

# BUJ303CD

NPN power transistor

8 November 2012

Product data sheet

## 1. Product profile

### 1.1 General description

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

### 1.2 Features and benefits

- Fast switching
- Low thermal resistance
- Surface mountable package
- Tight DC gain spreads
- Very high voltage capability
- Very low switching and conduction losses

### 1.3 Applications

- DC-to-DC converters
- High frequency electronic lighting ballasts
- Inverters
- Motor control systems

### 1.4 Quick reference data

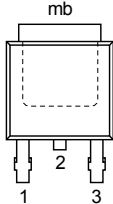
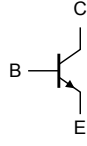
Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$I_C$	collector current	<a href="#">Fig. 1</a> ; <a href="#">Fig. 2</a> ; <a href="#">Fig. 4</a>	-	-	5	A
$P_{tot}$	total power dissipation	$T_{mb} \leq 25\text{ °C}$ ; <a href="#">Fig. 3</a>	-	-	80	W
$V_{CESM}$	collector-emitter peak voltage	$V_{BE} = 0\text{ V}$	-	-	1050	V
<b>Static characteristics</b>						
$h_{FE}$	DC current gain	$I_C = 10\text{ mA}$ ; $V_{CE} = 3\text{ V}$ ; $T_{mb} = 25\text{ °C}$ ; <a href="#">Fig. 12</a>	28	34	47	
		$I_C = 250\text{ mA}$ ; $V_{CE} = 3\text{ V}$ ; $T_{mb} = 25\text{ °C}$ ; <a href="#">Fig. 12</a>	35	43	57	
		$I_C = 800\text{ mA}$ ; $V_{CE} = 3\text{ V}$ ; $T_{mb} = 25\text{ °C}$ ; <a href="#">Fig. 12</a>	31	37	48	



## 2. Pinning information

**Table 2. Pinning information**

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	B	base	 <p style="text-align: center;"><b>DPAK (SOT428)</b></p>	 <p style="text-align: center;"><i>sym123</i></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.

## 3. Ordering information

**Table 3. Ordering information**

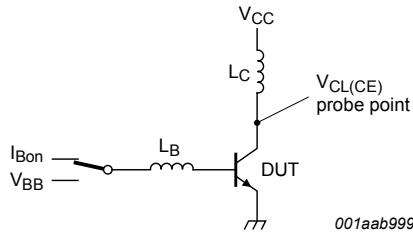
Type number	Package		
	Name	Description	Version
BUJ303CD	DPAK	plastic single-ended surface-mounted package (DPAK); 3 leads (one lead cropped)	SOT428

## 4. Limiting values

**Table 4. Limiting values**

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

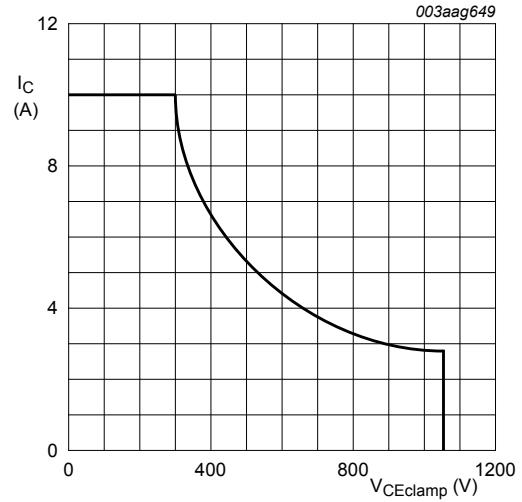
Symbol	Parameter	Conditions	Min	Max	Unit
$V_{CESM}$	collector-emitter peak voltage	$V_{BE} = 0\text{ V}$	-	1050	V
$V_{CEO}$	collector-emitter voltage	$I_B = 0\text{ A}$	-	400	V
$I_C$	collector current	<a href="#">Fig. 1</a> ; <a href="#">Fig. 2</a> ; <a href="#">Fig. 4</a>	-	5	A
$I_{CM}$	peak collector 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. 3</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**

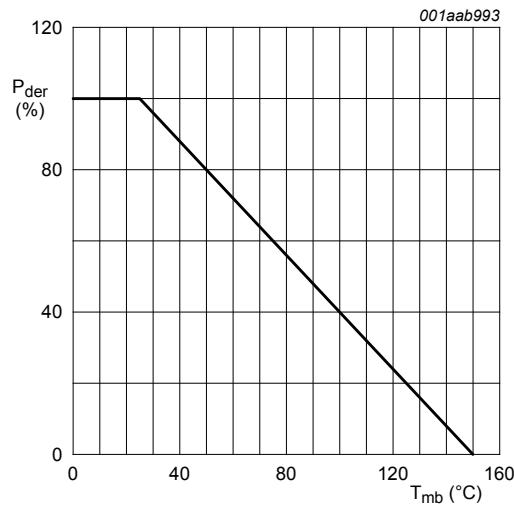
$$V_{CL(CE)} \leq 1000 \text{ V}; V_{CC} = 150 \text{ V}; V_{BB} = -5 \text{ V};$$

$$L_B = 1 \mu\text{H}; L_C = 200 \mu\text{H}$$



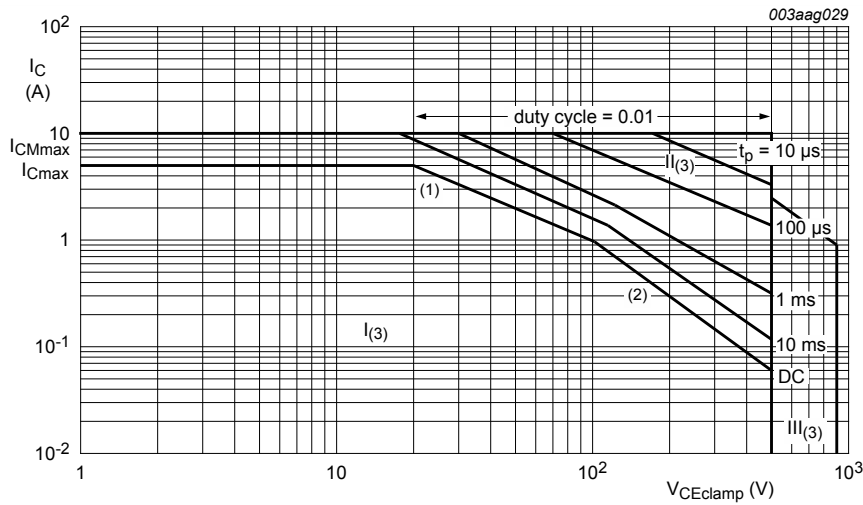
**Fig. 2. Reverse bias safe operating area**

$$T_j \leq T_{j(max)}$$



**Fig. 3. Normalized total power dissipation as a function of mounting base temperature**

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



- (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. 4. Forward bias safe operating area for  $T_{mb} \leq 25 \text{ }^\circ\text{C}$

## 5. Thermal characteristics

Table 5. Thermal characteristics

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

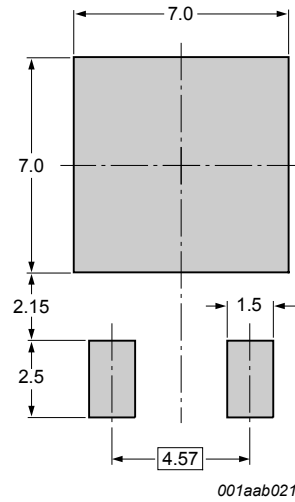


Fig. 5. Minimum footprint SOT428

all dimensions are in mm

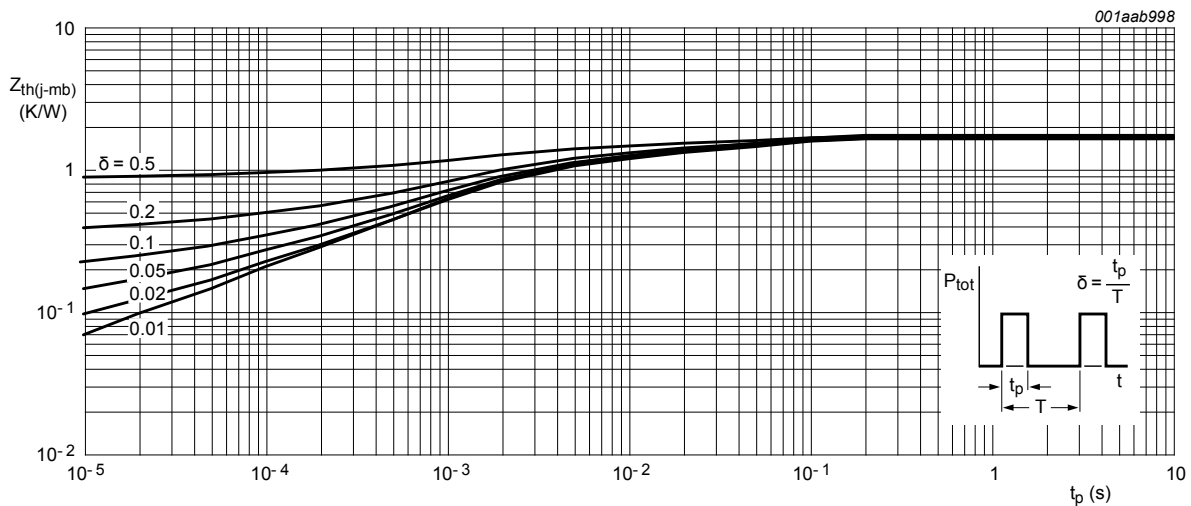


Fig. 6. Transient thermal impedance from junction to mounting base as a function of pulse width

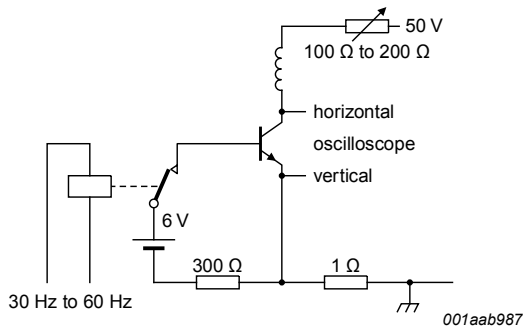
## 6. Characteristics

Table 6. Characteristics

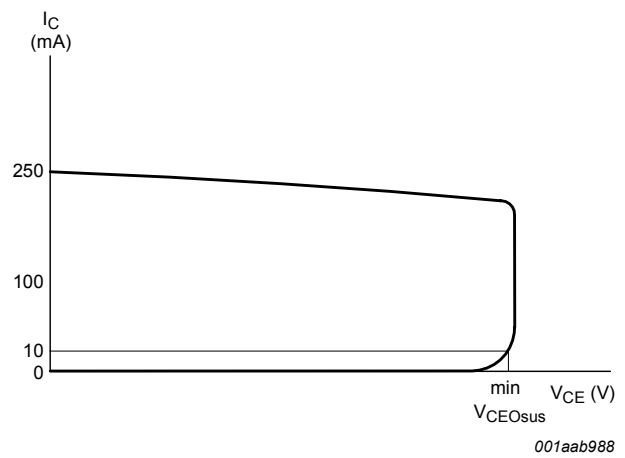
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
<b>Static characteristics</b>							
I <sub>CES</sub>	collector-emitter cut-off current	V <sub>BE</sub> = 0 V; V <sub>CE</sub> = 1050 V; T <sub>mb</sub> = 25 °C	[1]	-	-	1	mA
		V <sub>BE</sub> = 0 V; V <sub>CE</sub> = 1050 V; T <sub>j</sub> = 125 °C	[1]	-	-	2	mA
I <sub>CBO</sub>	collector-base cut-off current	V <sub>CB</sub> = 1050 V; I <sub>E</sub> = 0 A; T <sub>mb</sub> = 25 °C	[1]	-	-	1	mA
I <sub>CEO</sub>	collector-emitter cut-off current	V <sub>CE</sub> = 400 V; I <sub>B</sub> = 0 A; T <sub>mb</sub> = 25 °C	[1]	-	-	0.1	mA

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$I_{EBO}$	emitter-base cut-off current	$V_{EB} = 9\text{ V}$ ; $I_C = 0\text{ A}$ ; $T_{mb} = 25\text{ °C}$	-	-	0.1	mA
$V_{CEOsus}$	collector-emitter sustaining voltage	$I_B = 0\text{ A}$ ; $I_C = 100\text{ mA}$ ; $L_C = 25\text{ mH}$ ; $T_{mb} = 25\text{ °C}$ ; <a href="#">Fig. 7</a> ; <a href="#">Fig. 8</a>	400	-	-	V
$V_{CEsat}$	collector-emitter saturation voltage	$I_C = 1\text{ A}$ ; $I_B = 0.2\text{ A}$ ; $T_{mb} = 25\text{ °C}$ ; <a href="#">Fig. 9</a> ; <a href="#">Fig. 10</a>	-	-	0.5	V
		$I_C = 3\text{ A}$ ; $I_B = 1\text{ A}$ ; $T_{mb} = 25\text{ °C}$ ; <a href="#">Fig. 9</a> ; <a href="#">Fig. 10</a>	-	0.25	1.5	V
$V_{BEsat}$	base-emitter saturation voltage	$I_C = 3\text{ A}$ ; $I_B = 1\text{ A}$ ; $T_{mb} = 25\text{ °C}$ ; <a href="#">Fig. 11</a>	-	1	1.5	V
$h_{FE}$	DC current gain	$I_C = 10\text{ mA}$ ; $V_{CE} = 3\text{ V}$ ; $T_{mb} = 25\text{ °C}$ ; <a href="#">Fig. 12</a>	28	34	47	
		$I_C = 250\text{ mA}$ ; $V_{CE} = 3\text{ V}$ ; $T_{mb} = 25\text{ °C}$ ; <a href="#">Fig. 12</a>	35	43	57	
		$I_C = 800\text{ mA}$ ; $V_{CE} = 3\text{ V}$ ; $T_{mb} = 25\text{ °C}$ ; <a href="#">Fig. 12</a>	31	37	48	
<b>Dynamic Characteristics (switching times - resistive load)</b>						
$t_{on}$	turn-on time	$I_C = 2.5\text{ A}$ ; $I_{Bon} = 0.5\text{ A}$ ; $I_{Boff} = -1\text{ A}$ ; $R_L = 100\text{ }\Omega$ ; $V_{CC} = 250\text{ V}$ ; $T_j = 25\text{ °C}$ ; <a href="#">Fig. 13</a> ; <a href="#">Fig. 14</a>	-	1	-	ms
$t_s$	turn-off delay time		-	2.5	-	ms
$t_f$	fall time		-	0.3	-	ms
<b>Dynamic Characteristics (switching times - inductive load)</b>						
$t_s$	turn-off delay time	$I_C = 2.5\text{ A}$ ; $I_{Bon} = 0.5\text{ A}$ ; $V_{CC} = 350\text{ V}$ ; $V_{BB} = -5\text{ V}$ ; $L_B = 1\text{ }\mu\text{H}$ ; $T_j = 25\text{ °C}$ ; <a href="#">Fig. 15</a> ; <a href="#">Fig. 16</a>	-	2	-	ms
$t_s$	turn-off delay time	$I_C = 2.5\text{ A}$ ; $I_{Bon} = 0.5\text{ A}$ ; $V_{CC} = 350\text{ V}$ ; $V_{BB} = -5\text{ V}$ ; $L_B = 1\text{ }\mu\text{H}$ ; $T_j = 100\text{ °C}$ ; <a href="#">Fig. 15</a> ; <a href="#">Fig. 16</a>	-	3	-	ms
$t_f$	fall time	$I_C = 2.5\text{ A}$ ; $I_{Bon} = 0.5\text{ A}$ ; $V_{CC} = 350\text{ V}$ ; $V_{BB} = -5\text{ V}$ ; $L_B = 1\text{ }\mu\text{H}$ ; $T_j = 25\text{ °C}$ ; <a href="#">Fig. 15</a> ; <a href="#">Fig. 16</a>	-	200	-	ns
		$I_C = 2.5\text{ A}$ ; $I_{Bon} = 0.5\text{ A}$ ; $V_{CC} = 350\text{ V}$ ; $V_{BB} = -5\text{ V}$ ; $L_B = 1\text{ }\mu\text{H}$ ; $T_j = 100\text{ °C}$ ; <a href="#">Fig. 15</a> ; <a href="#">Fig. 16</a>	-	300	-	ns

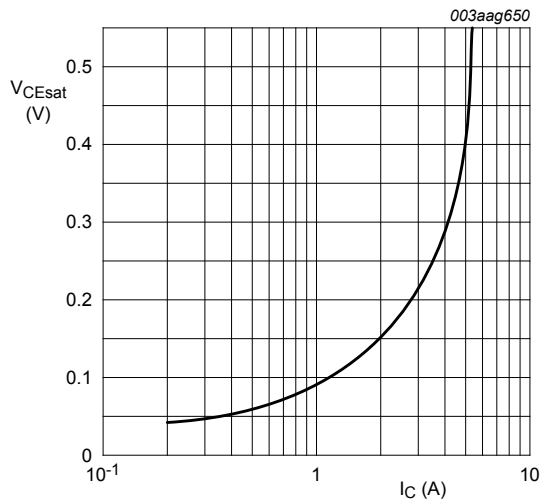
[1] Measured with half-sine wave voltage (curve tracer).



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

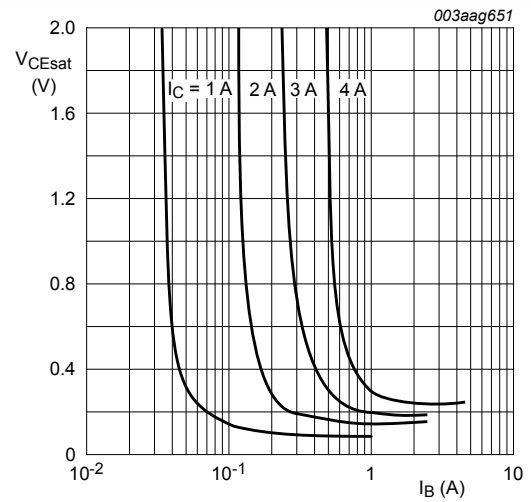


**Fig. 8. Oscilloscope display for collector-emitter sustaining voltage test waveform**



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

$$I_C / I_B = 4$$



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

$$T_j = 25 \text{ }^\circ\text{C}$$

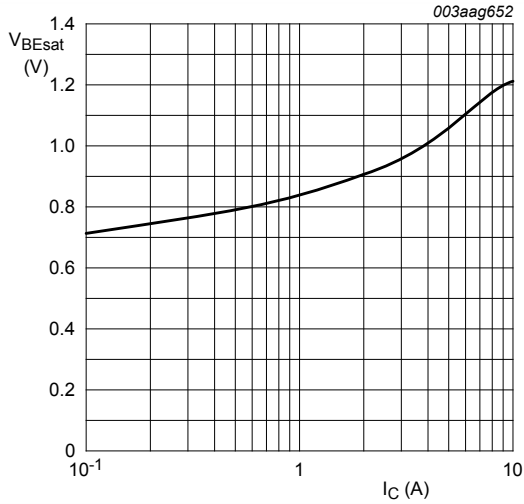


Fig. 11. Base-emitter saturation voltage as a function of collector current; typical values

$$I_C/I_B = 4$$

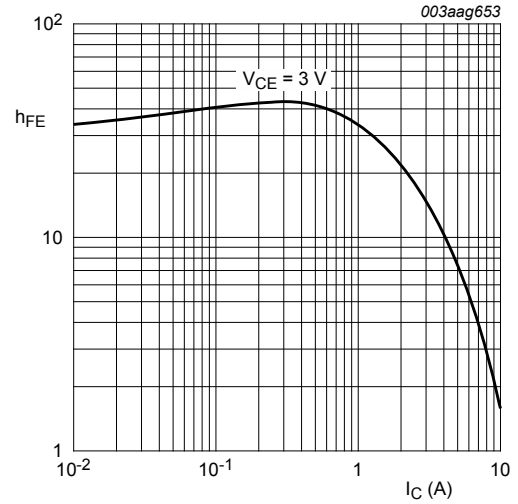


Fig. 12. DC current gain as a function of collector current; typical values

$$T_j = 25^\circ\text{C}$$

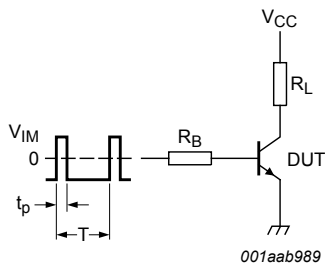


Fig. 13. Test circuit for resistive load switching

$V_{IM} = -6$  to  $+8$  V;  $V_{CC} = 250$  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.

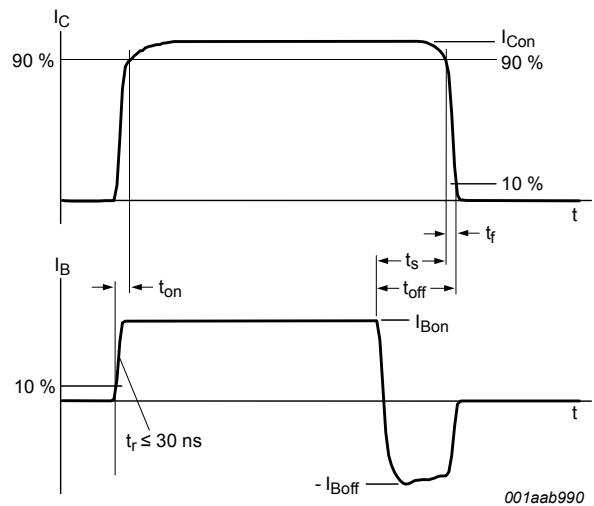
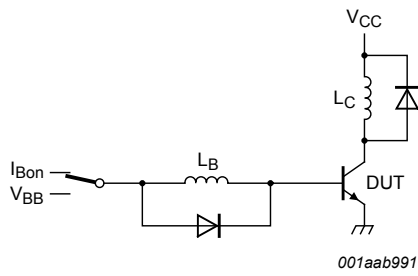


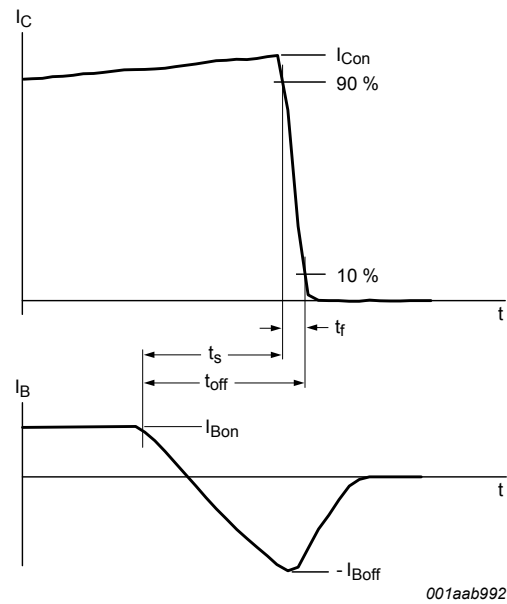
Fig. 14. Switching times waveforms for resistive load





**Fig. 15. Test circuit for inductive load switching**

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

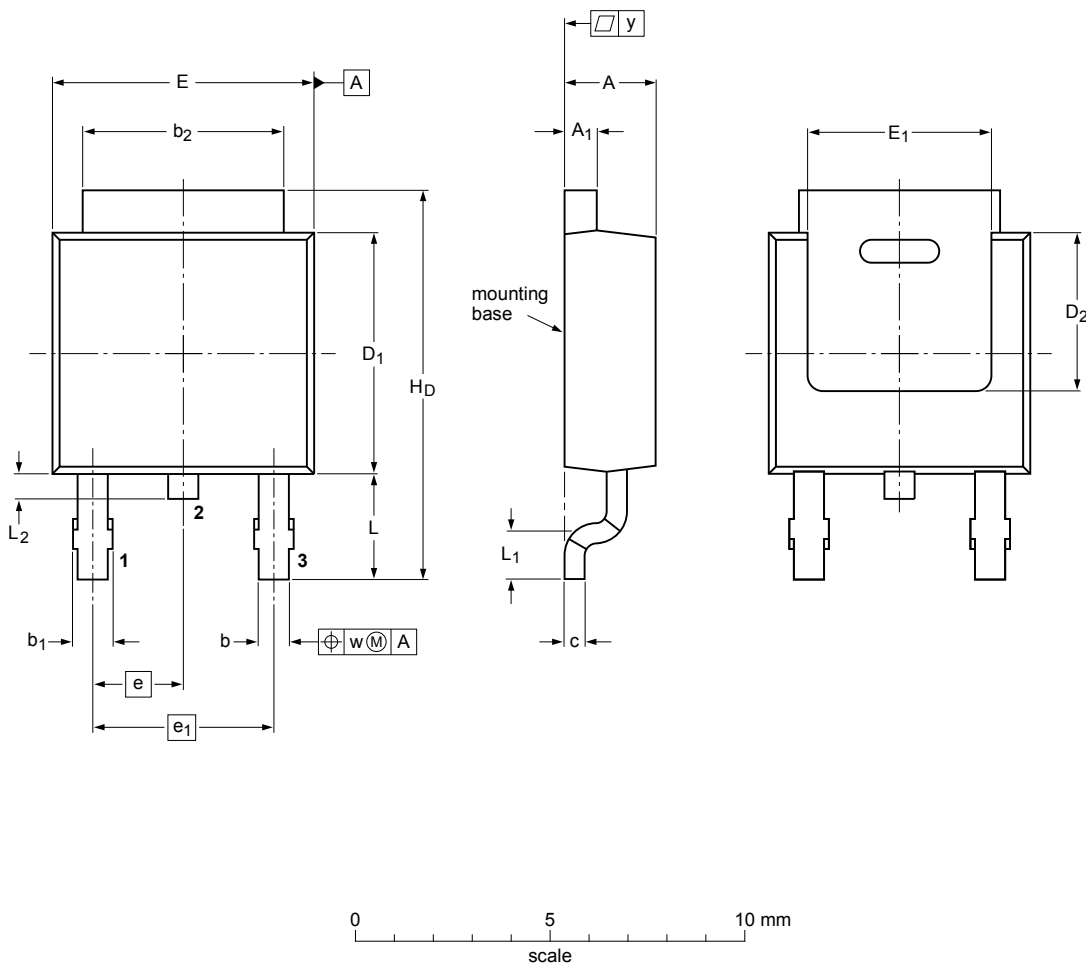


**Fig. 16. Switching times waveforms for inductive load**

## 7. Package outline

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

SOT428



**DIMENSIONS** (mm are the original dimensions)

UNIT	A	A <sub>1</sub>	b	b <sub>1</sub>	b <sub>2</sub>	c	D <sub>1</sub>	D <sub>2</sub> min	E	E <sub>1</sub> min	e	e <sub>1</sub>	H <sub>D</sub>	L	L <sub>1</sub> min	L <sub>2</sub>	w	y max
mm	2.38 2.22	0.93 0.46	0.89 0.71	1.1 0.9	5.46 5.00	0.56 0.20	6.22 5.98	4.0	6.73 6.47	4.45	2.285	4.57	10.4 9.6	2.95 2.55	0.5	0.9 0.5	0.2	0.2

OUTLINE VERSION	REFERENCES			EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA		
SOT428		TO-252	SC-63		06-02-14 06-03-16

Fig. 17. Package outline DPAK (SOT428)

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Document status [1][2]	Product status [3]	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

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## 9. Contents

<b>1</b>	<b>Product profile</b> .....	<b>1</b>
1.1	General description .....	1
1.2	Features and benefits .....	1
1.3	Applications .....	1
1.4	Quick reference data .....	1
<b>2</b>	<b>Pinning information</b> .....	<b>2</b>
<b>3</b>	<b>Ordering information</b> .....	<b>2</b>
<b>4</b>	<b>Limiting values</b> .....	<b>2</b>
<b>5</b>	<b>Thermal characteristics</b> .....	<b>4</b>
<b>6</b>	<b>Characteristics</b> .....	<b>5</b>
<b>7</b>	<b>Package outline</b> .....	<b>10</b>
<b>8</b>	<b>Legal information</b> .....	<b>11</b>
8.1	Data sheet status .....	11
8.2	Definitions .....	11
8.3	Disclaimers .....	11
8.4	Trademarks .....	12

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