BUJ103A

Silicon diffused power transistor

Rev.05 - 29 March 2018 Product data sheet

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

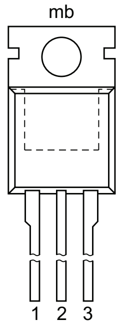
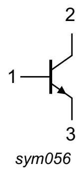
4. Quick reference data

Table 1. Quick reference data

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

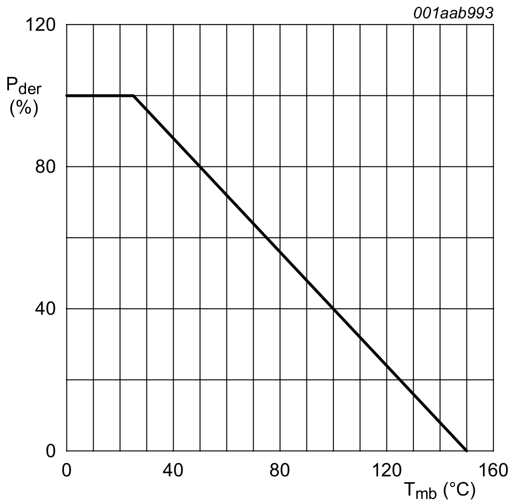
Type number	Marking codes
BUJ103A	BUJ103A

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 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; Fig. 1	80	W
T_{stg}	storage temperature		-65 to 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

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	Fig. 2		-	-	1.56	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air		-	60	-	K/W

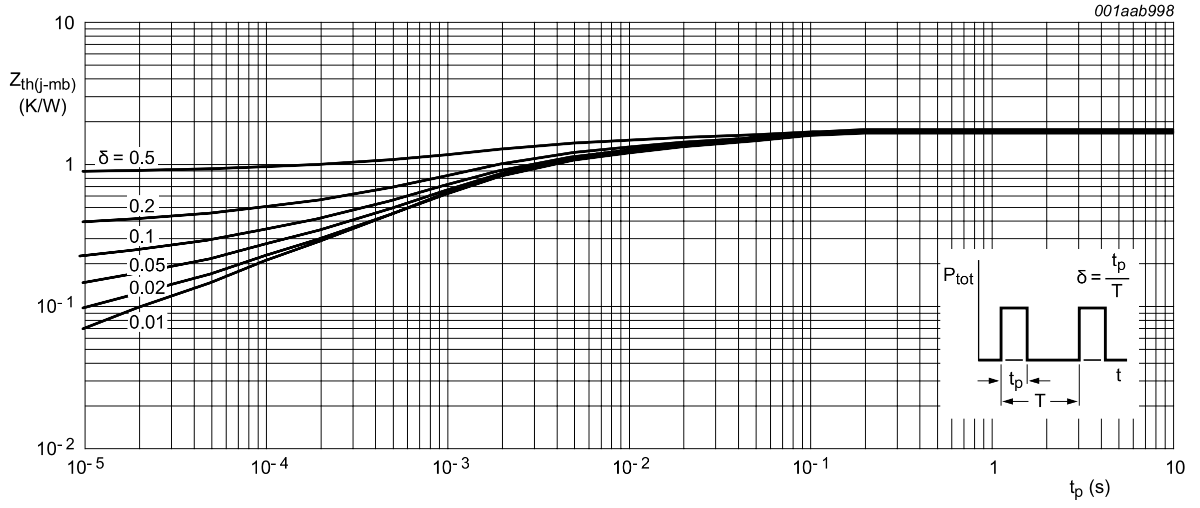


Fig. 2. Transient thermal impedance from junction to mounting base as a function of pulse duration

10. Characteristics

Table 7. Characteristics

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

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

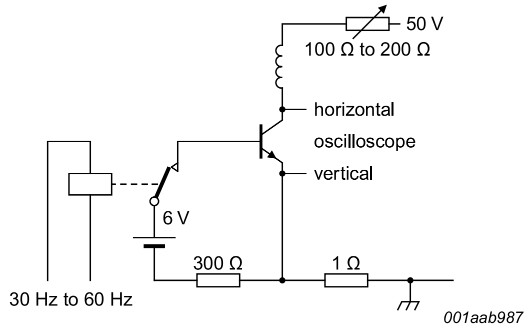


Fig. 3. Test circuit for collector-emitter sustaining voltage

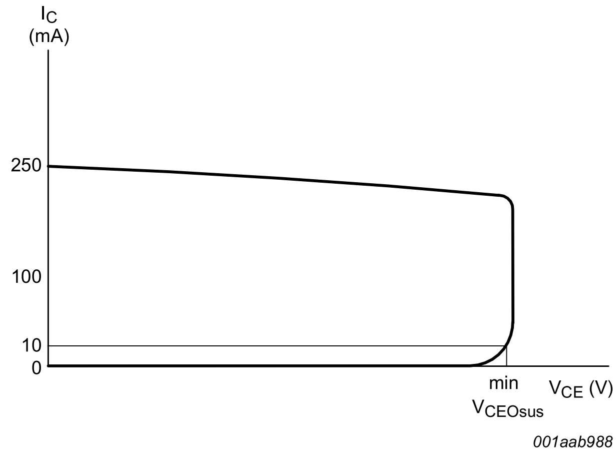
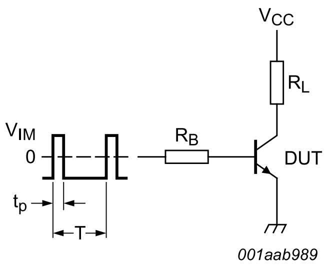


Fig. 4. Oscilloscope display for collector-emitter sustaining voltage test waveform



V_{IM} = -6 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

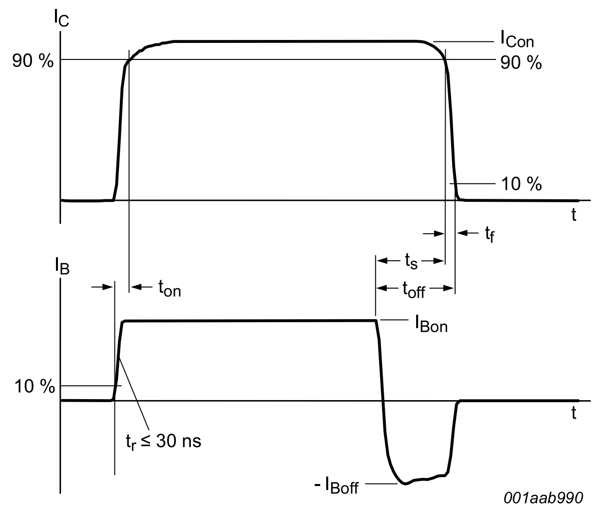
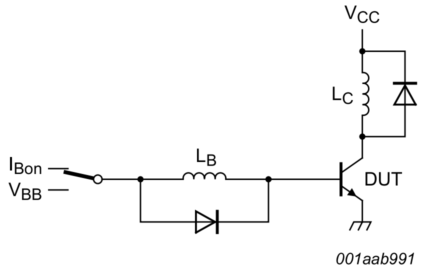


Fig. 6. Switching times waveforms for resistive load



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

Fig. 7. Test circuit for inductive load switching

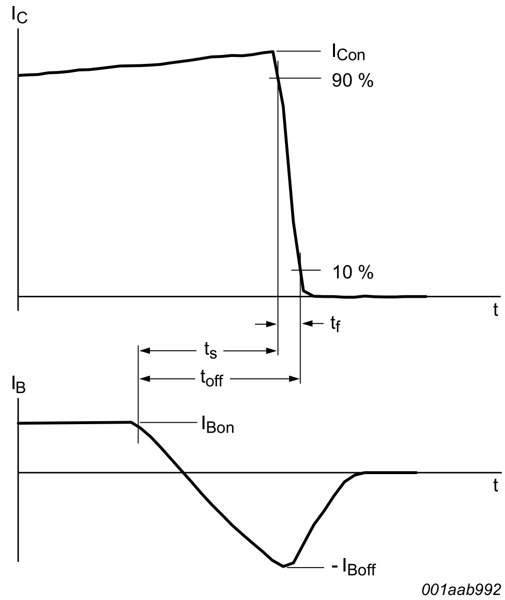


Fig. 8. Switching times waveforms for inductive load

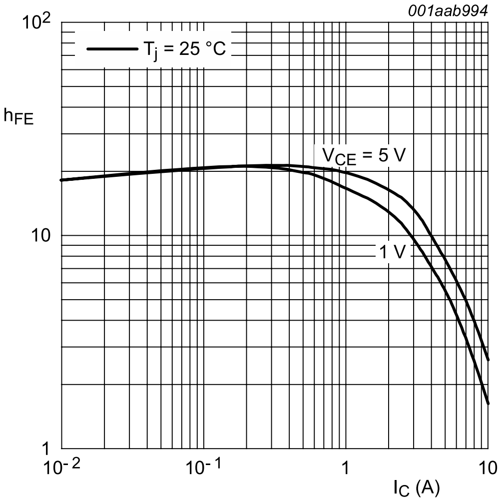
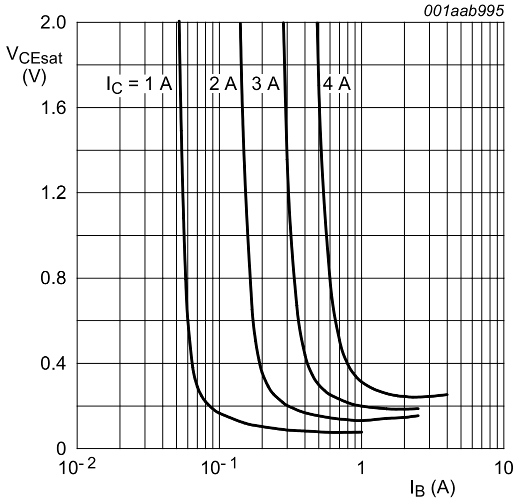
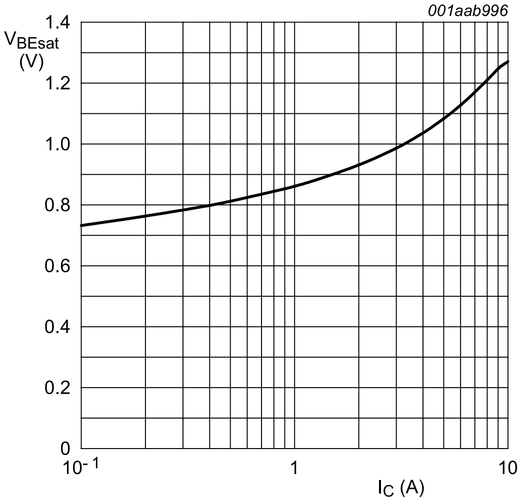


Fig. 9. DC current gain as a function of collector current; typical values



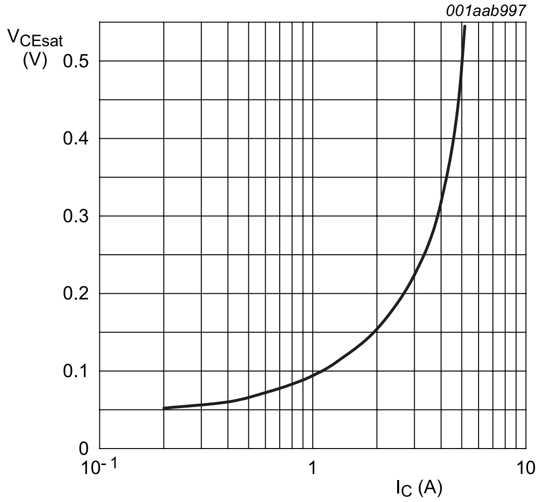
T_j = 25 °C

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



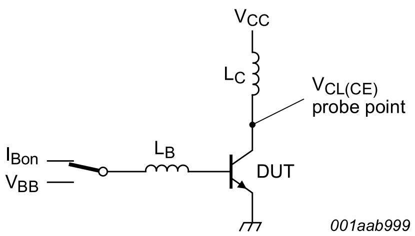
$I_C / I_B = 4$

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



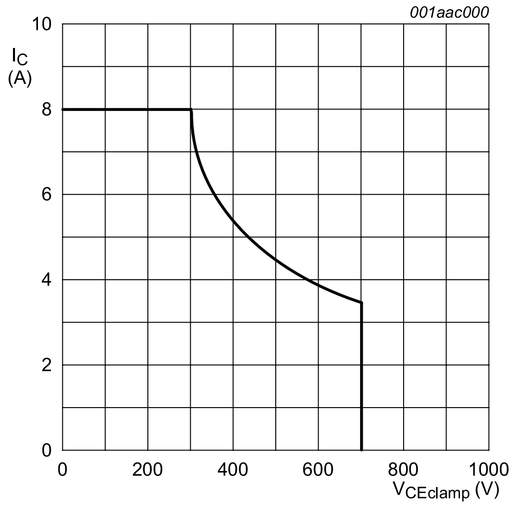
$I_C / I_B = 4$

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



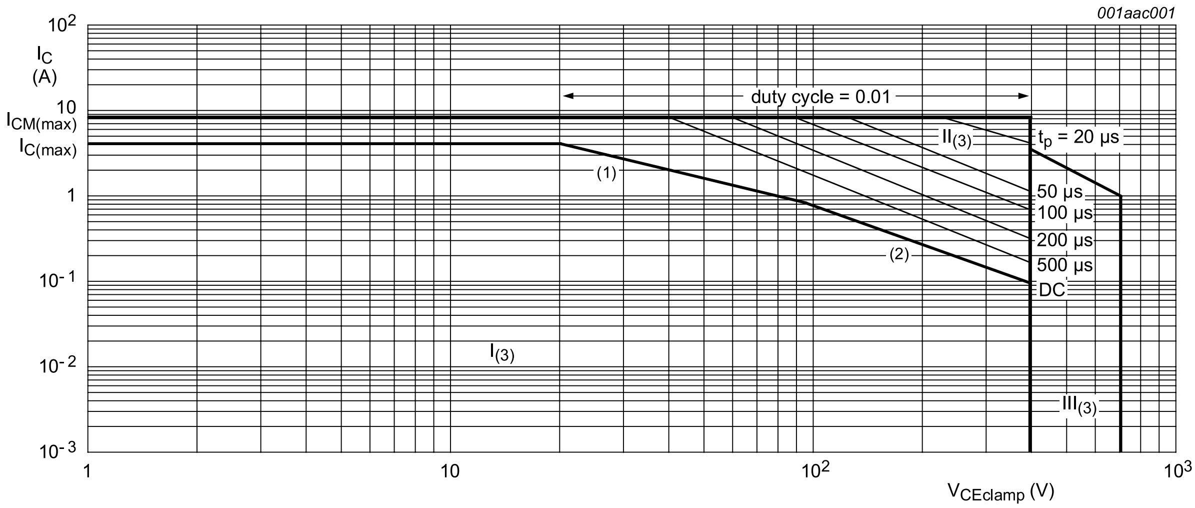
$V_{CEclamp}$ ≤ 1000 V; V_{CC} = 150 V; V_{BB} = -5 V;
L_B = 1 µH; L_C = 200 µH

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} ≤ 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.

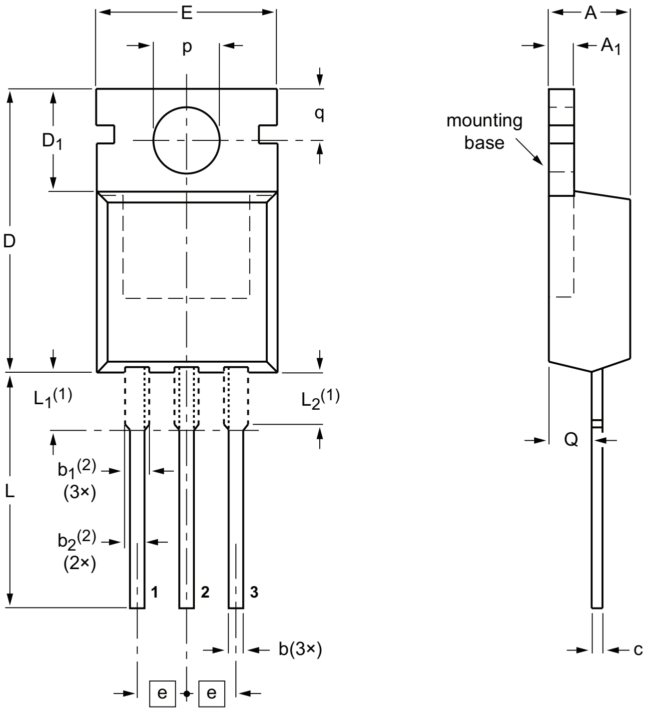
(2) Second breakdown limits.

(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} ≤ 100 Ω and t_p ≤ 0.6 μs.

Fig. 15. Forward bias safe operating area

11. Package outline

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



0 5 10 mm
scale

DIMENSIONS (mm are the original dimensions)

UNIT	A	A_1	b	$b_1^{(2)}$	$b_2^{(2)}$	c	D	D_1	E	e	L	$L_1^{(1)}$	$L_2^{(1)}$ 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:	• The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors. • Legal texts have been adapted to the new company name where appropriate.			
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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