

# DATA SHEET

## **BFG11; BFG11/X** NPN 2 GHz RF power transistor

Product specification  
Supersedes data of November 1992  
File under Discrete Semiconductors, SC14

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**Philips Semiconductors**



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# NPN 2 GHz RF power transistor

# BFG11; BFG11/X

### FEATURES

- High power gain
- High efficiency
- Small size discrete power amplifier
- 1.9 GHz operating area
- Gold metallization ensures excellent reliability.

### APPLICATIONS

- Common emitter class-AB operation in hand-held radio equipment at 1.9 GHz.

### PINNING

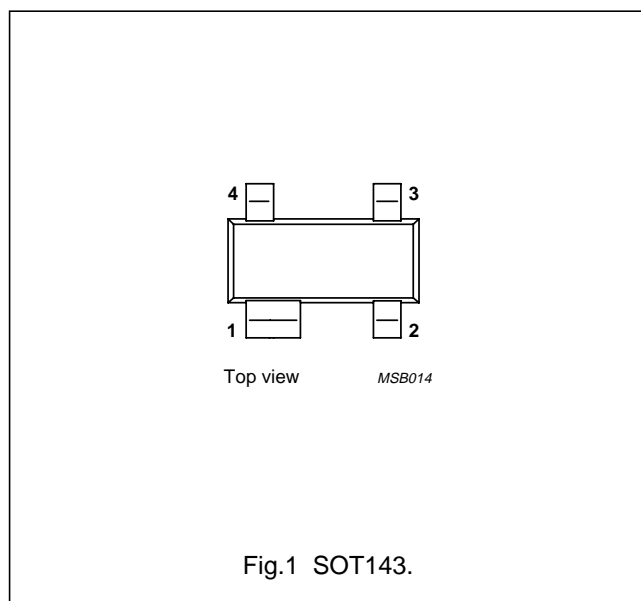
PIN	DESCRIPTION
<b>BFG11</b> (see Fig.1)	
1	collector
2	base
3	emitter
4	emitter
<b>BFG11/X</b> (see Fig.1)	
1	collector
2	emitter
3	base
4	emitter

### DESCRIPTION

NPN silicon planar epitaxial transistors encapsulated in a plastic, 4-pin dual-emitter SOT143 package.

### MARKING

TYPE NUMBER	CODE
BFG11	N72
BFG11/X	N73



### QUICK REFERENCE DATA

RF performance at  $T_{amb} = 25\text{ }^{\circ}\text{C}$  in a common-emitter test circuit (see Fig.7).

MODE OF OPERATION	f (GHz)	$V_{CE}$ (V)	$P_L$ (mW)	$G_p$ (dB)	$\eta_c$ (%)
Pulsed, class-AB, duty cycle < 1 : 8	1.9	3.6	400	$\geq 4$	$\geq 50$

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**LIMITING VALUES**

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

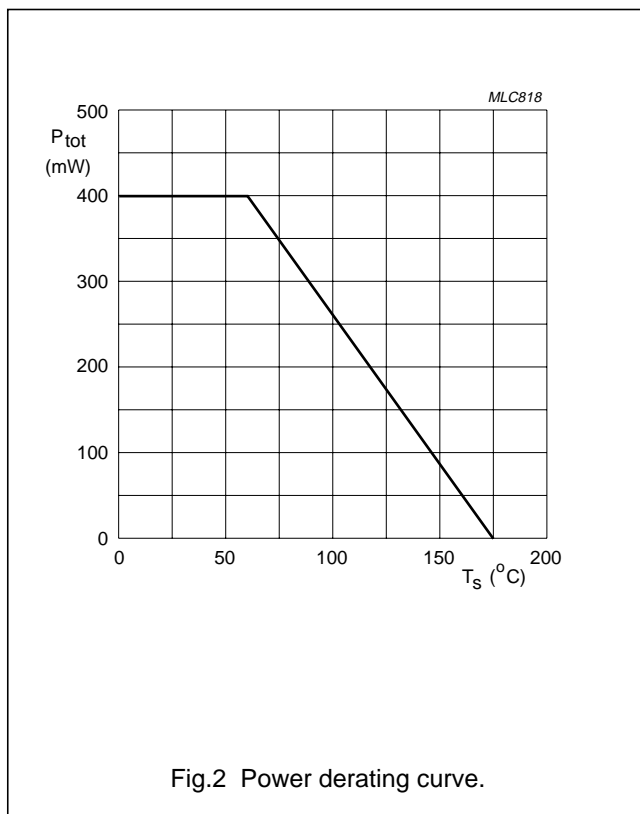
SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V <sub>CBO</sub>	collector-base voltage	open emitter	–	20	V
V <sub>CEO</sub>	collector-emitter voltage	open base	–	8	V
V <sub>EBO</sub>	emitter-base voltage	open collector	–	2.5	V
I <sub>C</sub>	collector current (DC)		–	500	mA
I <sub>C(AV)</sub>	average collector current		–	500	mA
P <sub>tot</sub>	total power dissipation	up to T <sub>s</sub> = 60 °C; note 1; see Fig.2	–	400	mW
T <sub>stg</sub>	storage temperature		–65	+150	°C
T <sub>j</sub>	junction temperature		–	175	°C

**THERMAL CHARACTERISTICS**

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
R <sub>th j-s</sub>	thermal resistance from junction to soldering point	up to T <sub>s</sub> = 60 °C; note 1; P <sub>tot</sub> = 400 mW	290	K/W

**Note to the “Limiting values” and “Thermal characteristics”**

1. T<sub>s</sub> is the temperature at the soldering point of the collector pin.



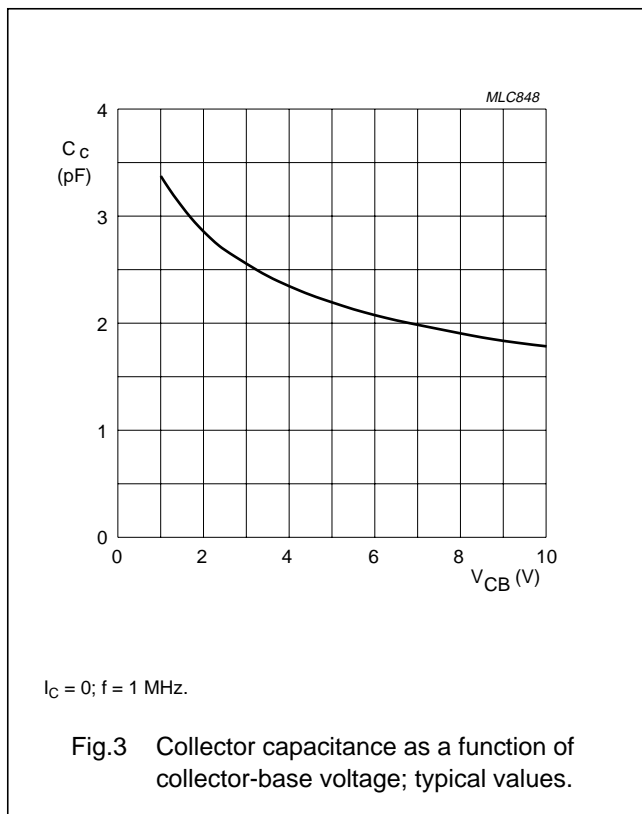
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**CHARACTERISTICS**

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	open emitter; $I_C = 0.1\text{ mA}$ ; $I_E = 0$	20	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; $I_C = 10\text{ mA}$ ; $I_B = 0$	8	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; $I_E = 0.1\text{ mA}$ ; $I_C = 0$	2.5	–	V
$I_{CES}$	collector cut-off current	$V_{CE} = 8\text{ V}$ ; $V_{BE} = 0$	–	100	$\mu\text{A}$
$h_{FE}$	DC current gain	$I_C = 100\text{ mA}$ ; $V_{CE} = 5\text{ V}$	25	–	
$C_c$	collector capacitance	$I_E = i_e = 0$ ; $V_{CB} = 3.6\text{ V}$ ; $f = 1\text{ MHz}$	–	4	pF
$C_{re}$	feedback capacitance	$I_C = 0$ ; $V_{CE} = 3.6\text{ V}$ ; $f = 1\text{ MHz}$	–	3	pF



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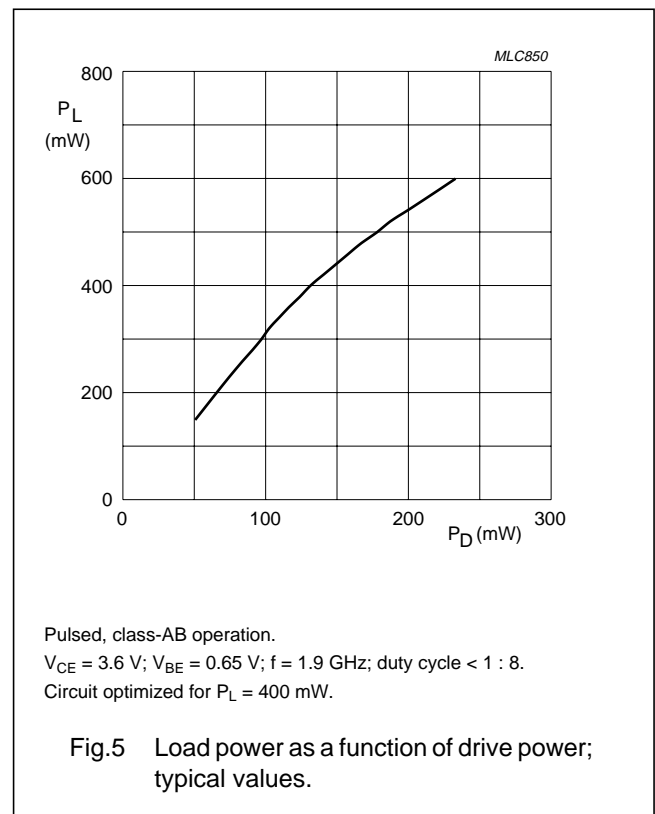
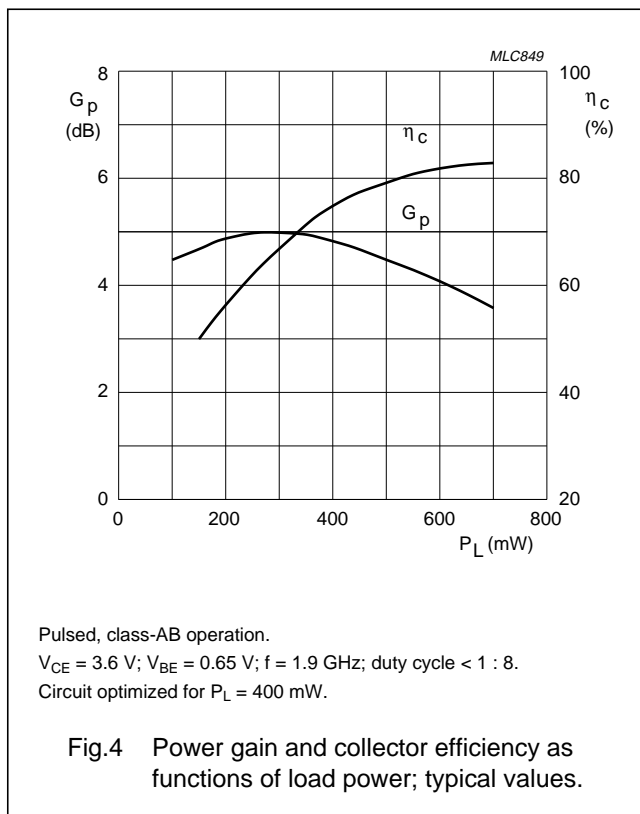
APPLICATION INFORMATION

RF performance at  $T_{amb} = 25\text{ }^{\circ}\text{C}$  in a common-emitter test circuit (see Fig.7).

MODE OF OPERATION	f (GHz)	V <sub>CE</sub> (V)	I <sub>CQ</sub> (mA)	P <sub>L</sub> (mW)	G <sub>p</sub> (dB)	η <sub>c</sub> (%)
Pulsed, class-AB, duty cycle < 1 : 8	1.9	3.6	1	400	≥4 typ. 5	≥50 typ. 70

Ruggedness in class-AB operation

The BFG11 is capable of withstanding a load mismatch corresponding to VSWR = 8 : 1 through all phases, at rated output power under pulsed conditions up to a supply voltage of 8 V, f = 1.9 GHz and a duty cycle of 1 : 8.



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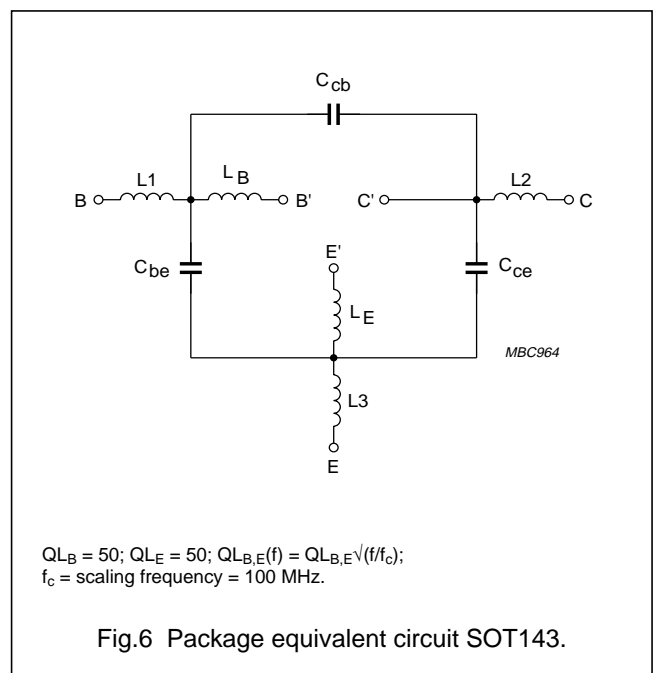
SPICE parameters for the BFG11 crystal

SEQUENCE No.	PARAMETER	VALUE	UNIT
1	IS	3.338	fA
2	BF	97.14	–
3	NF	0.988	–
4	VAF	31.40	V
5	IKF	51.45	A
6	ISE	23.53	pA
7	NE	2.386	–
8	BR	13.73	–
9	NR	0.989	–
10	VAR	2.448	V
11	IKR	100.0	A
12	ISC	54.10	fA
13	NC	1.224	–
14	RB	1.740	Ω
15	IRB	1.000	μA
16	RBM	1.740	Ω
17	RE	59.65	mΩ
18	RC	0.124	Ω
19 <sup>(1)</sup>	XTB	0.000	–
20 <sup>(1)</sup>	EG	1.110	eV
21 <sup>(1)</sup>	XTI	3.000	–
22	CJE	9.555	pF
23	VJE	0.600	V
24	MJE	0.315	–
25	TF	12.96	ps
26	XTF	400.0	–
27	VTF	0.866	V
28	ITF	5.940	A
29	PTF	0.000	deg
30	CJC	4.274	pF
31	VJC	0.650	V
32	MJC	0.392	–
33	XCJC	0.150	–
34 <sup>(1)</sup>	TR	0.000	ns
35 <sup>(1)</sup>	CJS	0.000	F

SEQUENCE No.	PARAMETER	VALUE	UNIT
36 <sup>(1)</sup>	VJS	750.0	mV
37 <sup>(1)</sup>	MJS	0.000	–
38	FC	0.742	–

Note

1. These parameters have not been extracted, the default values are shown.



List of components (see Fig.6)

DESIGNATION	VALUE	UNIT
C <sub>be</sub>	84	fF
C <sub>cb</sub>	17	fF
C <sub>ce</sub>	191	fF
L1	0.12	nH
L2	0.21	nH
L3	0.06	nH
L <sub>B</sub>	0.95	nH
L <sub>E</sub>	0.40	nH



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## List of components used in test circuit (see Fig.8)

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1, C8, C9, C10	multilayer ceramic chip capacitor; note 1	24 pF		
C2	multilayer ceramic chip capacitor; note 1	0.4 pF		
C3	multilayer ceramic chip capacitor; note 1	0.6 pF		
C4, C7	multilayer ceramic chip capacitor; note 1	1 pF		
C5, C6,	multilayer ceramic chip capacitor; note 1	1.5 pF		
C11, C12,C13	multilayer ceramic chip capacitor; note 1	10 nF		
C14, C15	electrolytic capacitor	10 V; 470 $\mu$ F		2222 031 34471
L1	stripline; note 2		length 4 mm width 0.93 mm	
L2	stripline; note 2		length 26 mm width 0.93 mm	
L3	stripline; note 2		length 1.9 mm width 0.93 mm	
L4	stripline; note 2		length 3.1 mm width 0.93 mm	
L5	stripline; note 2		length 1.8 mm width 0.93 mm	
L6	stripline; note 2		length 26.4 mm width 0.93 mm	
L7	stripline; note 2		length 10 mm width 0.93 mm	
L8	stripline; note 2		length 4.4 mm width 0.4 mm	
L9	stripline; note 2		length 19.3 mm width 0.93 mm	
L10	stripline; note 2		length 19.7 mm width 0.4 mm	
L11	micro choke			
T1	BD228			
R1	metal film resistor	20 $\Omega$ ; 0.4 W		2322 157 10209
R2	metal film resistor	265 $\Omega$ ; 0.4 W		2322 157 12651

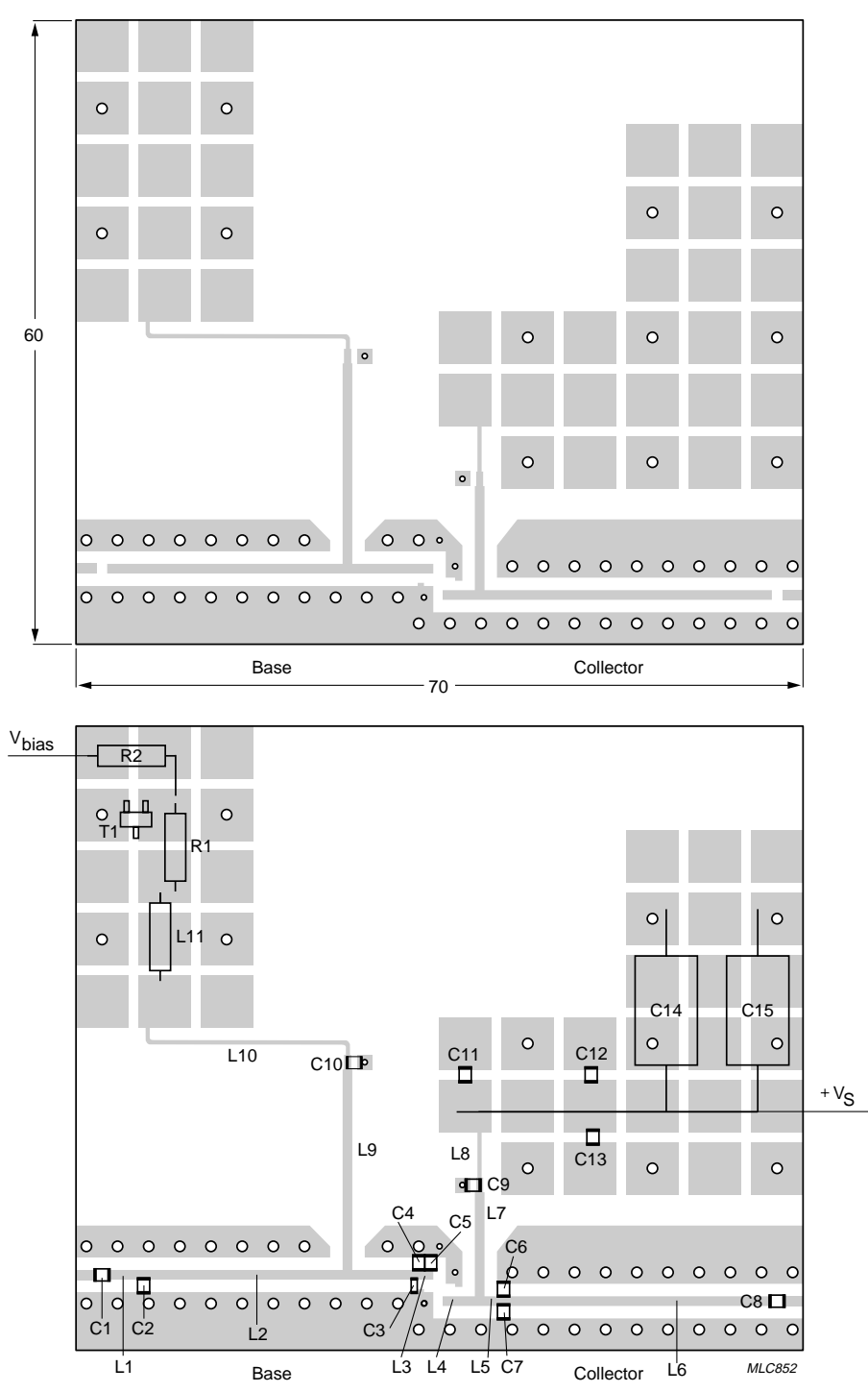
## Notes

- American Technical Ceramics (ATC) capacitor, type 100A or other capacitor of the same quality.
- The striplines are on a  $\frac{1}{32}$  inch double copper-clad printed-circuit board with PTFE fibre-glass dielectric ( $\epsilon_r = 6$ ).



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Dimensions in mm.

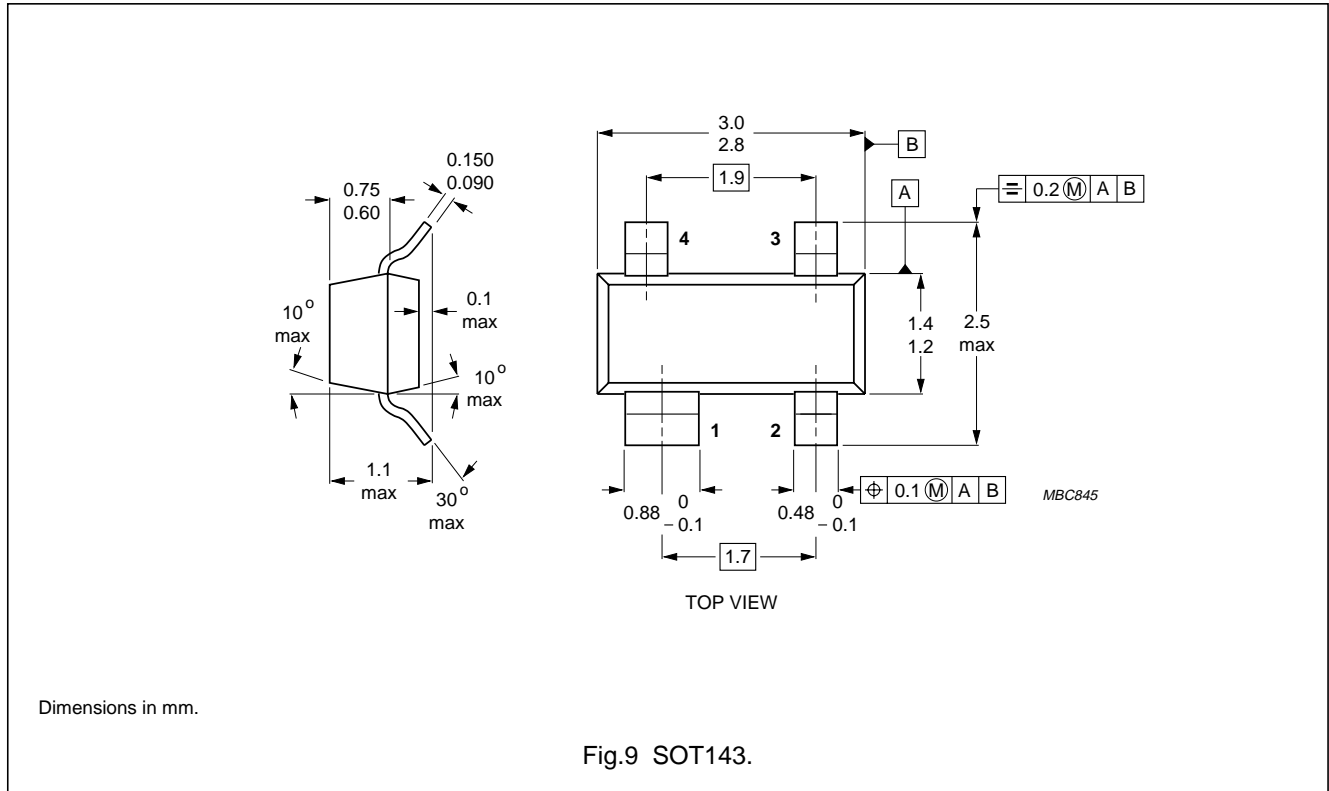
The components are situated on one side of the copper-clad PTFE microfibre-glass board, the other side is not etched and serves as a ground plane. Earth connections from the component side to the ground plane are made by through metallization.

Fig.8 Printed-circuit board and component lay-out for common-emitter test circuit in Fig.7.

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PACKAGE OUTLINE



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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