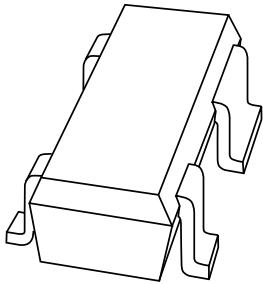


# DATA SHEET



## **BFG480W** NPN wideband transistor

Product specification  
Supersedes data of 1998 Jul 09

1998 Oct 21



# 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

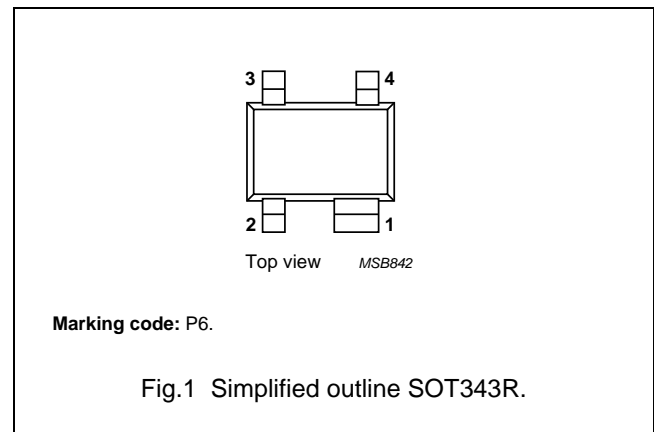
- RF front end with high linearity system demands (CDMA)
- Common emitter class AB driver.

## 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



## QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$V_{CE0}$	collector-emitter voltage	open base	–	4.5	V
$I_C$	collector current (DC)		80	250	mA
$P_{tot}$	total power dissipation	$T_s \leq 60\text{ }^\circ\text{C}$	–	360	mW
$f_T$	transition frequency	$I_C = 80\text{ mA}; V_{CE} = 2\text{ V}; f = 2\text{ GHz}; T_{amb} = 25\text{ }^\circ\text{C}$	21	–	GHz
$G_{max}$	maximum gain	$I_C = 80\text{ mA}; V_{CE} = 2\text{ V}; f = 2\text{ GHz}; T_{amb} = 25\text{ }^\circ\text{C}$	16	–	dB
F	noise figure	$I_C = 8\text{ mA}; V_{CE} = 2\text{ V}; f = 2\text{ GHz}; \Gamma_S = \Gamma_{opt}$	1.8	–	dB
$G_p$	power gain	Pulsed; class-AB; $\delta < 1 : 2$ ; $t_p = 5\text{ ms}$ ; $V_{CE} = 3.6\text{ V}; f = 2\text{ GHz}; P_L = 100\text{ mW}$	13.5	–	dB
$\eta_C$	collector efficiency	Pulsed; class-AB; $\delta < 1 : 2$ ; $t_p = 5\text{ ms}$ ; $V_{CE} = 3.6\text{ V}; f = 2\text{ GHz}; P_L = 100\text{ mW}$	45	–	%

## CAUTION

This product is supplied in anti-static packing to prevent damage caused by electrostatic discharge during transport and handling.

NPN wideband transistor

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**LIMITING VALUES**

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V <sub>CBO</sub>	collector-base voltage	open emitter	–	14.5	V
V <sub>CEO</sub>	collector-emitter voltage	open base	–	4.5	V
V <sub>EBO</sub>	emitter-base voltage	open collector	–	1	V
I <sub>C</sub>	collector current (DC)		–	250	mA
P <sub>tot</sub>	total power dissipation	T <sub>s</sub> ≤ 60 °C; note 1; see Fig.2	–	360	mW
T <sub>stg</sub>	storage temperature		–65	+150	°C
T <sub>j</sub>	operating junction temperature		–	150	°C

**Note**

1. T<sub>s</sub> is the temperature at the soldering point of the emitter pins.

**THERMAL CHARACTERISTICS**

SYMBOL	PARAMETER	VALUE	UNIT
R <sub>th j-s</sub>	thermal resistance from junction to soldering point	250	K/W

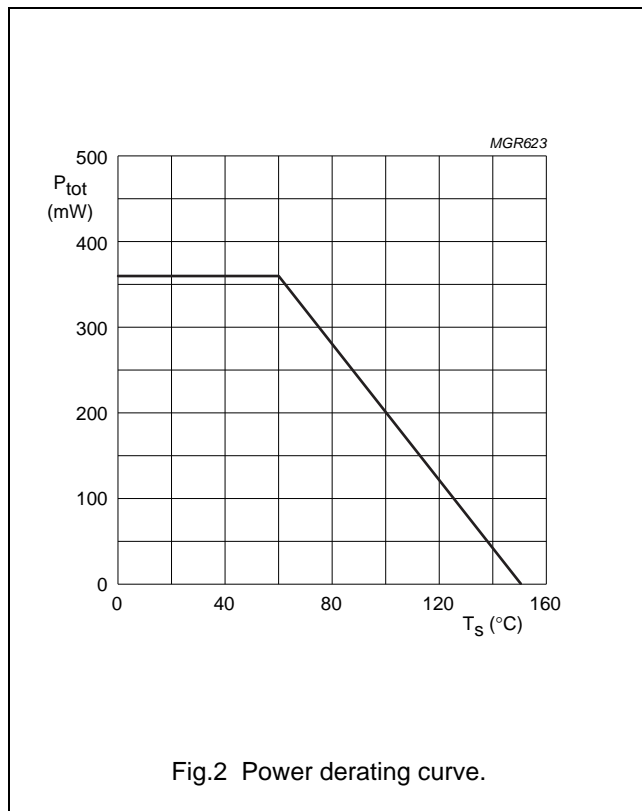


Fig.2 Power derating curve.

## NPN wideband transistor

## BFG480W

## CHARACTERISTICS

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

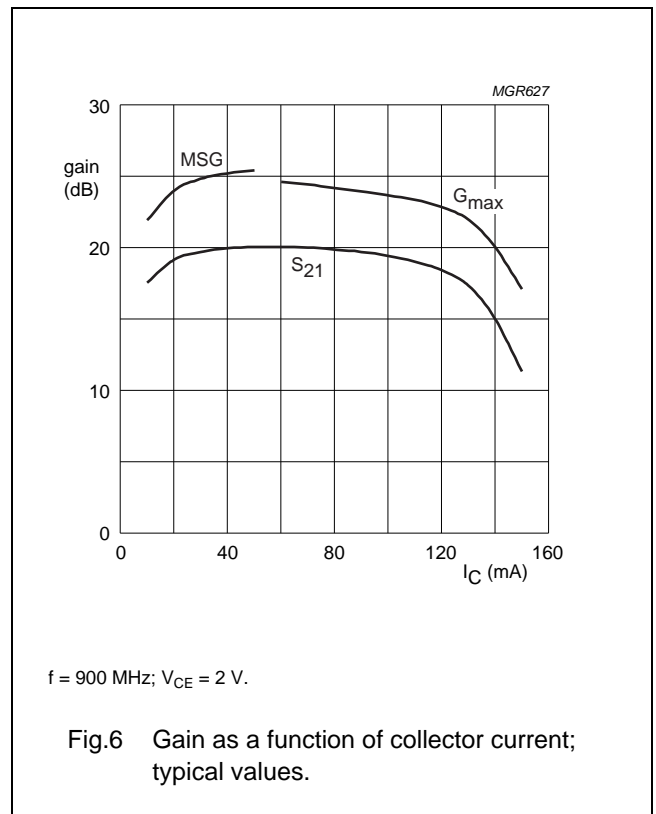
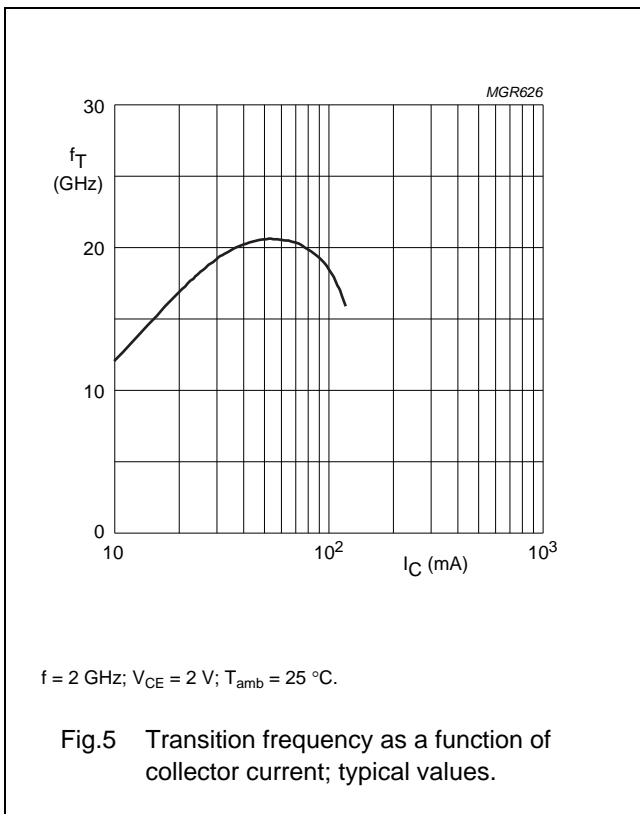
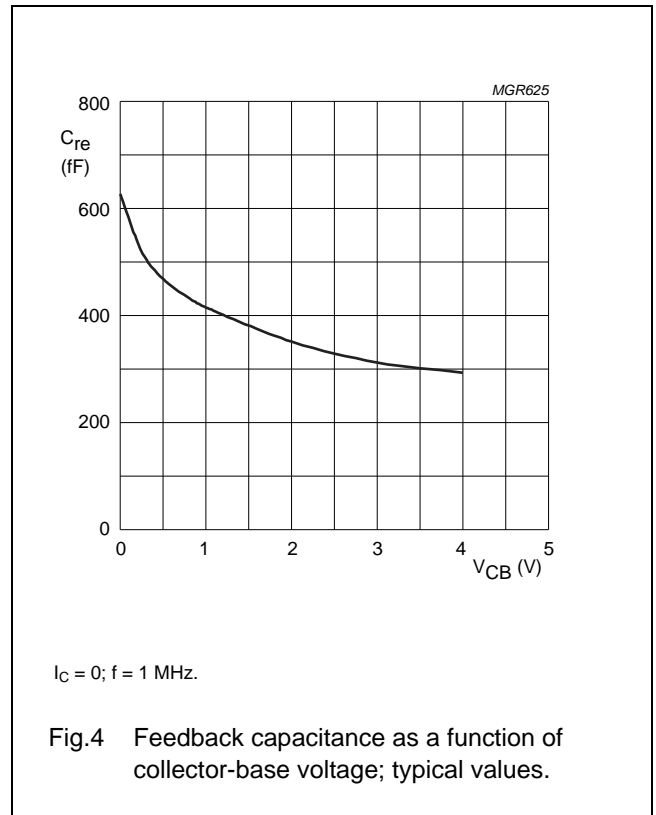
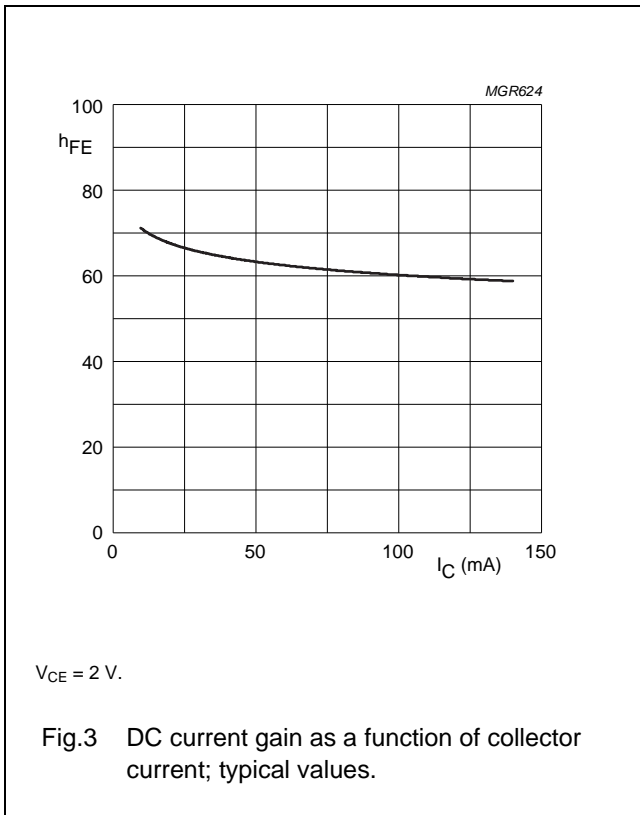
SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	$I_C = 50\ \mu\text{A}; I_E = 0$	14.5	–	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	$I_C = 5\ \text{mA}; I_B = 0$	4.5	–	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	$I_E = 100\ \mu\text{A}; I_C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

## Notes

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

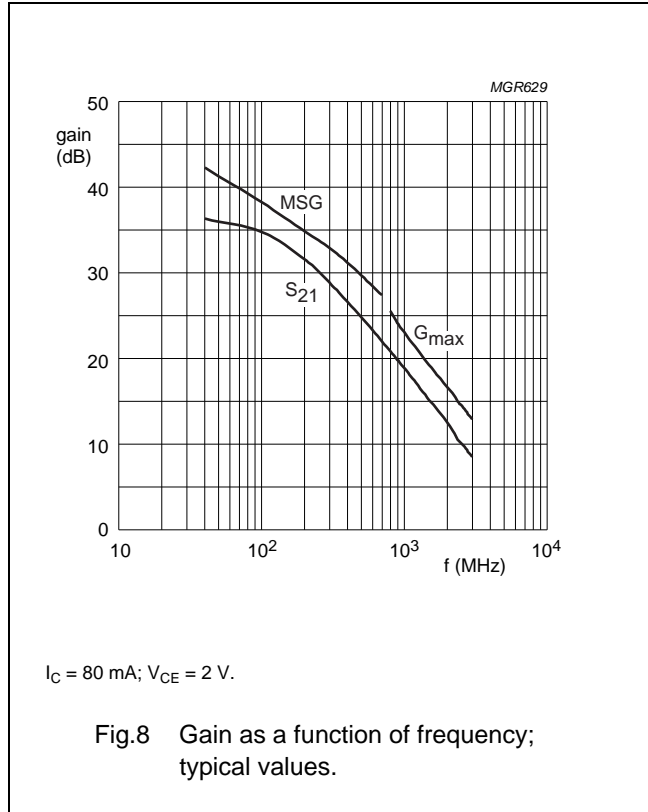
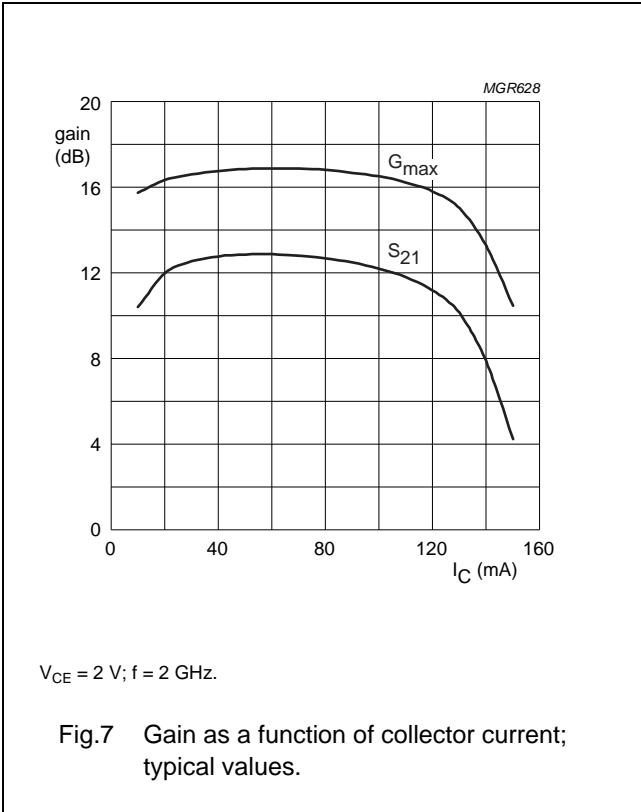
NPN wideband transistor

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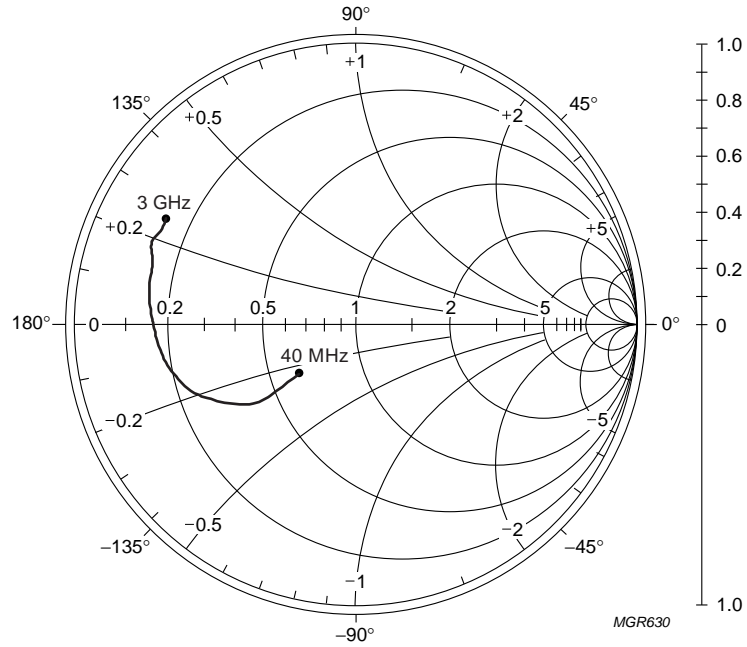
NPN wideband transistor

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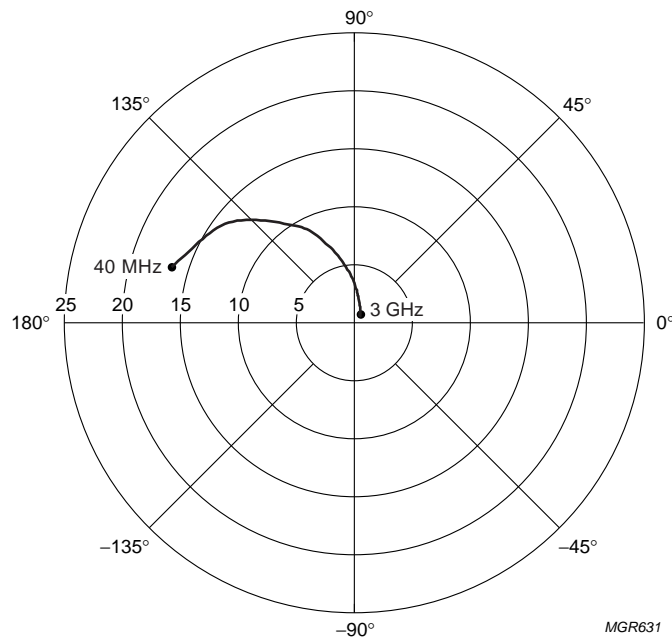
NPN wideband transistor

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$I_C = 80 \text{ mA}$ ;  $V_{CE} = 2 \text{ V}$ ;  $Z_0 = 50 \Omega$ .

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

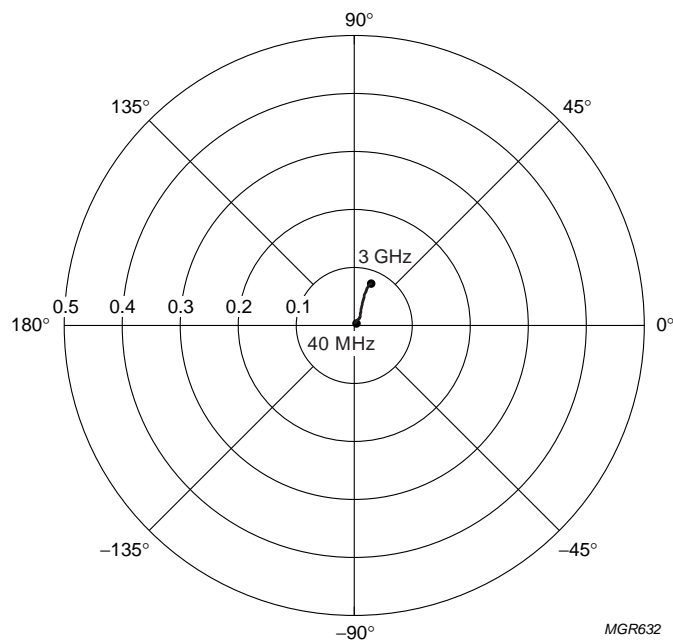


$I_C = 80 \text{ mA}$ ;  $V_{CE} = 2 \text{ V}$ .

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

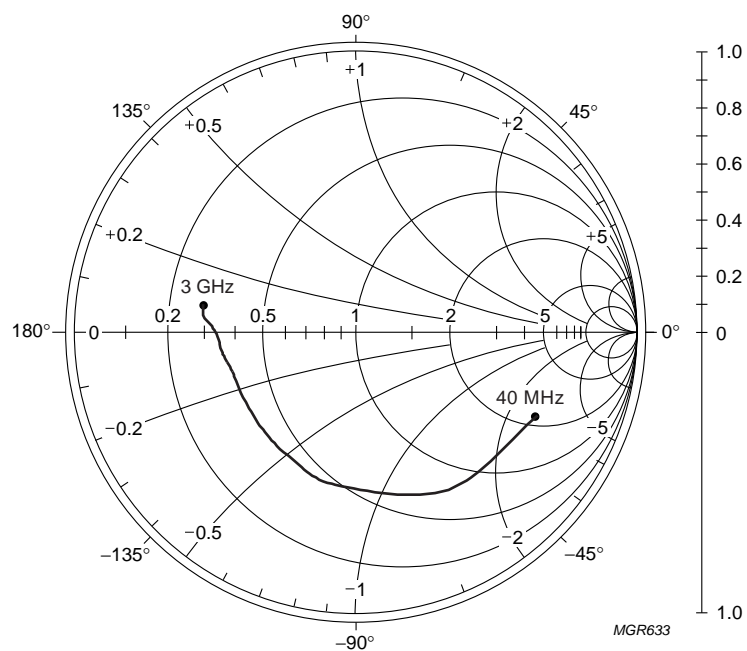
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$I_C = 80 \text{ mA}; V_{CE} = 2 \text{ V}.$

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



$I_C = 80 \text{ mA}; V_{CE} = 2 \text{ V}; Z_0 = 50 \Omega.$

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

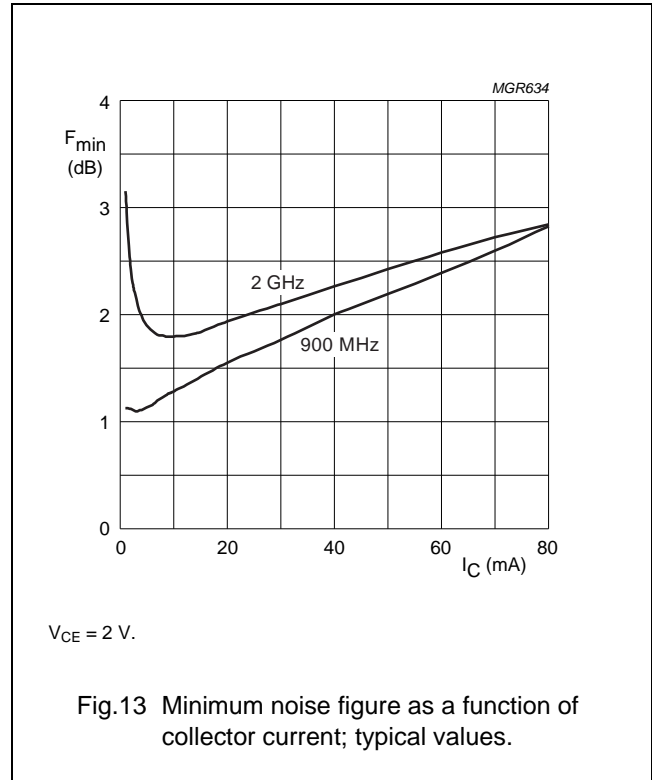
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Noise data

$V_{CE} = 2\text{ V}$ ; typical values.

f (MHz)	I <sub>C</sub> (mA)	F <sub>min</sub> (dB)	Γ <sub>mag</sub>	Γ <sub>angle</sub>	r <sub>n</sub> (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
2000	80	2.9	0.45	177.3	0.18
	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



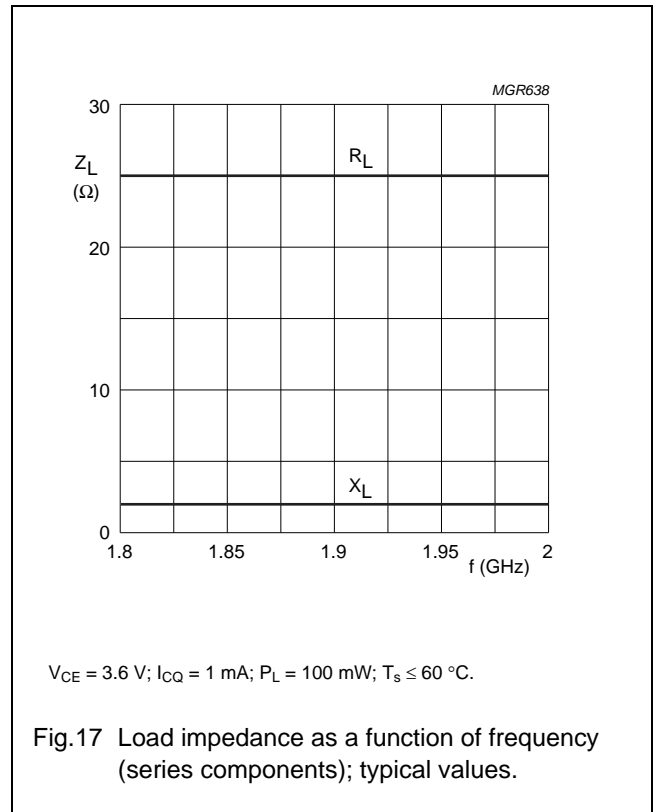
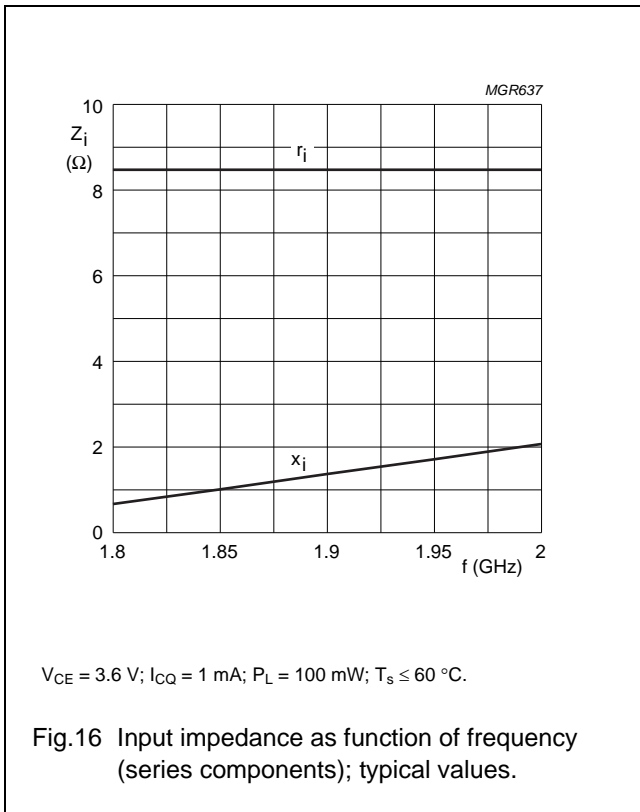
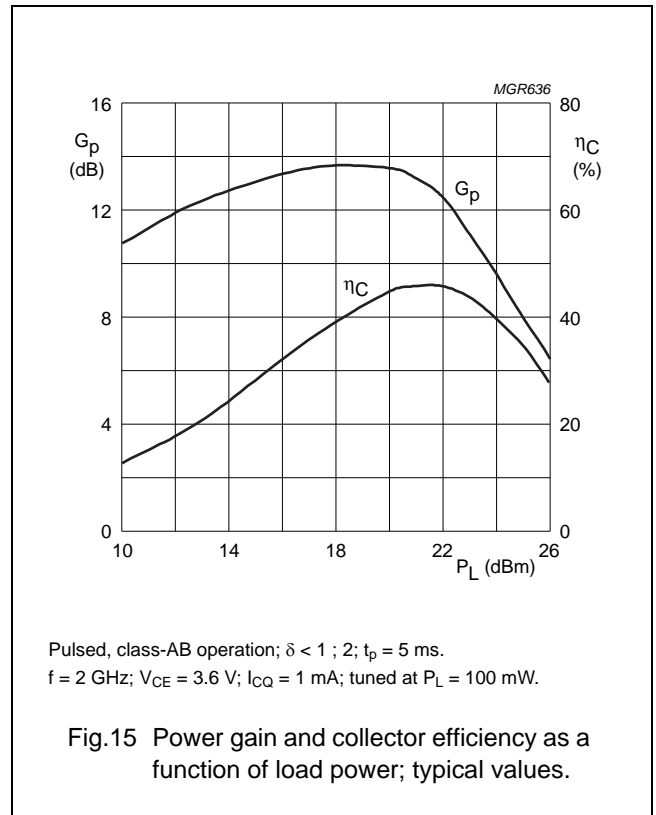
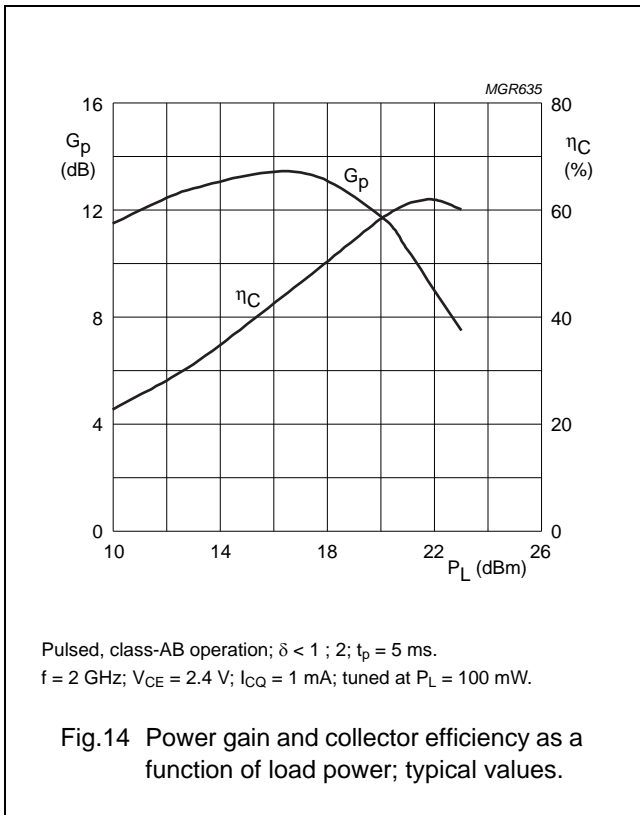
APPLICATION INFORMATION

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

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)	η <sub>c</sub> (%)
Pulsed; class-AB; δ < 1 : 2; t <sub>p</sub> = 5 ms	2	3.6	1	100	typ. 13.5	typ. 45

NPN wideband transistor

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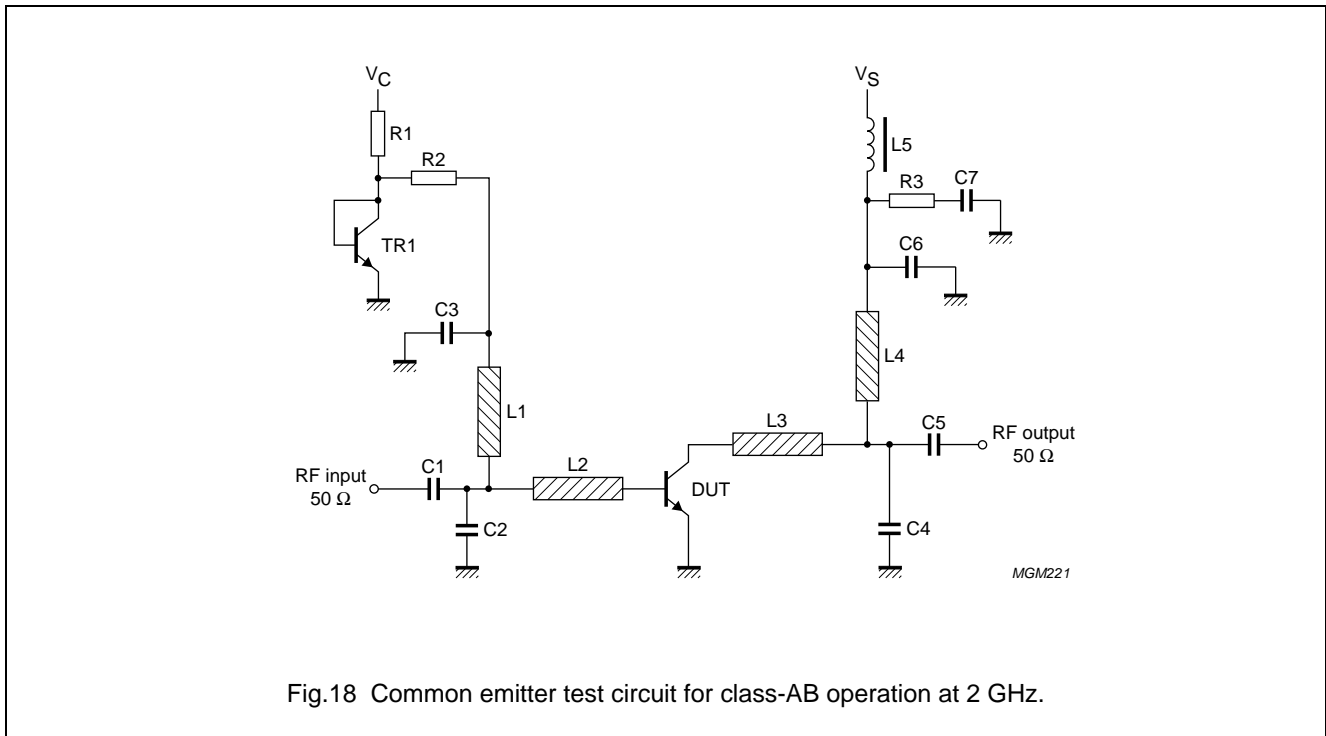


Fig.18 Common emitter test circuit for class-AB operation at 2 GHz.

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

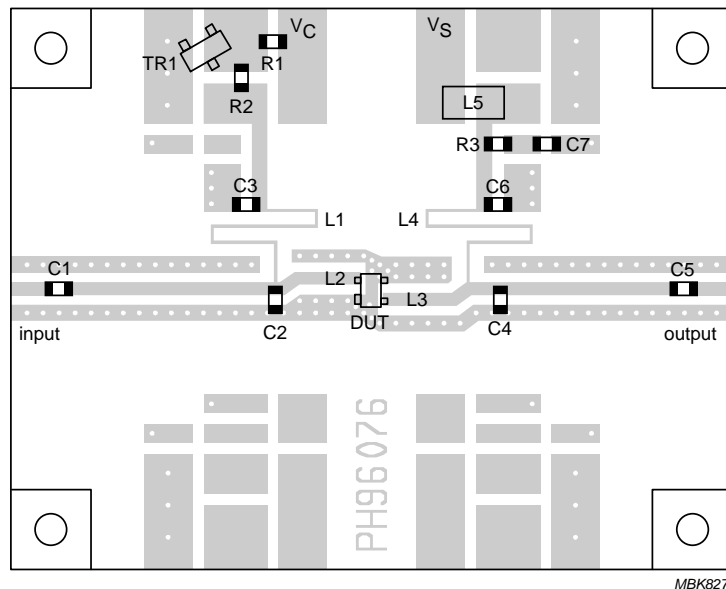
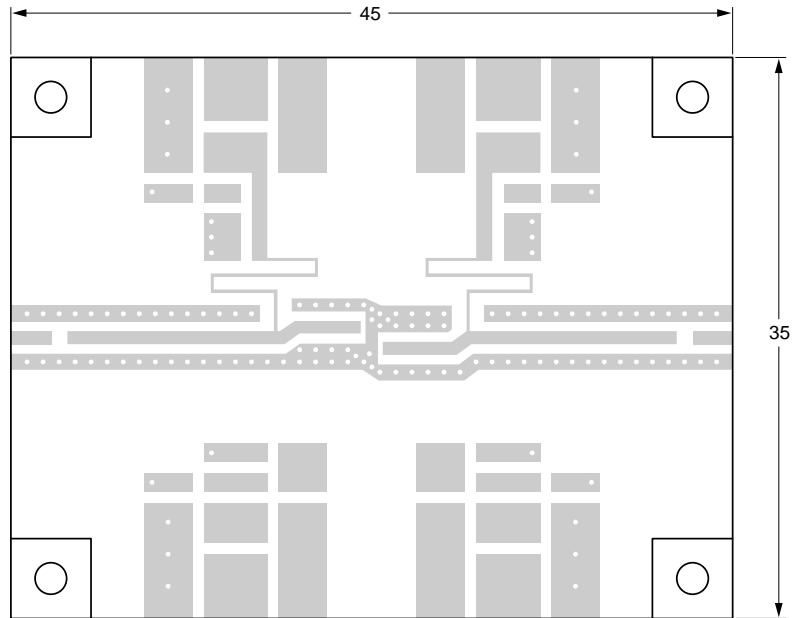
COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE No.
C1, C5	multilayer ceramic chip capacitor; note 1	24 pF		
C2, C4	multilayer ceramic chip capacitor; note 1	2 pF		
C3, C6	multilayer ceramic chip capacitor, note 1	15 pF		
C7	multilayer ceramic chip capacitor; note 1	1 nF		
L1, L4	stripline; note 2	100 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

- American Technical Ceramics type 100A or capacitor of same quality.
- The striplines are on a double copper-clad printed-circuit board with PTFE fibre-glass dielectric ( $\epsilon_r = 6.15$ ,  $\tan \delta = 0.0019$ ); thickness 0.64 mm, copper cladding = 35  $\mu\text{m}$ .

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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.

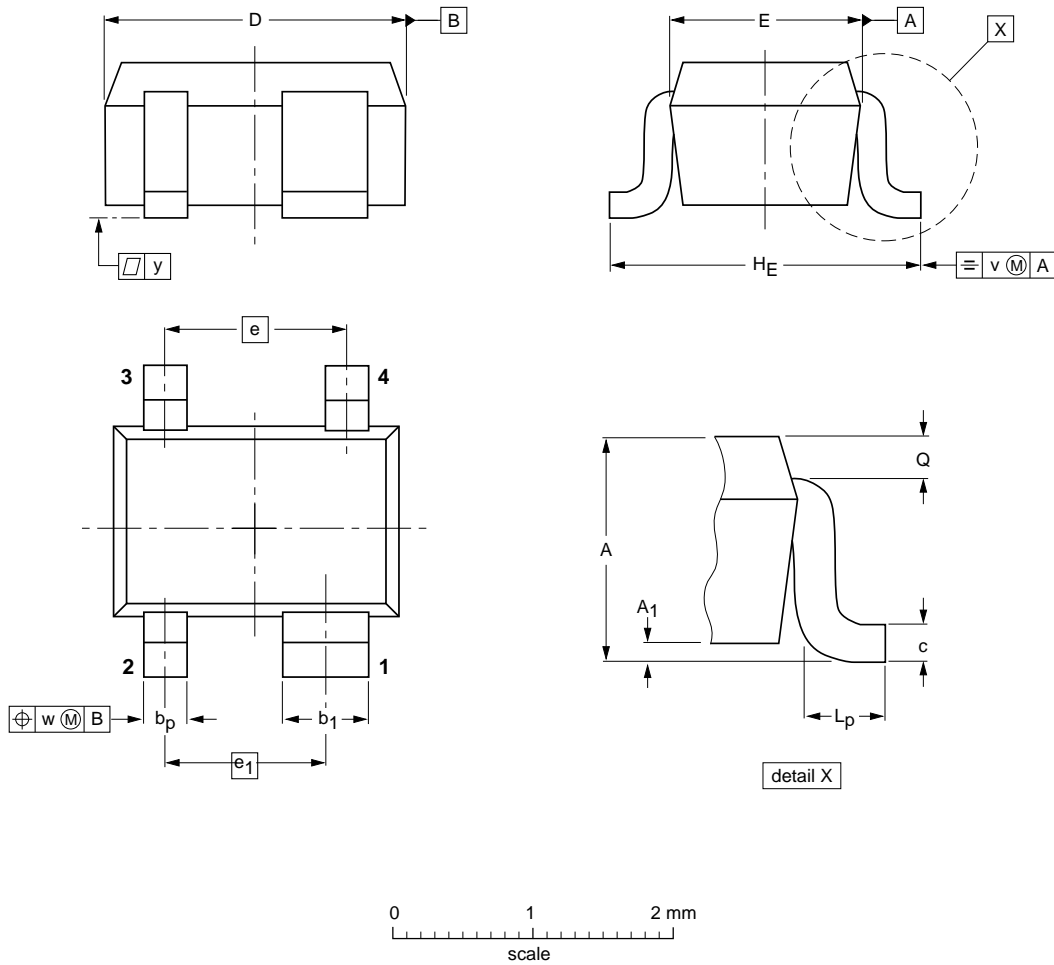
NPN wideband transistor

BFG480W

PACKAGE OUTLINE

Plastic surface-mounted package; reverse pinning; 4 leads

SOT343R



DIMENSIONS (mm are the original dimensions)

UNIT	A	A <sub>1</sub> max	b <sub>p</sub>	b <sub>1</sub>	c	D	E	e	e <sub>1</sub>	H <sub>E</sub>	L <sub>p</sub>	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 06-03-16

## NPN wideband transistor

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## DATA SHEET STATUS

DOCUMENT STATUS <sup>(1)</sup>	PRODUCT STATUS <sup>(2)</sup>	DEFINITION
Objective data sheet	Development	This document contains data from the objective specification for product development.
Preliminary data sheet	Qualification	This document contains data from the preliminary specification.
Product data sheet	Production	This document contains the product specification.

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## **Contact information**

For additional information please visit: <http://www.nxp.com>

For sales offices addresses send e-mail to: [salesaddresses@nxp.com](mailto:salesaddresses@nxp.com)

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