

1. General description

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

2. Features and benefits

- Fast switching
- Isolated package
- 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

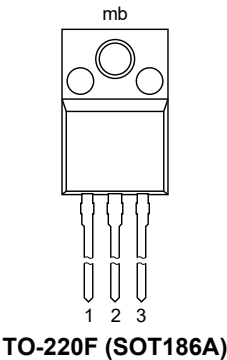
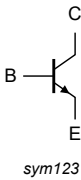
4. Quick reference data

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	$T_h \leq 25\text{ °C}$; Fig. 4	-	-	32	W
V_{CESM}	collector-emitter peak voltage	$V_{BE} = 0\text{ V}$	-	-	1000	V
Static characteristics						
h_{FE}	DC current gain	$I_C = 5\text{ mA}$; $V_{CE} = 5\text{ V}$; $T_h = 25\text{ °C}$; Fig. 11	10	22	35	
		$I_C = 500\text{ mA}$; $V_{CE} = 5\text{ V}$; $T_h = 25\text{ °C}$; Fig. 11	14	25	35	

5. Pinning information

Table 2. Pinning information

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

6. Ordering information

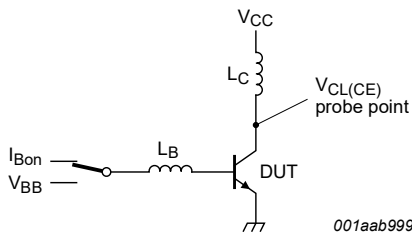
Table 3. Ordering information

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

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	$V_{BE} = 0\text{ V}$	-	1000	V
V_{CEO}	collector-emitter voltage	$I_B = 0\text{ A}$	-	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	DC	-	2	A
I_{BM}	peak base current		-	4	A
P_{tot}	total power dissipation	$T_h \leq 25\text{ °C}$; Fig. 4	-	32	W
T_{stg}	storage temperature		-65	150	°C
T_j	junction temperature		-	150	°C



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

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

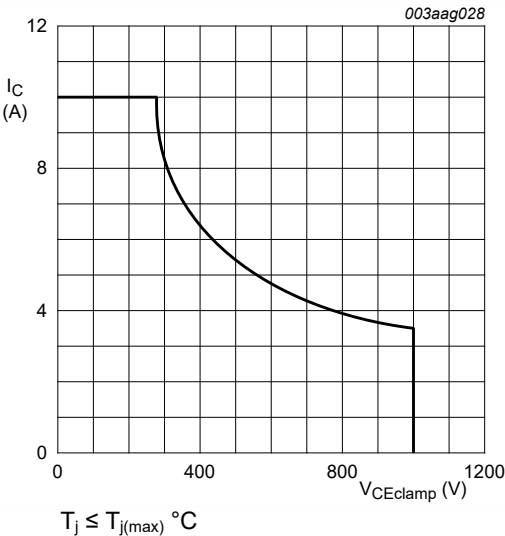
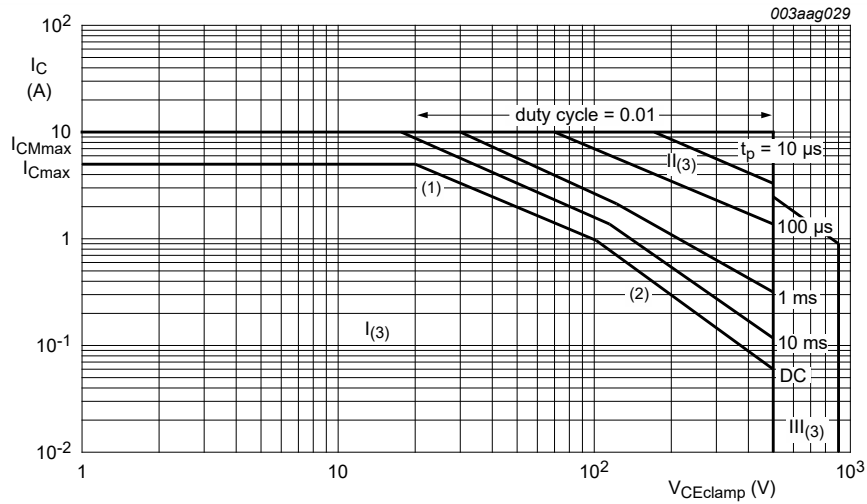


Fig. 2. Reverse bias safe operating area



(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 $t_p \leq 0.6 \mu s$.

Fig. 3. Forward bias safe operating area for $T_{mb} \leq 25^\circ C$

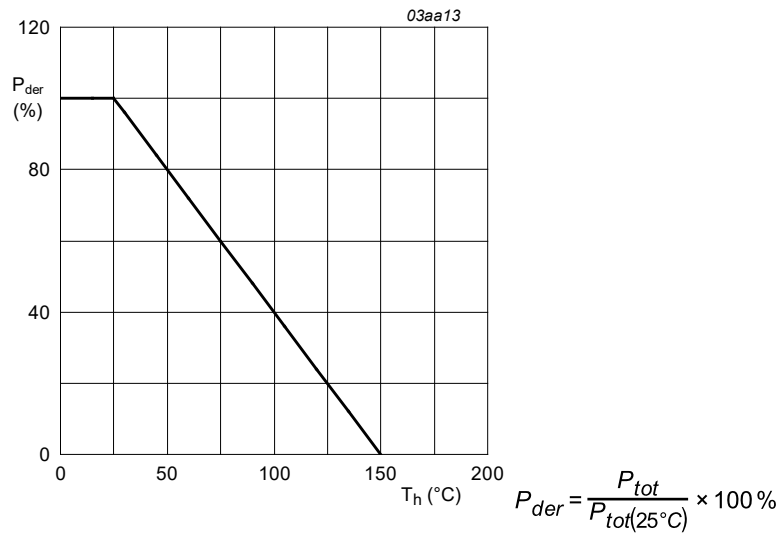
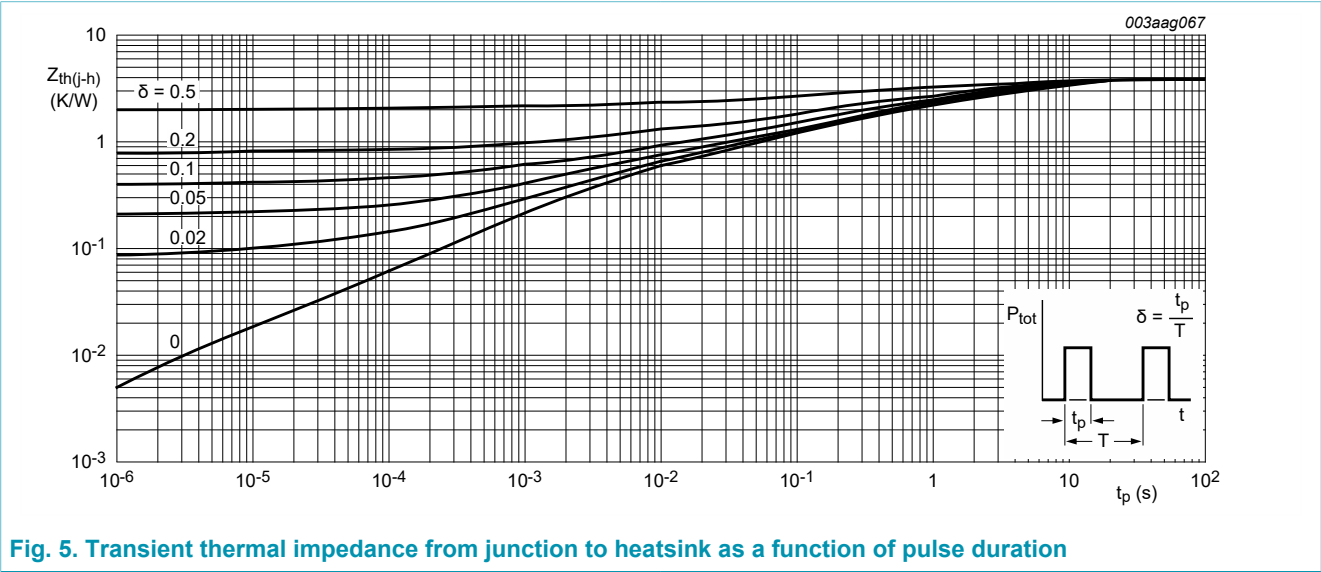


Fig. 4. Normalized total power dissipation as a function of heatsink temperature

8. 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; Fig. 5	-	-	3.95	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient free air	in free air	-	55	-	K/W



9. 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

10. Characteristics

Table 7. 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; Measured with half-sine wave voltage (curve tracer)		-	-	1	mA
				-	-	2	mA
I _{CBO}	collector-base cut-off current (emitter open)	V _{CB} = 1000 V; I _E = 0 A; T _h = 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 _h = 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 _h = 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 _h = 25 °C; Fig. 6 ; Fig. 7		500	-	-	V
V _{CEsat}	collector-emitter saturation voltage	I _C = 3 A; I _B = 0.6 A; T _h = 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 _h = 25 °C; Fig. 10		-	1.01	1.3	V
h _{FE}	DC current gain	I _C = 5 mA; V _{CE} = 5 V; T _h = 25 °C; Fig. 11		10	22	35	
		I _C = 500 mA; V _{CE} = 5 V; T _h = 25 °C; Fig. 11		14	25	35	
h _{FEsat}	DC saturation current gain	I _C = 2.5 A; V _{CE} = 5 V; T _h = 25 °C; Fig. 11		10	13.5	17	
		I _C = 3 A; V _{CE} = 5 V; T _h = 25 °C; Fig. 11		-	11	-	
Dynamic characteristics (switching times - resistive load)							
t _s	turn-off delay time	I _C = 2.5 A; I _{Bon} = 0.5 A; I _{Boff} = -0.5 A; R _L = 75 Ω; T _h = 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	turn-off delay time	I _C = 2.5 A; I _{Bon} = 0.5 A; V _{BB} = -5 V; L _B = 1 μH; T _h = 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 _h = 100 °C; Fig. 14 ; Fig. 15		-	1.7	1.9	μs
t _r	rise time	I _C = 2.5 A; I _{Bon} = 0.5 A; V _{BB} = -5 V; L _B = 1 μH; T _h = 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 _h = 100 °C; Fig. 14 ; Fig. 15		-	160	200	ns

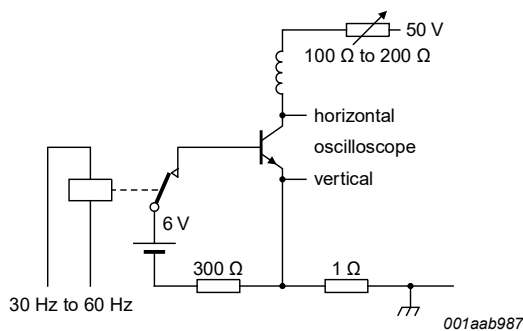


Fig. 6. Test circuit for collector-emitter sustaining voltage

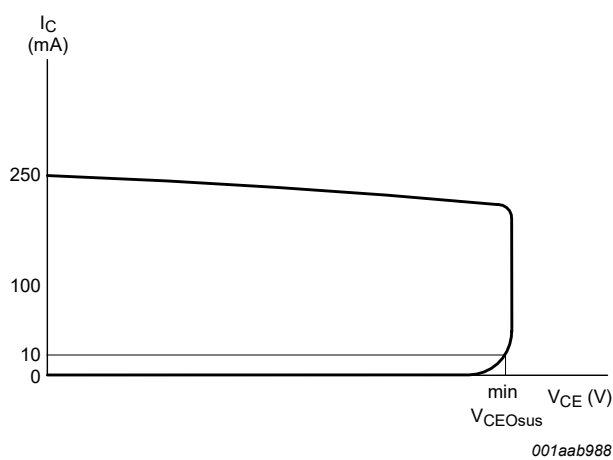


Fig. 7. Oscilloscope display for collector-emitter sustaining voltage test waveform

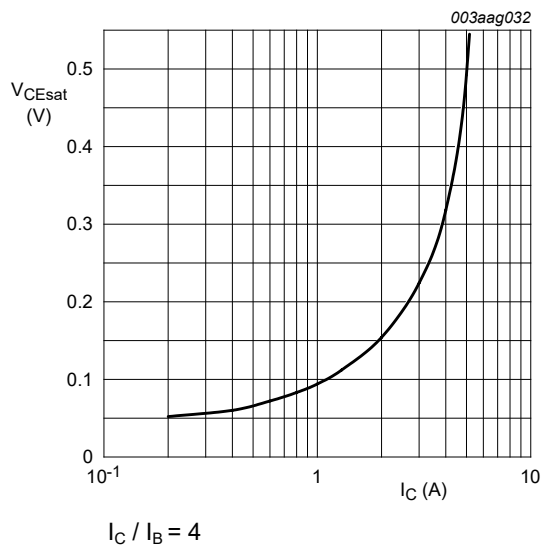


Fig. 8. Collector-emitter saturation voltage as a function of collector current; typical values

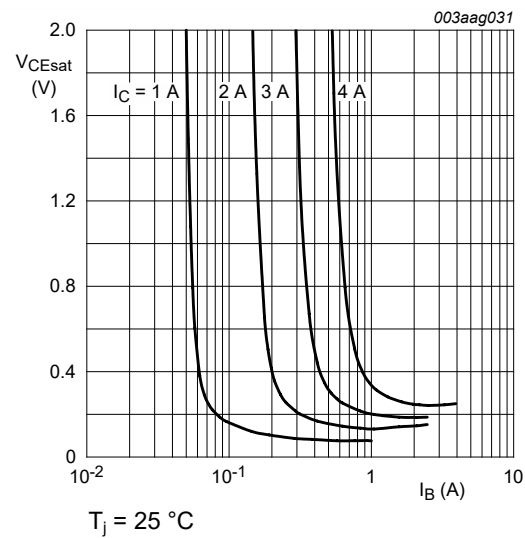


Fig. 9. Collector-emitter saturation voltage as a function of base current; typical values

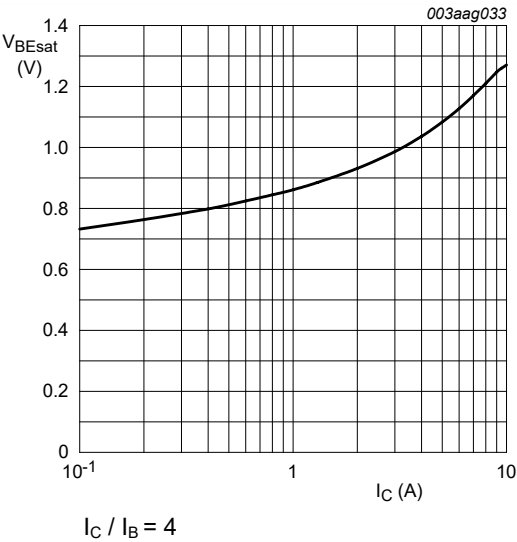


Fig. 10. Base-emitter saturation voltage as a function of collector current; typical values

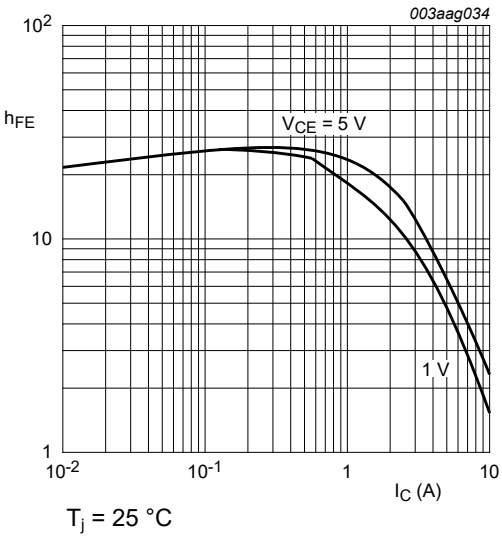
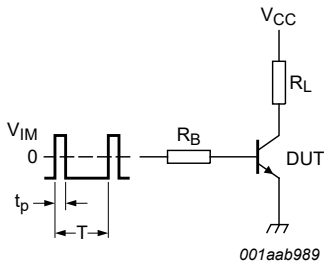


Fig. 11. DC current gain as a function of collector current; typical values



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

Fig. 12. Test circuit for resistive load switching

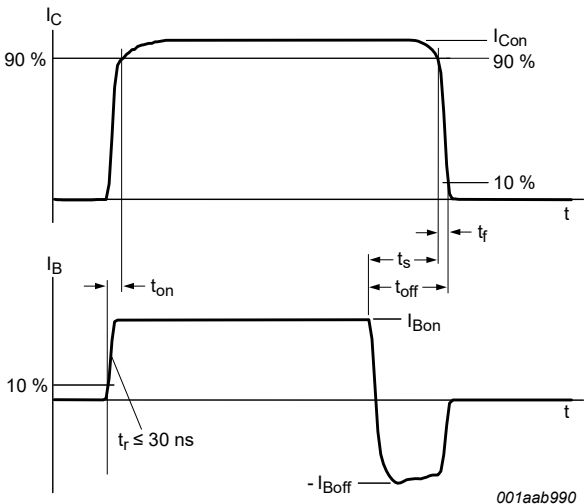
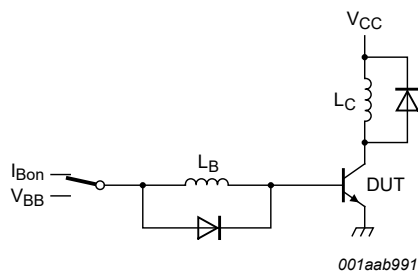


Fig. 13. Switching times waveforms for resistive load



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

Fig. 14. Test circuit for inductive load switching

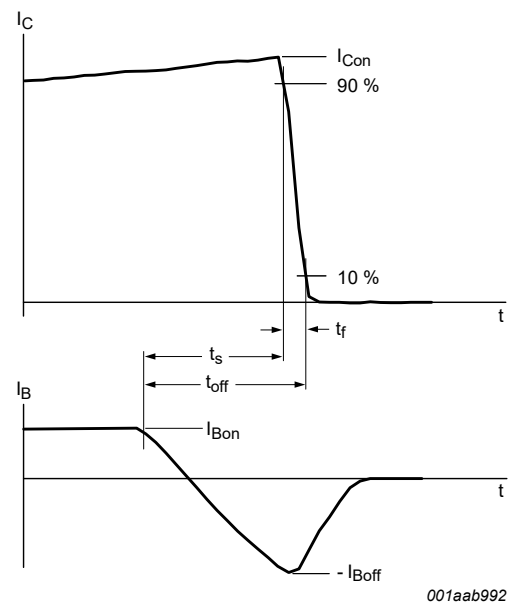


Fig. 15. Switching times waveforms for inductive load

11. Package outline

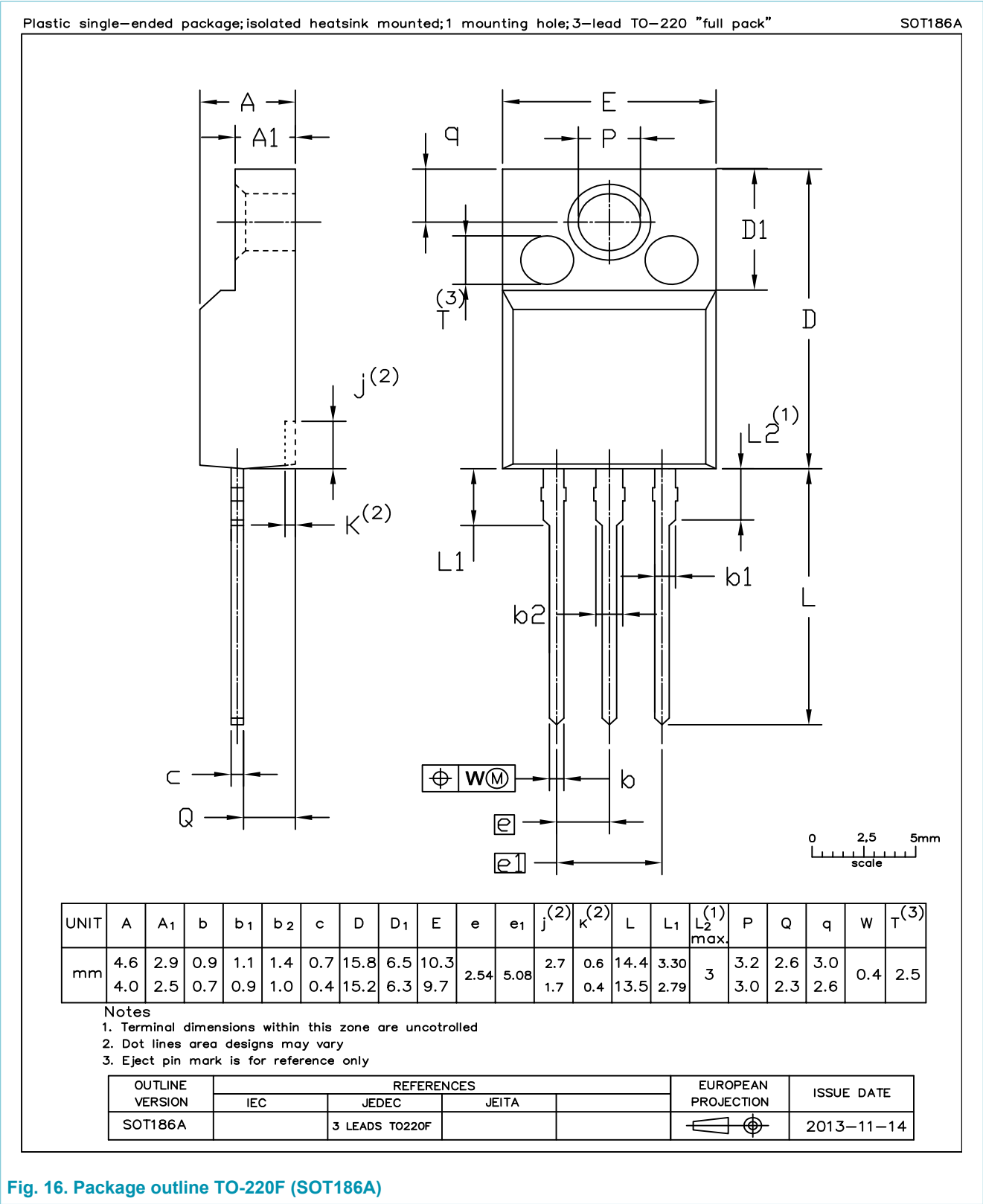


Fig. 16. Package outline TO-220F (SOT186A)

12. Legal information

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Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
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Телефон: 8 (812) 309-75-97 (многоканальный)

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Электронная почта: ocean@oceanchips.ru

Web: <http://oceanchips.ru/>

Адрес: 198099, г. Санкт-Петербург, ул. Калинина, д. 2, корп. 4, лит. А