

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

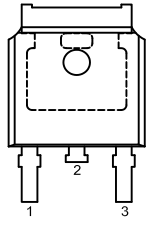
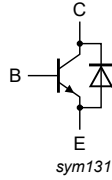
- Fast switching
- High voltage capability
- Integrated anti-parallel E-C diode
- Surface mountable package
- Very low switching and conduction losses

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>DPAK (SOT428)</p>	 <p>sym131</p>
2	C	collector ^[1]		
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

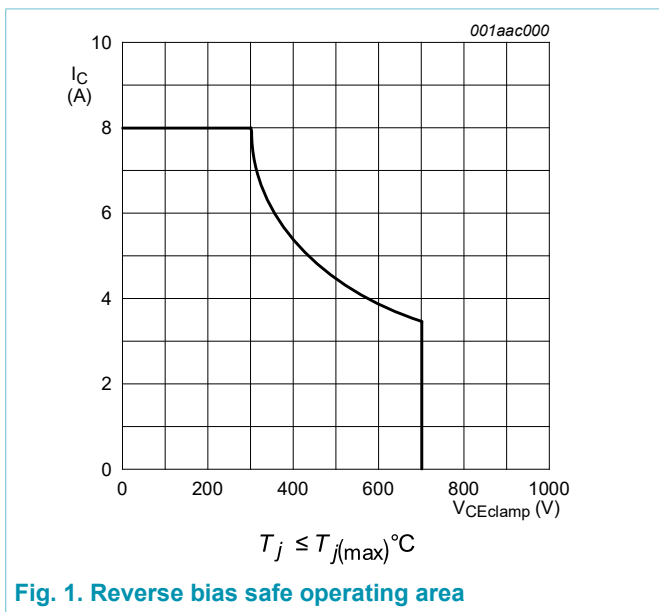


Fig. 1. Reverse bias safe operating area

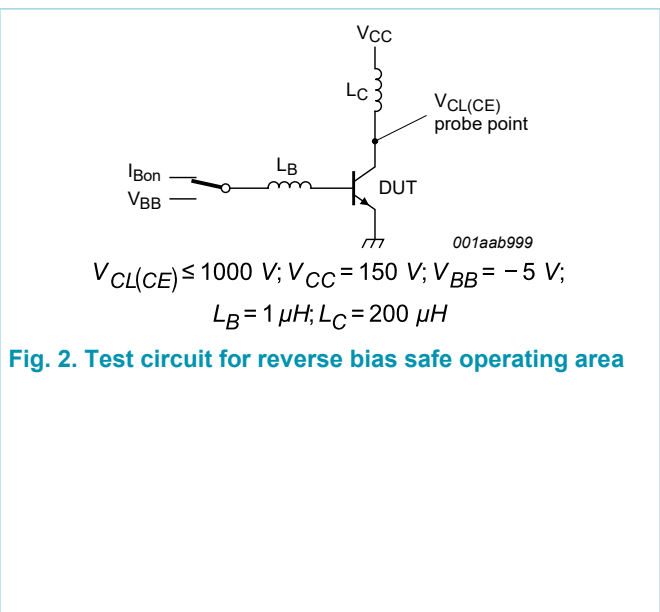
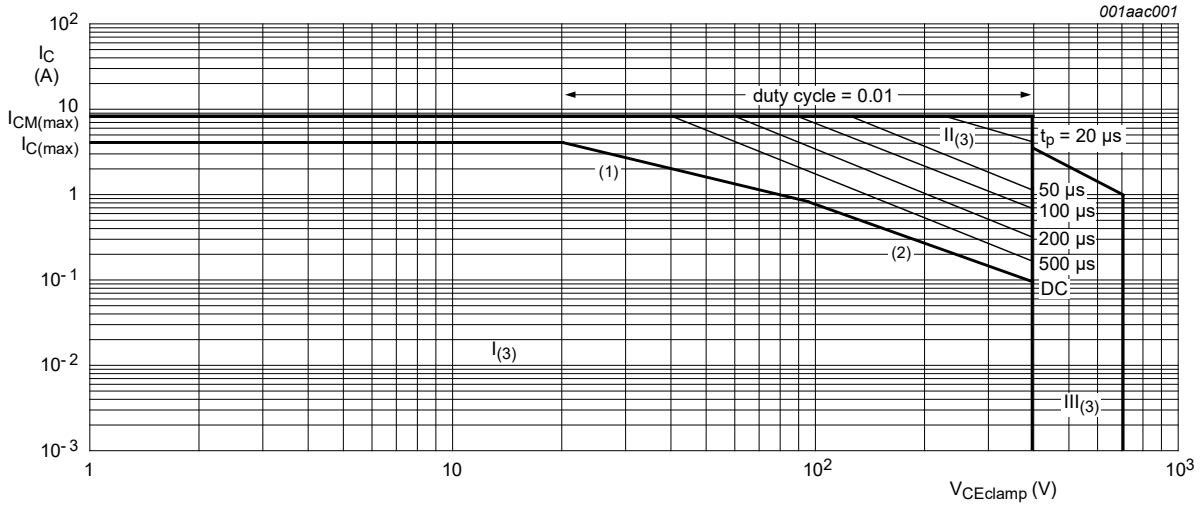
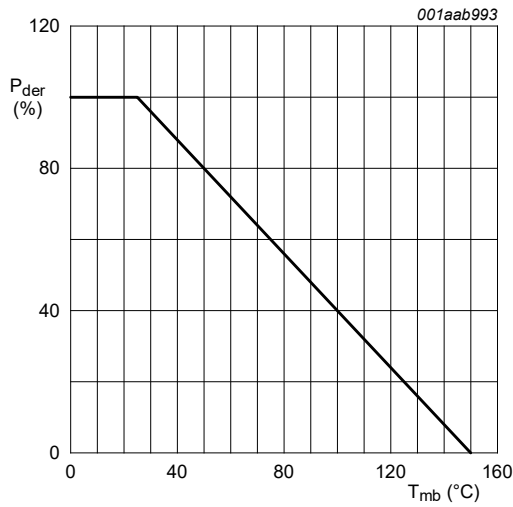


Fig. 2. Test circuit for reverse bias safe operating area



- 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 ≤ 100 Ω and tp ≤ 0.6 μs

Fig. 3. Forward bias safe operating area for Tmb ≤ 25 °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	Fig. 5	-	-	1.56	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient free air	printed circuit board (FR4) mounted; minimum footprint; Fig. 6	-	75	-	K/W

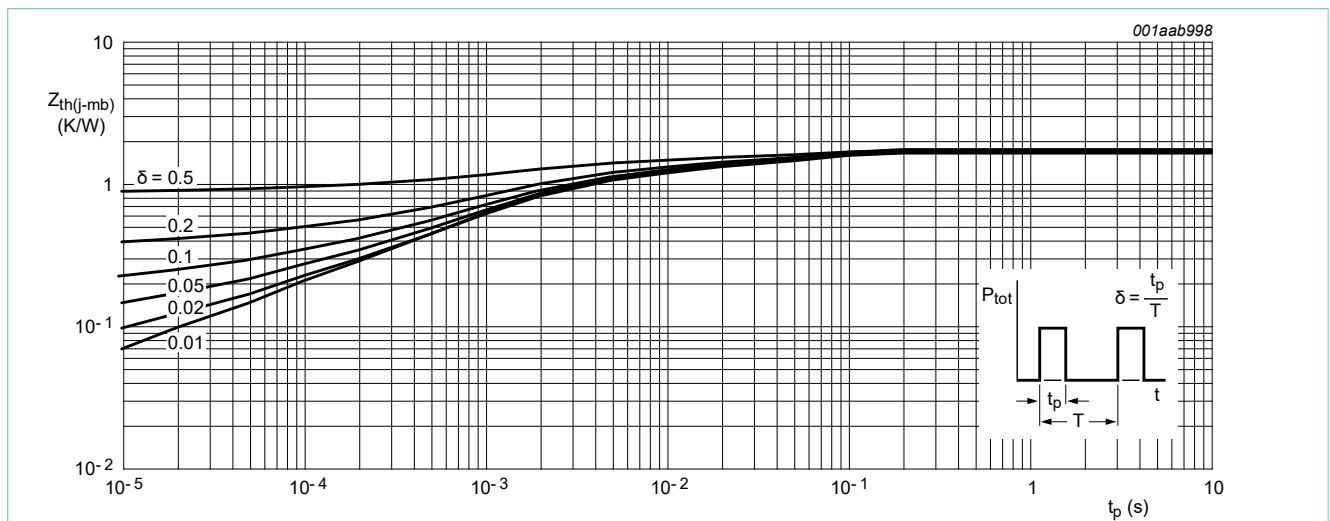


Fig. 5. Transient thermal impedance from junction to mounting base as a function of pulse width

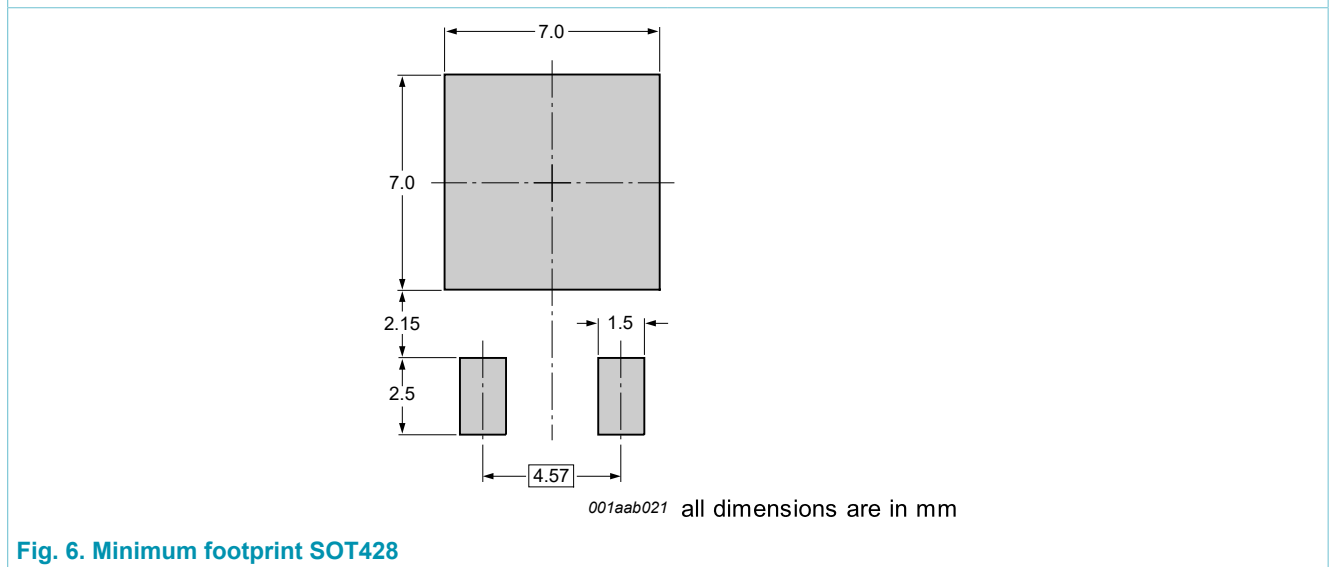


Fig. 6. Minimum footprint SOT428

8. Characteristics

Table 5. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
Static characteristics							
I_{CES}	collector-emitter cut-off current (base shorted)	$V_{BE} = 0\text{ V}; V_{CE} = 850\text{ V}; T_j = 125\text{ }^\circ\text{C}$	[1]	-	-	2	mA
		$V_{BE} = 0\text{ V}; V_{CE} = 850\text{ V}; T_j = 25\text{ }^\circ\text{C}$	[1]	-	-	1	mA
I_{CBO}	collector-base cut-off current (emitter open)	$V_{CB} = 850\text{ V}; I_E = 0\text{ A}$	[1]	-	-	1	mA
I_{CEO}	collector-emitter cut-off current (base open)	$V_{CE} = 425\text{ V}; I_B = 0\text{ A}$	[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_{CE0sus}	collector-emitter sustaining voltage (base open)	$I_B = 0\text{ A}; I_C = 10\text{ mA}; L_C = 25\text{ mH};$ Fig. 7 ; Fig. 8		400	450	-	V
V_{CEsat}	collector-emitter saturation voltage	$I_C = 3\text{ A}; I_B = 0.6\text{ A};$ Fig. 9 ; Fig. 10		-	0.29	1	V
V_{BEsat}	base-emitter saturation voltage	$I_C = 3\text{ A}; I_B = 0.6\text{ A};$ Fig. 11		-	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	$I_C = 1\text{ mA}; V_{CE} = 5\text{ V}; T_{mb} = 25\text{ }^\circ\text{C};$ Fig. 12		10	15	32	
		$I_C = 500\text{ mA}; V_{CE} = 5\text{ V}; T_{mb} = 25\text{ }^\circ\text{C};$ Fig. 12		13	21	32	
		$I_C = 2\text{ A}; V_{CE} = 5\text{ V}; T_{mb} = 25\text{ }^\circ\text{C};$ Fig. 12		11	16	22	
		$I_C = 3\text{ A}; V_{CE} = 5\text{ V}; T_{mb} = 25\text{ }^\circ\text{C};$ Fig. 12		-	12.5	-	
Dynamic characteristics							
t_{on}	turn-on time	$I_C = 2.5\text{ A}; I_{B0n} = 0.5\text{ A}; I_{B0f} = -0.5\text{ A};$ $R_L = 75\text{ }\Omega; T_j = 25\text{ }^\circ\text{C};$ resistive load; Fig. 13 ; Fig. 14		-	0.52	0.6	μs
t_s	storage time	$I_C = 2\text{ A}; I_{B0n} = 0.4\text{ A}; V_{BB} = -5\text{ V};$ $L_B = 1\text{ }\mu\text{H}; T_j = 25\text{ }^\circ\text{C};$ inductive load; Fig. 15 ; Fig. 16		-	2.7	3.3	μs
		$I_C = 2\text{ A}; I_{B0n} = 0.4\text{ A}; V_{BB} = -5\text{ V};$ $L_B = 1\text{ }\mu\text{H}; T_j = 100\text{ }^\circ\text{C};$ inductive load; Fig. 15 ; Fig. 16		-	1.2	1.4	μs
		$I_C = 2\text{ A}; I_{B0n} = 0.4\text{ A}; V_{BB} = -5\text{ V};$ $L_B = 1\text{ }\mu\text{H}; T_j = 100\text{ }^\circ\text{C};$ inductive load; Fig. 15 ; Fig. 16		-	-	1.8	μs
t_f	fall time	$I_C = 2.5\text{ A}; I_{B0n} = 0.5\text{ A}; I_{B0f} = -0.5\text{ A};$ $R_L = 75\text{ }\Omega;$ resistive load; Fig. 13 ; Fig. 14		-	0.3	0.35	μs
		$I_C = 2\text{ A}; I_{B0n} = 0.4\text{ A}; V_{BB} = -5\text{ V};$ $L_B = 1\text{ }\mu\text{H};$ inductive load; Fig. 15 ; Fig. 16		-	-	0.12	μs
				-	0.03	0.06	μs

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

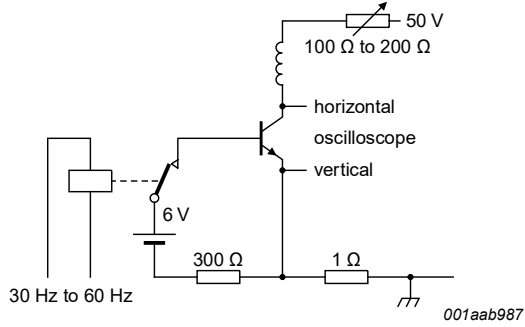


Fig. 7. Test circuit for collector-emitter sustaining voltage

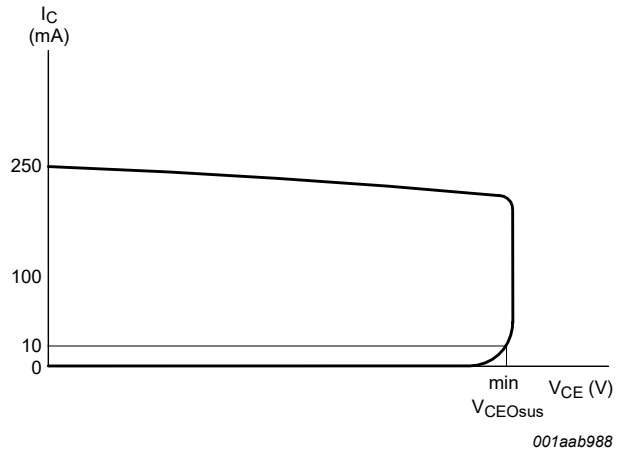


Fig. 8. Oscilloscope display for collector-emitter sustaining voltage test waveform

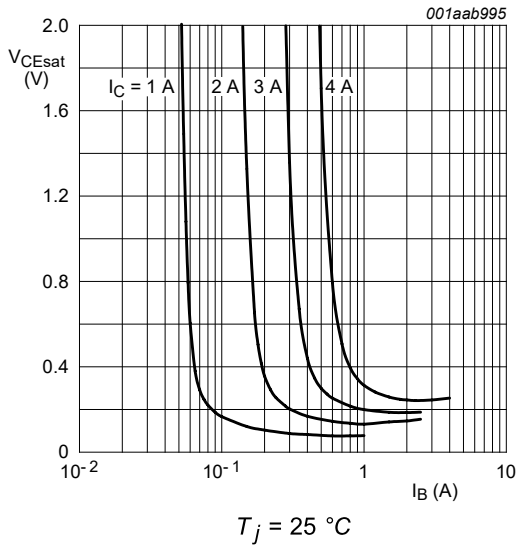


Fig. 9. Collector-emitter saturation voltage as a function of base current; typical values

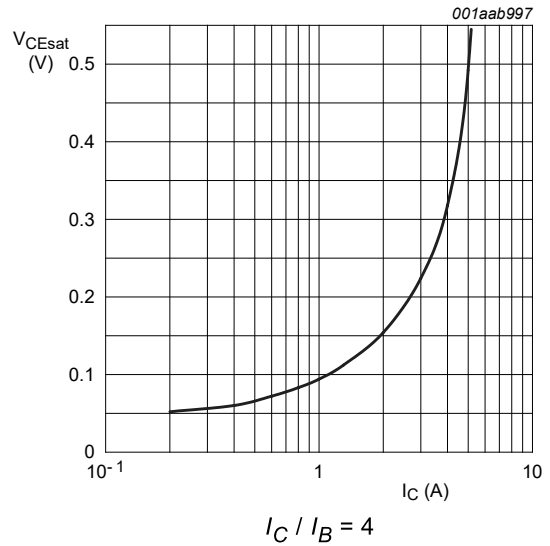


Fig. 10. Collector-emitter saturation voltage as a function of collector current; typical values

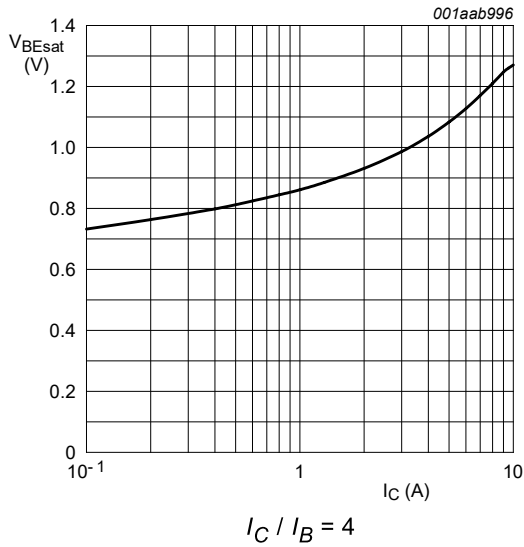


Fig. 11. Base-emitter saturation voltage as a function of collector current; typical values

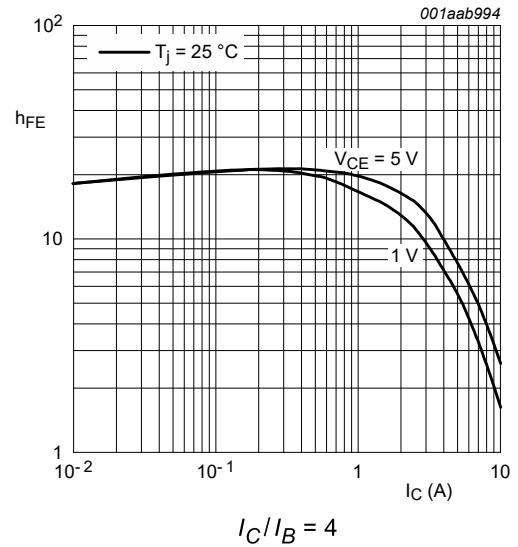
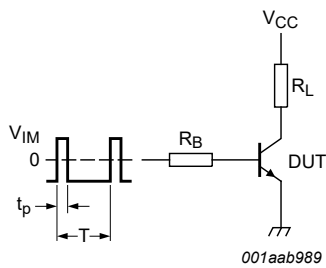


Fig. 12. DC current gain as a function of collector current; typical values



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

Fig. 13. Test circuit for resistive load switching

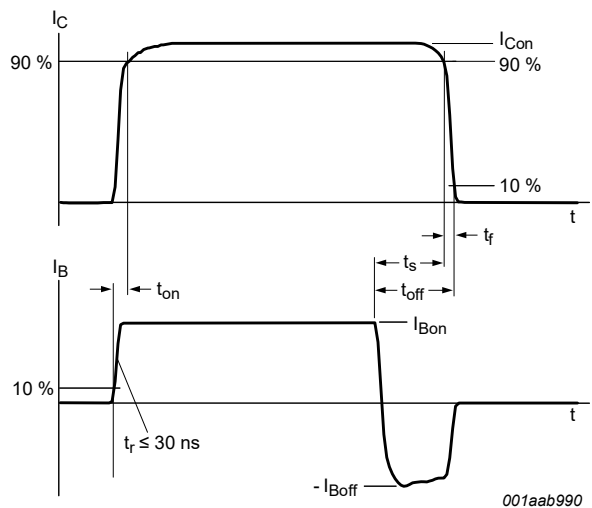


Fig. 14. Switching times waveforms for resistive load

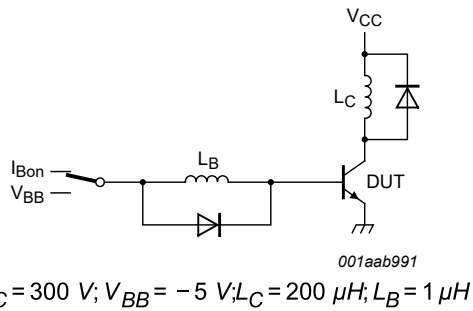


Fig. 15. Test circuit for inductive load switching

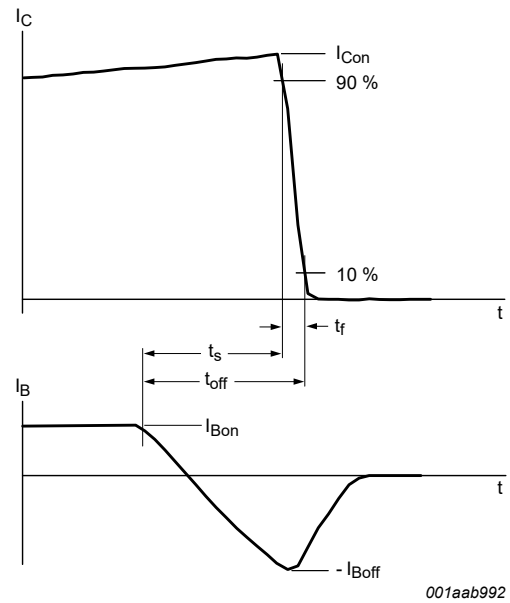


Fig. 16. Switching times waveforms for inductive load

9. Package outline

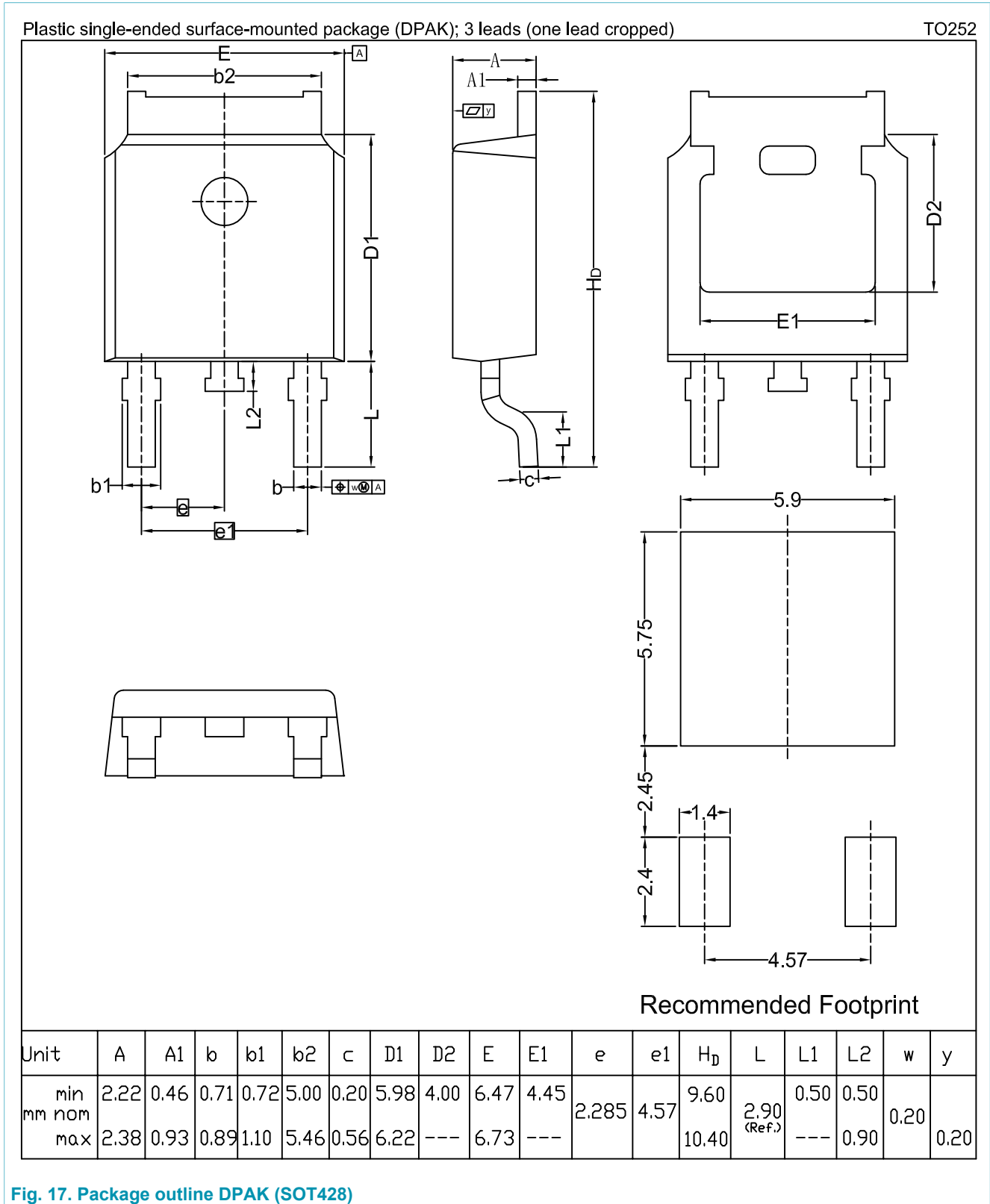


Fig. 17. Package outline DPAK (SOT428)

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11. Contents

1. General description.....	1
2. Features and benefits.....	1
3. Applications.....	1
4. Pinning information.....	1
5. Ordering information.....	2
6. Limiting values.....	3
7. Thermal characteristics.....	5
8. Characteristics.....	6
9. Package outline.....	10
10. Legal information.....	11

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