



# IMPORTANT NOTICE

10 December 2015

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## 1. Global joint venture starts operations as WeEn Semiconductors

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Dear customer,

As from November 9th, 2015 NXP Semiconductors N.V. and Beijing JianGuang Asset Management Co. Ltd established Bipolar Power joint venture (JV), **WeEn Semiconductors**, which will be used in future Bipolar Power documents together with new contact details.

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Thank you for your cooperation and understanding,

WeEn Semiconductors





# BUJ303A

NPN power transistor

Rev. 6 — 8 February 2012

Product data sheet

## 1. Product profile

### 1.1 General description

High voltage, high speed planar passivated NPN power switching transistor in a SOT78 (TO-220AB) plastic package.

### 1.2 Features and benefits

- Fast switching
- Low thermal resistance
- 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

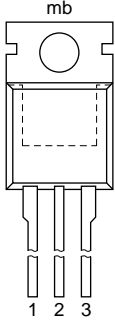
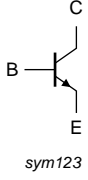
Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$I_C$	collector current	see <a href="#">Figure 1</a> ; see <a href="#">Figure 2</a> ; see <a href="#">Figure 4</a>	-	-	5	A
$P_{tot}$	total power dissipation	$T_{mb} \leq 25\text{ °C}$ ; see <a href="#">Figure 3</a>	-	-	100	W
$V_{CESM}$	collector-emitter peak voltage	$V_{BE} = 0\text{ V}$	-	-	1000	V
<b>Static characteristics</b>						
$h_{FE}$	DC current gain	$I_C = 5\text{ mA}$ ; $V_{CE} = 5\text{ V}$ ; $T_{mb} = 25\text{ °C}$ ; see <a href="#">Figure 11</a>	10	22	35	
		$I_C = 500\text{ mA}$ ; $V_{CE} = 5\text{ V}$ ; $T_{mb} = 25\text{ °C}$ ; see <a href="#">Figure 11</a>	14	25	35	



## 2. Pinning information

**Table 2. Pinning information**

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	B	base		 sym123
2	C	collector		
3	E	emitter		
mb	C	mounting base; connected to collector		

**SOT78 (TO-220AB)**

## 3. Ordering information

**Table 3. Ordering information**

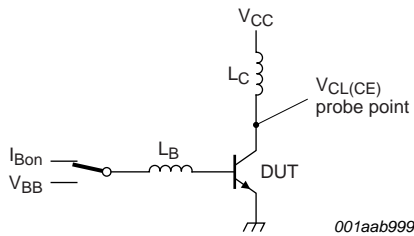
Type number	Package		
	Name	Description	Version
BUJ303A	TO-220AB	plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB	SOT78

## 4. Limiting values

**Table 4. Limiting values**

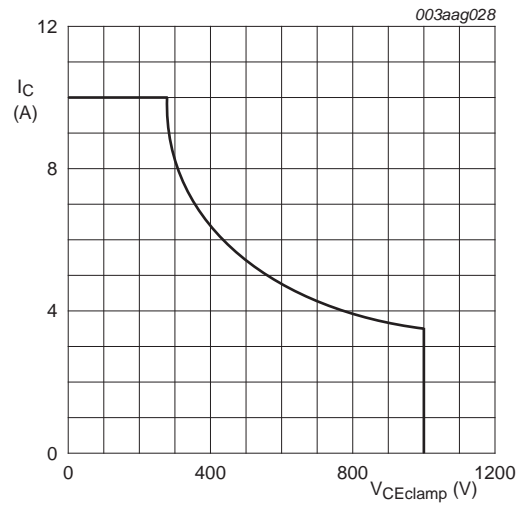
*In accordance with the Absolute Maximum Rating System (IEC 60134).*

Symbol	Parameter	Conditions	Min	Max	Unit
$V_{CESM}$	collector-emitter peak voltage	$V_{BE} = 0\text{ V}$	-	1000	V
$V_{CEO}$	collector-emitter voltage	$I_B = 0\text{ A}$	-	500	V
$I_C$	collector current	see <a href="#">Figure 1</a> ; see <a href="#">Figure 2</a> ; see <a href="#">Figure 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	$T_{mb} \leq 25\text{ °C}$ ; see <a href="#">Figure 3</a>	-	100	W
$T_{stg}$	storage temperature		-65	150	°C
$T_j$	junction temperature		-	150	°C



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

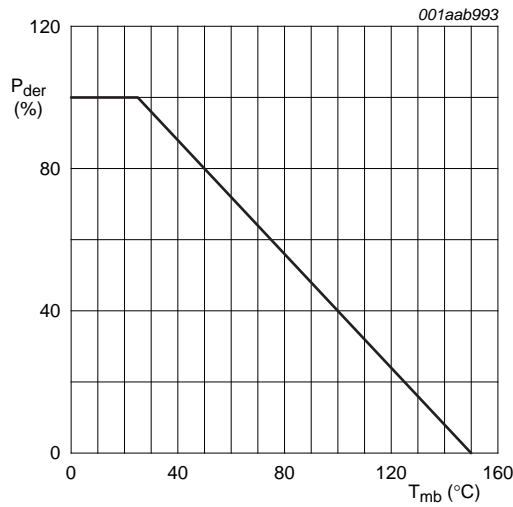
$$L_B = 1 \mu\text{H}; L_C = 200 \mu\text{H}$$



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

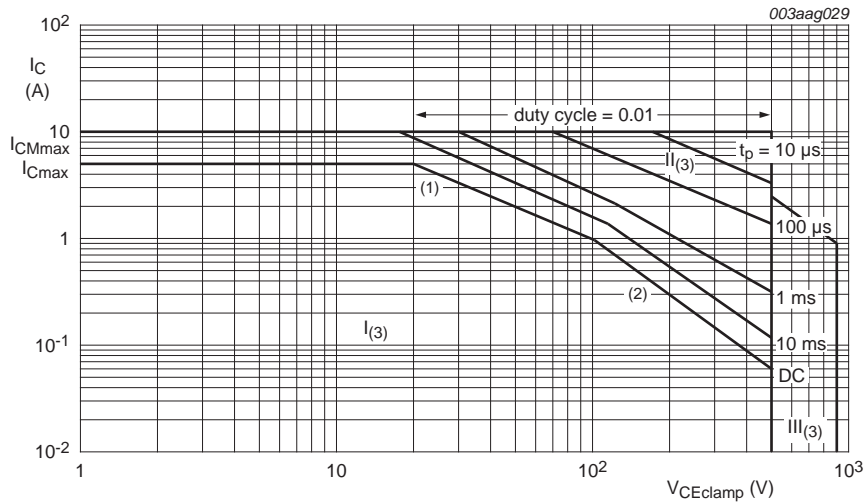
Fig 1. Test circuit for reverse bias safe operating area

Fig 2. Reverse bias safe operating area



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

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



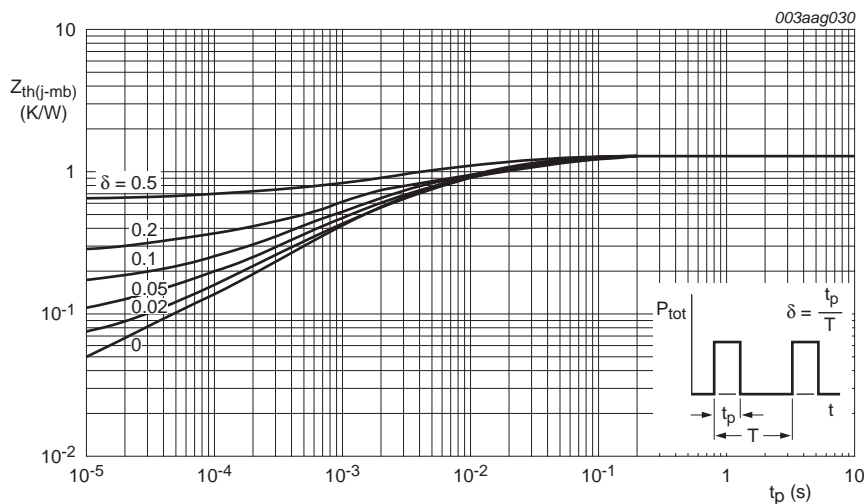
- (1)  $P_{tot}$  maximum and  $P_{tot}$  peak maximum lines.
- (2) Second breakdown limits.
- (3) I = Region of permissible DC operation.  
 II = Extension for repetitive pulse operation.  
 III = Extension during turn-on in single transistor converters provided that  $R_{BE} \leq 100 \Omega$  and  $t_p \leq 0.6 \mu s$ .

**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	see <a href="#">Figure 5</a>	-	-	1.25	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	-	60	-	K/W

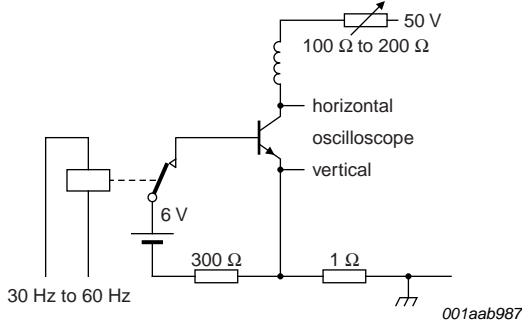


**Fig 5. Transient thermal impedance from junction to mounting base as a function of pulse width**

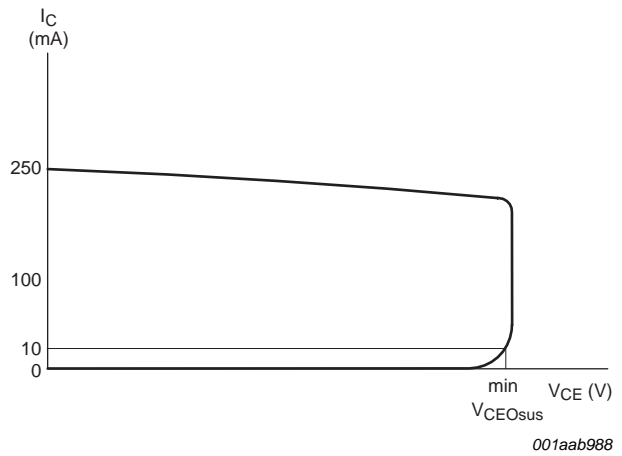
## 6. Characteristics

Table 6. Characteristics

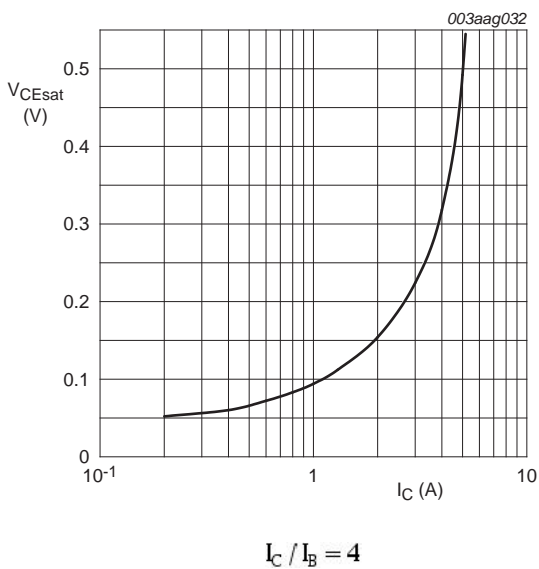
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Static characteristics</b>						
$I_{CES}$	collector-emitter cut-off current	$V_{BE} = 0\text{ V}$ ; $V_{CE} = 1000\text{ V}$ ; $T_{mb} = 25\text{ °C}$ ; Measured with half-sine wave voltage (curve tracer)	-	-	1	mA
		$V_{BE} = 0\text{ V}$ ; $V_{CE} = 1000\text{ V}$ ; $T_j = 125\text{ °C}$ ; Measured with half-sine wave voltage (curve tracer)	-	-	2	mA
$I_{CBO}$	collector-base cut-off current	$V_{CB} = 1000\text{ V}$ ; $I_E = 0\text{ A}$ ; $T_{mb} = 25\text{ °C}$ ; Measured with half-sine wave voltage (curve tracer)	-	-	1	mA
$I_{CEO}$	collector-emitter cut-off current	$V_{CE} = 500\text{ V}$ ; $I_B = 0\text{ A}$ ; $T_{mb} = 25\text{ °C}$ ; Measured with half-sine wave voltage (curve tracer)	-	-	0.1	mA
$I_{EBO}$	emitter-base cut-off current	$V_{EB} = 9\text{ V}$ ; $I_C = 0\text{ A}$ ; $T_{mb} = 25\text{ °C}$	-	-	0.1	mA
$V_{CE0sus}$	collector-emitter sustaining voltage	$I_B = 0\text{ A}$ ; $I_C = 100\text{ mA}$ ; $L_C = 25\text{ mH}$ ; $T_{mb} = 25\text{ °C}$ ; see <a href="#">Figure 6</a> ; see <a href="#">Figure 7</a>	500	-	-	V
$V_{CEsat}$	collector-emitter saturation voltage	$I_C = 3\text{ A}$ ; $I_B = 0.6\text{ A}$ ; $T_{mb} = 25\text{ °C}$ ; see <a href="#">Figure 8</a> ; see <a href="#">Figure 9</a>	-	0.35	1.5	V
$V_{BEsat}$	base-emitter saturation voltage	$I_C = 3\text{ A}$ ; $I_B = 0.6\text{ A}$ ; $T_{mb} = 25\text{ °C}$ ; see <a href="#">Figure 10</a>	-	1.01	1.3	V
$h_{FE}$	DC current gain	$I_C = 5\text{ mA}$ ; $V_{CE} = 5\text{ V}$ ; $T_{mb} = 25\text{ °C}$ ; see <a href="#">Figure 11</a>	10	22	35	
		$I_C = 500\text{ mA}$ ; $V_{CE} = 5\text{ V}$ ; $T_{mb} = 25\text{ °C}$ ; see <a href="#">Figure 11</a>	14	25	35	
$h_{FEsat}$	DC saturation current gain	$I_C = 2.5\text{ A}$ ; $V_{CE} = 5\text{ V}$ ; $T_{mb} = 25\text{ °C}$ ; see <a href="#">Figure 11</a>	10	13.5	17	
		$I_C = 3\text{ A}$ ; $V_{CE} = 5\text{ V}$ ; $T_{mb} = 25\text{ °C}$ ; see <a href="#">Figure 11</a>	-	11	-	
<b>Dynamic Characteristics (switching times - resistive load)</b>						
$t_s$	turn-off delay time	$I_C = 2.5\text{ A}$ ; $I_{Bon} = 0.5\text{ A}$ ; $I_{Boff} = -0.5\text{ A}$ ; $R_L = 75\text{ }\Omega$ ; $T_{mb} = 25\text{ °C}$ ; see <a href="#">Figure 12</a> ; see <a href="#">Figure 13</a>	-	3.3	4	$\mu\text{s}$
$t_f$	fall time		-	0.33	0.45	$\mu\text{s}$
<b>Dynamic Characteristics (switching times - inductive load)</b>						
$t_s$	turn-off delay time	$I_C = 2.5\text{ A}$ ; $I_{Bon} = 0.5\text{ A}$ ; $V_{BB} = -5\text{ V}$ ; $L_B = 1\text{ }\mu\text{H}$ ; $T_{mb} = 25\text{ °C}$ ; see <a href="#">Figure 14</a> ; see <a href="#">Figure 15</a>	-	1.4	1.6	$\mu\text{s}$
$t_s$	turn-off delay time	$I_C = 2.5\text{ A}$ ; $I_{Bon} = 0.5\text{ A}$ ; $V_{BB} = -5\text{ V}$ ; $L_B = 1\text{ }\mu\text{H}$ ; $T_j = 100\text{ °C}$ ; see <a href="#">Figure 14</a> ; see <a href="#">Figure 15</a>	-	1.7	1.9	$\mu\text{s}$
$t_f$	fall time	$I_C = 2.5\text{ A}$ ; $I_{Bon} = 0.5\text{ A}$ ; $V_{BB} = -5\text{ V}$ ; $L_B = 1\text{ }\mu\text{H}$ ; $T_{mb} = 25\text{ °C}$ ; see <a href="#">Figure 14</a> ; see <a href="#">Figure 15</a>	-	145	160	ns
		$I_C = 2.5\text{ A}$ ; $I_{Bon} = 0.5\text{ A}$ ; $V_{BB} = -5\text{ V}$ ; $L_B = 1\text{ }\mu\text{H}$ ; $T_j = 100\text{ °C}$ ; see <a href="#">Figure 14</a> ; see <a href="#">Figure 15</a>	-	160	200	ns



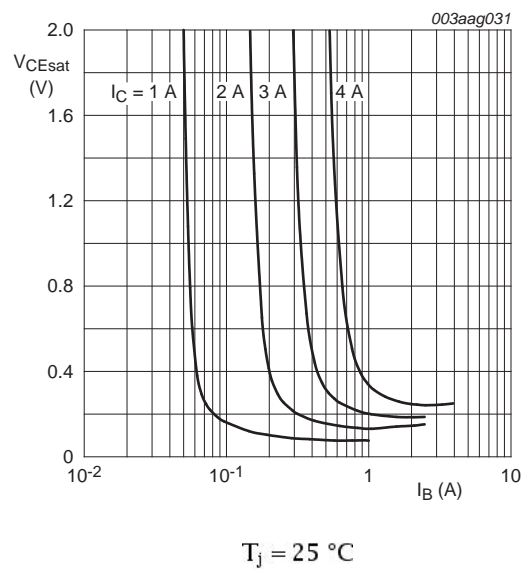
**Fig 6. Test circuit for collector-emitter sustaining voltage**



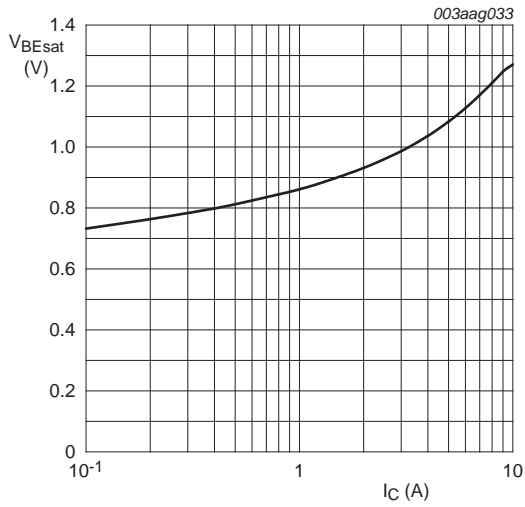
**Fig 7. Oscilloscope display for collector-emitter sustaining voltage test waveform**



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

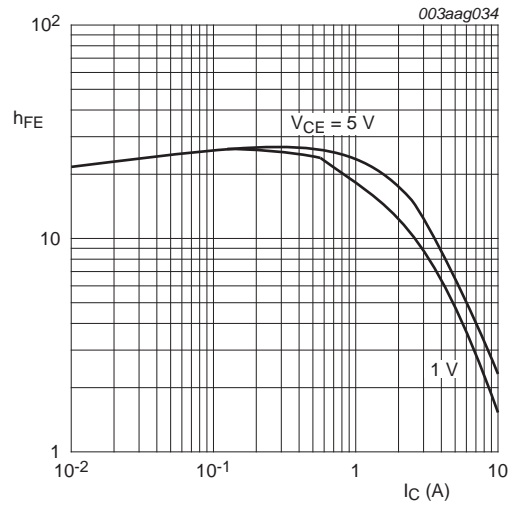


**Fig 9. Collector-emitter saturation voltage as a function of base current; typical values**



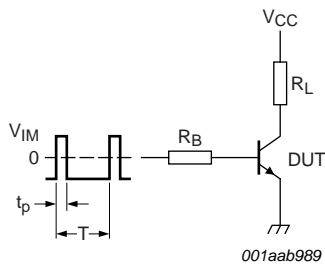
$I_C / I_B = 4$

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



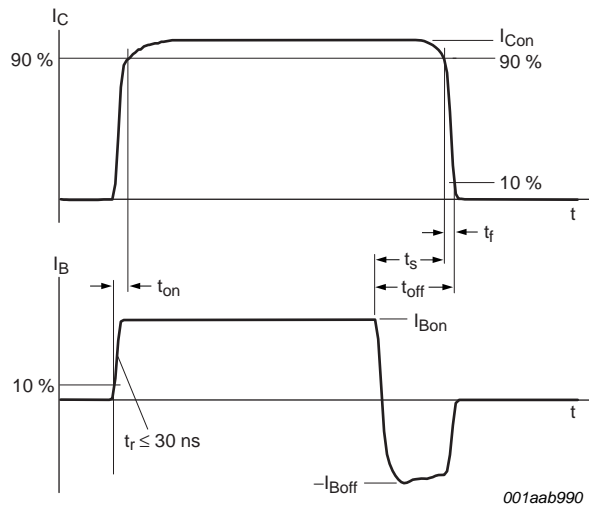
$T_j = 25\text{ }^\circ\text{C}$

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



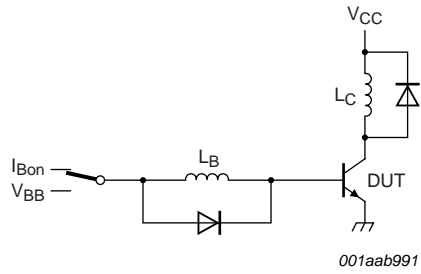
$V_{IM} = -6\text{ to }+8\text{V}; t_p = 20\text{ }\mu\text{s}; \delta = \frac{t_p}{T} = 0.01$   
 $R_B$  and  $R_L$  calculated from  $I_{Con}$  and  $I_{Bon}$  requirements.

**Fig 12. Test circuit for resistive load switching**



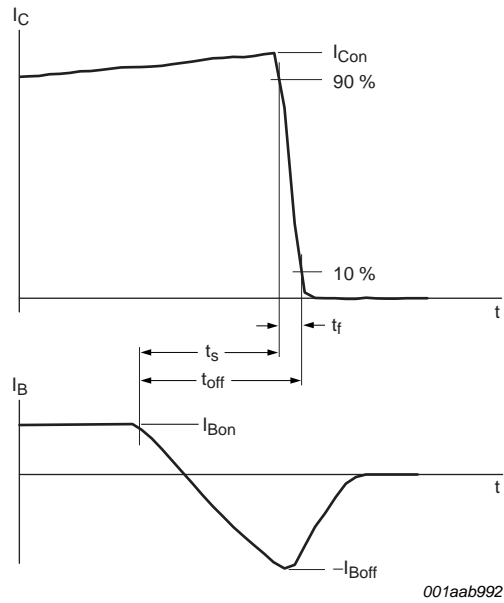
**Fig 13. Switching times waveforms for resistive load**





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

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

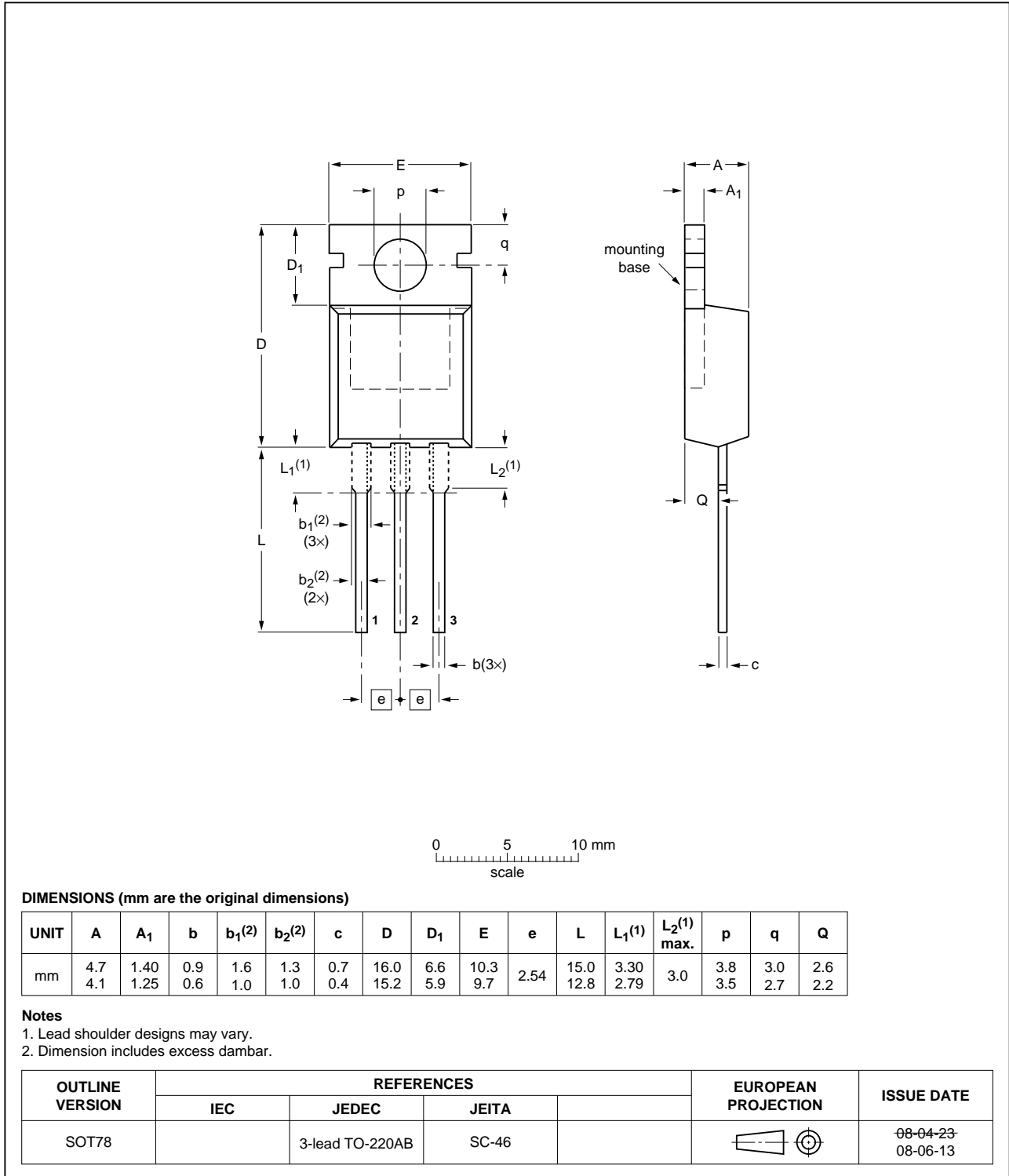


**Fig 15. Switching times waveforms for inductive load**

**7. Package outline**

Plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB

SOT78



**Fig 16. Package outline SOT78 (TO-220AB)**

## 8. Revision history

Table 7. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BUJ303A v.6	20120208	Product data sheet	-	BUJ303A v.5
Modifications:	• Various changes to content.			
BUJ303A v.5	20110503	Product data sheet	-	BUJ303A v.4

## 9. Legal information

### 9.1 Data sheet status

Document status <sup>[1]</sup> <sup>[2]</sup>	Product status <sup>[3]</sup>	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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[2] The term 'short data sheet' is explained in section "Definitions".

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