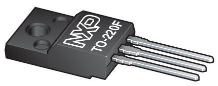


BUJ303AX

NPN power transistor

Rev. 05 — 3 May 2011 Product data sheet

1. Product profile

1.1 General description

High voltage, high speed, planar passivated NPN power switching transistor in a SOT186A (TO220F) "full pack" plastic package.

1.2 Features and benefits

- Fast switching
- Isolated package
- Very high voltage capability
- Very low switching and conduction losses

1.3 Applications

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

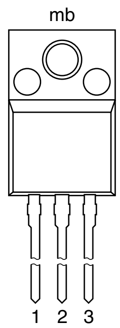
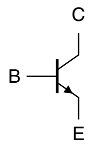
1.4 Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I_C	collector current	see Figure 1; see Figure 2; see Figure 4	-	-	5	A
P_{tot}	total power dissipation	$T_h \leq 25$ °C; see Figure 3	-	-	32	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; $T_h = 25$ °C; see Figure 11	10	22	35	
		$I_C = 500$ mA; $V_{CE} = 5$ V; $T_h = 25$ °C; see Figure 11	14	25	35	
Dynamic characteristics						
t_f	fall time	$I_C = 2.5$ A; $I_{Bon} = 0.5$ A; see Figure 14; see Figure 15; $V_{BB} = -5$ V; $L_B = 1$ µH; $T_h = 25$ °C	-	145	160	ns

2. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	B	base	 SOT186A (TO-220F)	 sym123
2	C	collector		
3	E	emitter		
mb	n.c.	mounting base; isolated		

3. Ordering information

Table 3. Ordering information

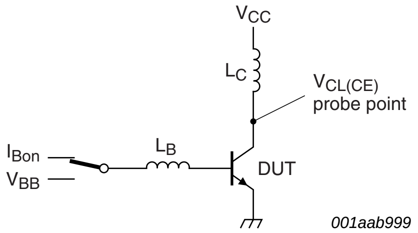
Type number	Package		
	Name	Description	Version
BUJ303AX	TO-220F	plastic single-ended package; isolated heatsink mounted; 1 mounting hole; 3-lead TO-220 "full pack"	SOT186A

4. Limiting values

Table 4. Limiting values

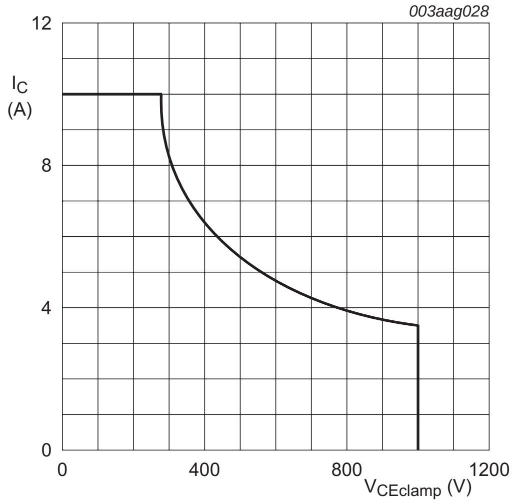
In accordance with the Absolute Maximum Rating System (IEC 60134).

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	see Figure 1; see Figure 2; see Figure 4	-	5	A
I_{CM}	peak collector current		-	10	A
I_B	base current	DC	-	2	A
I_{BM}	peak base current		-	4	A
P_{tot}	total power dissipation	T_h ≤ 25 °C; see Figure 3	-	32	W
T_{stg}	storage temperature		-65	150	°C
T_j	junction temperature		-	150	°C



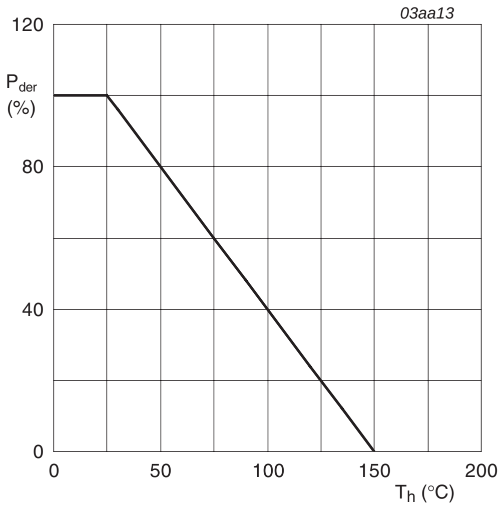
$$V_{CL(CE)} \leq 1000\ V; V_{CC} = 150\ V; V_{BB} = -5\ V;$$
$$L_B = 1\ \mu H; L_C = 200\ \mu H$$

Fig 1. Test circuit for reverse bias safe operating area



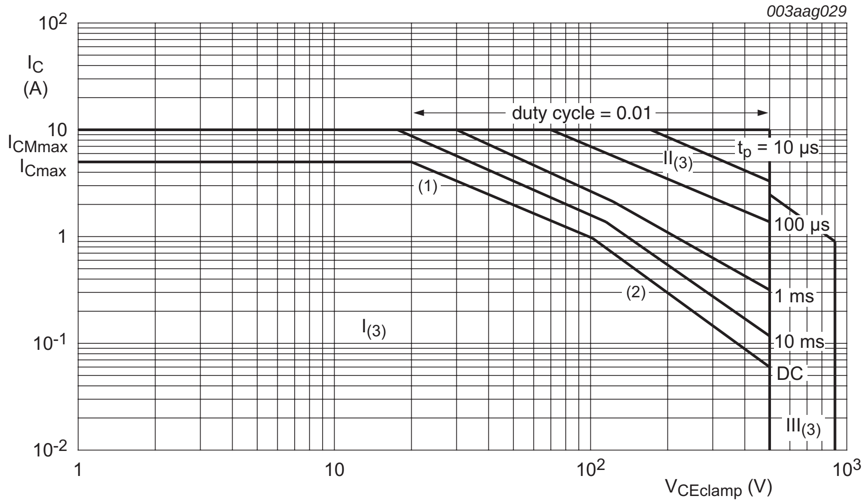
$T_j \leq T_{j(max)}$

Fig 2. Reverse bias safe operating area



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

Fig 3. Normalized total power dissipation as a function of heatsink temperature



(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 4. Forward bias safe operating area for $T_{mb} \leq 25$ °C

5. Thermal characteristics

Table 5. Thermal characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-h)}$	thermal resistance from junction to heatsink	with heatsink compound ; see Figure 5	-	-	3.95	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	-	55	-	K/W

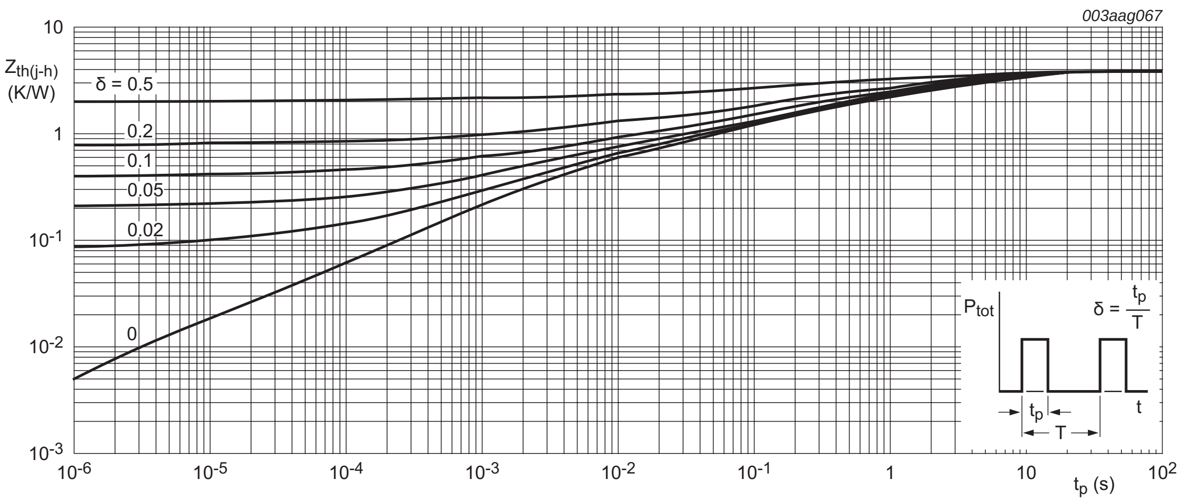


Fig 5. Transient thermal impedance from junction to heatsink as a function of pulse duration

6. Isolation characteristics

Table 6. Isolation characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{isol(RMS)}$	RMS isolation voltage	50 Hz ≤ f ≤ 60 Hz; RH ≤ 65 %; T_h = 25 °C; from all terminals to external heatsink; clean and dust free	-	-	2500	V
C_{isol}	isolation capacitance	from collector to external heatsink ; f = 1 MHz; T_h = 25 °C	-	10	-	pF

7. 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} = 1000 V; T_h = 25 °C	[1]	-	-	1	mA
		V_{BE} = 0 V; V_{CE} = 1000 V; T_j = 125 °C	[1]	-	-	2	mA
I_{CBO}	collector-base cut-off current	V_{CB} = 1000 V; I_E = 0 A; T_h = 25 °C	[1]	-	-	1	mA
I_{CEO}	collector-emitter cut-off current	V_{CE} = 500 V; I_B = 0 A; T_h = 25 °C	[1]	-	-	0.1	mA
I_{EBO}	emitter-base cut-off current	V_{EB} = 9 V; I_C = 0 A; T_h = 25 °C		-	-	0.1	mA
V_{CEOsus}	collector-emitter sustaining voltage	I_B = 0 A; I_C = 10 mA; L_C = 25 mH; T_h = 25 °C; see Figure 6; see Figure 7		500	-	-	V
V_{CEsat}	collector-emitter saturation voltage	I_C = 3 A; I_B = 0.6 A; T_h = 25 °C; see Figure 8; see Figure 9		-	0.25	1.5	V
V_{BEsat}	base-emitter saturation voltage	I_C = 3 A; I_B = 0.6 A; T_h = 25 °C; see Figure 10		-	0.97	1.3	V
h_{FE}	DC current gain	I_C = 5 mA; V_{CE} = 5 V; T_h = 25 °C; see Figure 11		10	22	35	
		I_C = 500 mA; V_{CE} = 5 V; T_h = 25 °C; see Figure 11		14	25	35	
h_{FEsat}	DC saturation current gain	I_C = 2.5 A; V_{CE} = 5 V; T_h = 25 °C; see Figure 11		10	13.5	17	
		I_C = 3 A; V_{CE} = 5 V; T_h = 25 °C; see Figure 11		-	12	-	
Dynamic characteristics							
t_{on}	turn-on time	I_C = 2.5 A; I_{Bon} = 0.5 A; I_{Boff} = -0.5 A; R_L = 75 Ω; V_{BB} = -4 V; T_h = 25 °C; resistive load; see Figure 12; see Figure 13		-	0.5	0.7	µs
t_s	storage time			-	3.3	4	µs
		I_C = 2.5 A; I_{Bon} = 0.5 A; V_{BB} = -5 V; L_B = 1 µH; T_h = 25 °C; inductive load; see Figure 14; see Figure 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; inductive load; see Figure 14; see Figure 15		-	1.7	1.9	µs
t_f	fall time	I_C = 2.5 A; I_{Bon} = 0.5 A; I_{Boff} = -0.5 A; R_L = 75 Ω; V_{BB} = -4 V; T_h = 25 °C; resistive load; see Figure 12; see Figure 13		-	0.33	0.45	µs
		I_C = 2.5 A; I_{Bon} = 0.5 A; V_{BB} = -5 V; L_B = 1 µH; T_h = 25 °C; see Figure 14; see Figure 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; inductive load; see Figure 14; see Figure 15		-	160	200	ns

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

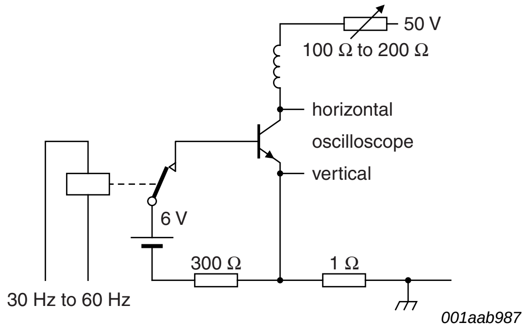


Fig 6. Test circuit for collector-emitter sustaining voltage

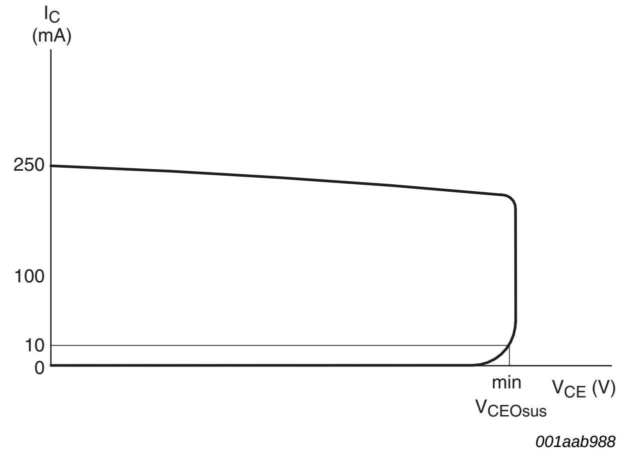


Fig 7. Oscilloscope display for collector-emitter sustaining voltage test waveform

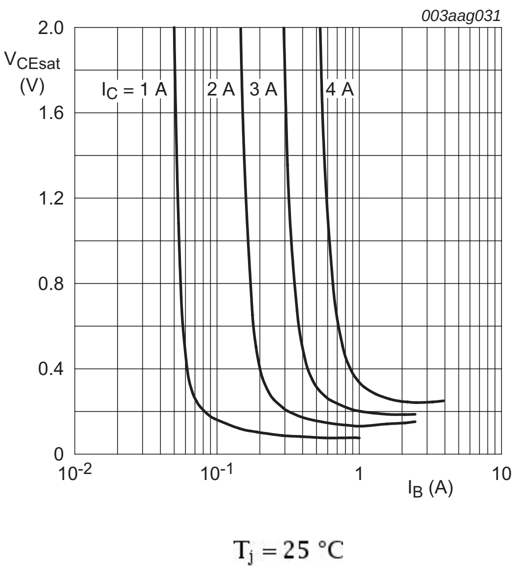


Fig 8. Collector-emitter saturation voltage as a function of base current; typical values

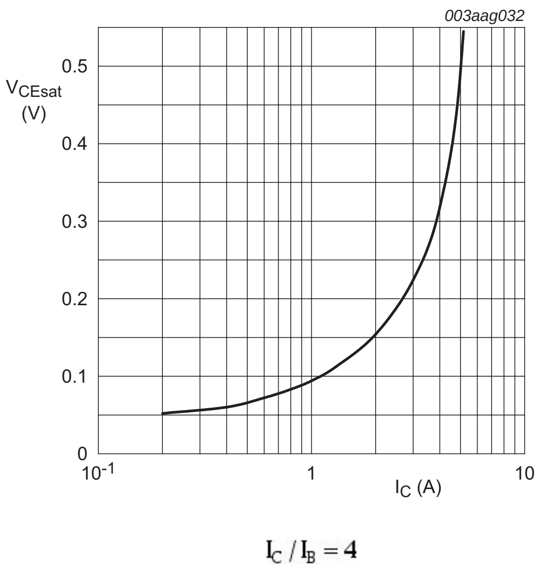
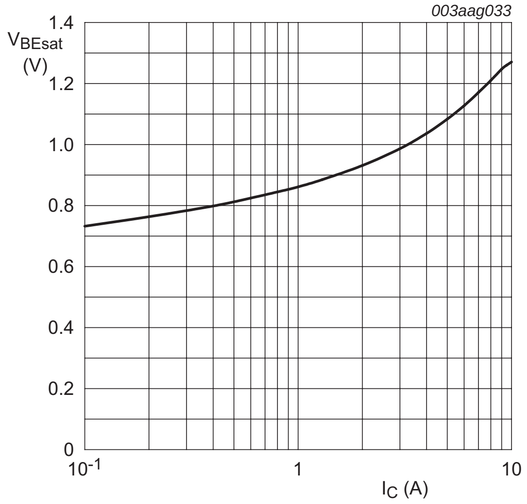
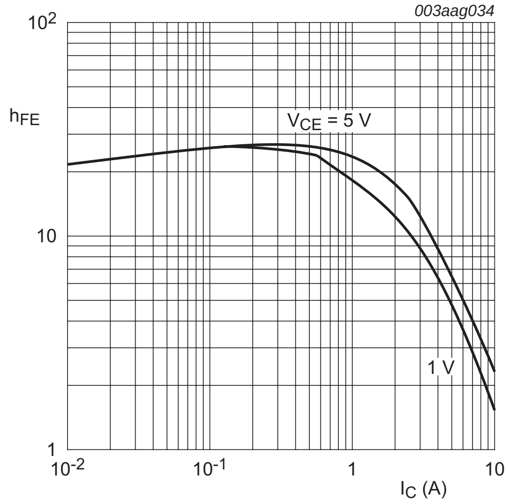


Fig 9. Collector-emitter saturation voltage as a function of collector current; typical values



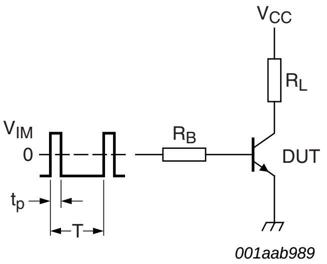
$I_C / I_B = 4$

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



$T_j = 25\ °C$

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



$V_{IM} = -6$ to $+8\ V$; $V_{CC} = 250\ V$; $t_p = 20\ \mu s$; $\delta = \frac{t_p}{T} = 0.01$

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

Fig 12. Test circuit for resistive load switching

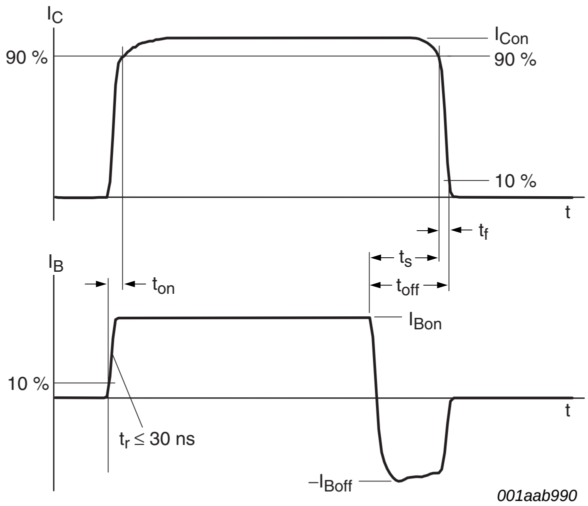
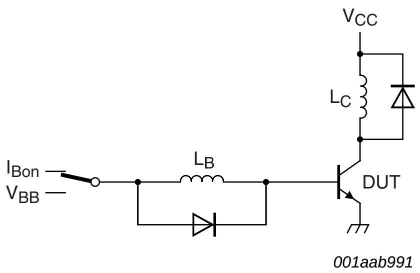


Fig 13. Switching times waveforms for resistive load



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

Fig 14. Test circuit for inductive load switching

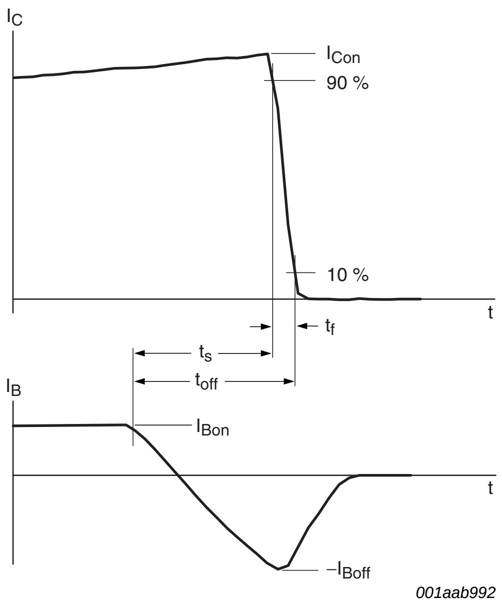
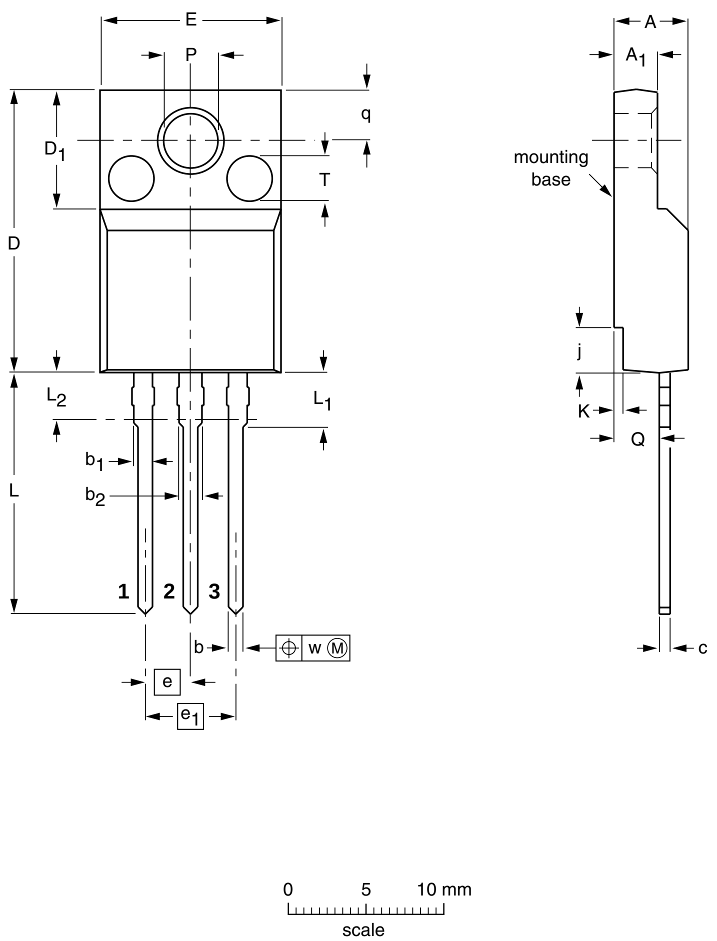


Fig 15. Switching times waveforms for inductive load

8. Package outline

Plastic single-ended package; isolated heatsink mounted; 1 mounting hole; 3-lead TO-220 'full pack'

SOT186A



DIMENSIONS (mm are the original dimensions)

UNIT	A	A_1	b	b_1	b_2	c	D	D_1	E	e	e_1	j	K	L	L_1	L_2(1) max.	P	Q	q	T(2)	w
mm	4.6 4.0	2.9 2.5	0.9 0.7	1.1 0.9	1.4 1.0	0.7 0.4	15.8 15.2	6.5 6.3	10.3 9.7	2.54	5.08	2.7 1.7	0.6 0.4	14.4 13.5	3.30 2.79	3	3.2 3.0	2.6 2.3	3.0 2.6	2.5	0.4

Notes

1. Terminal dimensions within this zone are uncontrolled.
2. Both recesses are ∅ 2.5 × 0.8 max. depth

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT186A		3-lead TO-220F				~~02-04-09~~ 06-02-14

Fig 16. Package outline SOT186A (TO-220F)

9. Revision history

Table 8. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BUJ303AX v.5	20110503	Product data sheet	-	BUJ303AX v.4
Modifications:	• Various changes to content.			
BUJ303AX v.4	20110415	Product data sheet	-	BUJ303AX v.3

10. Legal information

10.1 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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