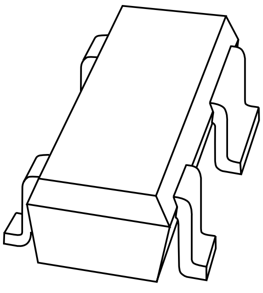
DATA SHEET



BFG480W
NPN wideband transistor

Product specification
Supersedes data of 1998 Jul 09

1998 Oct 21

Philips
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NPN wideband transistor | BFG480W

FEATURES

- High power gain
- High efficiency
- Low noise figure
- High transition frequency
- Emitter is thermal lead
- Low feedback capacitance
- Linear and non-linear operation.

APPLICATIONS

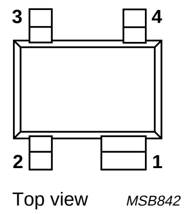
- RF front end with high linearity system demands (CDMA)
- Common emitter class AB driver.

DESCRIPTION

NPN double polysilicon wideband transistor with buried layer for low voltage applications in a 4-pin dual-emitter SOT343R plastic package.

PINNING

PIN	DESCRIPTION
1	emitter
2	base
3	emitter
4	collector



Marking code: P6.

Fig.1 Simplified outline SOT343R.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CEO}	collector-emitter voltage	open base	–	4.5	V
I_C	collector current (DC)		80	250	mA
P_{tot}	total power dissipation	$T_s \leq 60$ °C	–	360	mW
f_T	transition frequency	I_C = 80 mA; V_{CE} = 2 V; f = 2 GHz; T_{amb} = 25 °C	21	–	GHz
G_{max}	maximum gain	I_C = 80 mA; V_{CE} = 2 V; f = 2 GHz; T_{amb} = 25 °C	16	–	dB
F	noise figure	I_C = 8 mA; V_{CE} = 2 V; f = 2 GHz; $\Gamma_S = \Gamma_{opt}$	1.8	–	dB
G_p	power gain	Pulsed; class-AB; δ < 1 : 2; t_p = 5 ms; V_{CE} = 3.6 V; f = 2 GHz; P_L = 100 mW	13.5	–	dB
η_C	collector efficiency	Pulsed; class-AB; δ < 1 : 2; t_p = 5 ms; V_{CE} = 3.6 V; f = 2 GHz; P_L = 100 mW	45	–	%

CAUTION
This product is supplied in anti-static packing to prevent damage caused by electrostatic discharge during transport and handling. For further information, refer to Philips specs.: SNW-EQ-608, SNW-FQ-302A, and SNW-FQ-302B.

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	–	14.5	V
V_{CEO}	collector-emitter voltage	open base	–	4.5	V
V_{EBO}	emitter-base voltage	open collector	–	1	V
I_C	collector current (DC)		–	250	mA
P_{tot}	total power dissipation	$T_s \leq 60$ °C; note 1; see Fig.2	–	360	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	operating junction temperature		–	150	°C

Note

1. T_s is the temperature at the soldering point of the emitter pins.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	VALUE	UNIT
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	250	K/W

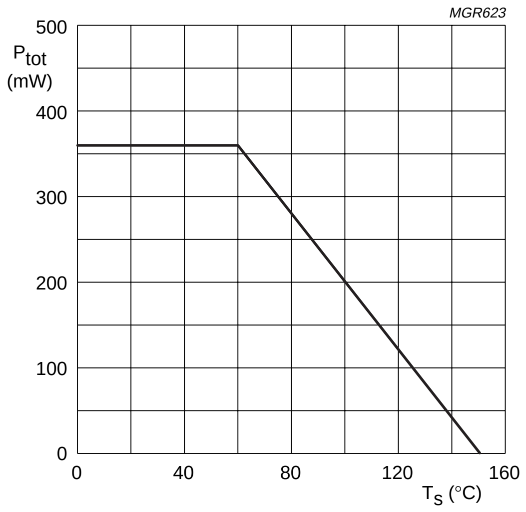


Fig.2 Power derating curve.

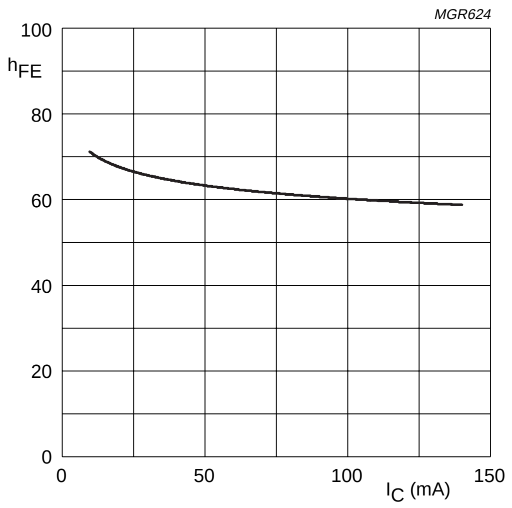
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	I_C = 50 μA; I_E = 0	14.5	–	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	I_C = 5 mA; I_B = 0	4.5	–	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	I_E = 100 μA; I_C = 0	1	–	–	V
I_{CBO}	collector-base leakage current	V_{CE} = 5 V; V_{BE} = 0	–	–	70	nA
h_{FE}	DC current gain	I_C = 80 mA; V_{CE} = 2 V; see Fig.3	40	60	100	
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 2 V; f = 1 MHz	–	1.4	–	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = 0.5 V; f = 1 MHz	–	2.2	–	pF
C_{re}	feedback capacitance	I_C = 0; V_{CB} = 2 V; f = 1 MHz; see Fig.4	–	340	–	fF
f_T	transition frequency	I_C = 80 mA; V_{CE} = 2 V; f = 2 GHz; T_{amb} = 25 °C; see Fig.5	–	21	–	GHz
G_{max}	maximum power gain; note 1	I_C = 80 mA; V_{CE} = 2 V; f = 2 GHz; T_{amb} = 25 °C; see Figs 7 and 8	–	16	–	dB
$\|S_{21}\|^2$	insertion power gain	I_C = 80 mA; V_{CE} = 2 V; f = 2 GHz; T_{amb} = 25 °C; see Fig.8	–	12	–	dB
F	noise figure	I_C = 8 mA; V_{CE} = 2 V; f = 900 MHz; $\Gamma_S = \Gamma_{opt}$; see Fig.13	–	1.2	–	dB
		I_C = 8 mA; V_{CE} = 2 V; f = 2 GHz; $\Gamma_S = \Gamma_{opt}$; see Fig.13	–	1.8	–	dB
P_{L1}	output power at 1 dB gain compression	Class-AB; δ < 1 : 2; t_p = 5 ms; V_{CE} = 3.6 V; I_{CQ} = 1 mA; f = 2 GHz	–	20	–	dBm
ITO	third order intercept point	I_C = 80 mA; V_{CE} = 2 V; f = 2 GHz; $Z_S = Z_{S\ opt}$; $Z_L = Z_{L\ opt}$; note 2	–	28	–	dBm

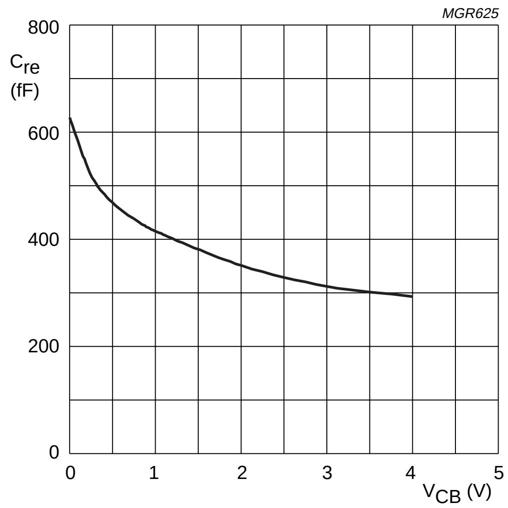
Notes

1. G_{max} is the maximum power gain, if K > 1. If K < 1 then G_{max} = MSG; see Figs 6, 7 and 8.
2. Z_S is optimized for noise; Z_L is optimized for gain.



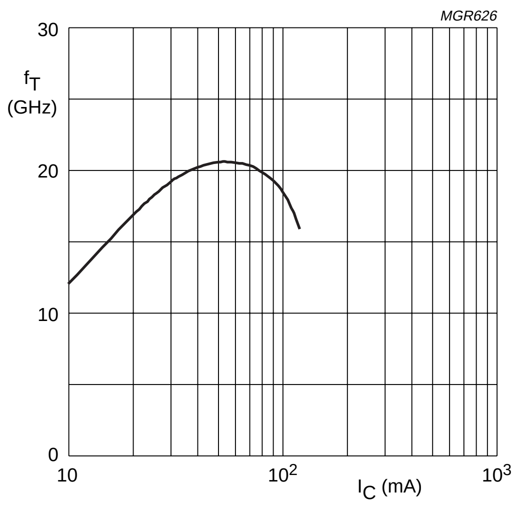
V_{CE} = 2 V.

Fig.3 DC current gain as a function of collector current; typical values.



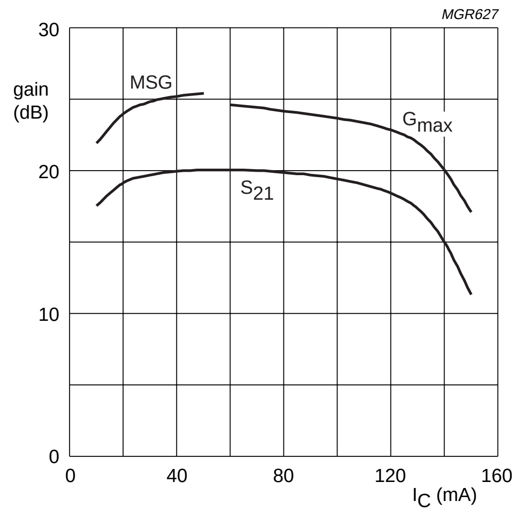
I_C = 0; f = 1 MHz.

Fig.4 Feedback capacitance as a function of collector-base voltage; typical values.



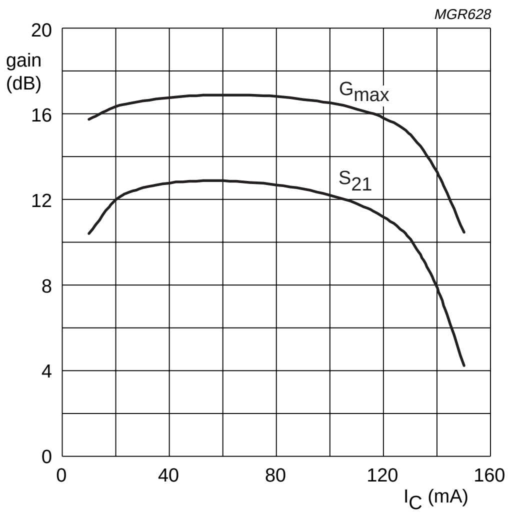
f = 2 GHz; V_{CE} = 2 V; T_{amb} = 25 °C.

Fig.5 Transition frequency as a function of collector current; typical values.



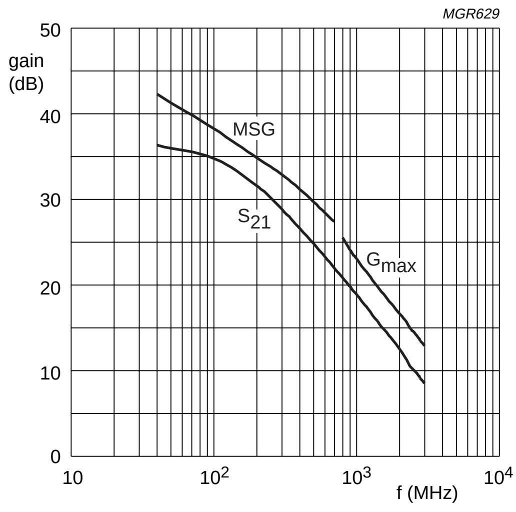
f = 900 MHz; V_{CE} = 2 V.

Fig.6 Gain as a function of collector current; typical values.



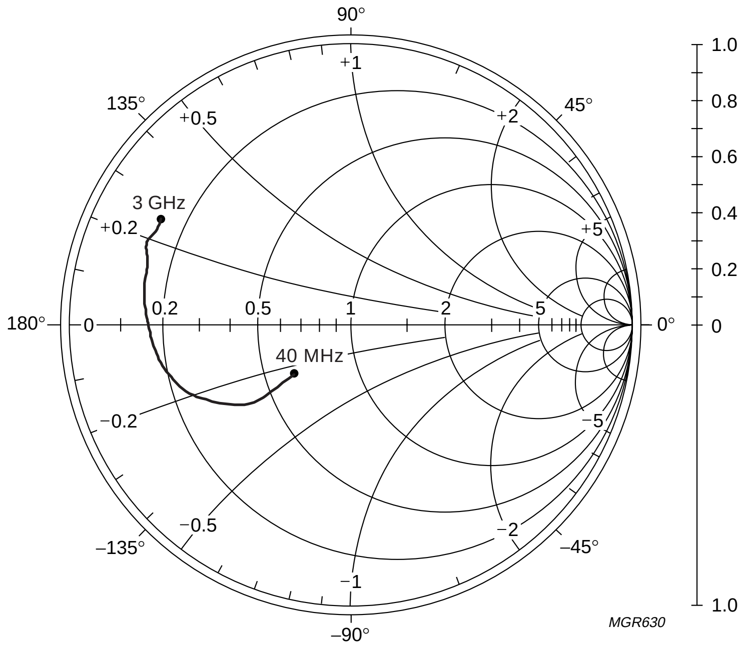
V_{CE} = 2 V; f = 2 GHz.

Fig.7 Gain as a function of collector current; typical values.



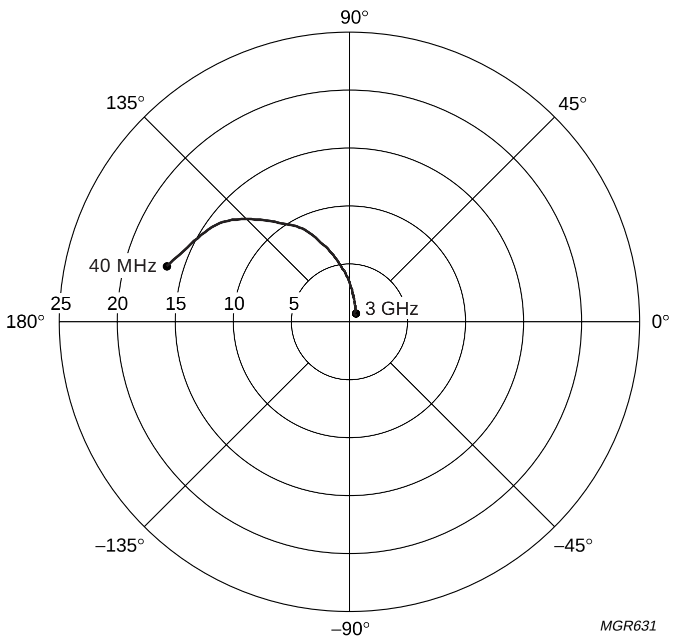
I_C = 80 mA; V_{CE} = 2 V.

Fig.8 Gain as a function of frequency; typical values.



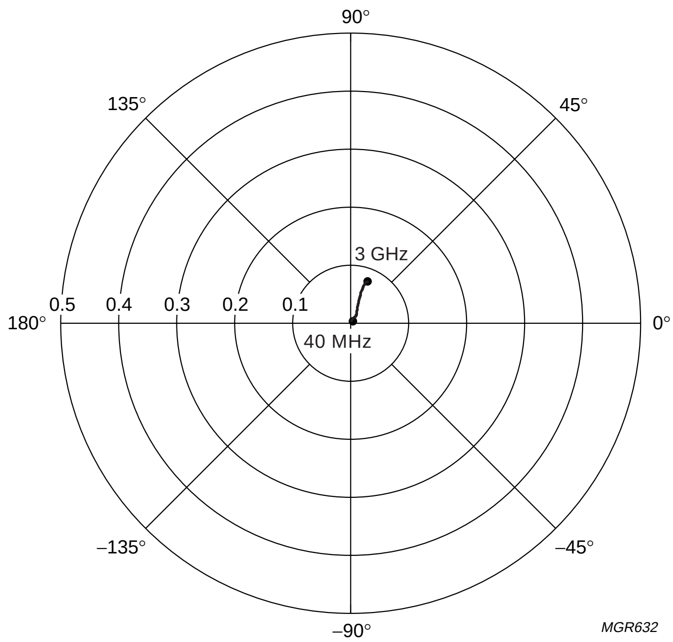
I_C = 80 mA; V_{CE} = 2 V; Z_o = 50 Ω.

Fig.9 Common emitter input reflection coefficient (S_{11}); typical values.



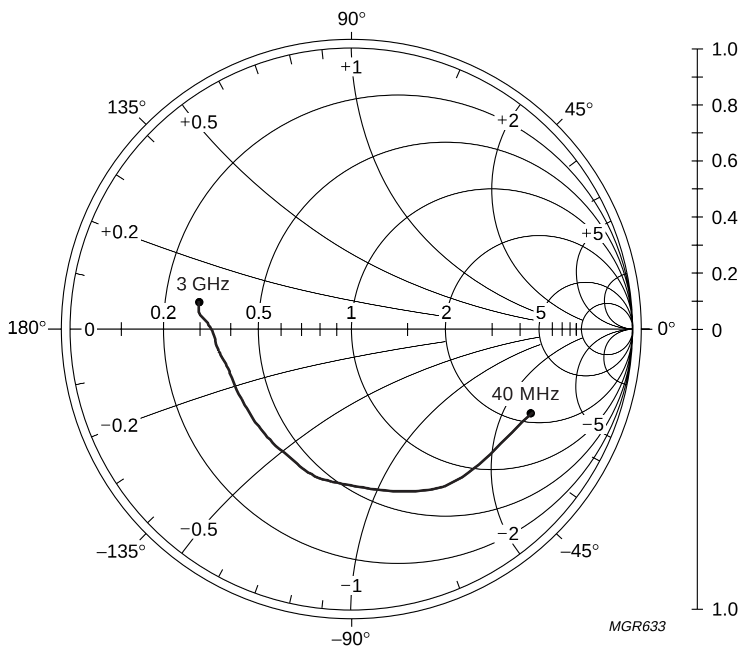
I_C = 80 mA; V_{CE} = 2 V.

Fig.10 Common emitter forward transmission coefficient (S_{21}); typical values.



I_C = 80 mA; V_{CE} = 2 V.

Fig.11 Common emitter reverse transmission coefficient (S_{12}); typical values.



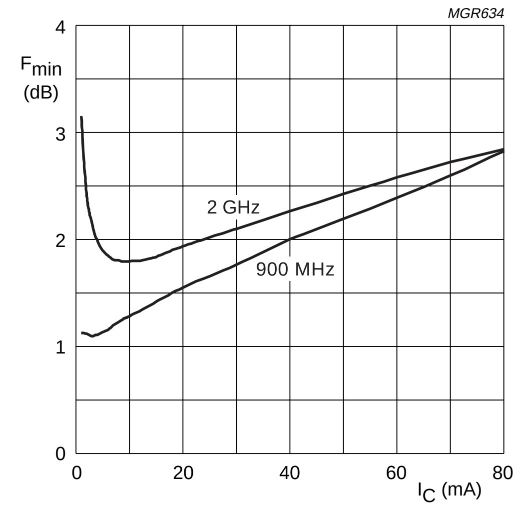
I_C = 80 mA; V_{CE} = 2 V; Z_o = 50 Ω.

Fig.12 Common emitter output reflection coefficient (S_{22}); typical values.

Noise data

V_{CE} = 2 V; typical values.

f (MHz)	I_C (mA)	F_{min} (dB)	Γ_{mag}	Γ_{angle}	r_n (Ω)
900	2	1.1	0.41	96.1	0.21
	4	1.1	0.31	106.6	0.14
	6	1.2	0.27	118.4	0.12
	8	1.2	0.26	131.7	0.10
	10	1.3	0.28	143.2	0.10
	20	1.6	0.39	166.2	0.07
	40	2.0	0.49	176.0	0.07
	60	2.3	0.57	179.5	0.07
	80	2.9	0.45	177.3	0.18
2000	2	2.4	0.57	171.9	0.09
	4	2.0	0.49	178.9	0.08
	6	1.8	0.46	–175.7	0.09
	8	1.8	0.44	–171.7	0.09
	10	1.8	0.43	–168.4	0.09
	12	1.8	0.44	–165.3	0.10
	14	1.8	0.44	–163.7	0.10
	20	1.9	0.46	–158.3	0.11
	40	2.3	0.52	–150.2	0.14
	60	2.6	0.56	–147.7	0.18
	80	2.8	0.60	–146.1	0.22



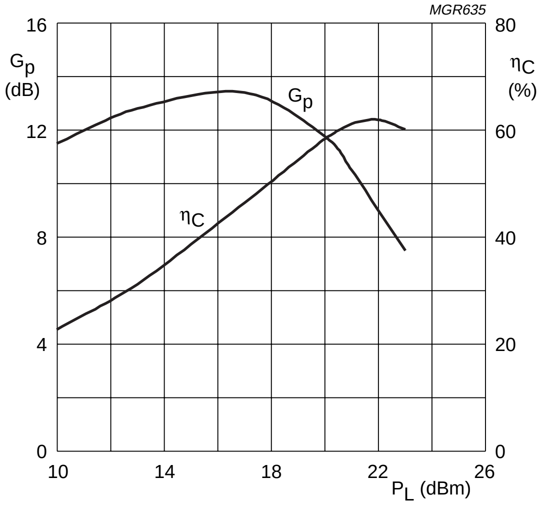
V_{CE} = 2 V.

Fig.13 Minimum noise figure as a function of collector current; typical values.

APPLICATION INFORMATION

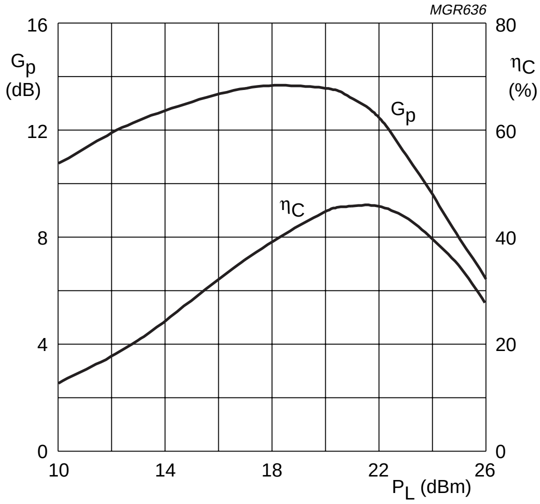
RF performance at $T_s \leq 60$ °C in a common emitter test circuit (see Figs 18 and 19).

MODE OF OPERATION	f (GHz)	V_{CE} (V)	I_{CQ} (mA)	P_L (mW)	G_p (dB)	η_C (%)
Pulsed; class-AB; δ < 1 : 2; t_p = 5 ms	2	3.6	1	100	typ. 13.5	typ. 45



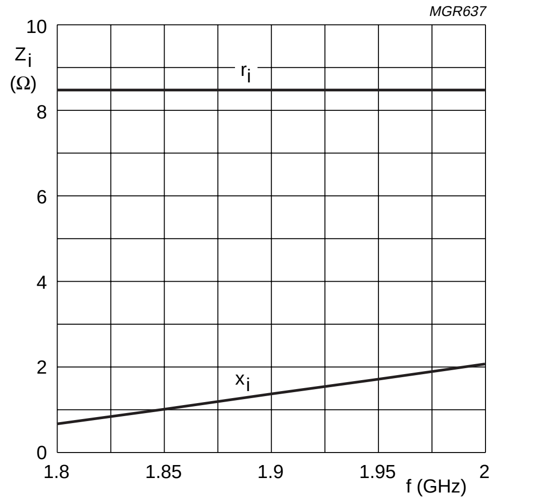
Pulsed, class-AB operation; δ < 1 ; 2; t_p = 5 ms.
f = 2 GHz; V_{CE} = 2.4 V; I_{CQ} = 1 mA; tuned at P_L = 100 mW.

Fig.14 Power gain and collector efficiency as a function of load power; typical values.



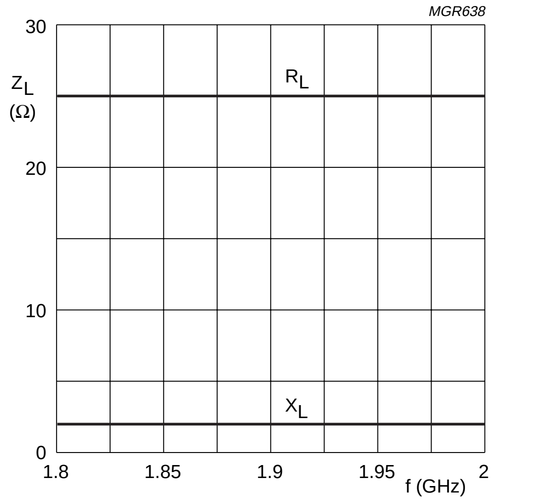
Pulsed, class-AB operation; δ < 1 ; 2; t_p = 5 ms.
f = 2 GHz; V_{CE} = 3.6 V; I_{CQ} = 1 mA; tuned at P_L = 100 mW.

Fig.15 Power gain and collector efficiency as a function of load power; typical values.



V_{CE} = 3.6 V; I_{CQ} = 1 mA; P_L = 100 mW; $T_s \leq 60$ °C.

Fig.16 Input impedance as function of frequency (series components); typical values.



V_{CE} = 3.6 V; I_{CQ} = 1 mA; P_L = 100 mW; $T_s \leq 60$ °C.

Fig.17 Load impedance as a function of frequency (series components); typical values.

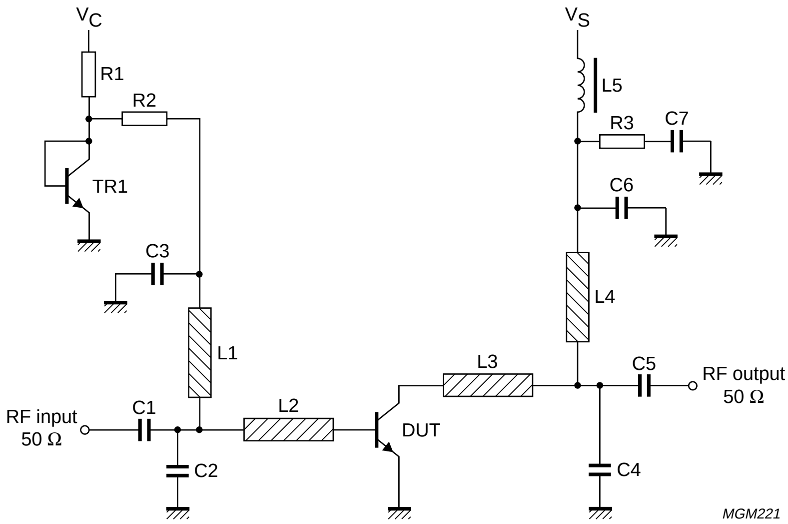


Fig.18 Common emitter test circuit for class-AB operation at 2 GHz.

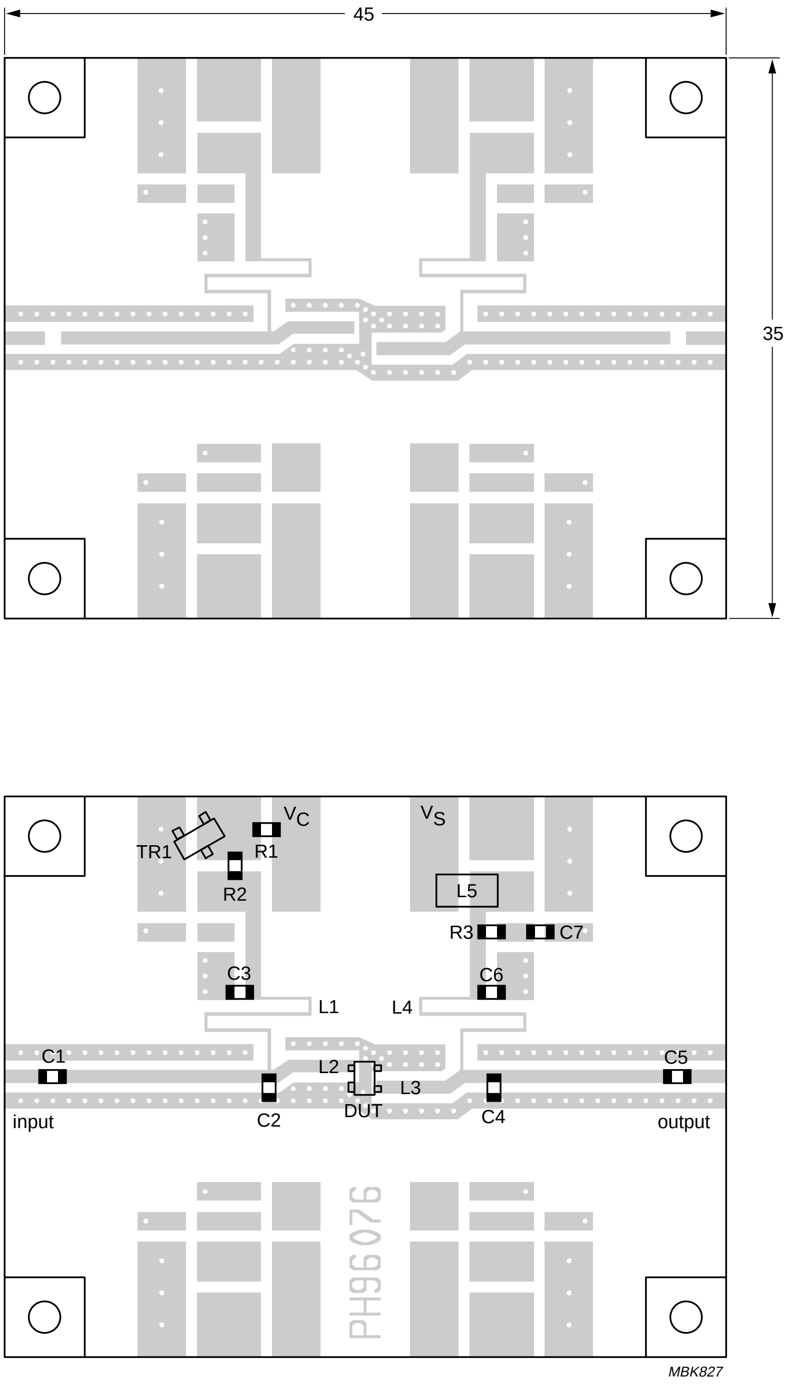
List of components used in test circuit (see Figs 18 and 19)

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE No.
C1, C5	multilayer ceramic chip capacitor; note 1	24 pF		
C2, C4	multilayer ceramic chip capacitor; note 1	2 pF		
C3, C6	multilayer ceramic chip capacitor, note 1	15 pF		
C7	multilayer ceramic chip capacitor; note 1	1 nF		
L1, L4	stripline; note 2	100 Ω	18 x 0.2 mm	
L2	stripline; note 2	50 Ω	5 x 0.8 mm	
L3	stripline; note 2	50 Ω	6 x 0.8 mm	
L5	Grade 4S2 Ferroxcube chip bead			4330 030 36300
R1	metal film resistor	220 Ω; 0.4 W		
R2, R3	metal film resistor	10 Ω; 0.4 W		
TR1	NPN transistor	BC817		9335 895 20215

Notes

1. American Technical Ceramics type 100A or capacitor of same quality.
2. The striplines are on a double copper-clad printed-circuit board with PTFE fibre-glass dielectric (ε_r = 6.15, tan δ = 0.0019); thickness 0.64 mm, copper cladding = 35 μm.

NPN wideband transistor BFG480W



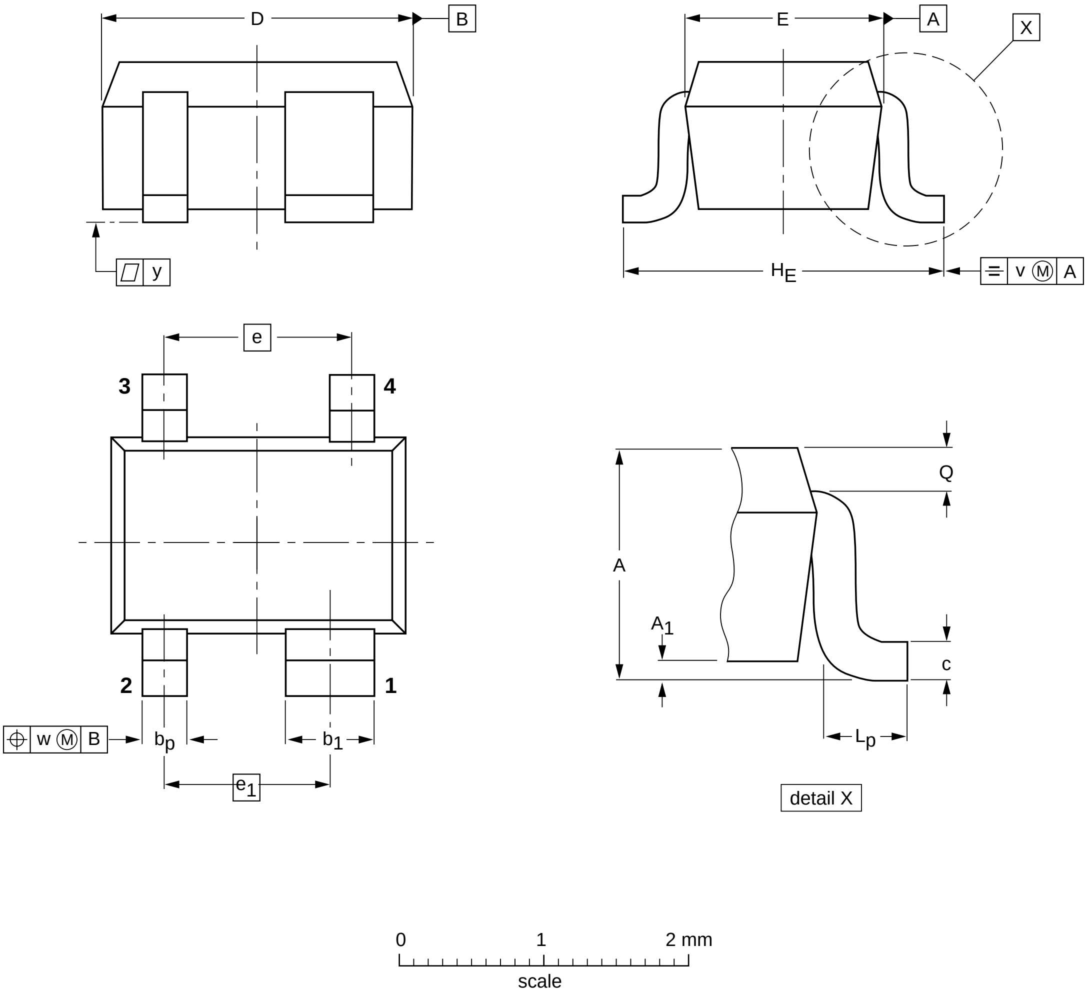
Dimensions in mm.

The components are situated on one side of the copper-clad PTFE fibre-glass board, the other side is unetched and serves as a ground plane. Earth connections from the component side to the ground plane are made by through metallization.

Fig.19 Printed-circuit board and component layout for 2 GHz class-AB test circuit in Fig.18.

PACKAGE OUTLINE

Plastic surface mounted package; reverse pinning; 4 leads **SOT343R**



DIMENSIONS (mm are the original dimensions)

UNIT	A	A_1 max	b_p	b_1	c	D	E	e	e_1	H_E	L_p	Q	v	w	y
mm	1.1 0.8	0.1	0.4 0.3	0.7 0.5	0.25 0.10	2.2 1.8	1.35 1.15	1.3	1.15	2.2 2.0	0.45 0.15	0.23 0.13	0.2	0.2	0.1

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT343R						97-05-21

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.

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