

DATA SHEET

BFR93AW

NPN 5 GHz wideband transistor

Product specification
Supersedes data of November 1992

1995 Sep 18



NPN 5 GHz wideband transistor

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FEATURES

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

APPLICATIONS

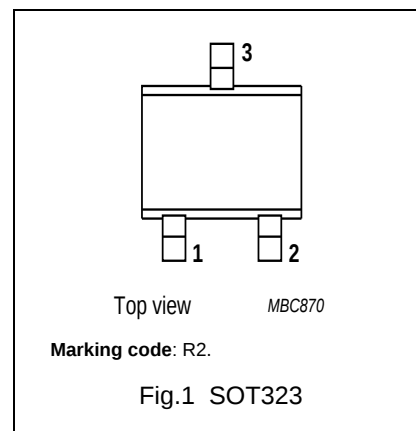
It is designed for use in RF amplifiers, mixers and oscillators with signal frequencies up to 1 GHz.

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



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 $T_s = 93\text{ °C}$; note 1	—	—	300	mW
h_{FE}	DC current gain	$I_C = 30\text{ mA}$; $V_{CE} = 5\text{ V}$	40	90	—	
C_{re}	feedback capacitance	$I_C = 0$; $V_{CE} = 5\text{ V}$; $f = 1\text{ MHz}$; $T_{amb} = 25\text{ °C}$	—	0.6	—	pF
f_T	transition frequency	$I_C = 30\text{ mA}$; $V_{CE} = 5\text{ V}$; $f = 500\text{ MHz}$	4	5	—	GHz
G_{UM}	maximum unilateral power gain	$I_C = 30\text{ mA}$; $V_{CE} = 8\text{ V}$; $f = 1\text{ GHz}$; $T_{amb} = 25\text{ °C}$	—	13	—	dB
		$I_C = 30\text{ mA}$; $V_{CE} = 8\text{ V}$; $f = 2\text{ GHz}$; $T_{amb} = 25\text{ °C}$	—	8	—	dB
F	noise figure	$I_C = 5\text{ mA}$; $V_{CE} = 8\text{ V}$; $f = 1\text{ GHz}$; $\Gamma_s = \Gamma_{opt}$	—	1.5	—	dB
T_j	junction temperature		—	—	150	°C

Note

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

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

Note to the Limiting values and Thermal characteristics

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

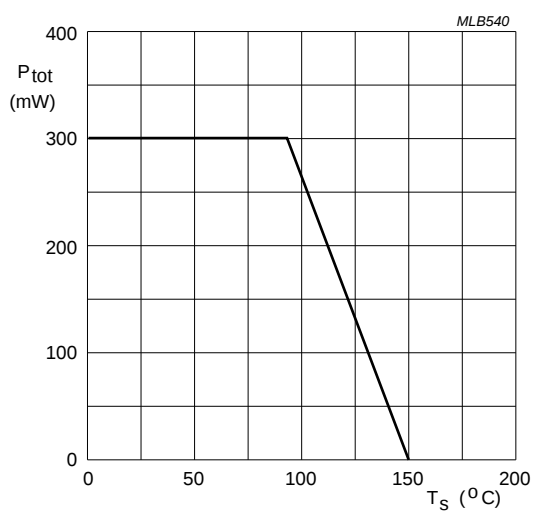


Fig.2 Power derating curve.

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CHARACTERISTICS

$T_j = 25\text{ °C}$ (unless otherwise specified).

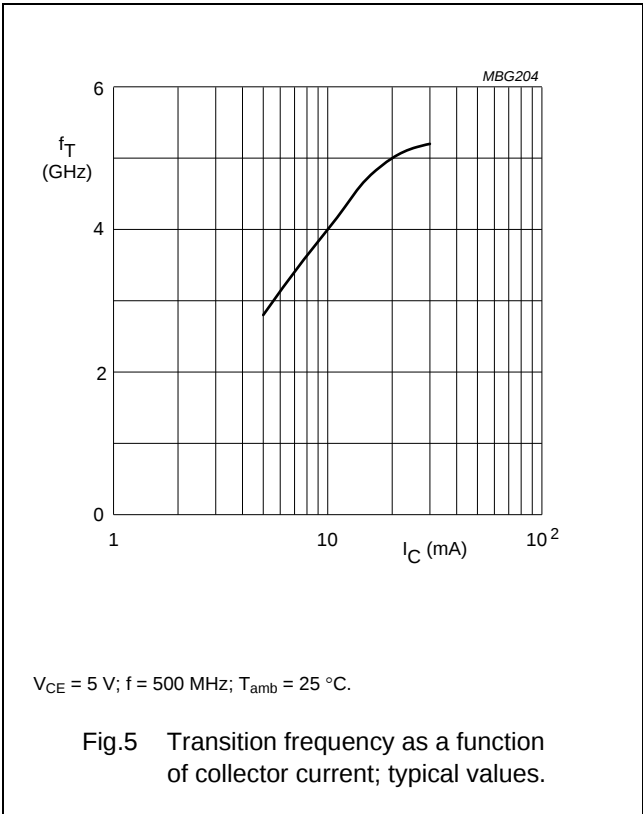
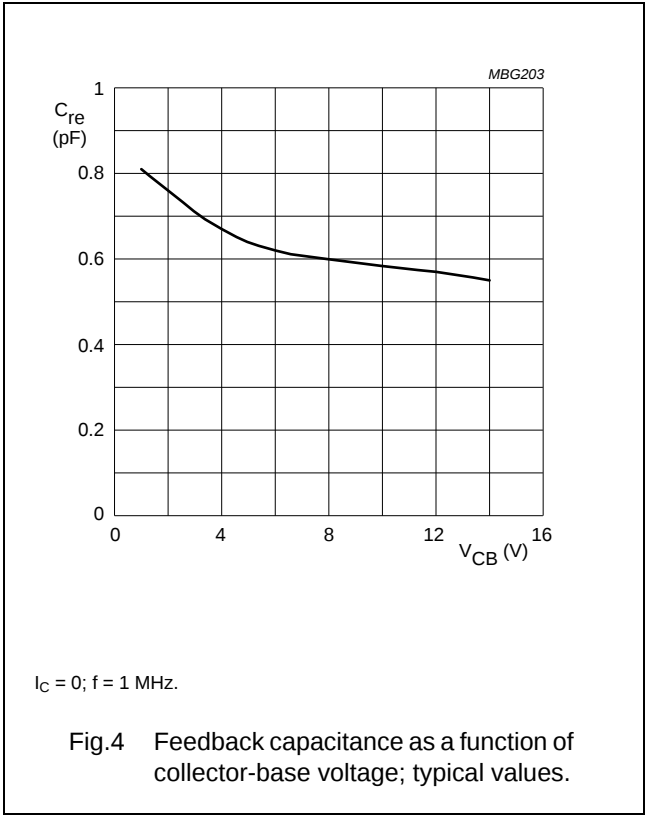
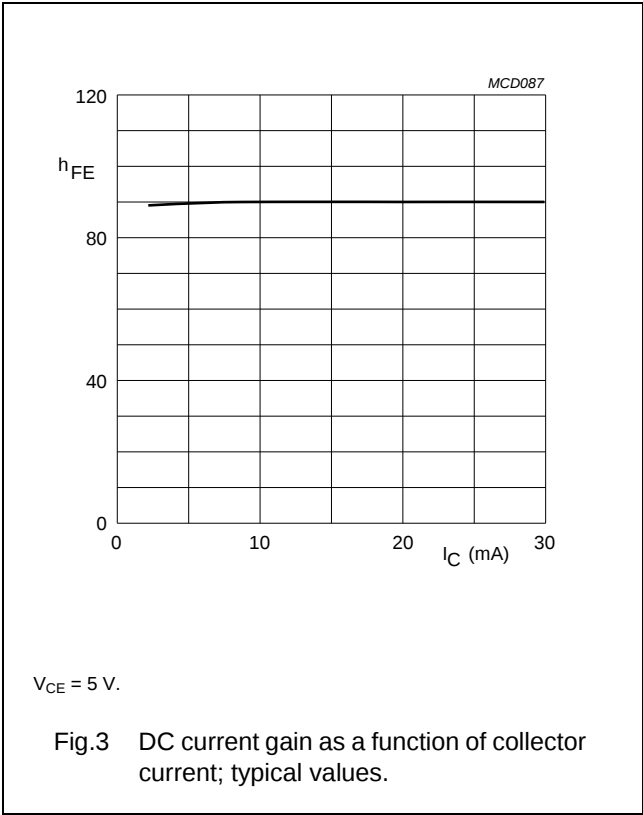
SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector leakage current	$I_E = 0; V_{CB} = 5\text{ V}$	–	–	50	nA
h_{FE}	DC current gain	$I_C = 30\text{ mA}; V_{CE} = 5\text{ V}$	40	90	–	
C_c	collector capacitance	$I_E = I_E = 0; V_{CB} = 5\text{ V}; f = 1\text{ MHz}$	–	0.7	–	pF
C_e	emitter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

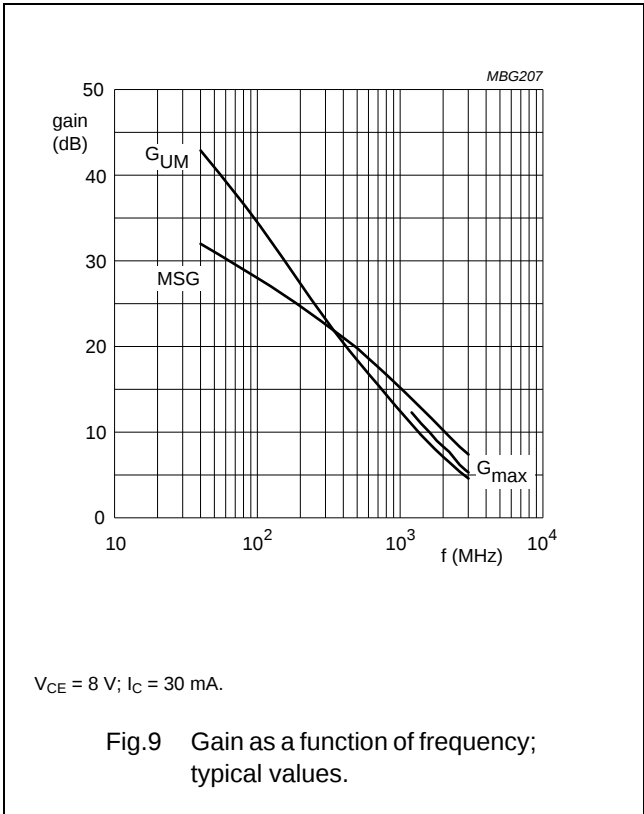
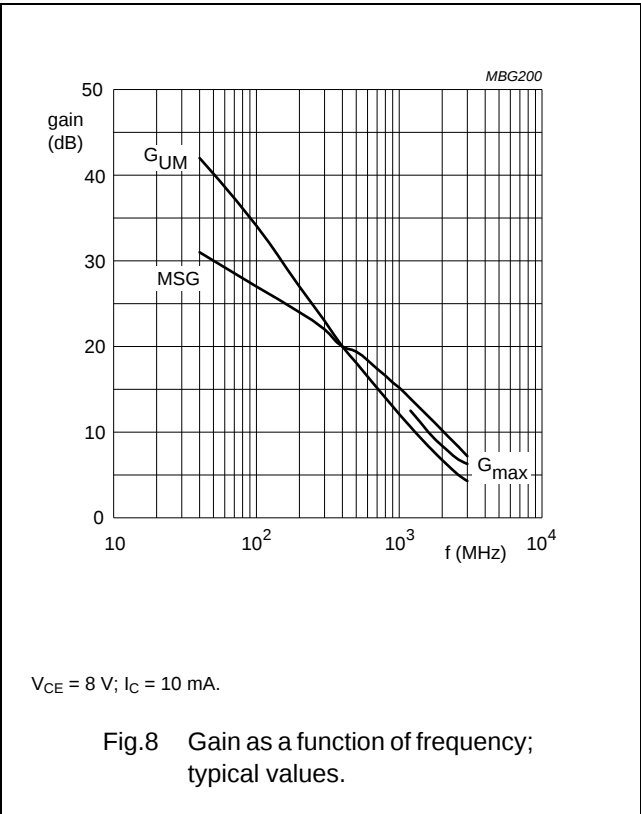
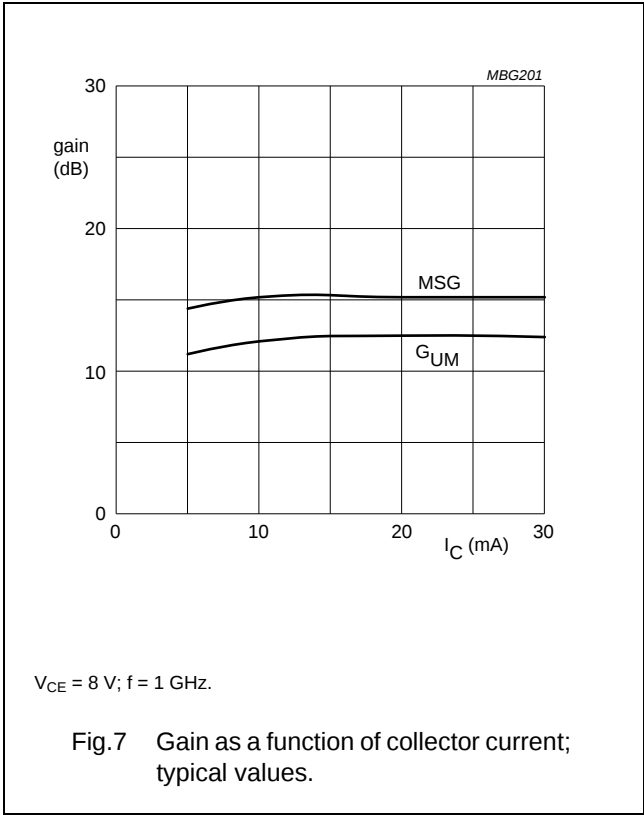
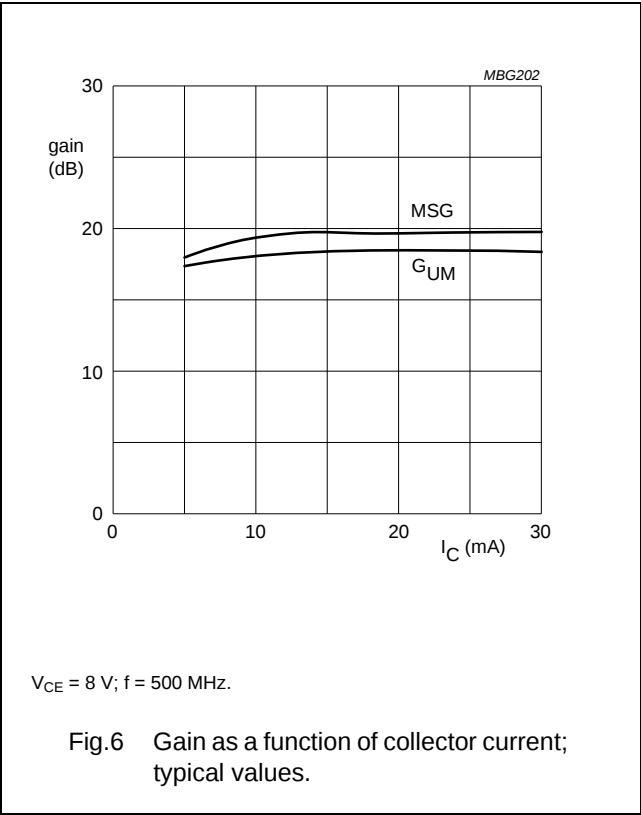
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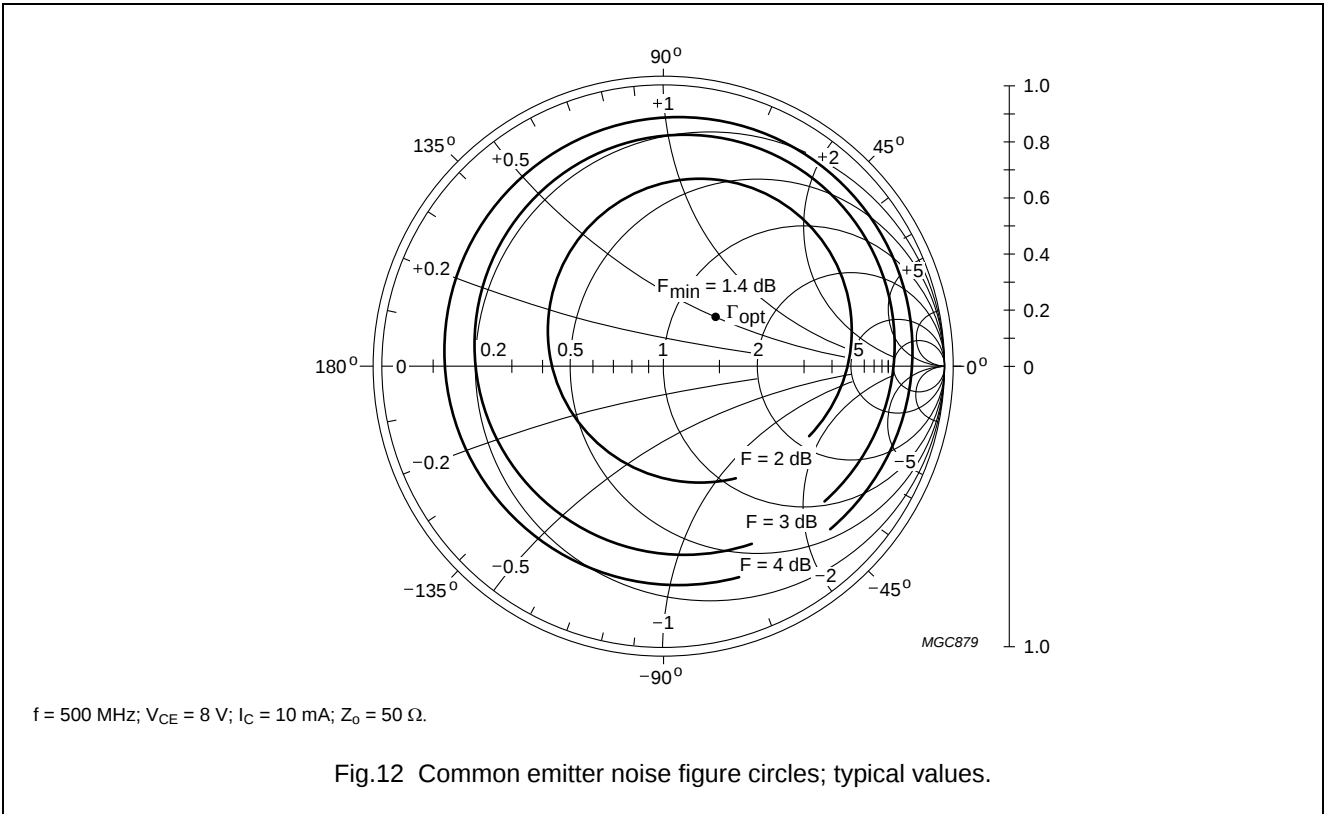
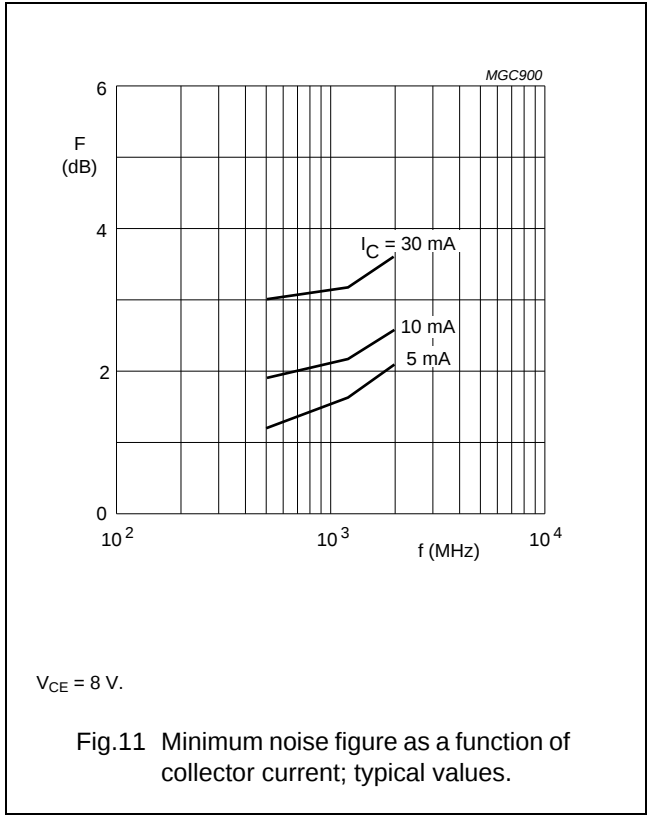
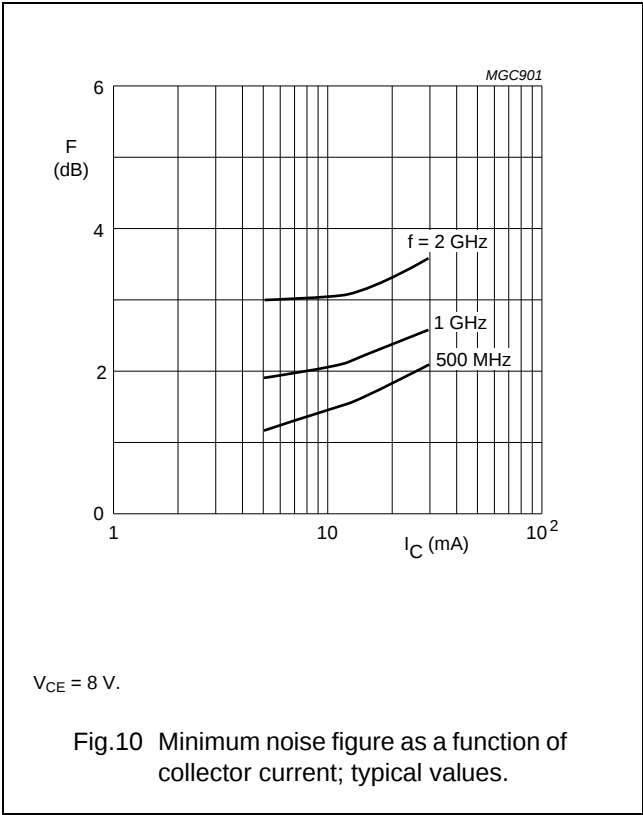
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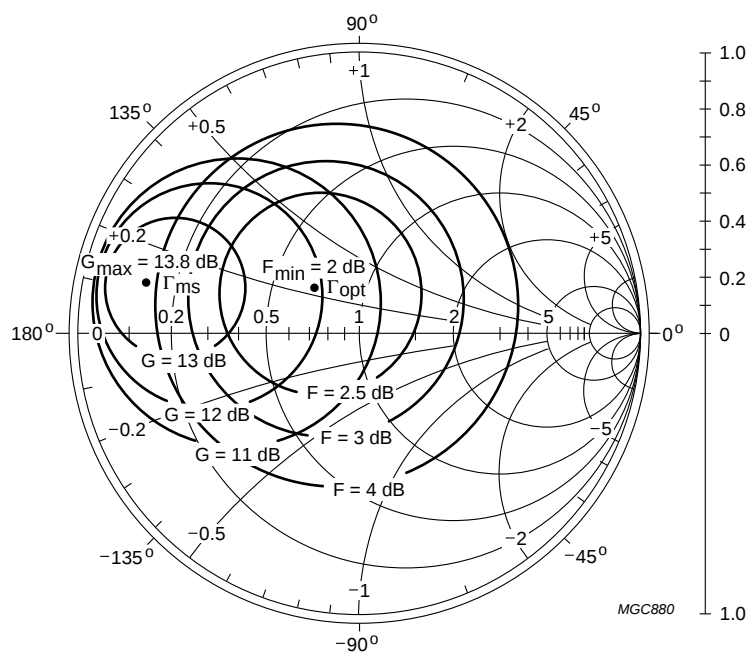
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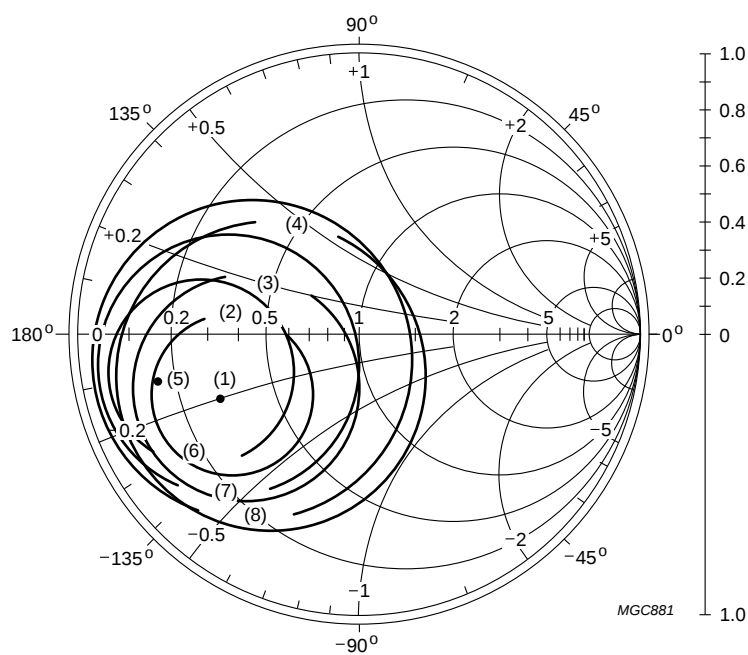
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$f = 1$ GHz; $V_{CE} = 8$ V; $I_C = 10$ mA; $Z_0 = 50 \Omega$.

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



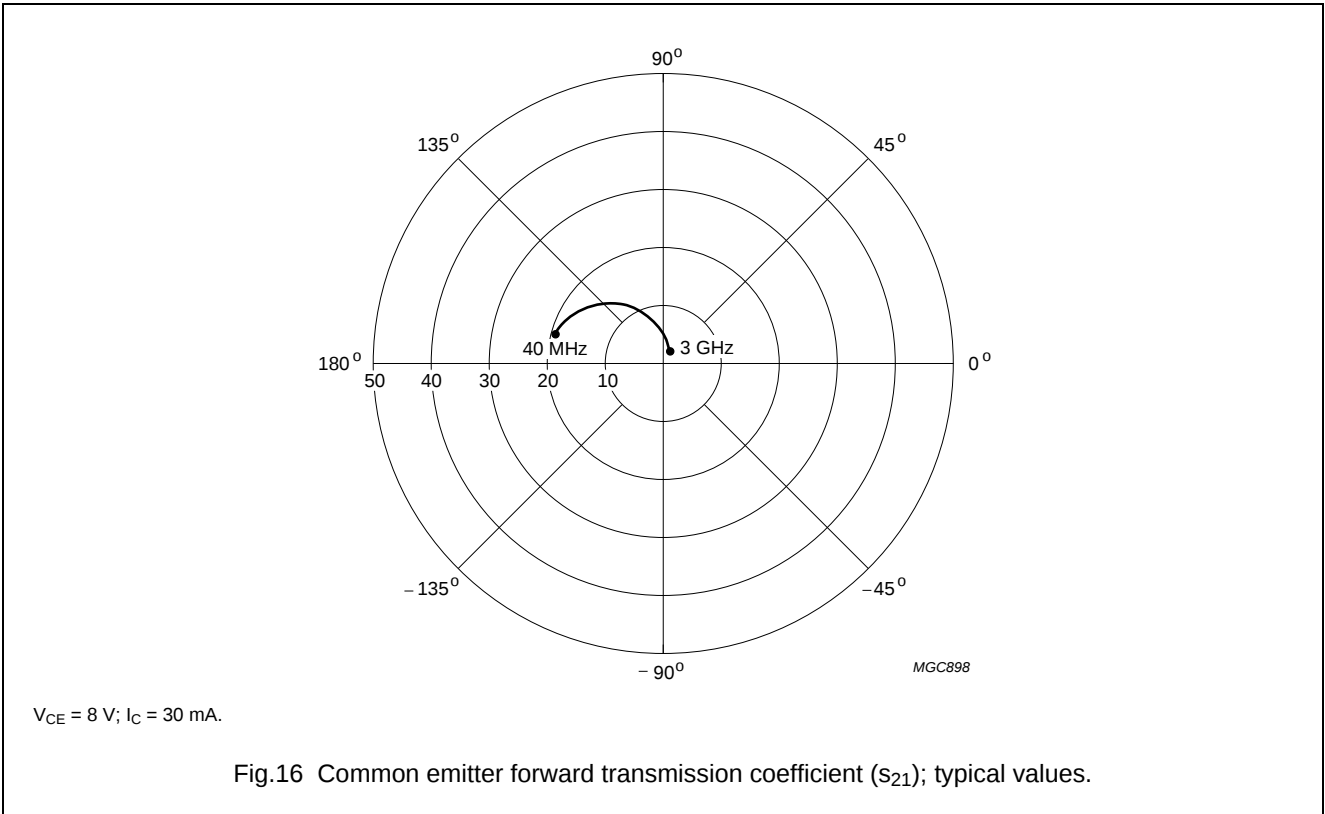
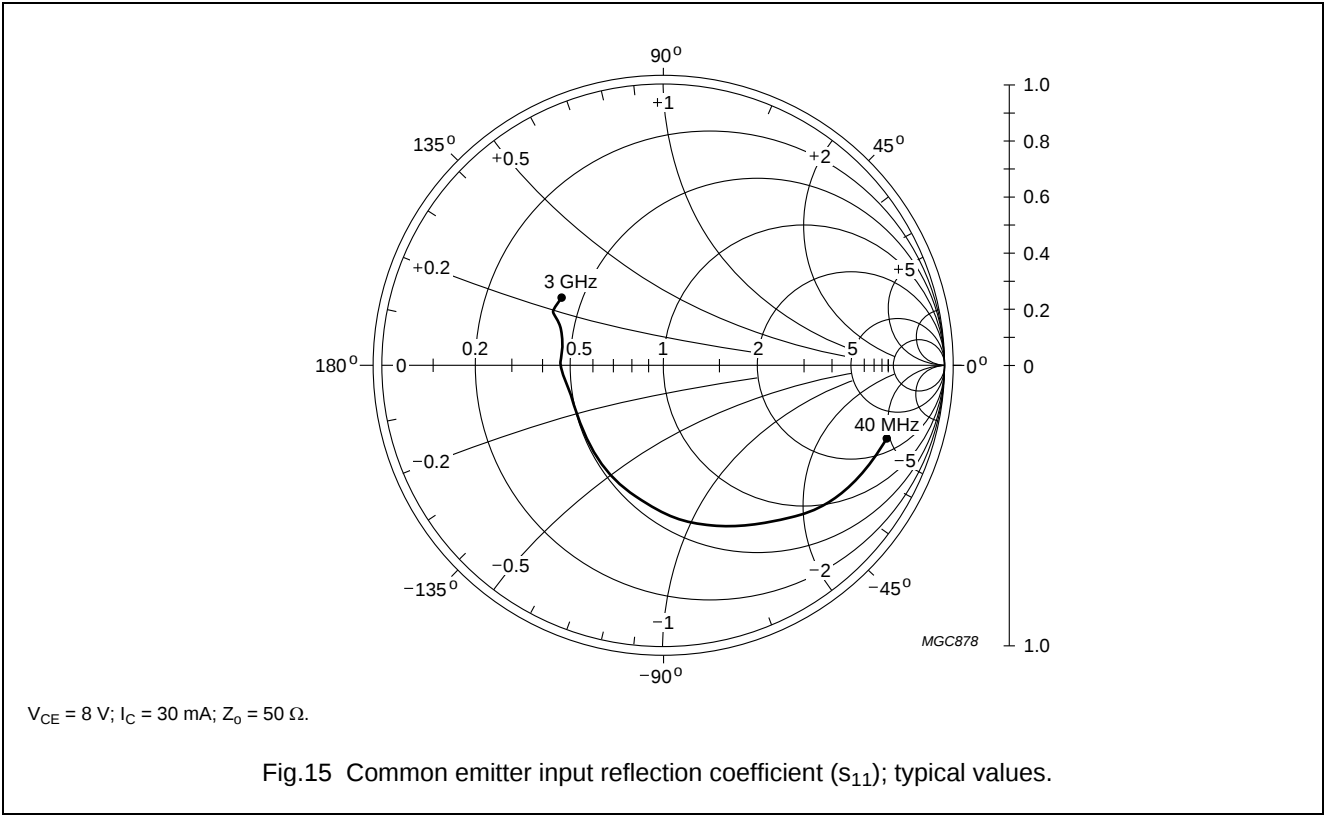
- (1) Γ_{opt} ; $F_{min} = 3$ dB.
- (2) $F = 3.5$ dB.
- (3) $F = 4$ dB.
- (4) $F = 5$ dB.
- (5) Γ_{ms} ; $G_{max} = 8.1$ dB.
- (6) $G = 7$ dB.
- (7) $G = 6$ dB.
- (8) $G = 5$ dB.

$f = 2$ GHz; $V_{CE} = 8$ V; $I_C = 10$ mA; $Z_0 = 50 \Omega$.

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

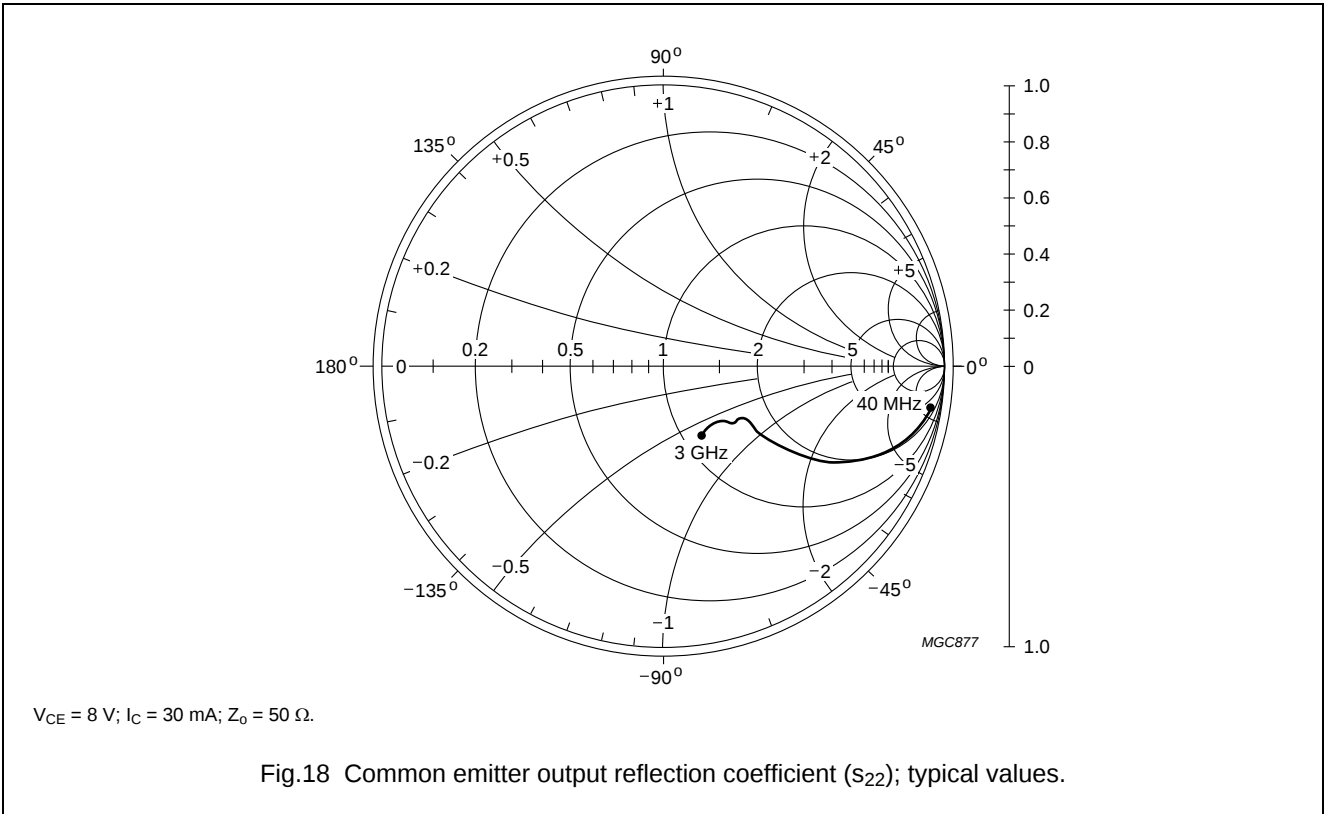
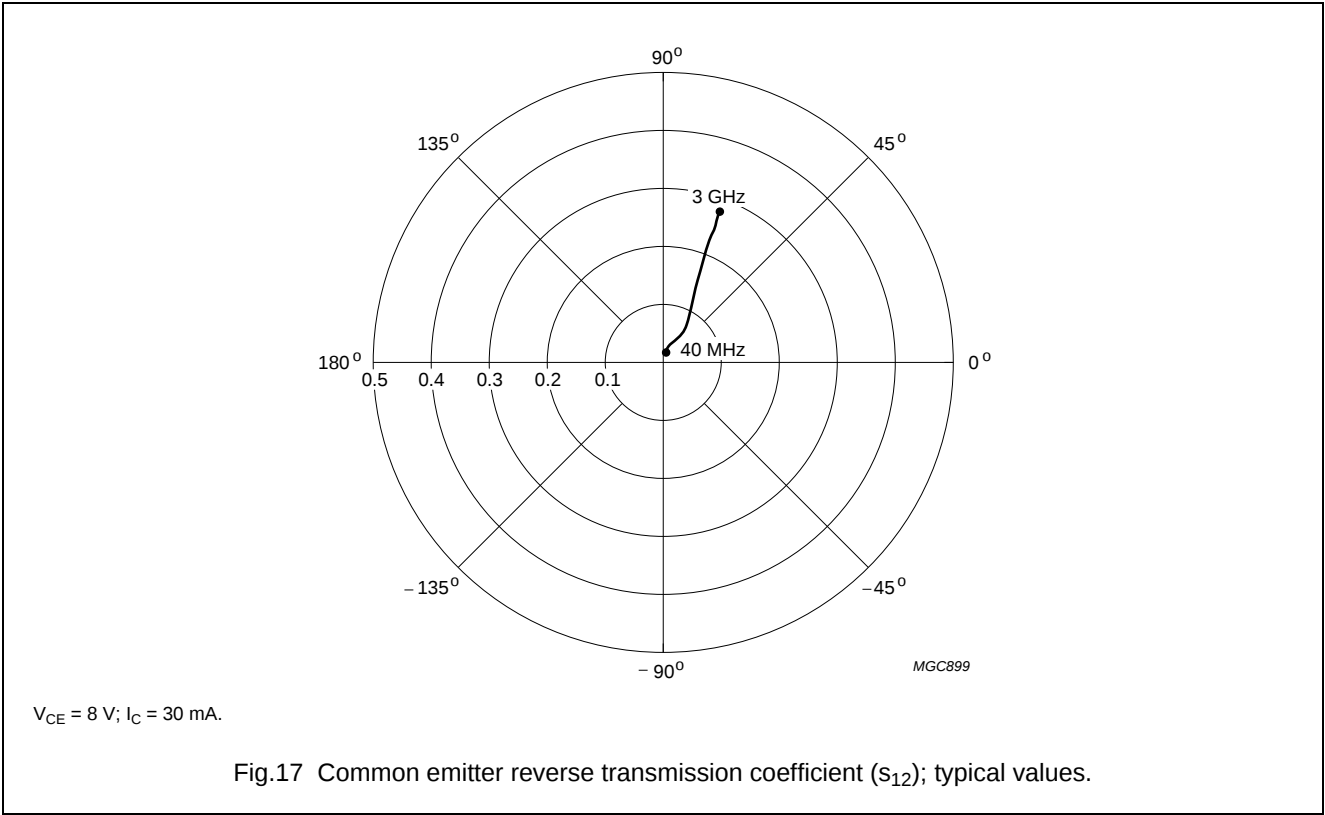
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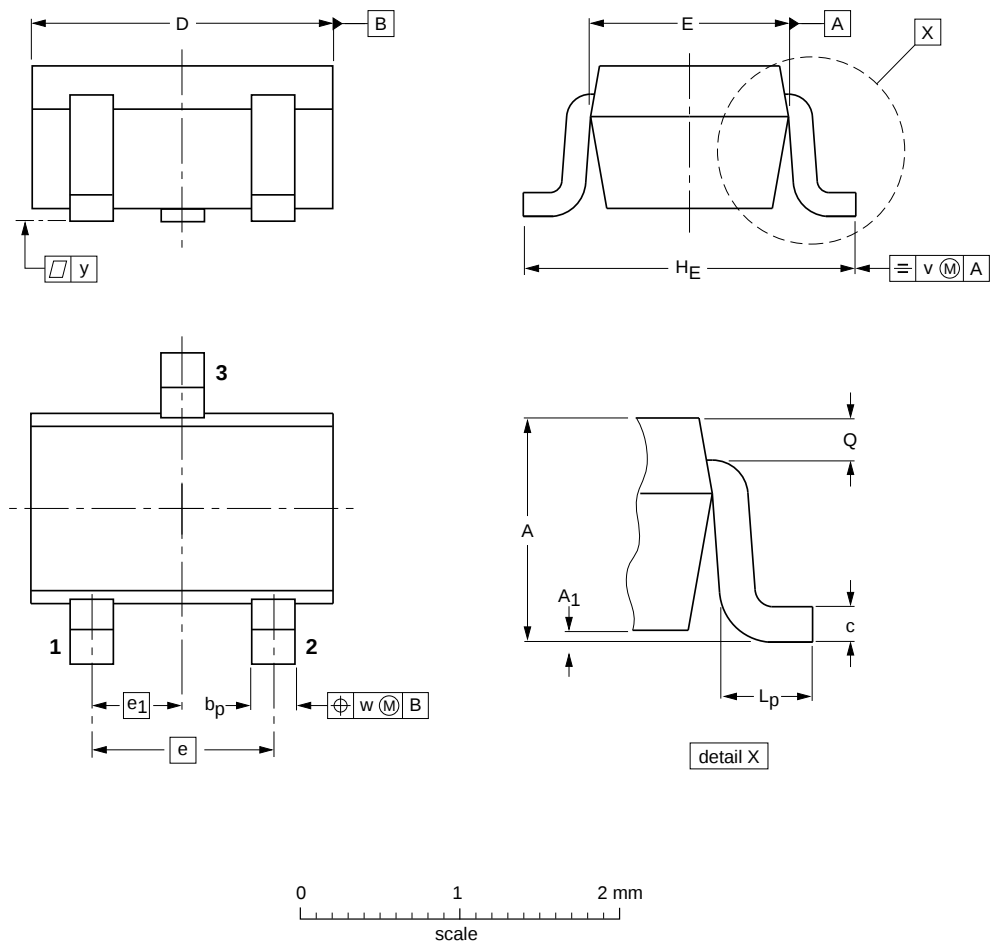
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PACKAGE OUTLINE

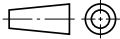
Plastic surface-mounted package; 3 leads

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

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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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