

# BFG10; BFG10/X

NPN 2 GHz RF power transistor

Rev. 05 — 22 November 2007

Product data sheet

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# NPN 2 GHz RF power transistor

# BFG10; BFG10/X

### FEATURES

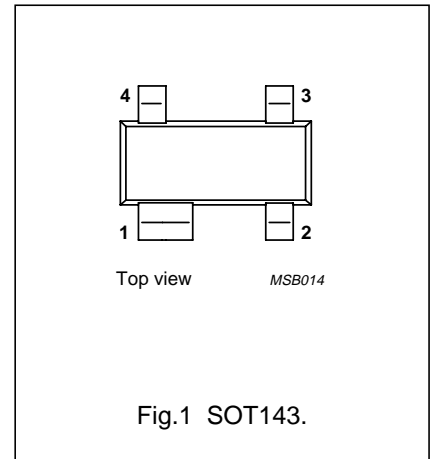
- High power gain
- High efficiency
- Small size discrete power amplifier
- 1.9 GHz operating area
- Gold metallization ensures excellent reliability.

### APPLICATIONS

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

### PINNING

PIN	DESCRIPTION
<b>BFG10</b> (see Fig.1)	
1	collector
2	base
3	emitter
4	emitter
<b>BFG10/X</b> (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  $T_{amb} = 25\text{ °C}$  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	200	$\geq 5$	$\geq 50$

### 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 $T_s = 60\text{ °C}$ ; 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 $T_s = 60\text{ }^\circ\text{C}$ ; note 1; $P_{tot} = 400\text{ mW}$	290	K/W

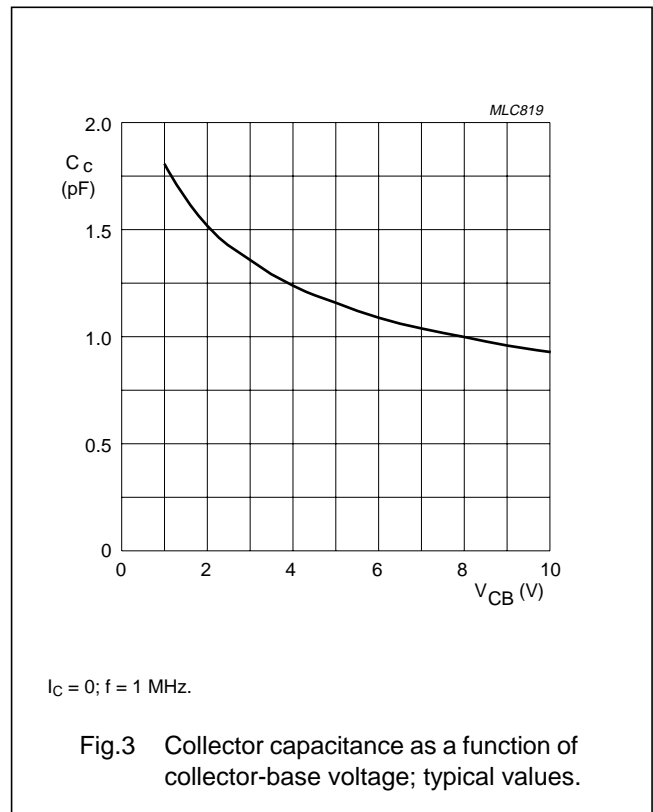
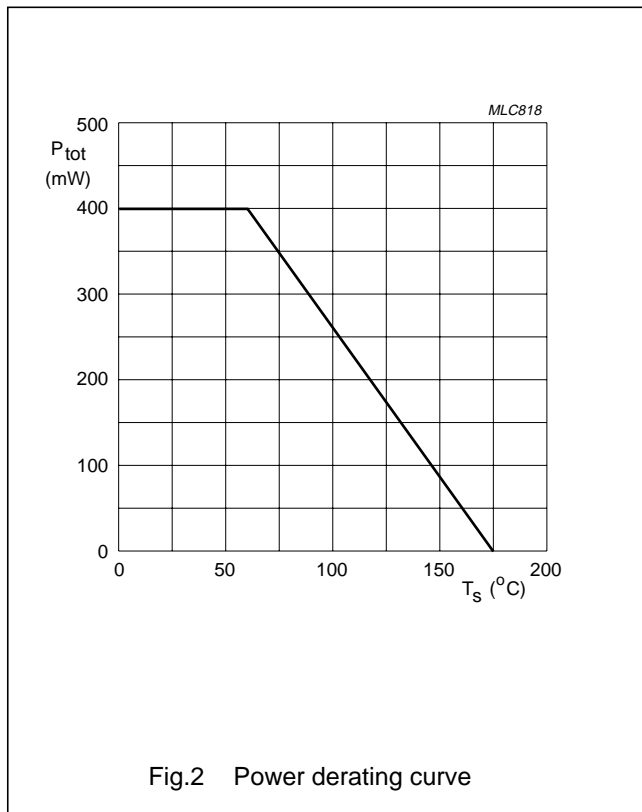
**Note**

- $T_s$  is the temperature at the soldering point of the collector pin.

**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; $I_C = 0.1\text{ mA}$	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	$\mu\text{A}$
$h_{FE}$	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



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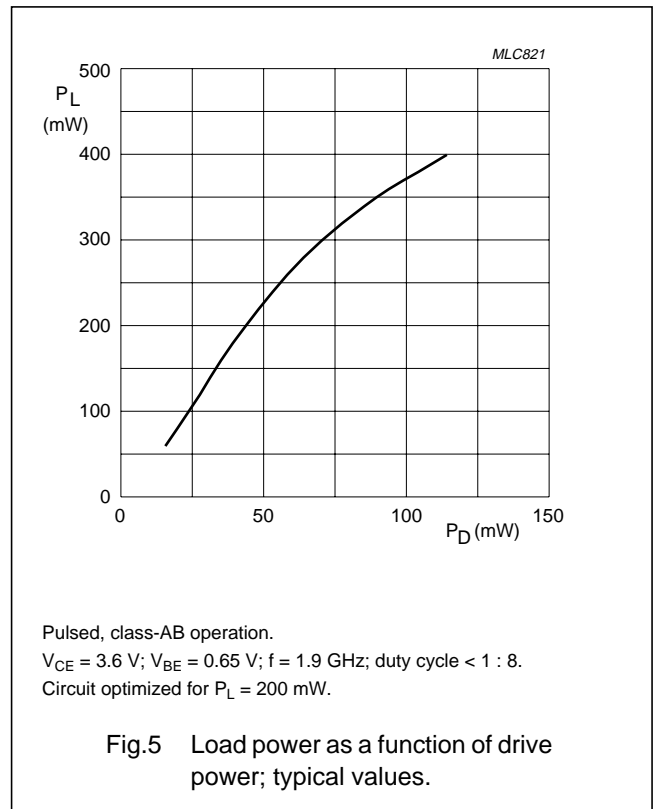
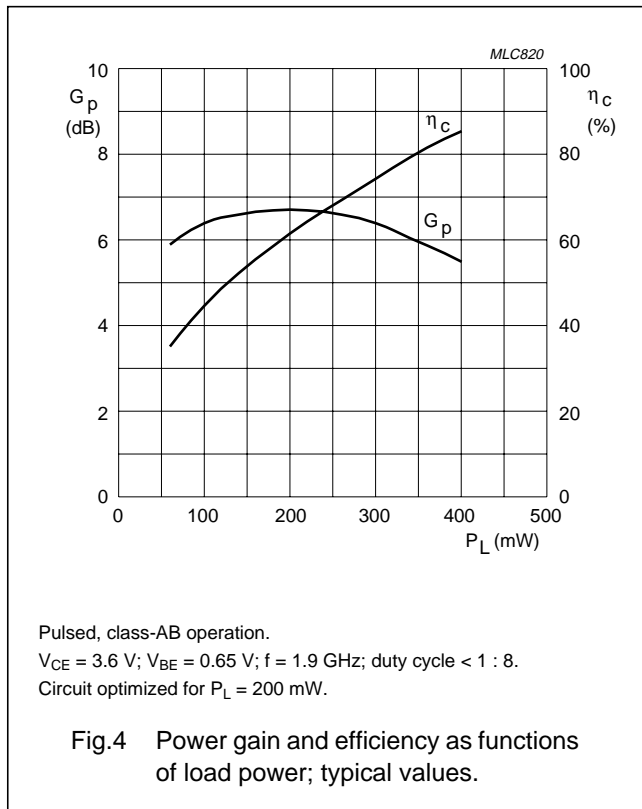
**APPLICATION INFORMATION**

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)	$\eta_c$ (%)
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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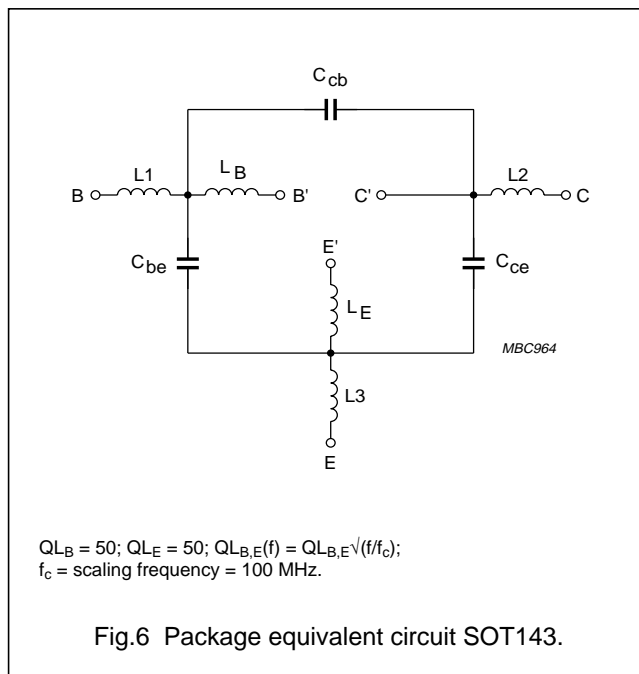
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SPICE parameters for the BFG10 crystal

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	μA
16	RBM	3.500	Ω
17	RE	0.217	Ω
18	RC	0.196	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	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 <sup>(1)</sup>	TR	0.000	ns
35 <sup>(1)</sup>	CJS	0.000	F
36 <sup>(1)</sup>	VJS	750.0	mV
37 <sup>(1)</sup>	MJS	0.000	–
38	FC	0.652	–

Note

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



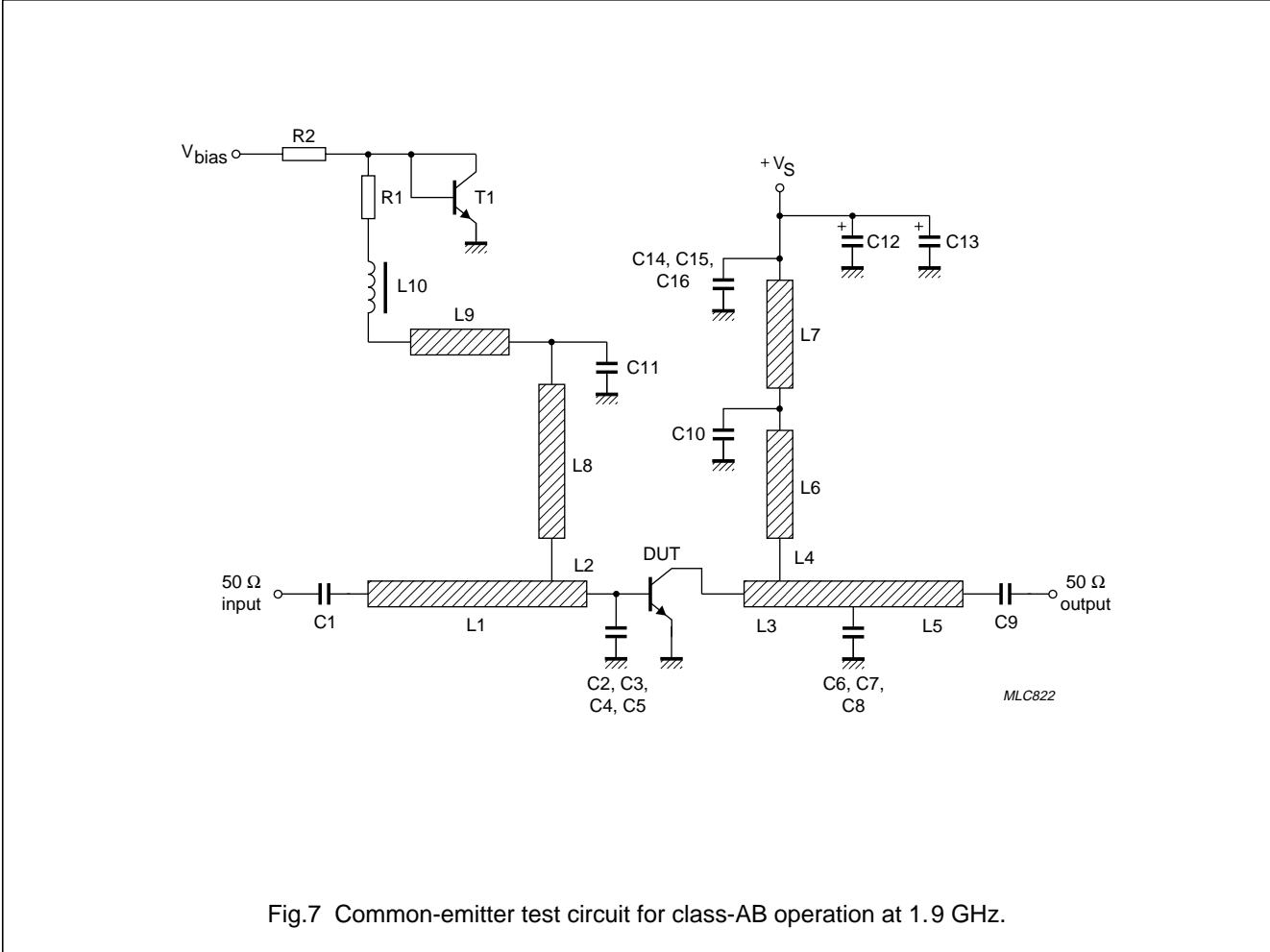
List of components (see Fig.6)

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



## NPN 2 GHz RF power transistor

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

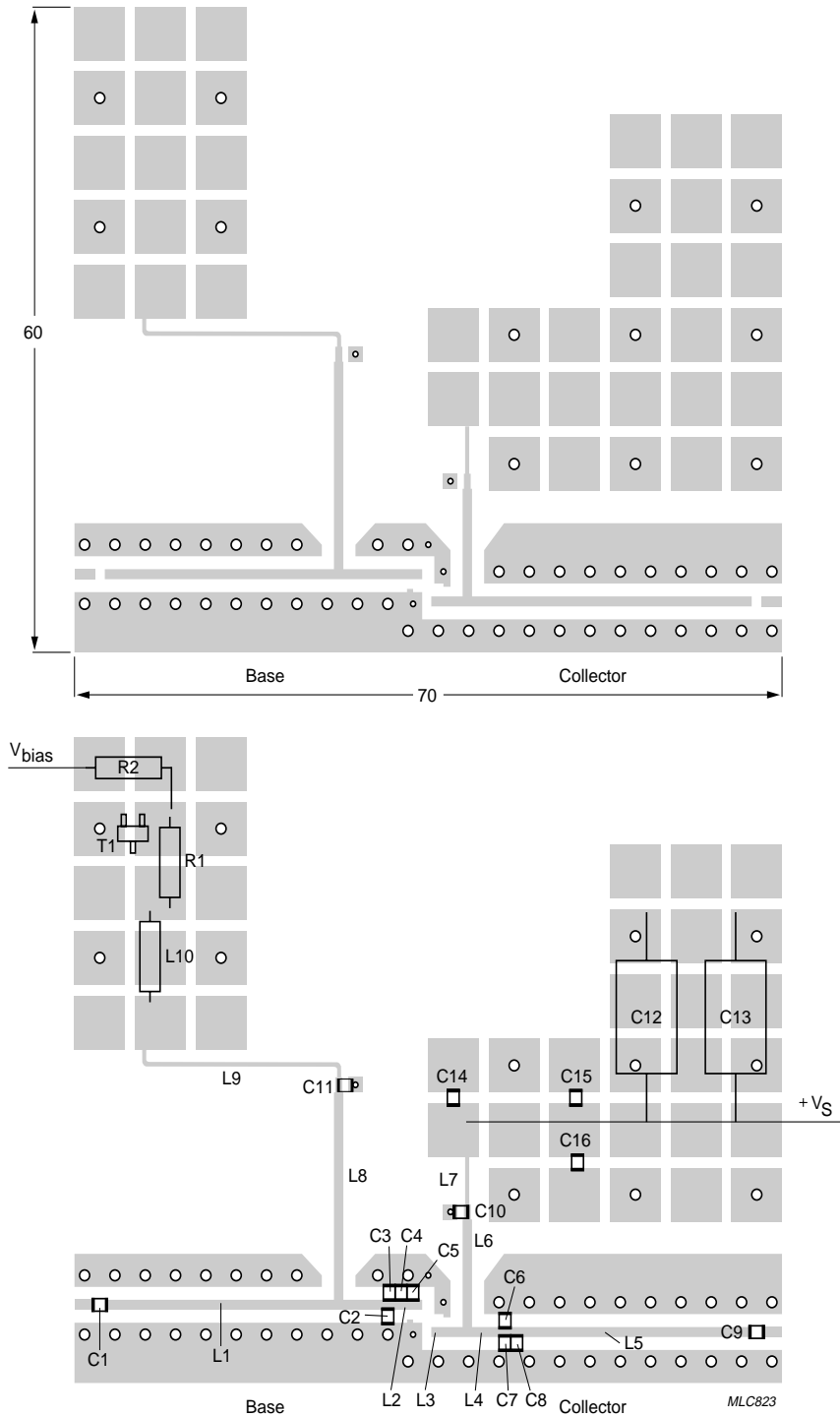
COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE No.
C1, C9, C10, C11	multilayer ceramic chip capacitor; note 1	24 pF		
C2, C3, C4, C5, C6, C7	multilayer ceramic chip capacitor; note 1	0.86 pF		
C8	multilayer ceramic chip capacitor; note 1	1.1 pF		
C12, C13	electrolytic capacitor	470 $\mu$ F; 10 V		2222 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 $\Omega$ ; 0.4 W		2322 157 10209
R2	metal film resistor	530 $\Omega$ ; 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.

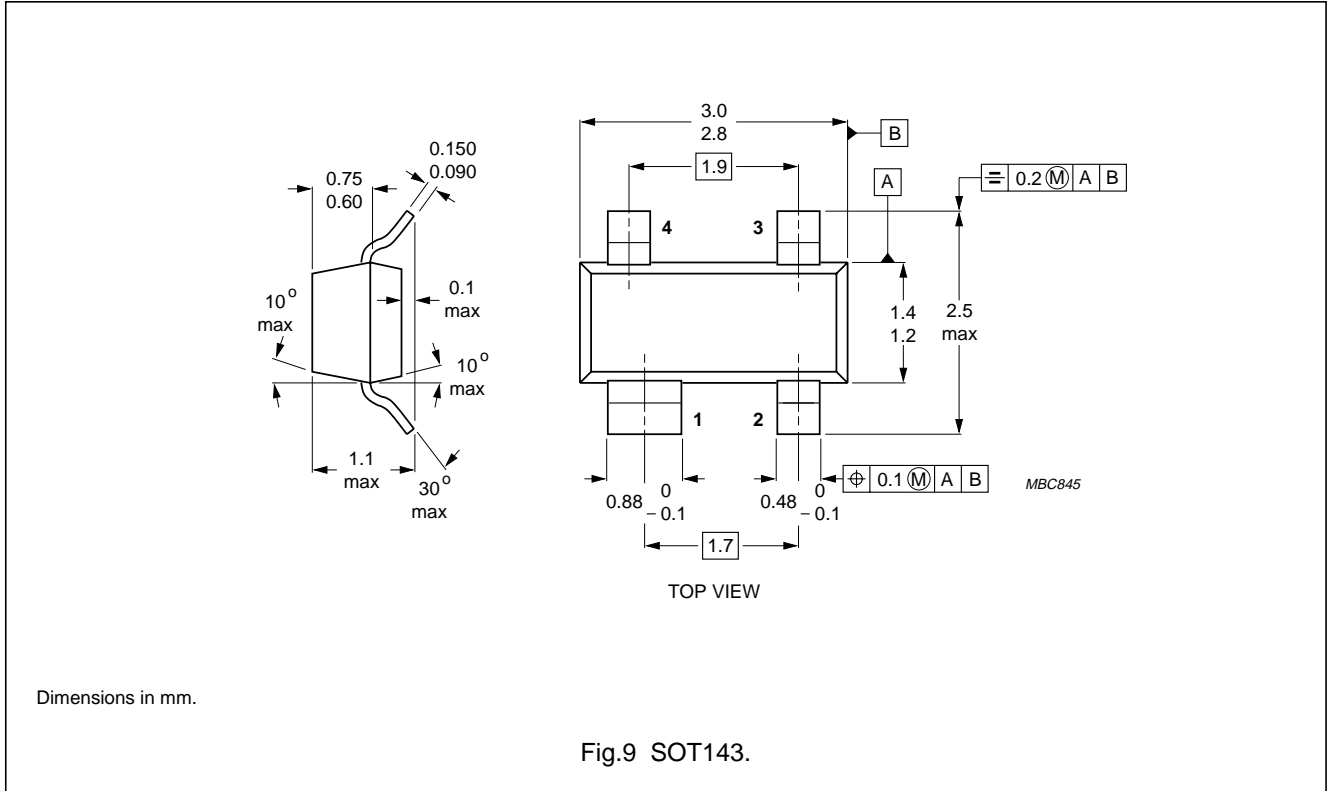
Fig.8 Printed-circuit board and component lay-out for common-emitter test circuit in Fig.7.



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PACKAGE OUTLINE



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### Data sheet status

Document status <sup>[1][2]</sup>	Product status <sup>[3]</sup>	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

[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:	• 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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