

## 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

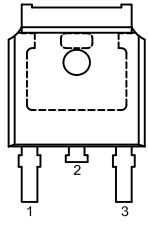
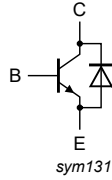
- Fast switching
- High voltage capability
- Integrated anti-parallel E-C diode
- Surface mountable package
- Very low switching and conduction losses

## 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

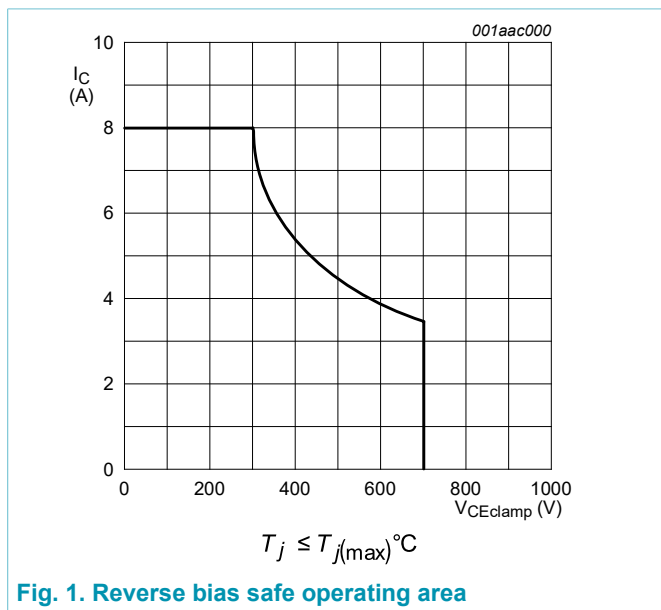
Type number	Package		
	Name	Description	Version
BUJD203AD	DPAK	plastic single-ended surface-mounted package (DPAK); 3 leads (one lead cropped)	SOT428

## 6. Limiting values

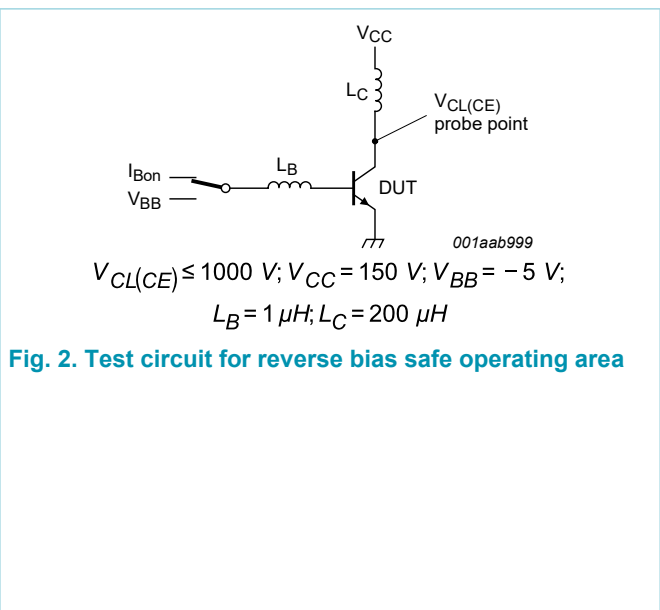
**Table 3. Limiting values**

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

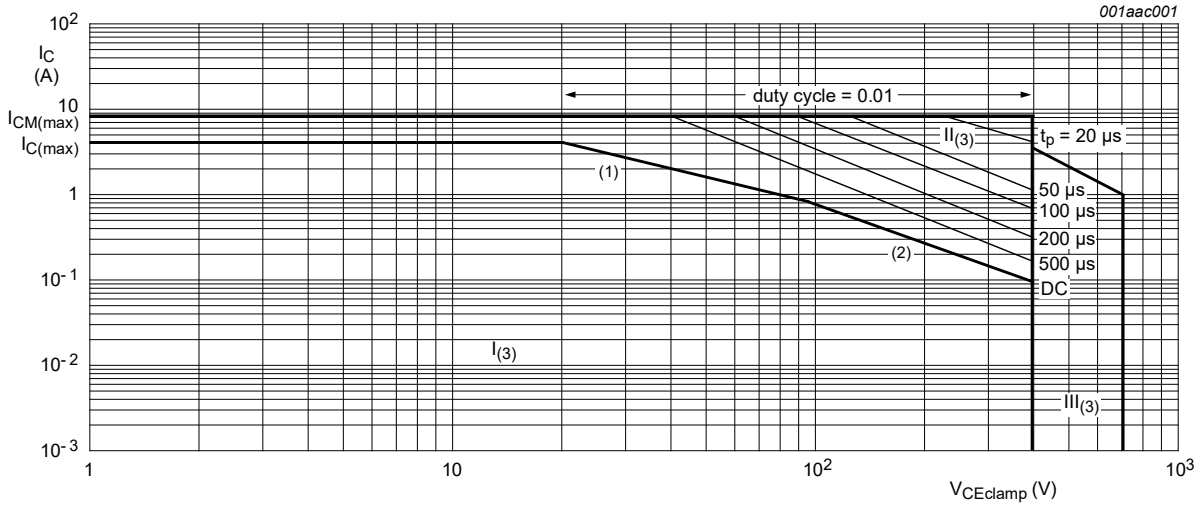
Symbol	Parameter	Conditions	Min	Max	Unit
$V_{CESM}$	collector-emitter peak voltage	$V_{BE} = 0\text{ V}$	-	850	V
$V_{CBO}$	collector-base voltage	$I_E = 0\text{ A}$	-	850	V
$V_{CEO}$	collector-emitter voltage	$I_B = 0\text{ A}$	-	425	V
$I_C$	collector current	DC; Fig. 1; Fig. 2; Fig. 3	-	4	A
$I_{CM}$	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**

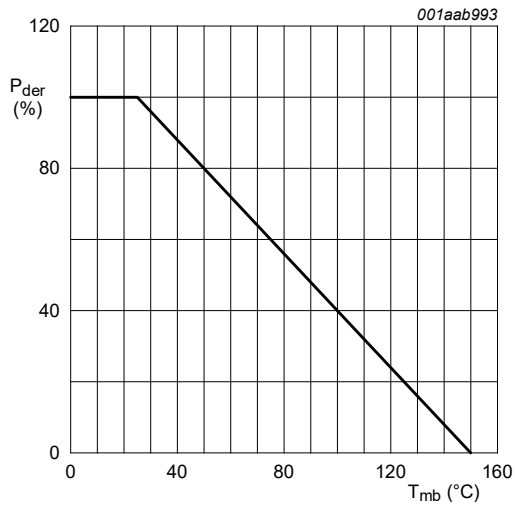


**Fig. 2. Test circuit for reverse bias safe operating area**



- 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  $T_{mb} \leq 25 \text{ }^\circ\text{C}$



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

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

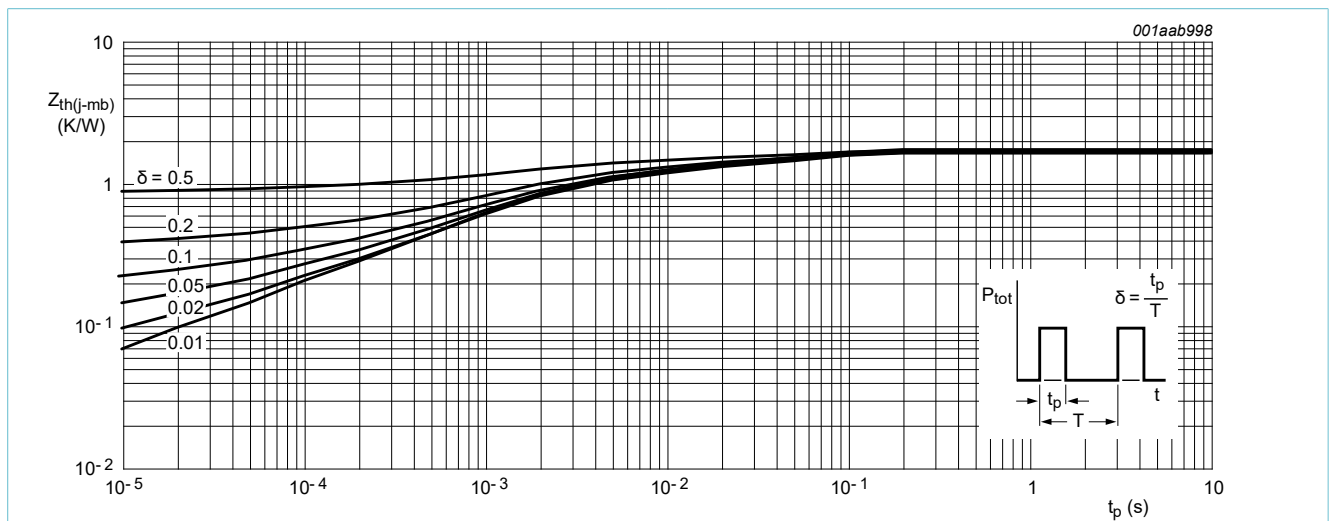


Fig. 5. Transient thermal impedance from junction to mounting base as a function of pulse width

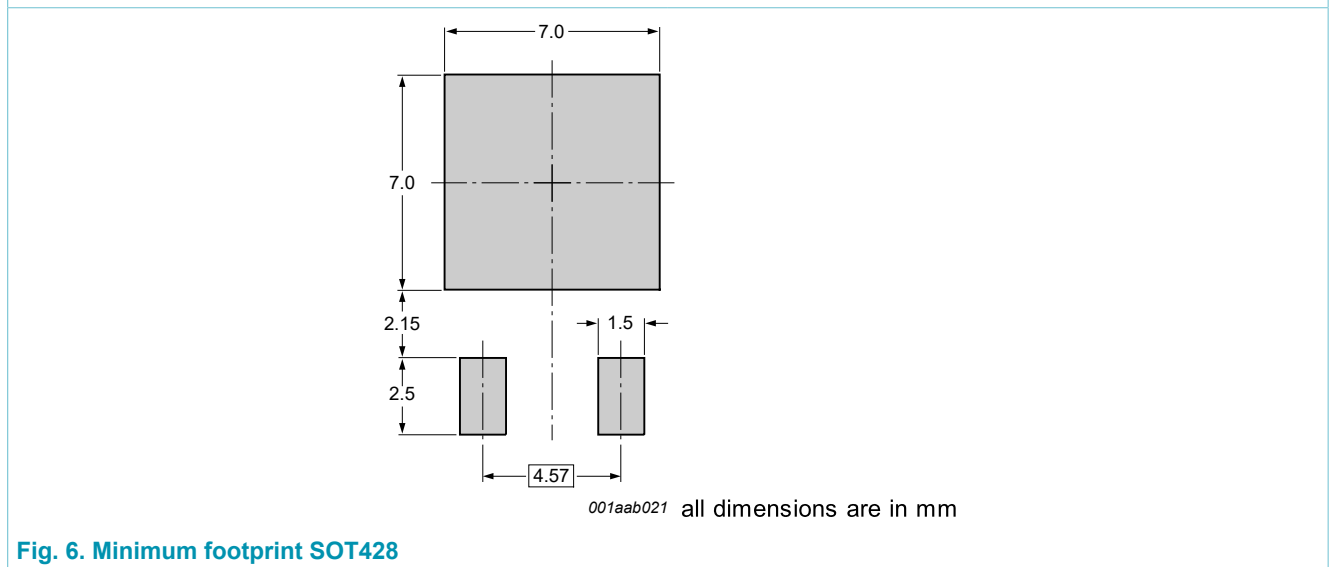


Fig. 6. Minimum footprint SOT428

## 8. Characteristics

**Table 5. Characteristics**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
<b>Static characteristics</b>							
I <sub>CES</sub>	collector-emitter cut-off current (base shorted)	V <sub>BE</sub> = 0 V; V <sub>CE</sub> = 850 V; T <sub>j</sub> = 125 °C	[1]	-	-	2	mA
		V <sub>BE</sub> = 0 V; V <sub>CE</sub> = 850 V; T <sub>j</sub> = 25 °C	[1]	-	-	1	mA
I <sub>CBO</sub>	collector-base cut-off current (emitter open)	V <sub>CB</sub> = 850 V; I <sub>E</sub> = 0 A	[1]	-	-	1	mA
I <sub>CEO</sub>	collector-emitter cut-off current (base open)	V <sub>CE</sub> = 425 V; I <sub>B</sub> = 0 A	[1]	-	-	0.1	mA
I <sub>EBO</sub>	emitter-base cut-off current (collector open)	V <sub>EB</sub> = 7 V; I <sub>C</sub> = 0 A		-	-	10	mA
V <sub>CE0sus</sub>	collector-emitter sustaining voltage (base open)	I <sub>B</sub> = 0 A; I <sub>C</sub> = 10 mA; L <sub>C</sub> = 25 mH; <a href="#">Fig. 7</a> ; <a href="#">Fig. 8</a>		400	450	-	V
V <sub>CEsat</sub>	collector-emitter saturation voltage	I <sub>C</sub> = 3 A; I <sub>B</sub> = 0.6 A; <a href="#">Fig. 9</a> ; <a href="#">Fig. 10</a>		-	0.29	1	V
V <sub>BEsat</sub>	base-emitter saturation voltage	I <sub>C</sub> = 3 A; I <sub>B</sub> = 0.6 A; <a href="#">Fig. 11</a>		-	0.99	1.5	V
V <sub>F</sub>	forward voltage	I <sub>F</sub> = 2 A; T <sub>j</sub> = 25 °C		-	1.04	1.5	V
h <sub>FE</sub>	DC current gain	I <sub>C</sub> = 1 mA; V <sub>CE</sub> = 5 V; T <sub>mb</sub> = 25 °C; <a href="#">Fig. 12</a>		10	15	32	
		I <sub>C</sub> = 500 mA; V <sub>CE</sub> = 5 V; T <sub>mb</sub> = 25 °C; <a href="#">Fig. 12</a>		13	21	32	
		I <sub>C</sub> = 2 A; V <sub>CE</sub> = 5 V; T <sub>mb</sub> = 25 °C; <a href="#">Fig. 12</a>		11	16	22	
		I <sub>C</sub> = 3 A; V <sub>CE</sub> = 5 V; T <sub>mb</sub> = 25 °C; <a href="#">Fig. 12</a>		-	12.5	-	
<b>Dynamic characteristics</b>							
t <sub>on</sub>	turn-on time	I <sub>C</sub> = 2.5 A; I <sub>Bon</sub> = 0.5 A; I <sub>Boff</sub> = -0.5 A; R <sub>L</sub> = 75 Ω; T <sub>j</sub> = 25 °C; resistive load; <a href="#">Fig. 13</a> ; <a href="#">Fig. 14</a>		-	0.52	0.6	μs
t <sub>s</sub>	storage time	I <sub>C</sub> = 2 A; I <sub>Bon</sub> = 0.4 A; V <sub>BB</sub> = -5 V; L <sub>B</sub> = 1 μH; T <sub>j</sub> = 25 °C; inductive load; <a href="#">Fig. 15</a> ; <a href="#">Fig. 16</a>		-	2.7	3.3	μs
		I <sub>C</sub> = 2 A; I <sub>Bon</sub> = 0.4 A; V <sub>BB</sub> = -5 V; L <sub>B</sub> = 1 μH; T <sub>j</sub> = 25 °C; inductive load; <a href="#">Fig. 15</a> ; <a href="#">Fig. 16</a>		-	1.2	1.4	μs
		I <sub>C</sub> = 2 A; I <sub>Bon</sub> = 0.4 A; V <sub>BB</sub> = -5 V; L <sub>B</sub> = 1 μH; T <sub>j</sub> = 100 °C; inductive load; <a href="#">Fig. 15</a> ; <a href="#">Fig. 16</a>		-	-	1.8	μs
t <sub>f</sub>	fall time	I <sub>C</sub> = 2.5 A; I <sub>Bon</sub> = 0.5 A; I <sub>Boff</sub> = -0.5 A; R <sub>L</sub> = 75 Ω; resistive load; <a href="#">Fig. 13</a> ; <a href="#">Fig. 14</a>		-	0.3	0.35	μs
		I <sub>C</sub> = 2 A; I <sub>Bon</sub> = 0.4 A; V <sub>BB</sub> = -5 V; L <sub>B</sub> = 1 μH; inductive load; <a href="#">Fig. 15</a> ; <a href="#">Fig. 16</a>		-	-	0.12	μs
				-	0.03	0.06	μs

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

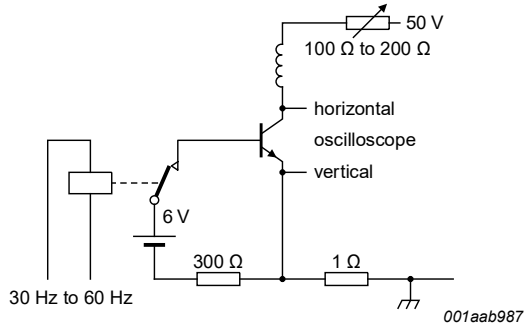


Fig. 7. Test circuit for collector-emitter sustaining voltage

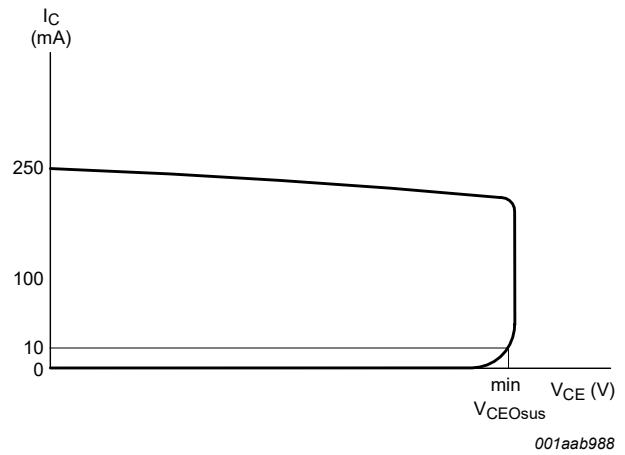


Fig. 8. Oscilloscope display for collector-emitter sustaining voltage test waveform

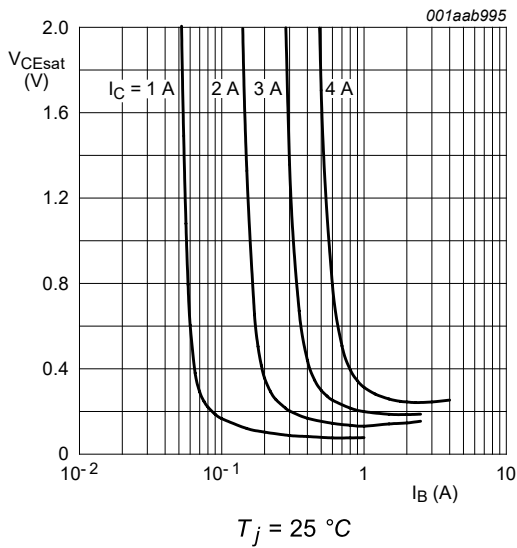


Fig. 9. Collector-emitter saturation voltage as a function of base current; typical values

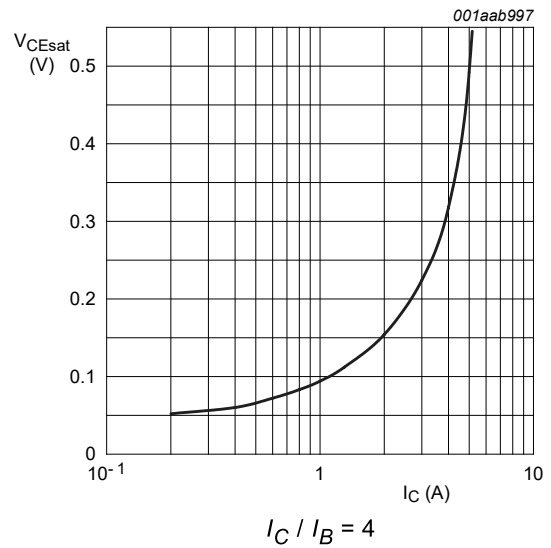


Fig. 10. Collector-emitter saturation voltage as a function of collector current; typical values

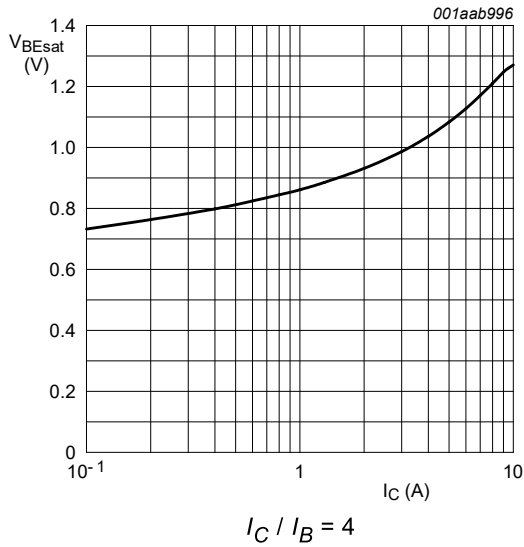


Fig. 11. Base-emitter saturation voltage as a function of collector current; typical values

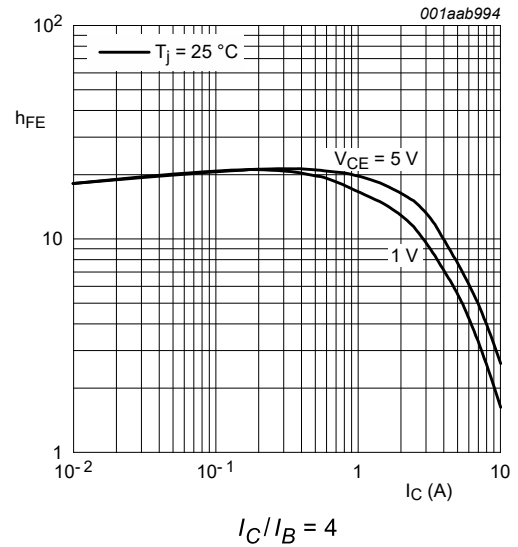
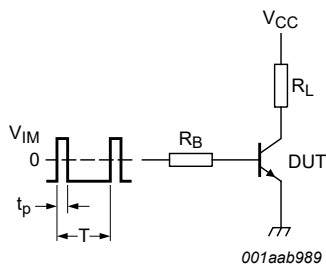


Fig. 12. DC current gain as a function of collector current; typical values



$V_{IM} = -6$  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. 13. Test circuit for resistive load switching

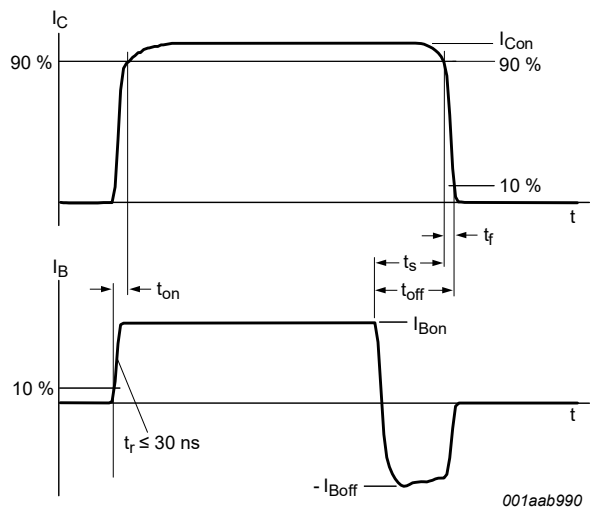


Fig. 14. Switching times waveforms for resistive load



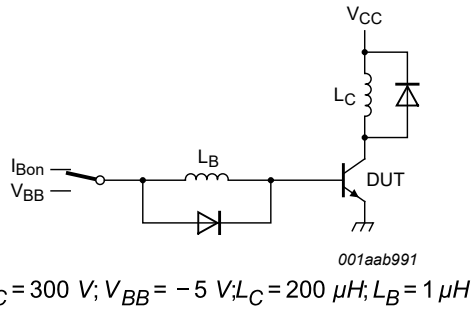


Fig. 15. Test circuit for inductive load switching

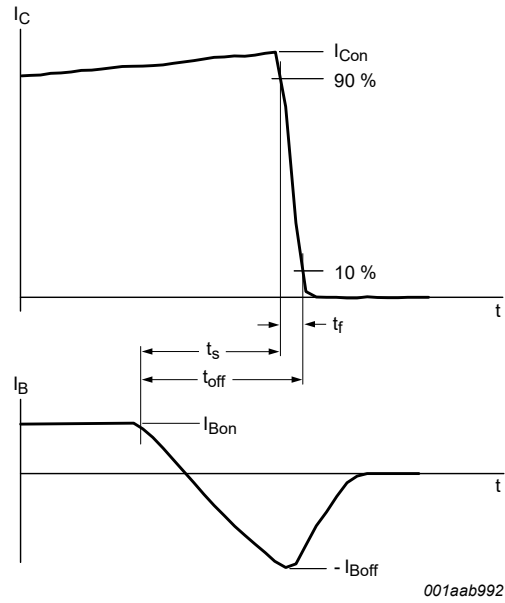
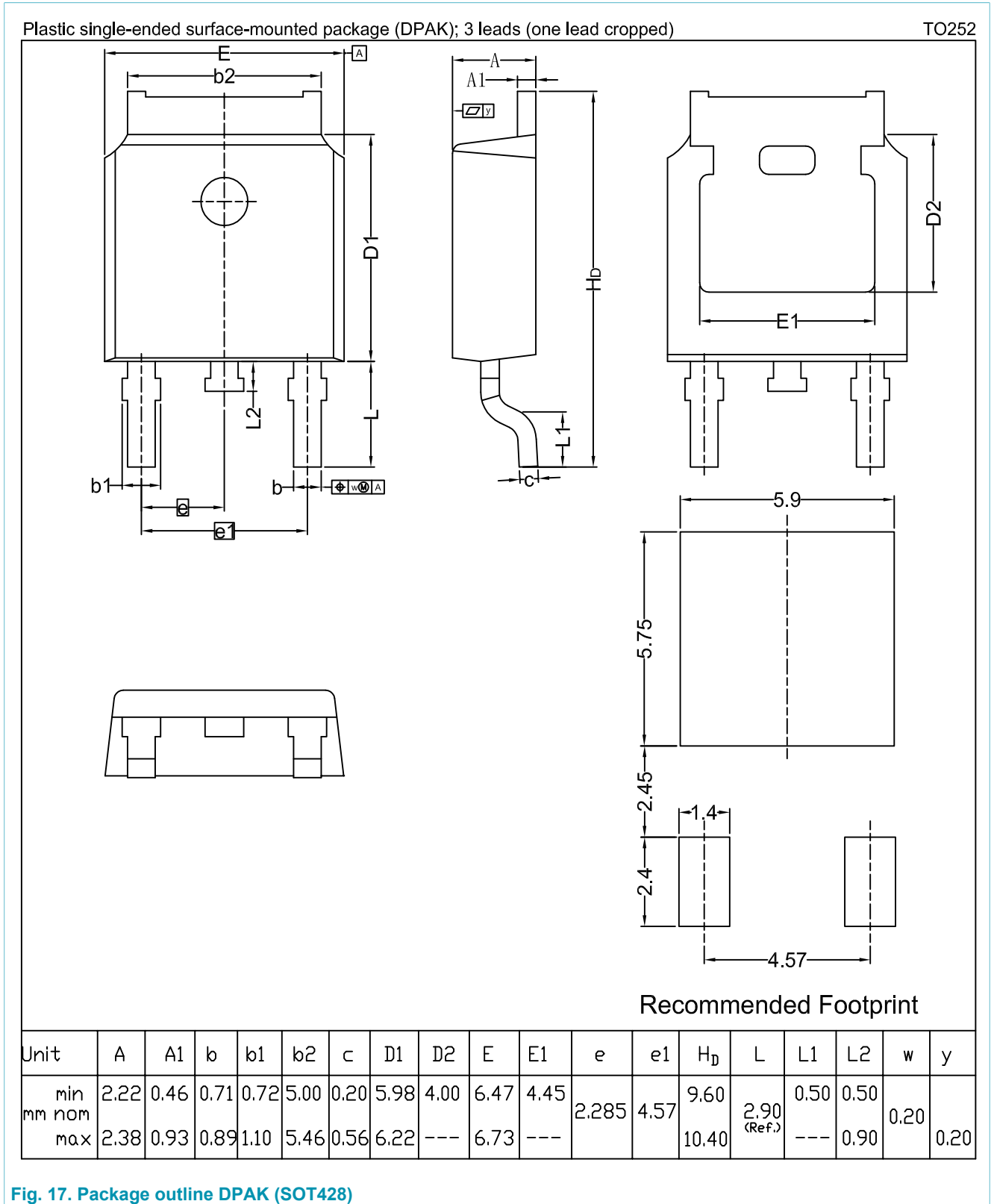


Fig. 16. Switching times waveforms for inductive load

**9. Package outline**



**Fig. 17. Package outline DPAK (SOT428)**

## 10. Legal information

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