DATA SHEET

BFG505; BFG505/X; BFG505/XR
NPN 9 GHz wideband transistor

Product specification
File under Discrete Semiconductors, SC14

September 1995

Philips
Semiconductors

PHILIPS

NPN 9 GHz wideband transistor — BFG505; BFG505/X; BFG505/XR

FEATURES

- High power gain
- Low noise figure
- High transition frequency
- Gold metallization ensures excellent reliability.

DESCRIPTION

The BFG505 is an NPN silicon planar epitaxial transistor, intended for applications in the RF frontend in the GHz range, such as analog and digital cellular telephones, cordless telephones (CT1, CT2, DECT, etc.), radar detectors, pagers and satellite TV tuners (SATV).

The transistors are mounted in a plastic SOT143 envelope.

PINNING

PIN	DESCRIPTION
BFG505 (Fig.1) Code: N33	
1	collector
2	base
3	emitter
4	emitter
BFG505/X (Fig.1) Code: N39	
1	collector
2	emitter
3	base
4	emitter
BFG505/XR (Fig.2) Code: N45	
1	collector
2	emitter
3	base
4	emitter

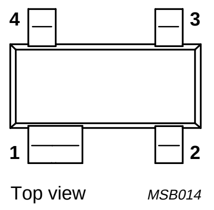


Fig.1 SOT143B.

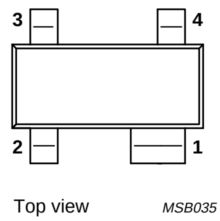


Fig.2 SOT143R.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	20	V
V_{CES}	collector-emitter voltage	R_{BE} = 0	–	–	15	V
I_c	DC collector current		–	–	18	mA
P_{tot}	total power dissipation	up to T_s = 130 °C; note 1	–	–	150	mW
h_{FE}	DC current gain	V_{CE} = 6 V; I_C = 5 mA	60	120	250	
C_{re}	feedback capacitance	V_{CB} = 6 V; I_C = i_c = 0; f = 1 MHz	–	0.2	–	pF
f_T	transition frequency	V_{CE} = 6 V; I_C = 5 mA; f = 1 GHz	–	9	–	GHz
G_{UM}	maximum unilateral power gain	V_{CE} = 6 V; I_C = 5 mA; T_{amb} = 25 °C; f = 900 MHz	–	20	–	dB
		V_{CE} = 6 V; I_C = 5 mA; T_{amb} = 25 °C; f = 2 GHz	–	13	–	dB
$\|S_{21}\|^2$	insertion power gain	V_{CE} = 6 V; I_c = 5 mA; T_{amb} = 25 °C; f = 900 MHz	16	17	–	dB
F	noise figure	$\Gamma_s = \Gamma_{opt}$; V_{CE} = 6 V; I_c = 1.25 mA; T_{amb} = 25 °C; f = 900 MHz	–	1.2	1.7	dB
		$\Gamma_s = \Gamma_{opt}$; V_{CE} = 6 V; I_c = 5 mA; T_{amb} = 25 °C; f = 900 MHz	–	1.6	2.1	dB
		$\Gamma_s = \Gamma_{opt}$; V_{CE} = 6 V; I_c = 1.25 mA; T_{amb} = 25 °C; f = 2 GHz	–	1.9	–	dB

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CES}	collector-emitter voltage	R_{BE} = 0	–	15	V
V_{EBO}	emitter-base voltage	open collector	–	2.5	V
I_C	DC collector current		–	18	mA
P_{tot}	total power dissipation	up to T_s = 130 °C; note 1	–	150	mW
T_{stg}	storage temperature range		–65	150	°C
T_j	junction temperature		–	175	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	from junction to soldering point (note 1)	290 K/W

Note

1. T_s is the temperature at the soldering point of the collector tab.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	V_{CB} = 6 V; I_E = 0;	–	–	50	nA
h_{FE}	DC current gain	V_{CE} = 6 V; I_C = 5 mA;	60	120	250	
C_e	emitter capacitance	V_{EB} = 0.5 V; I_C = i_c = 0; f = 1 MHz	–	0.4	–	pF
C_c	collector capacitance	V_{CB} = 6 V; I_E = i_e = 0; f = 1 MHz	–	0.3	–	pF
C_{re}	feedback capacitance	V_{CB} = 6 V; I_C = 0; f = 1 MHz	–	0.2	–	pF
f_T	transition frequency	V_{CE} = 6 V; I_C = 5 mA; f = 1 GHz	–	9	–	GHz
G_{UM}	maximum unilateral power gain (note 1)	V_{CE} = 6 V; I_c = 5 mA; T_{amb} = 25 °C; f = 900 MHz	–	20	–	dB
		V_{CE} = 6 V; I_c = 5 mA; T_{amb} = 25 °C; f = 2 GHz	–	13	–	dB
$\|S_{21}\|^2$	insertion power gain	V_{CE} = 6 V; I_c = 5 mA; T_{amb} = 25 °C; f = 900 MHz	16	17	–	dB
F	noise figure	$\Gamma_s = \Gamma_{opt}$; V_{CE} = 6 V; I_c = 1.25 mA; T_{amb} = 25 °C; f = 900 MHz	–	1.2	1.7	dB
		$\Gamma_s = \Gamma_{opt}$; V_{CE} = 6 V; I_c = 5 mA; T_{amb} = 25 °C; f = 900 MHz	–	1.6	2.1	dB
		$\Gamma_s = \Gamma_{opt}$; V_{CE} = 6 V; I_c = 1.25 mA; T_{amb} = 25 °C; f = 2 GHz	–	1.9	–	dB
P_{L1}	output power at 1 dB gain compression	V_{CE} = 6 V; I_C = 5 mA; R_L = 50 Ω; T_{amb} = 25 °C; f = 900 MHz	–	4	–	dBm
ITO	third order intercept point	note 2	–	10	–	dBm

Notes

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and

$$G_{UM} = 10 \log \frac{|S_{21}|^2}{\left(1-|S_{11}|^2\right)\left(1-|S_{22}|^2\right)} \text{dB.}$$

2. V_{CE} = 6 V; I_C = 5 mA; R_L = 50 Ω; T_{amb} = 25 °C;
   f_p = 900 MHz; f_q = 902 MHz;
   measured at $f_{(2p-q)}$ = 898 MHz and $f_{2q-p)}$ = 904 MHz.

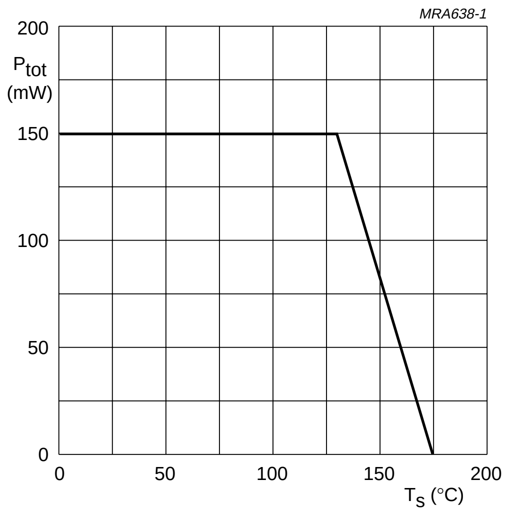
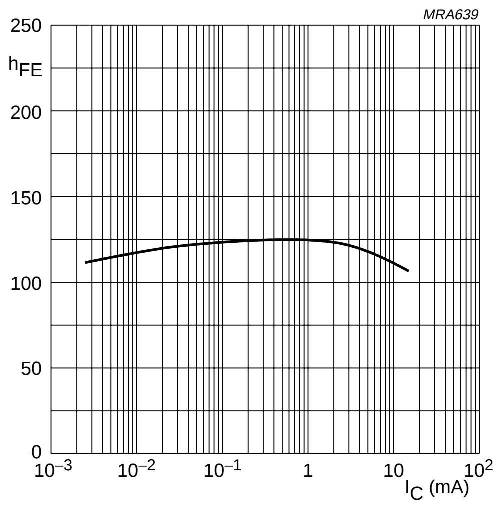
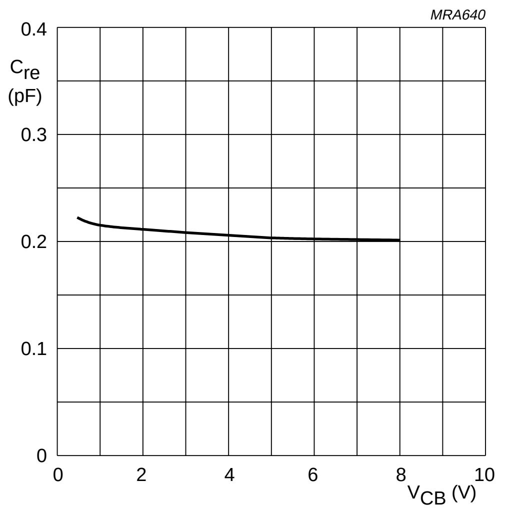


Fig.3 Power derating curve.



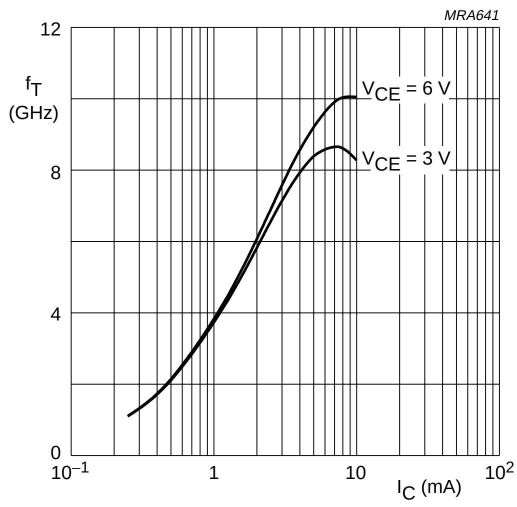
V_{CE} = 6 V.

Fig.4 DC current gain as a function of collector current.



I_C = 0; f = 1 MHz.

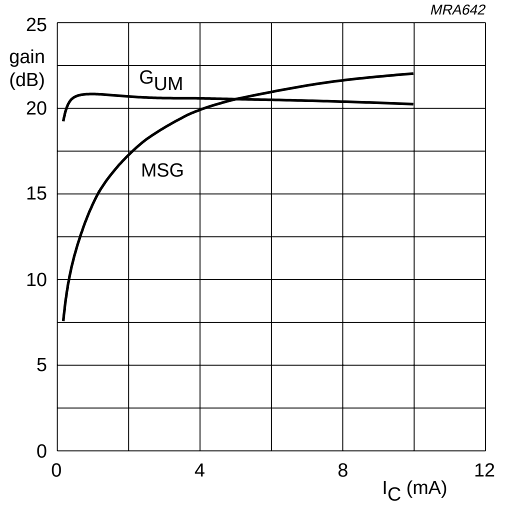
Fig.5 Feedback capacitance as a function of collector-base voltage.



T_{amb} = 25 °C; f = 1 GHz.

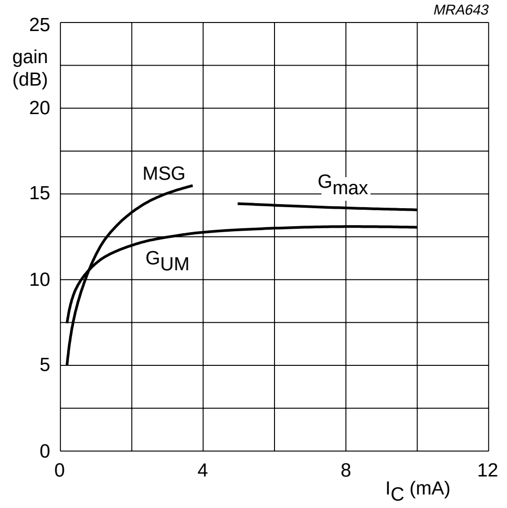
Fig.6 Transition frequency as a function of collector current.

In Figs 7 to 10, G_{UM} = maximum unilateral power gain; MSG = maximum stable gain; G_{max} = maximum available gain.



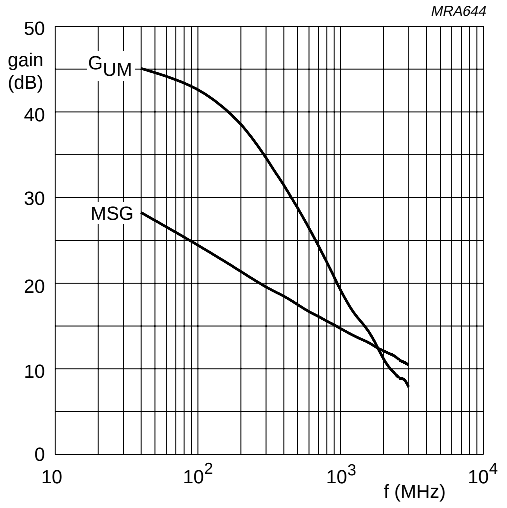
V_{CE} = 6 V; f = 900 MHz.

Fig.7 Gain as a function of collector current.



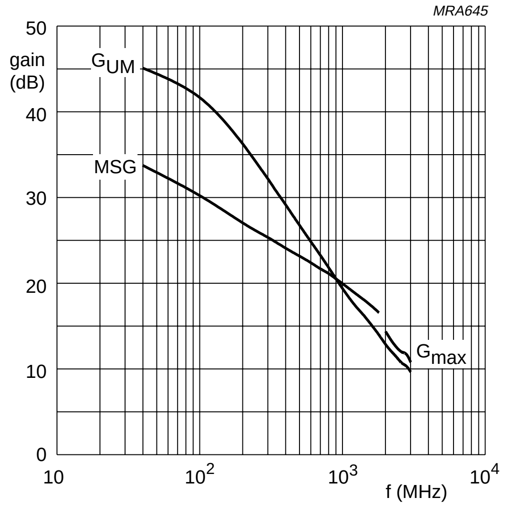
V_{CE} = 6 V; f = 2 GHz.

Fig.8 Gain as a function of collector current.



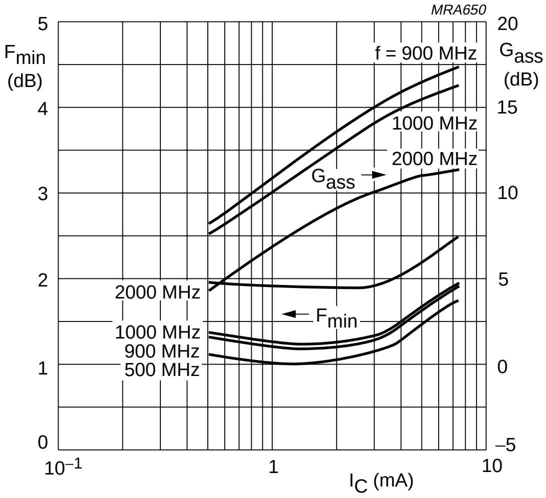
V_{CE} = 6 V; I_C = 1.25 mA.

Fig.9 Gain as a function of frequency.



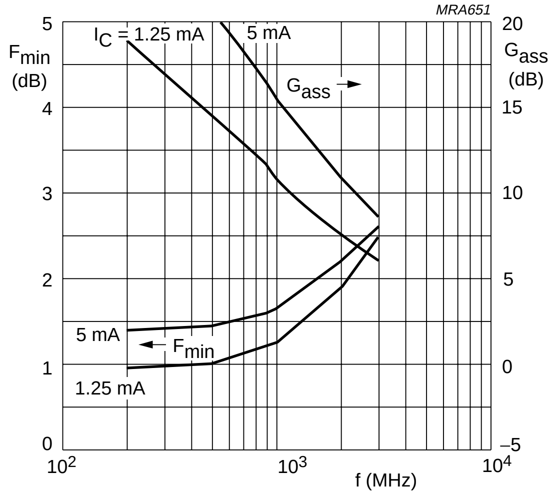
V_{CE} = 6 V; I_C = 5 mA.

Fig.10 Gain as a function of frequency.



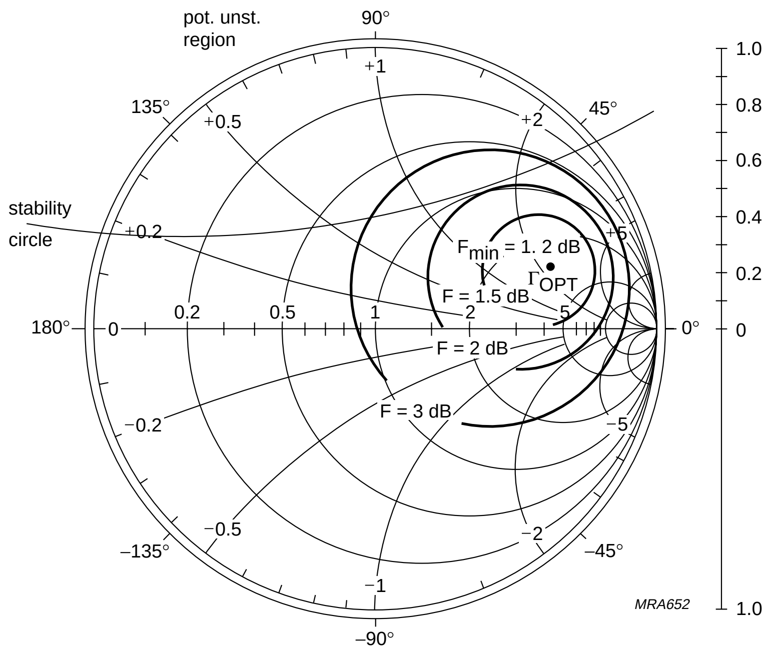
V_{CE} = 6 V.

Fig.11 Minimum noise figure and associated available gain as functions of collector current.



V_{CE} = 6 V.

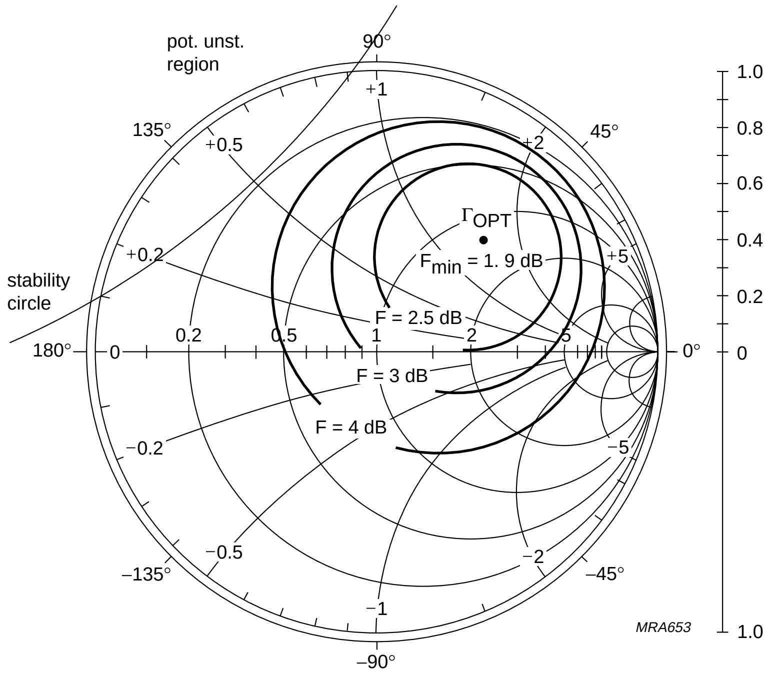
Fig.12 Minimum noise figure and associated available gain as functions of frequency.



Z_o = 50 Ω.

V_{CE} = 6 V; I_c = 1.25 mA; f = 900 MHz.

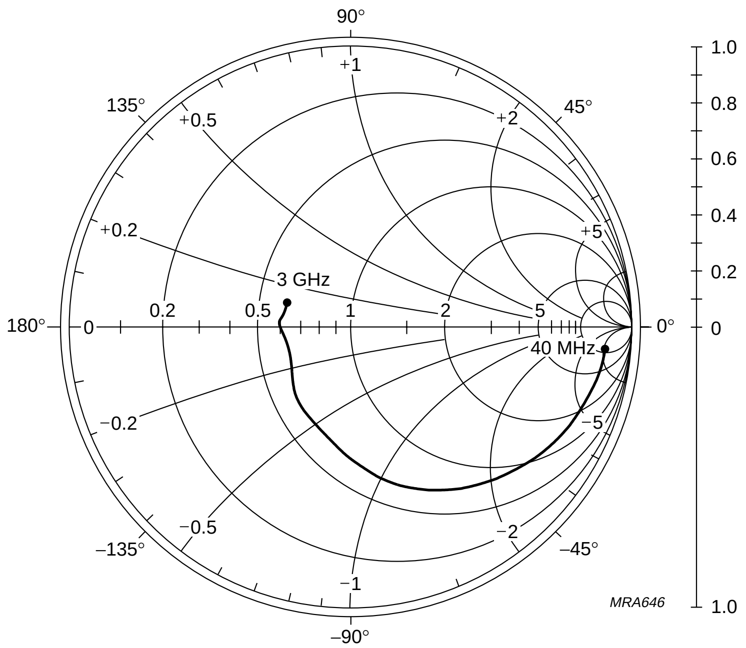
Fig.13 Noise circle figure.



Z_o = 50 Ω.

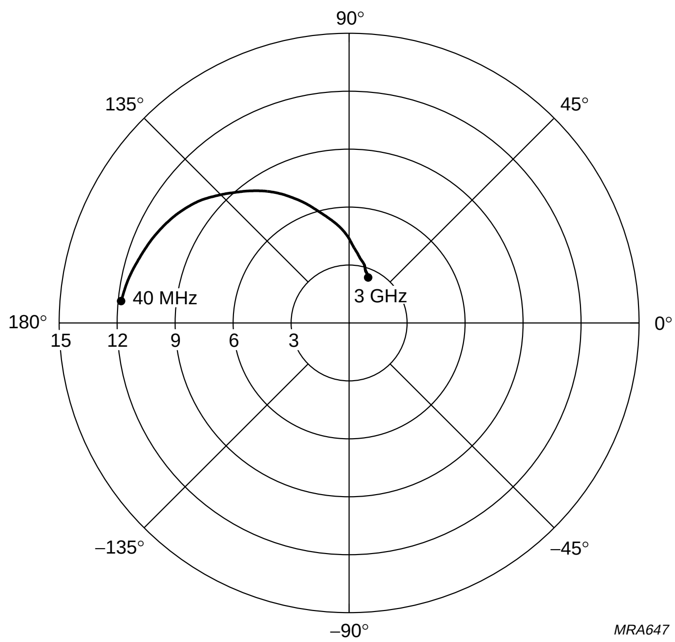
V_{CE} = 6 V; I_c = 1.25 mA; f = 2000 MHz.

Fig.14 Noise circle figure.



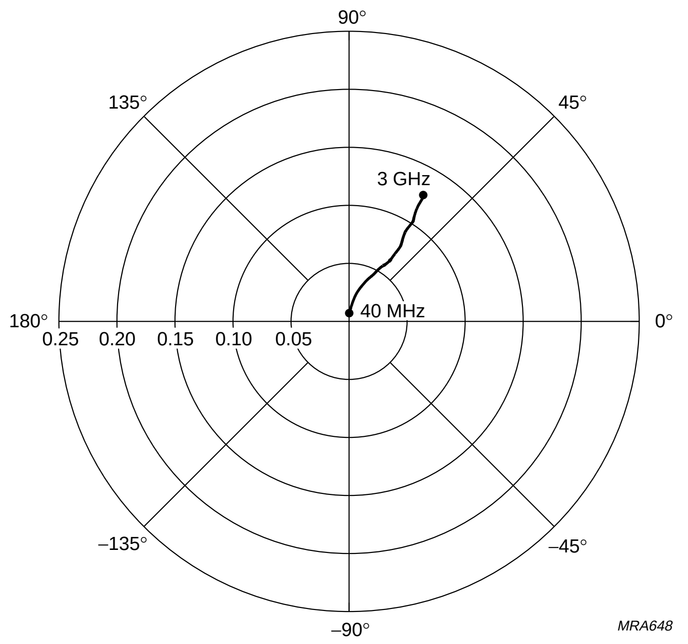
V_{CE} = 6 V; I_c = 5 mA.
Z_o = 50 Ω.

Fig.15 Common emitter input reflection coefficient (S_{11}).



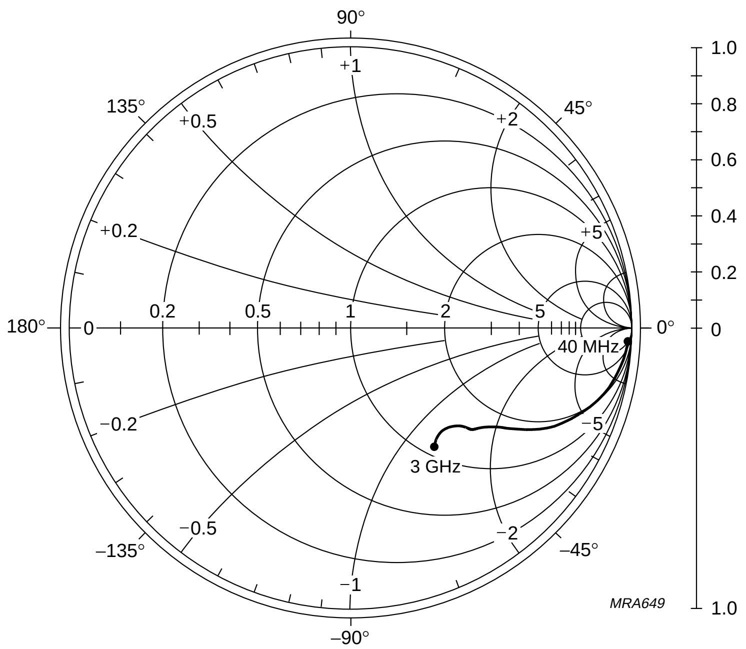
V_{CE} = 6 V; I_c = 5 mA.

Fig.16 Common emitter forward transmission coefficient (S_{21}).



V_{CE} = 6 V; I_c = 5 mA.

Fig.17 Common emitter reverse transmission coefficient (S_{12}).

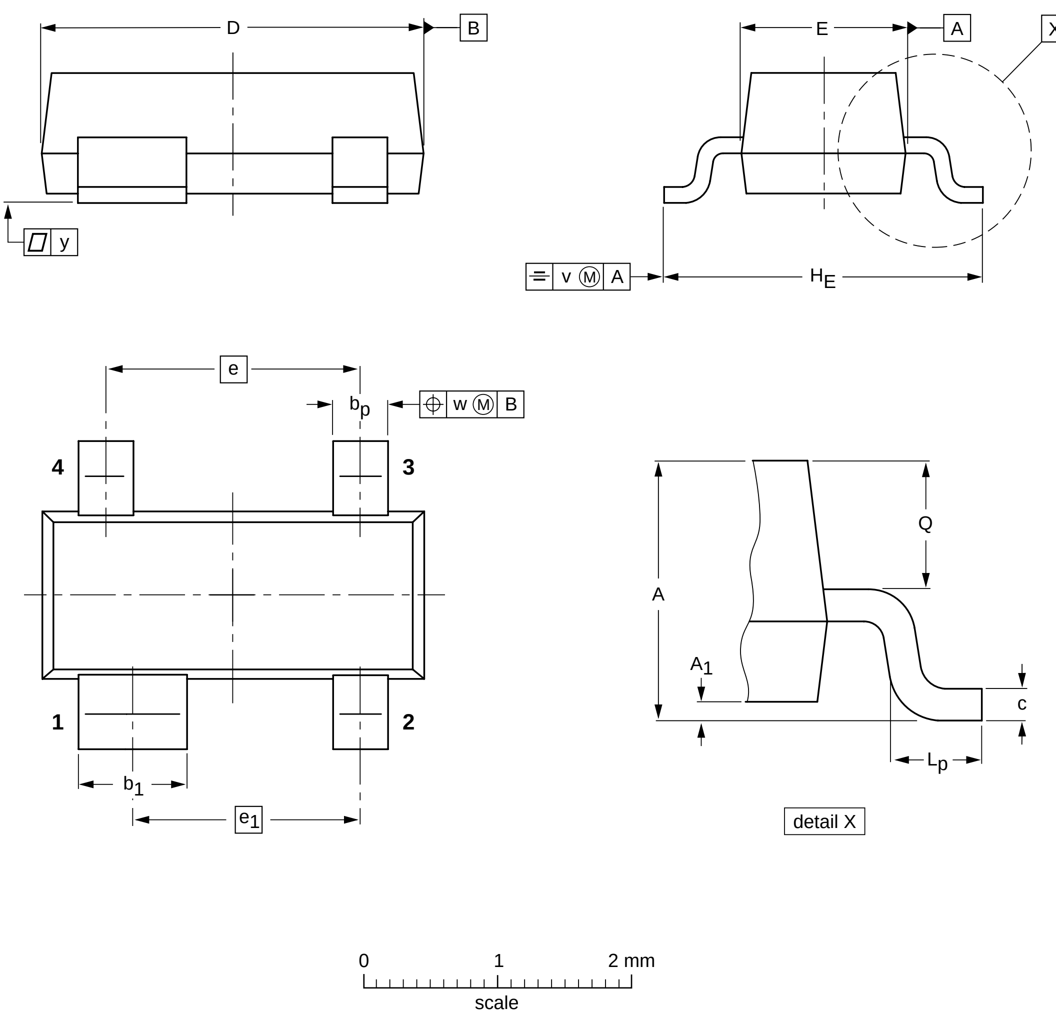


V_{CE} = 6 V; I_c = 5 mA.
Z_o = 50 Ω.

Fig.18 Common emitter output reflection coefficient (S_{22}).

PACKAGE OUTLINES

Plastic surface mounted package; 4 leads **SOT143B**

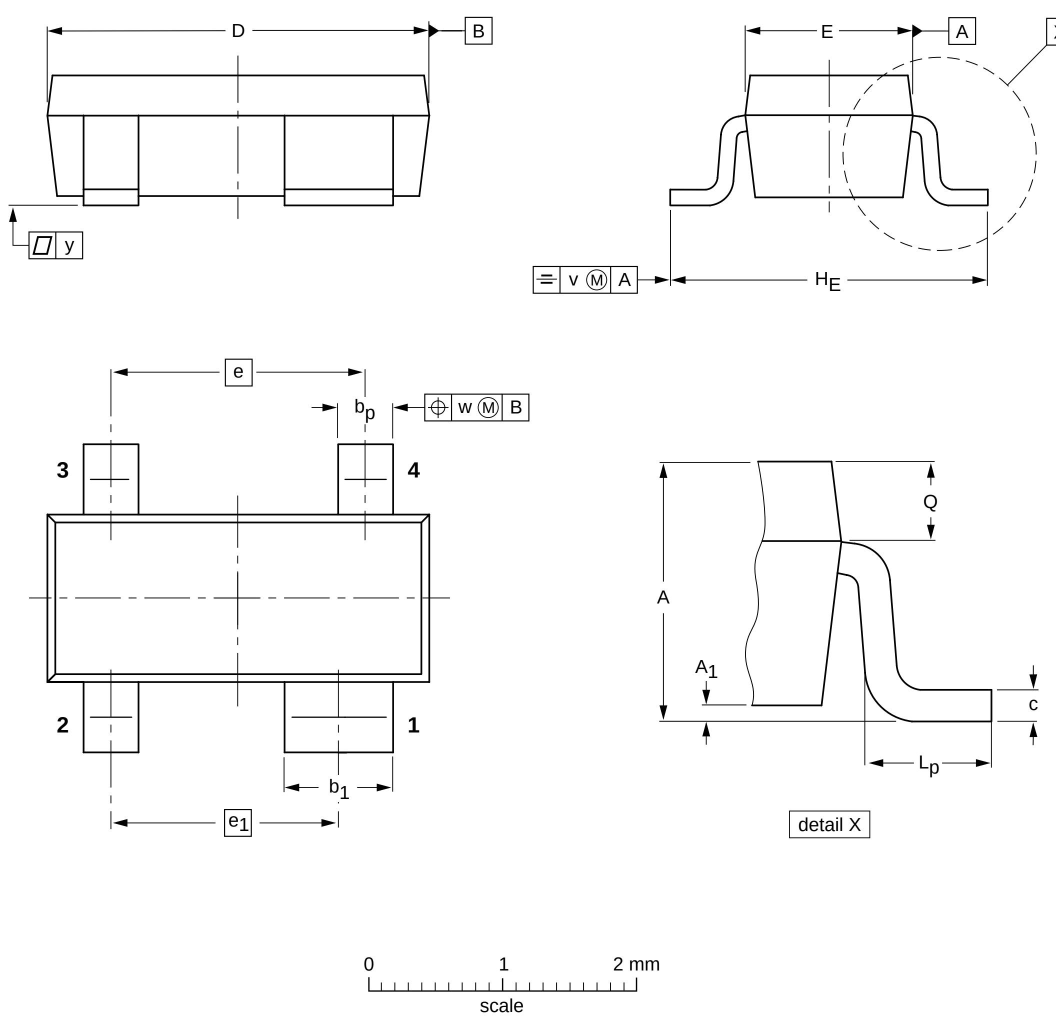


DIMENSIONS (mm are the original dimensions)

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 0.9	0.1	0.48 0.38	0.88 0.78	0.15 0.09	3.0 2.8	1.4 1.2	1.9	1.7	2.5 2.1	0.45 0.15	0.55 0.45	0.2	0.1	0.1

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT143B						97-02-28

Plastic surface mounted package; reverse pinning; 4 leads **SOT143R**



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 0.9	0.1	0.48 0.38	0.88 0.78	0.15 0.09	3.0 2.8	1.4 1.2	1.9	1.7	2.5 2.1	0.55 0.25	0.45 0.25	0.2	0.1	0.1

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT143R						97-03-10

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.