

DATA SHEET

BUT18; BUT18A Silicon diffused power transistors

Product specification
Supersedes data of 1997 Aug 13

1999 Jun 11

Silicon diffused power transistors

BUT18; BUT18A

DESCRIPTION

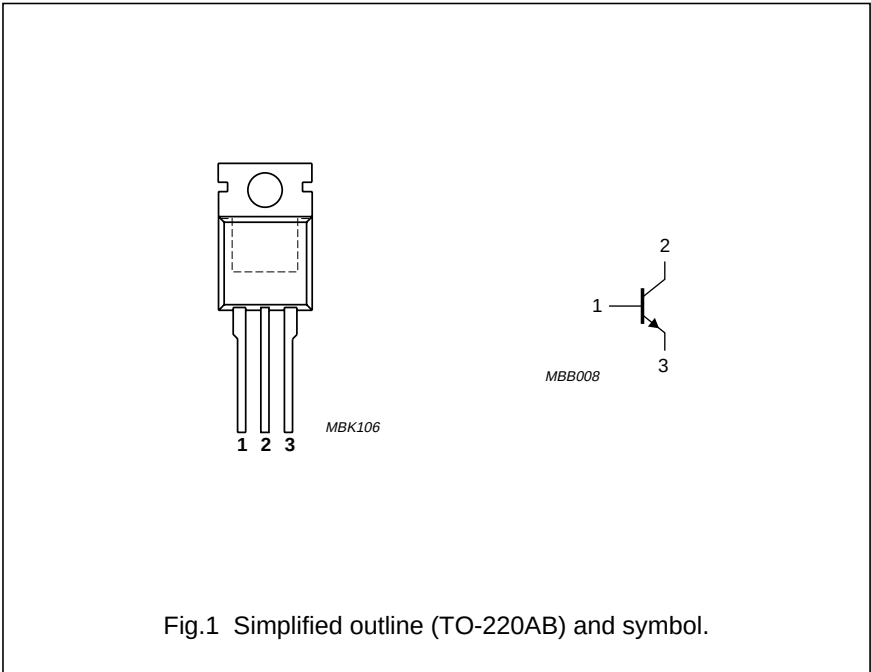
High-voltage, high-speed, glass-passivated NPN power transistor in a TO-220AB package.

APPLICATIONS

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

PINNING

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



QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MAX.	UNIT
V_{CESM}	collector-emitter peak voltage	$V_{BE} = 0$		
	BUT18		850	V
	BUT18A		1000	V
V_{CEO}	collector-emitter voltage	open base		
	BUT18		400	V
	BUT18A		450	V
V_{CEsat}	collector-emitter saturation voltage	see Fig.7	1.5	V
I_{Csat}	collector saturation current		4	A
I_C	collector current (DC)	see Fig.2	6	A
I_{CM}	collector current (peak value)	see Fig.2	12	A
P_{tot}	total power dissipation	$T_{mb} \leq 25\text{ }^{\circ}\text{C}$; see Fig.4	110	W
t_f	fall time	resistive load; see Figs 10 and 11	0.8	μs

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	VALUE	UNIT
$R_{th\ j-mb}$	thermal resistance from junction to mounting base	1.15	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	$V_{BE} = 0$			
	BUT18		–	850	V
	BUT18A		–	1000	V
V_{CEO}	collector-emitter voltage	open base			
	BUT18		–	400	V
	BUT18A		–	450	V
I_{CSat}	collector saturation current		–	4	A
I_C	collector current (DC)	see Fig.2	–	6	A
I_{CM}	collector current (peak value)	see Fig.2	–	12	A
I_B	base current (DC)		–	3	A
I_{BM}	base current (peak value)		–	6	A
P_{tot}	total power dissipation	$T_{mb} \leq 25\text{ °C}$; see Fig.4	–	110	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C

CHARACTERISTICS

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

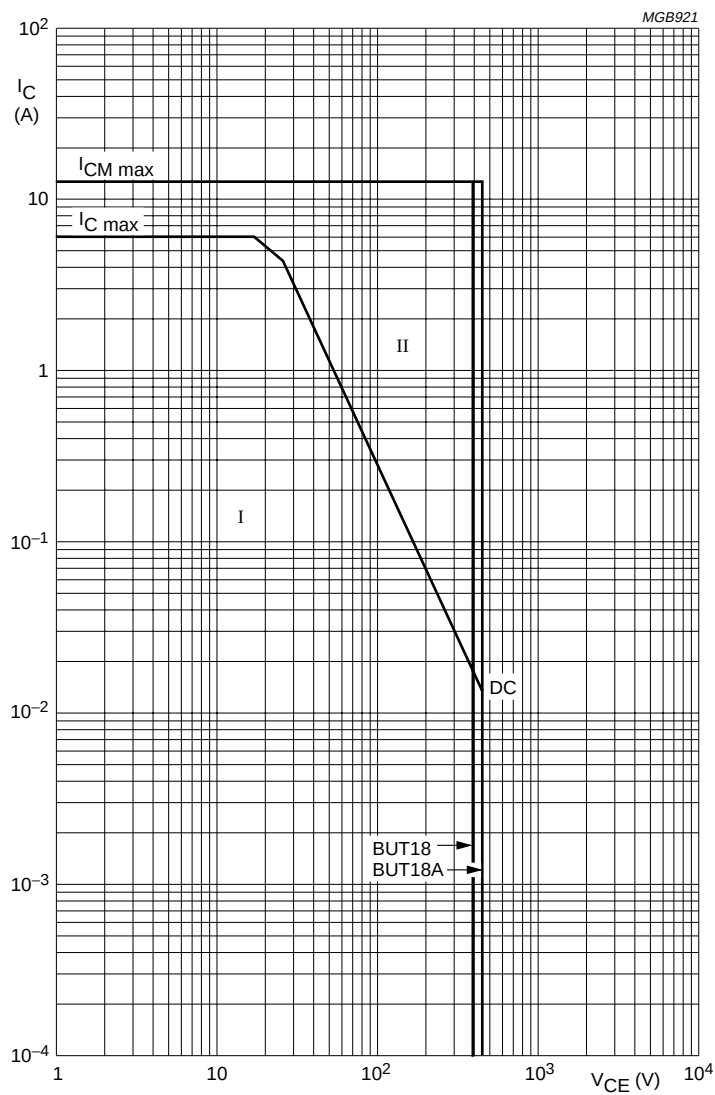
SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{CEOsust}$	collector-emitter sustaining voltage	$I_C = 0.1\text{ A}$; $I_{Boff} = 0$; $L = 25\text{ mH}$; see Figs 5 and 6				
	BUT18		400	–	–	V
	BUT18A		450	–	–	V
V_{CESat}	collector-emitter saturation voltage	$I_C = 4\text{ A}$; $I_B = 0.8\text{ A}$; see Fig.7	–	–	1.5	V
V_{BESat}	base-emitter saturation voltage	$I_C = 4\text{ A}$; $I_B = 0.8\text{ A}$; see Fig.8	–	–	1.3	V
I_{CES}	collector-emitter cut-off current	$V_{CE} = V_{CESMmax}$; $V_{BE} = 0$; note 1	–	–	1	mA
		$V_{CE} = V_{CESMmax}$; $V_{BE} = 0$; $T_j = 125\text{ }^{\circ}\text{C}$; 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	$V_{CE} = 5\text{ V}$; $I_C = 10\text{ mA}$; see Fig.9	10	18	35	
		$V_{CE} = 5\text{ V}$; $I_C = 1\text{ A}$; see Fig.9	10	20	35	
Switching times resistive load (see Figs 10 and 11)						
t_{on}	turn-on time	$I_{Con} = 4\text{ A}$; $I_{Bon} = -I_{Boff} = 800\text{ mA}$	–	–	1	μs
t_s	storage time	$I_{Con} = 4\text{ A}$; $I_{Bon} = -I_{Boff} = 800\text{ mA}$	–	–	4	μs
t_f	fall time	$I_{Con} = 4\text{ A}$; $I_{Bon} = -I_{Boff} = 800\text{ mA}$	–	–	0.8	μs
Switching times inductive load (see Figs 10 and 13)						
t_s	storage time	$I_{Con} = 4\text{ A}$; $I_{Bon} = 800\text{ mA}$; $V_{CL} = 250\text{ V}$	–	1.6	2.5	μs
t_f	fall time	$I_{Con} = 4\text{ A}$; $I_{Bon} = 800\text{ mA}$; $V_{CL} = 250\text{ V}$	–	150	400	ns

Note

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

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

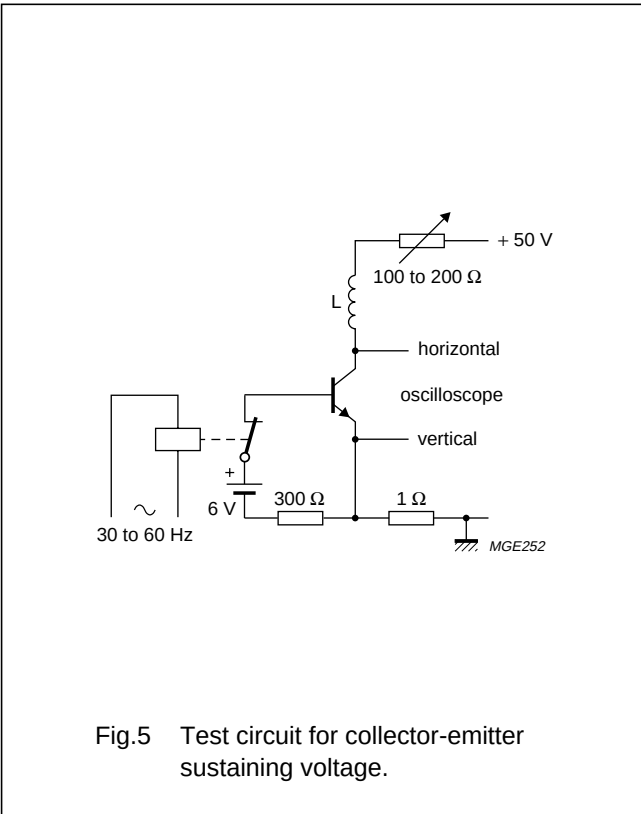
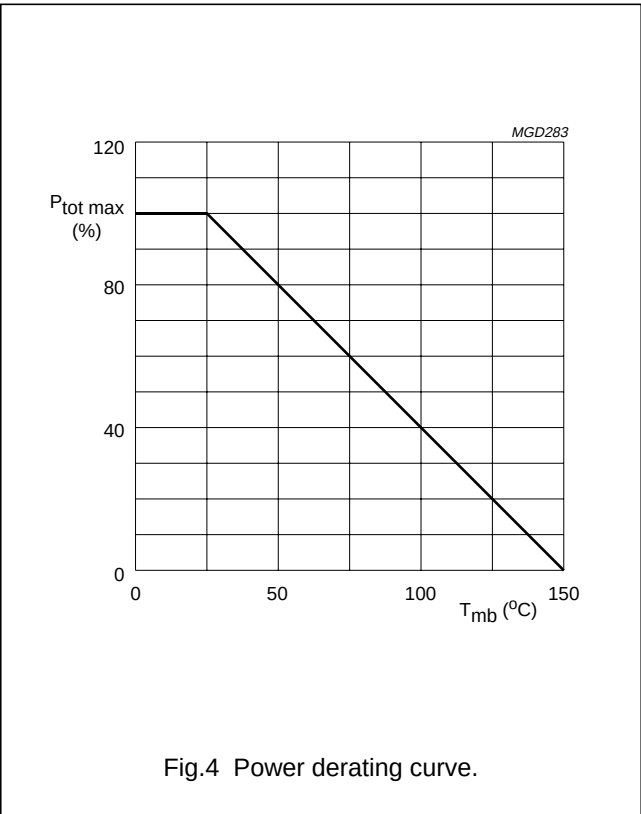
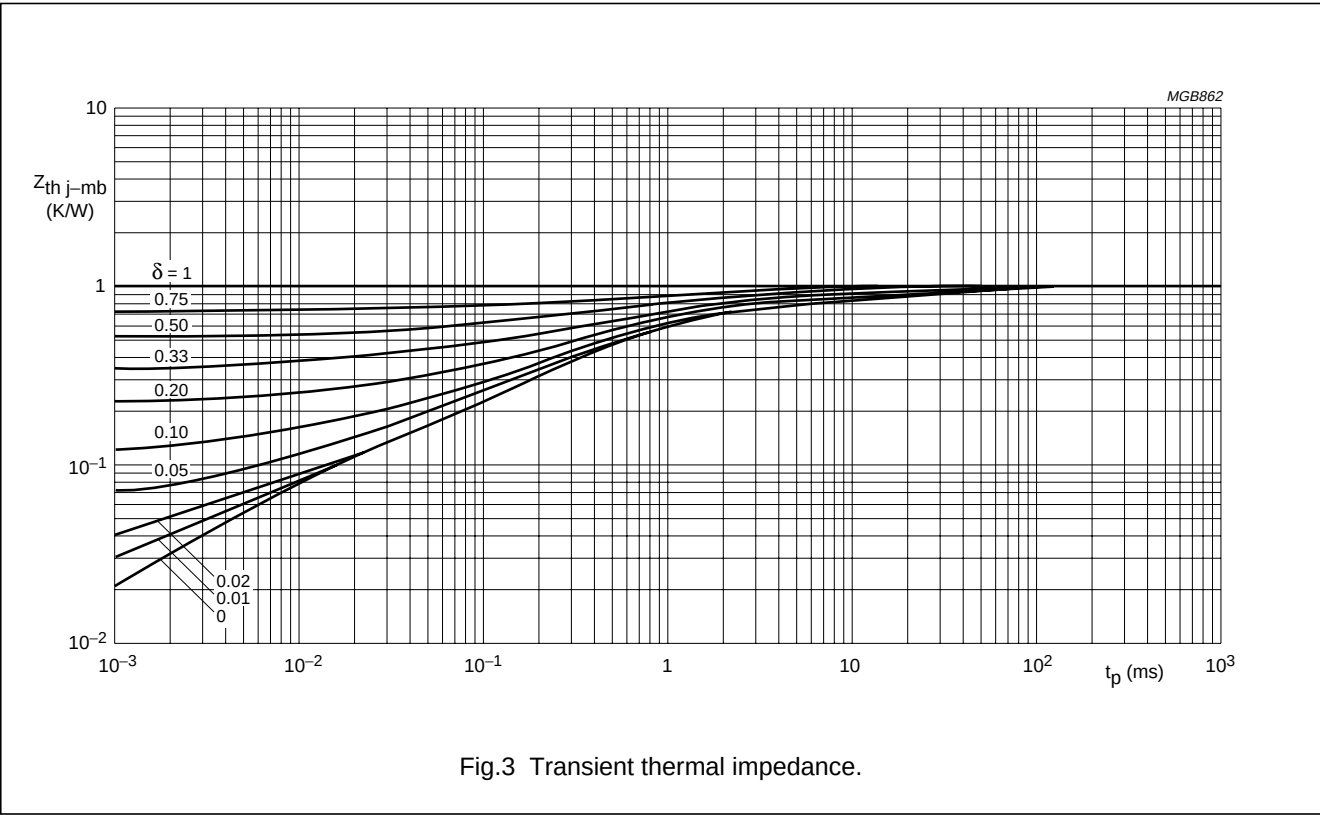
I - Region of permissible DC operation.

II - Permissible extension for repetitive pulse operation.

Fig.2 Forward bias SOAR.

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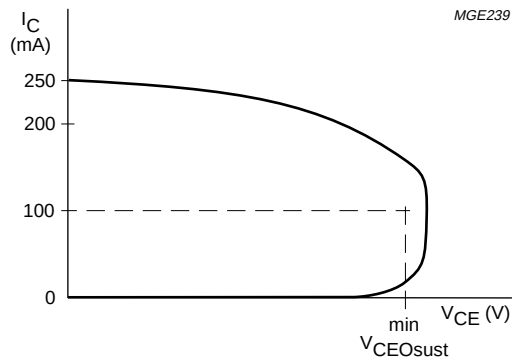
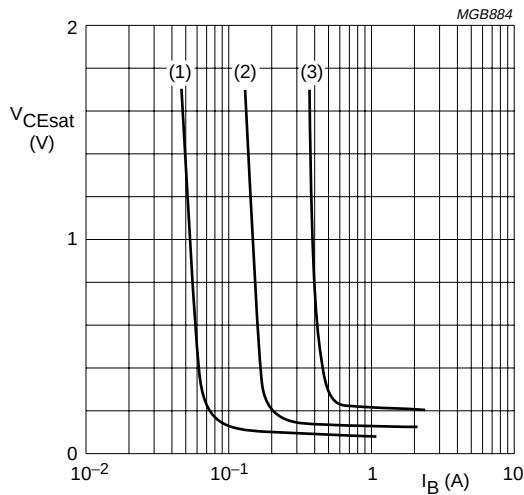
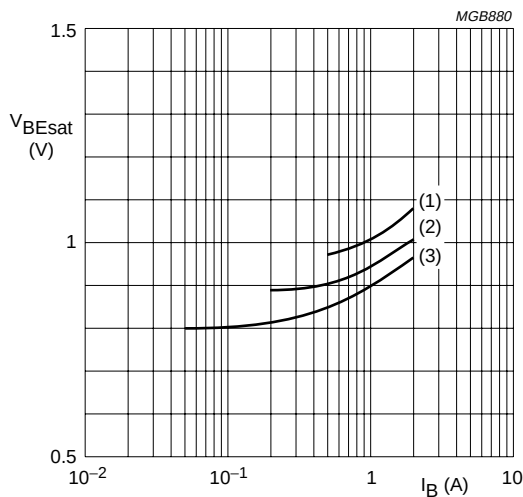


Fig.6 Oscilloscope display for collector-emitter sustaining voltage.



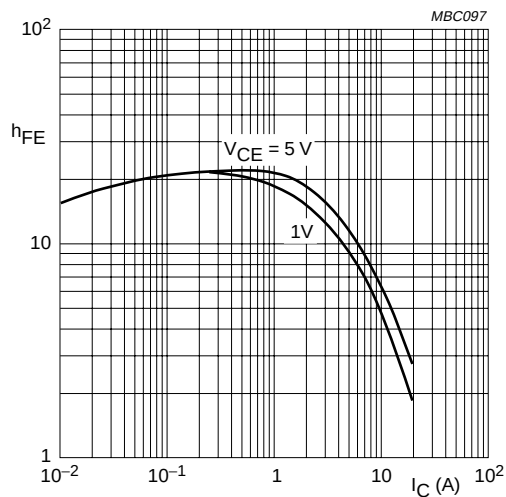
$T_j = 25\text{ }^{\circ}\text{C}$.
(1) $I_C = 1\text{ A}$.
(2) $I_C = 2\text{ A}$.
(3) $I_C = 4\text{ A}$.

Fig.7 Collector-emitter saturation voltage as a function of base current.



$T_j = 25\text{ }^{\circ}\text{C}$.
(1) $I_C = 4\text{ A}$.
(2) $I_C = 2\text{ A}$.
(3) $I_C = 1\text{ A}$.

Fig.8 Base-emitter saturation voltage as a function of base current.

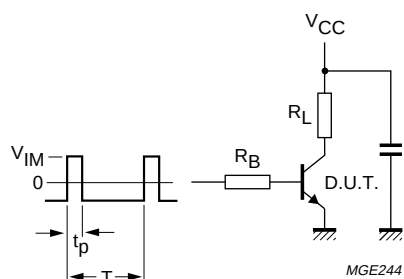


$V_{CE} = 5\text{ V}$; $T_j = 25\text{ }^{\circ}\text{C}$.

Fig.9 DC current gain; typical values.

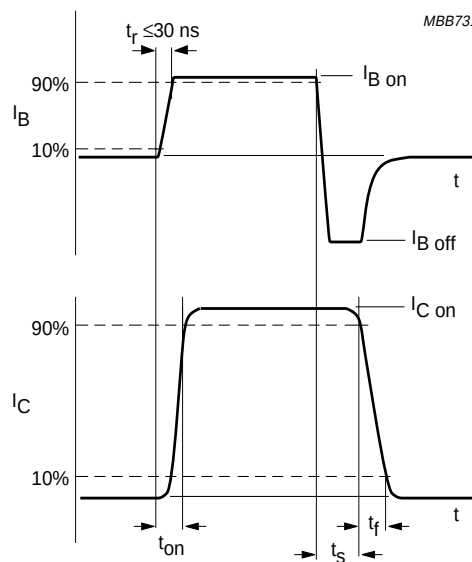
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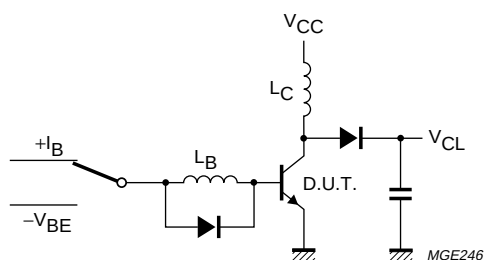
$V_{CC} = 250 \text{ V}$; $t_p = 20 \mu\text{s}$; $V_{IM} = -6 \text{ to } +8 \text{ V}$; $t_p/T = 0.01$.
The values of R_B and R_L are selected in accordance with $I_{C\text{on}}$ and $I_{B\text{on}}$ requirements.

Fig.10 Test circuit resistive load.



$t_r \leq 30 \text{ ns}$.

Fig.11 Switching time waveforms with resistive load.



$V_{CL} = \text{up to } 1000 \text{ V}$; $V_{CC} = 30 \text{ V}$; $V_{BE} = -5 \text{ V}$; $L_B = 1 \mu\text{H}$ (0 for reverse bias SOAR); $L_C = 200 \mu\text{H}$.

Fig.12 Test circuit inductive load and reverse bias SOAR.

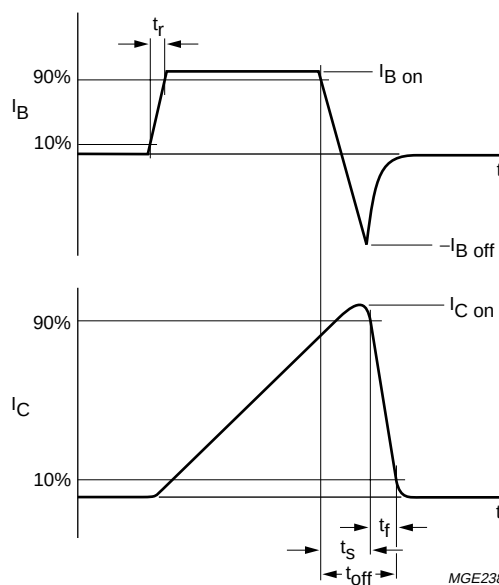


Fig.13 Switching times waveforms with inductive load.

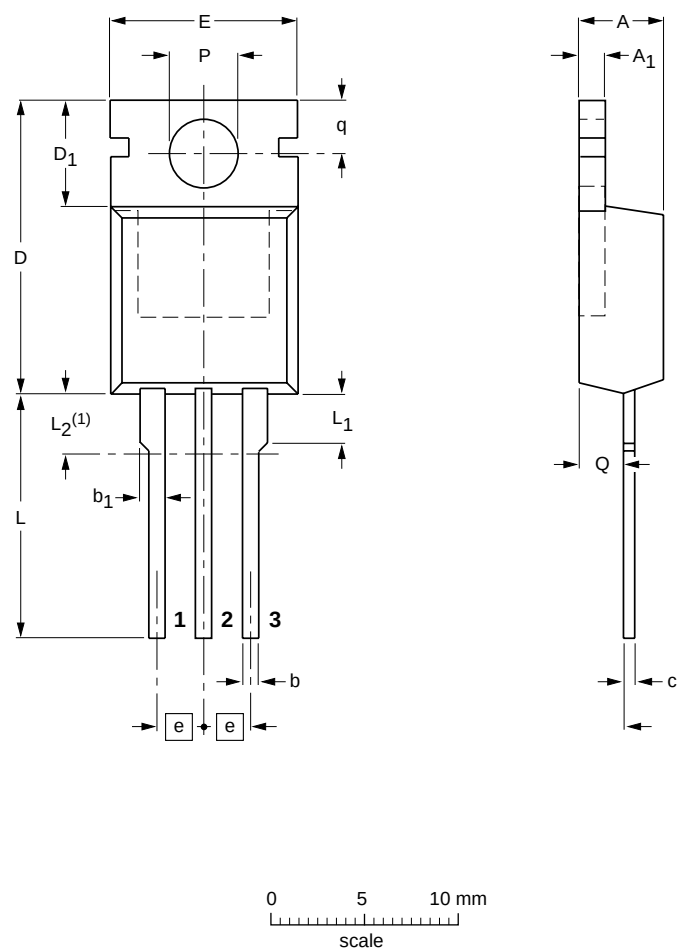
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PACKAGE OUTLINE

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

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 4.1	1.39 1.27	0.9 0.7	1.3 1.0	0.7 0.4	15.8 15.2	6.4 5.9	10.3 9.7	2.54	15.0 13.5	3.30 2.79	3.0	3.8 3.6	3.0 2.7	2.6 2.2

Note
1. Terminals in this zone are not tinned.

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

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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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NOTES

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