DATA SHEET

BFR92A
NPN 5 GHz wideband transistor

Product specification
Supersedes data of September 1995
File under discrete semiconductors, SC14

1997 Oct 29

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FEATURES

- High power gain
- Low noise figure
- Low intermodulation distortion.

APPLICATIONS

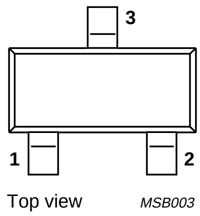
- RF wideband amplifiers and oscillators.

DESCRIPTION

NPN wideband transistor in a plastic SOT23 package.
PNP complement: BFT92.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector



Marking code: P2p.

Fig.1 SOT23.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage		–	20	V
V_{CEO}	collector-emitter voltage		–	15	V
I_C	collector current (DC)		–	25	mA
P_{tot}	total power dissipation	$T_s \leq 95$ °C	–	300	mW
C_{re}	feedback capacitance	$I_C = i_c = 0$; $V_{CE} = 10$ V; f = 1 MHz	0.35	–	pF
f_T	transition frequency	$I_C = 15$ mA; $V_{CE} = 10$ V; f = 500 MHz	5	–	GHz
G_{UM}	maximum unilateral power gain	$I_C = 15$ mA; $V_{CE} = 10$ V; f = 1 GHz; $T_{amb} = 25$ °C	14	–	dB
		$I_C = 15$ mA; $V_{CE} = 10$ V; f = 2 GHz; $T_{amb} = 25$ °C	8	–	dB
F	noise figure	$I_C = 5$ mA; $V_{CE} = 10$ V; f = 1 GHz; $\Gamma_s = \Gamma_{opt}$; $T_{amb} = 25$ °C	2.1	–	dB
V_O	output voltage	$d_{im} = -60$ dB; $I_C = 14$ mA; $V_{CE} = 10$ V; $R_L = 75\ \Omega$; $f_p + f_q - f_r = 793.25$ MHz	150	–	mV

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
V_{EBO}	emitter-base voltage	open collector	–	2	V
I_C	collector current (DC)		–	25	mA
P_{tot}	total power dissipation	$T_s \leq 95$ °C; note 1; see Fig.3	–	300	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	175	°C

Note

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

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	$T_s \leq 95$ °C; note 1	260	K/W

Note

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

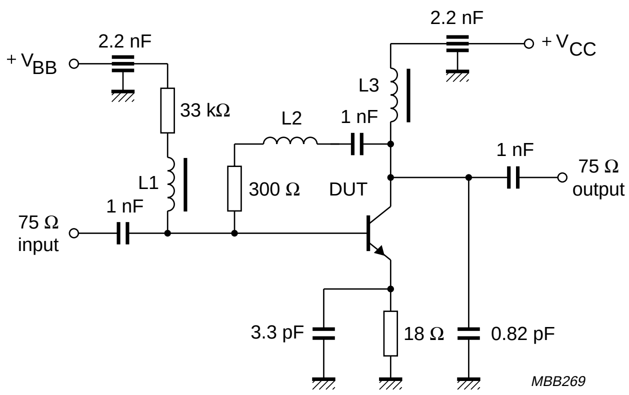
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector leakage current	I_E = 0; V_{CB} = 10 V	–	–	50	nA
h_{FE}	DC current gain	I_C = 15 mA; V_{CE} = 10 V; see Fig.4	40	90	–	
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 10 V; f = 1 MHz; see Fig.5	–	0.6	–	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = 10 V; f = 1 MHz	–	1.2	–	pF
C_{re}	feedback capacitance	$I_C = i_c$ = 0; V_{CE} = 10 V; f = 1 MHz	–	0.35	–	pF
f_T	transition frequency	I_C = 15 mA; V_{CE} = 10 V; f = 500 MHz; see Fig.6	–	5	–	GHz
G_{UM}	maximum unilateral power gain (note 1)	I_C = 15 mA; V_{CE} = 10 V; f = 1 GHz; T_{amb} = 25 °C	–	14	–	dB
		I_C = 15 mA; V_{CE} = 10 V; f = 2 GHz; T_{amb} = 25 °C	–	8	–	dB
F	noise figure	I_C = 5 mA; V_{CE} = 10 V; f = 1 GHz; $\Gamma_s = \Gamma_{opt}$; T_{amb} = 25 °C; see Figs 13 and 14	–	2.1	–	dB
		I_C = 5 mA; V_{CE} = 10 V; f = 2 GHz; $\Gamma_s = \Gamma_{opt}$; T_{amb} = 25 °C; see Figs 13 and 14	–	3	–	dB
V_O	output voltage	notes 2 and 3	–	150	–	mV
d_2	second order intermodulation distortion	notes 2 and 4; see Fig.16	–	–50	–	dB

Notes

1. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10\log\frac{|S_{21}|^2}{(1-|S_{11}|^2)(1-|S_{22}|^2)}$ dB.
2. Measured on the same die in a SOT37 package (BFR90A).
3. d_{im} = –60 dB (DIN 45004B); I_C = 14 mA; V_{CE} = 10 V; R_L = 75 Ω; VSWR < 2; T_{amb} = 25 °C
   $V_p = V_O$ at d_{im} = –60 dB; f_p = 795.25 MHz;
   $V_q = V_O$ –6 dB; f_q = 803.25 MHz;
   $V_r = V_O$ –6 dB; f_r = 805.25 MHz;
   measured at $f_p + f_q - f_r$ = 793.25 MHz.
4. I_C = 14 mA; V_{CE} = 10 V; R_L = 75 Ω; VSWR < 2; T_{amb} = 25 °C
   V_p = 60 mV at f_p = 250 MHz;
   V_q = 60 mV at f_q = 560 MHz;
   measured at $f_p + f_q$ = 810 MHz.



L1 = L3 = 5 μH choke.

L2 = 3 turns 0.4 mm copper wire, internal diameter 3 mm, winding pitch 1 mm.

Fig.2 Intermodulation distortion and second harmonic distortion MATV test circuit.

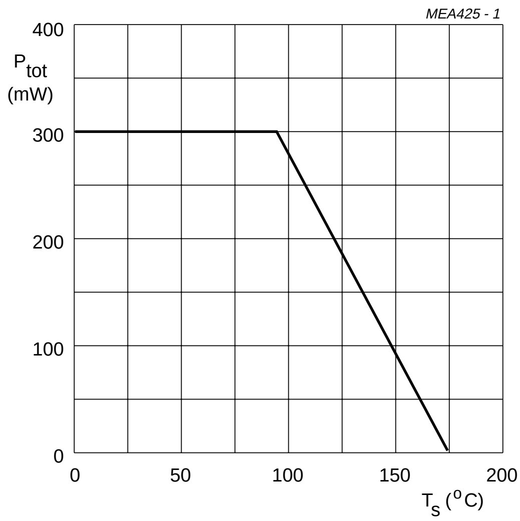
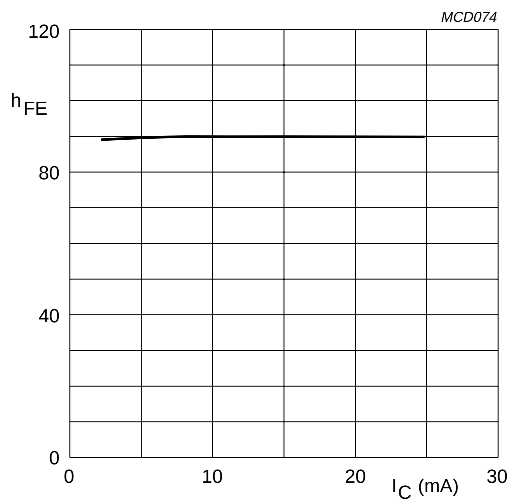
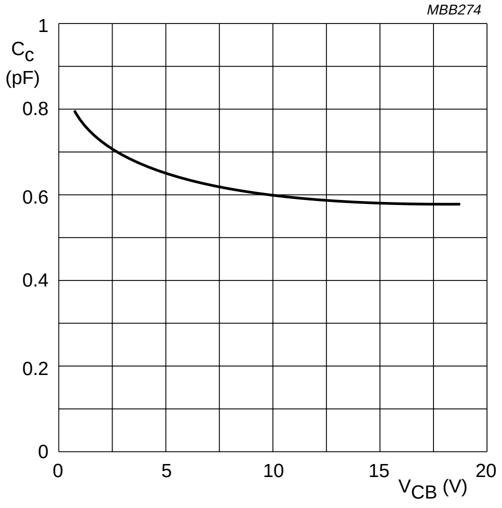


Fig.3 Power derating curve.



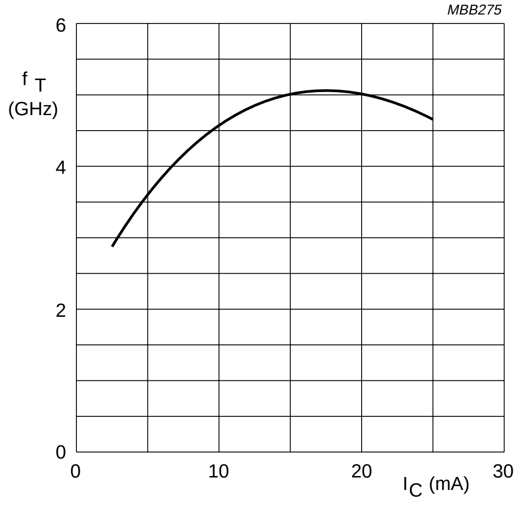
V_{CE} = 10 V; T_j = 25 °C.

Fig.4 DC current gain as a function of collector current; typical values.



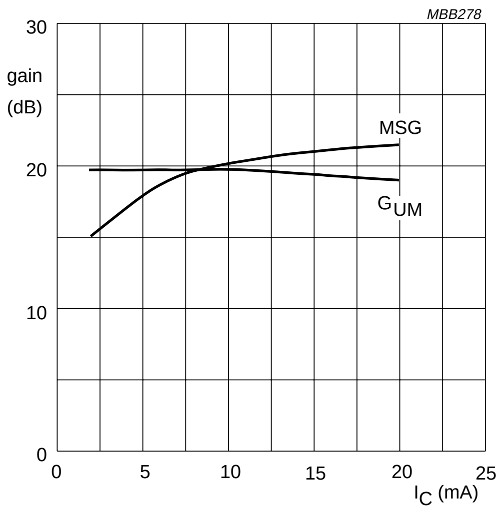
$I_C = i_c = 0$; f = 1 MHz; T_j = 25 °C.

Fig.5 Collector capacitance as a function of collector-base voltage; typical values.



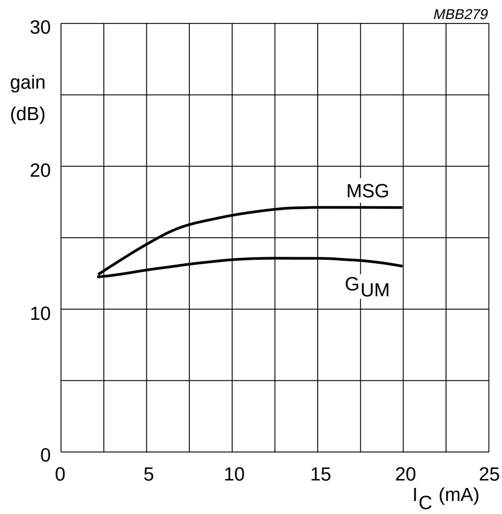
V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C.

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



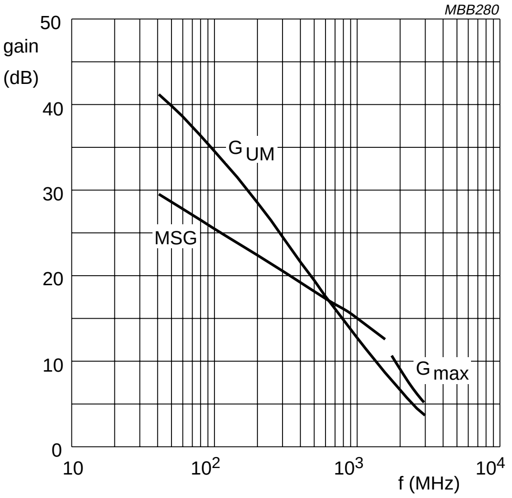
V_{CE} = 10 V; f = 500 MHz.
MSG = maximum stable gain;
G_{UM} = maximum unilateral power gain.

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



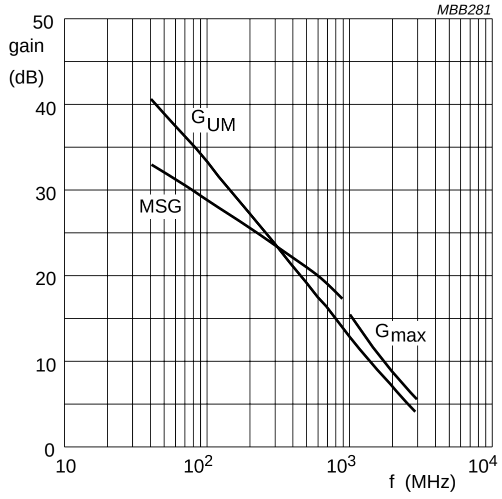
V_{CE} = 10 V; f = 1 GHz.
MSG = maximum stable gain;
G_{UM} = maximum unilateral power gain.

Fig.8 Gain as a function of collector current; typical values.



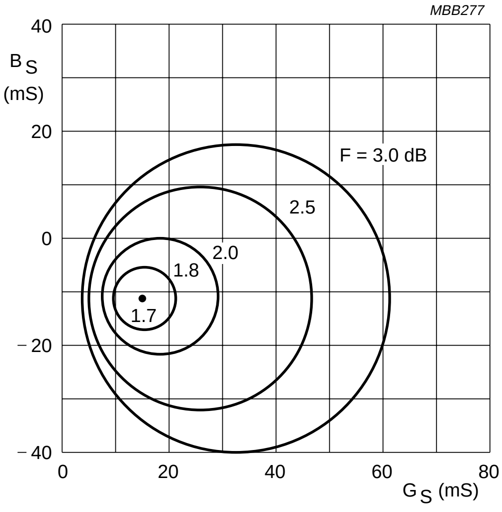
I_C = 5 mA; V_{CE} = 10 V.
G_{UM} = maximum unilateral power gain; MSG = maximum stable gain;
G_{max} = maximum available gain.

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



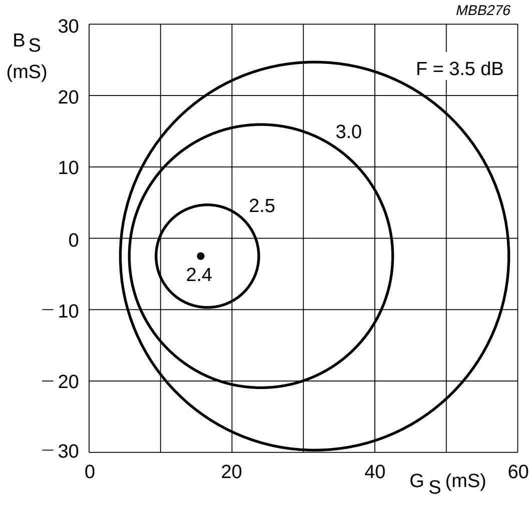
I_C = 15 mA; V_{CE} = 10 V.
G_{UM} = maximum unilateral power gain; MSG = maximum stable gain;
G_{max} = maximum available gain.

Fig.10 Gain as a function of frequency; typical values.



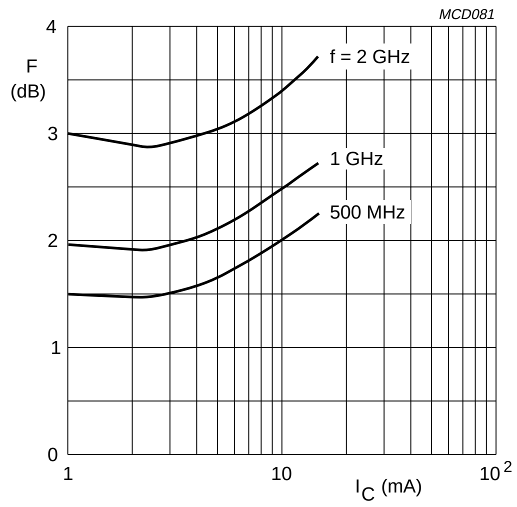
I_C = 4 mA; V_{CE} = 10 V; f = 800 MHz.

Fig.11 Circles of constant noise figure; typical values.



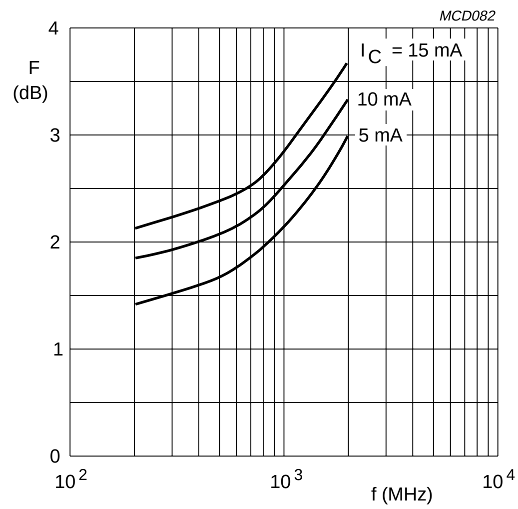
I_C = 14 mA; V_{CE} = 10 V; f = 800 MHz.

Fig.12 Circles of constant noise figure; typical values.



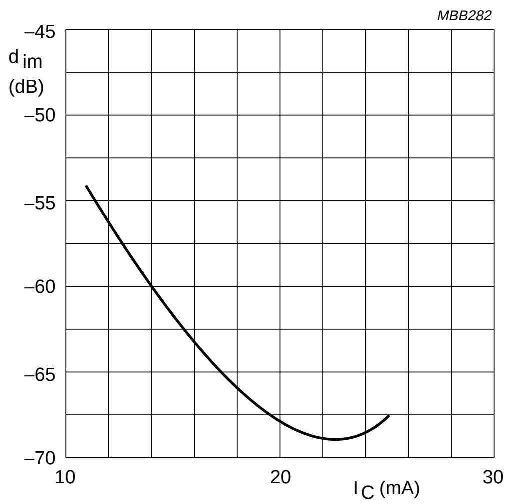
V_{CE} = 10 V.

Fig.13 Minimum noise figure as a function of collector current; typical values.



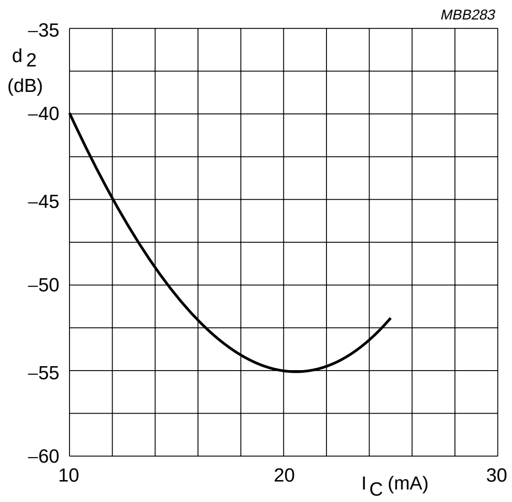
V_{CE} = 10 V.

Fig.14 Minimum noise figure as a function of frequency; typical values.



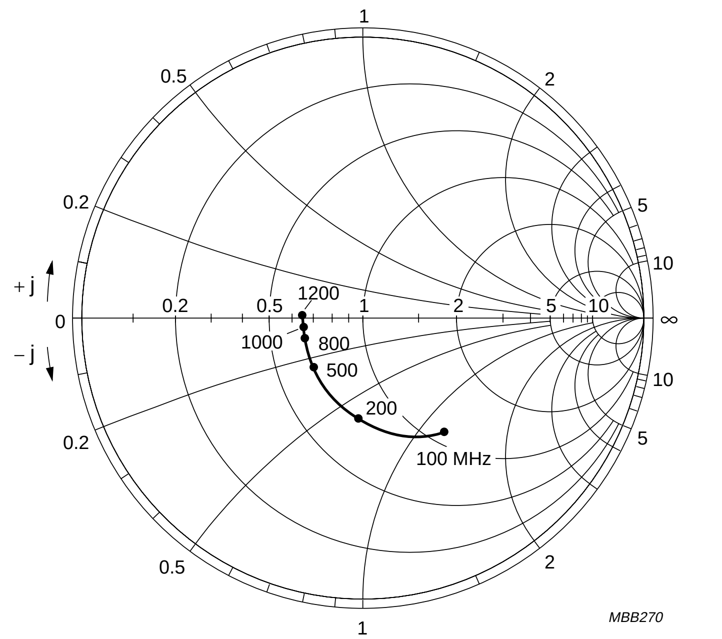
V_{CE} = 10 V; V_O = 150 mV (43.5 dBmV);
$f_p + f_q – f_r$ = 793.25 MHz; T_{amb} = 25 °C.
Measured in MATV test circuit (see Fig.2).

Fig.15 Intermodulation distortion; typical values.



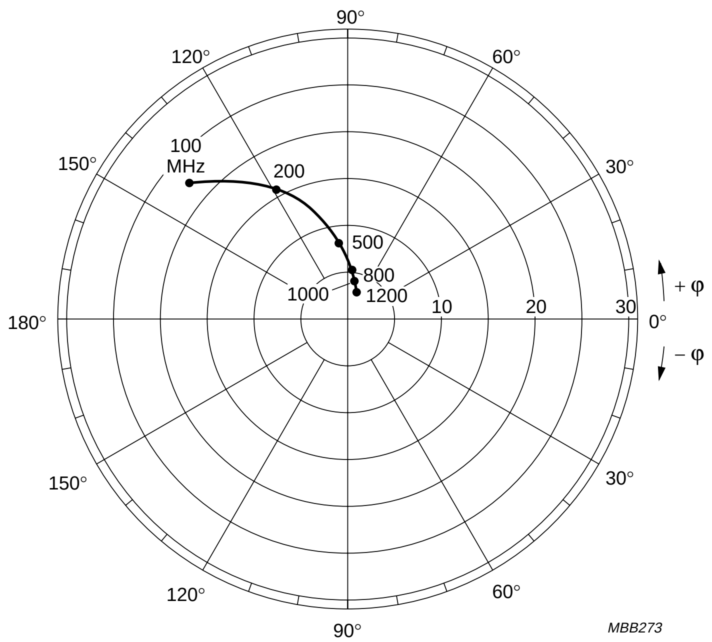
V_{CE} = 10 V; V_O = 60 mV; $f_p + f_q – f_r$ = 810 MHz; T_{amb} = 25 °C.
Measured in MATV test circuit (see Fig.2).

Fig.16 Second order intermodulation distortion; typical values.



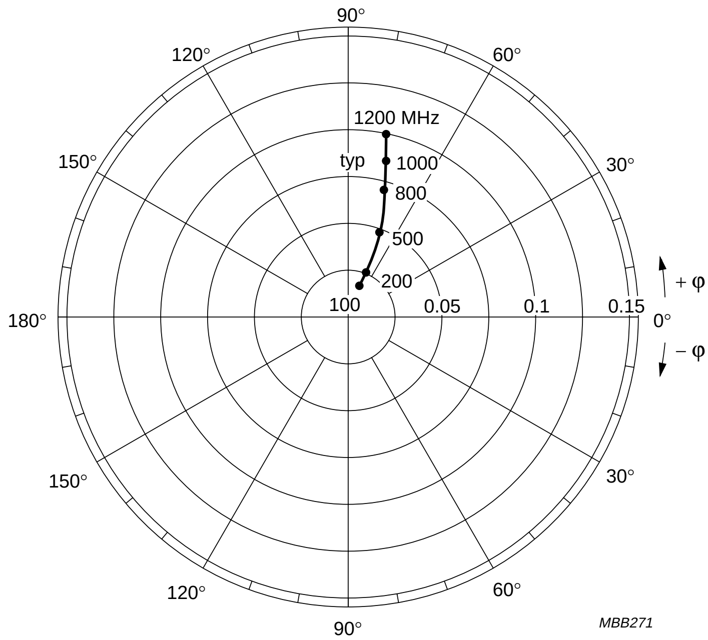
I_C = 14 mA; V_{CE} = 10 V; Z_o = 50 Ω; T_{amb} = 25 °C.

Fig.17 Common emitter input reflection coefficient (S_{11}); typical values.



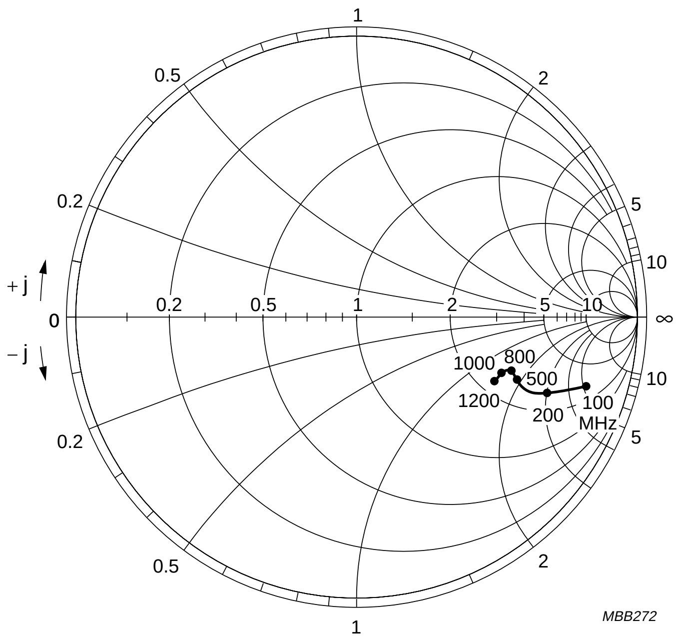
I_C = 14 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.18 Common emitter forward transmission coefficient (S_{21}); typical values.



I_C = 14 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.19 Common emitter reverse transmission coefficient (S_{12}); typical values.

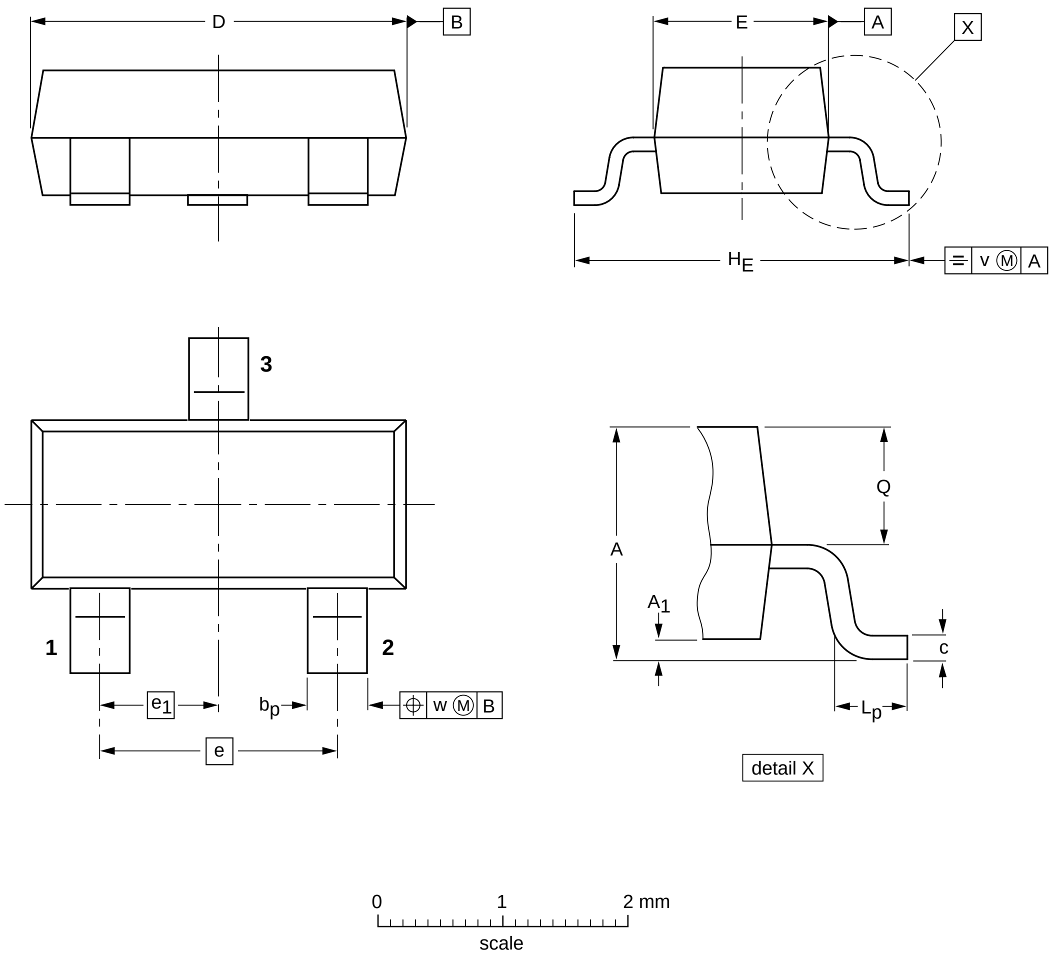


I_C = 14 mA; V_{CE} = 10 V; Z_o = 50 Ω; T_{amb} = 25 °C.

Fig.20 Common emitter output reflection coefficient (S_{22}); typical values.

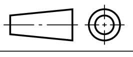
PACKAGE OUTLINE

Plastic surface mounted package; 3 leads **SOT23**



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 0.9	0.1	0.48 0.38	0.15 0.09	3.0 2.8	1.4 1.2	1.9	0.95	2.5 2.1	0.45 0.15	0.55 0.45	0.2	0.1

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT23						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.
Short-form specification	The data in this 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	
Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134). 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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