

## 1. General description

High voltage, high speed planar passivated NPN power switching transistor in a SOT428 (DPAK) surface mountable plastic package.

## 2. Features and benefits

- Fast switching
- Low thermal resistance
- Surface mountable 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

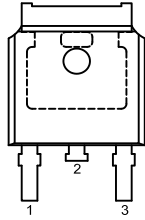
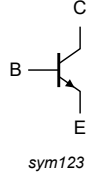
## 4. Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$I_{CM}$	peak collector current	<a href="#">Fig. 1</a> ; <a href="#">Fig. 2</a> ; <a href="#">Fig. 3</a>	-	-	10	A
$P_{tot}$	total power dissipation	$T_{mb} \leq 25\text{ °C}$ ; <a href="#">Fig. 4</a>	-	-	80	W
$V_{CESM}$	collector-emitter peak voltage	$V_{BE} = 0\text{ V}$	-	-	1000	V
<b>Static characteristics</b>						
$h_{FE}$	DC current gain	$I_C = 5\text{ mA}$ ; $V_{CE} = 5\text{ V}$ ; $T_{mb} = 25\text{ °C}$ ; <a href="#">Fig. 11</a>	10	22	30	
		$I_C = 500\text{ mA}$ ; $V_{CE} = 5\text{ V}$ ; $T_{mb} = 25\text{ °C}$ ; <a href="#">Fig. 11</a>	14	25	35	

## 5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	B	base	 <p><b>DPAK (SOT428)</b></p>	 <p>sym123</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.

## 6. Ordering information

Table 3. Ordering information

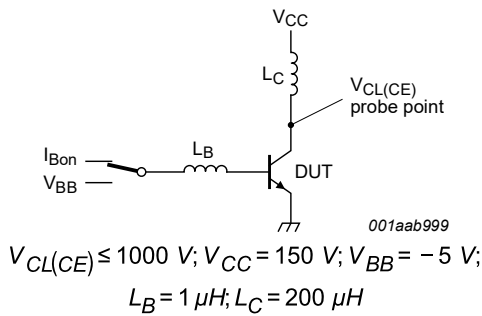
Type number	Package		
	Name	Description	Version
BUJ303AD	DPAK	plastic single-ended surface-mounted package (DPAK); 3 leads (one lead cropped)	SOT428

## 7. Limiting values

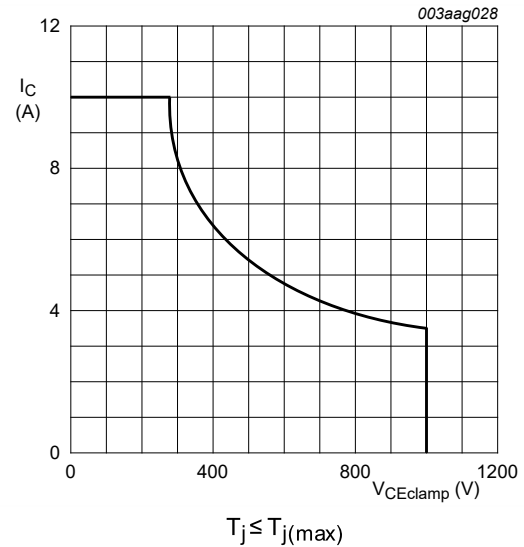
**Table 4. Limiting values**

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

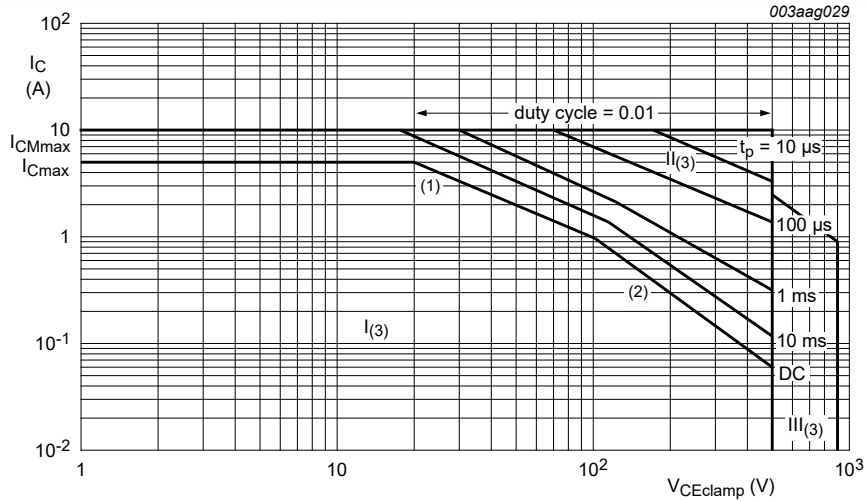
Symbol	Parameter	Conditions	Min	Max	Unit
$V_{CESM}$	collector-emitter peak voltage	$V_{BE} = 0\text{ V}$	-	1000	V
$V_{CEO}$	collector-emitter voltage	$I_B = 0\text{ A}$	-	500	V
$I_C$	collector current	<a href="#">Fig. 1</a> ; <a href="#">Fig. 2</a> ; <a href="#">Fig. 3</a>	-	5	A
$I_{CM}$	peak collector current		-	10	A
$I_B$	base current		-	2	A
$I_{BM}$	peak base current		-	4	A
$P_{tot}$	total power dissipation	$T_{mb} \leq 25\text{ °C}$ ; <a href="#">Fig. 4</a>	-	80	W
$T_{stg}$	storage temperature		-65	150	°C
$T_j$	junction temperature		-	150	°C



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

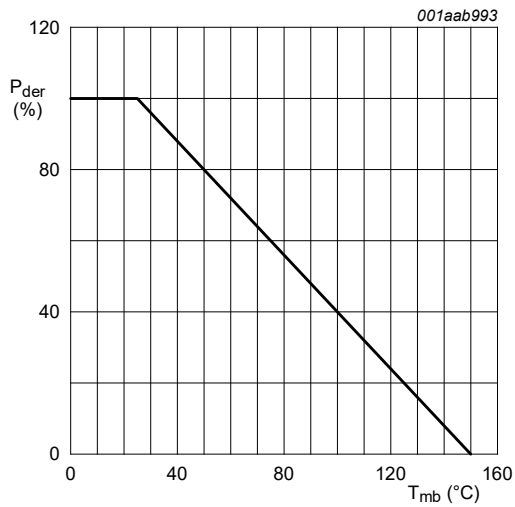


**Fig. 2. Reverse bias safe operating area**



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



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

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

### 8. Thermal characteristics

Table 5. 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	-	75	-	K/W

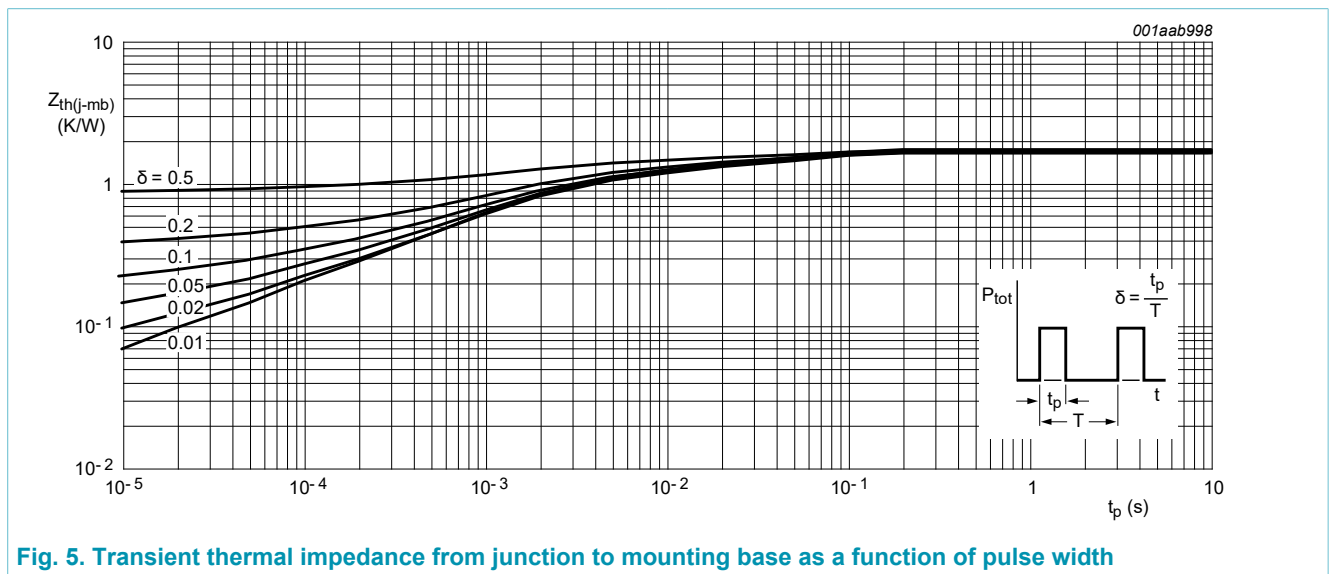


Fig. 5. Transient thermal impedance from junction to mounting base as a function of pulse width

## 9. Characteristics

Table 6. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
<b>Static characteristics</b>							
$I_{CES}$	collector-emitter cut-off current (base shorted)	$V_{BE} = 0\text{ V}; V_{CE} = 1000\text{ V}$	[1]	-	-	1	mA
		$V_{BE} = 0\text{ V}; V_{CE} = 1000\text{ V}; T_j = 125\text{ °C}$	[1]	-	-	2	mA
$I_{CBO}$	collector-base cut-off current (emitter open)	$V_{CB} = 1000\text{ V}; I_E = 0\text{ A}; T_{mb} = 25\text{ °C}$	[1]	-	-	1	mA
$I_{CEO}$	collector-emitter cut-off current (base open)	$V_{CE} = 500\text{ V}; I_B = 0\text{ A}; T_{mb} = 25\text{ °C}$	[1]	-	-	0.1	mA
$I_{EBO}$	emitter-base cut-off current (collector open)	$V_{EB} = 9\text{ V}; I_C = 0\text{ A}; T_{mb} = 25\text{ °C}$		-	-	0.1	mA
$V_{CE0sus}$	collector-emitter sustaining voltage (base open)	$I_B = 0\text{ A}; I_C = 100\text{ mA}; L_C = 25\text{ mH}; T_{mb} = 25\text{ °C};$ <a href="#">Fig. 6</a> ; <a href="#">Fig. 7</a>		500	-	-	V
$V_{CEsat}$	collector-emitter saturation voltage	$I_C = 3\text{ A}; I_B = 0.6\text{ A}; T_{mb} = 25\text{ °C};$ <a href="#">Fig. 8</a> ; <a href="#">Fig. 9</a>		-	0.25	1.5	V
$V_{BEsat}$	base-emitter saturation voltage	$I_C = 3\text{ A}; I_B = 0.6\text{ A}; T_{mb} = 25\text{ °C};$ <a href="#">Fig. 10</a>		-	0.97	1.3	V
$h_{FE}$	DC current gain	$I_C = 5\text{ mA}; V_{CE} = 5\text{ V}; T_{mb} = 25\text{ °C};$ <a href="#">Fig. 11</a>		10	22	30	
		$I_C = 500\text{ mA}; V_{CE} = 5\text{ V}; T_{mb} = 25\text{ °C};$ <a href="#">Fig. 11</a>		14	25	35	
$h_{FEsat}$	DC saturation current gain	$I_C = 2.5\text{ A}; V_{CE} = 5\text{ V}; T_{mb} = 25\text{ °C};$ <a href="#">Fig. 11</a>		10	13.5	17	
		$I_C = 3\text{ A}; V_{CE} = 5\text{ V}; T_{mb} = 25\text{ °C};$ <a href="#">Fig. 11</a>		-	12	-	
<b>Dynamic characteristics (switching times - resistive load)</b>							
$t_s$	storage time	$I_C = 2.5\text{ A}; I_{B0n} = 0.5\text{ A}; I_{B0ff} = -0.5\text{ A}; R_L = 75\text{ }\Omega; T_{mb} = 25\text{ °C};$ <a href="#">Fig. 12</a> ; <a href="#">Fig. 13</a>		-	3.4	4	$\mu\text{s}$
$t_f$	fall time			-	0.33	0.45	$\mu\text{s}$
<b>Dynamic characteristics (switching times - inductive load)</b>							
$t_s$	storage time	$I_C = 2.5\text{ A}; I_{B0n} = 0.5\text{ A}; V_{BB} = -5\text{ V}; L_B = 1\text{ }\mu\text{H}; T_{mb} = 25\text{ °C};$ <a href="#">Fig. 14</a> ; <a href="#">Fig. 15</a>		-	1.4	1.6	$\mu\text{s}$
				-	1.7	1.9	$\mu\text{s}$
$t_f$	fall time	$I_C = 2.5\text{ A}; I_{B0n} = 0.5\text{ A}; V_{BB} = -5\text{ V}; L_B = 1\text{ }\mu\text{H}; T_j = 100\text{ °C};$ <a href="#">Fig. 14</a> ; <a href="#">Fig. 15</a>		-	145	160	ns
				-	160	200	ns

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

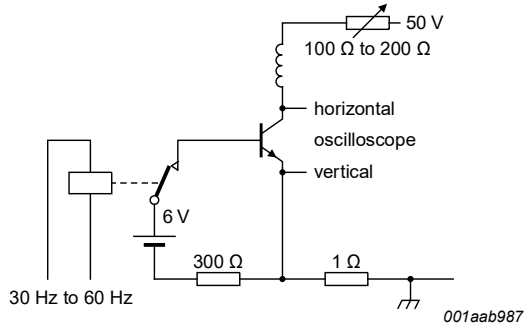


Fig. 6. Test circuit for collector-emitter sustaining voltage

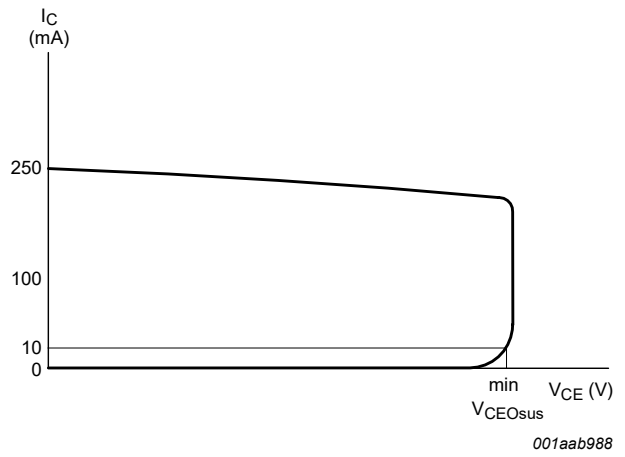


Fig. 7. Oscilloscope display for collector-emitter sustaining voltage test waveform

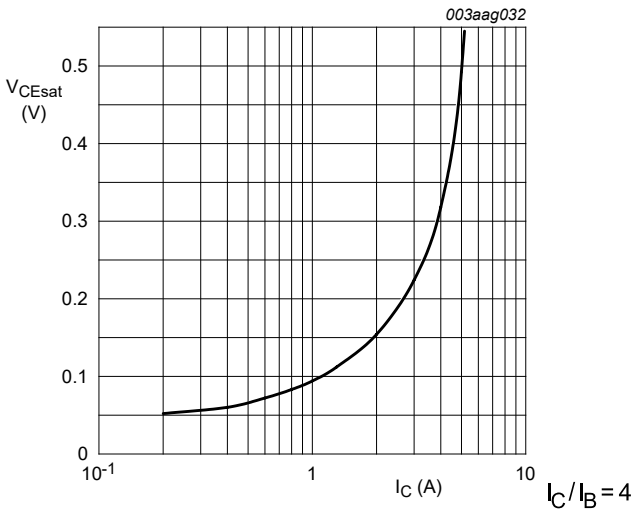


Fig. 8. Collector-emitter saturation voltage as a function of collector current; typical values

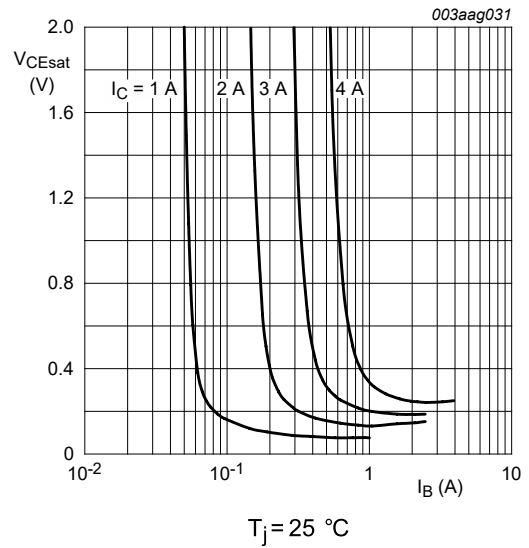


Fig. 9. Collector-emitter saturation voltage as a function of base current; typical values

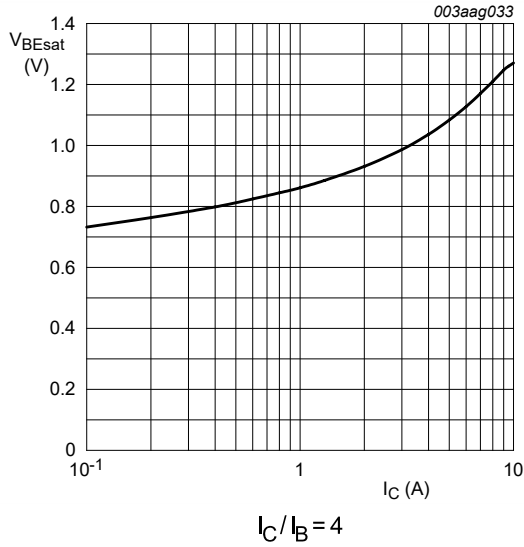


Fig. 10. Base-emitter saturation voltage as a function of collector current; typical values

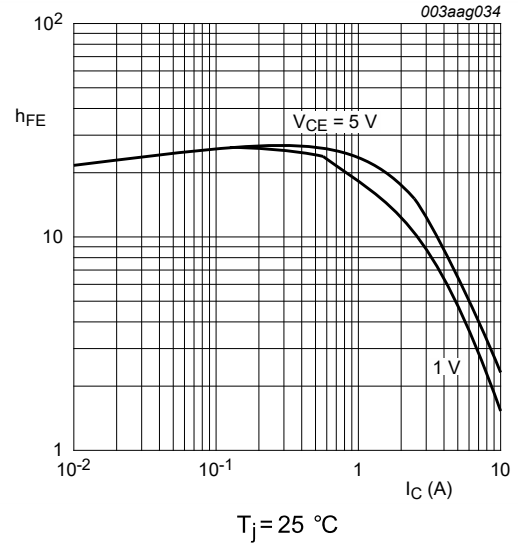
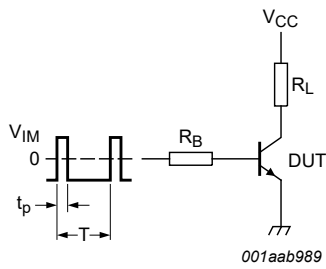


Fig. 11. DC current gain as a function of collector current; typical values



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

Fig. 12. Test circuit for resistive load switching

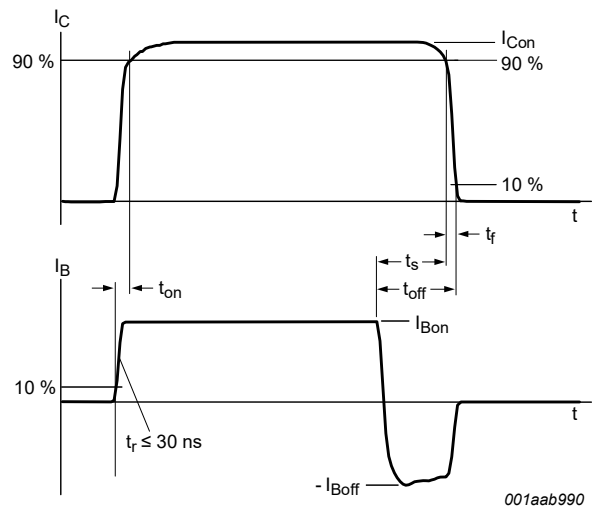
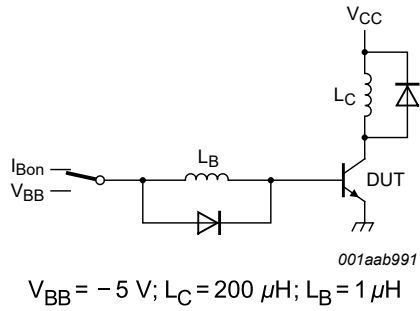
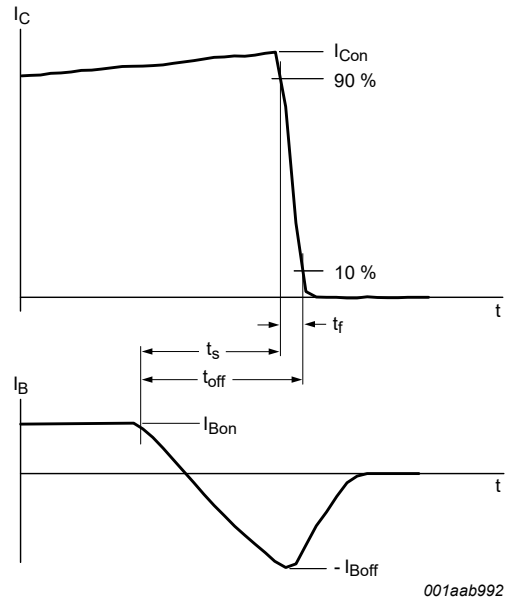


Fig. 13. Switching times waveforms for resistive load



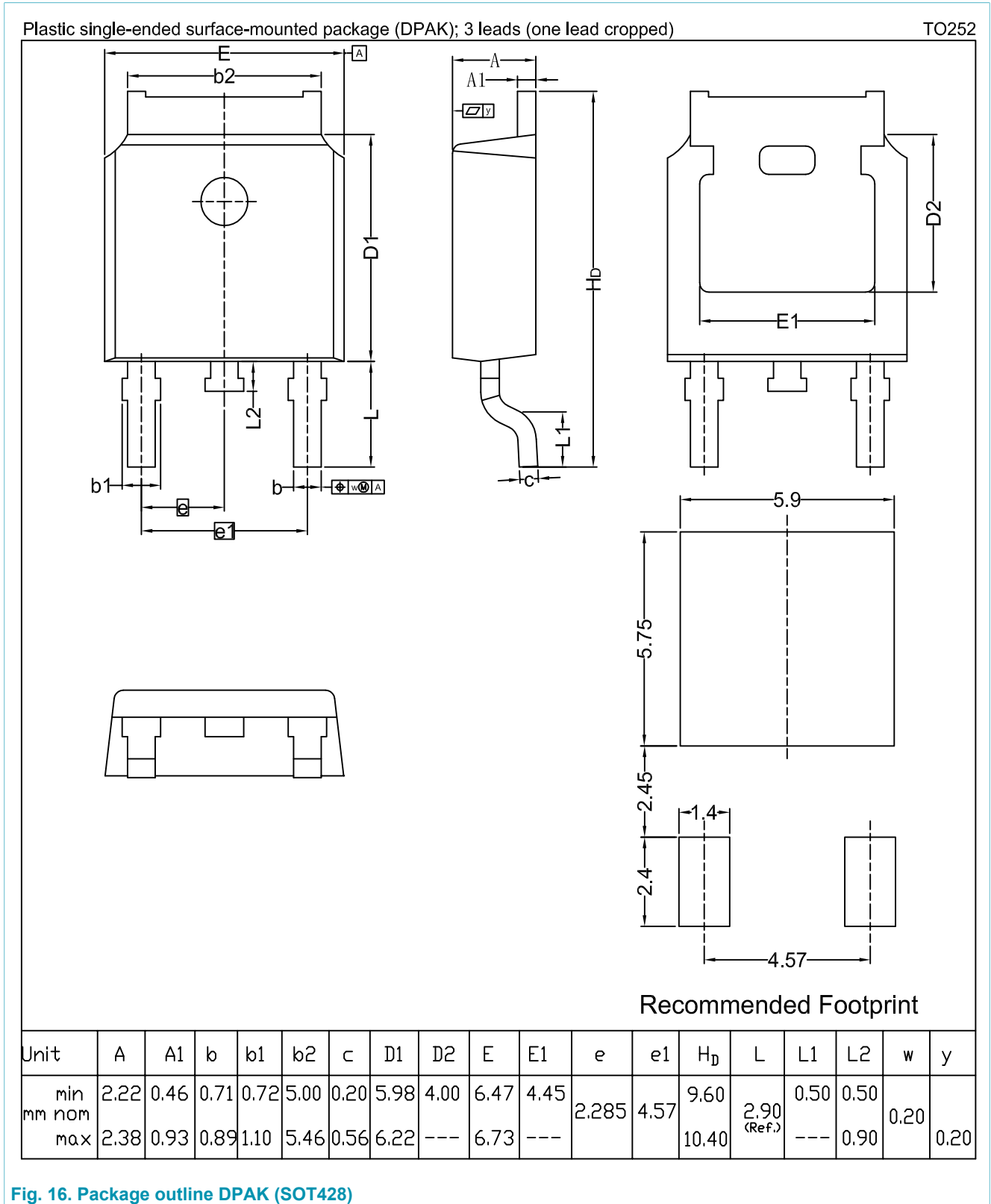


**Fig. 14. Test circuit for inductive load switching**



**Fig. 15. Switching times waveforms for inductive load**

**10. Package outline**



**Fig. 16. Package outline DPAK (SOT428)**

## 11. Legal information

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