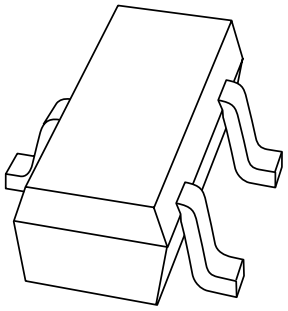
DATA SHEET



BFR93AT
NPN 5 GHz wideband transistor

Product specification
Supersedes data of 1999 Nov 02

2000 Mar 09

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NPN 5 GHz wideband transistor BFR93AT

FEATURES

- High power gain
- Gold metallization ensures excellent reliability
- SOT416 (SC-75) package.

APPLICATIONS

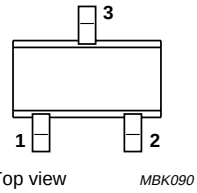
Designed for use in RF amplifiers, mixers and oscillators with signal frequencies up to 1 GHz.

DESCRIPTION

Silicon NPN transistor encapsulated in a plastic SOT416 (SC-75) package. The BFR93AT uses the same die as the SOT23 version: BFR93A.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector



Top view MBK090

Marking code: R2.

Fig.1 SOT416.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	15	V
V_{CEO}	collector-emitter voltage	open base	–	–	12	V
I_C	collector current (DC)		–	–	35	mA
P_{tot}	total power dissipation	$T_s \leq 75$ °C; note 1	–	–	150	mW
h_{FE}	DC current gain	I_C = 30 mA; V_{CE} = 5 V	40	90	–	
C_{re}	feedback capacitance	I_C = 0; V_{CE} = 5 V; f = 1 MHz; T_{amb} = 25 °C	–	0.6	–	pF
f_T	transition frequency	I_C = 30 mA; V_{CE} = 5 V; f = 500 MHz	4	5	–	GHz
G_{UM}	maximum unilateral power gain	I_C = 30 mA; V_{CE} = 8 V; T_{amb} = 25 °C;				
		f = 1 GHz	–	13	–	dB
		f = 2 GHz	–	8	–	dB
F	noise figure	I_C = 5 mA; V_{CE} = 8 V; f = 1 GHz; $\Gamma_s = \Gamma_{opt}$	–	1.5	–	dB
T_j	junction temperature		–	–	150	°C

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	CONDITION	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	15	V
V_{CEO}	collector-emitter voltage	open base	–	12	V
V_{EBO}	emitter-base voltage	open collector	–	2	V
I_C	DC collector current		–	35	mA
P_{tot}	total power dissipation	$T_s \leq 75$ °C; see Fig.2	–	150	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C

THERMAL CHARACTERISTICS

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

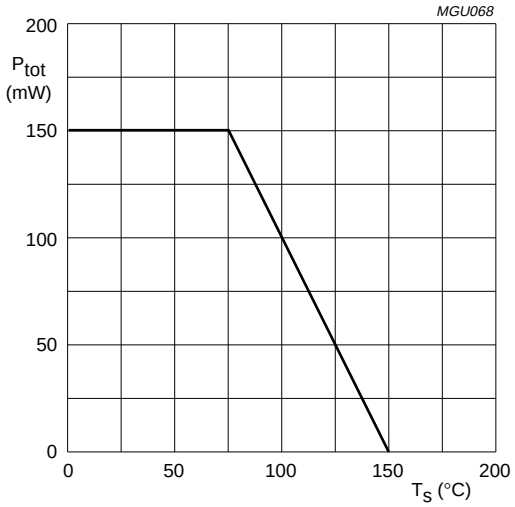


Fig.2 Power derating curve.

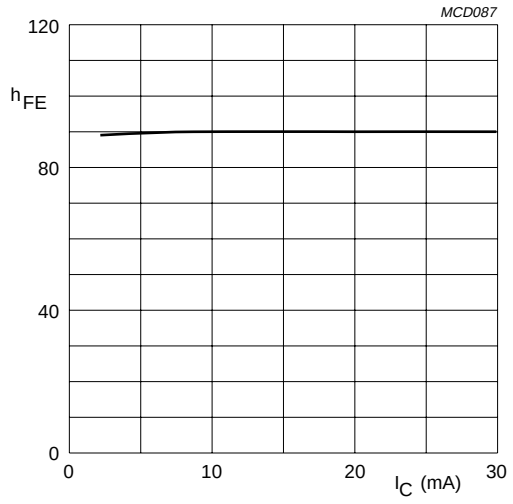
CHARACTERISTICS

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} = 5 V	–	–	50	nA
h_{FE}	DC current gain	I_C = 30 mA; V_{CE} = 5 V	40	90	–	
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 5 V; f = 1 MHz	–	0.7	–	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = 0.5 V; f = 1 MHz	–	2.3	–	pF
C_{re}	feedback capacitance	I_C = 0; V_{CE} = 5 V; f = 1 MHz	–	0.6	–	pF
f_T	transition frequency	I_C = 30 mA; V_{CE} = 5 V; f = 500 MHz	4	5	–	GHz
G_{UM}	maximum unilateral power gain	I_C = 30 mA; V_{CE} = 8 V; T_{amb} = 25 °C; note 1;				
		f = 1 GHz	–	13	–	dB
		f = 2 GHz	–	8	–	dB
F	noise figure	I_C = 5 mA; V_{CE} = 8 V; $\Gamma_s = \Gamma_{opt}$;				
		f = 1 GHz	–	1.5	–	dB
		f = 2 GHz	–	2.1	–	dB

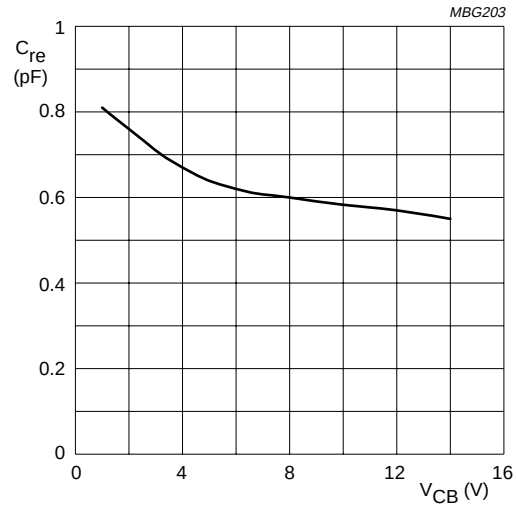
Note

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



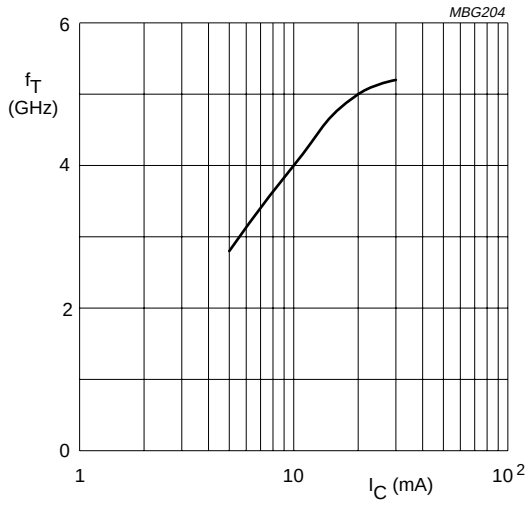
V_{CE} = 5 V.

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



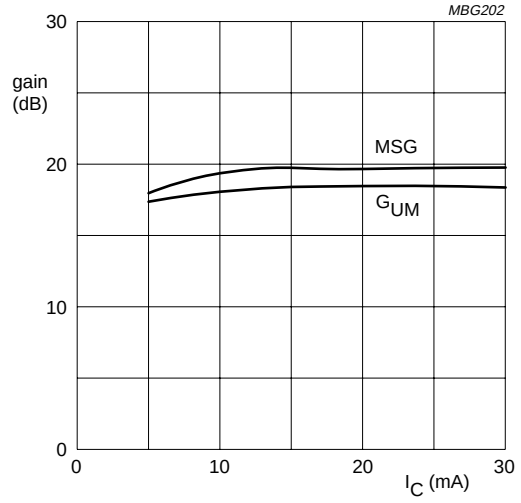
I_C = 0; f = 1 MHz.

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



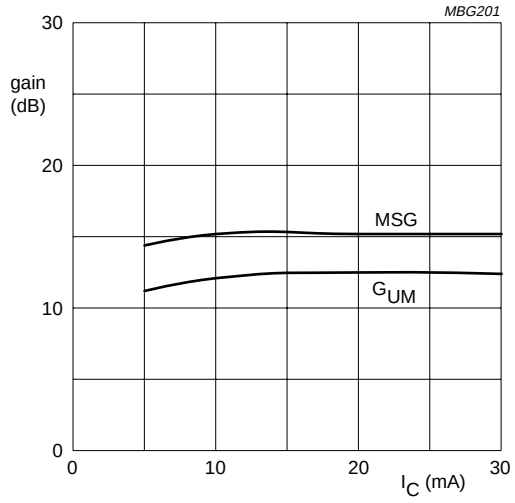
V_{CE} = 5 V; f = 500 MHz; T_{amb} = 25 °C.

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



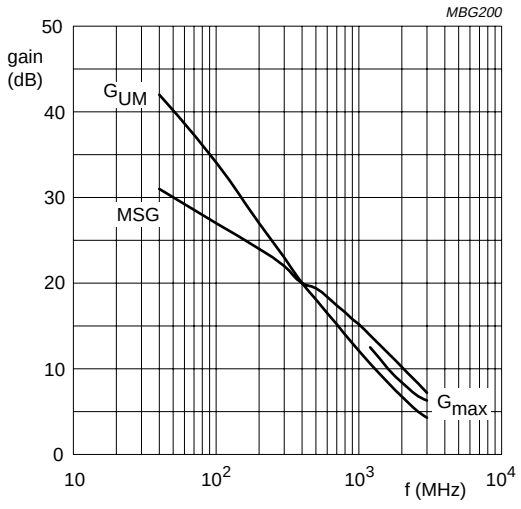
V_{CE} = 8 V; f = 500 MHz.

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



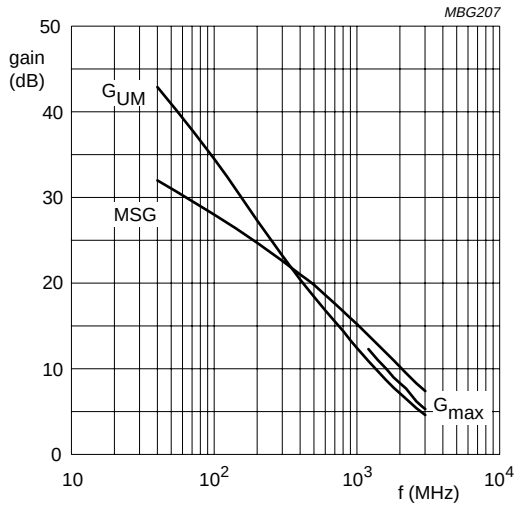
V_{CE} = 8 V; f = 1 GHz.

Fig.7 Gain as a function of collector current; typical values.



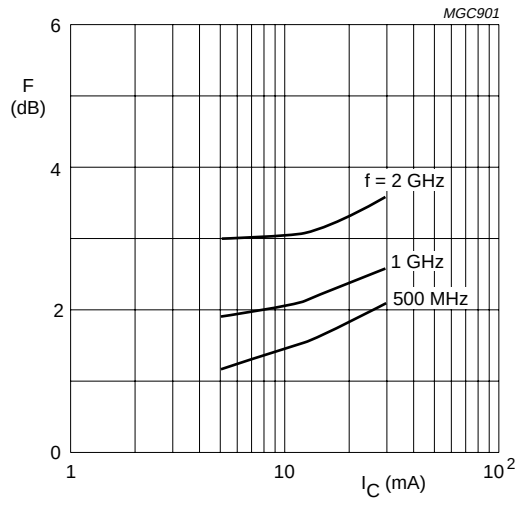
V_{CE} = 8 V; I_C = 10 mA.

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



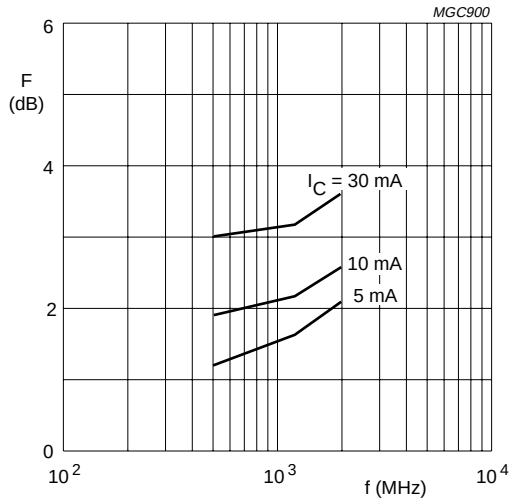
V_{CE} = 8 V; I_C = 30 mA.

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



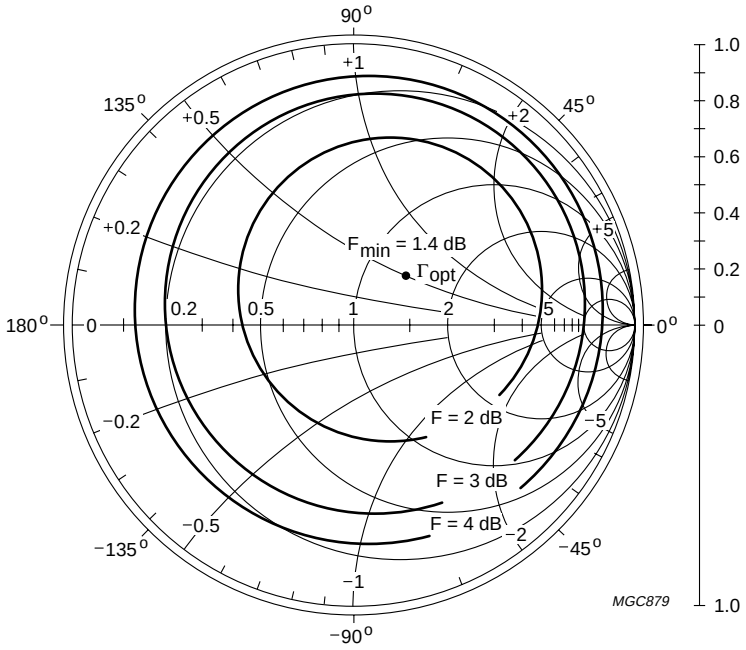
V_{CE} = 8 V.

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



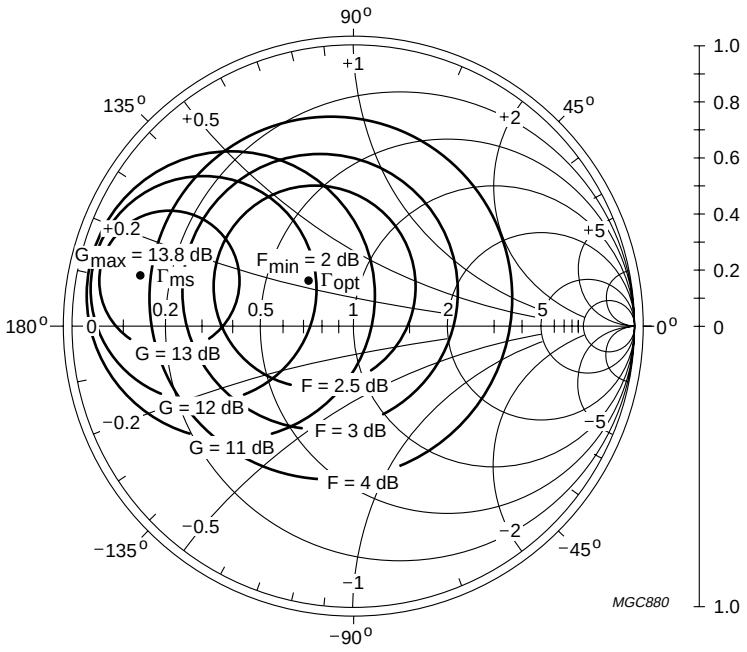
V_{CE} = 8 V.

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



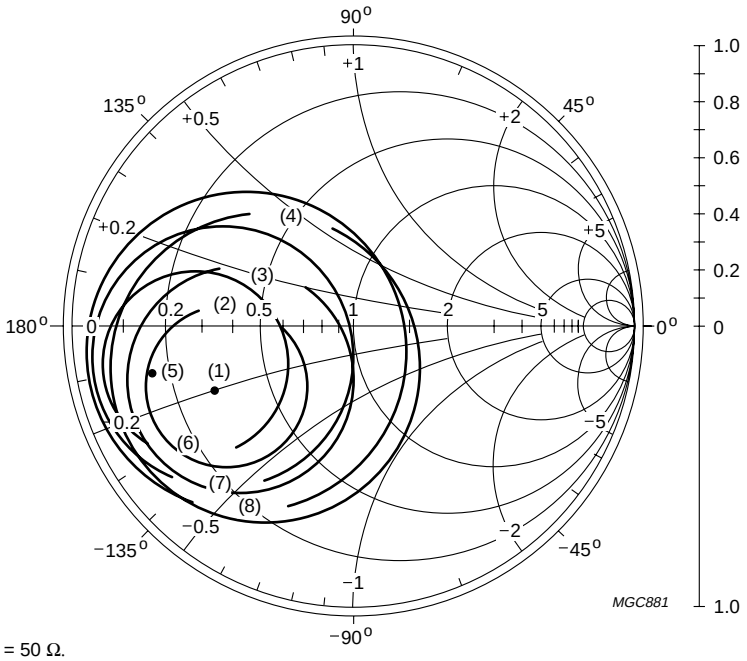
f = 500 MHz; V_{CE} = 8 V; I_C = 10 mA; Z_o = 50 Ω.

Fig.12 Common emitter noise figure circles; typical values.



f = 1 GHz; V_{CE} = 8 V; I_C = 10 mA; Z_o = 50 Ω.

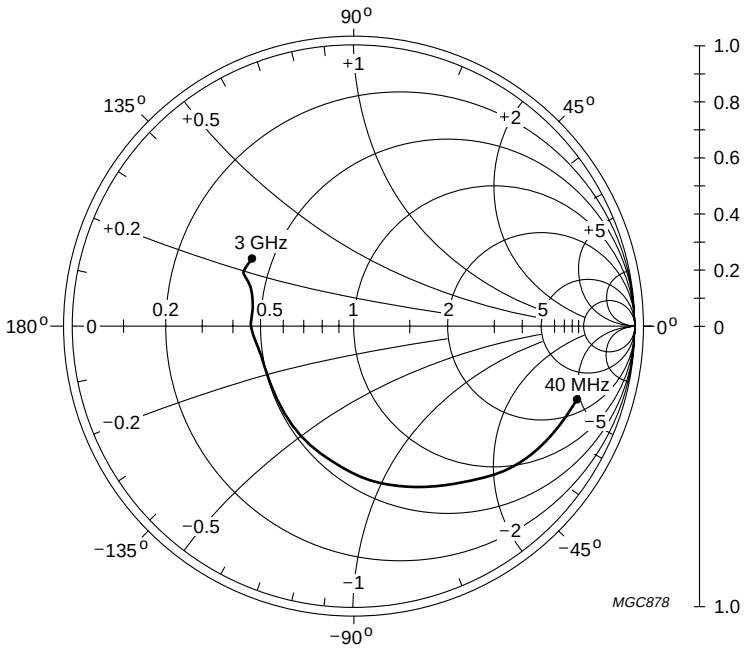
Fig.13 Common emitter noise figure circles; typical values.



(1) Γ_{opt}; F_{min} = 3 dB.
(2) F = 3.5 dB.
(3) F = 4 dB.
(4) F = 5 dB.
(5) Γ_{ms}; G_{max} = 8.1 dB.
(6) G = 7 dB.
(7) G = 6 dB.
(8) G = 5 dB.

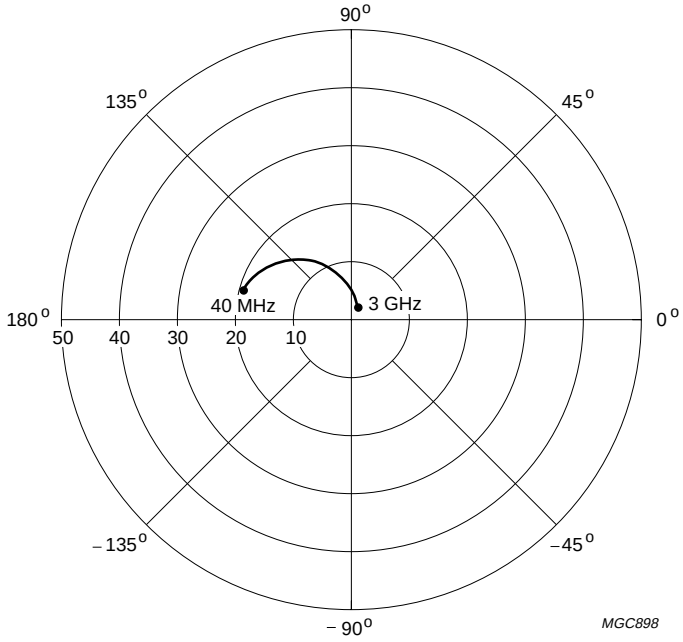
f = 2 GHz; V_{CE} = 8 V; I_C = 10 mA; Z_o = 50 Ω.

Fig.14 Common emitter noise figure circles; typical values.



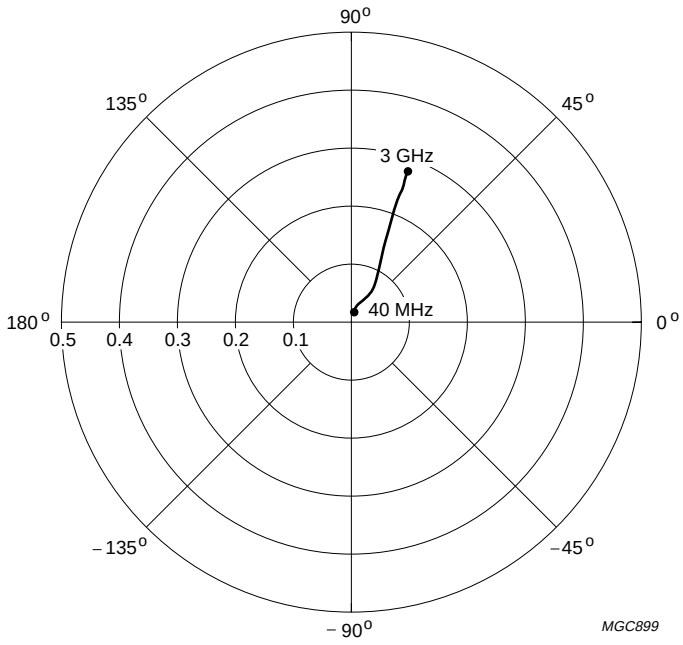
V_{CE} = 8 V; I_C = 30 mA; Z_o = 50 Ω.

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



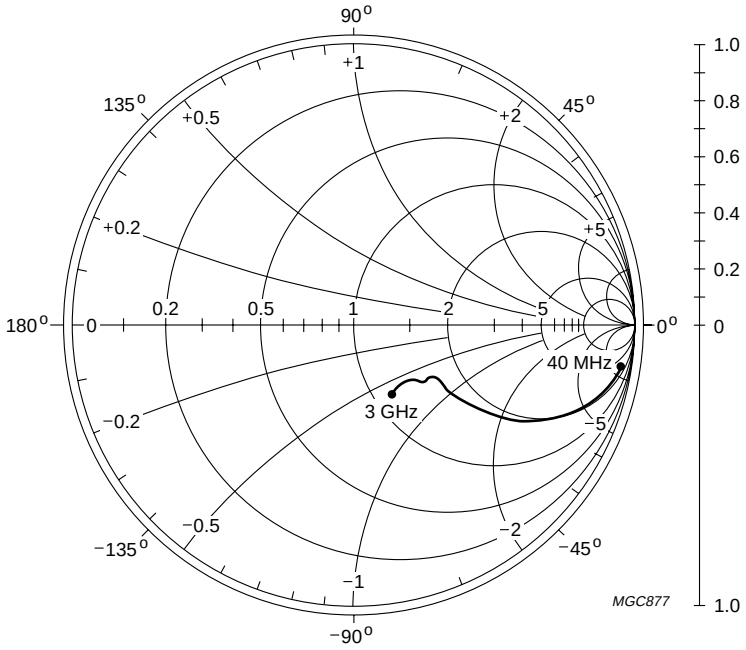
V_{CE} = 8 V; I_C = 30 mA.

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



V_{CE} = 8 V; I_C = 30 mA.

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

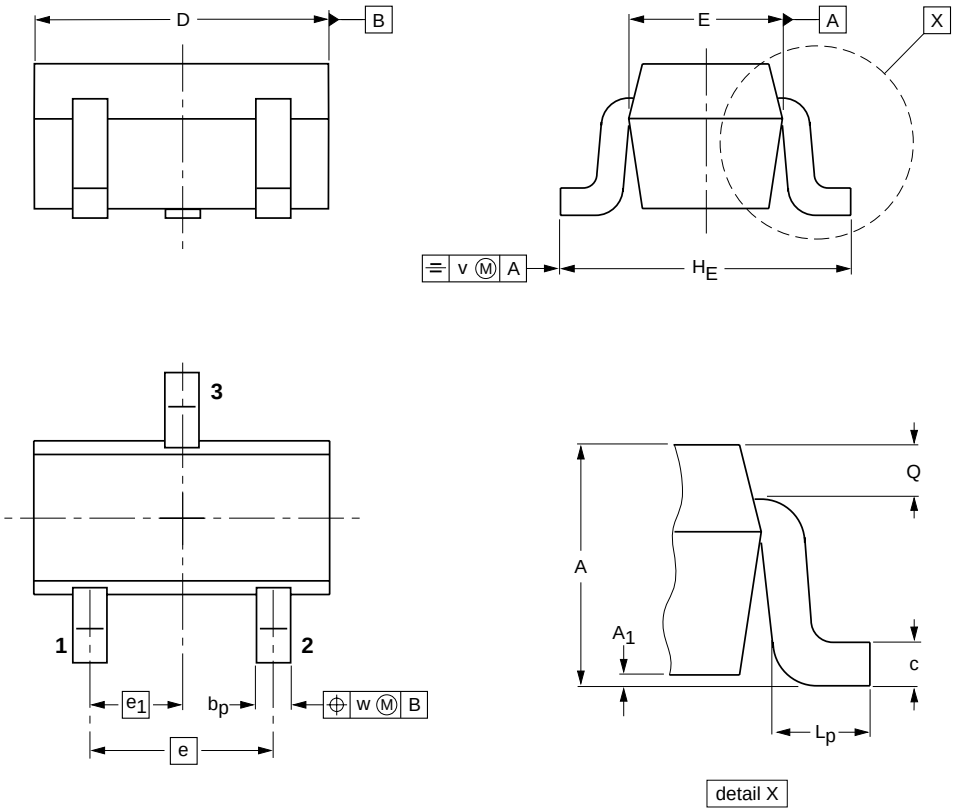


V_{CE} = 8 V; I_C = 30 mA; Z_o = 50 Ω.

Fig.18 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

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 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.	
Application information	
Where application information is given, it is advisory and does not form part of the specification.	

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NOTES

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