

NPN 2 GHz RF power transistor

BLT11

FEATURES

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

APPLICATIONS

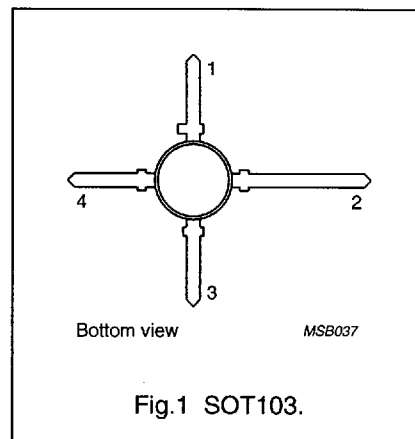
- Common emitter class-AB operation in hand-held radio equipment at 1.9 GHz.

DESCRIPTION

NPN silicon planar epitaxial transistor encapsulated in a 4-pin dual-emitter SOT103 plastic package.

PINNING

PIN	DESCRIPTION
1	emitter
2	collector
3	emitter
4	base



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 : 2	1.9	6	600	≥ 6	≥ 50

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	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)		—	500	mA
$I_{C(AV)}$	average collector current		—	500	mA
P_{tot}	total power dissipation	up to $T_s = 60\text{ }^{\circ}\text{C}$; note 1; see Fig.2	—	1.75	W
T_{stg}	storage temperature		-65	+150	$^{\circ}\text{C}$
T_j	junction temperature		—	175	$^{\circ}\text{C}$

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; $P_{tot} = 1.75\ \text{W}$	65	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; $I_C = 0.1\ \text{mA}$; $I_E = 0$	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	μA
h_{FE}	DC current gain	$I_C = 300\ \text{mA}$; $V_{CE} = 5\ \text{V}$	25	—	
C_c	collector capacitance	$I_E = I_e = 0$; $V_{CB} = 6\ \text{V}$; $f = 1\ \text{MHz}$	—	4	pF
C_{re}	feedback capacitance	$I_C = 0$; $V_{CE} = 6\ \text{V}$; $f = 1\ \text{MHz}$	—	3	pF

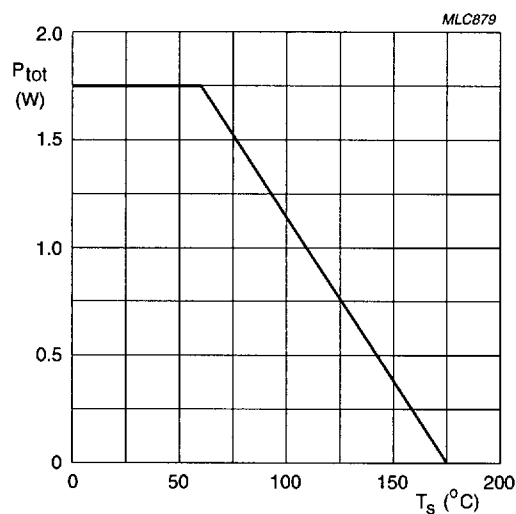
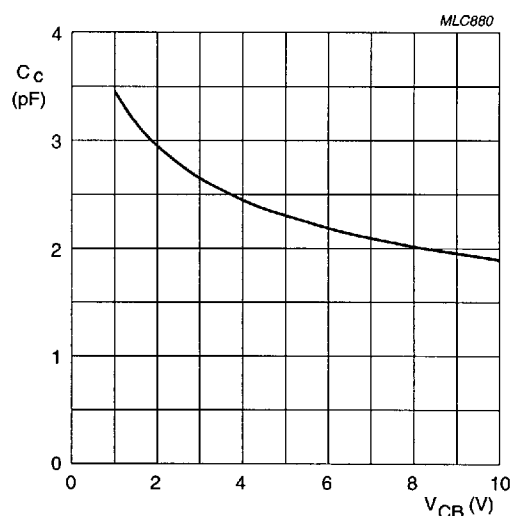


Fig.2 Power derating curve.



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

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

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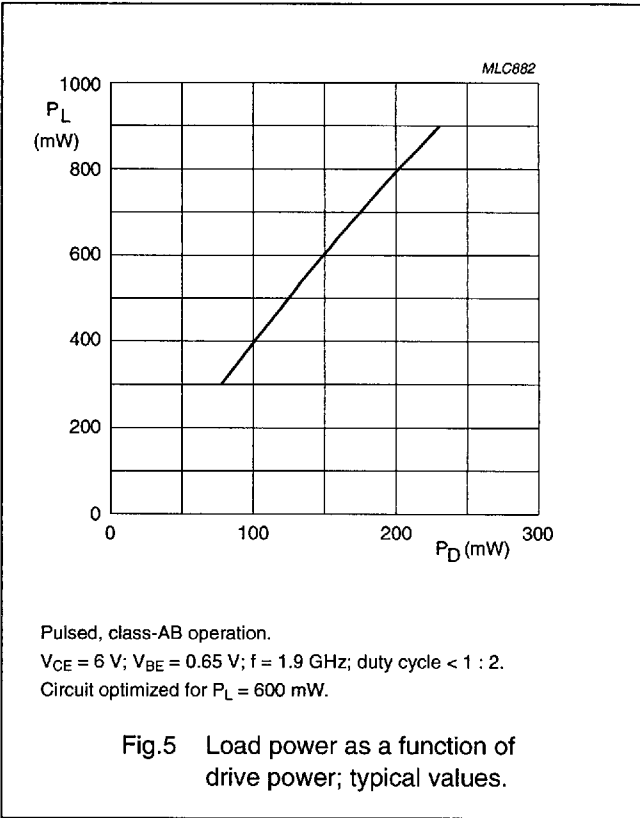
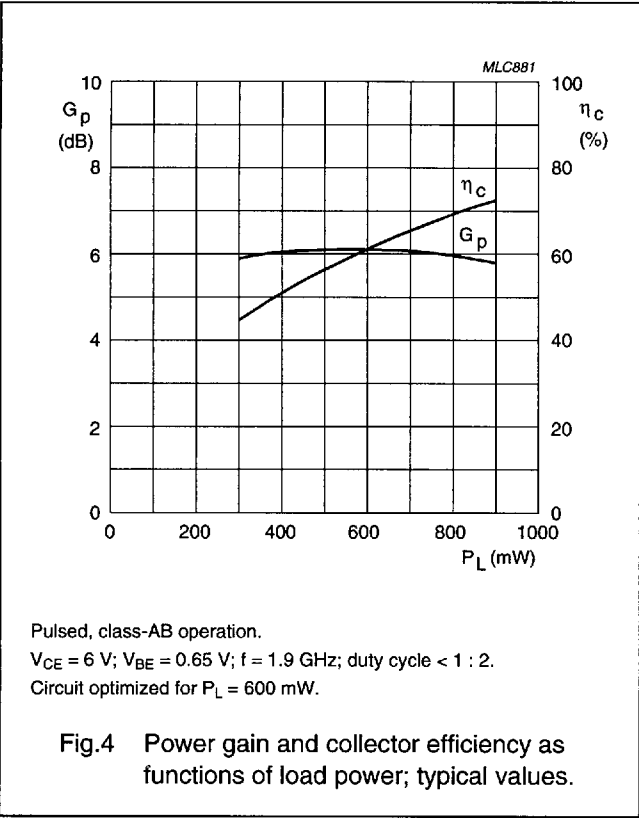
APPLICATION INFORMATION

RF performance at $T_{\text{amb}} = 25\text{ }^{\circ}\text{C}$ 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 : 2	1.9	6	1	600	≥6 typ. 6.5	≥50 typ. 60

Ruggedness in class-AB operation

The BLT11 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, $f = 1.9\text{ GHz}$ and a duty cycle of 1 : 2.



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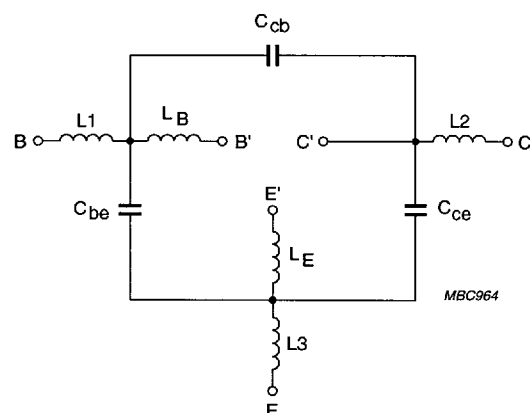
SPICE parameters for the BLT11 crystal

SEQUENCE No.	PARAMETER	VALUE	UNIT
1	IS	3.338	fA
2	BF	97.14	—
3	NF	0.988	—
4	VA	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	μ A
16	RBM	1.740	Ω
17	RE	59.65	m Ω
18	RC	0.124	Ω
19 ⁽¹⁾	XTB	0.000	—
20 ⁽¹⁾	EG	1.110	eV
21 ⁽¹⁾	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 ⁽¹⁾	TR	0.000	ns
35 ⁽¹⁾	CJS	0.000	F

SEQUENCE No.	PARAMETER	VALUE	UNIT
36 ⁽¹⁾	VJS	750.0	mV
37 ⁽¹⁾	MJS	0.000	—
38	FC	0.742	—

Note

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



$$Q_{LB} = 50; Q_{LE} = 50; Q_{LB,E}(f) = Q_{LB,E} \sqrt{f/f_c};$$

$$f_c = \text{scaling frequency} = 1 \text{ GHz.}$$

Fig.6 Package equivalent circuit SOT103.

List of components (see Fig.6)

DESIGNATION	VALUE	UNIT
C _{be}	241	fF
C _{cb}	12	fF
C _{ce}	238	fF
L1	0.64	nH
L2	0.57	nH
L3	0.40	nH
L _B	0.40	nH
L _E	0.05	nH

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Test circuit information

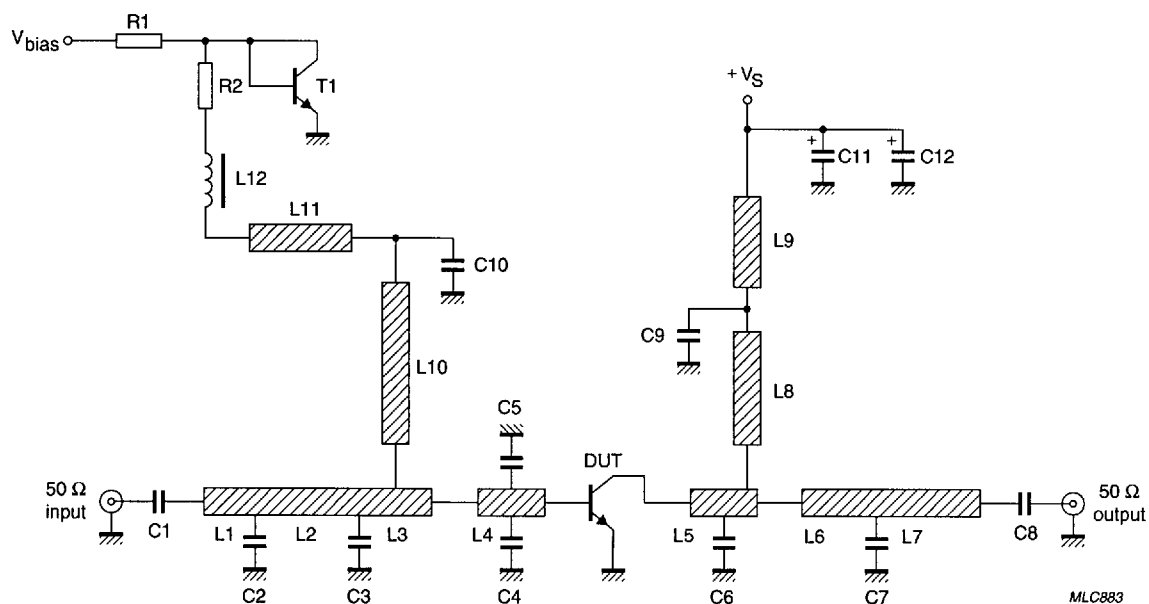


Fig.7 Common-emitter test circuit for class-AB operation at 1900 MHz.

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

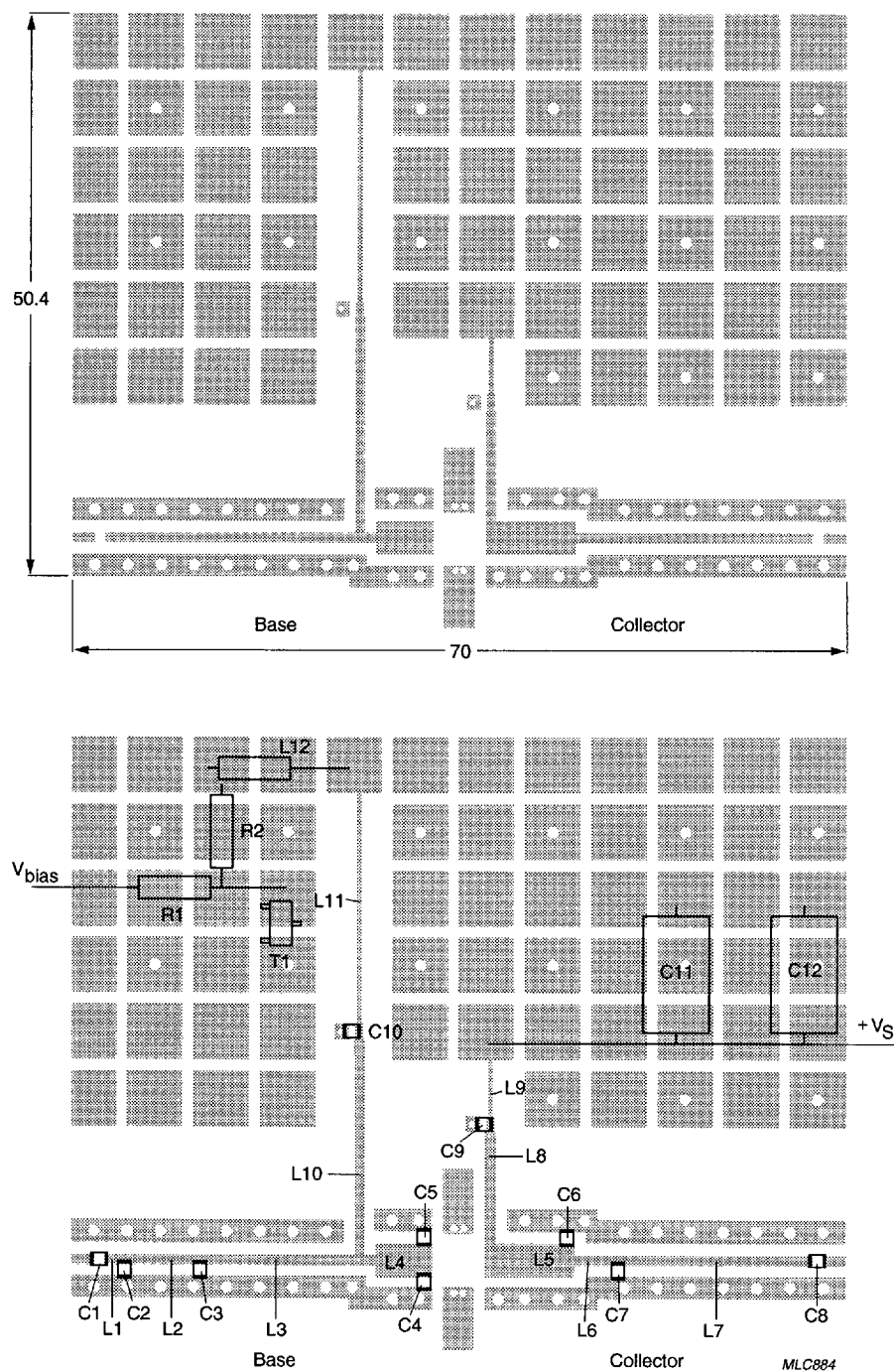
COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE No.
C1, C8, C9, C10	multilayer ceramic chip capacitor; note 1	24 pF		
C2	multilayer ceramic chip capacitor; note 1	0.6 pF		
C3, C5	multilayer ceramic chip capacitor; note 1	0.4 pF		
C4	multilayer ceramic chip capacitor; note 1	0.7 pF		
C6, C7	multilayer ceramic chip capacitor; note 1	0.5 pF		
C11, C12	electrolytic capacitor	1500 μ F; 10 V		2222 032 15152
L1	stripline; note 2		length 2.3 mm width 0.93 mm	
L2	stripline; note 2		length 6.8 mm width 0.93 mm	
L3	stripline; note 2		length 15.9 mm width 0.93 mm	
L4	stripline; note 2		length 4.4 mm width 3 mm	
L5	stripline; note 2		length 7.5 mm width 3 mm	
L6	stripline; note 2		length 4 mm width 0.93 mm	
L7	stripline; note 2		length 17.3 mm width 0.93 mm	
L8	stripline; note 2		length 10 mm width 0.93 mm	
L9	stripline; note 2		length 5 mm width 0.4 mm	
L10	stripline; note 2		length 19.3 mm width 0.93 mm	
L11	stripline; note 2		length 20.8 mm width 0.4 mm	
L12	micro choke			
T1	BD228			
R1	metal film resistor	20 Ω ; 0.4 W		2322 157 10209
R2	metal film resistor	500 Ω ; 0.4 W		2322 157 15001

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.

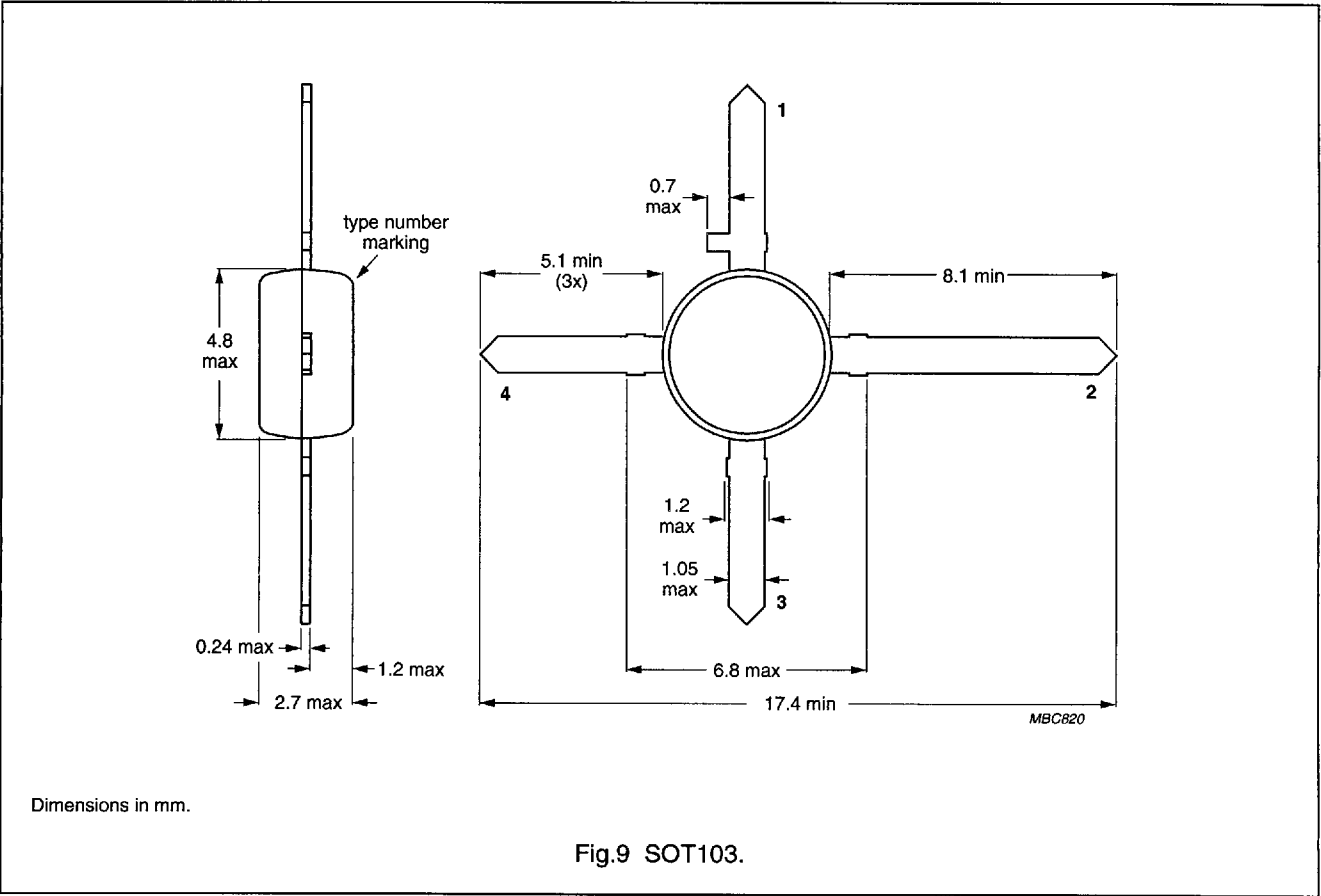
The components are situated on one side of the copper-clad PTFE microfiber-glass board, the other side is not etched and serves as a ground plane. Earth connections from the component side to the ground plane are made by through metallization.

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

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PACKAGE OUTLINE



DEFINITIONS

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.	

LIFE SUPPORT APPLICATIONS

These products are not designed for use in life support appliances, devices, or systems where malfunction of these products can reasonably be expected to result in personal injury. Philips customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Philips for any damages resulting from such improper use or sale.