

## 1. General description

High voltage, high speed, planar passivated NPN power switching transistor with integrated anti-parallel E-C diode in a SOT428 (DPAK) surface mountable plastic package.

## 2. Features and benefits

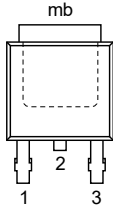
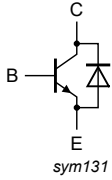
- Fast switching
- High voltage capability
- Integrated anti-parallel E-C diode
- Surface mountable package
- Very low switching and conduction losses

## 3. Applications

- DC-to-DC converters
- Electronic lighting ballasts
- Inverters
- Motor control systems

## 4. Pinning information

Table 1. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	B	base	 <p><b>DPAK (SOT428)</b></p>	 <p>sym131</p>
2	C	collector <sup>[1]</sup>		
3	E	emitter		
mb	C	mounting base; connected to collector		

[1] it is not possible to make a connection to pin 2 of the SOT428 (DPAK) package

## 5. Ordering information

Table 2. Ordering information

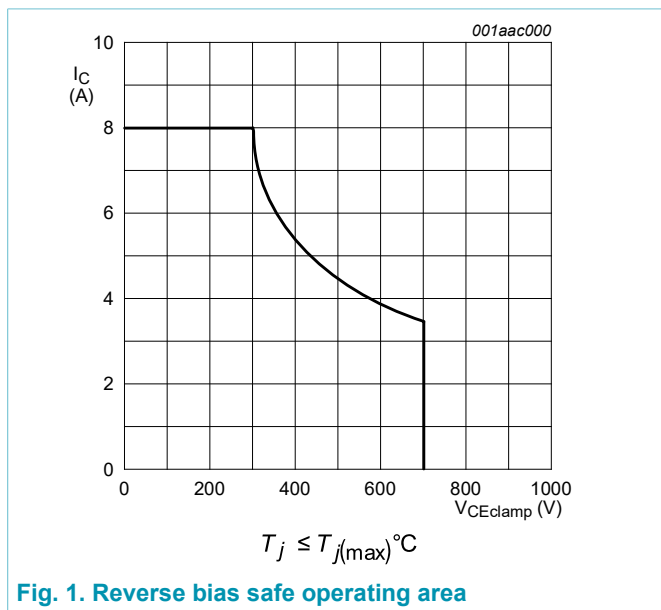
Type number	Package		
	Name	Description	Version
BUJD103AD	DPAK	plastic single-ended surface-mounted package (DPAK); 3 leads (one lead cropped)	SOT428

## 6. Limiting values

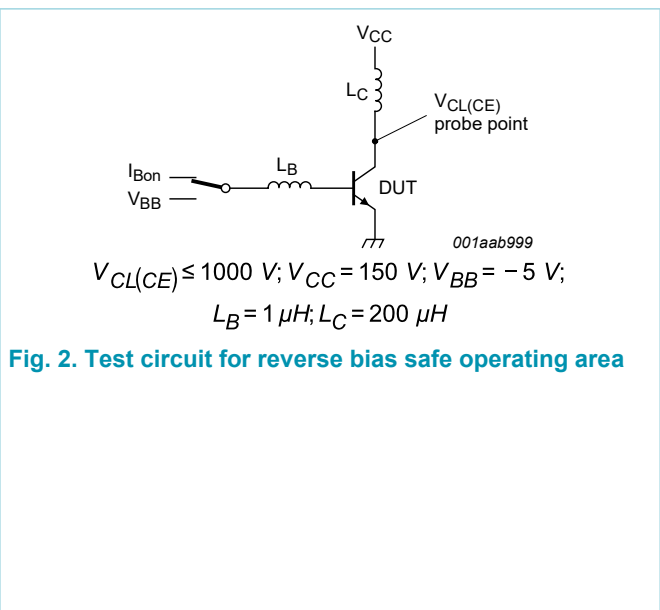
**Table 3. Limiting values**

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

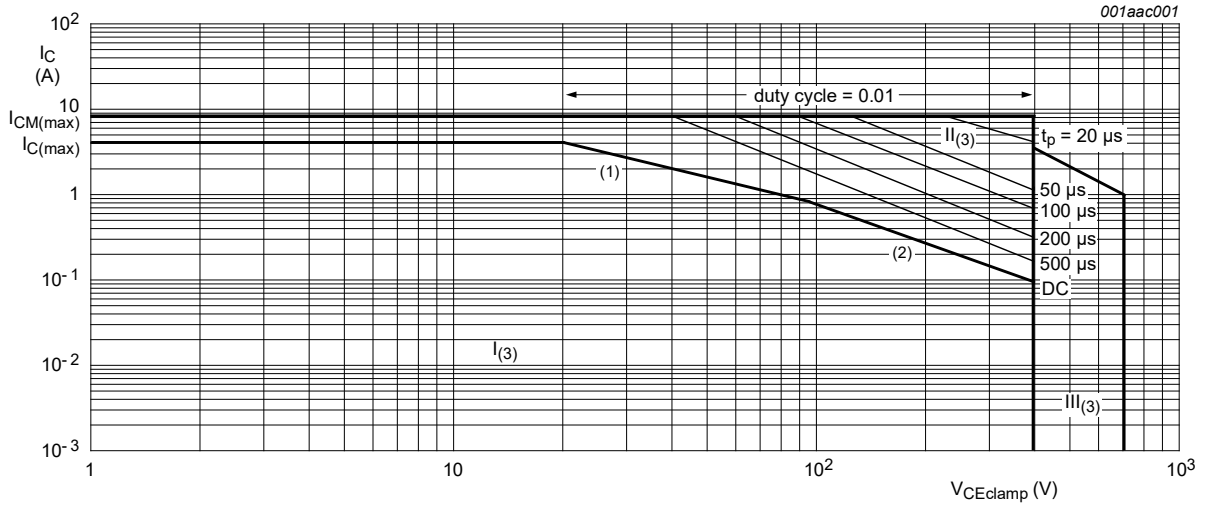
Symbol	Parameter	Conditions	Min	Max	Unit
$V_{CESM}$	collector-emitter peak voltage	$V_{BE} = 0\text{ V}$	-	700	V
$V_{CBO}$	collector-base voltage	$I_E = 0\text{ A}$	-	700	V
$V_{CEO}$	collector-emitter voltage	$I_B = 0\text{ A}$	-	400	V
$I_C$	collector current	DC; Fig. 1; Fig. 2; Fig. 3	-	4	A
$I_{CM}$	peak collector current	Fig. 1; Fig. 2; Fig. 3	-	8	A
$I_B$	base current	DC	-	2	A
$I_{BM}$	peak base current		-	4	A
$P_{tot}$	total power dissipation	$T_{mb} \leq 25\text{ °C}$ ; Fig. 4	-	80	W
$T_{stg}$	storage temperature		-65	150	°C
$T_j$	junction temperature		-	150	°C



**Fig. 1. Reverse bias safe operating area**

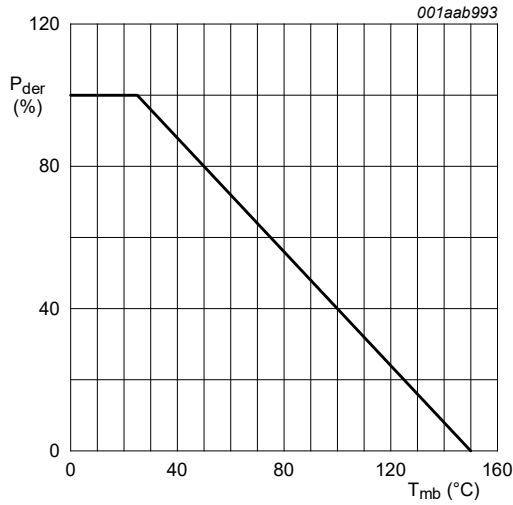


**Fig. 2. Test circuit for reverse bias safe operating area**



- 1) Ptot maximum and Ptot 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  $RBE \leq 100 \Omega$  and  $t_p \leq 0.6 \mu s$

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



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

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

### 7. Thermal characteristics

Table 4. Thermal characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-mb)}$	thermal resistance from junction to mounting base	<a href="#">Fig. 5</a>	-	-	1.56	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient free air	printed circuit board (FR4) mounted; minimum footprint; <a href="#">Fig. 6</a>	-	75	-	K/W

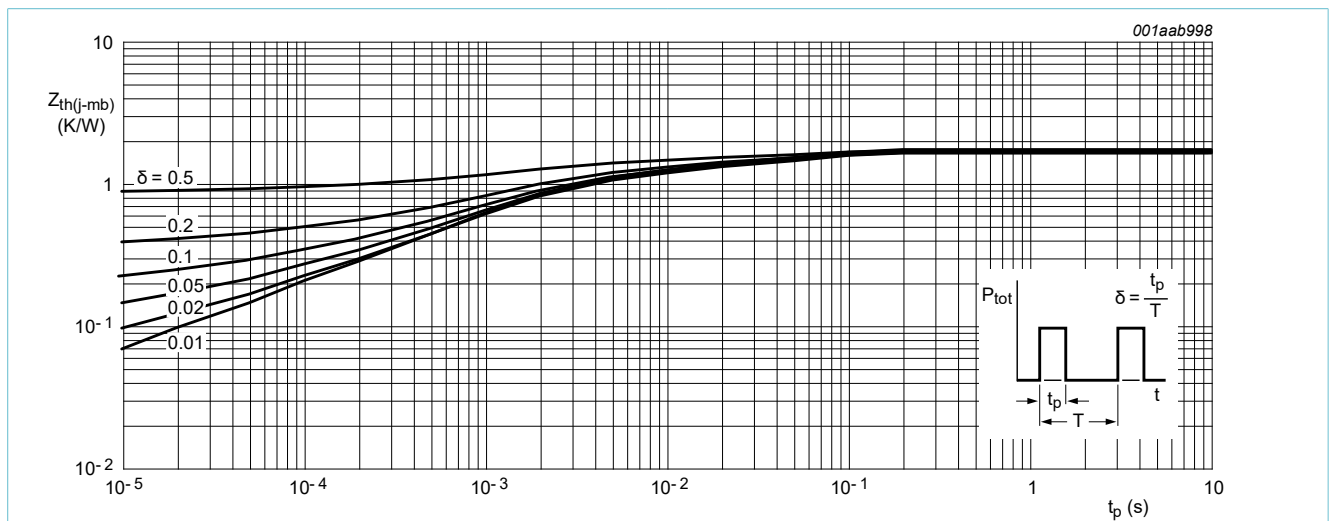


Fig. 5. Transient thermal impedance from junction to mounting base as a function of pulse width

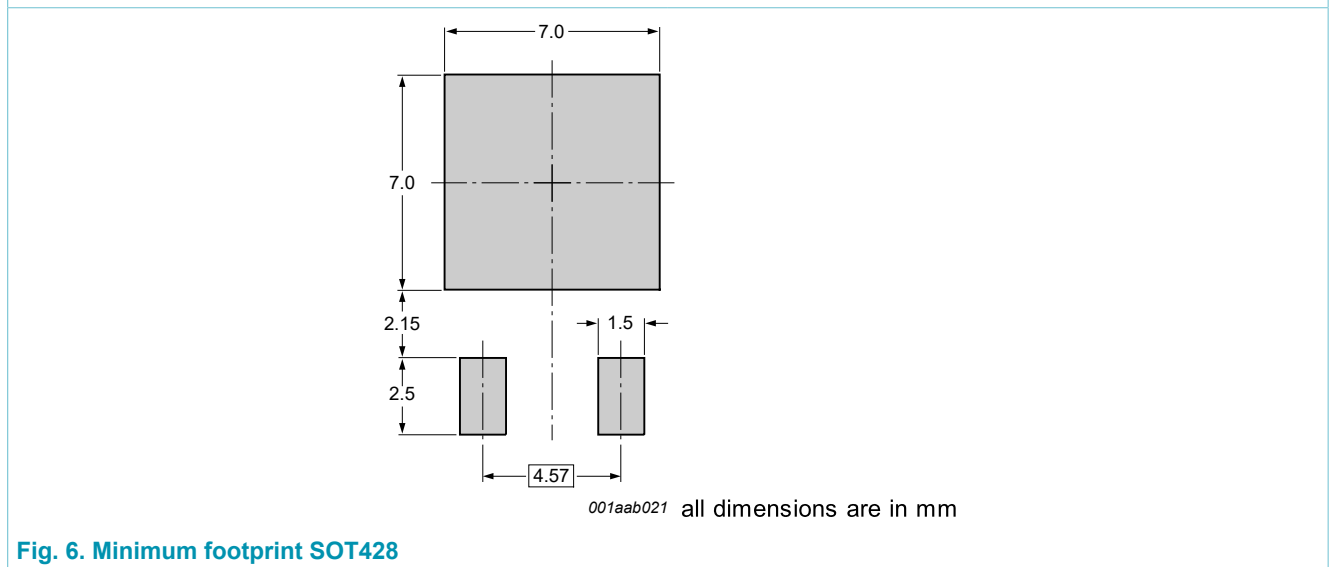


Fig. 6. Minimum footprint SOT428

## 8. Characteristics

Table 5. Characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit	
<b>Static characteristics</b>								
$I_{CES}$	collector-emitter cut-off current (base shorted)	$V_{BE} = 0\text{ V}; V_{CE} = 700\text{ V}; T_j = 125\text{ }^\circ\text{C}$	[1]	-	-	2	mA	
		$V_{BE} = 0\text{ V}; V_{CE} = 700\text{ V}; T_j = 25\text{ }^\circ\text{C}$	[1]	-	-	1	mA	
$I_{CBO}$	collector-base cut-off current (emitter open)	$V_{CB} = 700\text{ V}; I_E = 0\text{ A}$	[1]	-	-	1	mA	
$I_{CEO}$	collector-emitter cut-off current (base open)	$V_{CE} = 400\text{ V}; I_B = 0\text{ A}$	[1]	-	-	0.1	mA	
$I_{EBO}$	emitter-base cut-off current (collector open)	$V_{EB} = 7\text{ V}; I_C = 0\text{ A}$		-	-	10	mA	
$V_{CEsat}$	collector-emitter saturation voltage	$I_C = 3\text{ A}; I_B = 0.6\text{ A};$ <a href="#">Fig. 7</a> ; <a href="#">Fig. 8</a>		-	0.29	1	V	
$V_{BEsat}$	base-emitter saturation voltage	$I_C = 3\text{ A}; I_B = 0.6\text{ A};$ <a href="#">Fig. 9</a>		-	0.99	1.5	V	
$V_F$	forward voltage	$I_F = 2\text{ A}; T_j = 25\text{ }^\circ\text{C}$		-	1.04	1.5	V	
$h_{FE}$	DC current gain	$I_C = 1\text{ mA}; V_{CE} = 5\text{ V}; T_{mb} = 25\text{ }^\circ\text{C};$ <a href="#">Fig. 10</a>		10	15	32		
		$I_C = 500\text{ mA}; V_{CE} = 5\text{ V}; T_{mb} = 25\text{ }^\circ\text{C};$ <a href="#">Fig. 10</a>		13	21	32		
		$I_C = 2\text{ A}; V_{CE} = 5\text{ V}; T_{mb} = 25\text{ }^\circ\text{C};$ <a href="#">Fig. 10</a>		11	16	22		
		$I_C = 3\text{ A}; V_{CE} = 5\text{ V}; T_{mb} = 25\text{ }^\circ\text{C};$ <a href="#">Fig. 10</a>		-	12.5	-		
<b>Dynamic characteristics</b>								
$t_{on}$	turn-on time	$I_C = 2.5\text{ A}; I_{Bon} = 0.5\text{ A}; I_{Boff} = -0.5\text{ A};$ $R_L = 75\text{ }\Omega; T_j = 25\text{ }^\circ\text{C};$ resistive load; <a href="#">Fig. 11</a> ; <a href="#">Fig. 12</a>		-	0.52	0.6	$\mu\text{s}$	
$t_s$	storage time		$I_C = 2\text{ A}; I_{Bon} = 0.4\text{ A}; V_{BB} = -5\text{ V};$ $L_B = 1\text{ }\mu\text{H}; T_j = 25\text{ }^\circ\text{C};$ inductive load; <a href="#">Fig. 13</a> ; <a href="#">Fig. 14</a>		-	1.2	1.4	$\mu\text{s}$
			$I_C = 2\text{ A}; I_{Bon} = 0.4\text{ A}; V_{BB} = -5\text{ V};$ $L_B = 1\text{ }\mu\text{H}; T_j = 100\text{ }^\circ\text{C};$ inductive load; <a href="#">Fig. 13</a> ; <a href="#">Fig. 14</a>		-	-	1.8	$\mu\text{s}$
$t_f$	fall time	$I_C = 2.5\text{ A}; I_{Bon} = 0.5\text{ A}; I_{Boff} = -0.5\text{ A};$ $R_L = 75\text{ }\Omega;$ resistive load; <a href="#">Fig. 11</a> ; <a href="#">Fig. 12</a>		-	0.3	0.35	$\mu\text{s}$	
		$I_C = 2\text{ A}; I_{Bon} = 0.4\text{ A}; V_{BB} = -5\text{ V};$ $L_B = 1\text{ }\mu\text{H};$ inductive load; <a href="#">Fig. 13</a> ; <a href="#">Fig. 14</a>		-	-	0.12	$\mu\text{s}$	
				-	0.03	0.06	$\mu\text{s}$	

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

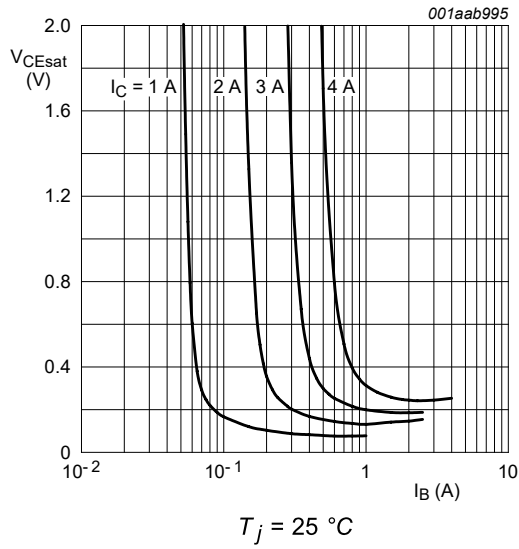


Fig. 7. Collector-emitter saturation voltage as a function of base current; typical values

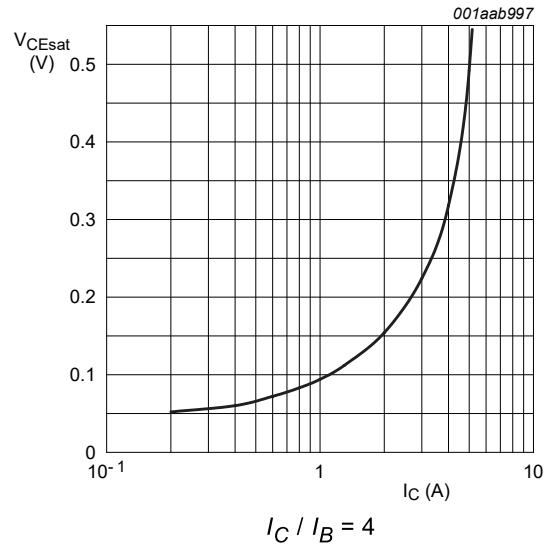


Fig. 8. Collector-emitter saturation voltage as a function of collector current; typical values

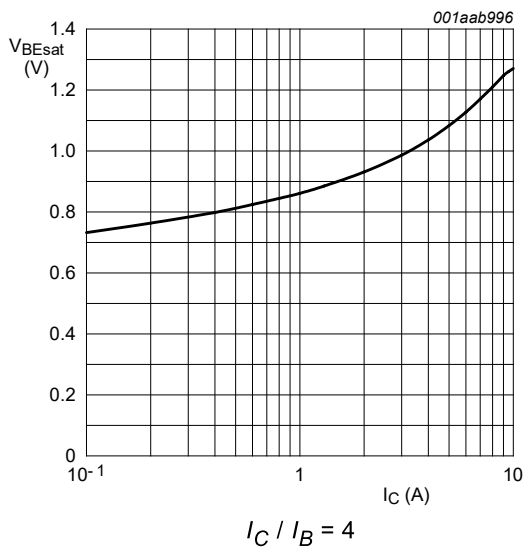


Fig. 9. Base-emitter saturation voltage as a function of collector current; typical values

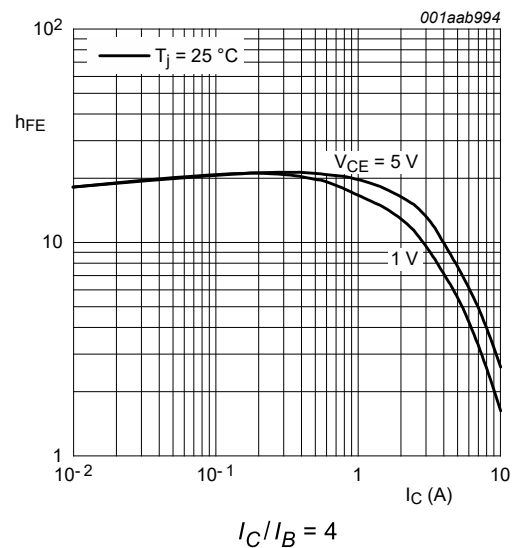
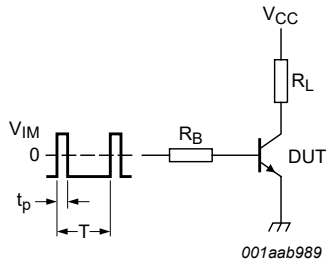


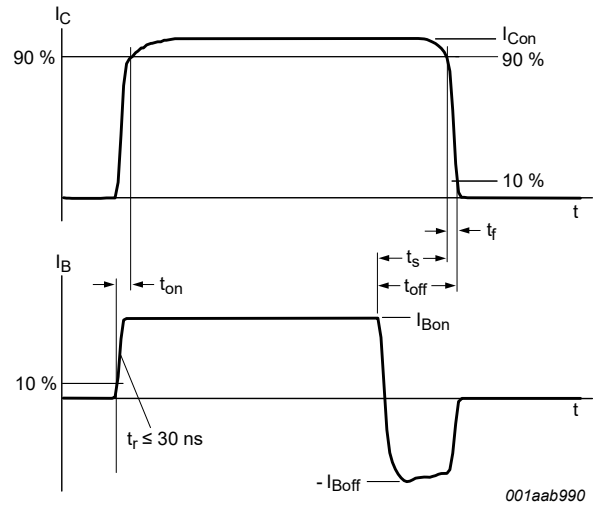
Fig. 10. DC current gain as a function of collector current; typical values



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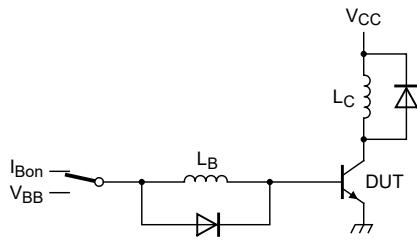
$V_{IM} = -6 \text{ to } +8 \text{ V}; V_{CC} = 250 \text{ V}; t_p = 20 \mu\text{s}; \delta = \frac{t_p}{T} = 0.01$   
 $R_B$  and  $R_L$  calculated from  $I_{Con}$  and  $I_{Bon}$  requirements.

Fig. 11. Test circuit for resistive load switching



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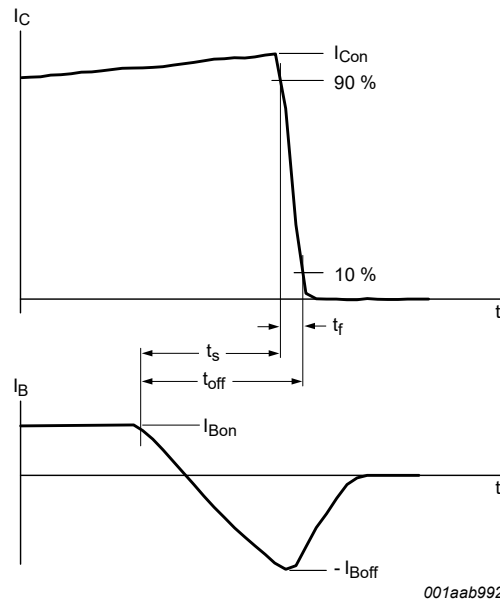
Fig. 12. Switching times waveforms for resistive load



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

Fig. 13. Test circuit for inductive load switching



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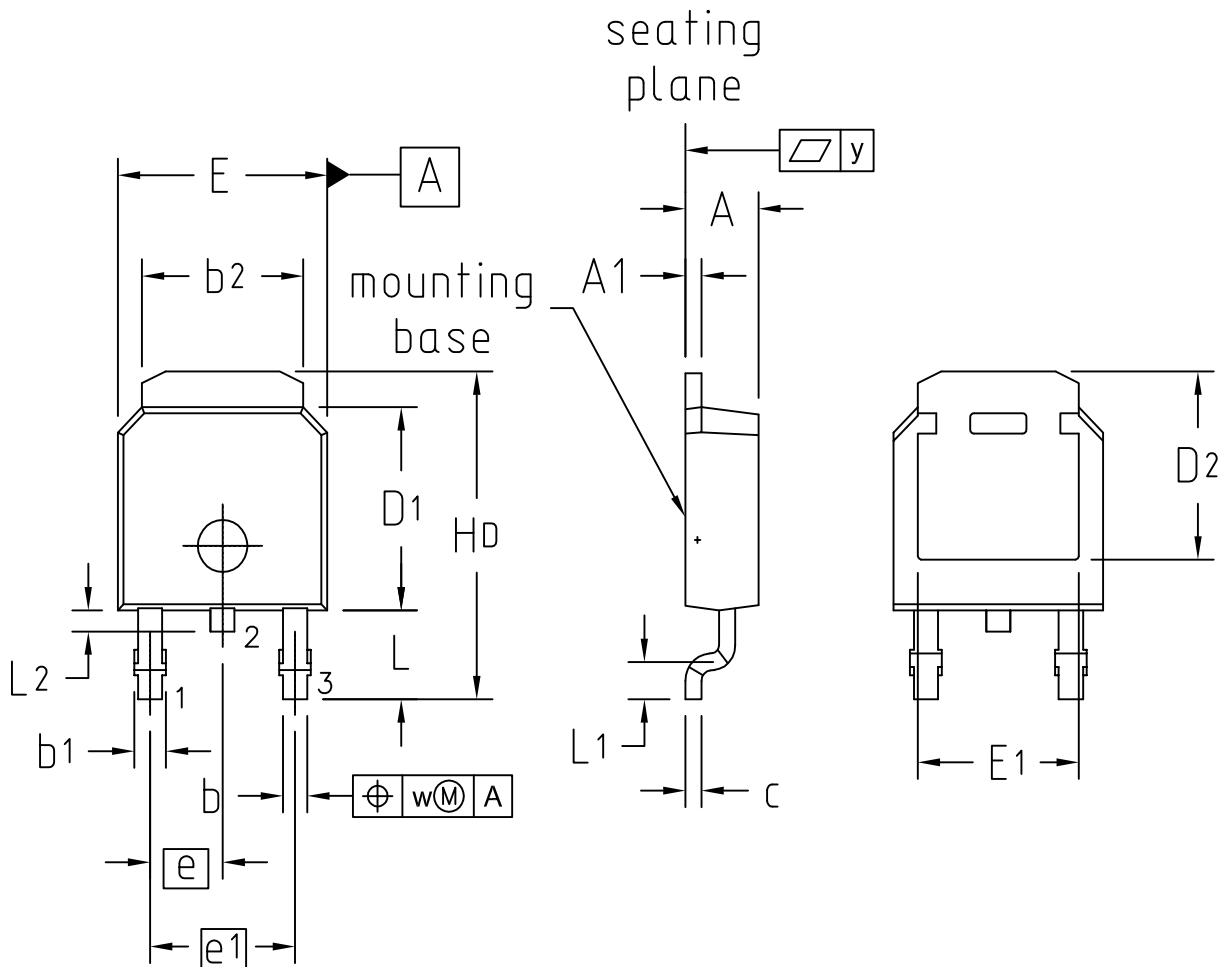
Fig. 14. Switching times waveforms for inductive load



9. Package outline

Plastic single-ended surface-mounted package (DPAK); 3 leads (one lead cropped)

SOT428



UNIT	A	A <sub>1</sub>	b	b <sub>1</sub>	b <sub>2</sub>	c	D <sub>1</sub>	D <sub>2</sub>	E	E <sub>1</sub>	e	e <sub>1</sub>	H <sub>d</sub>	L	L <sub>1</sub>	L <sub>2</sub>	w	y
mm	2.38	0.93	0.89	1.1	5.46	0.56	6.22	4.00	6.73	4.45	2.285	4.57	10.40	2.95	0.5	0.90	0.2	0.20
	2.22	0.46	0.71	0.9	5.00	0.20	5.98	min.	6.47	min.			9.60	2.55	min.	0.50	0.2	max.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT428		TO-252				

Fig. 15. Package outline DPAK (SOT428)

## 10. Legal information

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