

# DATA SHEET

## **BUW11F; BUW11AF** Silicon diffused power transistors

Product specification  
Supersedes data of February 1996  
File under Discrete Semiconductors, SC06

1997 Aug 14

Silicon diffused power transistors

BUW11F; BUW11AF

DESCRIPTION

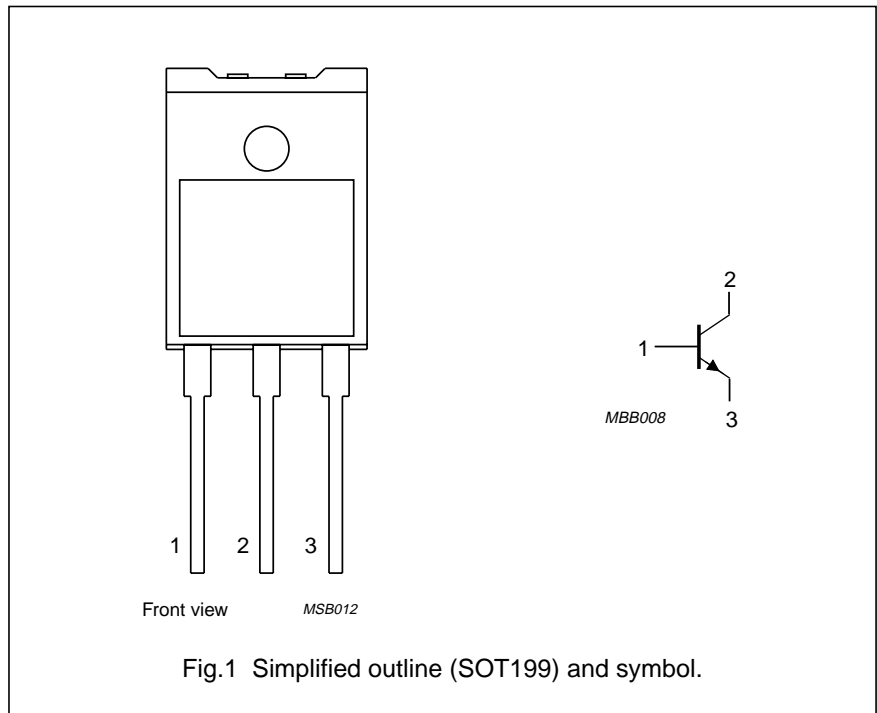
High-voltage, high-speed, glass-passivated NPN power transistor in a SOT199 package.

APPLICATIONS

- Converters
- Inverters
- Switching regulators
- Motor control systems.

PINNING

PIN	DESCRIPTION
1	base
2	collector
3	emitter
mb	mounting base; electrically isolated



QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
$V_{CESM}$	collector-emitter peak voltage	$V_{BE} = 0$	850	V
	BUW11F			
$V_{CEO}$	collector-emitter voltage	open base	400	V
	BUW11AF			
$V_{CEsat}$	collector-emitter saturation voltage		1.5	V
$I_{Csat}$	collector saturation current		3	A
	BUW11AF			
$I_C$	collector current (DC)	see Figs 2 and 4	5	A
$I_{CM}$	collector current (peak value)	$t_p < 20$ ms; see Fig.2	10	A
$P_{tot}$	total power dissipation	$T_h \leq 25$ °C; see Fig.3	32	W
$t_f$	fall time	resistive load; see Figs 8 and 9	0.8	$\mu$ s

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## THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j-h}$	thermal resistance from junction to external heatsink	note 1	3.95	K/W
		note 2	3.05	K/W
$R_{th\ j-a}$	thermal resistance from junction to ambient		35	K/W

## Notes

1. Mounted **without** heatsink compound and  $30 \pm 5$  N force on centre of package.
2. Mounted **with** heatsink compound and  $30 \pm 5$  N force on centre of package.

## LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$V_{CESM}$	collector-emitter peak voltage BUW11F BUW11AF	$V_{BE} = 0$	–	850	V
			–	1000	V
$V_{CEO}$	collector-emitter voltage BUW11F BUW11AF	open base	–	400	V
			–	450	V
$I_{Csat}$	collector saturation current BUW11F BUW11AF		–	3	A
			–	2.5	A
$I_C$	collector current (DC)	see Figs 2 and 4	–	5	A
$I_{CM}$	collector current (peak value)	$t_p < 20$ ms; see Fig.2	–	10	A
$I_B$	base current (DC)		–	2	A
$I_{BM}$	base current (peak value)	$t_p < 20$ ms	–	4	A
$P_{tot}$	total power dissipation	$T_h \leq 25$ °C; see Fig.3; note 1	–	32	W
		$T_h \leq 25$ °C; see Fig.3; note 2	–	41	W
$T_{stg}$	storage temperature		–65	+150	°C
$T_j$	junction temperature		–	150	°C

## Notes

1. Mounted **without** heatsink compound and  $30 \pm 5$  N force on centre of package.
2. Mounted **with** heatsink compound and  $30 \pm 5$  N force on centre of package.

## ISOLATION CHARACTERISTICS

SYMBOL	PARAMETER	TYP.	MAX.	UNIT
$V_{isolM}$	isolation voltage from all terminals to external heatsink (peak value)	–	1500	V
$C_{isol}$	isolation capacitance from collector to external heatsink	–	21	pF

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## CHARACTERISTICS

$T_j = 25\text{ °C}$  unless otherwise specified.

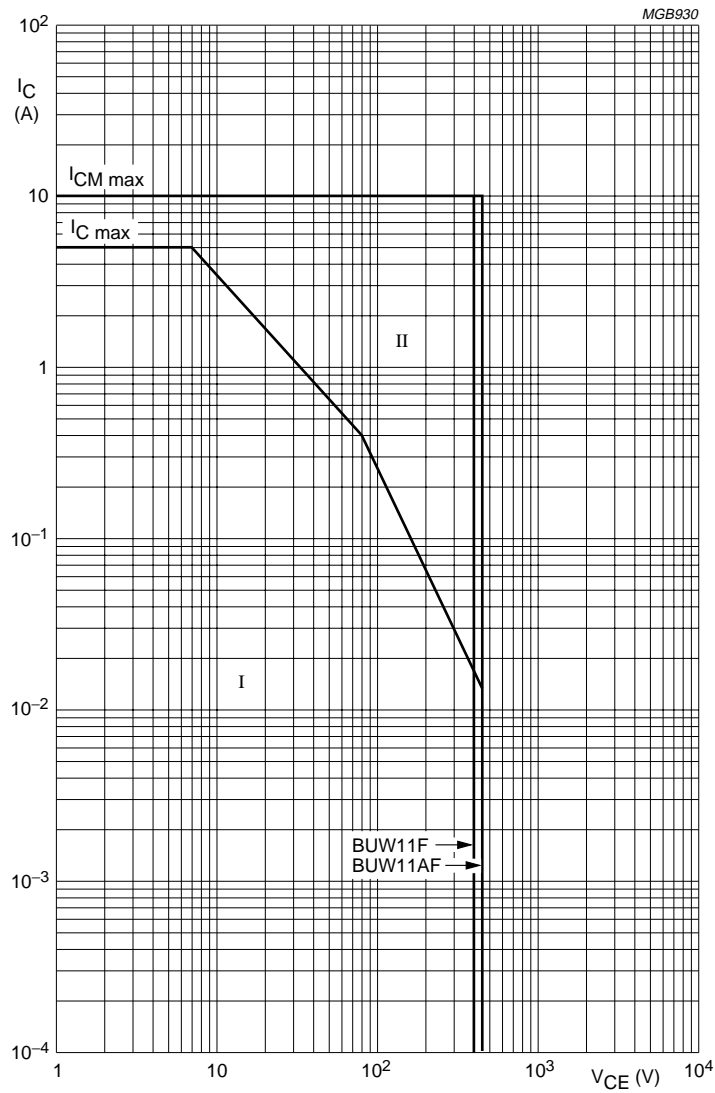
SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{CEOsust}$	collector-emitter sustaining voltage BUW11F BUW11AF	$I_C = 100\text{ mA}$ ; $I_{Boff} = 0$ ; $L = 25\text{ mH}$ ; see Figs 5 and 6	400	–	–	V
			450	–	–	V
$V_{CEsat}$	collector-emitter saturation voltage BUW11F BUW11AF	$I_C = 3\text{ A}$ ; $I_B = 600\text{ mA}$	–	–	1.5	V
		$I_C = 2.5\text{ A}$ ; $I_B = 500\text{ mA}$	–	–	1.5	V
$V_{BEsat}$	base-emitter saturation voltage BUW11F BUW11AF	$I_C = 3\text{ A}$ ; $I_B = 600\text{ mA}$	–	–	1.4	V
		$I_C = 2.5\text{ A}$ ; $I_B = 500\text{ mA}$	–	–	1.4	V
$I_{Csat}$	collector saturation current BUW11F BUW11AF	$V_{CE} = 1.5\text{ V}$	–	–	3	A
			–	–	2.5	A
$I_{CES}$	collector-emitter cut-off current	$V_{CE} = V_{CESMmax}$ ; $V_{BE} = 0$ ; note 1	–	–	1	mA
		$V_{CE} = V_{CESMmax}$ ; $V_{BE} = 0$ ; $T_j = 125\text{ °C}$ ; note 1	–	–	2	mA
$I_{EBO}$	emitter-base cut-off current	$V_{EB} = 9\text{ V}$ ; $I_C = 0$	–	–	10	mA
$h_{FE}$	DC current gain	$V_{CE} = 5\text{ V}$ ; $I_C = 5\text{ mA}$ ; see Fig.7	10	18	35	
		$V_{CE} = 5\text{ V}$ ; $I_C = 0.5\text{ A}$ ; see Fig.7	10	20	35	
<b>Switching times resistive load (Figs 8 and 9)</b>						
$t_{on}$	turn-on time BUW11F BUW11AF	$I_{Con} = 3\text{ A}$ ; $I_{Bon} = -I_{Boff} = 600\text{ mA}$	–	–	1	$\mu\text{s}$
		$I_{Con} = 2.5\text{ A}$ ; $I_{Bon} = -I_{Boff} = 500\text{ mA}$	–	–	1	$\mu\text{s}$
$t_s$	storage time BUW11F BUW11AF	$I_{Con} = 3\text{ A}$ ; $I_{Bon} = -I_{Boff} = 600\text{ mA}$	–	–	4	$\mu\text{s}$
		$I_{Con} = 2.5\text{ A}$ ; $I_{Bon} = -I_{Boff} = 500\text{ mA}$	–	–	4	$\mu\text{s}$
$t_f$	fall time BUW11F BUW11AF	$I_{Con} = 3\text{ A}$ ; $I_{Bon} = -I_{Boff} = 600\text{ mA}$	–	–	0.8	$\mu\text{s}$
		$I_{Con} = 2.5\text{ A}$ ; $I_{Bon} = -I_{Boff} = 500\text{ mA}$	–	–	0.8	$\mu\text{s}$
<b>Switching times inductive load (Figs 10 and 11)</b>						
$t_s$	storage time BUW11F BUW11AF	$I_{Con} = 3\text{ A}$ ; $I_B = 600\text{ mA}$ ; $V_{CL} = 250\text{ V}$ ; $T_c = 100\text{ °C}$	–	2	2.5	$\mu\text{s}$
		$I_{Con} = 2.5\text{ A}$ ; $I_B = 500\text{ mA}$ ; $V_{CL} = 300\text{ V}$ ; $T_c = 100\text{ °C}$	–	2	2.5	$\mu\text{s}$
$t_f$	fall time BUW11F BUW11AF	$I_{Con} = 3\text{ A}$ ; $I_B = 600\text{ mA}$ ; $V_{CL} = 250\text{ V}$ ; $T_c = 100\text{ °C}$	–	200	300	ns
		$I_{Con} = 2.5\text{ A}$ ; $I_B = 500\text{ mA}$ ; $V_{CL} = 300\text{ V}$ ; $T_c = 100\text{ °C}$	–	200	300	ns

## Note

1. Measured with a half-sinewave voltage (curve tracer).

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Mounted **without** heatsink compound and  $30 \pm 5$  N force on centre of package.

$T_{mb} < 25$  °C.

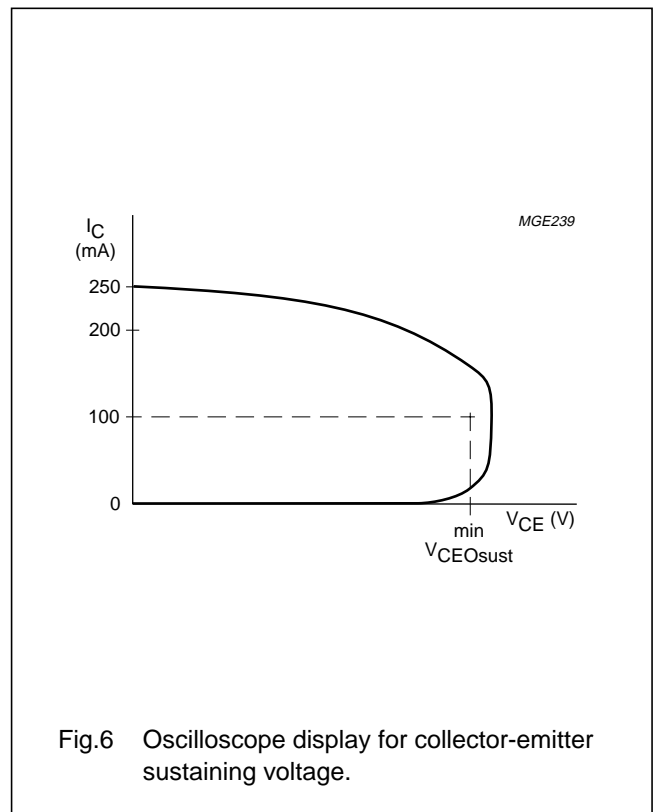
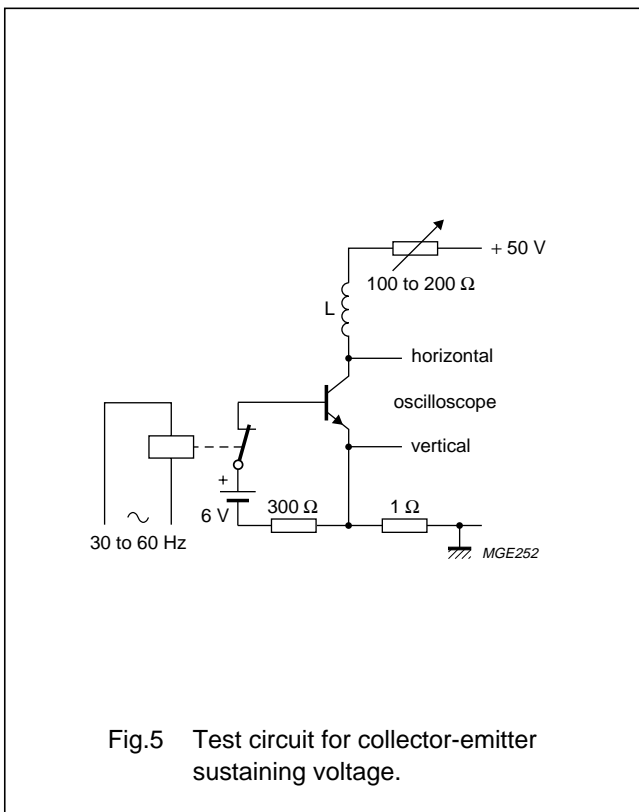
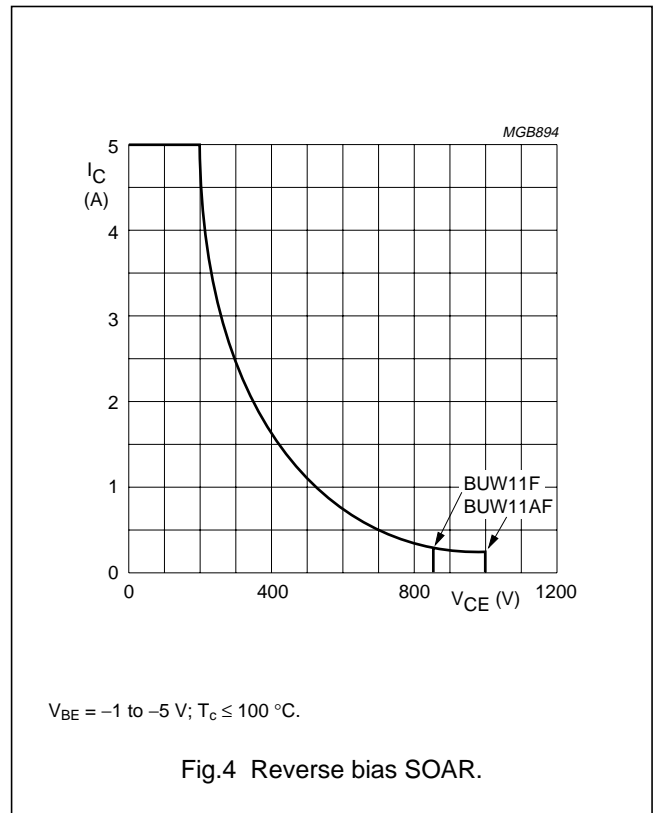
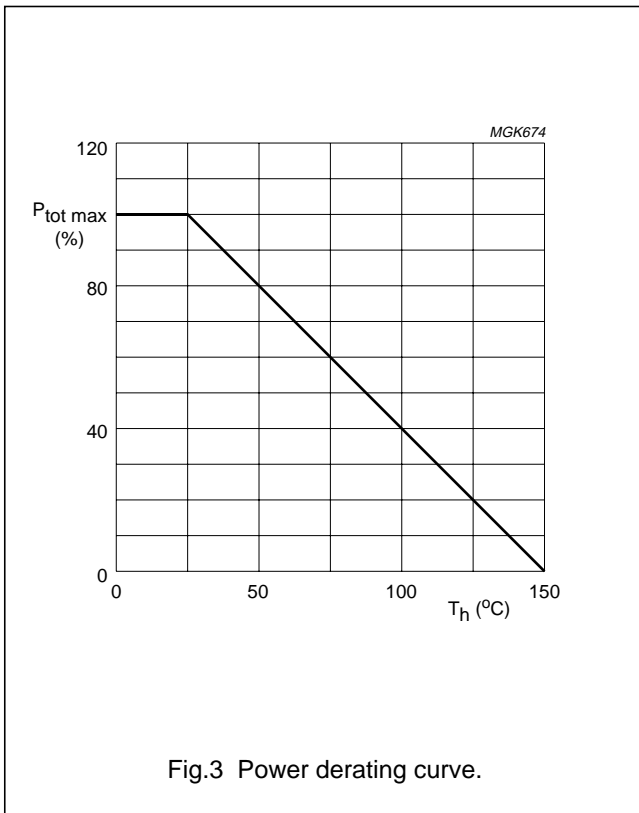
I - Region of permissible DC operation.

II - Permissible extension for repetitive pulse operation.

Fig.2 Forward bias SOAR.

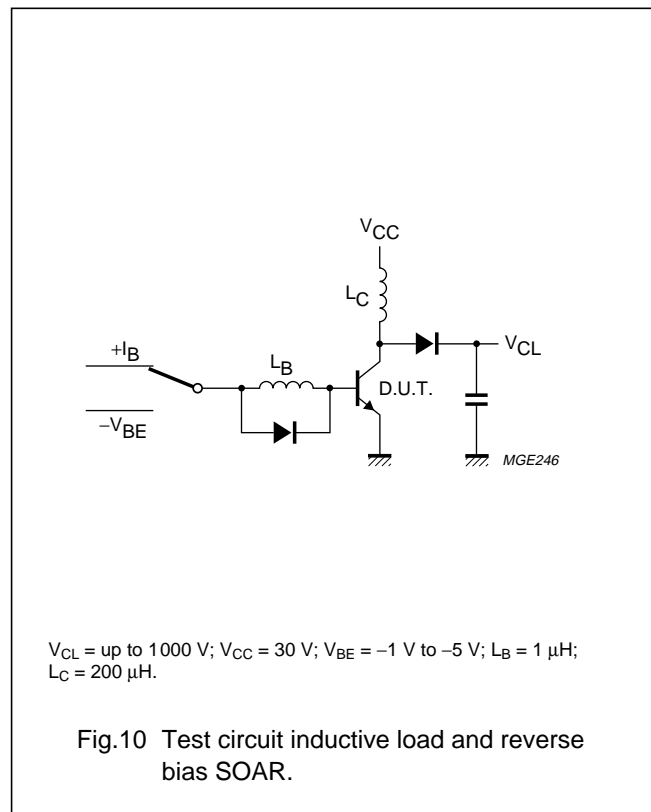
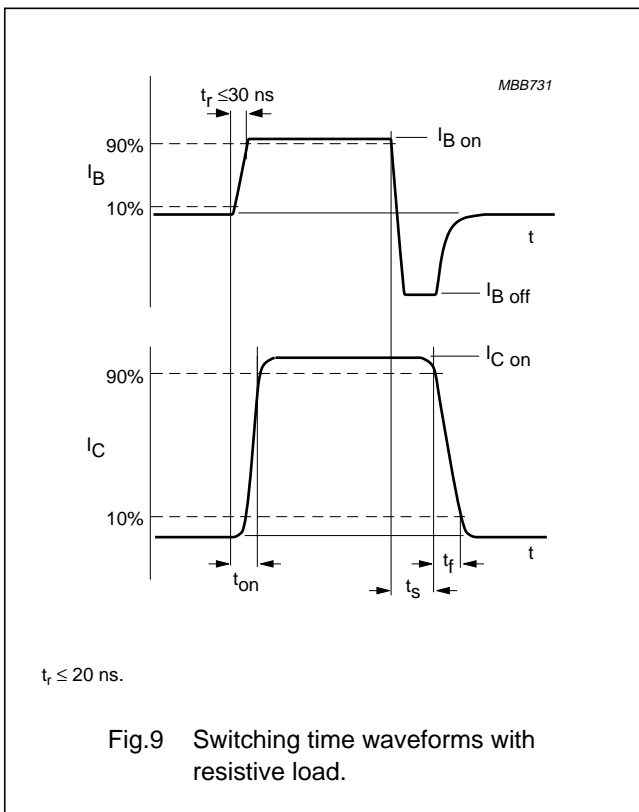
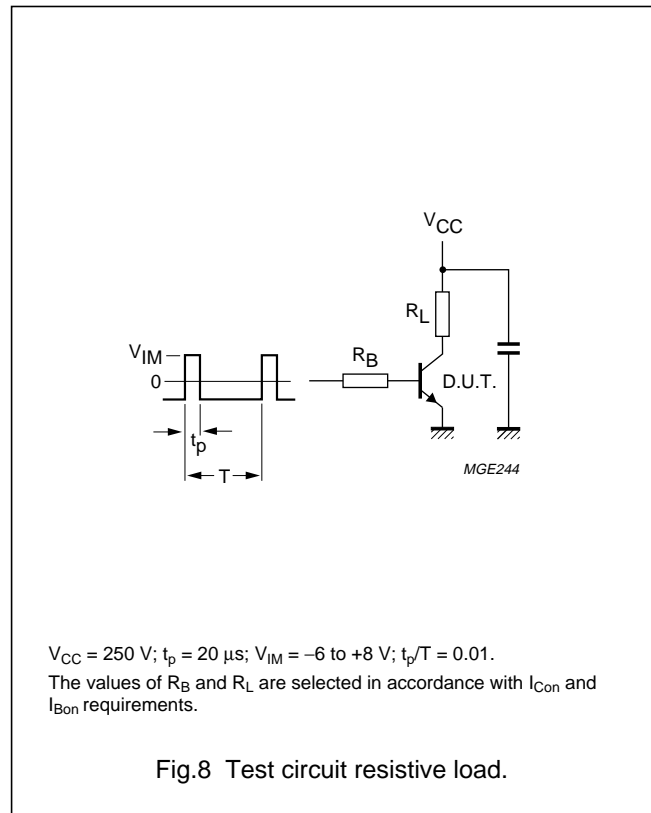
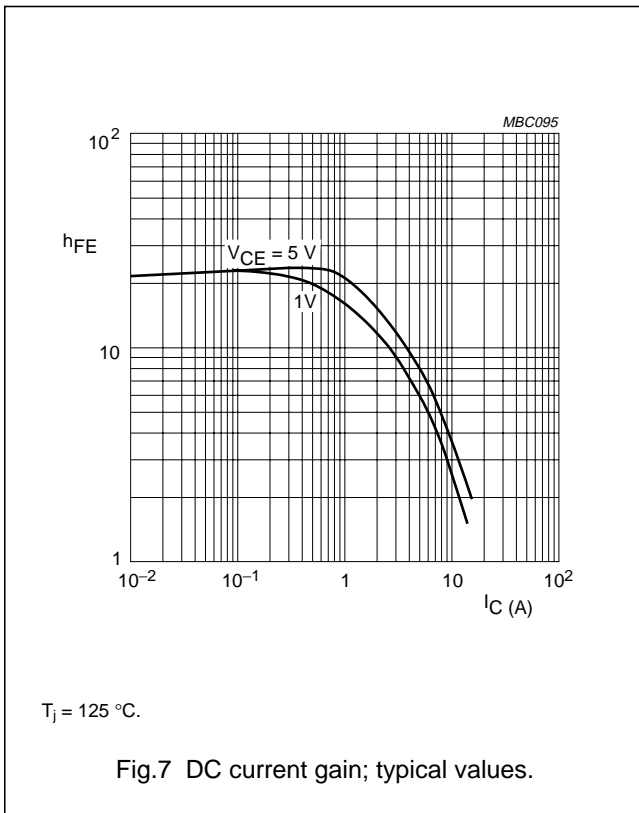
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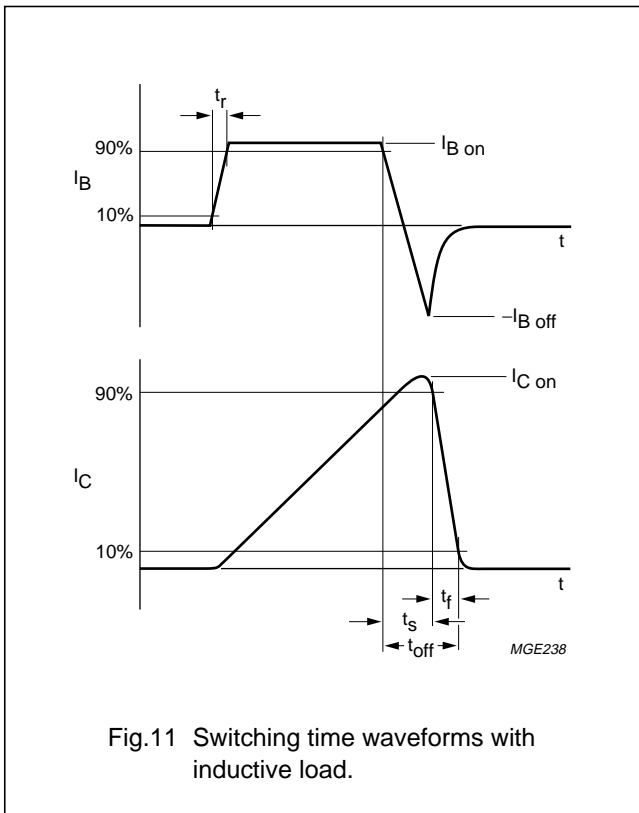


Fig.11 Switching time waveforms with inductive load.

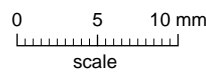
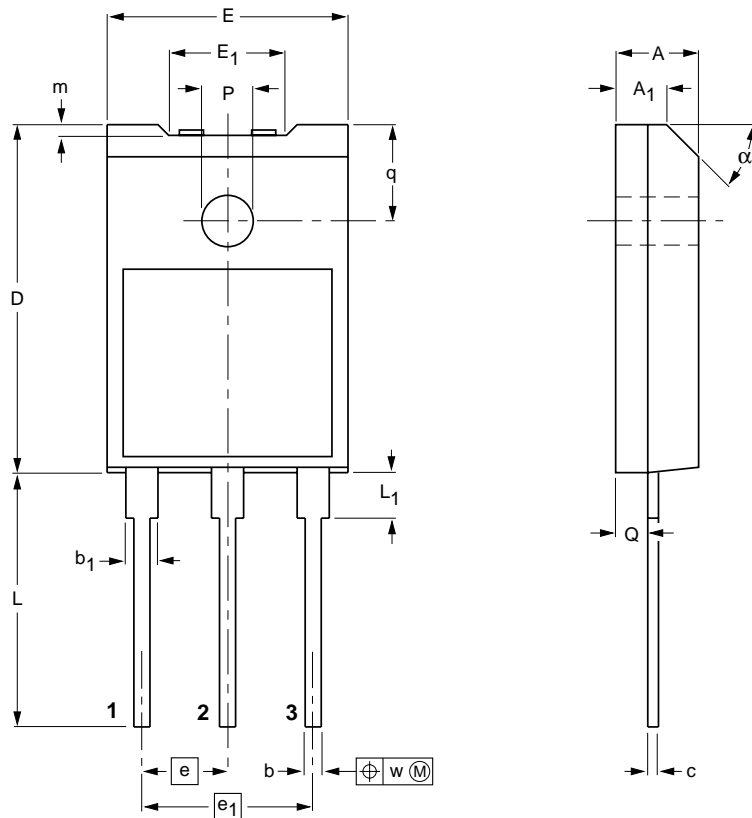
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PACKAGE OUTLINE

Plastic single-ended package; heatsink mounted; 1 mounting hole; 3 leads (in-line)

SOT199



DIMENSIONS (mm are the original dimensions)

UNIT	A	A <sub>1</sub>	b	b <sub>1</sub>	c	D	E	E <sub>1</sub>	e	e <sub>1</sub>	L	L <sub>1</sub> <sup>(1)</sup>	m	P	Q	q	w	α
mm	5.2 4.8	3.4 3.0	1.2 1.0	2.1 1.9	0.6 0.5	21.5 20.5	15.3 14.7	7.8 6.8	5.45	10.9	16.5 15.7	3.7 3.3	0.8 0.6	3.3 3.1	2.1 1.9	6.2 5.8	0.4	45°

Note

1. Terminals in this zone are not tinned.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT199						97-06-27

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**DEFINITIONS**

<b>Data sheet status</b>	
Objective specification	This data sheet contains target or goal specifications for product development.
Preliminary specification	This data sheet contains preliminary data; supplementary data may be published later.
Product specification	This data sheet contains final product specifications.
<b>Limiting values</b>	
Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.	
<b>Application information</b>	
Where application information is given, it is advisory and does not form part of the specification.	

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