DATA SHEET

BUW13F; BUW13AF
Silicon diffused power transistors

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

1997 Aug 13

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Silicon diffused power transistors BUW13F; BUW13AF

DESCRIPTION

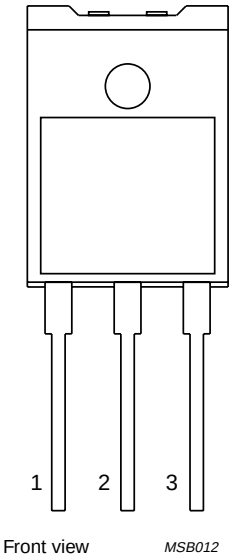
High-voltage, high-speed, glass-passivated NPN power transistor in a SOT199 package.

APPLICATIONS

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

PINNING

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



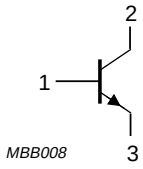


Fig.1 Simplified outline (SOT199) and symbol.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_{CESM}	collector-emitter peak voltage	V_{BE} = 0		
	BUW13F		850	V
	BUW13AF		1000	V
V_{CEO}	collector-emitter voltage	open base		
	BUW13F		400	V
	BUW13AF		450	V
V_{CEsat}	collector-emitter saturation voltage	see Figs 8 and 10	1.5	V
I_{Csat}	collector saturation current			
	BUW13F		10	A
	BUW13AF		8	A
I_C	collector current (DC)	see Figs 3 and 4	15	A
I_{CM}	collector current (peak value)	t_p < 20 ms; see Fig 4	30	A
P_{tot}	total power dissipation	$T_h \leq 25$ °C; see Fig.2	37	W
t_f	fall time	resistive load; see Fig.13	0.8	µs

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}h}$	thermal resistance from junction to external heatsink	note 1	3.4	K/W
		note 2	2.5	K/W
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient		35	K/W

Notes

1. Mounted **without** heatsink compound and 30 ±5 N force on centre of package.
2. Mounted **with** heatsink compound and 30 ±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	V_{BE} = 0			
	BUW13F		–	850	V
	BUW13AF		–	1000	V
V_{CEO}	collector-emitter voltage	open base			
	BUW13F		–	400	V
	BUW13AF		–	450	V
I_{Csat}	collector saturation current				
	BUW13F		–	10	A
	BUW13AF		–	8	A
I_C	collector current (DC)	see Figs 3 and 4	–	15	A
I_{CM}	collector current (peak value)	t_p < 20 ms; see Fig 4	–	30	A
I_B	base current (DC)		–	6	A
I_{BM}	base current (peak value)	t_p = –20 ms	–	9	A
P_{tot}	total power dissipation	$T_h \leq 25$ °C; see Fig.2; note 1	–	37	W
		$T_h \leq 25$ °C; see Fig.2; note 2	–	50	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C

Notes

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

ISOLATION CHARACTERISTICS

SYMBOL	PARAMETER	MAX.	UNIT
V_{isolM}	isolation voltage from all terminals to external heatsink (peak value); note 1	2000	V
C_{isol}	isolation capacitance from collector to external heatsink	21	pF

Note

1. Repetitive peak operation with RH ≤ 65% under clean and dust-free conditions.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{CEOsust}$	collector-emitter sustaining voltage	I_C = 100 mA; I_{Boff} = 0; L = 25 mH; see Figs 6 and 7				
	BUW13F		400	–	–	V
	BUW13AF		450	–	–	V
V_{CEsat}	collector-emitter saturation voltage					
	BUW13F	I_C = 10 A; I_B = 2 A; see Figs 8 and 10	–	–	1.5	V
	BUW13AF	I_C = 8 A; I_B = 1.6 A; see Figs 8 and 10	–	–	1.5	V
V_{BEsat}	base-emitter saturation voltage					
	BUW13F	I_C = 10 A; I_B = 2 A; see Fig.8	–	–	1.6	V
	BUW13AF	I_C = 8 A; I_B = 1.6 A; see Fig.8	–	–	1.6	V
I_{Csat}	collector saturation current	V_{CE} = 1.5 V				
	BUW13F		–	–	10	A
	BUW13AF		–	–	8	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 °C; note 1	–	–	4	mA
I_{EBO}	emitter-base cut-off current	V_{EB} = 9 V; I_C = 0	–	–	10	mA
h_{FE}	DC current gain	V_{CE} = 5 V; I_C = 20 mA; see Fig.11	10	18	35	
		V_{CE} = 5 V; I_C = 1.5 A; see Fig.11	10	20	35	
Switching times resistive load (see Figs 12 and 13)						
t_{on}	turn-on time					
	BUW13F	I_{Con} = 10 A; I_{Bon} = I_{Boff} = 2 A	–	–	1	µs
	BUW13AF	I_{Con} = 8 A; I_{Bon} = I_{Boff} = 1.6 A	–	–	1	µs
t_s	storage time					
	BUW13F	I_{Con} = 10 A; I_{Bon} = I_{Boff} = 2 A	–	–	4	µs
	BUW13AF	I_{Con} = 8 A; I_{Bon} = I_{Boff} = 1.6 A	–	–	4	µs
t_f	fall time					
	BUW13F	I_{Con} = 10 A; I_{Bon} = I_{Boff} = 2 A	–	–	0.8	µs
	BUW13AF	I_{Con} = 8 A; I_{Bon} = I_{Boff} = 1.6 A	–	–	0.8	µs
Switching times inductive load (see Figs 14 and 15)						
t_s	storage time					
	BUW13F	I_{Con} = 10 A; I_B = 2 A; V_{CL} = 250 V; T_c = 100 °C	–	2.8	3.5	µs
	BUW13AF	I_{Con} = 8 A; I_B = 1.6 A; V_{CL} = 300 V; T_c = 100 °C	–	2.8	3.5	µs

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
t_f	fall time					
	BUW13F	I_{Con} = 10 A; I_B = 2 A; V_{CL} = 250 V; T_c = 100 °C	–	200	300	ns
	BUW13AF	I_{Con} = 8 A; I_B = 1.6 A; V_{CL} = 300 V; T_c = 100 °C	–	200	300	ns

Note

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

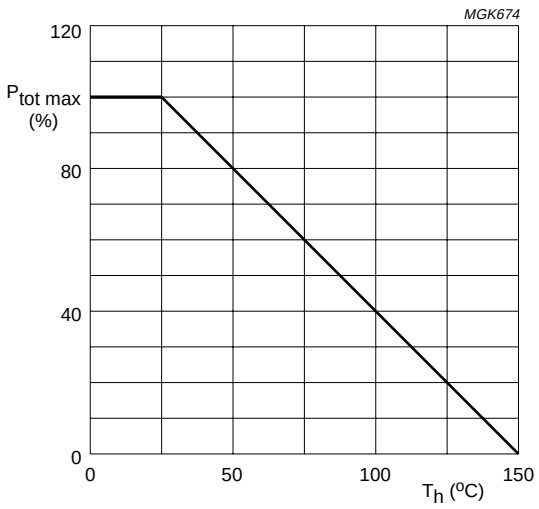
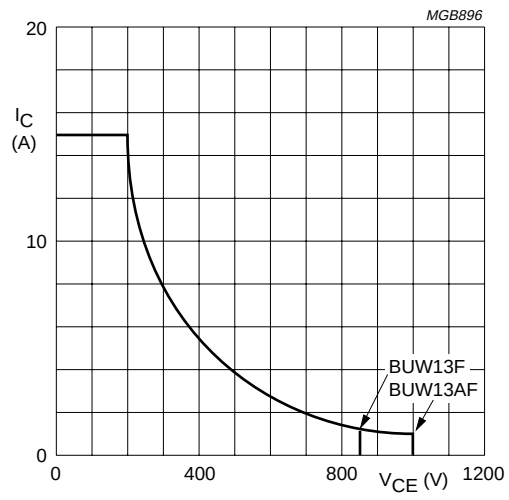
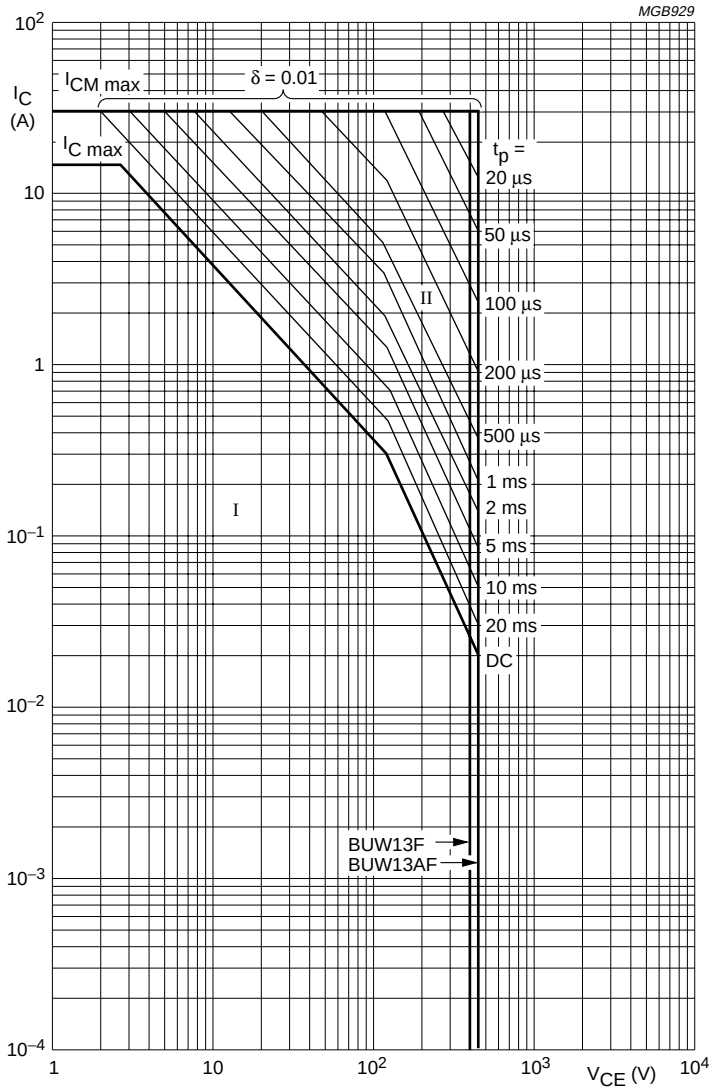


Fig.2 Power derating curve.



$T_c \leq 100$ °C; V_{BE} = –1 to –5 V.

Fig.3 Reverse bias SOAR.



T_{mb} = 25 °C.

I - Region of permissible DC operation.

II - Permissible extension for repetitive pulse operation.

(1) $P_{tot\ max}$ and $P_{tot\ peak\ max}$ lines.

(2) Second breakdown limits (independent of temperature).

Fig.4 Forward bias SOAR.

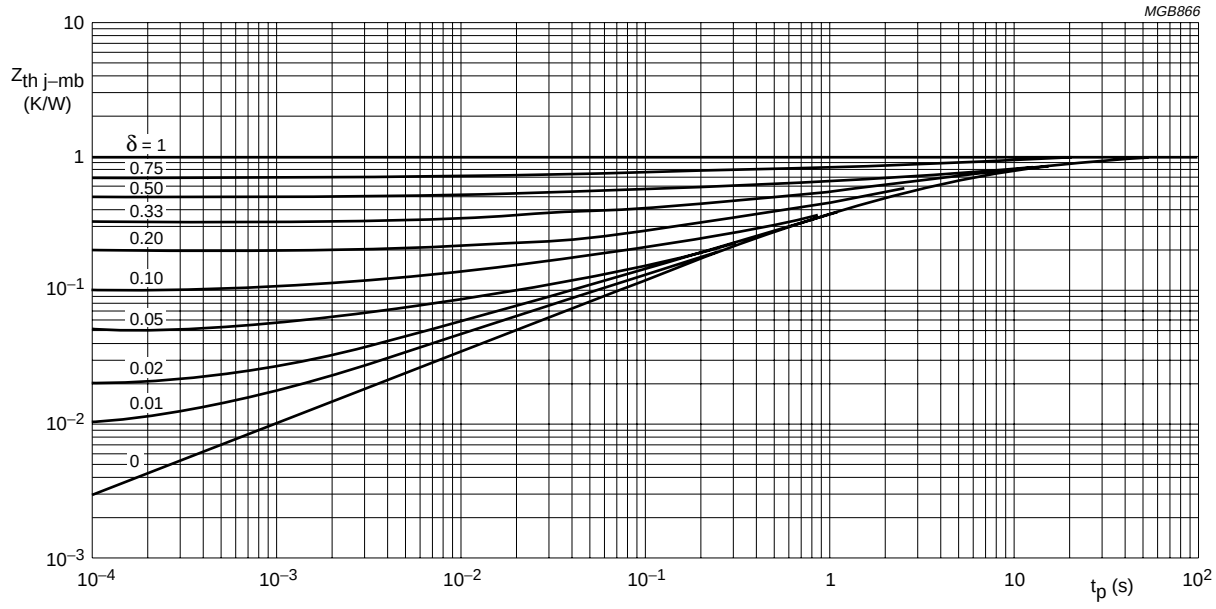


Fig.5 Transient thermal impedance.

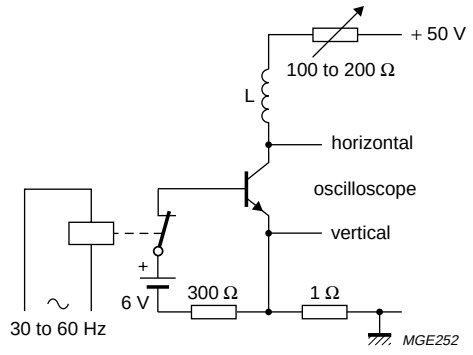


Fig.6 Test circuit for collector-emitter sustaining voltage.

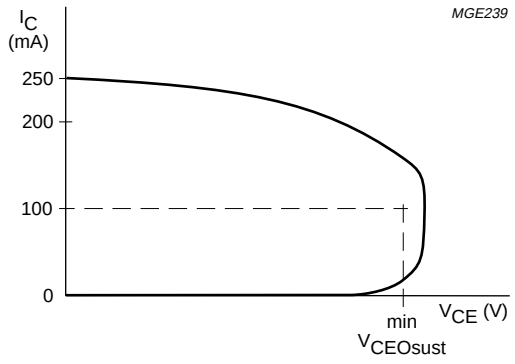
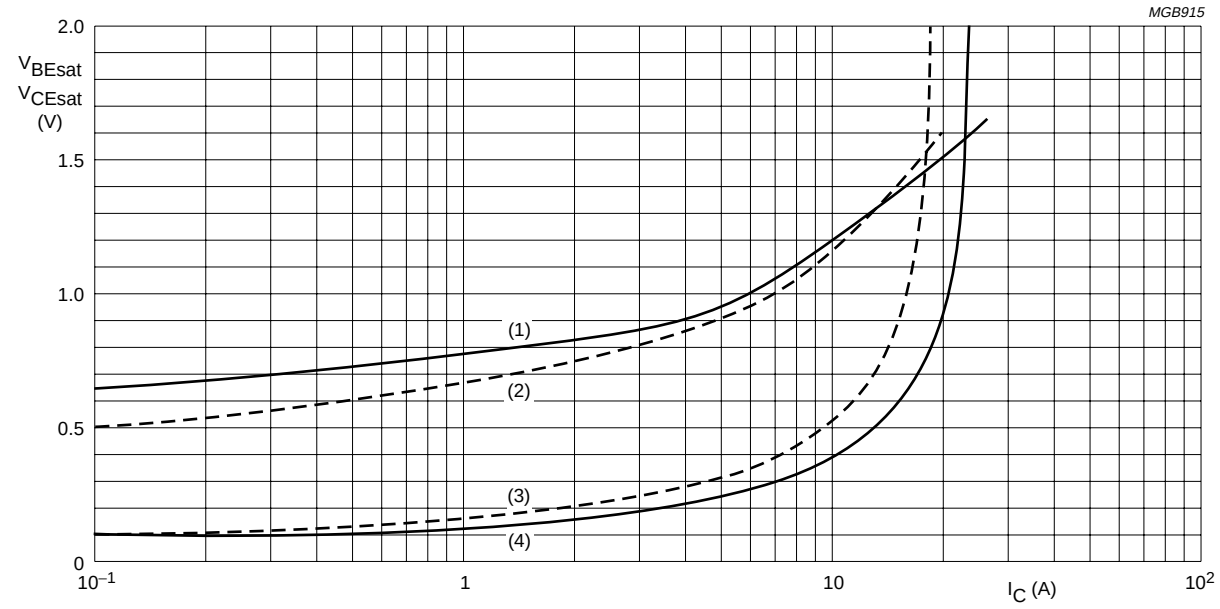
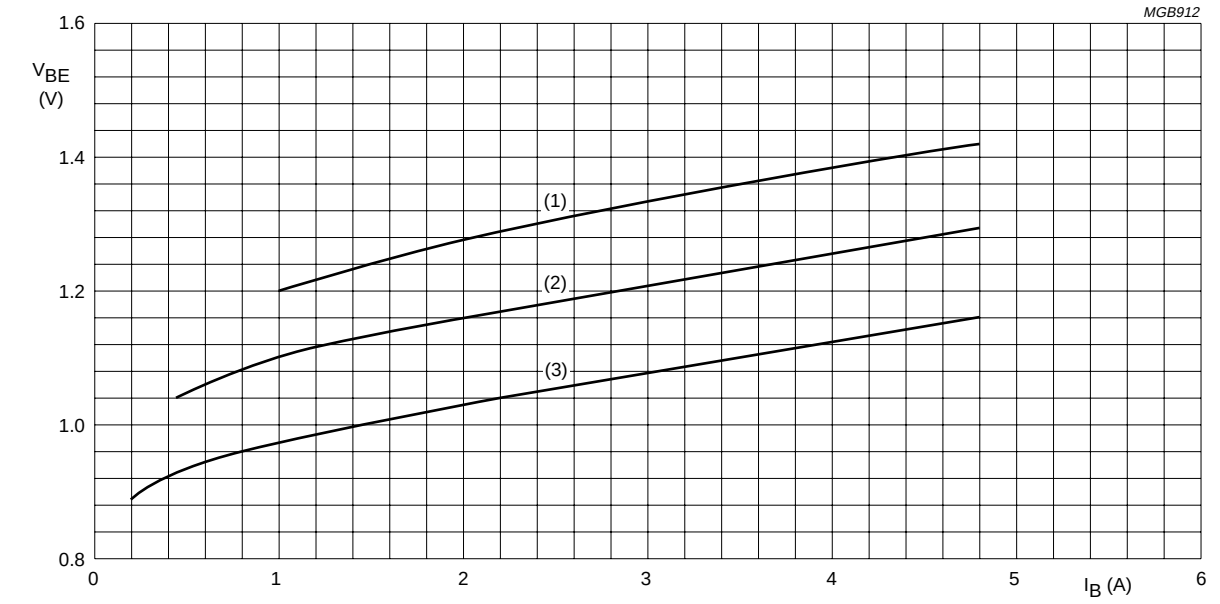


Fig.7 Oscilloscope display for collector-emitter sustaining voltage.



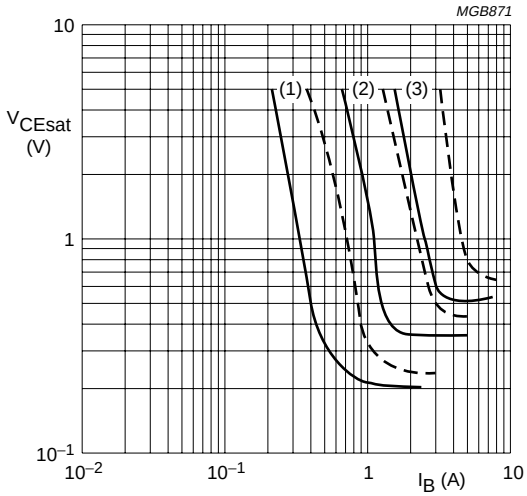
I_C/I_B = 5.
(1) V_{BE}; T_j = 25 °C.
(2) V_{BE}; T_j = 100 °C.
(3) V_{CE}; T_j = 100 °C.
(4) V_{CE}; T_j = 25 °C.

Fig.8 Base-emitter and collector-emitter saturation voltages as functions of collector current; typical values.



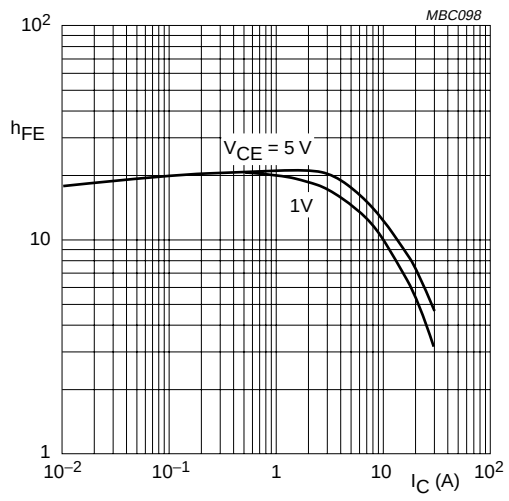
T_j = 25 °C.
(1) I_C = 15 A.
(2) I_C = 10 A.
(3) I_C = 5 A.

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



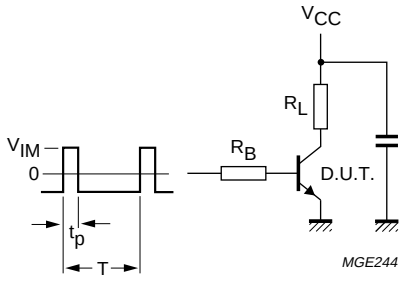
(1) I_C = 5 A.
(2) I_C = 10 A.
(3) I_C = 15 A.
T_j = 25 °C; solid line: typical values; dotted line: maximum values.

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



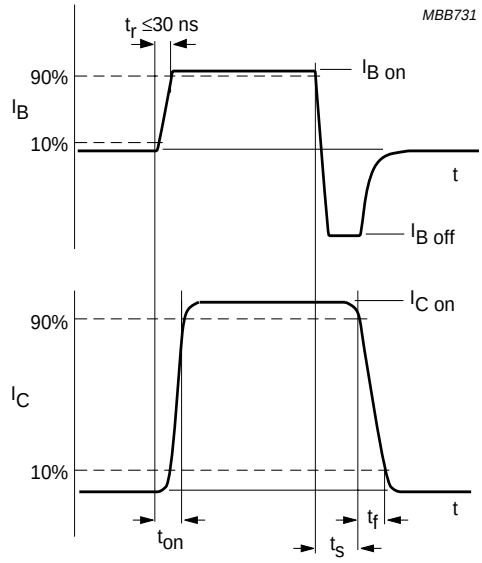
T_j = 125 °C.

Fig.11 DC current gain; typical values.



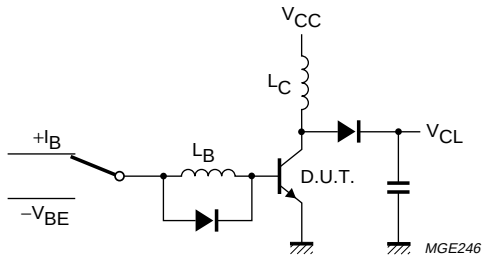
V_{CC} = 250 V; t_p = 20 µs; V_{IM} = –6 to +8 V; t_p/T = 0.01.
The values of R_B and R_L are selected in accordance with I_{Con} and I_{Bon} requirements.

Fig.12 Test circuit resistive load.



t_r ≤ 20 ns.

Fig.13 Switching time waveforms with resistive load.



$V_{CL} \leq$ up to 1000 V; V_{CC} = 30 V; V_{BE} = –5 V; L_B = 1 µH; L_C = 200 µH.

Fig.14 Test circuit inductive load and reverse bias SOAR.

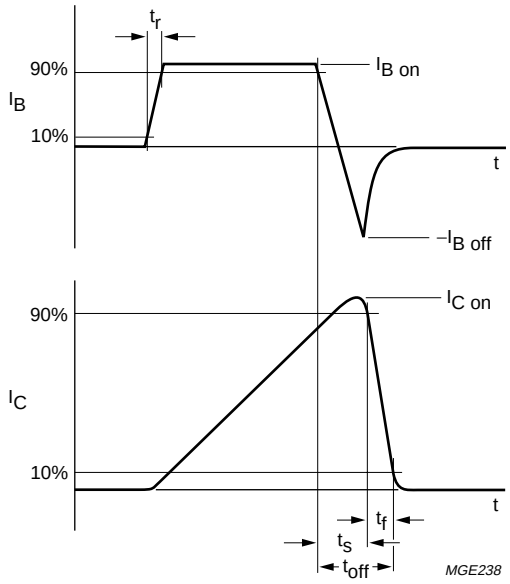
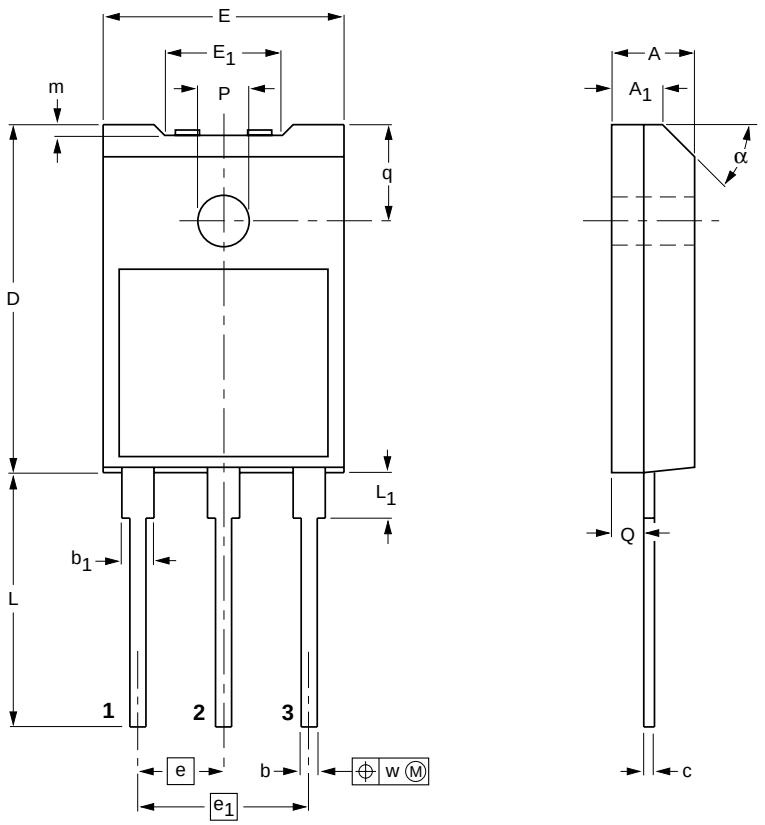
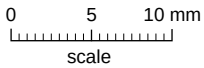


Fig.15 Switching time waveforms with inductive load.

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_1	b	b_1	c	D	E	E_1	e	e_1	L	L_1 (1)	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

DEFINITIONS

Data sheet status	
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.
Limiting values	
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.	
Application information	
Where application information is given, it is advisory and does not form part of the specification.	

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SUNSTAR 商斯达实业集团是集研发、生产、工程、销售、代理经销 、技术咨询、信息服务等为一体的高科技企业，是专业高科技电子产品生产厂家，是具有 10 多年历史的专业电子元器件供应商，是中国最早和最大的仓储式连锁规模经营大型综合电子零部件代理分销商之一,是一家专业代理和分銷世界各大品牌 IC 芯片和電子元器件的连锁经营綜合性国际公司，专业经营进口、国产名厂名牌电子元件，型号、种类齐全。在香港、北京、深圳、上海、西安、成都等全国主要电子市场设有直属分公司和产品展示展销窗口门市部专卖店及代理分销商,已在全国范围内建成强大统一的供货和代理分销网络。 我们专业代理经销、开发生产电子元器件、集成电路、传感器、微波光电元器件、工控机/DOC/DOM 电子盘、专用电路、单片机开发、MCU/DSP/ARM/FPGA 软件硬件、二极管、三极管、模块等，是您可靠的一站式现货配套供应商、方案提供商、部件功能模块开发配套商。商斯达实业公司拥有庞大的资料库，有数位毕业于著名高校——有中国电子工业摇篮之称的西安电子科技大学（西军电）并长期从事国防尖端科技研究的高级工程师为您精挑细选、量身订做各种高科技电子元器件，并解决各种技术问题。

微波光电部专业代理经销高频、微波、光纤、光电元器件、组件、部件、模块、整机；电磁兼容元器件、材料、设备；微波 CAD、EDA 软件、开发测试仿真工具；微波、光纤仪器仪表。欢迎国外高科技微波、光纤厂商将优秀产品介绍到中国、共同开拓市场。长期大量现货专业批发高频、微波、卫星、光纤、电视、CATV 器件： 晶振、VCO、连接器、PIN 开关、变容二极管、开关二极管、低噪晶体管、功率电阻及电容、放大器、功率管、MMIC、混频器、耦合器、功分器、振荡器、合成器、衰减器、滤波器、隔离器、环行器、移相器、调制解调器；光电子元器件和组件：红外发射管、红外接收管、光电开关、光敏管、发光二极管和发光二极管组件、半导体激光二极管和激光器组件、光电探测器和光接收组件、光发射接收模块、光纤激光器和光放大器、光调制器、光开关、DWDM 用光发射和接收器件、用户接入系统光光收发器件与模块、光纤连接器、光纤跳线/尾纤、光衰减器、光纤适 配器、光隔离器、光耦合器、光环行器、光复用器/转换器；无线收发芯片和模组、蓝牙芯片和模组。

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