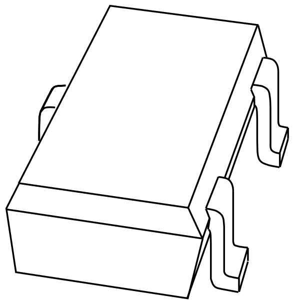
DATA SHEET



BFS540
NPN 9 GHz wideband transistor

Product specification
Supersedes data of 1997 Dec 05

2000 May 30

Philips
Semiconductors

PHILIPS

NPN 9 GHz wideband transistor — BFS540

FEATURES

- High power gain
- Low noise figure
- High transition frequency
- Gold metallization ensures excellent reliability
- SOT323 package.

APPLICATIONS

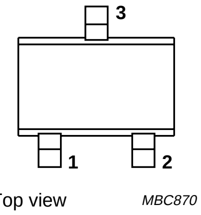
RF wideband amplifier applications such as satellite TV systems and RF portable communication equipment with signal frequencies up to 2 GHz.

DESCRIPTION

NPN transistor in a SOT323 plastic package.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector



Marking code: N4.

Fig.1 SOT323.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	–	15	V
I_C	DC collector current		–	–	120	mA
P_{tot}	total power dissipation	$T_s \leq 80$ °C; note 1	–	–	500	mW
h_{FE}	DC current gain	$I_C = 40$ mA; $V_{CE} = 8$ V; $T_j = 25$ °C	100	120	250	
f_T	transition frequency	$I_C = 40$ mA; $V_{CE} = 8$ V; f = 1 GHz; $T_{amb} = 25$ °C	–	9	–	GHz
G_{UM}	maximum unilateral power gain	$I_C = 40$ mA; $V_{CE} = 8$ V; f = 900 MHz; $T_{amb} = 25$ °C	–	14	–	dB
F	noise figure	$I_C = 10$ mA; $V_{CE} = 8$ V; f = 900 MHz; $T_{amb} = 25$ °C	–	1.3	1.7	dB

Note

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

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 60134).

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		–	120	mA
P_{tot}	total power dissipation	$T_s \leq 80$ °C; note 1	–	500	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 tab.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	$T_s \leq 80$ °C; note 1	190	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.

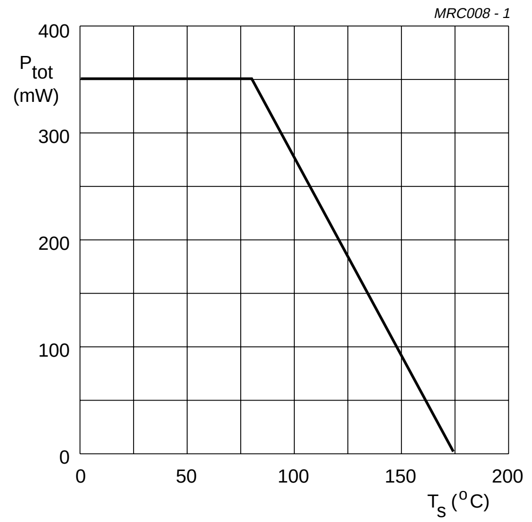
SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0$; $V_{CE} = 8$ V	–	–	50	nA
h_{FE}	DC current gain	$I_C = 40$ mA; $V_{CE} = 8$ V	100	120	250	
C_e	emitter capacitance	$I_C = i_c = 0$; $V_{EB} = 0.5$ V; f = 1 MHz	–	2	–	pF
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 8$ V; f = 1 MHz	–	0.9	–	pF
C_{re}	feedback capacitance	$I_C = 0$; $V_{CB} = 8$ V; f = 1 MHz	–	0.6	–	pF
f_T	transition frequency	$I_C = 40$ mA; $V_{CE} = 8$ V; f = 1 GHz; $T_{amb} = 25$ °C	–	9	–	GHz
G_{UM}	maximum unilateral power gain (note 1)	$I_C = 40$ mA; $V_{CE} = 8$ V; f = 900 MHz; $T_{amb} = 25$ °C	–	14	–	dB
		$I_C = 40$ mA; $V_{CE} = 8$ V; f = 2 GHz; $T_{amb} = 25$ °C	–	8	–	dB
$\|s_{21}\|^2$	insertion power gain	$I_C = 40$ mA; $V_{CE} = 8$ V; f = 900 MHz; $T_{amb} = 25$ °C	12	13	–	dB
F	noise figure	$\Gamma_s = \Gamma_{opt}$; $I_C = 10$ mA; $V_{CE} = 8$ V; f = 900 MHz; $T_{amb} = 25$ °C	–	1.3	1.8	dB
		$\Gamma_s = \Gamma_{opt}$; $I_C = 40$ mA; $V_{CE} = 8$ V; f = 900 MHz; $T_{amb} = 25$ °C	–	1.9	2.4	dB
		$\Gamma_s = \Gamma_{opt}$; $I_C = 10$ mA; $V_{CE} = 8$ V; f = 2 GHz; $T_{amb} = 25$ °C	–	2.1	–	dB
P_{L1}	output power at 1 dB gain compression	$I_c = 40$ mA; $V_{CE} = 8$ V; $R_L = 50$ Ω; f = 900 MHz; $T_{amb} = 25$ °C	–	21	–	dBm
ITO	third order intercept point	note 2	–	34	–	dBm

Notes

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

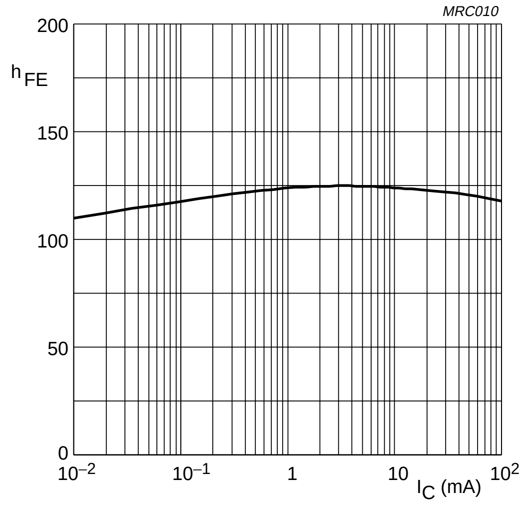
$$G_{UM} = 10\log\frac{|s_{21}|^2}{(1-|s_{11}|^2)(1-|s_{22}|^2)}\ \text{dB.}$$

2. $I_C = 40$ mA; $V_{CE} = 8$ V; $R_L = 50$ Ω; f = 900 MHz; $T_{amb} = 25$ °C; $f_p = 900$ MHz; $f_q = 902$ MHz; measured at $f_{(2p-q)} = 898$ MHz and at $f_{(2q-p)} = 904$ MHz.



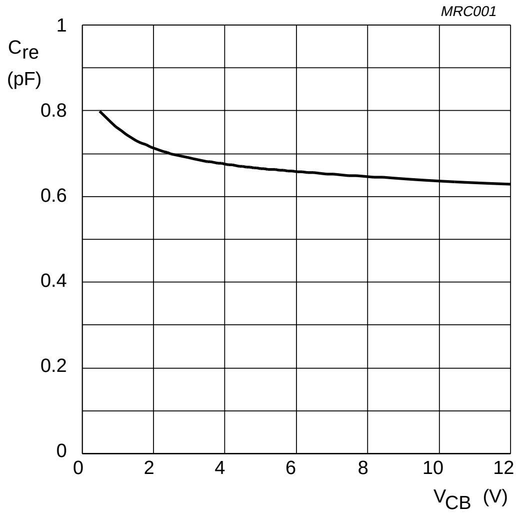
$V_{CE} \leq 10$ V.

Fig.2 Power derating curve.



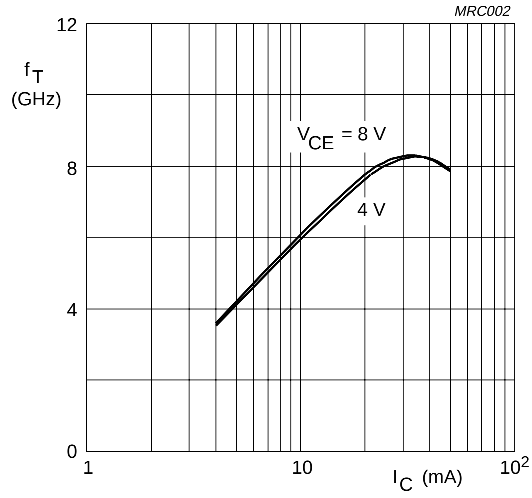
$V_{CE} = 8$ V; $T_j = 25$ °C.

Fig.3 DC current gain as a function of collector current.



$I_C = 0$; f = 1 MHz.

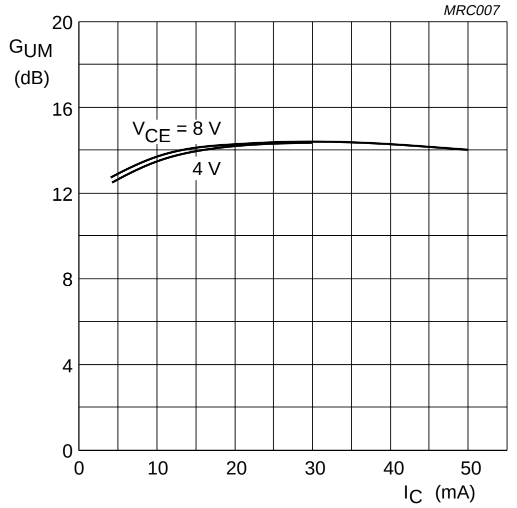
Fig.4 Feedback capacitance as a function of collector-base voltage.



f = 1 GHz; $T_{amb} = 25$ °C.

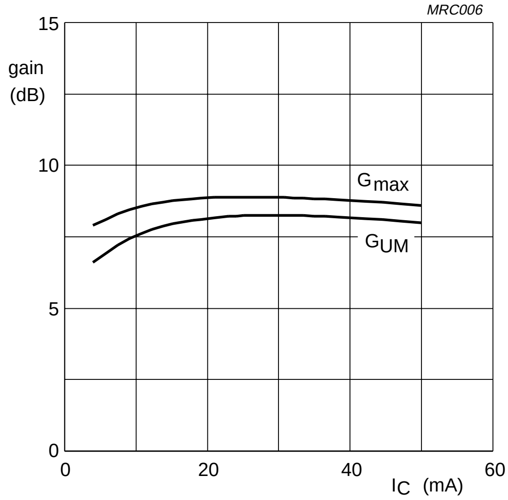
Fig.5 Transition frequency as a function of collector current.

In Figs 6 to 9, G_{UM} = maximum unilateral power gain; MSG = maximum stable gain; G_{max} = maximum available gain.



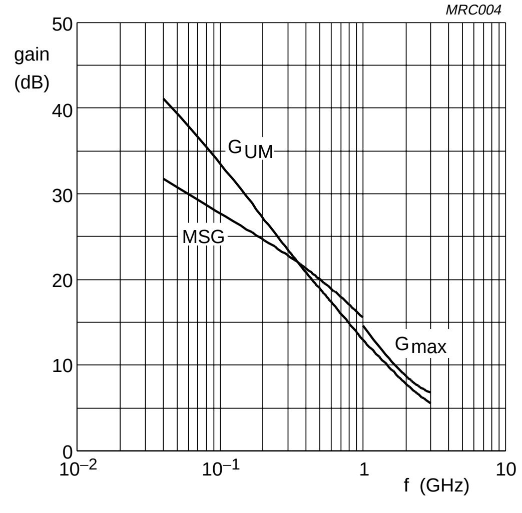
f = 900 MHz; T_{amb} = 25 °C.

Fig.6 Maximum unilateral power gain as a function of collector current.



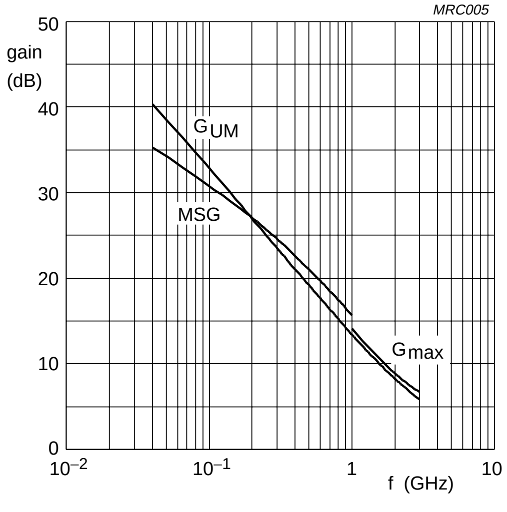
V_{CE} = 8 V; f = 2 GHz; T_{amb} = 25 °C.

Fig.7 Gain as a function of collector current.



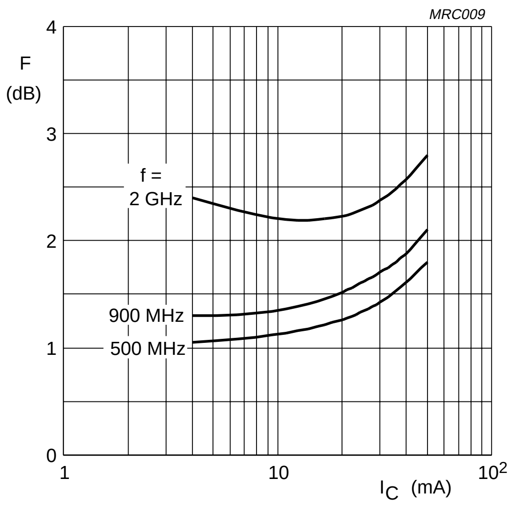
I_C = 10 mA; V_{CE} = 8 V; T_{amb} = 25 °C.

Fig.8 Gain as a function of frequency.



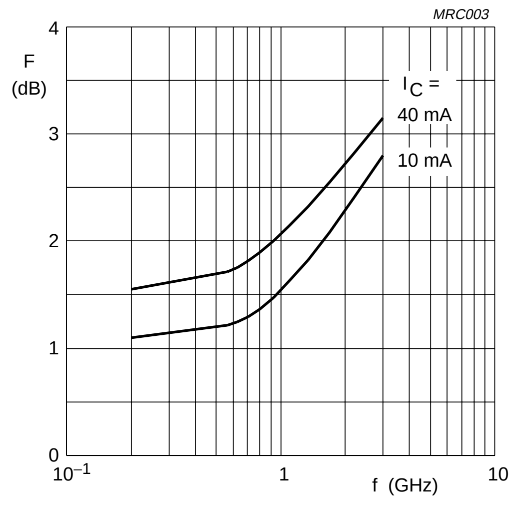
I_C = 40 mA; V_{CE} = 8 V; T_{amb} = 25 °C.

Fig.9 Gain as a function of frequency.



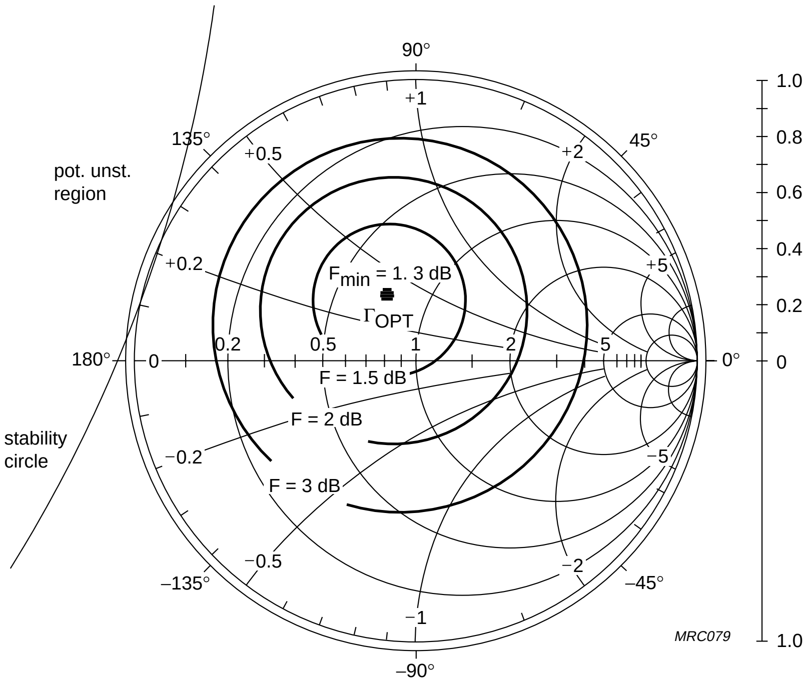
V_{CE} = 8 V; T_{amb} = 25 °C.

Fig.10 Minimum noise figure as a function of collector current.



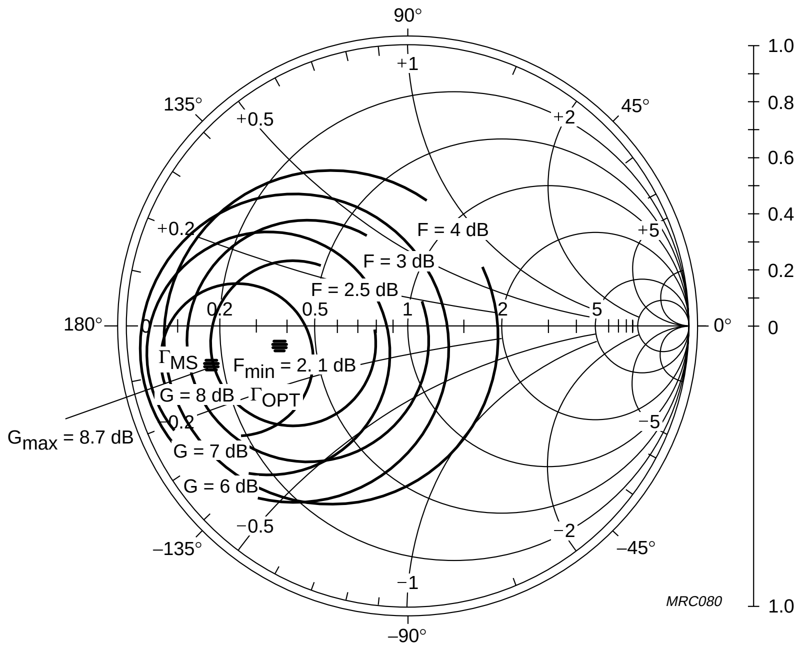
V_{CE} = 8 V; T_{amb} = 25 °C.

Fig.11 Minimum noise figure as a function of frequency.



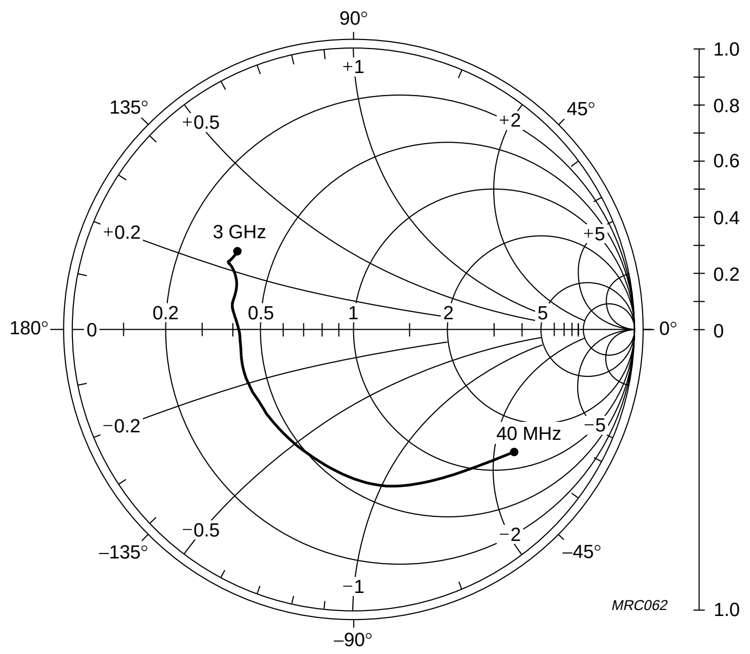
I_C = 10 mA; V_{CE} = 8 V;
f = 900 MHz; Z_o = 50 Ω.

Fig.12 Noise circle.



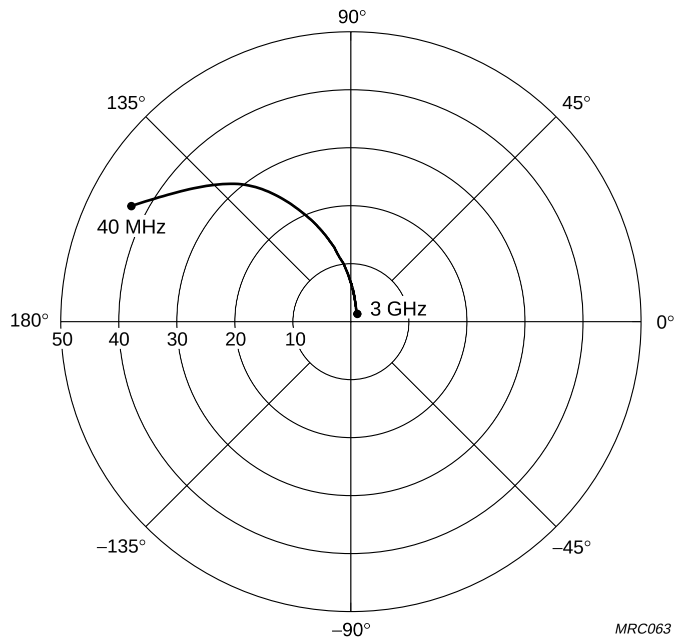
I_C = 10 mA; V_{CE} = 8 V;
f = 2 GHz; Z_o = 50 Ω.

Fig.13 Noise circle.



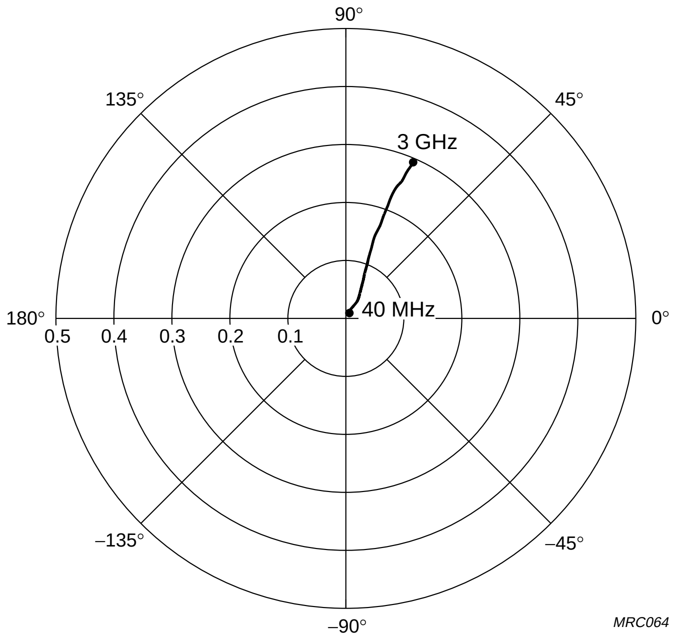
I_C = 40 mA; V_{CE} = 8 V;
Z_o = 50 Ω.

Fig.14 Common emitter input reflection coefficient (s_{11}).



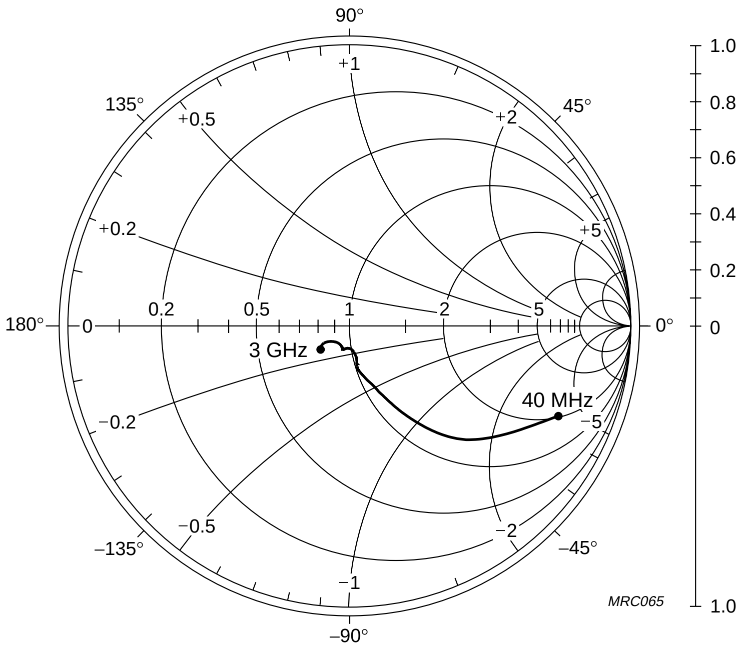
I_C = 40 mA; V_{CE} = 8 V.

Fig.15 Common emitter forward transmission coefficient (s_{21}).



I_C = 40 mA; V_{CE} = 8 V.

Fig.16 Common emitter reverse transmission coefficient (s_{12}).

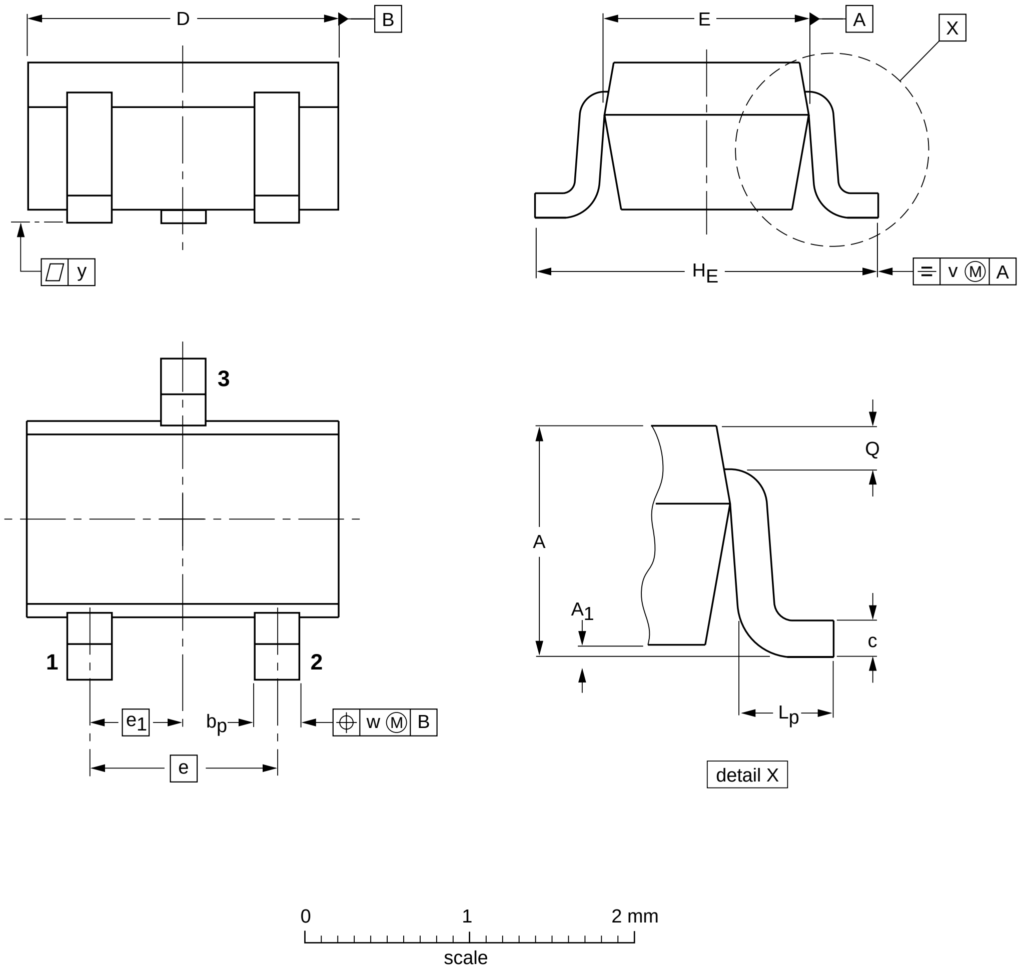


I_C = 40 mA; V_{CE} = 8 V;
Z_o = 50 Ω.

Fig.17 Common emitter output reflection coefficient (s_{22}).

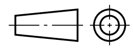
PACKAGE OUTLINE

Plastic surface mounted package; 3 leads **SOT323**



DIMENSIONS (mm are the original dimensions)

UNIT	A	A_1 max	b_p	c	D	E	e	e_1	H_E	L_p	Q	v	w
mm	1.1 0.8	0.1	0.4 0.3	0.25 0.10	2.2 1.8	1.35 1.15	1.3	0.65	2.2 2.0	0.45 0.15	0.23 0.13	0.2	0.2

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT323			SC-70			97-02-28

DATA SHEET STATUS

DATA SHEET STATUS	PRODUCT STATUS	DEFINITIONS (1)
Objective specification	Development	This data sheet contains the design target or goal specifications for product development. Specification may change in any manner without notice.
Preliminary specification	Qualification	This data sheet contains preliminary data, and supplementary data will be published at a later date. Philips Semiconductors reserves the right to make changes at any time without notice in order to improve design and supply the best possible product.
Product specification	Production	This data sheet contains final specifications. Philips Semiconductors reserves the right to make changes at any time without notice in order to improve design and supply the best possible product.

Note

1. Please consult the most recently issued data sheet before initiating or completing a design.

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