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BUJ303A

NPN power transistor

12 October 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

- Fast switching
- Low thermal resistance
- Very high voltage capability
- Very low switching and conduction losses

3. Applications

- DC-to-DC converters
- High frequency electronic lighting ballasts
- Inverters
- Motor control systems

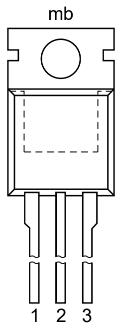
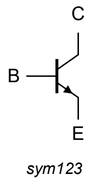
4. Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
I_{CM}	peak collector current	Fig. 1; Fig. 2; Fig. 3		-	-	10	A
P_{tot}	total power dissipation	$T_{mb} \leq$ 25 °C; Fig. 4		-	-	100	W
V_{CESM}	collector-emitter peak voltage	V_{BE} = 0 V		-	-	1000	V
Static characteristics							
h_{FE}	DC current gain	I_C = 5 mA; V_{CE} = 5 V; T_{mb} = 25 °C; Fig. 11		10	22	35	
		I_C = 500 mA; V_{CE} = 5 V; T_{mb} = 25 °C; Fig. 11		14	25	35	

5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	B	base	 **TO-220AB (SOT78)**	
2	C	collector		
3	E	emitter		
mb	C	mounting base; connected to collector		

6. Ordering information

Table 3. Ordering information

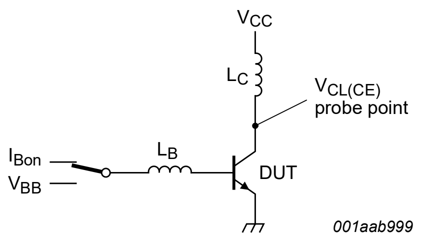
Type number	Package		
	Name	Description	Version
BUJ303A	TO-220AB	plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB	SOT78

7. Limiting values

Table 4. Limiting values

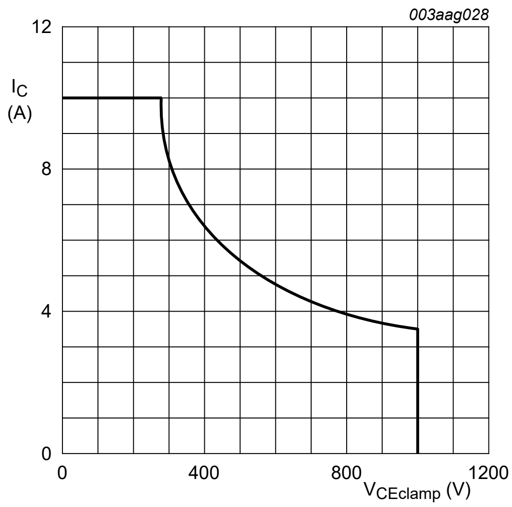
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions		Min	Max	Unit
V_{CESM}	collector-emitter peak voltage	V_{BE} = 0 V		-	1000	V
V_{CEO}	collector-emitter voltage	I_B = 0 A		-	500	V
I_C	collector current	Fig. 1; Fig. 2; Fig. 3		-	5	A
I_{CM}	peak collector current			-	10	A
I_B	base current			-	2	A
I_{BM}	peak base current			-	4	A
P_{tot}	total power dissipation	T_{mb} ≤ 25 °C; Fig. 4		-	100	W
T_{stg}	storage temperature			-65	150	°C
T_j	junction temperature			-	150	°C



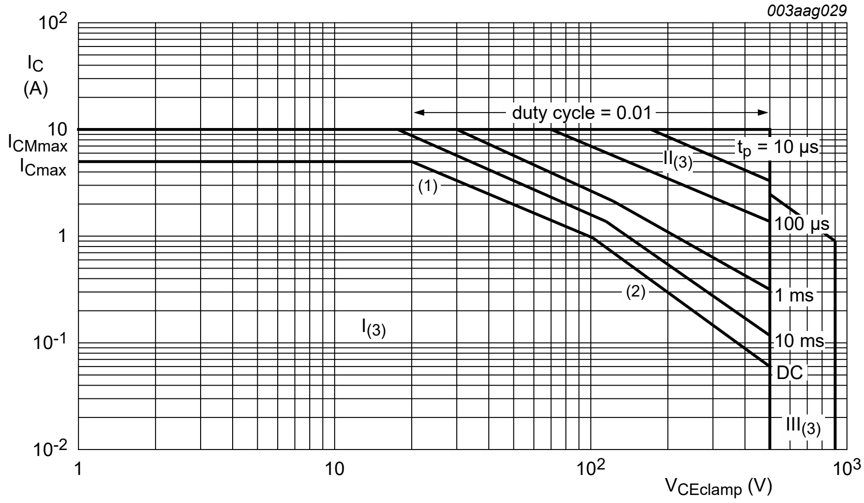
$V_{CEclamp}$ ≤ 1000 V; V_{CC} = 150 V; V_{BB} = -5 V;
L_B = 1 µH; L_C = 200 µH.

Fig. 1. Test circuit for reverse bias safe operating area



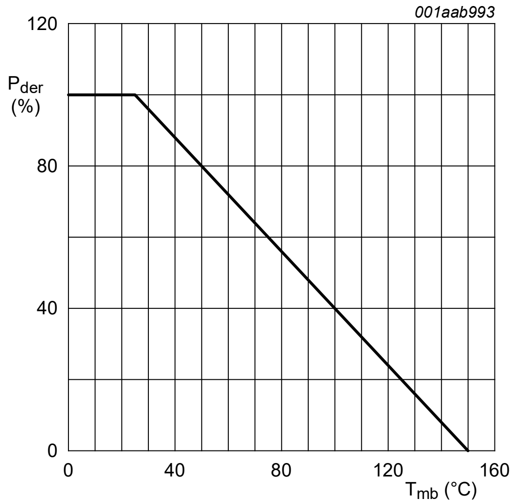
T_j ≤ $T_{j(max)}$

Fig. 2. Reverse bias safe operating area



(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. 3. Forward bias safe operating area for Tmb ≤ 25 °C



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

Fig. 4. Normalized total power dissipation as a function of mounting base temperature

8. Thermal characteristics

Table 5. Thermal characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$R_{th(j-mb)}$	thermal resistance from junction to mounting base	Fig. 5		-	-	1.25	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient free air	in free air		-	60	-	K/W

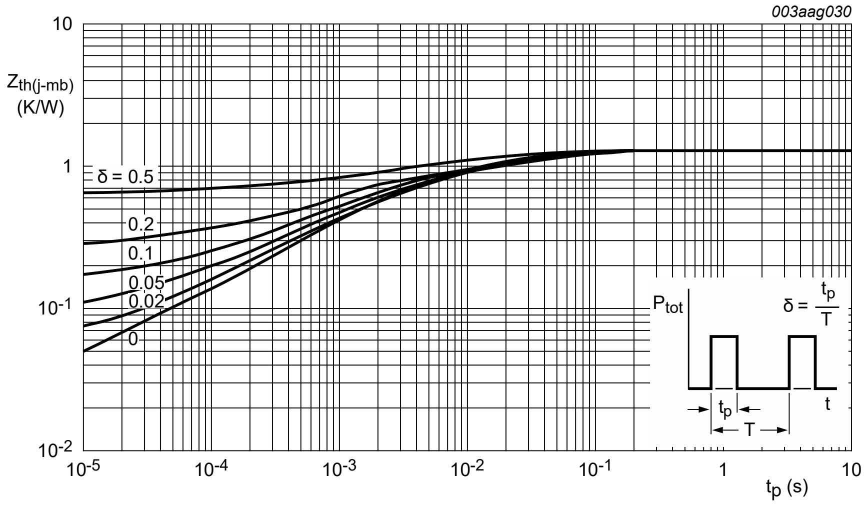


Fig. 5. Transient thermal impedance from junction to mounting base as a function of pulse width

9. Characteristics

Table 6. Characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Static characteristics							
I_{CES}	collector-emitter cut-off current (base shorted)	V_{BE} = 0 V; V_{CE} = 1000 V; T_{mb} = 25 °C; Measured with half-sine wave voltage (curve tracer)		-	-	1	mA
		V_{BE} = 0 V; V_{CE} = 1000 V; T_{mb} = 125 °C; Measured with half-sine wave voltage (curve tracer)		-	-	2	mA
I_{CBO}	collector-base cut-off current (emitter open)	V_{CB} = 1000 V; I_E = 0 A; T_{mb} = 25 °C; Measured with half-sine wave voltage (curve tracer)		-	-	1	mA
I_{CEO}	collector-emitter cut-off current (base open)	V_{CE} = 500 V; I_B = 0 A; T_{mb} = 25 °C; Measured with half-sine wave voltage (curve tracer)		-	-	0.1	mA
I_{EBO}	emitter-base cut-off current (collector open)	V_{EB} = 9 V; I_C = 0 A; T_{mb} = 25 °C		-	-	0.1	mA
V_{CEOsus}	collector-emitter sustaining voltage (base open)	I_B = 0 A; I_C = 100 mA; L_C = 25 mH; T_{mb} = 25 °C; Fig. 6; Fig. 7		500	-	-	V
V_{CEsat}	collector-emitter saturation voltage	I_C = 3 A; I_B = 0.6 A; T_{mb} = 25 °C; Fig. 8; Fig. 9		-	0.35	1.5	V
V_{BEsat}	base-emitter saturation voltage	I_C = 3 A; I_B = 0.6 A; T_{mb} = 25 °C; Fig. 10		-	1.01	1.3	V
h_{FE}	DC current gain	I_C = 5 mA; V_{CE} = 5 V; T_{mb} = 25 °C; Fig. 11		10	22	35	
		I_C = 500 mA; V_{CE} = 5 V; T_{mb} = 25 °C; Fig. 11		14	25	35	
h_{FEsat}	DC saturation current gain	I_C = 2.5 A; V_{CE} = 5 V; T_{mb} = 25 °C; Fig. 11		10	13.5	17	
		I_C = 3 A; V_{CE} = 5 V; T_{mb} = 25 °C; Fig. 11		-	11	-	
Dynamic characteristics (switching times - resistive load)							
t_s	storage time	I_C = 2.5 A; I_{Bon} = 0.5 A; I_{Boff} = -0.5 A; R_L = 75 Ω; T_{mb} = 25 °C; Fig. 12; Fig. 13		-	3.3	4	μs
t_f	fall time			-	0.33	0.45	μs
Dynamic characteristics (switching times - inductive load)							
t_s	storage time	I_C = 2.5 A; I_{Bon} = 0.5 A; V_{BB} = -5 V; L_B = 1 μH; T_{mb} = 25 °C; Fig. 14; Fig. 15		-	1.4	1.6	μs
		I_C = 2.5 A; I_{Bon} = 0.5 A; V_{BB} = -5 V; L_B = 1 μH; T_j = 100 °C; Fig. 14; Fig. 15		-	1.7	1.9	μs
t_f	fall time	I_C = 2.5 A; I_{Bon} = 0.5 A; V_{BB} = -5 V; L_B = 1 μH; T_{mb} = 25 °C; Fig. 14; Fig. 15		-	145	160	ns
		I_C = 2.5 A; I_{Bon} = 0.5 A; V_{BB} = -5 V; L_B = 1 μH; T_j = 100 °C; Fig. 14; Fig. 15		-	160	200	ns

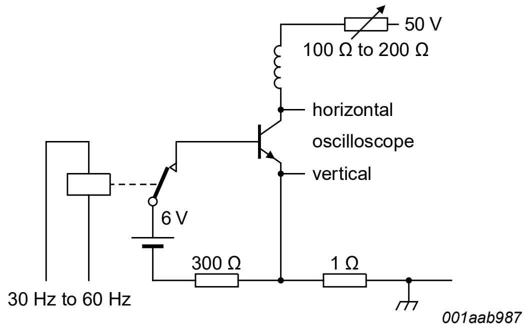


Fig. 6. Test circuit for collector-emitter sustaining voltage

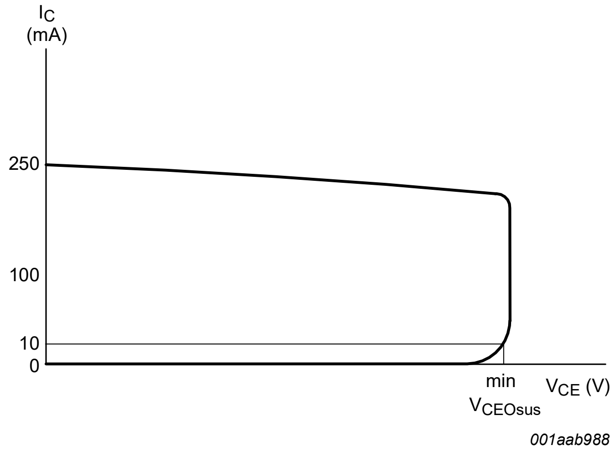


Fig. 7. Oscilloscope display for collector-emitter sustaining voltage test waveform

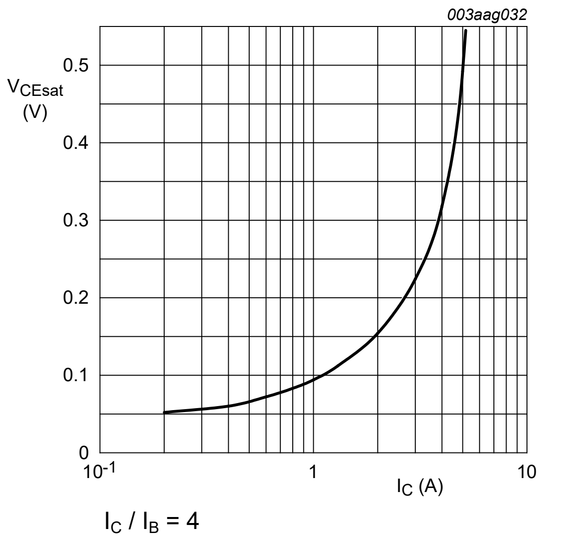


Fig. 8. Collector-emitter saturation voltage as a function of collector current; typical values

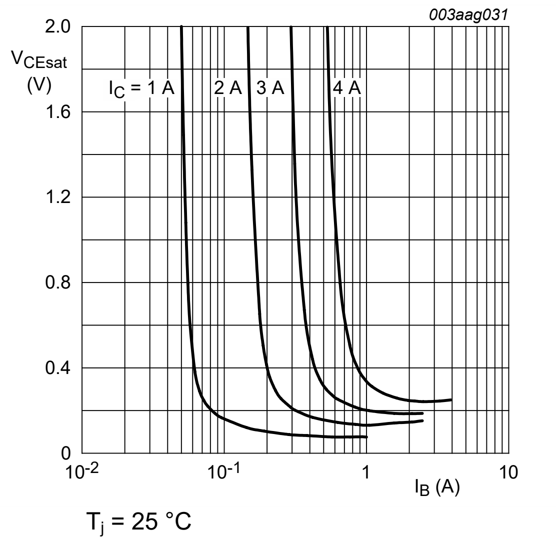


Fig. 9. Collector-emitter saturation voltage as a function of base current; typical values

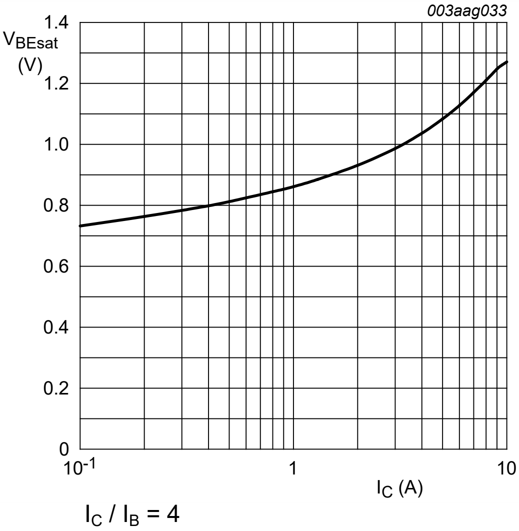


Fig. 10. Base-emitter saturation voltage as a function of collector current; typical values

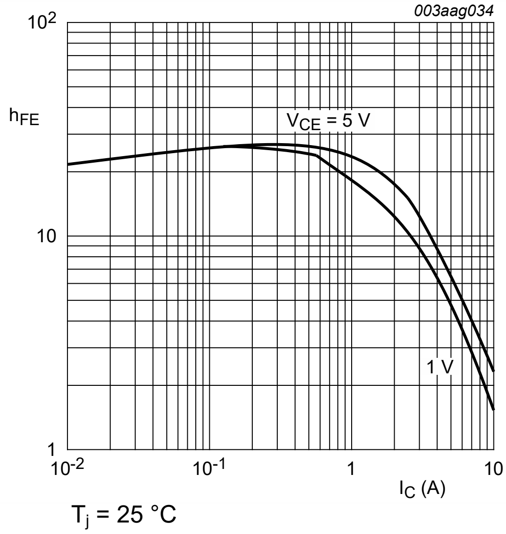
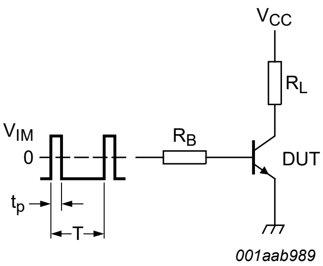


Fig. 11. DC current gain as a function of collector current; typical values



V_{IM} = -6 V to +8 V; V_{CC} = 250 V; t_p = 20 µs;
δ = t_p / T = 0.01
R_B and R_L calculated from I_{Con} and I_{Bon} requirements

Fig. 12. Test circuit for resistive load switching

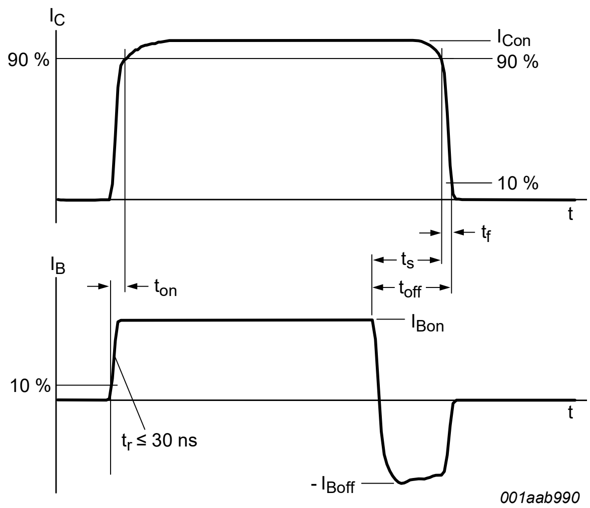
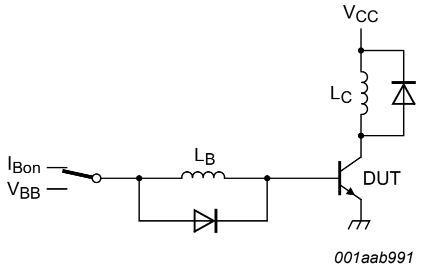


Fig. 13. Switching times waveforms for resistive load



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

Fig. 14. Test circuit for inductive load switching

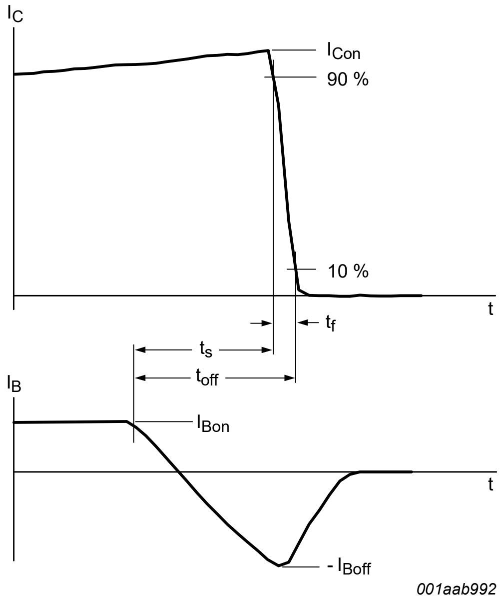
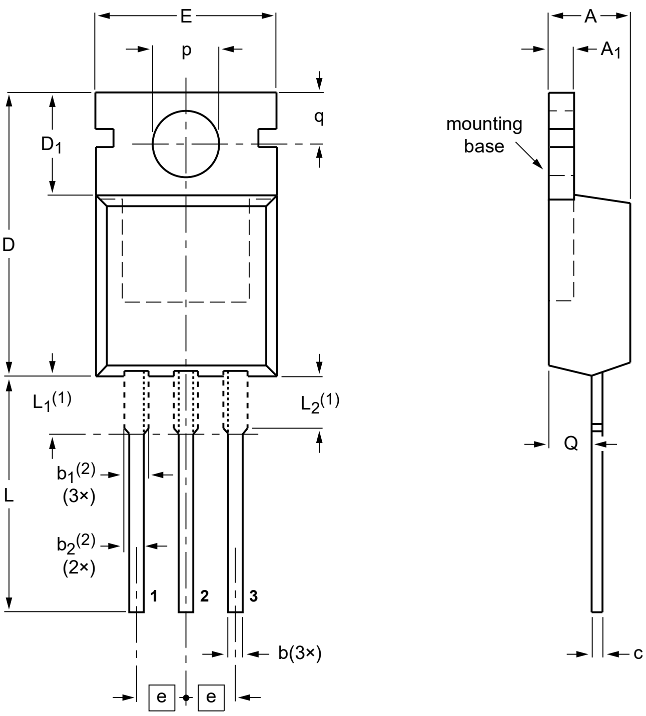


Fig. 15. Switching times waveforms for inductive load

10. 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(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.

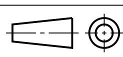
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT78		3-lead TO-220AB	SC-46			~~08-04-23~~ 08-06-13

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

11. Legal information

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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: 12 October 2018

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