



BUJ302AX

NPN power transistor

Rev. 02 — 28 March 2011

Product data sheet

1. Product profile

1.1 General description

High-voltage, high-speed planar-passivated NPN power switching transistor in a SOT186A (TO-220F) plastic package.

1.2 Features and benefits

- Fast switching
- High voltage capability
- Isolated package
- Low thermal resistance

1.3 Applications

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

1.4 Quick reference data

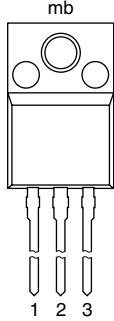
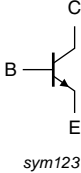
Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I_C	collector current	see Figure 1 ; see Figure 2 ; see Figure 4	-	-	4	A
P_{tot}	total power dissipation	$T_h \leq 25\text{ °C}$; see Figure 3	-	-	26	W
V_{CESM}	collector-emitter peak voltage	$V_{BE} = 0\text{ V}$	-	-	1050	V
Static characteristics						
h_{FE}	DC current gain	$I_C = 0.1\text{ A}$; $V_{CE} = 5\text{ V}$; $T_h = 25\text{ °C}$; see Figure 11	48	66	100	
		$I_C = 0.8\text{ A}$; $V_{CE} = 3\text{ V}$; $T_h = 25\text{ °C}$; see Figure 12	25	42	50	



2. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	B	base		
2	C	collector		
3	E	emitter		
mb	n.c.	isolated		

SOT186A (TO-220F)

3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
BUJ302AX	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	$V_{BE} = 0\text{ V}$	-	1050	V
V_{CEO}	collector-emitter voltage	$I_B = 0\text{ A}$	-	400	V
I_C	collector current	see Figure 1 ; see Figure 2 ; see Figure 4	-	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	$T_h \leq 25\text{ °C}$; see Figure 3	-	26	W
T_{stg}	storage temperature		-65	150	°C
T_j	junction temperature		-	150	°C
V_{EBO}	emitter-base voltage	$I_C = 0\text{ A}$; $I_E = 2\text{ A}$; $t_p < 10\text{ ms}$	-	24	V

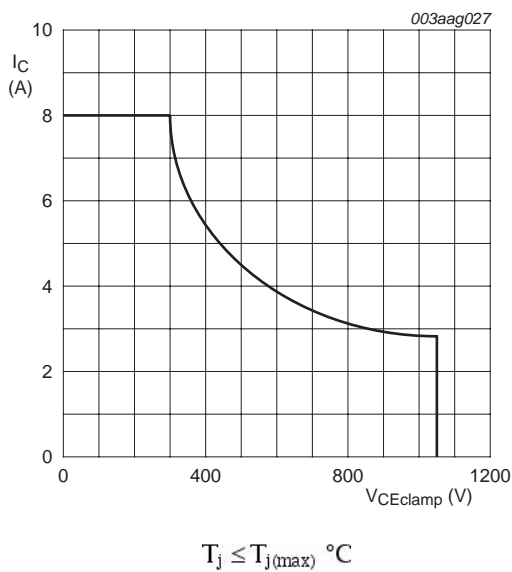


Fig 1. Reverse bias safe operating area

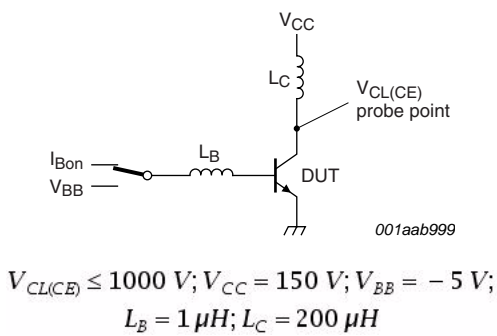
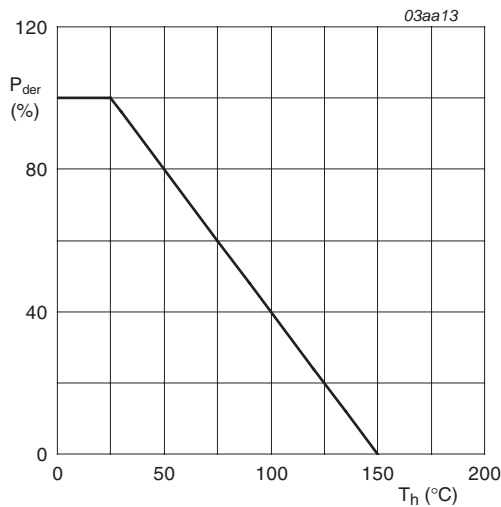
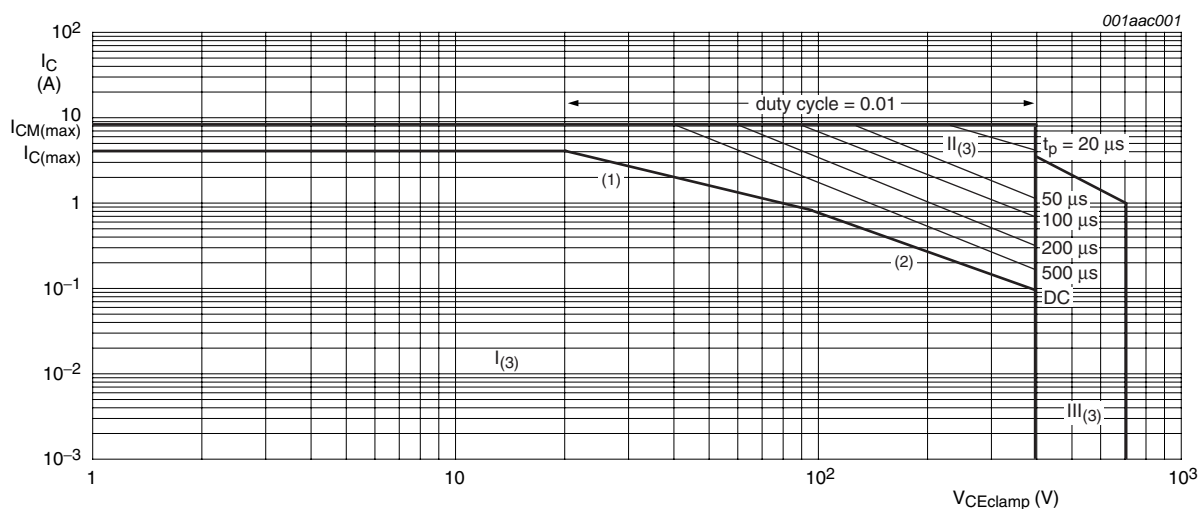


Fig 2. Test circuit for reverse bias safe operating area



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

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} ≤ 100 Ω and t_p ≤ 0.6 μs

Fig 4. Forward bias safe operating area for T_{mb} ≤ 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	-	-	4.8	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	-	55	-	K/W

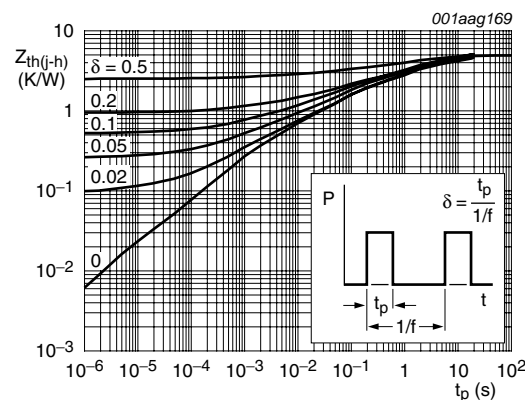


Fig 5. Transient thermal impedance from junction to heatsink as a function of pulse duration

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} = 1050 V; T _j = 25 °C	-	0.2	10	μA
I _{CEO}	collector-emitter cut-off current	V _{CE} = 400 V; I _B = 0 A; T _h = 25 °C	-	10	250	μA
V _{(BR)EBO}	open-collector emitter-base breakdown voltage	I _B = 1 mA; I _C = 0 A; T _h = 25 °C	15	19	-	V
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	400	470	-	V
V _{CEsat}	collector-emitter saturation voltage	I _C = 1 A; I _B = 0.2 A; T _h = 25 °C; see Figure 8 ; see Figure 9	-	0.15	0.5	V
		I _C = 3.5 A; I _B = 1 A; T _h = 25 °C; see Figure 8 ; see Figure 9	-	0.6	1.5	V
V _{BEsat}	base-emitter saturation voltage	I _C = 3.5 A; I _B = 1 A; T _h = 25 °C; see Figure 10	-	1.1	1.5	V
h _{FE}	DC current gain	I _C = 0.1 A; V _{CE} = 5 V; T _h = 25 °C; see Figure 11	48	66	100	
		I _C = 0.8 A; V _{CE} = 3 V; T _h = 25 °C; see Figure 12	25	42	50	
Dynamic characteristics						
t _s	storage time	I _C = 2.5 A; I _{Bon} = 0.5 A; I _{Boff} = -0.5 A; R _L = 60 Ω; V _{BB} = -5 V; T _h = 25 °C; resistive load; t _p = 300 μs; see Figure 13 ; see Figure 14	-	-	3.5	μs
t _f	fall time		-	-	500	ns

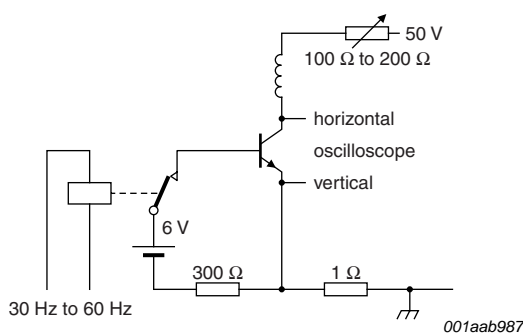


Fig 6. Test circuit for collector-emitter sustaining voltage

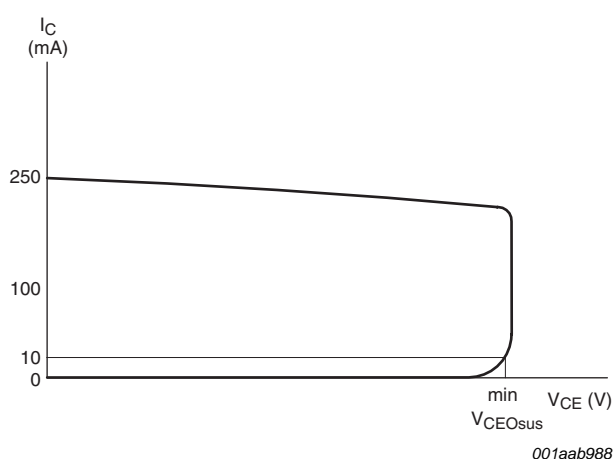


Fig 7. Oscilloscope display for collector-emitter sustaining voltage test waveform

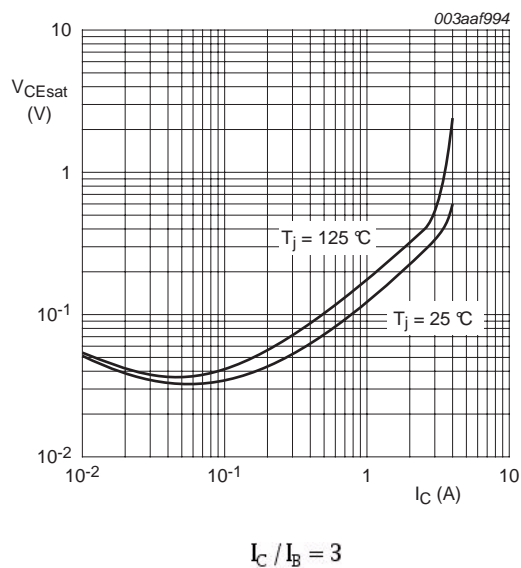


Fig 8. Collector-emitter saturation voltage as a function of collector current; typical values

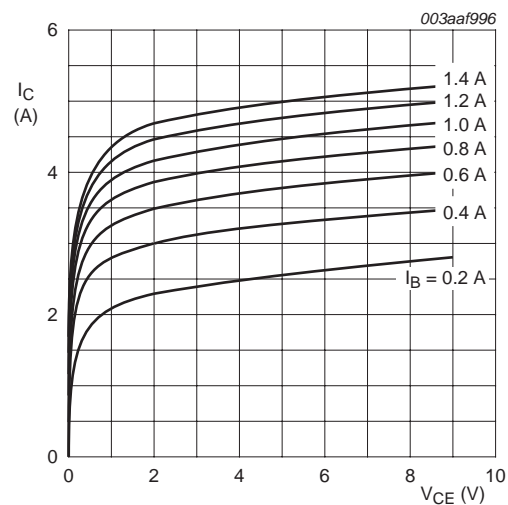


Fig 9. Collector current as a function of collector-emitter voltage; typical values

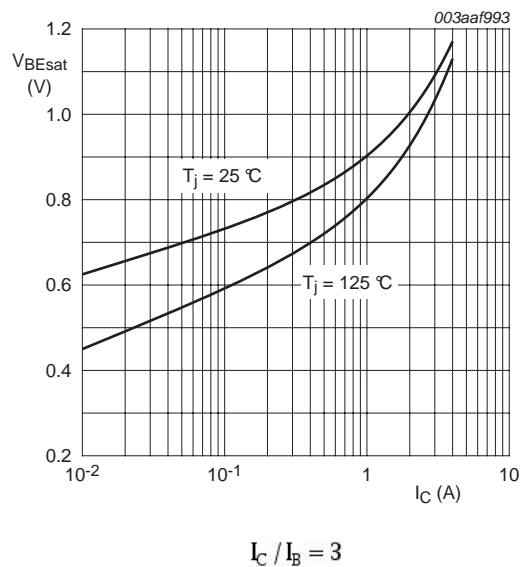


Fig 10. Base-emitter saturation voltage as a function of collector current; typical values

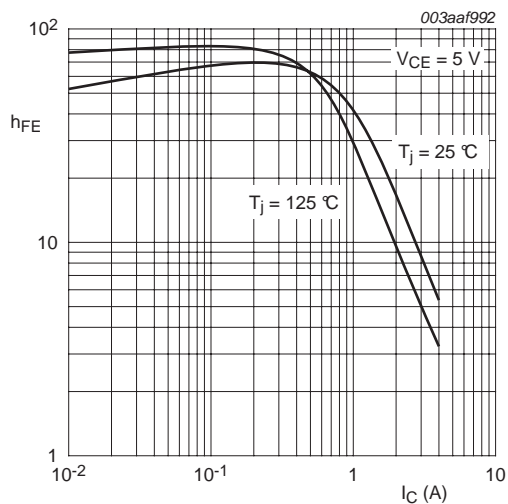


Fig 11. DC current gain as a function of collector current; typical values

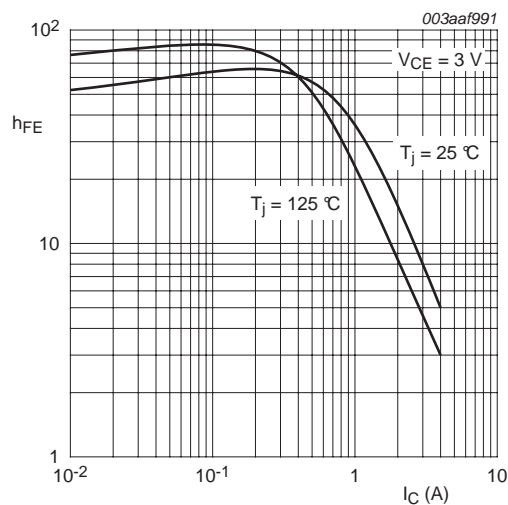
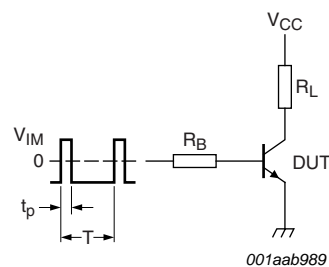


Fig 12. DC current gain as a function of collector current; typical values



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

Fig 13. Test circuit for resistive load switching

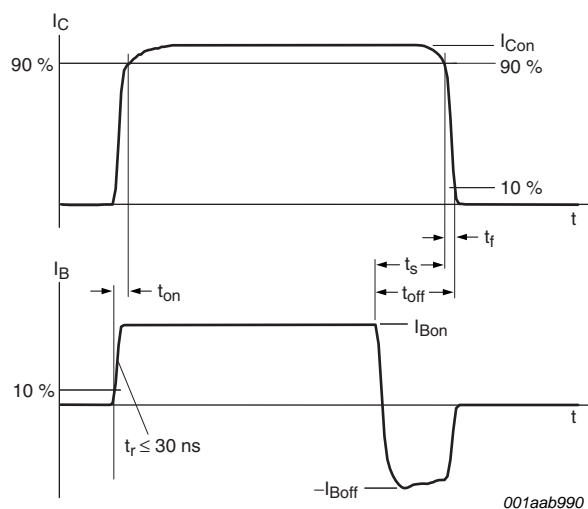


Fig 14. Switching times waveforms for resistive load

8. Package outline

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

SOT186A

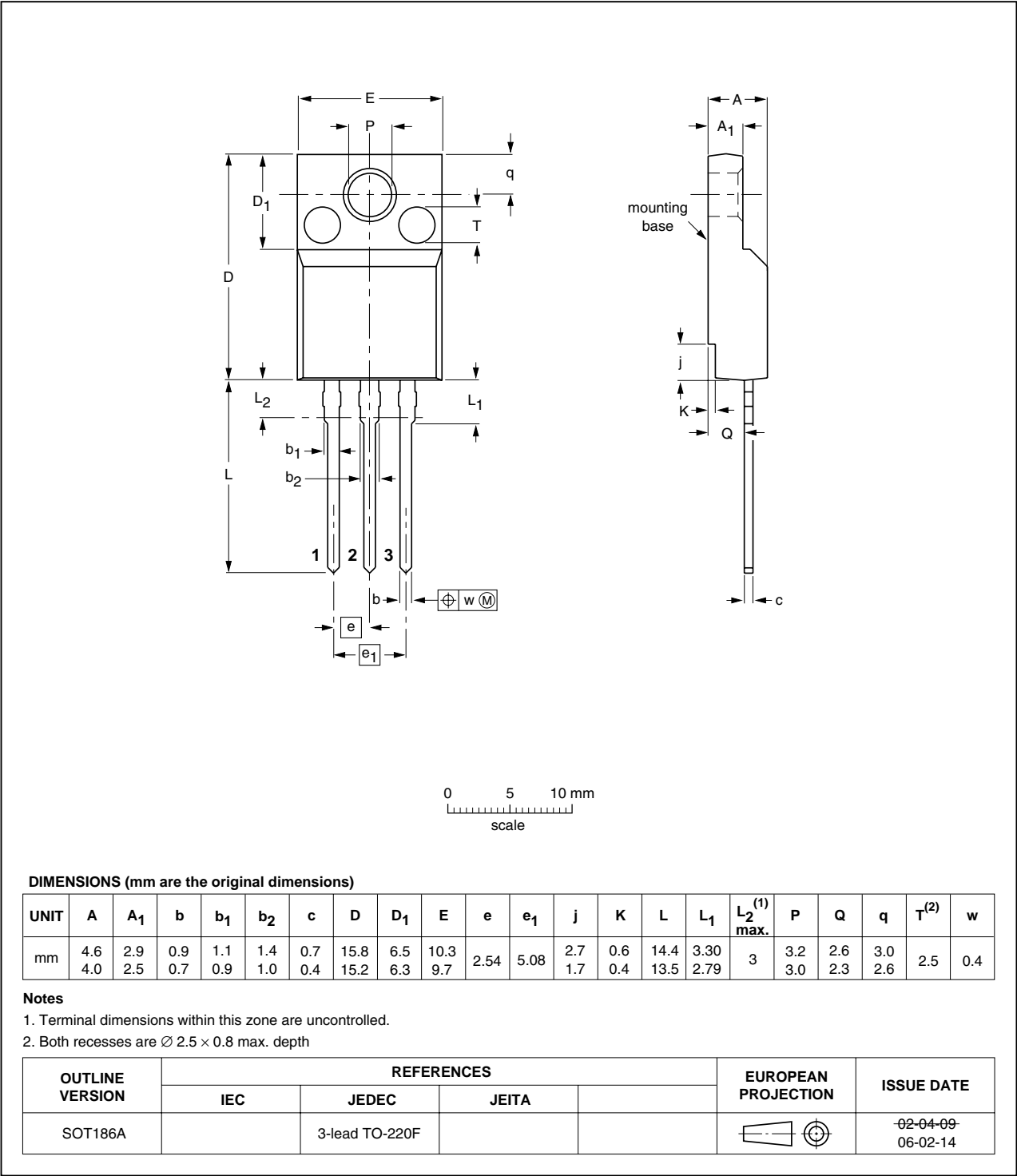


Fig 15. Package outline SOT186A (TO-220F)

9. Revision history

Table 8. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BUJ302AX v.2	20110328	Product data sheet	-	BUJ302AX v.1
Modifications:	<ul style="list-style-type: none">• 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.			
BUJ302AX v.1	19980801	Objective specification	-	-

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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: 28 March 2011

Document identifier: BUJ302AX