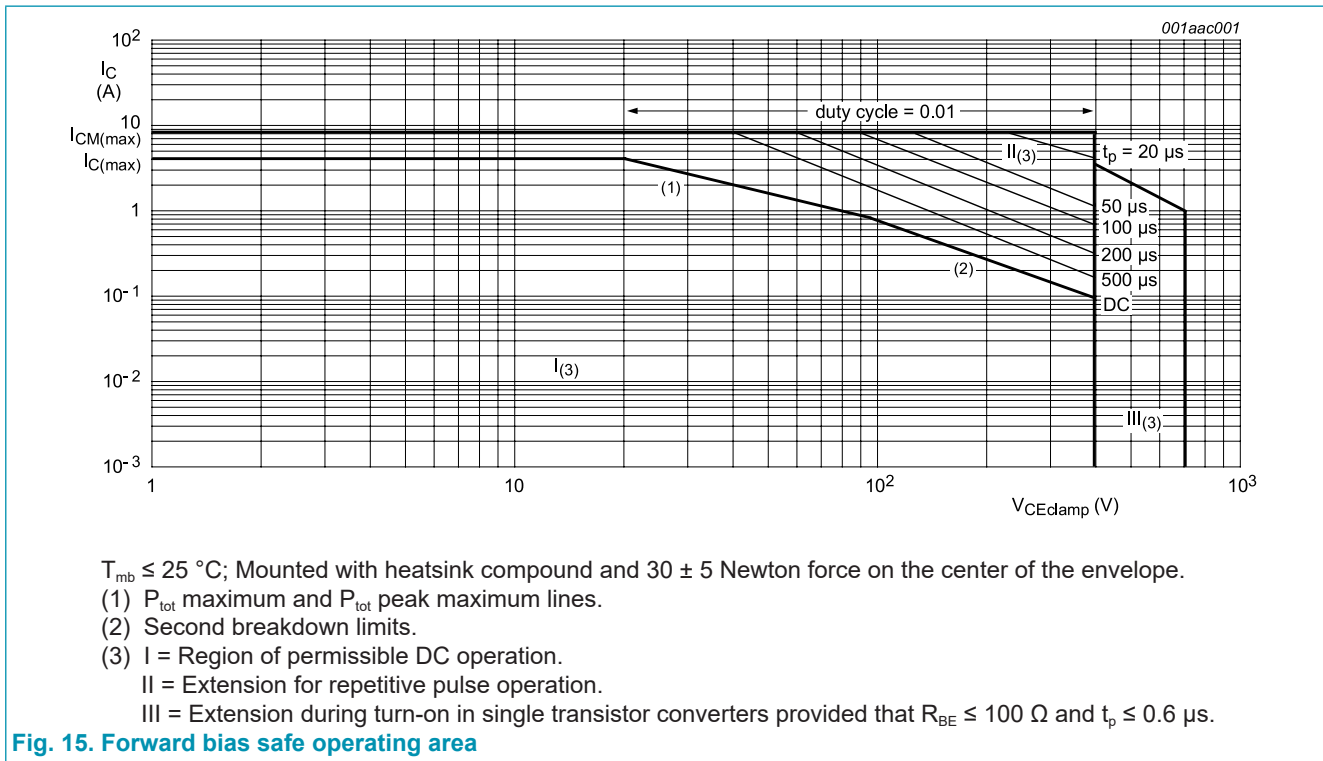
Fig. 13. Test circuit for reverse bias safe operating area



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

Fig. 14. Reverse bias safe operating area

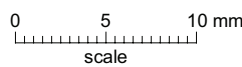
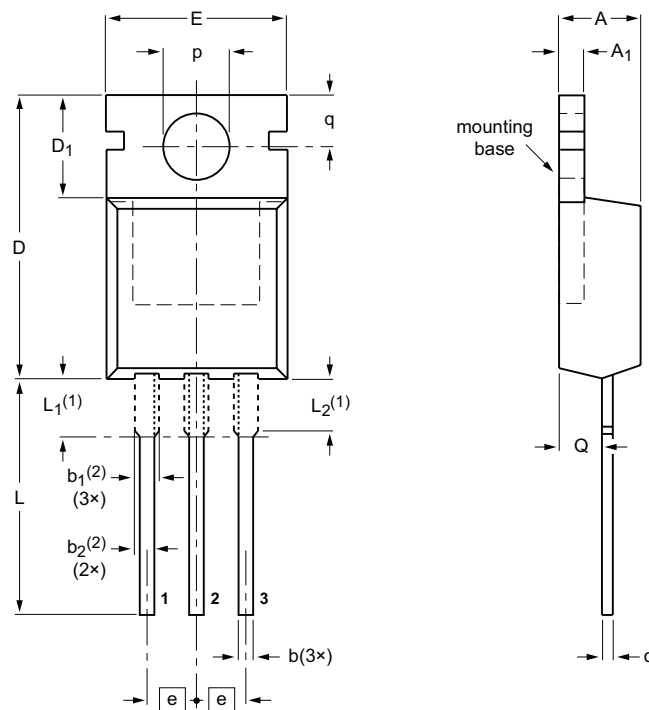




### 11. Package outline

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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Date of release: 29 March 2018

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