

BFG10; BFG10/X

NPN 2 GHz RF power transistor

Rev. 05 — 22 November 2007

Product data sheet

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FEATURES

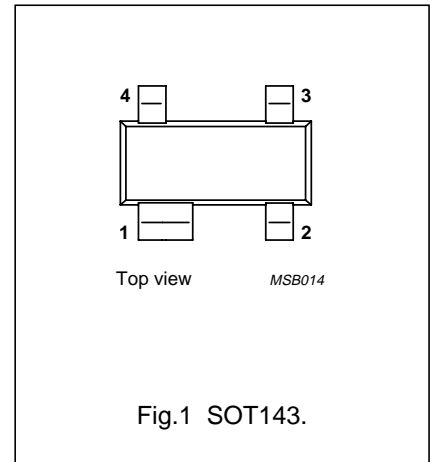
- High power gain
- High efficiency
- Small size discrete power amplifier
- 1.9 GHz operating area
- Gold metallization ensures excellent reliability.

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 $T_{amb} = 25\text{ °C}$ 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 $T_s = 60\text{ °C}$; 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.

NPN 2 GHz RF power transistor

BFG10; BFG10/X

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 |

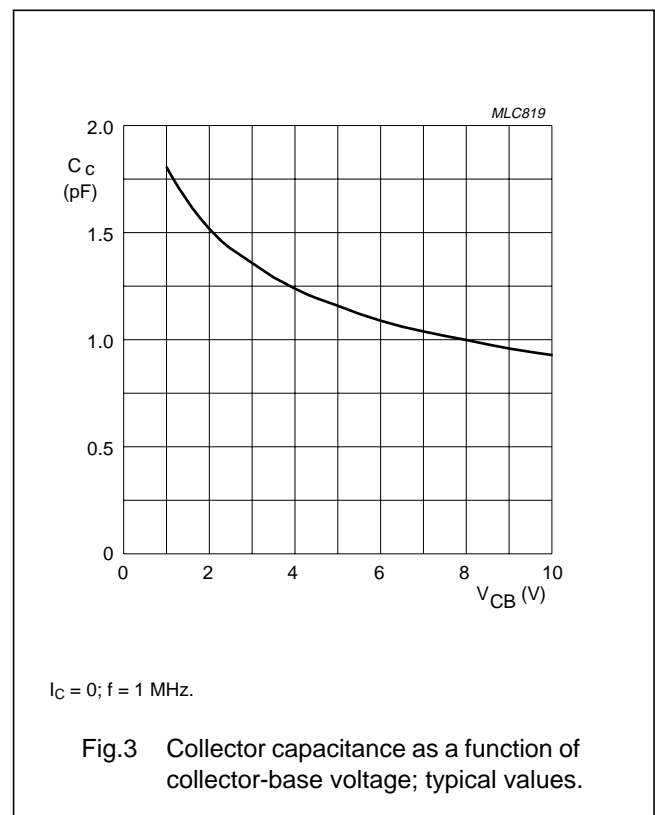
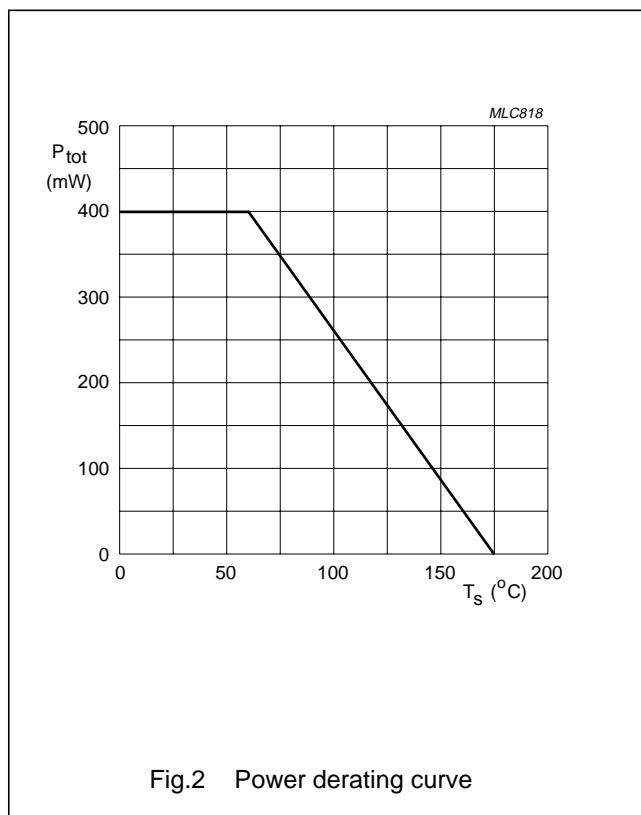
Note

- 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 | 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 |



NPN 2 GHz RF power transistor

BFG10; BFG10/X

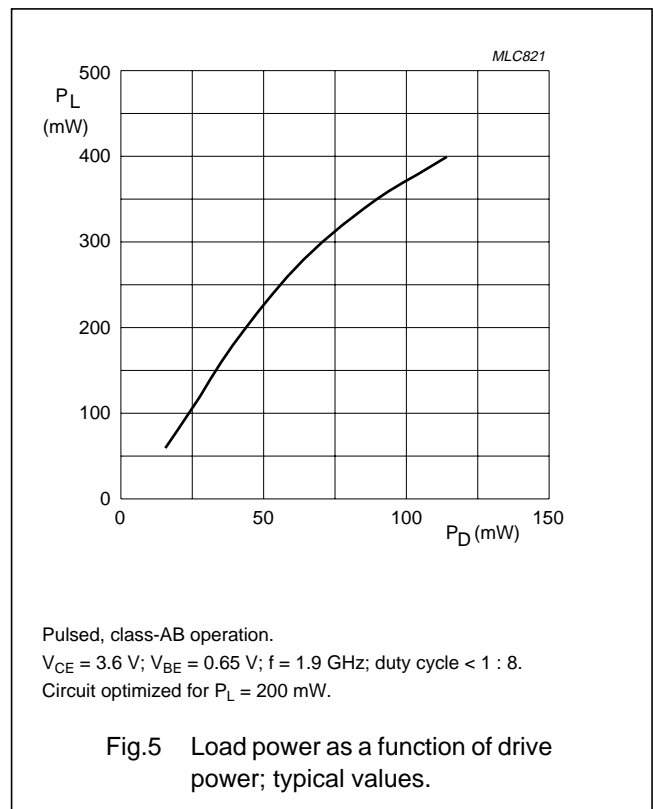
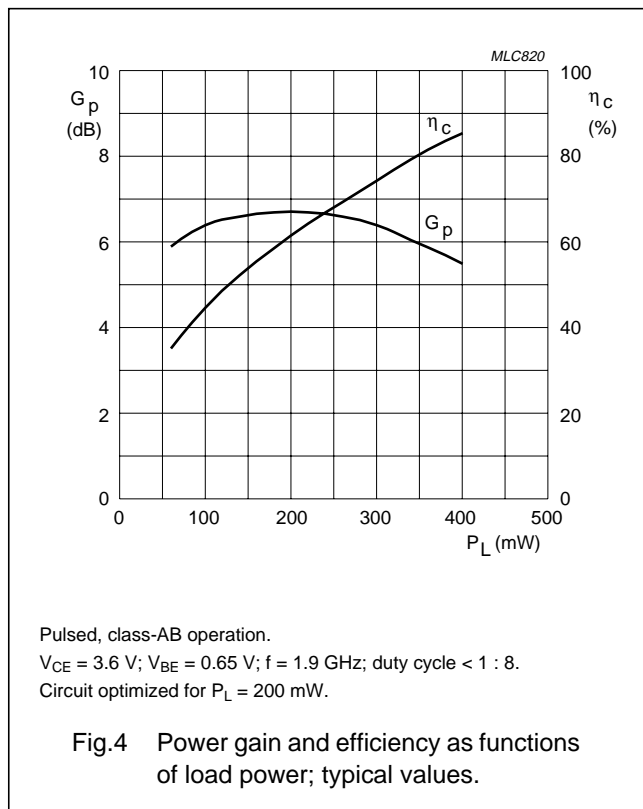
APPLICATION INFORMATION

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.



NPN 2 GHz RF power transistor

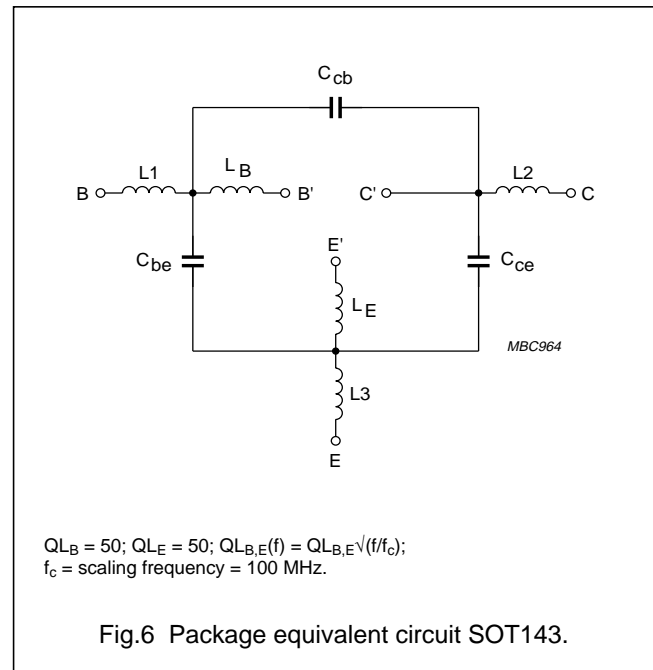
BFG10; BFG10/X

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 ⁽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

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 |

NPN 2 GHz RF power transistor

BFG10; BFG10/X

Test circuit information

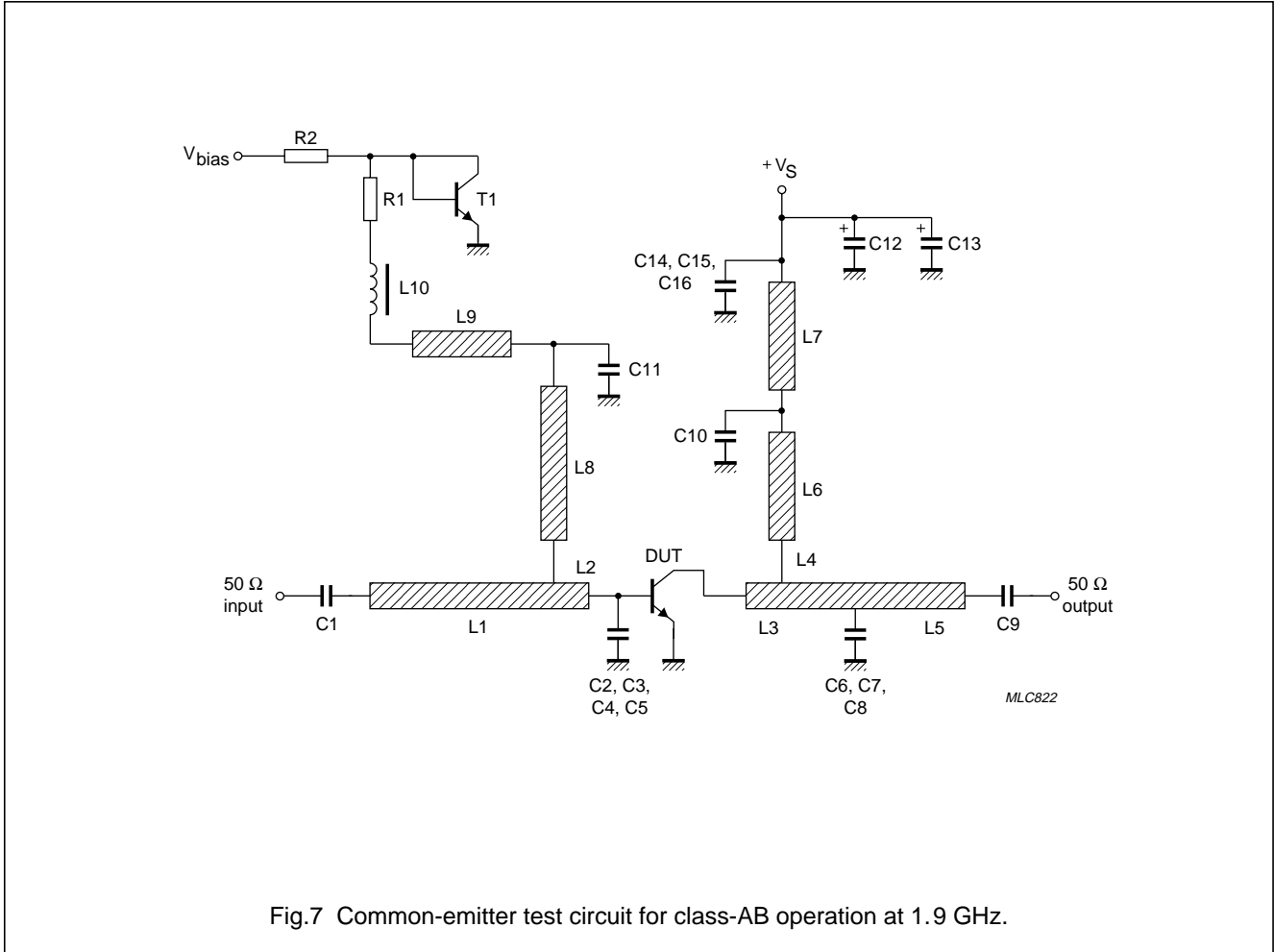


Fig.7 Common-emitter test circuit for class-AB operation at 1.9 GHz.

NPN 2 GHz RF power transistor

BFG10; BFG10/X

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

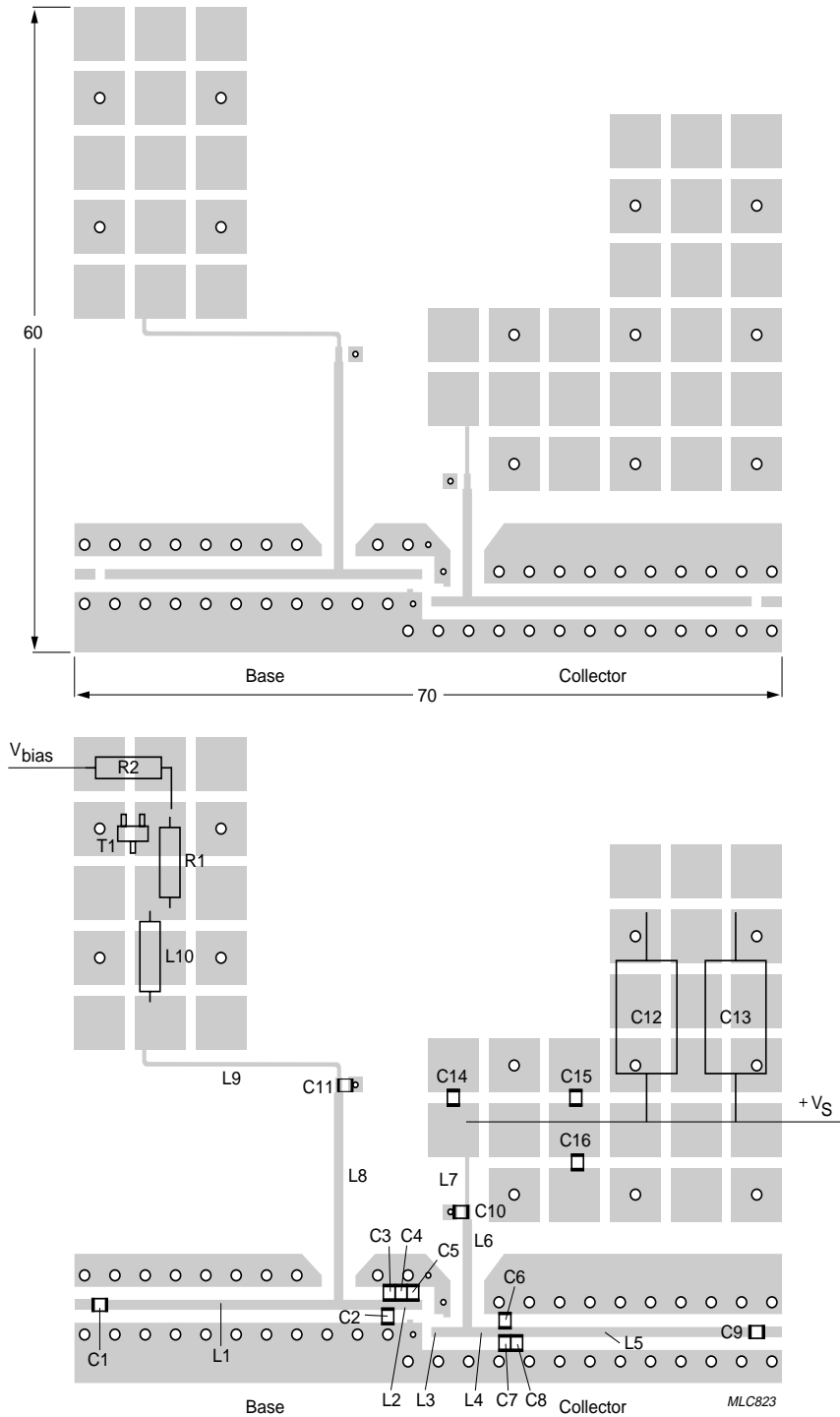
| COMPONENT | DESCRIPTION | VALUE | DIMENSIONS | CATALOGUE No. |
|------------------------|---|----------------------|---------------------------------|----------------|
| C1, C9, C10, C11 | multilayer ceramic chip capacitor; note 1 | 24 pF | | |
| C2, C3, C4, C5, C6, C7 | multilayer ceramic chip capacitor; 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 ($\epsilon_r = 6$).

NPN 2 GHz RF power transistor

BFG10; BFG10/X



Dimensions in mm.

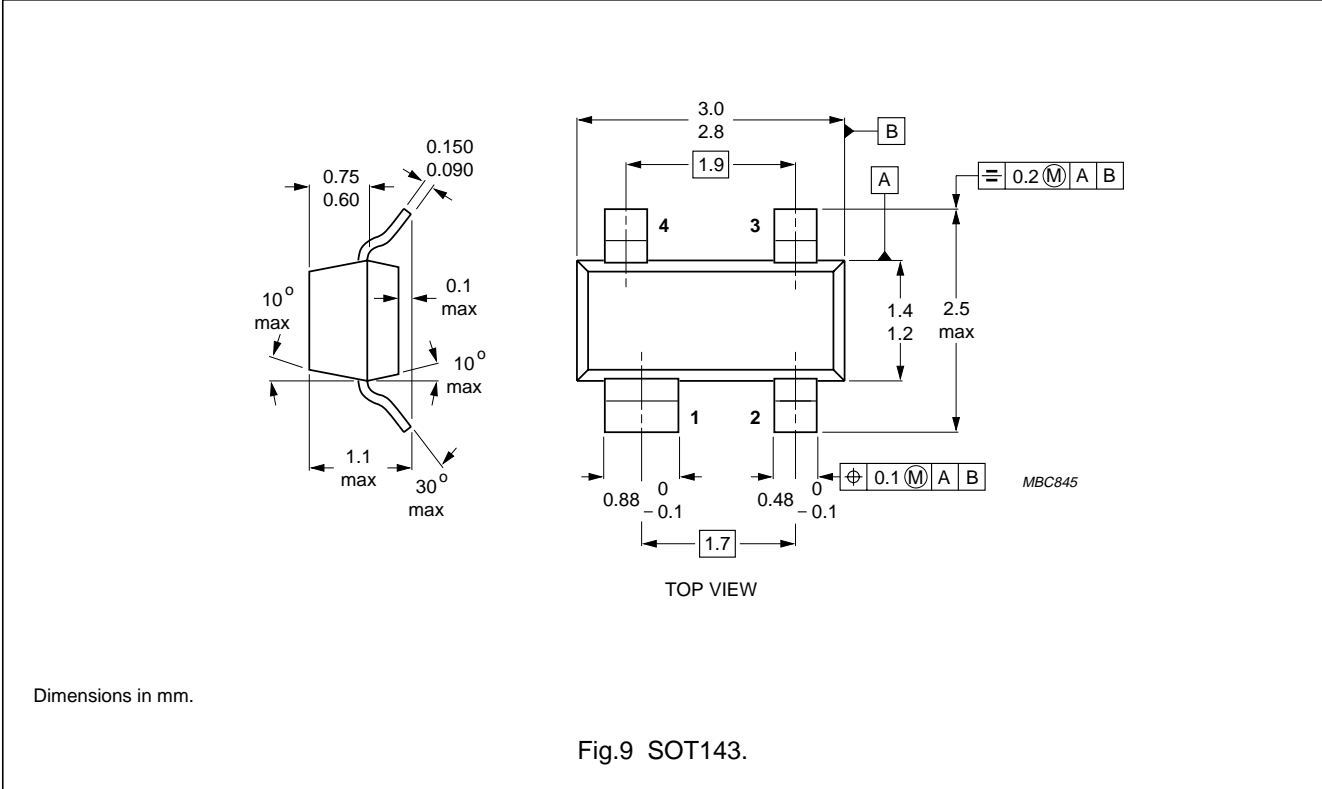
The components are situated on one side of the copper-clad PTFE microfibre-glass board, the other side is not etched and serves as a ground plane. Earth connections from the component side to the ground plane are made by through metallization.

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

NPN 2 GHz RF power transistor

BFG10; BFG10/X

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|-----------------------------------|-------------------------------|---|
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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 |
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