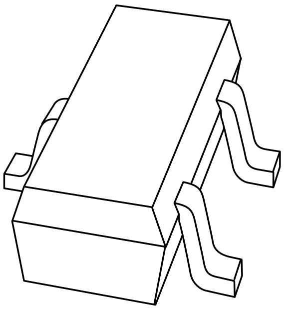
DATA SHEET



PRF949
UHF wideband transistor

Product specification
Supersedes data of 1999 Nov 02

2000 Apr 03

Philips
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FEATURES

- Small size
- Low noise
- Low distortion
- High gain
- Gold metallization ensures excellent reliability.

APPLICATIONS

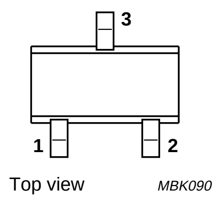
- Communication and instrumentation systems.

DESCRIPTION

Silicon NPN transistor in a surface mount 3-pin SOT416 (SC-75) package. The transistor is primarily intended for wideband applications in the GHz range in the RF front end of analog and digital cellular telephones, cordless phones, radar detectors, pagers and satellite TV-tuners.

PINNING SOT416 (SC-75)

PIN	DESCRIPTION
1	base
2	emitter
3	collector



Marking code: V0.

Fig.1 Simplified outline (SOT416).

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
C_{re}	feedback capacitance	$I_C = 0$; $V_{CB} = 6$ V; f = 1 MHz	–	0.3	–	pF
f_T	transition frequency	$I_C = 15$ mA; $V_{CE} = 6$ V; $f_m = 1$ GHz	7	9	–	GHz
G_{UM}	maximum unilateral power gain	$I_C = 15$ mA; $V_{CE} = 6$ V; $T_{amb} = 25$ °C; f = 1 GHz	–	16	–	dB
NF	noise figure	$\Gamma_S = \Gamma_{opt}$; $I_C = 5$ mA; $V_{CE} = 6$ V; f = 1 GHz	–	1.5	2.5	dB
P_{tot}	total power dissipation	$T_s = 75$ °C; note 1	–	–	150	mW
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point		–	–	500	K/W

Note

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

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	10	V
V_{EBO}	emitter-base voltage	open collector	–	1.5	V
I_C	collector current (DC)		–	50	mA
$I_{C(AV)}$	average collector current		–	50	mA
P_{tot}	total power dissipation	T_s = 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 CHARACTERISTICS

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

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
DC characteristics						
$V_{(BR)CBO}$	collector-base breakdown voltage	I_C = 100 μA; I_E = 0	20	–	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	I_C = 100 μA; I_B = 0	10	–	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	I_E = 10 μA; I_C = 0	1.5	–	–	V
V_{BEF}	forward base-emitter voltage	I_E = 25 mA	–	–	1.05	V
I_{CBO}	collector-base leakage current	V_{CB} = 10 V; I_E = 0	–	–	100	nA
I_{EBO}	emitter-base leakage current	V_{EB} = 1 V; I_C = 0	–	–	100	nA
h_{FE}	DC current gain	I_C = 5 mA; V_{CE} = 6 V	100	150	200	
		I_C = 15 mA; V_{CE} = 6 V	–	150	–	
AC characteristics						
C_{re}	feedback capacitance	I_C = 0; V_{CB} = 6 V; f = 1 MHz	–	0.3	–	pF
f_T	transition frequency	I_C = 15 mA; V_{CE} = 6 V; f_m = 1 GHz	7	9	–	GHz
$\|s_{21}\|^2$	insertion gain	I_C = 15 mA; V_{CE} = 6 V; f = 1 GHz	13	15	–	dB
G_{UM}	maximum unilateral power gain; note 1	I_C = 15 mA; V_{CE} = 6 V; T_{amb} = 25 °C; f = 1 GHz	–	16	–	dB
		I_C = 15 mA; V_{CE} = 6 V; T_{amb} = 25 °C; f = 2 GHz	–	10	–	dB
NF	noise figure	$\Gamma_S = \Gamma_{opt}$; I_C = 5 mA; V_{CE} = 6 V; f = 1 GHz	–	1.5	2.5	dB
		$\Gamma_S = \Gamma_{opt}$; I_C = 5 mA; V_{CE} = 6 V; f = 2 GHz	–	2.1	–	dB

Note

1. G_{UM} is the maximum unilateral power gain, assuming s_{12} is zero. $G_{UM} = 10 \log \frac{|s_{21}|^2}{(1-|s_{11}|^2)(1-|s_{22}|^2)}$ dB

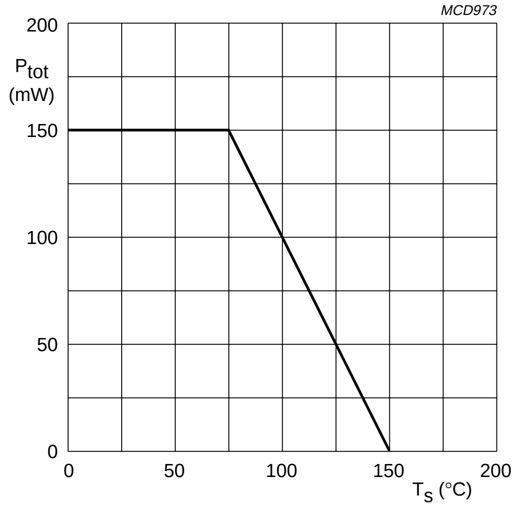
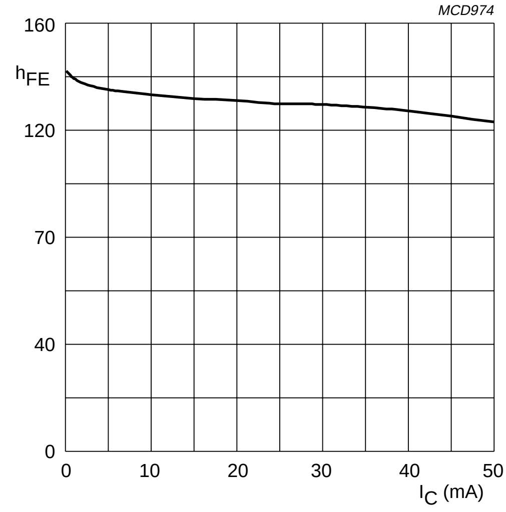
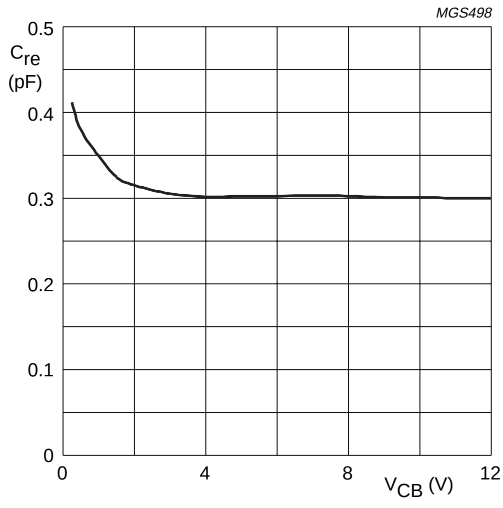


Fig.2 Power derating as a function of soldering point temperature.



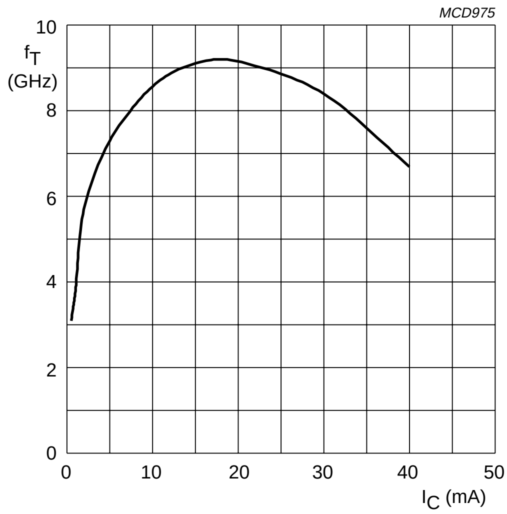
V_{CE} = 6 V.

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



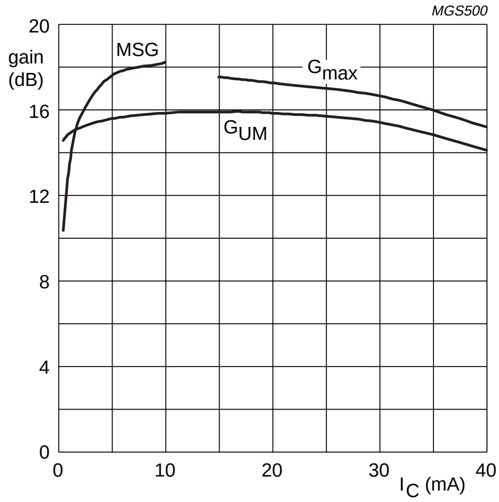
I_C = I_c = 0; f = 1 MHz.

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



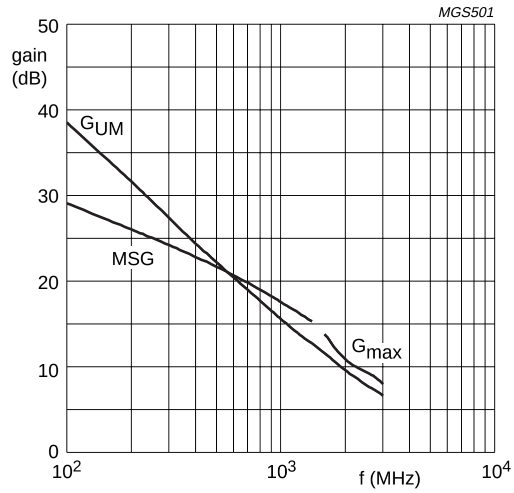
V_{CE} = 6 V; f_m = 1 GHz; T_{amb} = 25 °C.

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



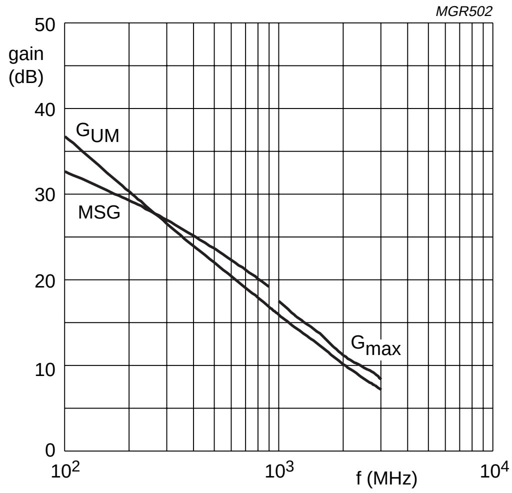
f = 1 GHz; V_{CE} = 6 V.
G_{UM} = maximum unilateral power gain.
MSG = maximum stable gain.
G_{max} = maximum available gain.

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



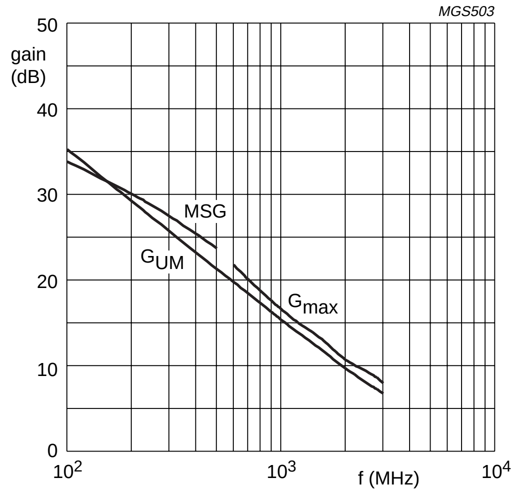
I_C = 5 mA; V_{CE} = 6 V.
G_{UM} = maximum unilateral power gain.
MSG = maximum stable gain.
G_{max} = maximum available gain.

Fig.7 Gain as a function of frequency; typical values.



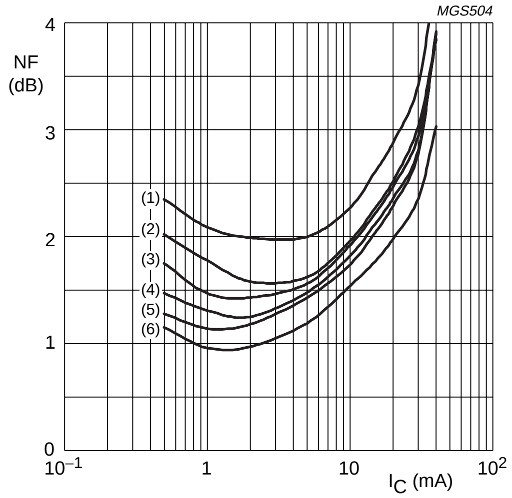
I_C = 15 mA; V_{CE} = 6 V.
G_{UM} = maximum unilateral power gain.
MSG = maximum stable gain.
G_{max} = maximum available gain.

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



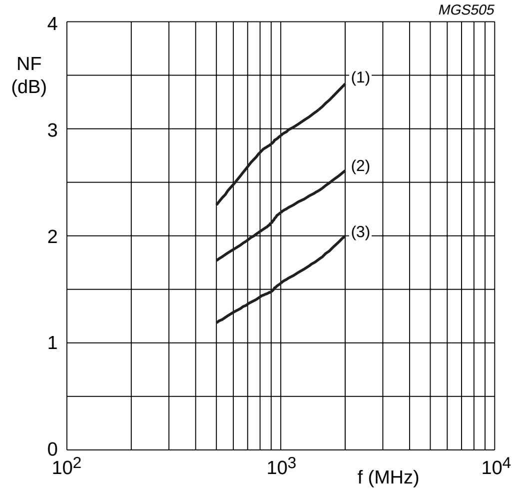
I_C = 30 mA; V_{CE} = 6 V.
G_{UM} = maximum unilateral power gain.
MSG = maximum stable gain.
G_{max} = maximum available gain.

Fig.9 Gain as a function of frequency; typical values.



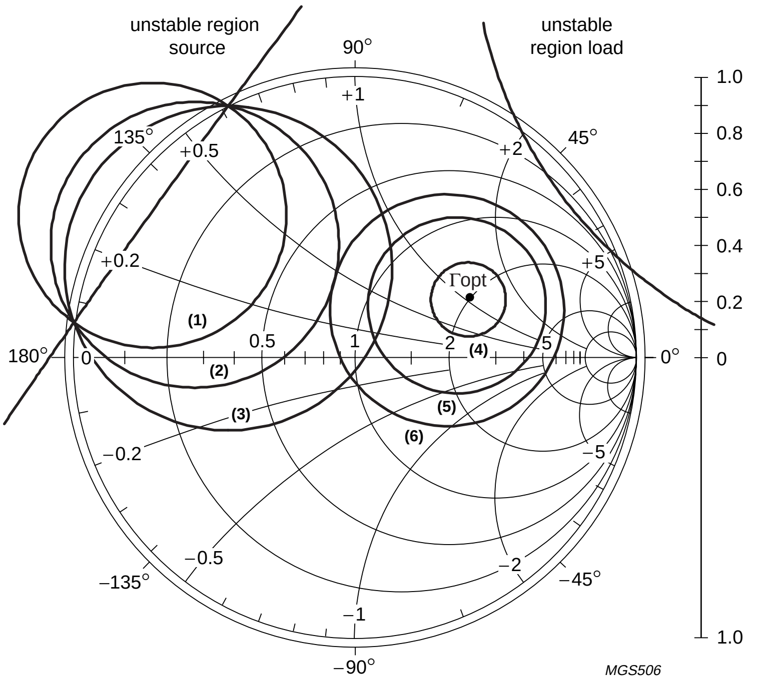
V_{CE} = 6 V.
(1) f = 2 GHz.
(2) f = 1.5 GHz.
(3) f = 1 GHz.
(4) f = 900 MHz.
(5) f = 800 MHz.
(6) f = 500 MHz.

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



V_{CE} = 6 V.
(1) I_C = 30 mA.
(2) I_C = 15 mA.
(3) I_C = 5 mA.

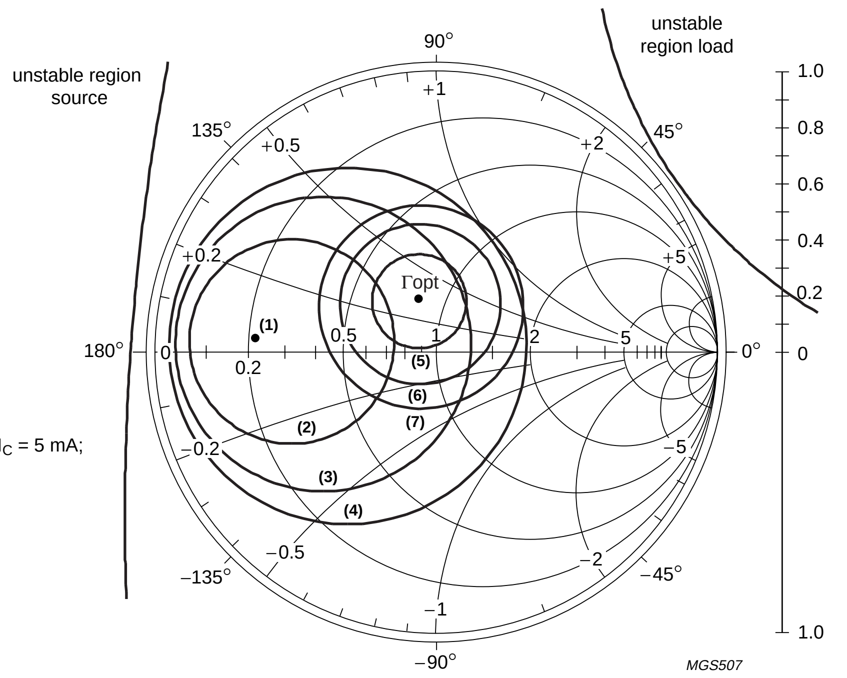
Fig.11 Minimum noise figure as a function of frequency; typical values.



f = 1 GHz; V_{CE} = 6 V;
I_C = 5 mA; Z_o = 50 Ω.

(1) G = 17 dB.
(2) G = 16 dB.
(3) G = 15 dB.
(4) NF = 1.6 dB.
(5) NF = 1.8 dB.
(6) NF = 2 dB.

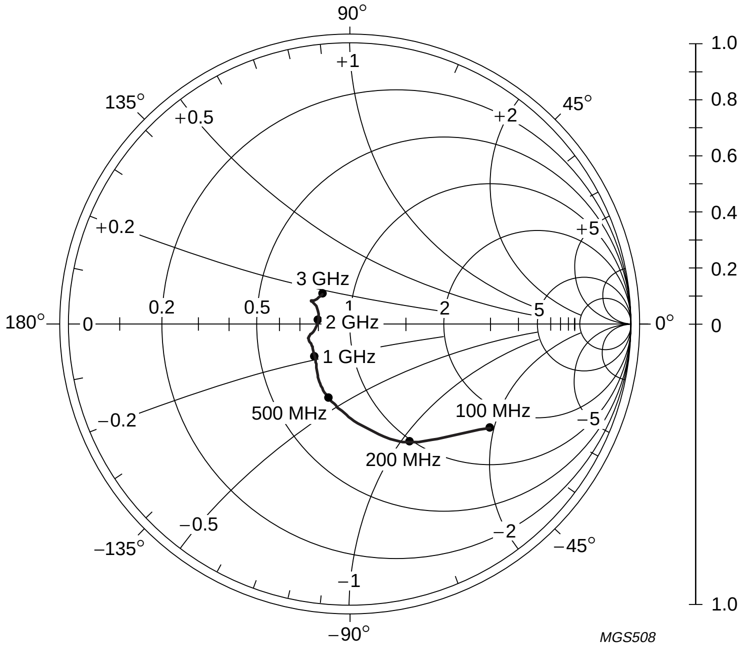
Fig.12 Common emitter available gain, noise and stability circles; typical values.



f = 2 GHz; V_{CE} = 6 V; I_C = 5 mA;
Z_o = 50 Ω.

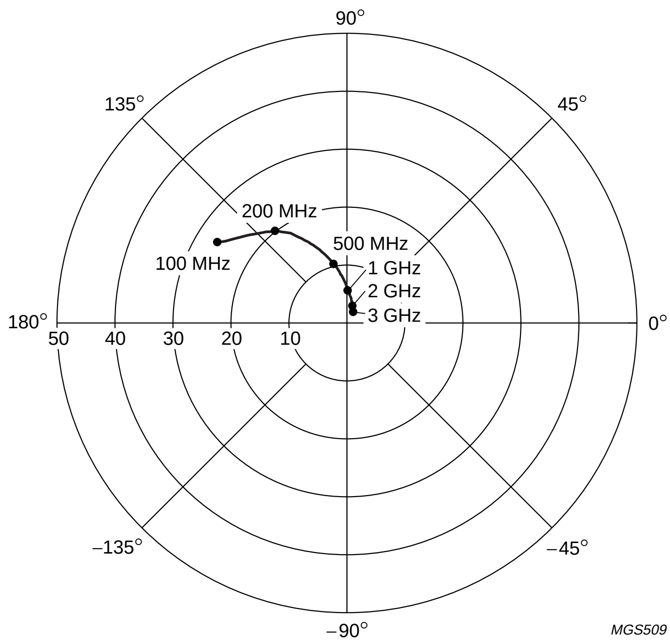
(1) G_{max} = 10.9 dB.
(2) G = 10 dB.
(3) G = 9 dB.
(4) G = 8 dB.
(5) NF = 2.1 dB.
(6) NF = 2.3 dB.
(7) NF = 2.5 dB.

Fig.13 Common emitter available gain, noise and stability circles; typical values.



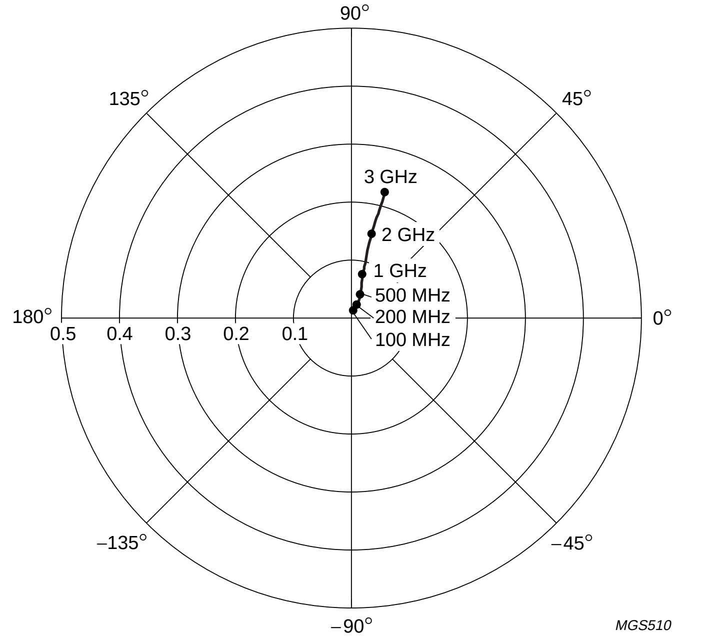
V_{CE} = 6 V; I_C = 15 mA; Z_o = 50 Ω.

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



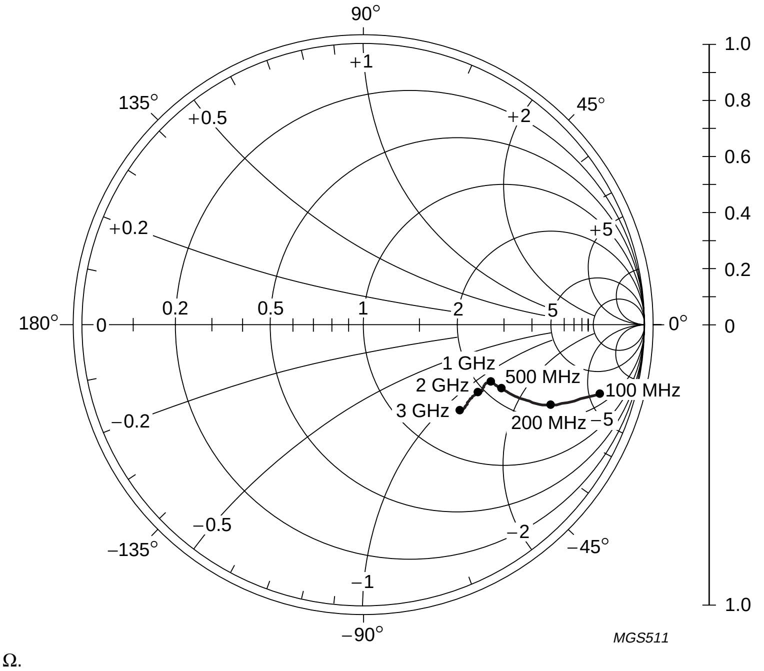
V_{CE} = 6 V; I_C = 15 mA.

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



V_{CE} = 6 V; I_C = 15 mA.

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

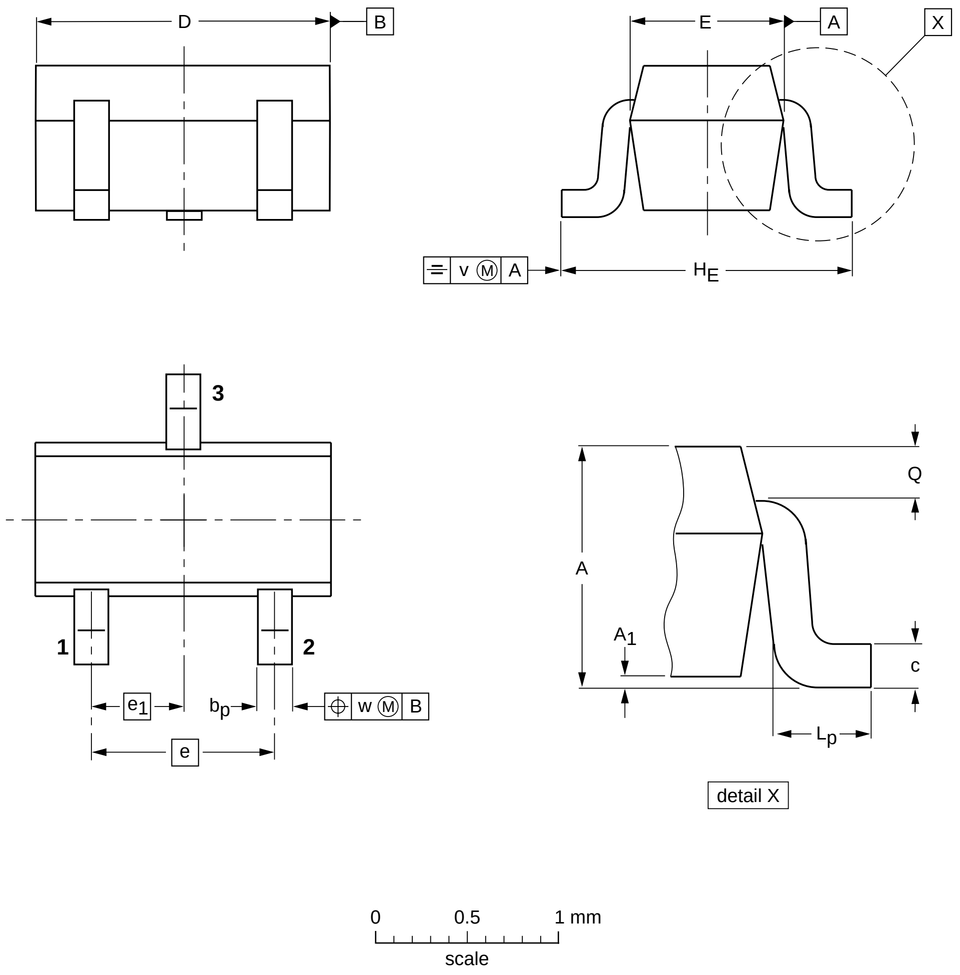


V_{CE} = 6 V; I_C = 15 mA; Z_o = 50 Ω.

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

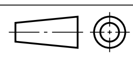
PACKAGE OUTLINE

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.

DEFINITIONS

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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