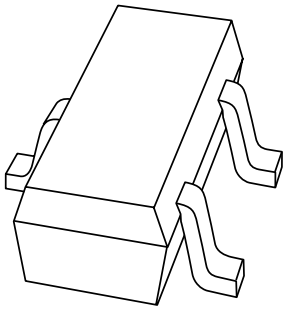
DATA SHEET



BFR505T
NPN 9 GHz wideband transistor

Product specification
Supersedes data of 2000 Mar 14

2000 May 17

Philips
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NPN 9 GHz wideband transistor BFR505T

FEATURES

- Low current consumption
- High power gain
- Low noise figure
- High transition frequency
- Gold metallization ensures excellent reliability
- SOT416 (SC-75) package.

APPLICATIONS

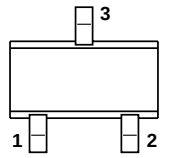
Low power amplifiers, oscillators and mixers particularly in RF portable communication equipment (cellular phones, cordless phones and pagers) up to 2 GHz.

DESCRIPTION

NPN transistor in a plastic SOT416 (SC-75) package.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector



Top view MBK090

Marking code: N0.

Fig.1 SOT416.

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	$T_s \leq 75$ °C; note 1	–	–	150	mW
h_{FE}	DC current gain	I_C = 5 mA; V_{CE} = 6 V; T_j = 25 °C	60	120	250	
f_T	transition frequency	I_C = 5 mA; V_{CE} = 6 V; f = 1 GHz; T_{amb} = 25 °C	–	9	–	GHz
G_{UM}	maximum unilateral power gain	I_C = 5 mA; V_{CE} = 6 V; f = 900 MHz; T_{amb} = 25 °C	–	17	–	dB
F	noise figure	I_C = 1.25 mA; V_{CE} = 6 V; f = 900 MHz; T_{amb} = 25 °C	–	1.2	1.7	dB

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_{CE}	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	$T_s \leq 75$ °C; note 1	–	150	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C

Note

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

THERMAL RESISTANCE

SYMBOL	PARAMETER	VALUE	UNIT
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	500	K/W

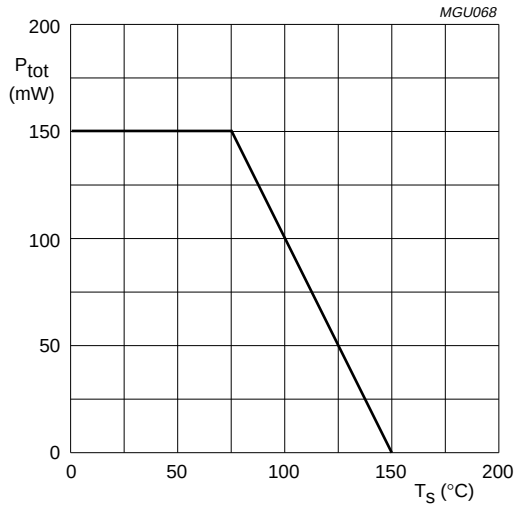


Fig.2 Power derating curve.

CHARACTERISTICS

T_j = 25 °C; unless otherwise specified.

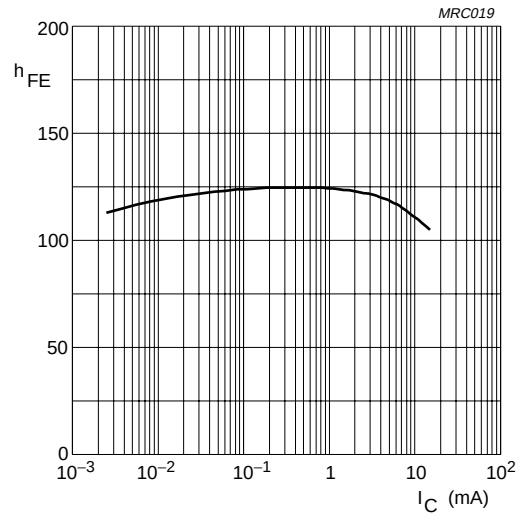
SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 6 V	–	–	50	nA
h_{FE}	DC current gain	I_C = 5 mA; V_{CE} = 6 V	60	120	250	
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 6 V; f = 1 MHz	–	0.4	–	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = 0.5 V; f = 1 MHz	–	0.4	–	pF
C_{re}	feedback capacitance	I_C = 0; V_{CB} = 6 V; f = 1 MHz	–	0.3	–	pF
f_T	transition frequency	I_C = 5 mA; V_{CE} = 6 V; f = 1 GHz; T_{amb} = 25 °C	–	9	–	GHz
G_{UM}	maximum unilateral power gain; note 1	I_C = 5 mA; V_{CE} = 6 V; T_{amb} = 25 °C;				
		f = 900 MHz	–	17	–	dB
		f = 2 GHz	–	10	–	dB
$\lvert S_{21}\rvert^2$	insertion power gain	I_C = 5 mA; V_{CE} = 6 V; f = 900 MHz; T_{amb} = 25 °C	13	14	–	dB
F	noise figure	$\Gamma_s = \Gamma_{opt}$; I_C = 1.25 mA; V_{CE} = 6 V; f = 900 MHz; T_{amb} = 25 °C	–	1.2	1.7	dB
		$\Gamma_s = \Gamma_{opt}$; I_C = 5 mA; V_{CE} = 6 V; f = 900 MHz; T_{amb} = 25 °C	–	1.6	2.1	dB
		$\Gamma_s = \Gamma_{opt}$; I_C = 1.25 mA; V_{CE} = 6 V; f = 2 GHz; T_{amb} = 25 °C	–	1.9	–	dB
P_{L1}	output power at 1 dB gain compression	I_C = 5 mA; V_{CE} = 6 V; R_L = 50 Ω; f = 900 MHz; T_{amb} = 25 °C	–	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

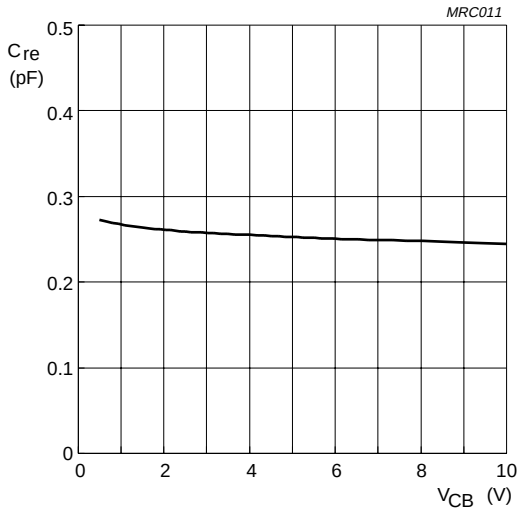
$$G_{UM} = 10 \log \frac{|S_{21}|^2}{(1-|S_{11}|^2)(1-|S_{22}|^2)} \text{ dB}$$

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



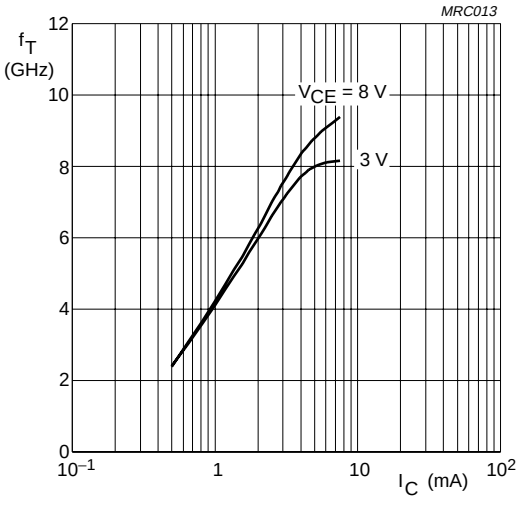
V_{CE} = 6 V; T_j = 25 °C.

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



I_C = 0; f = 1 MHz.

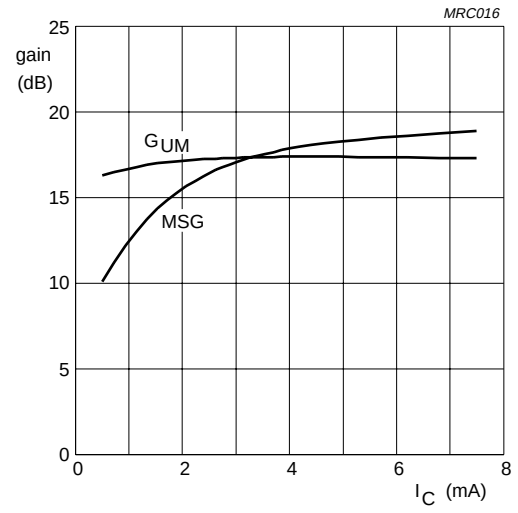
Fig.4 Feedback capacitance as a function of collector-base voltage.



f = 1 GHz; T_{amb} = 25 °C.

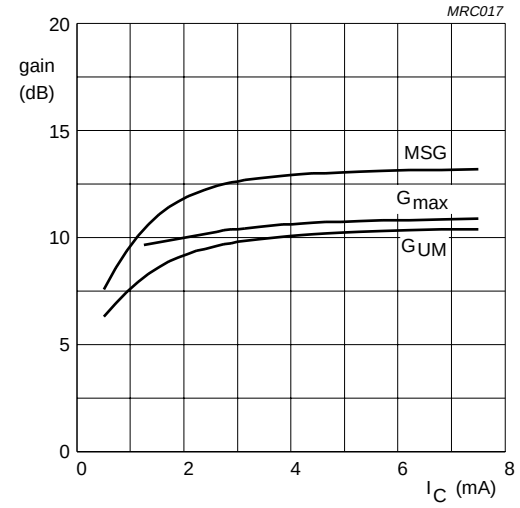
Fig.5 Transition frequency as a function of collector current.

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



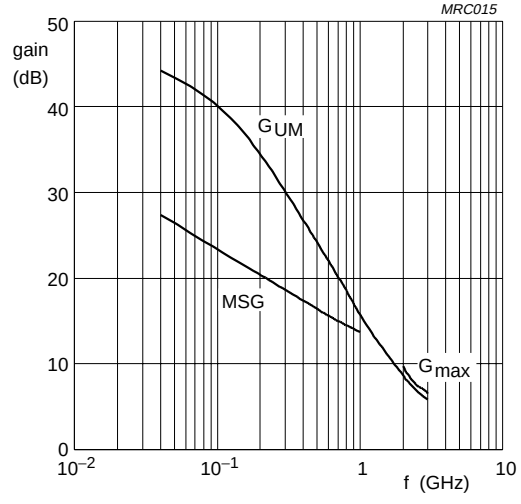
V_{CE} = 6 V; f = 900 MHz; T_{amb} = 25 °C.

Fig.6 Gain as a function of collector current.



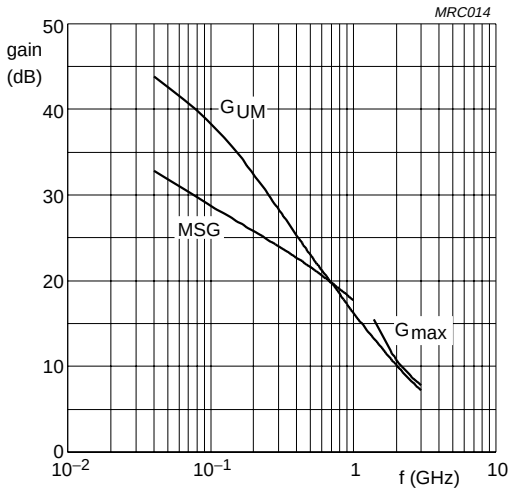
V_{CE} = 6 V; f = 2 GHz; T_{amb} = 25 °C.

Fig.7 Gain as a function of collector current.



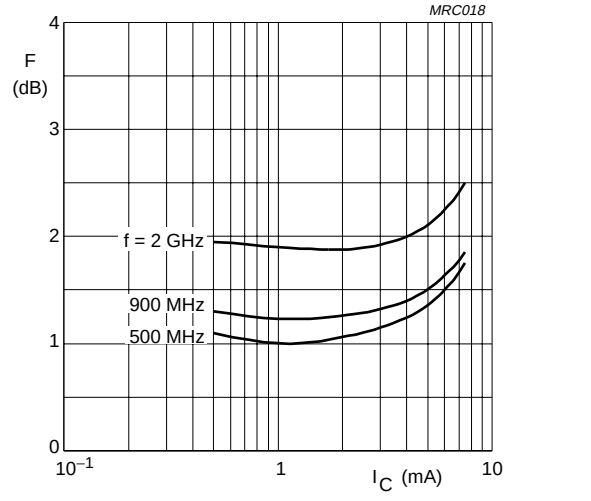
I_C = 1.25 mA; V_{CE} = 6 V; T_{amb} = 25 °C.

Fig.8 Gain as a function of frequency.



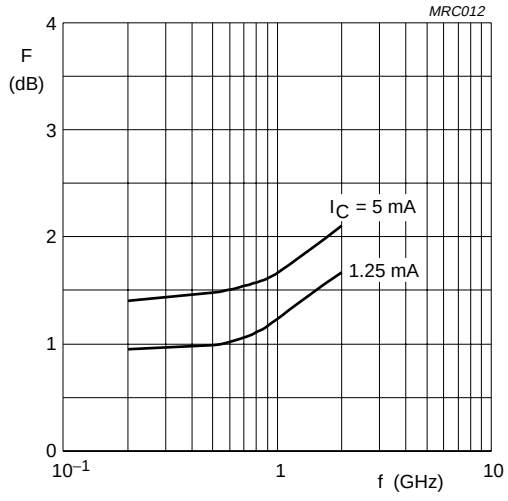
I_C = 5 mA; V_{CE} = 6 V; T_{amb} = 25 °C.

Fig.9 Gain as a function of frequency.



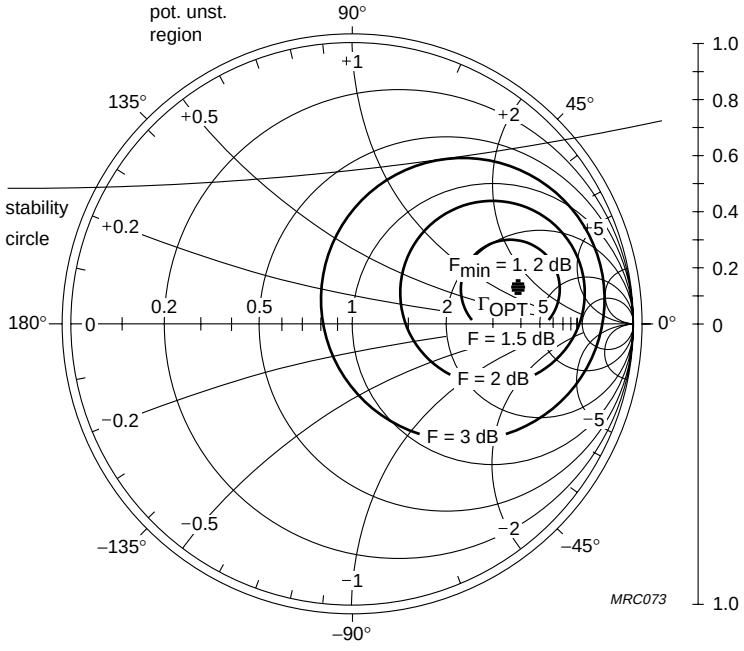
V_{CE} = 6 V; T_{amb} = 25 °C.

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



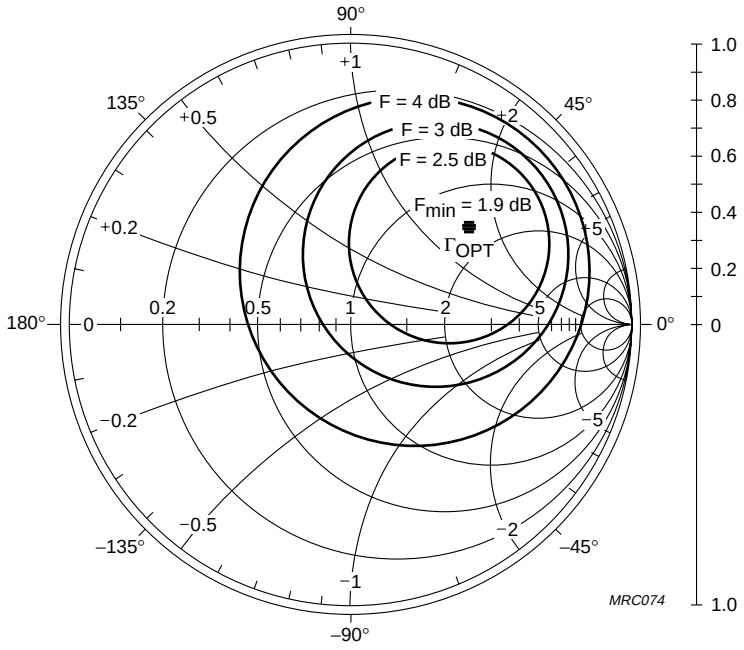
V_{CE} = 6 V; T_{amb} = 25 °C.

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



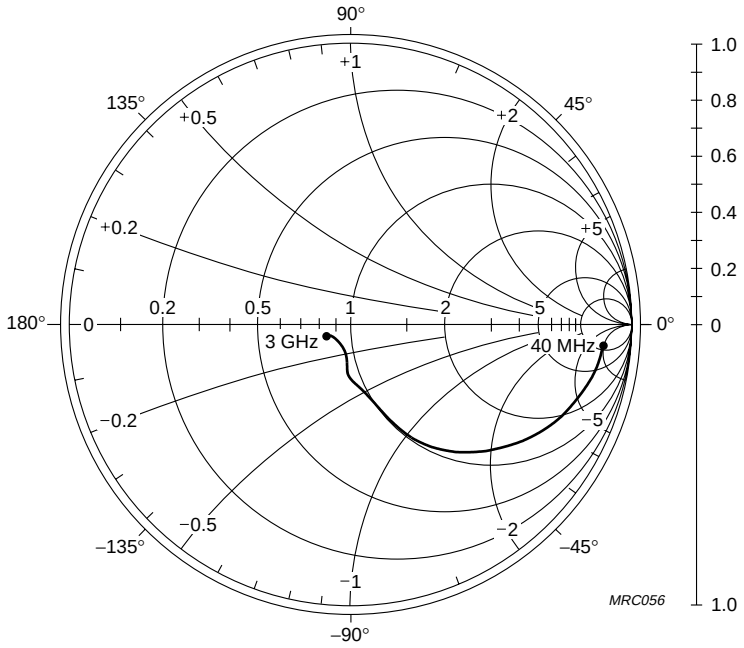
I_C = 1.25 mA; V_{CE} = 6 V;
f = 900 MHz; Z_o = 50 Ω.

Fig.12 Noise circle.



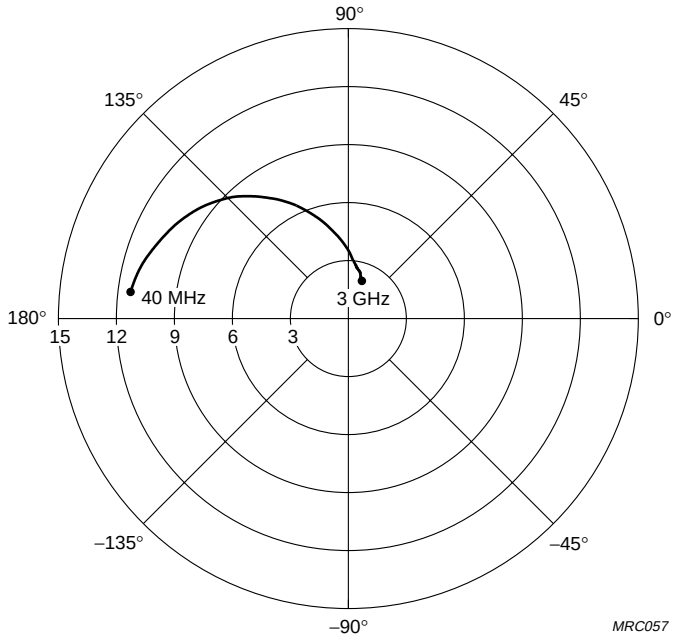
I_C = 1.25 mA; V_{CE} = 6 V;
f = 2 GHz; Z_o = 50 Ω.

Fig.13 Noise circle.



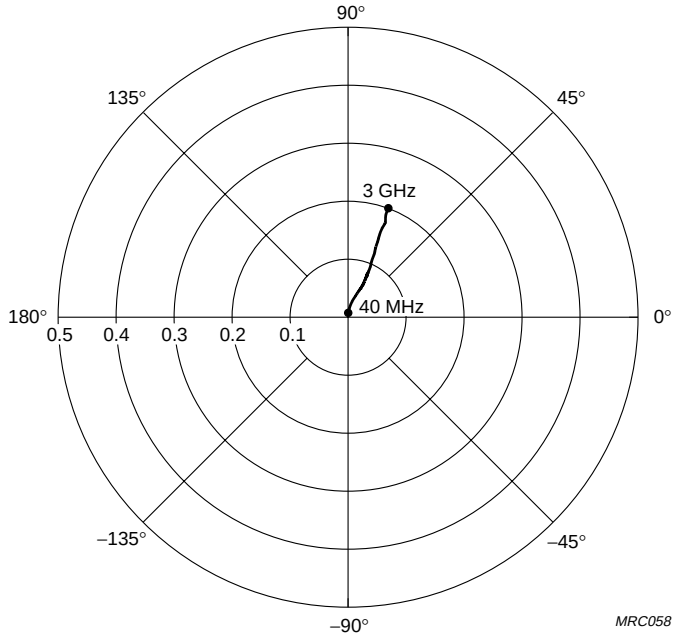
I_C = 5 mA; V_{CE} = 6 V;
Z_o = 50 Ω.

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



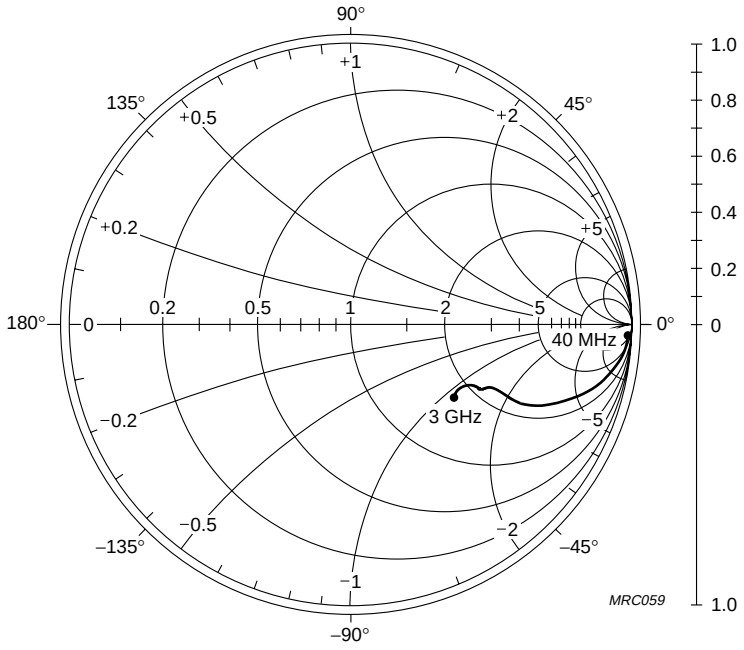
I_C = 5 mA; V_{CE} = 6 V.

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



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

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

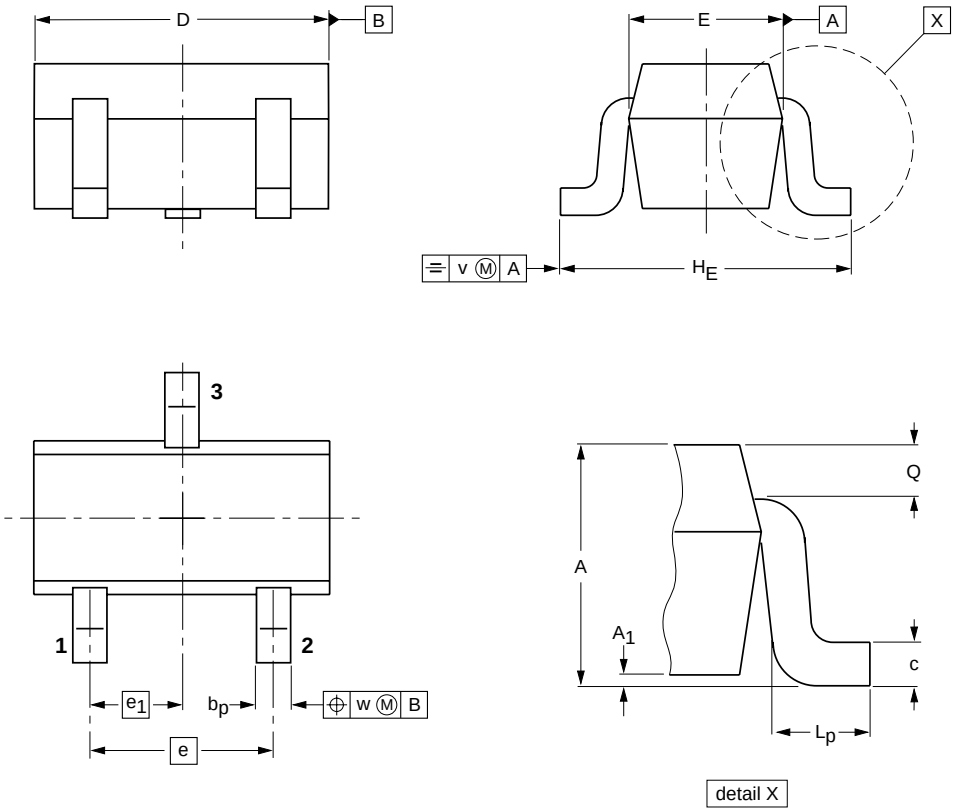


I_C = 5 mA; V_{CE} = 6 V;
Z_o = 50 Ω.

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

PACKAGE OUTLINE

Plastic surface mounted package; 3 leads **SOT416**



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	0.95 0.60	0.1	0.30 0.15	0.25 0.10	1.8 1.4	0.9 0.7	1	0.5	1.75 1.45	0.45 0.15	0.23 0.13	0.2	0.2

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT416			SC-75			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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Short-form specification — The data in a short-form specification is extracted from a full data sheet with the same type number and title. For detailed information see the relevant data sheet or data handbook.

Limiting values definition — Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 60134). 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.

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