DATA SHEET

BFR93AW
NPN 5 GHz wideband transistor

Product specification
Supersedes data of November 1992

1995 Sep 18

NPN 5 GHz wideband transistor BFR93AW

FEATURES

- High power gain
- Gold metallization ensures excellent reliability
- SOT323 (S-mini) package.

APPLICATIONS

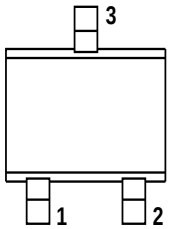
It is designed for use in RF amplifiers, mixers and oscillators with signal frequencies up to 1 GHz.

DESCRIPTION

Silicon NPN transistor encapsulated in a plastic SOT323 (S-mini) package. The BFR93AW uses the same crystal as the SOT23 version, BFR93A.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector



Top view MBC870

Marking code: R2.

Fig.1 SOT323

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	up to T_s = 93 °C; note 1	–	–	300	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; f = 1 GHz; T_{amb} = 25 °C	–	13	–	dB
		I_C = 30 mA; V_{CE} = 8 V; f = 2 GHz; T_{amb} = 25 °C	–	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 134).

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	collector current (DC)		–	35	mA
P_{tot}	total power dissipation	up to T_s = 93 °C; see Fig.2; note 1	–	300	mW
T_{stg}	storage temperature		−65	+150	°C
T_j	junction temperature		–	150	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITION	VALUE	UNIT
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 93 °C; note 1	190	K/W

Note to the Limiting values and Thermal characteristics

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

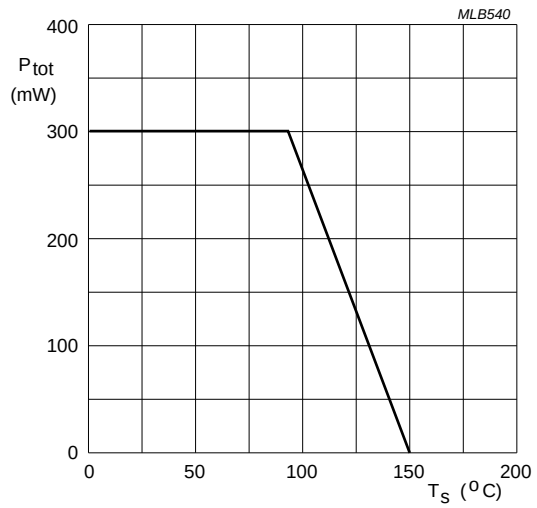


Fig.2 Power derating curve.

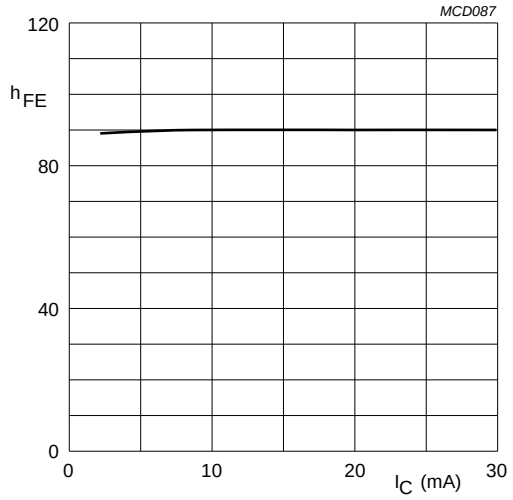
CHARACTERISTICS

T_j = 25 °C (unless otherwise specified).

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector leakage 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; note 1	I_C = 30 mA; V_{CE} = 8 V; f = 1 GHz; T_{amb} = 25 °C	–	13	–	dB
		I_C = 30 mA; V_{CE} = 8 V; f = 2 GHz; T_{amb} = 25 °C	–	8	–	dB
F	noise figure	I_C = 5 mA; V_{CE} = 8 V; f = 1 GHz; $\Gamma_s = \Gamma_{opt}$	–	1.5	–	dB
		I_C = 5 mA; V_{CE} = 8 V; f = 2 GHz; $\Gamma_s = \Gamma_{opt}$	–	2.1	–	dB

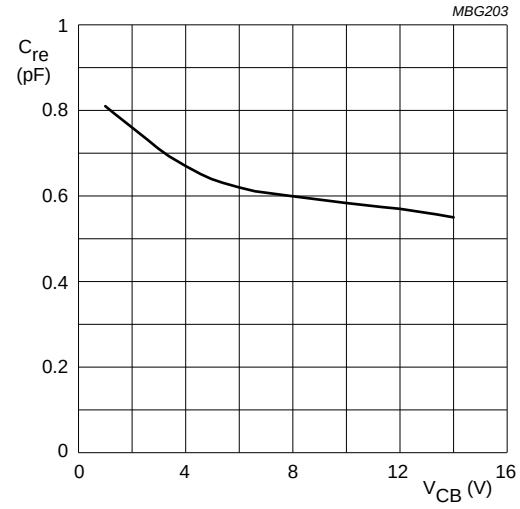
Note

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.



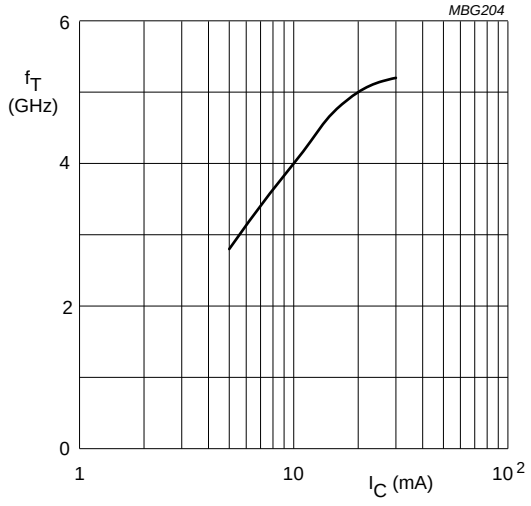
V_{CE} = 5 V.

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



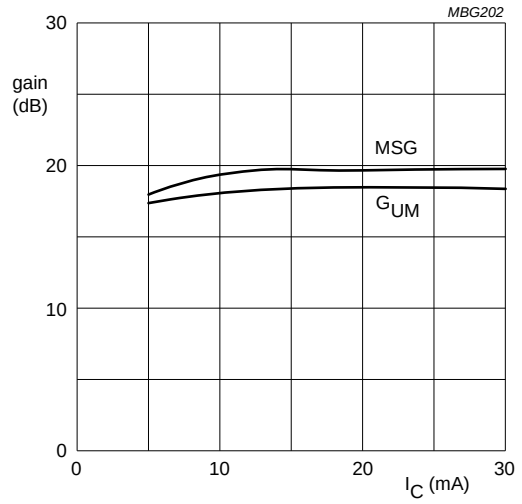
I_C = 0; f = 1 MHz.

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



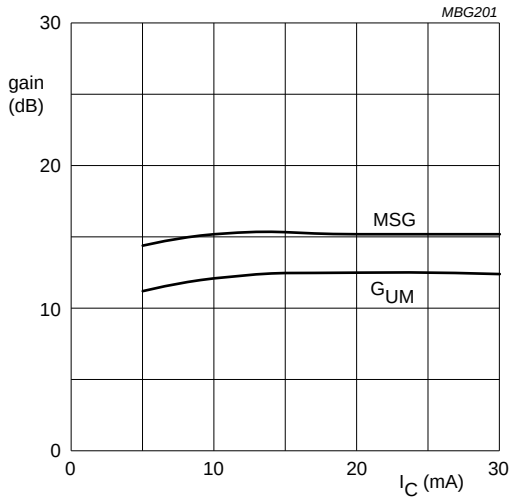
V_{CE} = 5 V; f = 500 MHz; T_{amb} = 25 °C.

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



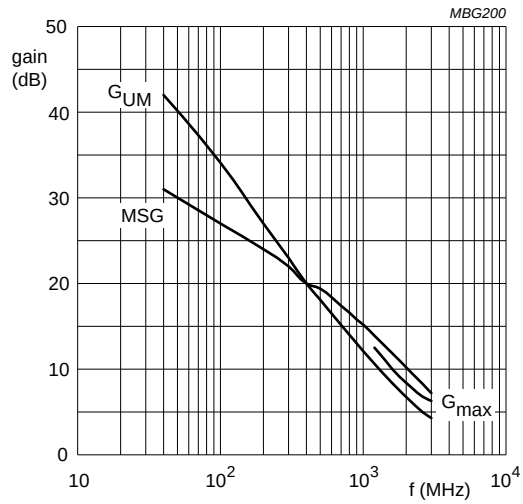
V_{CE} = 8 V; f = 500 MHz.

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



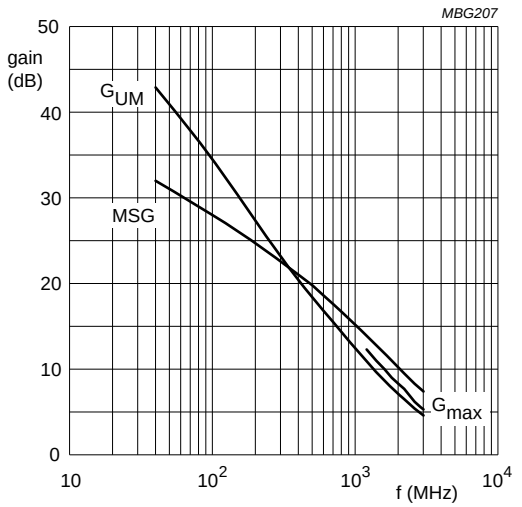
V_{CE} = 8 V; f = 1 GHz.

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



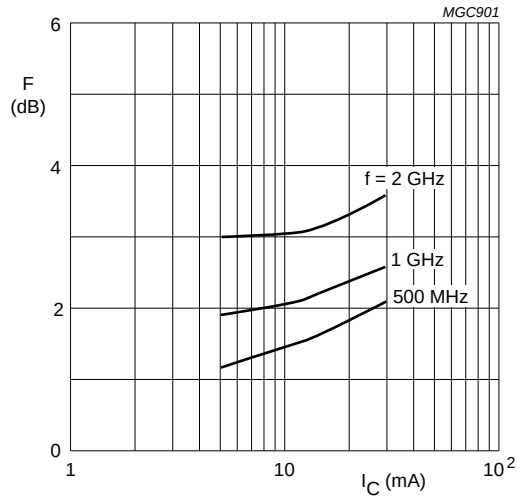
V_{CE} = 8 V; I_C = 10 mA.

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



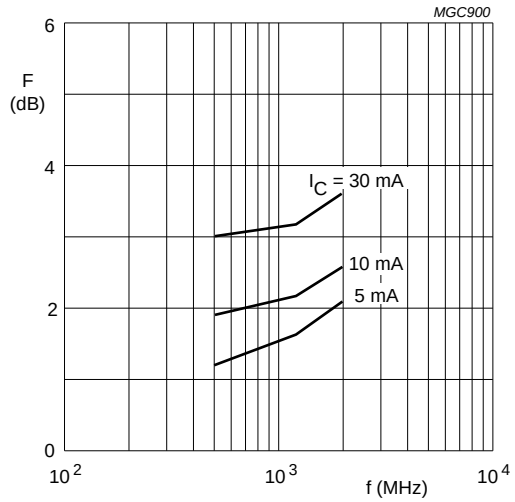
V_{CE} = 8 V; I_C = 30 mA.

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



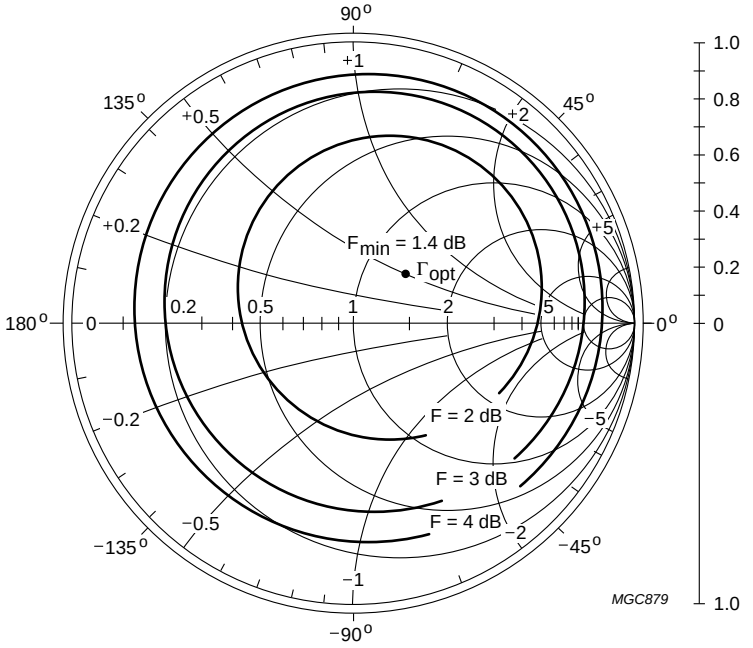
V_{CE} = 8 V.

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



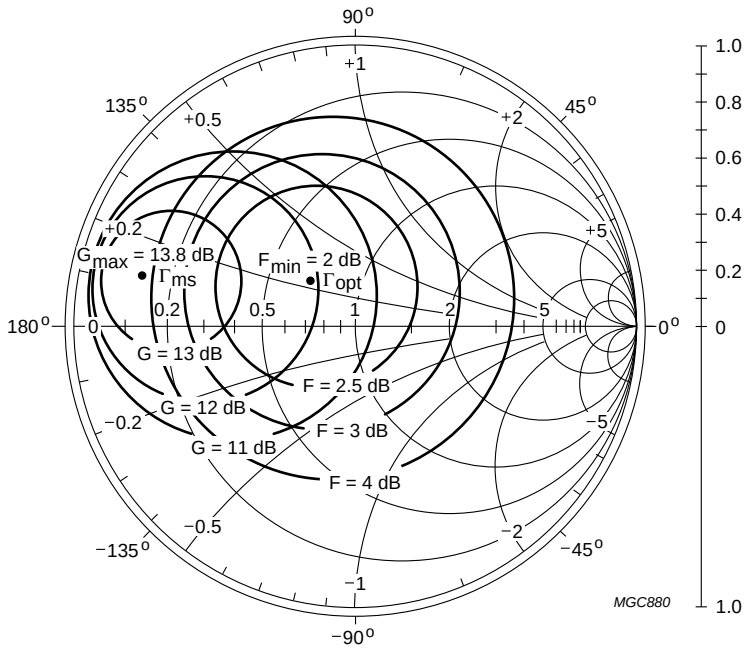
V_{CE} = 8 V.

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



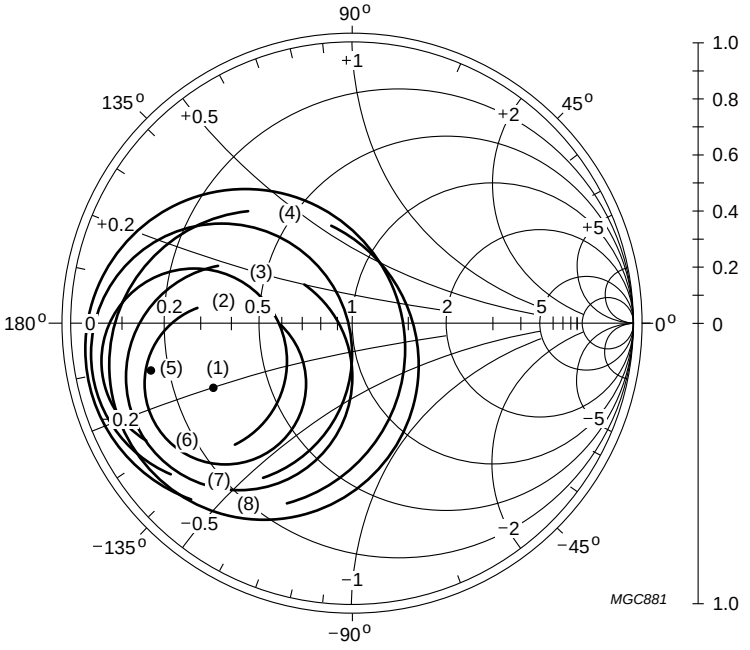
f = 500 MHz; V_{CE} = 8 V; I_C = 10 mA; Z_o = 50 Ω.

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



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

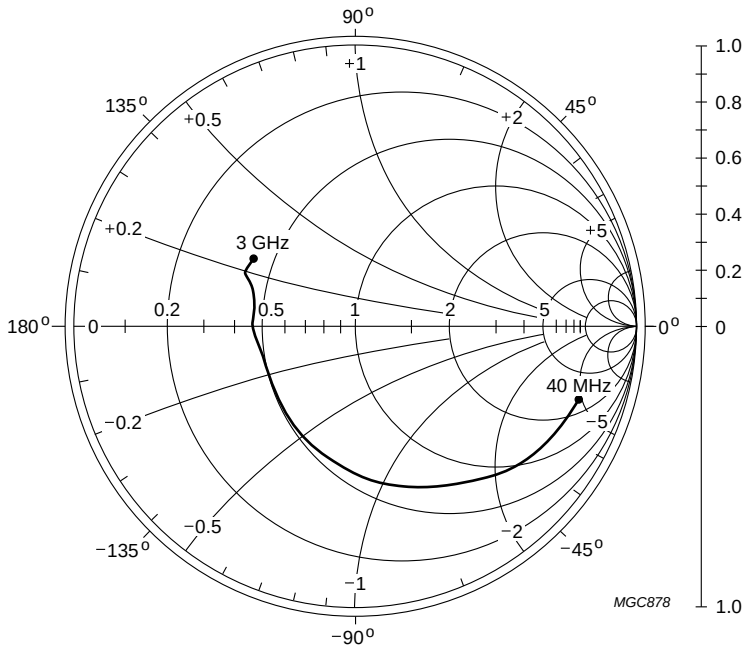
Fig.13 Common emitter noise figure circles; typical values.



(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.

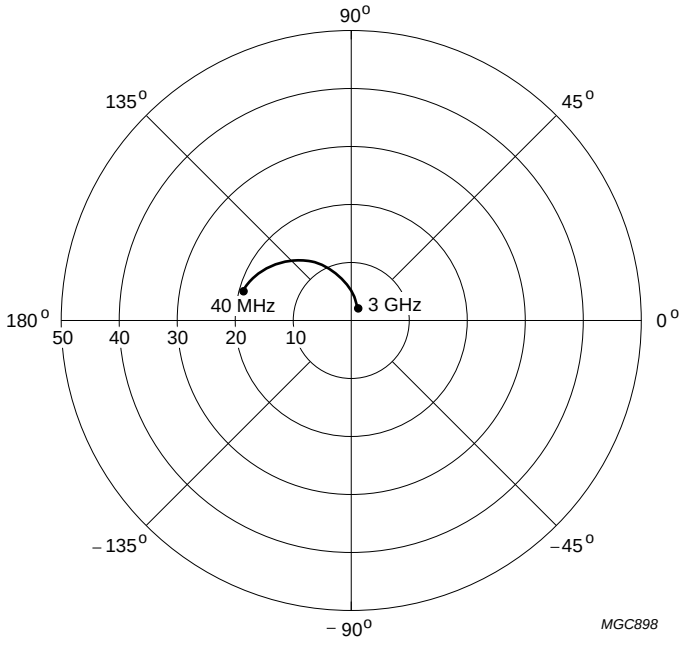
f = 2 GHz; V_{CE} = 8 V; I_C = 10 mA; Z_o = 50 Ω.

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



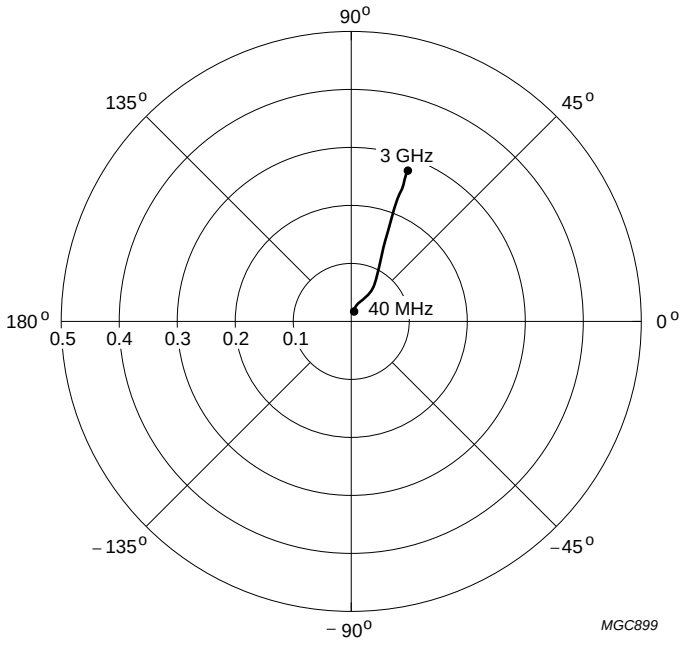
V_{CE} = 8 V; I_C = 30 mA; Z_o = 50 Ω.

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



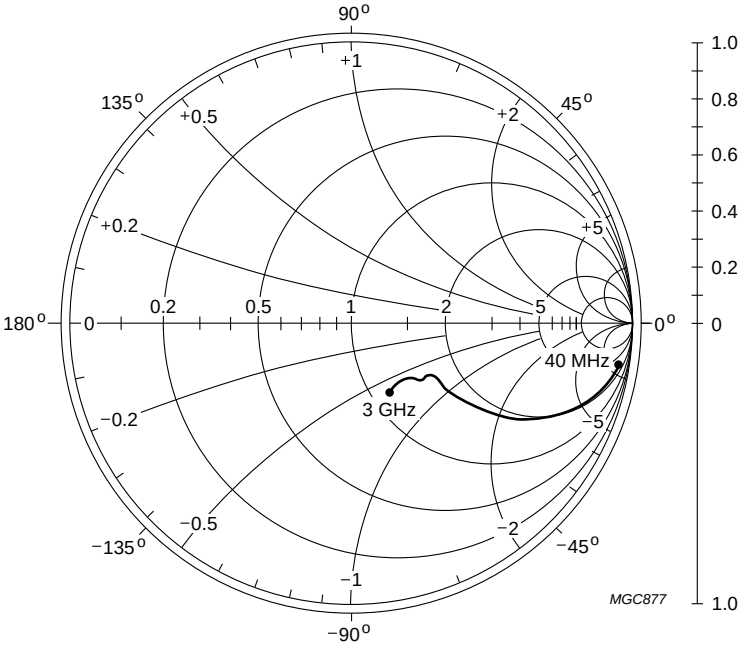
V_{CE} = 8 V; I_C = 30 mA.

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.

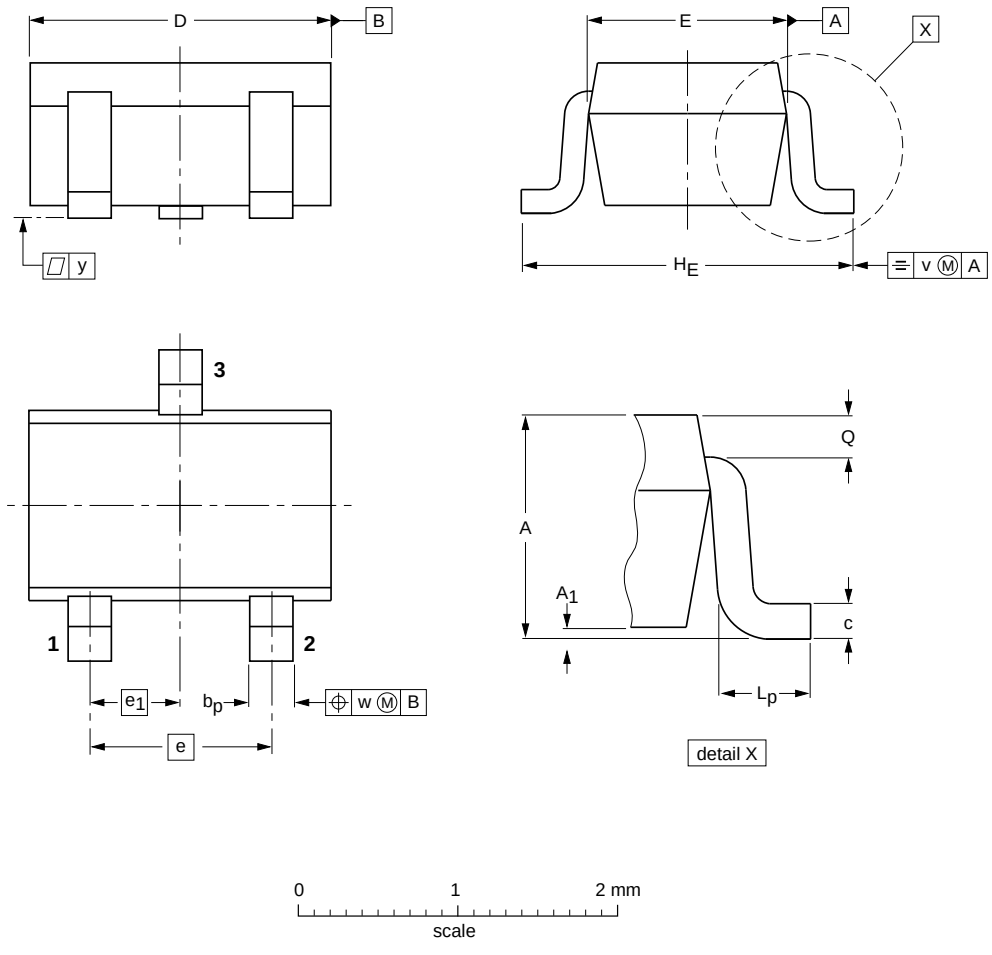


V_{CE} = 8 V; I_C = 30 mA; Z_o = 50 Ω.

Fig.18 Common emitter output reflection coefficient (s_{22}); typical values.

PACKAGE OUTLINE

Plastic surface-mounted package; 3 leads **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	JEITA			
SOT323			SC-70			~~04-11-04~~ 06-03-16

DATA SHEET STATUS

DOCUMENT STATUS[1]	PRODUCT STATUS[2]	DEFINITION
Objective data sheet	Development	This document contains data from the objective specification for product development.
Preliminary data sheet	Qualification	This document contains data from the preliminary specification.
Product data sheet	Production	This document contains the product specification.

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This data sheet was changed to reflect the new company name NXP Semiconductors, including new legal definitions and disclaimers. No changes were made to the technical content, except for package outline drawings which were updated to the latest version.

Contact information

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