

BFG10; BFG10/X

NPN 2 GHz RF power transistor

Rev. 05 — 22 November 2007

Product data sheet

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NXP Semiconductors

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FEATURES

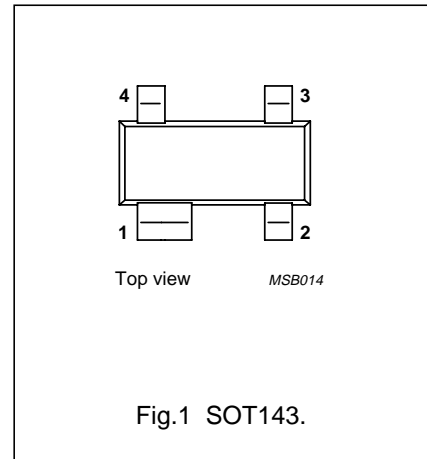
- High power gain
- High efficiency
- Small size discrete power amplifier
- 1.9 GHz operating area
- Gold metallization ensures excellent reliability.

APPLICATIONS

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

PINNING

PIN	DESCRIPTION
BFG10 (see Fig.1)	
1	collector
2	base
3	emitter
4	emitter
BFG10/X (see Fig.1)	
1	collector
2	emitter
3	base
4	emitter



DESCRIPTION

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

MARKING

TYPE NUMBER	CODE
BFG10	%MS
BFG10/X	%MT

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)	η_c (%)
Pulsed, class-AB, duty cycle: < 1 : 8	1.9	3.6	200	≥5	≥50

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V _{CB0}	collector-base voltage	open emitter	—	20	V
V _{CEO}	collector-emitter voltage	open base	—	8	V
V _{EBO}	emitter-base voltage	open collector	—	2.5	V
I _C	collector current (DC)		—	250	mA
I _{C(AV)}	average collector current		—	250	mA
P _{tot}	total power dissipation	up to T _s = 60 °C; see Fig.2; note 1	—	400	mW
T _{stg}	storage temperature		−65	+150	°C
T _j	junction temperature		—	175	°C

Note

1. T_s is the temperature at the soldering point of the collector pin.

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THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j-s}$	thermal resistance from junction to soldering point	up to $T_s = 60\ ^\circ\text{C}$; note 1; $P_{tot} = 400\ \text{mW}$	290	K/W

Note

1. T_s is the temperature at the soldering point of the collector pin.

CHARACTERISTICS

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	open emitter; $I_C = 0.1\ \text{mA}$	20	—	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; $I_C = 5\ \text{mA}$	8	—	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; $I_E = 0.1\ \text{mA}$	2.5	—	V
I_{CES}	collector leakage current	$V_{CE} = 5\ \text{V}$; $V_{BE} = 0$	—	100	μA
h_{FE}	DC current gain	$I_C = 50\ \text{mA}$; $V_{CE} = 5\ \text{V}$	25	—	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 3.6\ \text{V}$; $f = 1\ \text{MHz}$	—	3	pF
C_{re}	feedback capacitance	$I_C = 0$; $V_{CE} = 3.6\ \text{V}$; $f = 1\ \text{MHz}$	—	2	pF

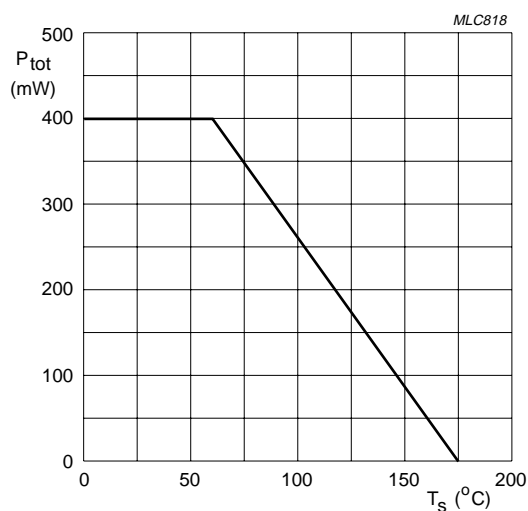
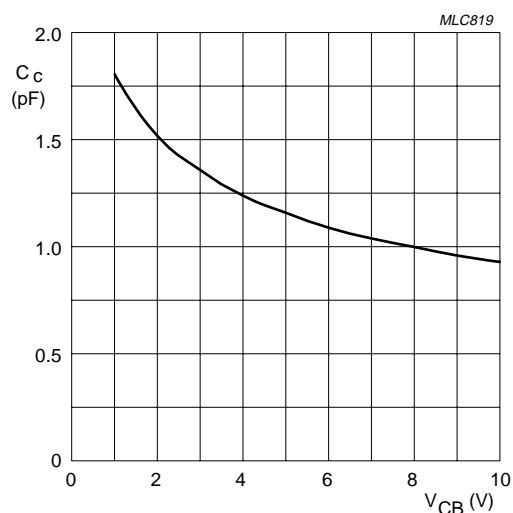


Fig. 2 Power derating curve



$I_C = 0$; $f = 1\ \text{MHz}$.

Fig. 3 Collector capacitance as a function of collector-base voltage; typical values.

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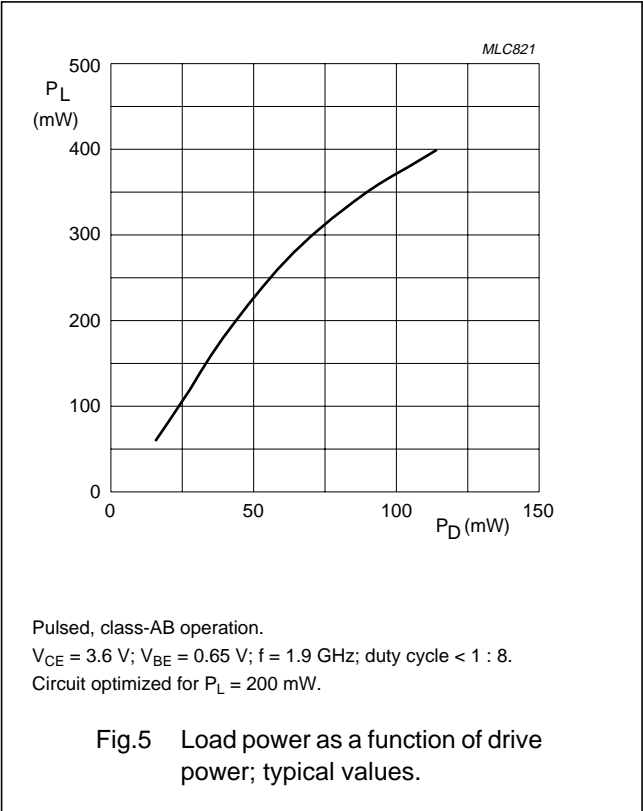
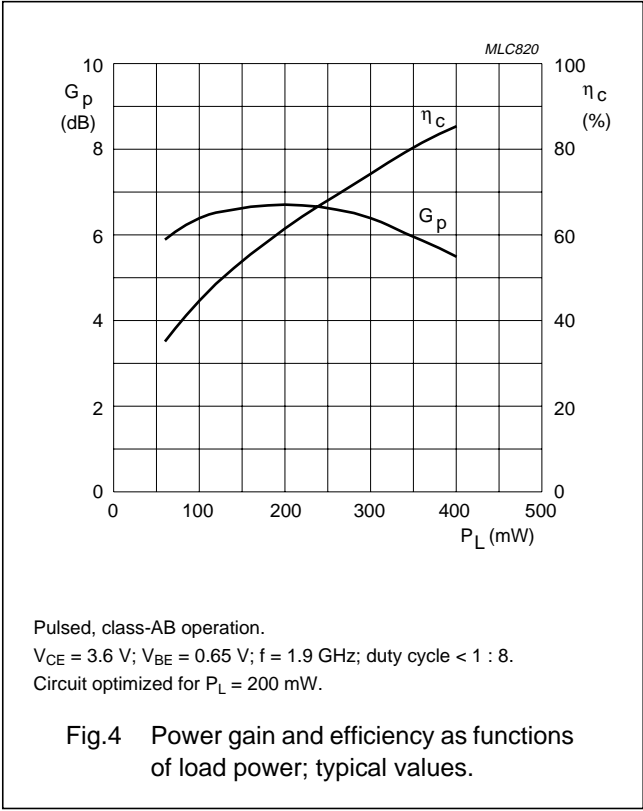
APPLICATION INFORMATION

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 _{CE} (V)	I _{CQ} (mA)	P _L (mW)	G _p (dB)	η _c (%)
Pulsed, class-AB, duty cycle: < 1 : 8	1.9	3.6	1	200	>5 typ. 7	>50 typ. 60

Ruggedness in class-AB operation

The BFG10 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 7 V, f = 1.9 GHz and a duty cycle of 1 : 8.



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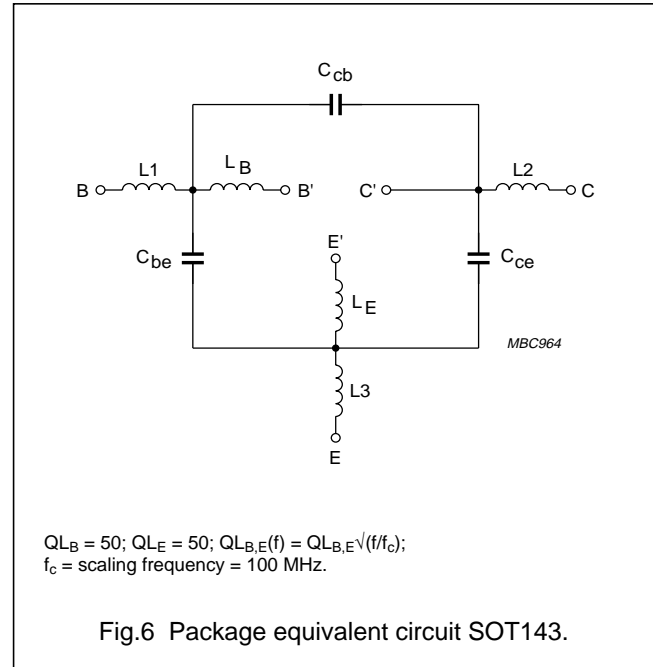
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SPICE parameters for the BFG10 crystal

SEQUENCE No.	PARAMETER	VALUE	UNIT
1	IS	2.714	fA
2	BF	102.8	—
3	NF	0.998	—
4	VAF	28.12	V
5	IKF	6.009	A
6	ISE	403.2	pA
7	NE	2.937	—
8	BR	31.01	—
9	NR	0.999	—
10	VAR	2.889	V
11	IKR	0.284	A
12	ISC	1.487	fA
13	NC	1.100	—
14	RB	3.500	Ω
15	IRB	1.000	μ A
16	RBM	3.500	Ω
17	RE	0.217	Ω
18	RC	0.196	Ω
19 ⁽¹⁾	XTB	0.000	—
20 ⁽¹⁾	EG	1.110	eV
21 ⁽¹⁾	XTI	3.000	—
22	CJE	5.125	pF
23	VJE	0.600	V
24	MJE	0.367	—
25	TF	12.07	ps
26	XTF	99.40	—
27	VTF	7.220	V
28	ITF	3.950	A
29	PTF	0.000	deg
30	CJC	2.327	pF
31	VJC	0.668	V
32	MJC	0.398	—
33	XCJC	0.160	—
34 ⁽¹⁾	TR	0.000	ns
35 ⁽¹⁾	CJS	0.000	F
36 ⁽¹⁾	VJS	750.0	mV
37 ⁽¹⁾	MJS	0.000	—
38	FC	0.652	—

Note

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



List of components (see Fig.6)

DESIGNATION	VALUE	UNIT
C_{be}	84	fF
C_{cb}	17	fF
C_{ce}	191	fF
L1	0.12	nH
L2	0.21	nH
L3	0.06	nH
L_B	0.95	nH
L_E	0.40	nH

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Test circuit information

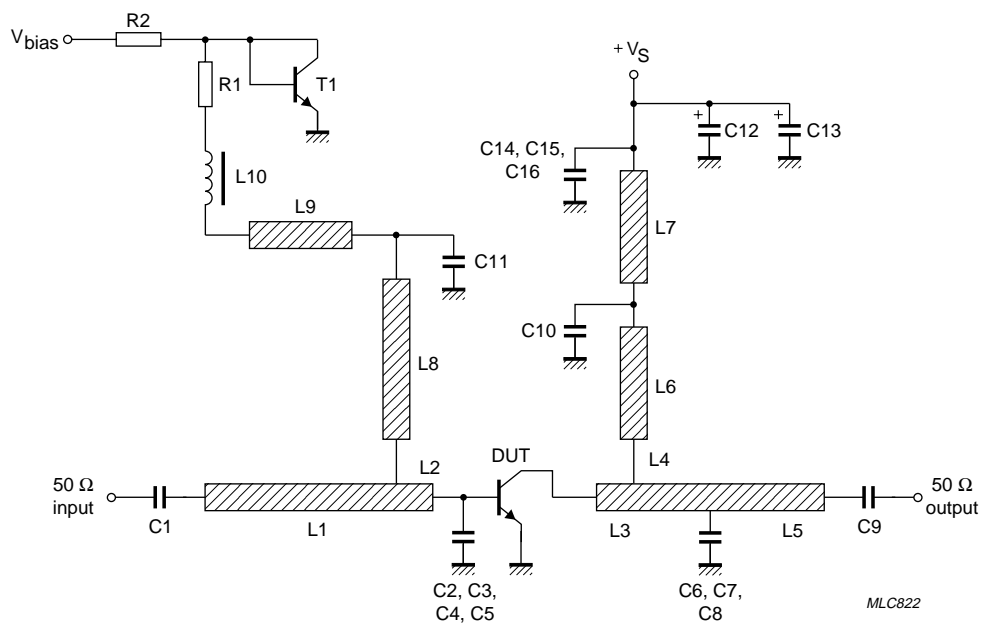


Fig.7 Common-emitter test circuit for class-AB operation at 1.9 GHz.

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List of components used in test circuit (see Fig.7)

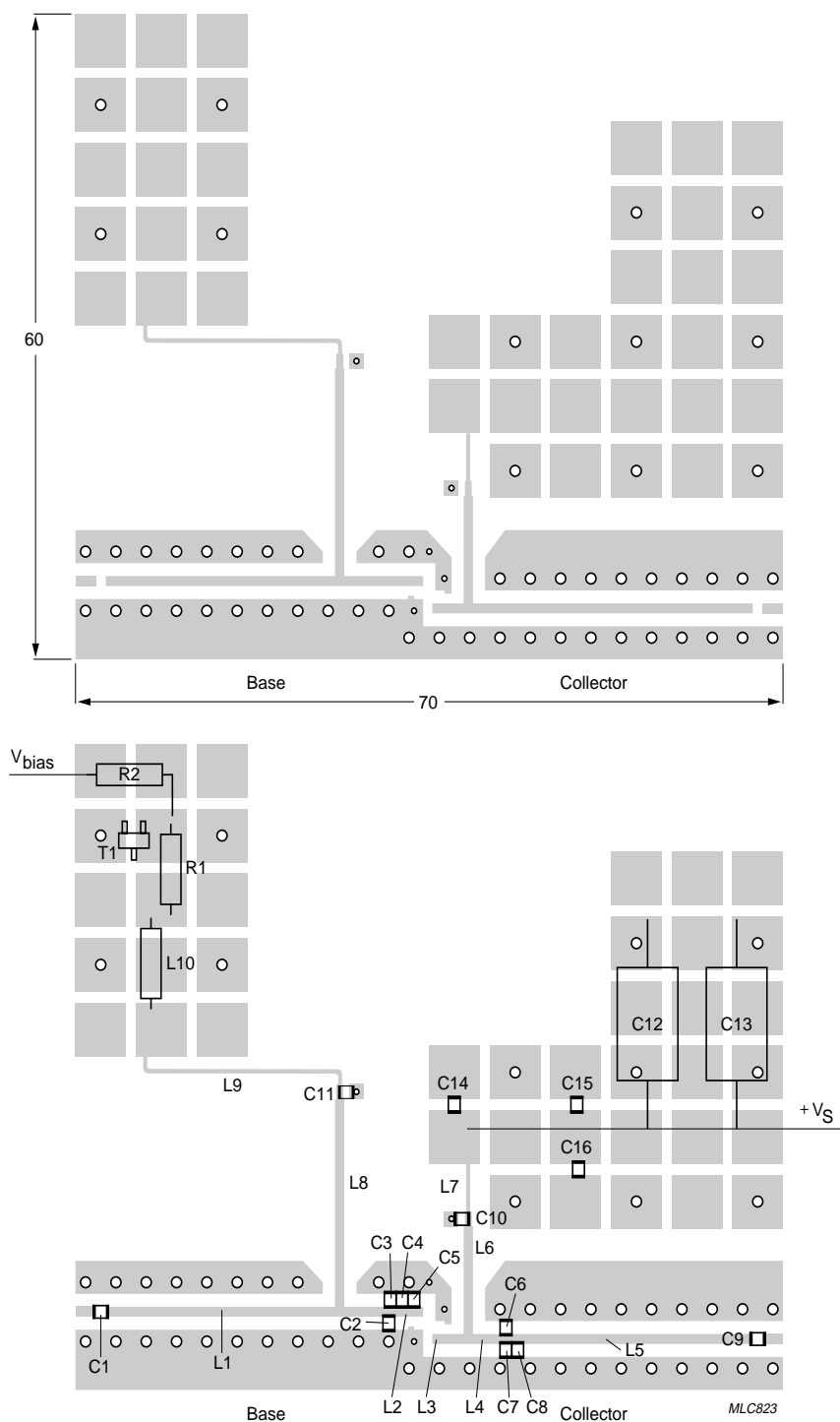
COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE No.
C1, C9, C10, C11	multilayer ceramic chip capacitor; note 1	24 pF		
C2, C3, C4, C5, C6, C7	multilayer ceramic chip capacitor; note 1	0.86 pF		
C8	multilayer ceramic chip capacitor; note 1	1.1 pF		
C12, C13	electrolytic capacitor	470 μ F; 10 V		2222 031 34471
C14, C15, C16	multilayer ceramic chip capacitor; note 1	10 nF		
L1	stripline; note 2		length 28.5 mm width 0.93 mm	
L2	stripline; note 2		length 2.3 mm width 0.93 mm	
L3	stripline; note 2		length 3.1 mm width 0.93 mm	
L4	stripline; note 2		length 3.3 mm width 0.93 mm	
L5	stripline; note 2		length 16.3 mm width 0.93 mm	
L6	stripline; note 2		length 10 mm width 0.93 mm	
L7	stripline; note 2		length 4.4 mm width 0.4 mm	
L8	stripline; note 2		length 19.3 mm width 0.93 mm	
L9	stripline; note 2		length 19.7 mm width 0.4 mm	
L10	micro choke			
T1	BD228			
R1	metal film resistor	20 Ω ; 0.4 W		2322 157 10209
R2	metal film resistor	530 Ω ; 0.4 W		2322 157 15301

Notes

1. American Technical Ceramics (ATC) capacitor, type 100A or other capacitor of the same quality.
2. 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.

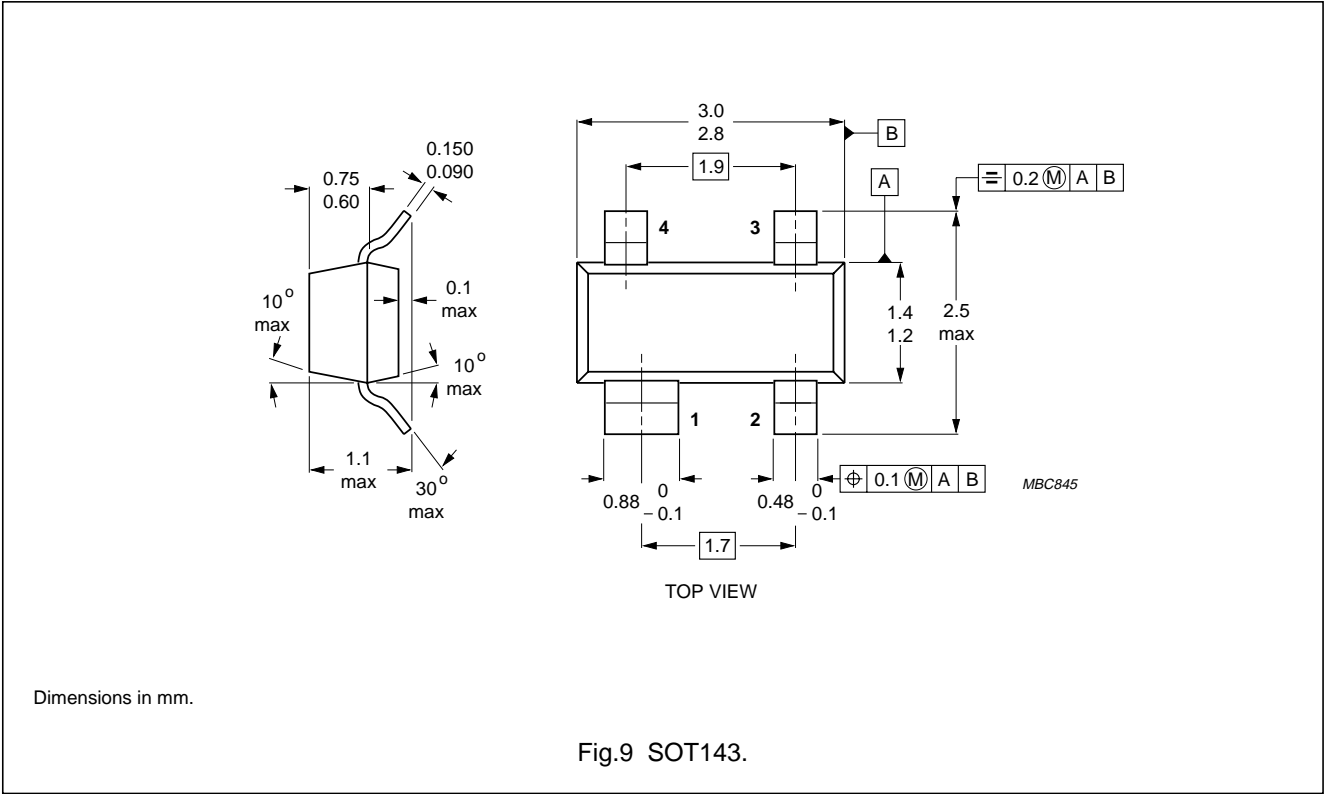
The components are situated on one side of the copper-clad PTFE microfibre-glass board, the other side is not etched and serves as a ground plane. Earth connections from the component side to the ground plane are made by through metallization.

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

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Document status ^{[1][2]}	Product status ^[3]	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
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[1] Please consult the most recently issued document before initiating or completing a design.

[2] The term 'short data sheet' is explained in section "Definitions".

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Revision history

Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BFG10X_N_5	20071122	Product data sheet	-	BFG10X_4
Modifications: <ul style="list-style-type: none">Marking table on page 2; changed code				
BFG10X_4	19950831	Product specification	-	BFG10X_3
BFG10X_3	19950307	-	-	BFG10X_2
BFG10X_2	-	-	-	BFG10X_1
BFG10X_1	-	-	-	-

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