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

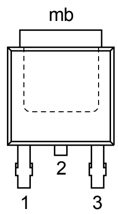
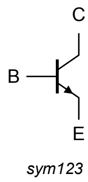
1.4 Quick reference data

Table 1. Quick reference data

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

2. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	B	base		
2	C	collector[1]		
3	E	emitter		
mb	C	mounting base; connected to collector	**DPAK (SOT428)**	

[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 V		-	1050	V
V_{CEO}	collector-emitter voltage	I_B = 0 A		-	400	V
I_C	collector current	Fig. 1; Fig. 2; Fig. 4		-	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} ≤ 25 °C; Fig. 3		-	80	W
T_{stg}	storage temperature			-65	150	°C
T_j	junction temperature			-	150	°C

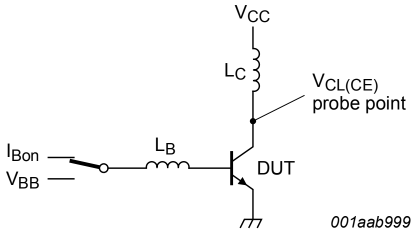


Fig. 1. Test circuit for reverse bias safe operating area

$$V_{CL(CE)} \leq 1000\ V; V_{CC} = 150\ V; V_{BB} = -5\ V;$$
$$L_B = 1\ \mu H; L_C = 200\ \mu H$$

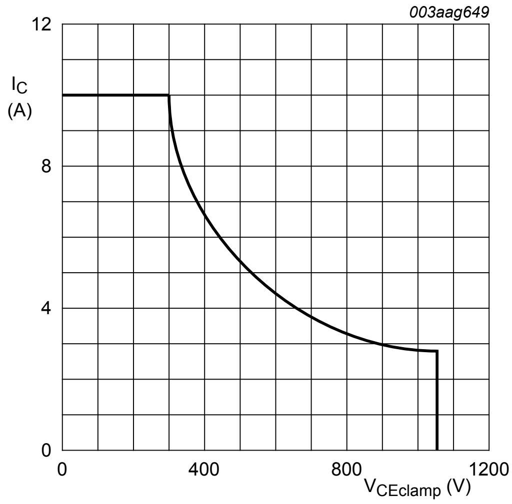


Fig. 2. Reverse bias safe operating area

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

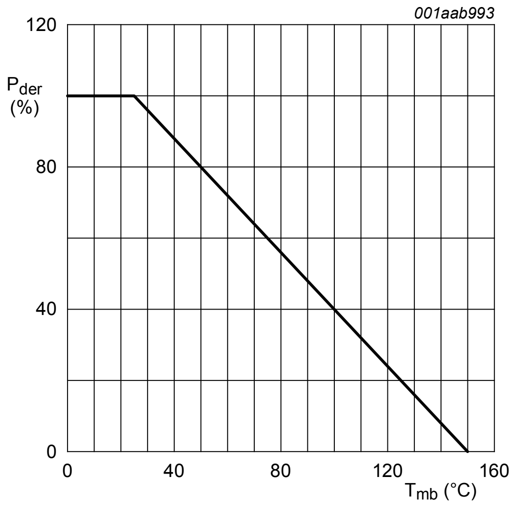
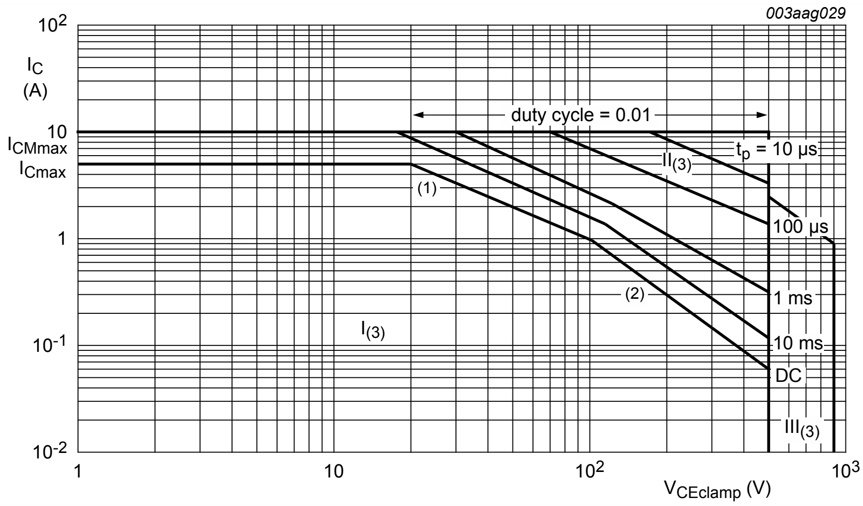


Fig. 3. Normalized total power dissipation as a function of mounting base temperature

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



(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 $t_p \leq 0.6$ µs.

Fig. 4. Forward bias safe operating area for Tmb ≤ 25 °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

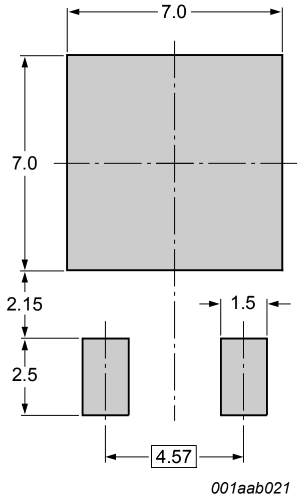


Fig. 5. Minimum footprint SOT428

all dimensions are in mm

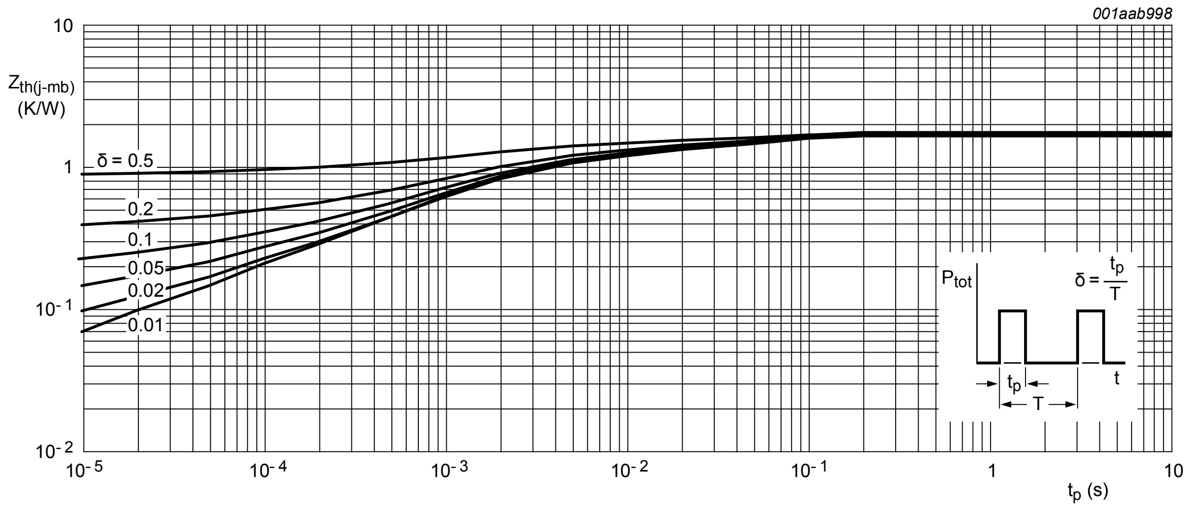


Fig. 6. Transient thermal impedance from junction to mounting base as a function of pulse width

6. Characteristics

Table 6. Characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Static characteristics							
I_{CES}	collector-emitter cut-off current	V_{BE} = 0 V; V_{CE} = 1050 V; T_{mb} = 25 °C	[1]	-	-	1	mA
		V_{BE} = 0 V; V_{CE} = 1050 V; T_j = 125 °C	[1]	-	-	2	mA
I_{CBO}	collector-base cut-off current	V_{CB} = 1050 V; I_E = 0 A; T_{mb} = 25 °C	[1]	-	-	1	mA
I_{CEO}	collector-emitter cut-off current	V_{CE} = 400 V; I_B = 0 A; T_{mb} = 25 °C	[1]	-	-	0.1	mA

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

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

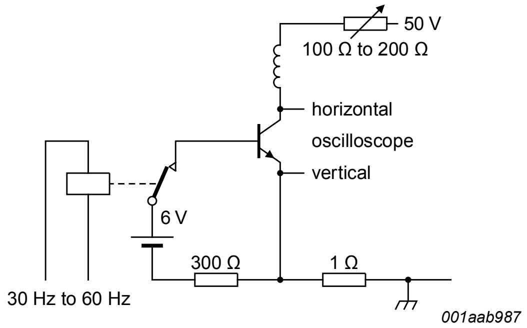


Fig. 7. Test circuit for collector-emitter sustaining voltage

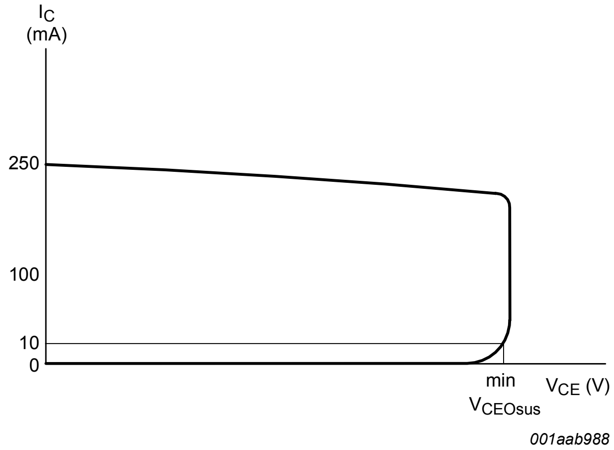


Fig. 8. Oscilloscope display for collector-emitter sustaining voltage test waveform

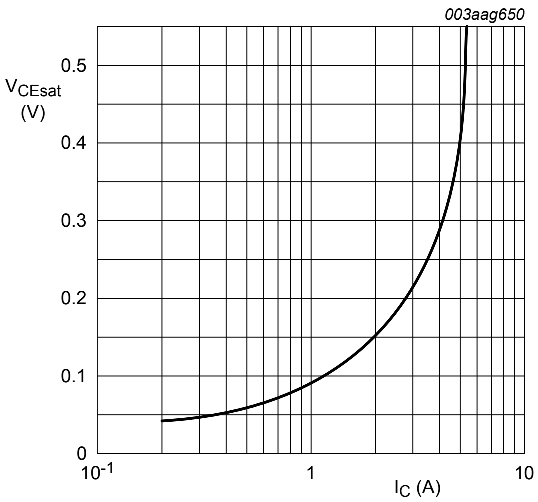


Fig. 9. Collector-emitter saturation voltage as a function of collector current; typical values

$I_C / I_B = 4$

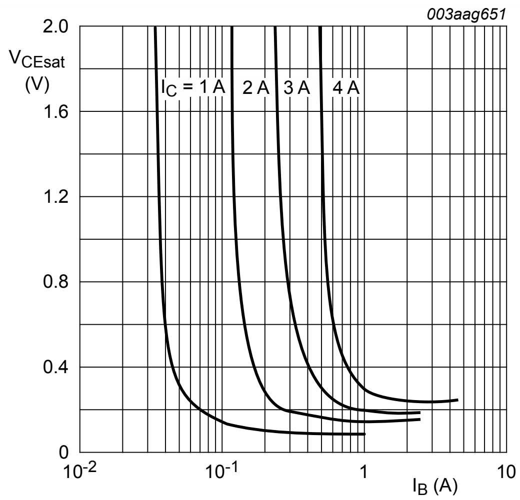


Fig. 10. Collector-emitter saturation voltage as a function of base current; typical values

$T_j = 25$ °C

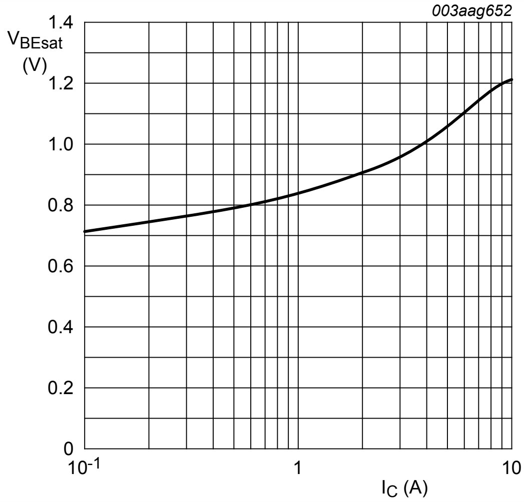


Fig. 11. Base-emitter saturation voltage as a function of collector current; typical values

$I_C/I_B = 4$

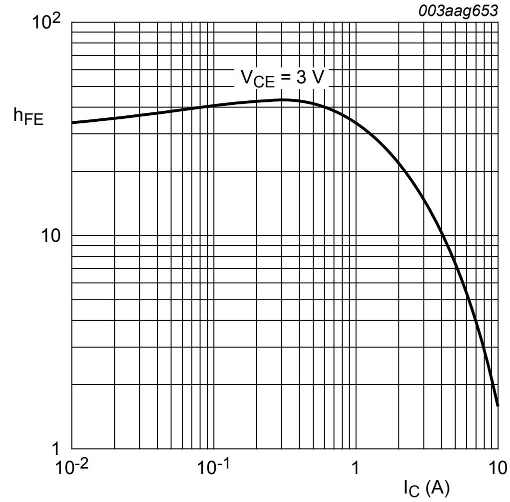


Fig. 12. DC current gain as a function of collector current; typical values

$T_j = 25$ °C

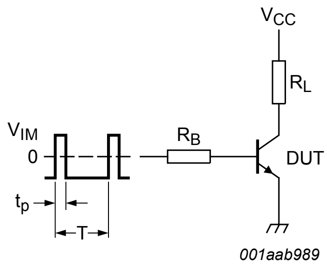


Fig. 13. Test circuit for resistive load switching

$$V_{IM} = -6 \text{ to } +8\ V;\ V_{CC} = 250\ V;\ t_p = 20\ \mu s;\ \delta = \frac{t_p}{T} = 0.01$$

R_B and R_L calculated from I_{Con} and I_{Bon} requirements.

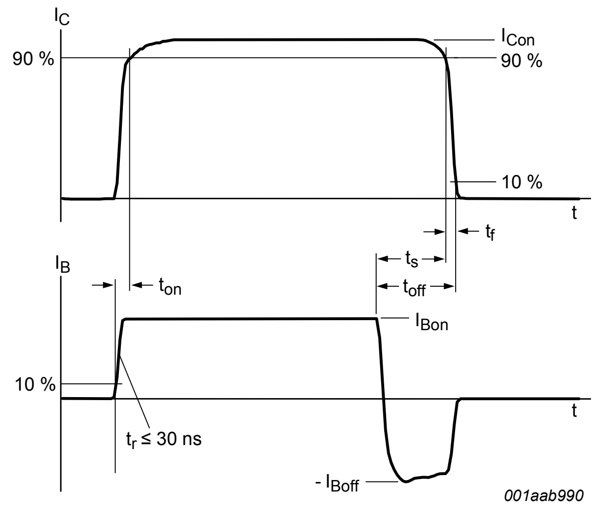


Fig. 14. Switching times waveforms for resistive load

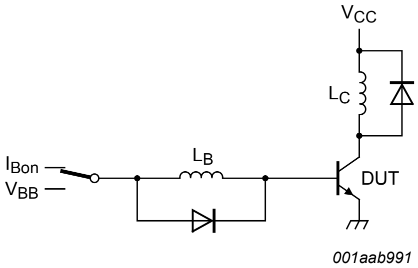


Fig. 15. Test circuit for inductive load switching

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

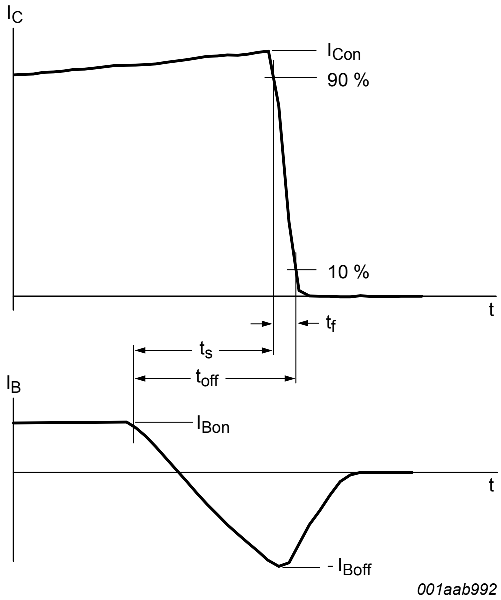
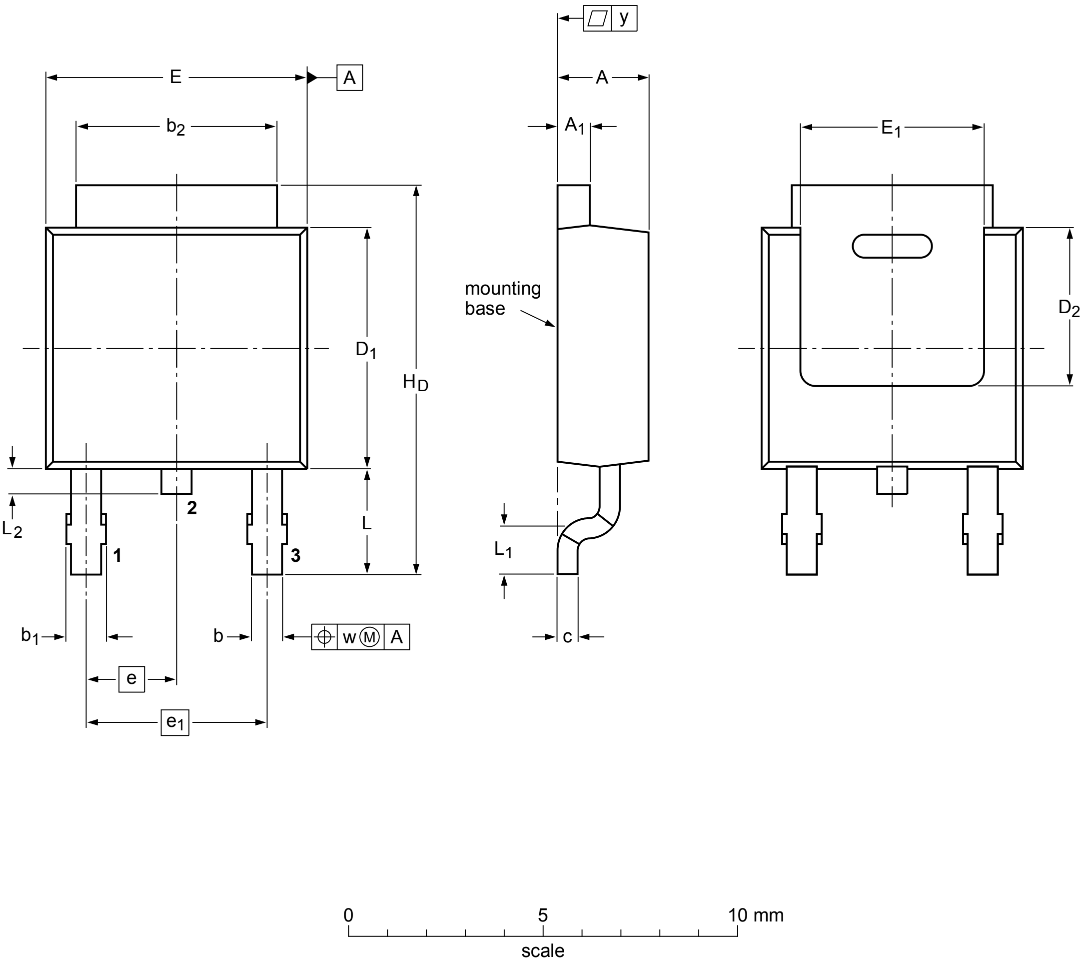


Fig. 16. Switching times waveforms for inductive load

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_1	b	b_1	b_2	c	D_1	D_2 min	E	E_1 min	e	e_1	H_D	L	L_1 min	L_2	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)

8. Legal information

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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.
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Date of release: 8 November 2012