

DATA SHEET

BUT12; BUT12A Silicon diffused power transistors

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

1997 Aug 13

Philips
Semiconductors



PHILIPS

Silicon diffused power transistors

BUT12; BUT12A

DESCRIPTION

High-voltage, high-speed, glass-passivated NPN power transistor in a TO-220AB package.

APPLICATIONS

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

PINNING

PIN	DESCRIPTION
1	base
2	collector; connected to mounting base
3	emitter

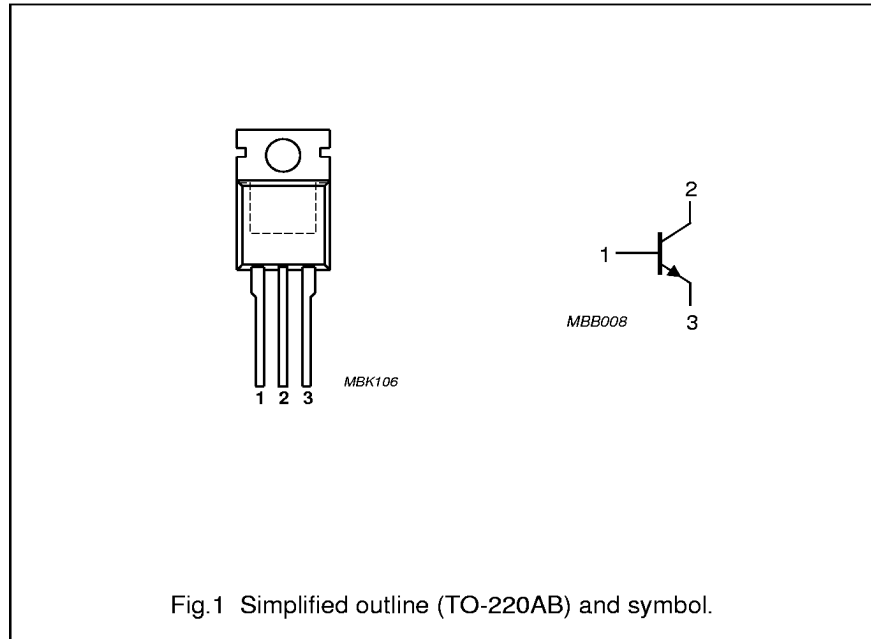


Fig. 1 Simplified outline (TO-220AB) and symbol.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_{CESM}	collector-emitter peak voltage	$V_{BE} = 0$	850 1000	V V
	BUT12 BUT12A			
V_{CEO}	collector-emitter voltage	open base	400 450	V V
	BUT12 BUT12A			
V_{CEsat}	collector-emitter saturation voltage	see Fig. 8	1.5	V
I_{Csat}	collector saturation current		6 5	A A
	BUT12 BUT12A			
I_C	collector current (DC)	see Figs 3 and 4	8	A
I_{CM}	collector current (peak value)	see Fig. 4	20	A
P_{tot}	total power dissipation	$T_{mb} \leq 25\text{ }^\circ\text{C}$; see Fig. 2	125	W
t_f	fall time	resistive load; see Figs 12 and 13	0.8	μs

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	VALUE	UNIT
$R_{th\ j-mb}$	thermal resistance from junction to mounting base	1	K/W

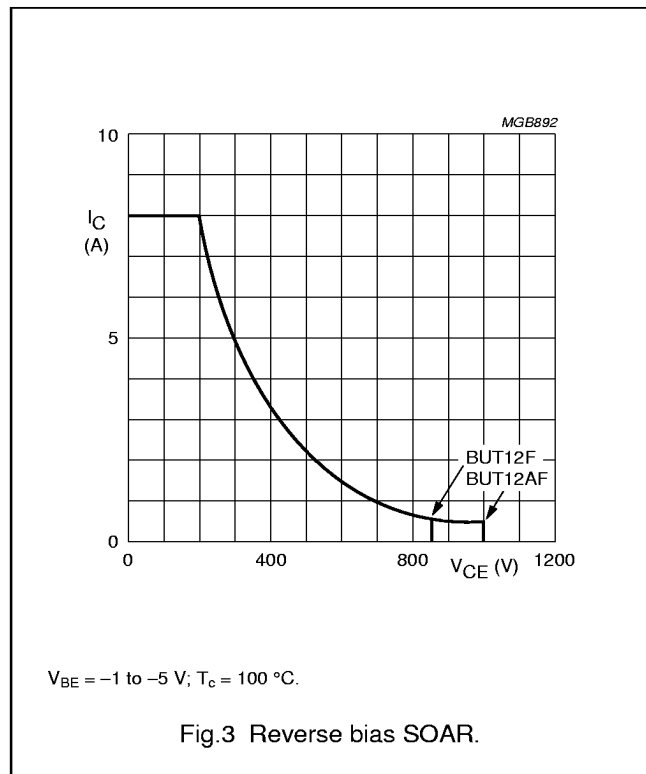
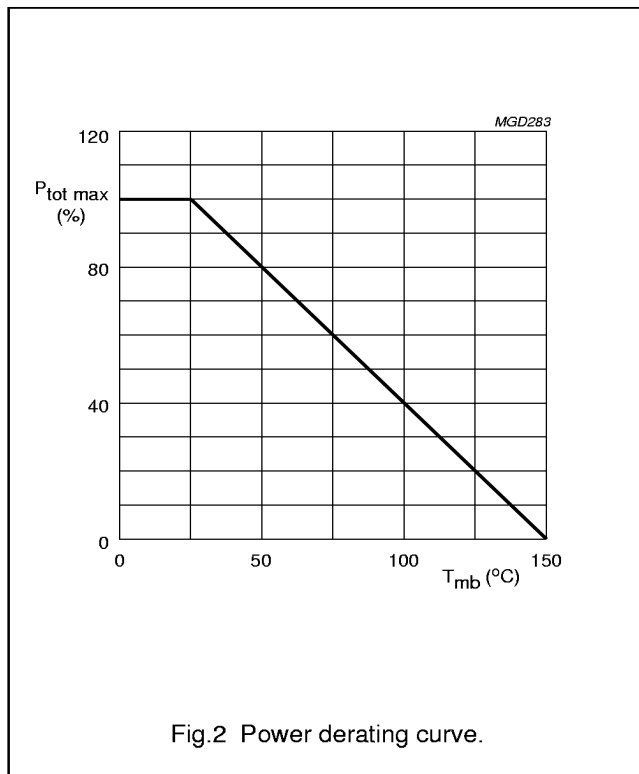
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LIMITING VALUES

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	-	850	V
	BUT12			1000	V
V _{CEO}	collector-emitter voltage	open base	-	400	V
	BUT12A			450	V
I _{Csat}	collector saturation current		-	6	A
	BUT12A			5	A
I _C	collector current (DC)	see Figs 3 and 4	-	8	A
I _{CM}	collector current (peak value)	see Fig. 4	-	20	A
I _B	base current (DC)		-	4	A
I _{BM}	base current (peak value)		-	6	A
P _{tot}	total power dissipation	T _{mb} ≤ 25 °C; see Fig.2	-	125	W
T _{stg}	storage temperature		-65	+150	°C
T _j	junction temperature		-	150	°C



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CHARACTERISTICS

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

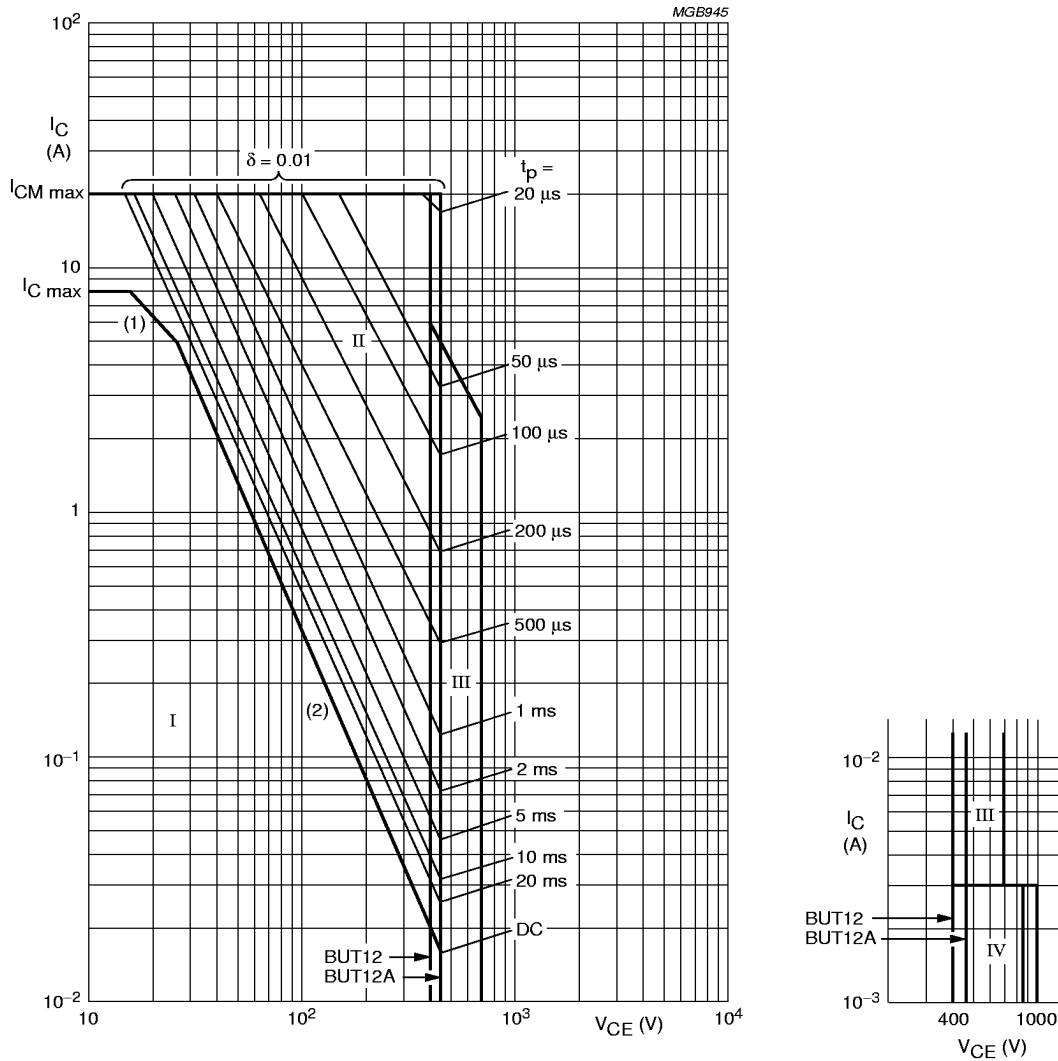
SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{CEOsust}$	collector-emitter sustaining voltage BUT12 BUT12A	$I_C = 100\text{ mA}$; $I_{Boff} = 0$; $L = 25\text{ mH}$; see Figs 6 and 7	400	–	–	V
			450	–	–	V
V_{CEsat}	collector-emitter saturation voltage BUT12 BUT12A	$I_C = 6\text{ A}$; $I_B = 1.2\text{ A}$; see Figs 8 and 10	–	–	1.5	V
		$I_C = 5\text{ A}$; $I_B = 1\text{ A}$; see Figs 8 and 10	–	–	1.5	V
V_{BEsat}	base-emitter saturation voltage BUT12 BUT12A	$I_C = 6\text{ A}$; $I_B = 1.2\text{ A}$; see Fig.8	–	–	1.5	V
		$I_C = 5\text{ A}$; $I_B = 1\text{ A}$; see Fig.8	–	–	1.5	V
I_{CES}	collector-emitter cut-off current	$V_{CE} = V_{CESmax}$; $V_{BE} = 0$; note 1	–	–	1	mA
		$V_{CE} = V_{CESmax}$; $V_{BE} = 0$; $T_j = 125\text{ °C}$; note 1	–	–	3	mA
I_{EBO}	emitter-base cut-off current	$V_{EB} = 9\text{ V}$; $I_C = 0$	–	–	10	mA
h_{FE}	DC current gain	$V_{CE} = 5\text{ V}$; $I_C = 10\text{ mA}$; see Fig.11	10	18	35	
		$V_{CE} = 5\text{ V}$; $I_C = 1\text{ A}$; see Fig.11	10	20	35	
Switching times resistive load (see Figs 12 and 13)						
t_{on}	turn-on time BUT12 BUT12A	$I_{Con} = 6\text{ A}$; $I_{Bon} = -I_{Boff} = 1.2\text{ A}$	–	–	1	μs
		$I_{Con} = 5\text{ A}$; $I_{Bon} = -I_{Boff} = 1\text{ A}$	–	–	1	μs
t_s	storage time BUT12 BUT12A	$I_{Con} = 6\text{ A}$; $I_{Bon} = -I_{Boff} = 1.2\text{ A}$	–	–	4	μs
		$I_{Con} = 5\text{ A}$; $I_{Bon} = -I_{Boff} = 1\text{ A}$	–	–	4	μs
t_f	fall time BUT12 BUT12A	$I_{Con} = 6\text{ A}$; $I_{Bon} = -I_{Boff} = 1.2\text{ A}$	–	–	0.8	μs
		$I_{Con} = 5\text{ A}$; $I_{Bon} = -I_{Boff} = 1\text{ A}$	–	–	0.8	μs
Switching times inductive load (see Figs 14 and 15)						
t_s	storage time BUT12 BUT12A	$I_{Con} = 6\text{ A}$; $I_{Bon} = 1.2\text{ A}$; $V_{CL} = 250\text{ V}$; $T_c = 100\text{ °C}$	–	1.9	2.5	μs
		$I_{Con} = 5\text{ A}$; $I_{Bon} = 1\text{ A}$; $V_{CL} = 300\text{ V}$; $T_c = 100\text{ °C}$	–	1.9	2.5	μs
t_f	fall time BUT12 BUT12A	$I_{Con} = 6\text{ A}$; $I_{Bon} = 1.2\text{ A}$; $V_{CL} = 250\text{ V}$; $T_c = 100\text{ °C}$	–	200	300	ns
		$I_{Con} = 5\text{ A}$; $I_{Bon} = 1\text{ A}$; $V_{CL} = 300\text{ V}$; $T_c = 100\text{ °C}$	–	200	300	ns

Note

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

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$T_{mb} < 25\text{ }^{\circ}\text{C}$.

I - Region of permissible DC operation.

II - Permissible extension for repetitive pulse operation.

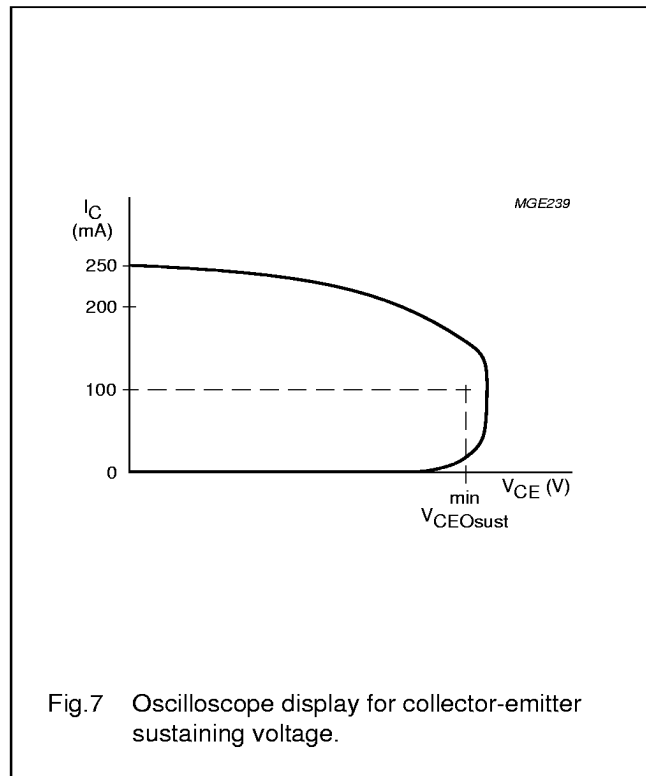
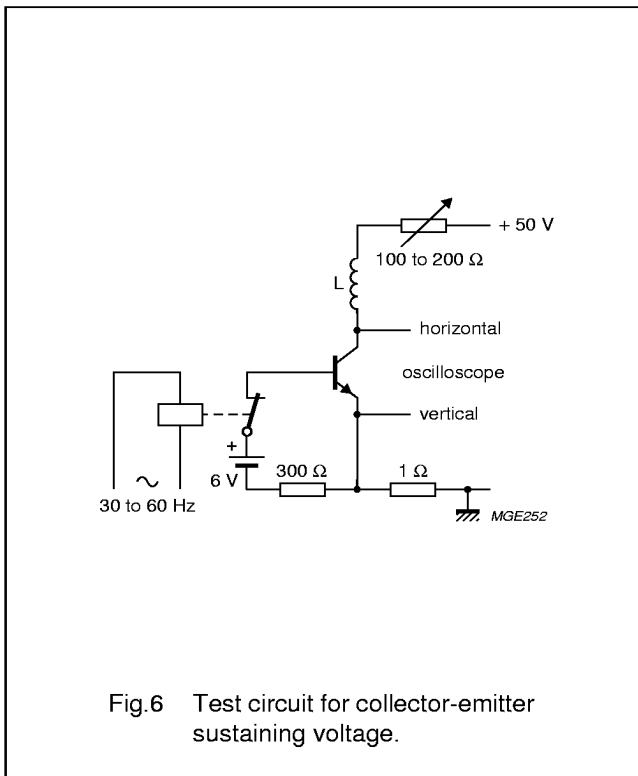
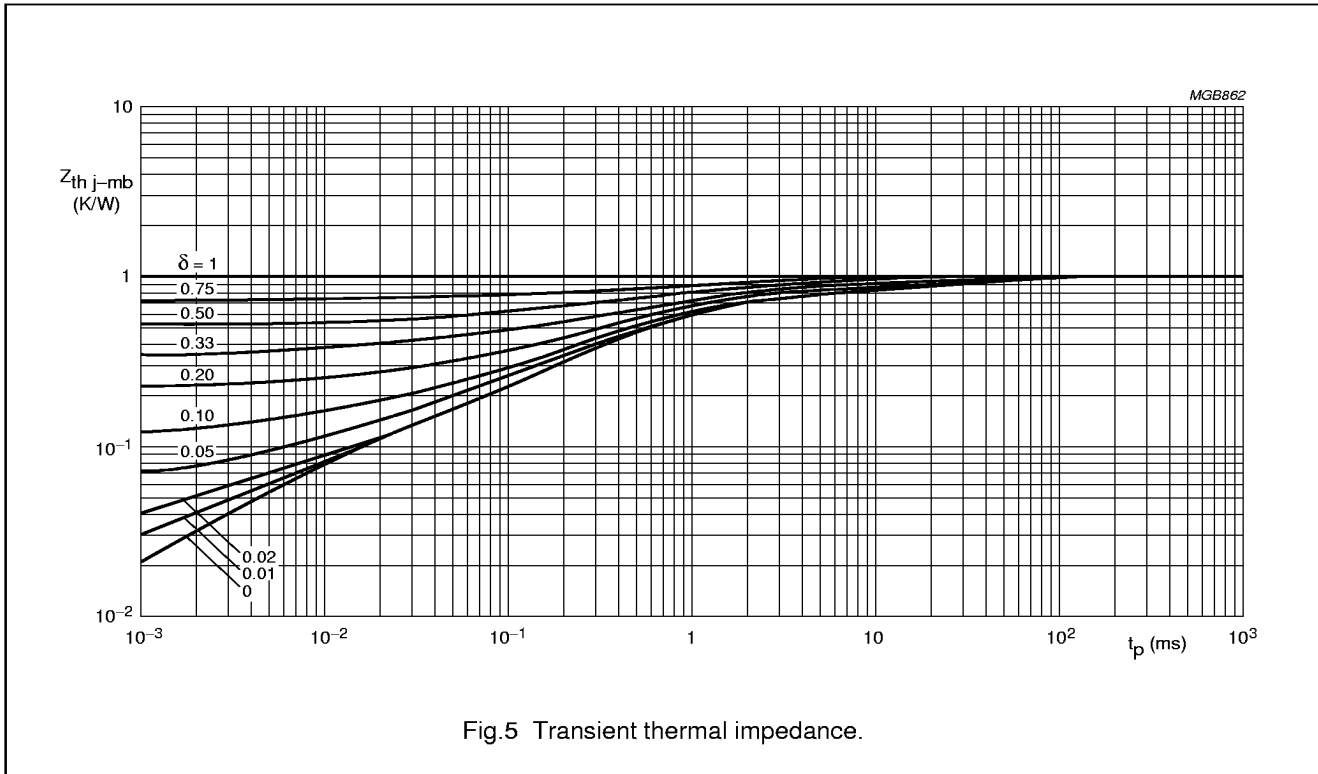
(1) $P_{tot\ max}$ and $P_{tot\ peak\ max}$ lines.

(2) Second breakdown limits.

Fig.4 Forward bias SOAR.

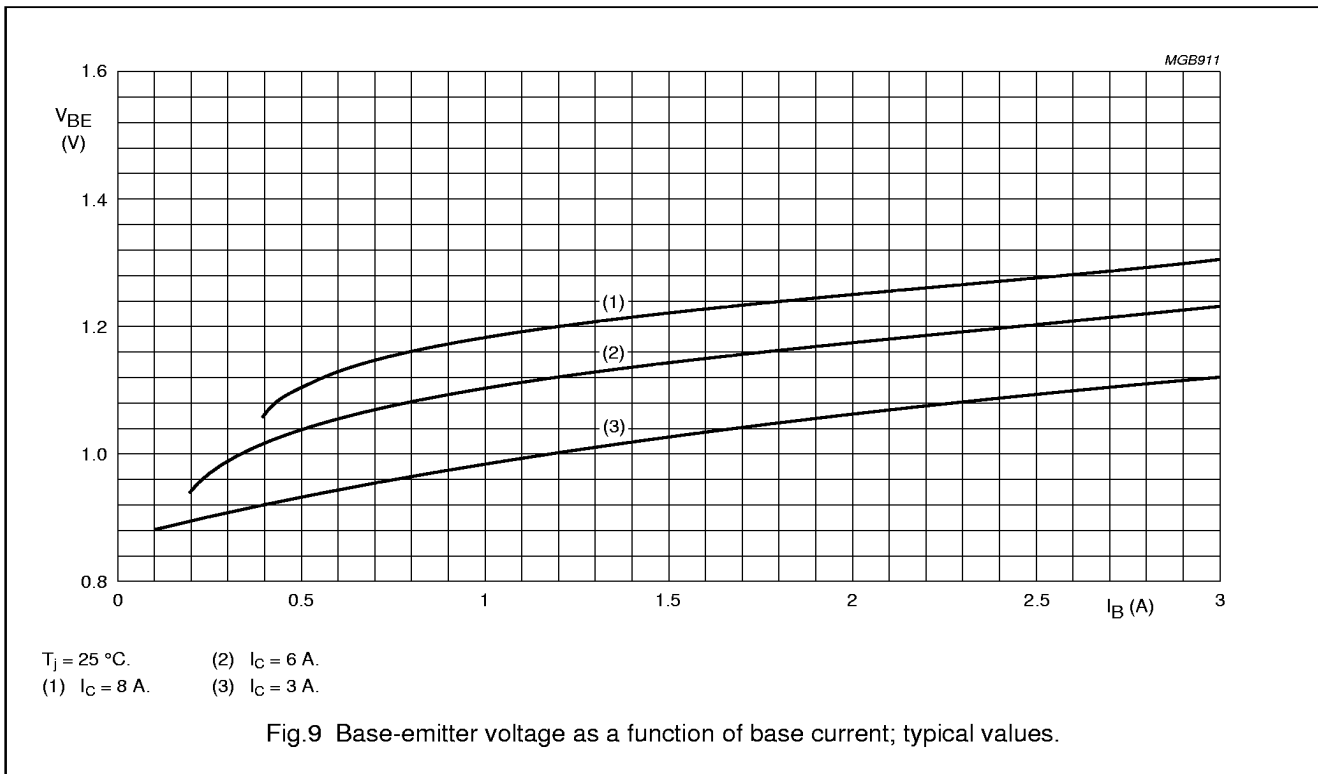
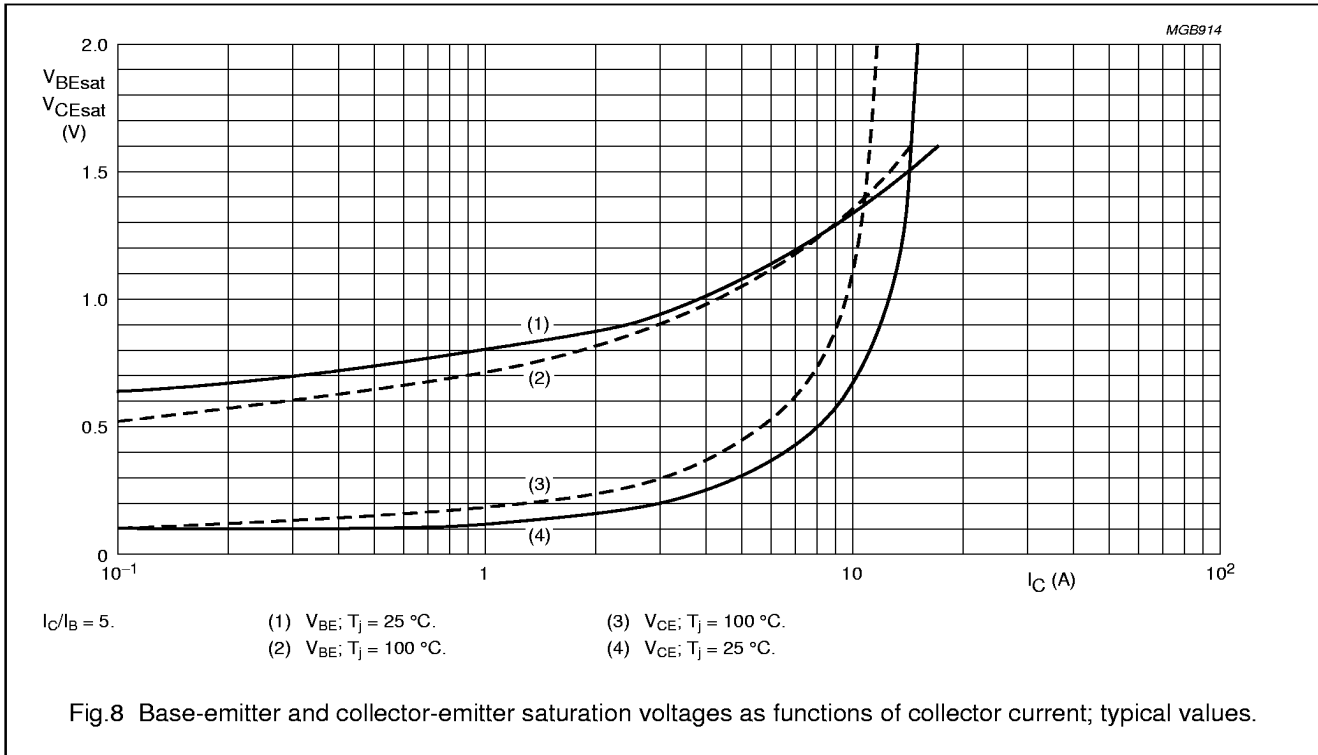
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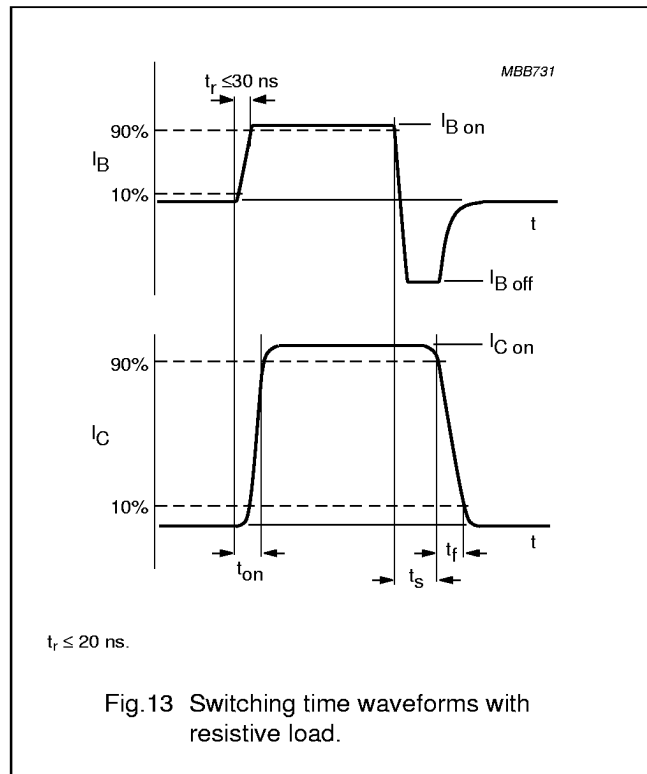
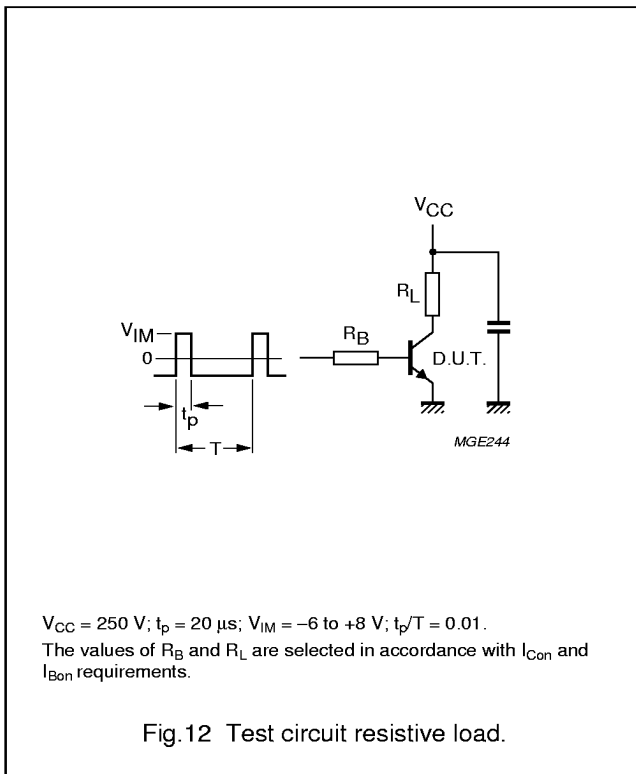
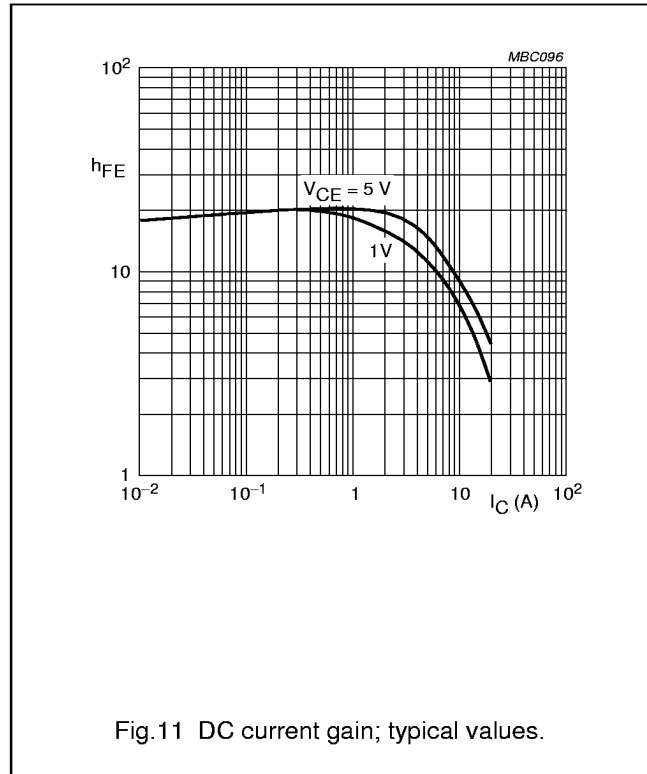
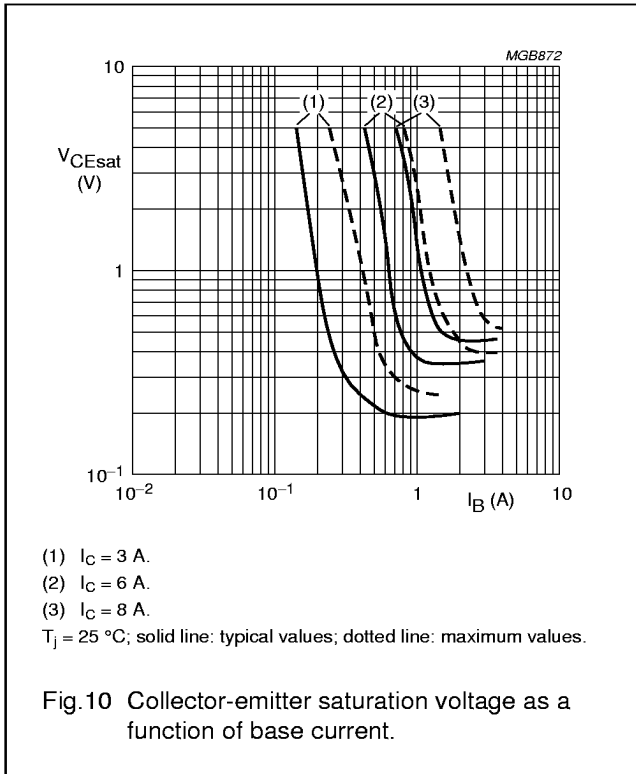
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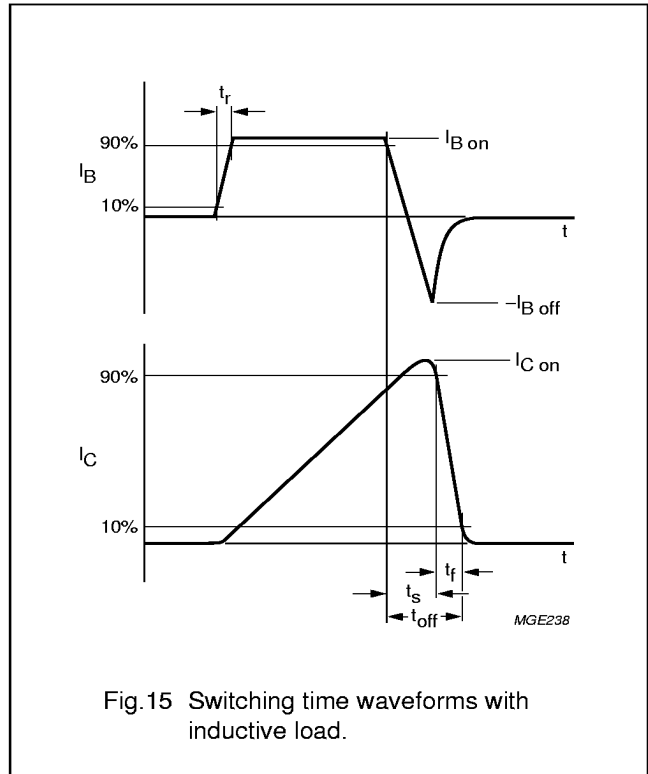
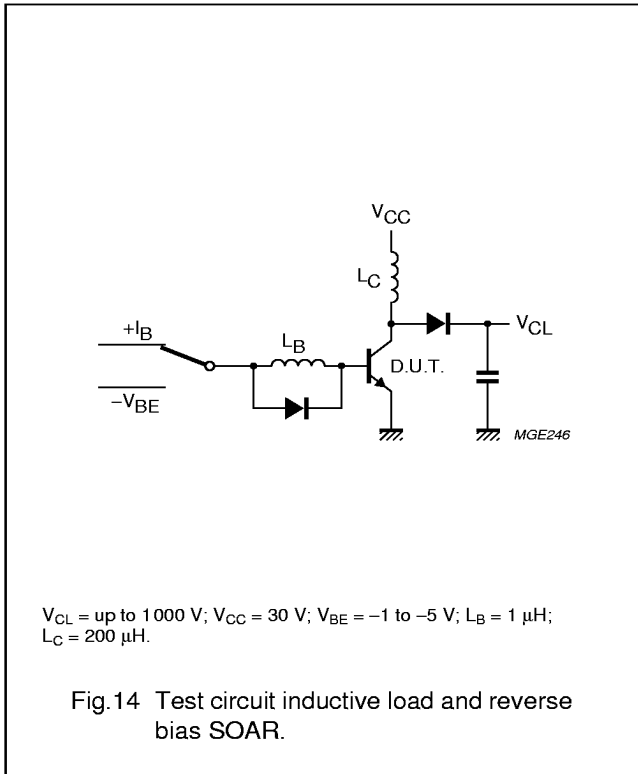
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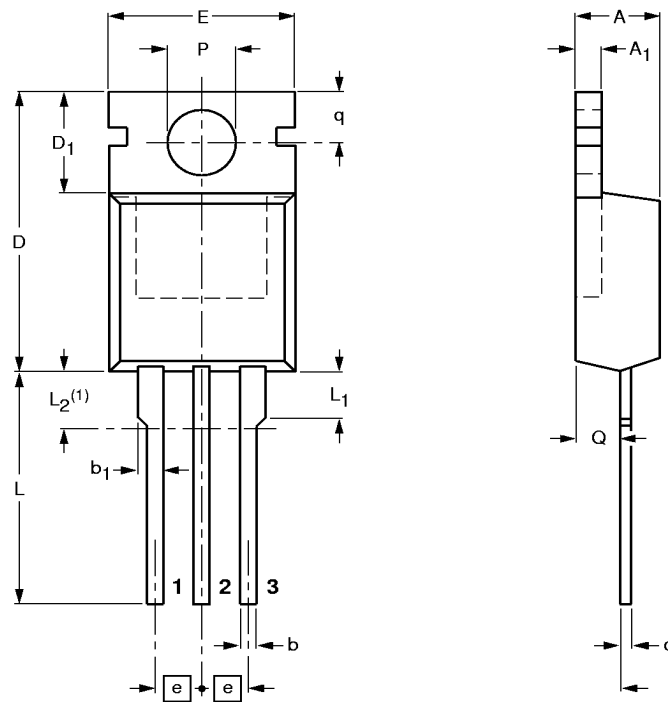
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PACKAGE OUTLINE

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

SOT78



DIMENSIONS (mm are the original dimensions)

UNIT	A	A ₁	b	b ₁	c	D	D ₁	E	e	L	L ₁	L ₂ ⁽¹⁾ max.	P	q	Q
mm	4.5	1.39	0.9	1.3	0.7	15.8	6.4	10.3	2.54	15.0	3.30	3.0	3.8	3.0	2.6
	4.1	1.27	0.7	1.0	0.4	15.2	5.9	9.7		13.5	2.79		3.6	2.7	2.2

Note

1. Terminals in this zone are not tinned.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT78		TO-220				97-06-11