

UHF wideband transistor

PBR941

FEATURES

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

APPLICATIONS

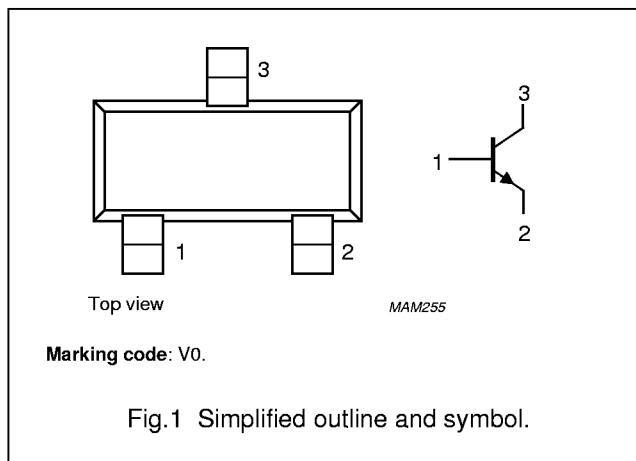
- Communication and instrumentation systems.

DESCRIPTION

Silicon NPN transistor in a surface mount 3-pin SOT23 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 - SOT23

PIN	DESCRIPTION
1	base
2	emitter
3	collector



QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	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	8	—	GHz
G_{UM}	maximum unilateral power gain	$I_C = 15$ mA; $V_{CE} = 6$ V; $f = 1$ GHz; $T_{amb} = 25$ °C	15	—	dB
F	noise figure	$\Gamma_S = \Gamma_{opt}$; $I_C = 5$ mA; $V_{CE} = 6$ V; $f = 1$ GHz	1.4	—	dB
P_{tot}	total power dissipation	$T_s = 60$ °C; note 1	—	360	mW
$R_{th\ j-s}$	thermal resistance from junction to soldering point	$P_{tot} = 360$ mW	—	320	K/W

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	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	$T_s = 60\text{ °C}$; note 1	–	360	mW
T_{sig}	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
$R_{th\ j-s}$	thermal resistance from junction to soldering point; note 1	$P_{tot} = 360\text{ mW}$; $T_s = 60\text{ °C}$; note 1	320	K/W

Note

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

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CHARACTERISTICS

$T_j = 25\text{ }^{\circ}\text{C}$; 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
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	50	100	200	
		I _C = 15 mA; V _{CE} = 6 V	—	100	—	
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 = 1 GHz	—	8	—	GHz
G _{UM}	maximum unilateral power gain; note 1	I _C = 15 mA; V _{CE} = 6 V; T _{amb} = 25 °C; f = 1 GHz	—	15	—	dB
		I _C = 15 mA; V _{CE} = 6 V; T _{amb} = 25 °C; f = 2 GHz	—	9.5	—	dB
F	noise figure	Γ _S = Γ _{opt} ; I _C = 5 mA; V _{CE} = 6 V; f = 1 GHz	—	1.4	—	dB
		Γ _S = Γ _{opt} ; I _C = 5 mA; V _{CE} = 6 V; f = 2 GHz	—	2	—	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

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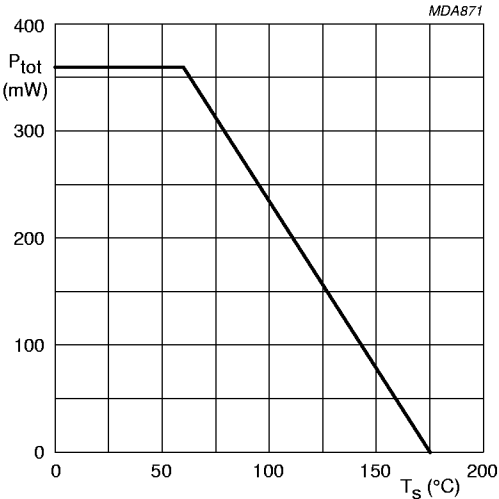
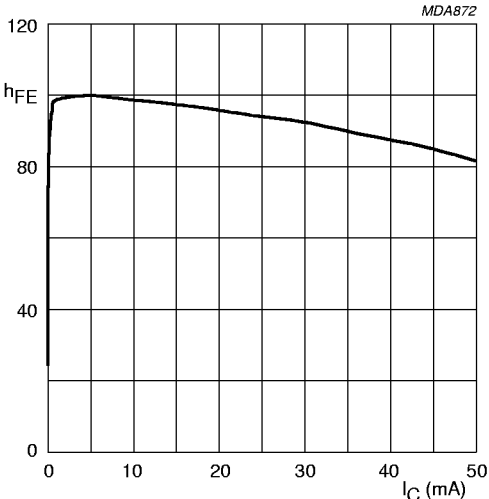
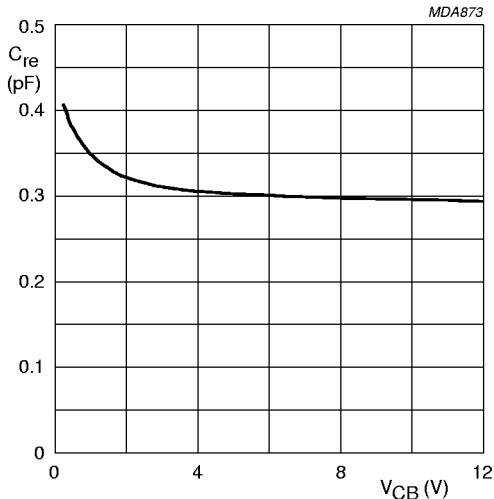


Fig.2 Power derating as a function of soldering point temperature.



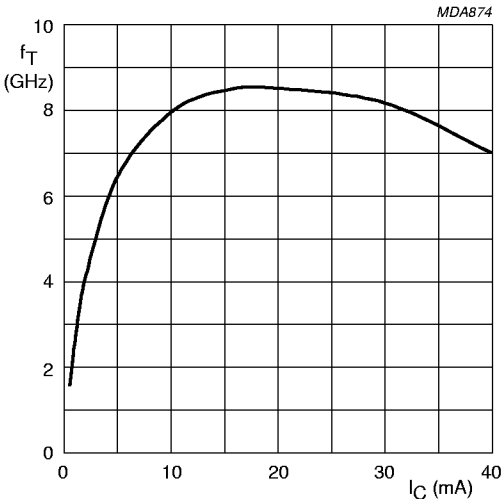
$V_{CE} = 6\text{ V}$.

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



$I_C = 0$; $f = 1\text{ MHz}$.

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

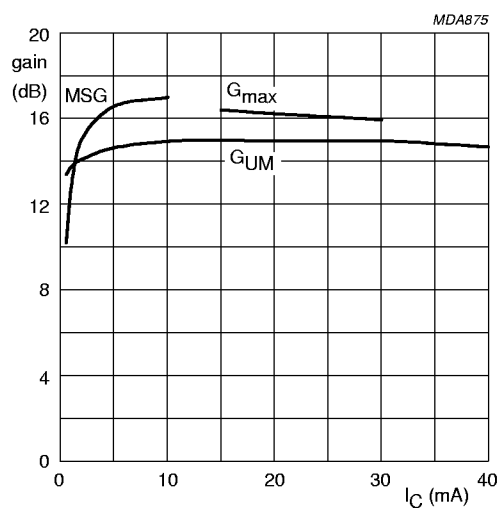


$V_{CE} = 6\text{ V}$; $f = 1\text{ GHz}$; $T_{amb} = 25\text{ °C}$.

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

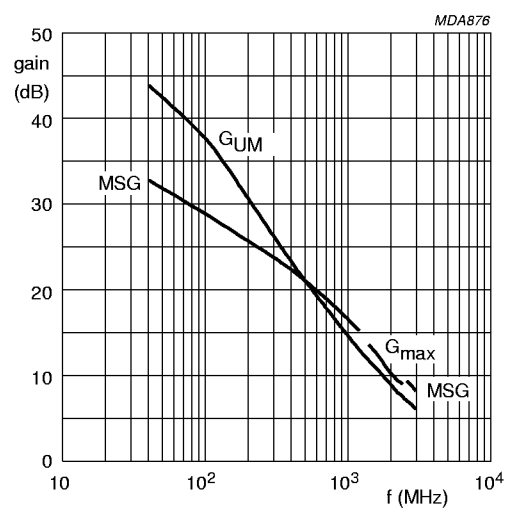
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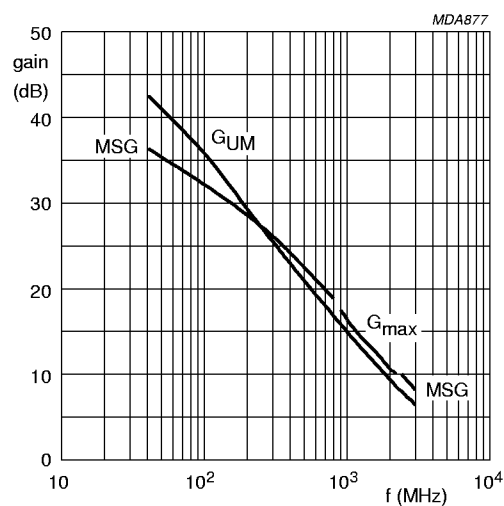
$f = 1 \text{ GHz}$; $V_{CE} = 6 \text{ V}$.

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



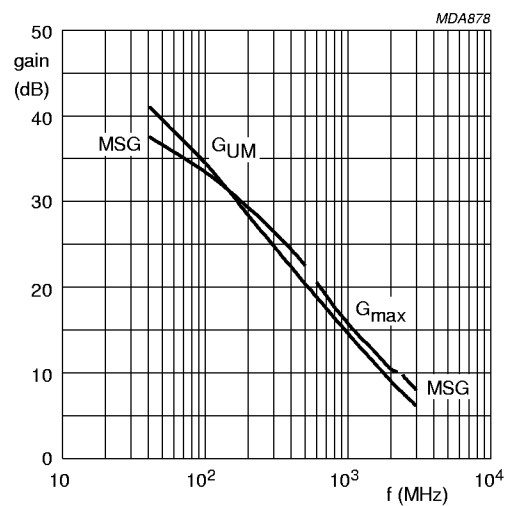
$I_C = 5 \text{ mA}$; $V_{CE} = 6 \text{ V}$.

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



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

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

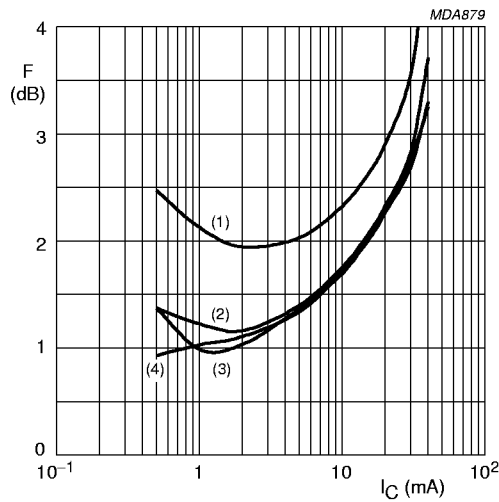


$I_C = 30 \text{ mA}$; $V_{CE} = 6 \text{ V}$.

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

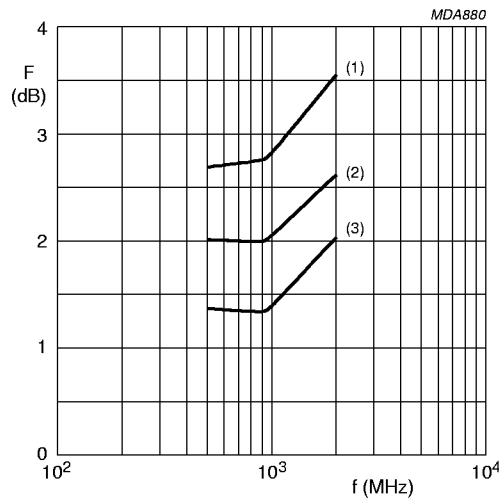
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$V_{CE} = 6\text{ V.}$
(1) $f = 2000\text{ MHz.}$ (3) $f = 500\text{ MHz.}$
(2) $f = 1000\text{ MHz.}$ (4) $f = 900\text{ MHz.}$

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



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

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

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APPLICATION INFORMATION

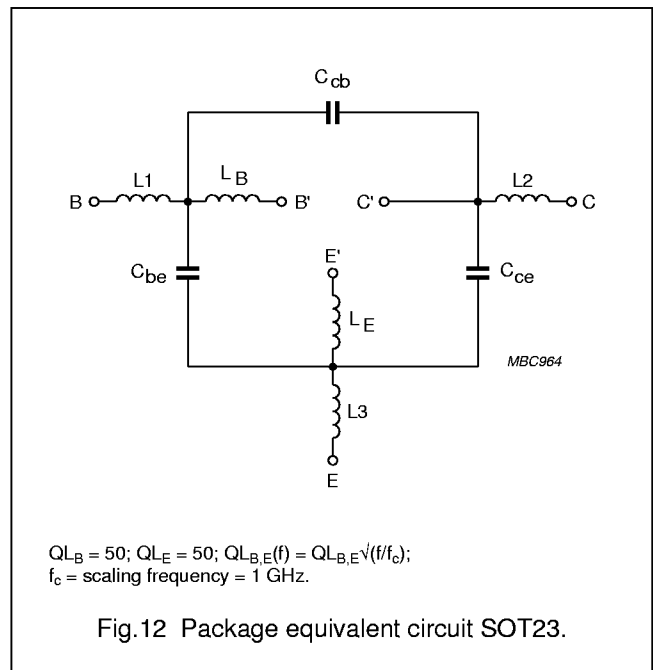
SPICE parameters for the PBR941 die

SEQUENCE No.	PARAMETER	VALUE	UNIT
1	IS	0.466	fA
2	BF	150.4	—
3	NF	1.000	—
4	VAF	53.06	V
5	IKF	180.0	mA
6	ISE	57.30	fA
7	NE	2.000	—
8	BR	27.68	—
9	NR	1.000	—
10	VAR	1.976	V
11	IKR	9.943	mA
12	ISC	1.420	aA
13	NC	1.000	—
14	RB	12.14	Ω
15	IRB	0.000	μ A
16	RBM	4.957	Ω
17	RE	0.597	Ω
18	RC	1.988	Ω
19 ⁽¹⁾	XTB	0.000	—
20 ⁽¹⁾	EG	1.110	eV
21 ⁽¹⁾	XTI	3.000	—
22	CJE	0.568	pF
23	VJE	600.0	mV
24	MJE	0.412	—
25	TF	2.037	ps
26	XTF	30.90	—
27	VTF	3.148	V
28	ITF	131.8	mA
29	PTF	0.000	deg
30	CJC	205.8	fF
31	VJC	296.2	mV
32	MJC	0.118	—
33	XCJC	0.104	—
34	TR	0.000	ps
35 ⁽¹⁾	CJS	0.000	F
36 ⁽¹⁾	VJS	700.0	mV
37 ⁽¹⁾	MJS	0.000	—
38	FC	0.943	—

SEQUENCE No.	PARAMETER	VALUE	UNIT
39 ⁽²⁾	C_{bpb}	83.00	fF
40 ⁽²⁾	C_{bpe}	84.00	fF
41	AF	1.000	—
42	KF	4×10^{-16}	—

Notes

- These parameters have not been extracted, the default values are shown.
- C_{bpb} , C_{bpe} ; base-bondpad and emitter-bondpad capacitance to collector.

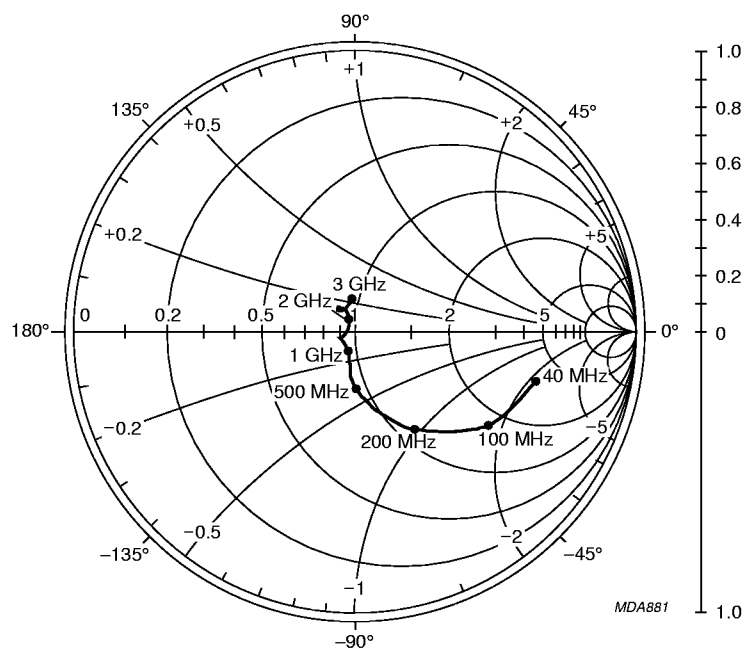


List of components (see Fig.12)

DESIGNATION	VALUE	UNIT
C_{be}	7	fF
C_{cb}	80	fF
C_{ce}	80	fF
L1	0.35	nH
L2	0.17	nH
L3	0.35	nH
L_B	0.40	nH
L_E	0.83	nH

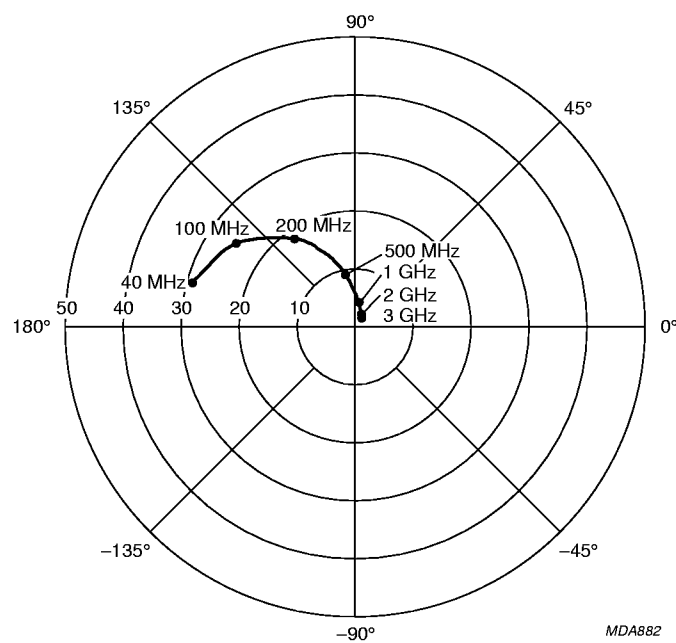
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$V_{CE} = 6\text{ V}$; $I_C = 15\text{ mA}$; $Z_0 = 50\ \Omega$.

Fig.13 Common emitter input reflection coefficient (S_{11}); typical values.

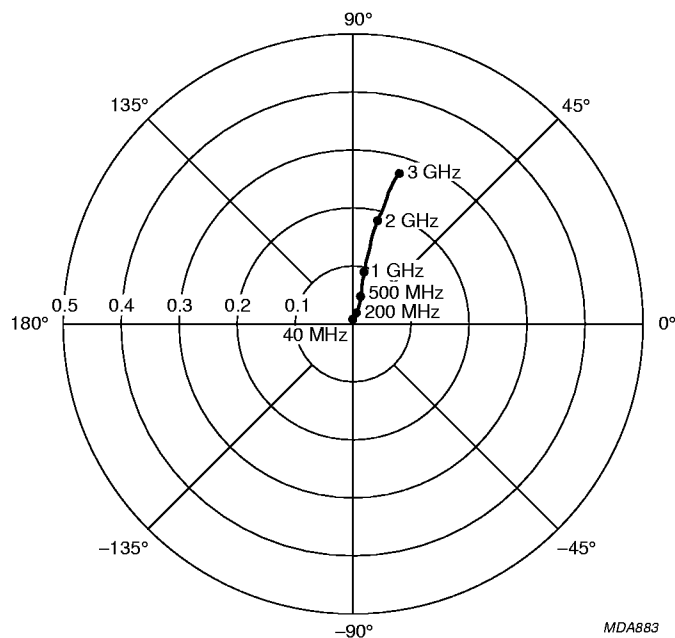


$V_{CE} = 6\text{ V}$; $I_C = 15\text{ mA}$.

Fig.14 Common emitter forward transmission coefficient (S_{21}); typical values.

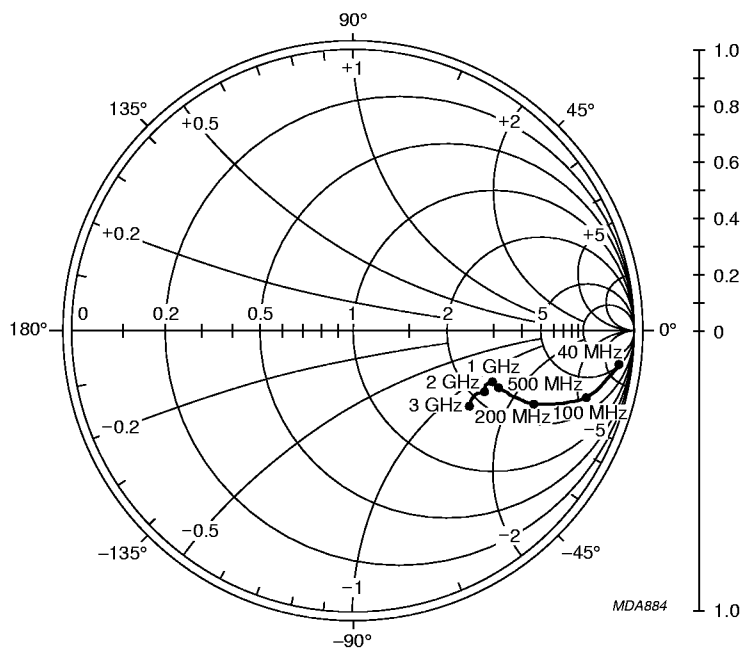
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$V_{CE} = 6\text{ V}$; $I_C = 15\text{ mA}$.

Fig.15 Common emitter reverse transmission coefficient (S_{12}); typical values.

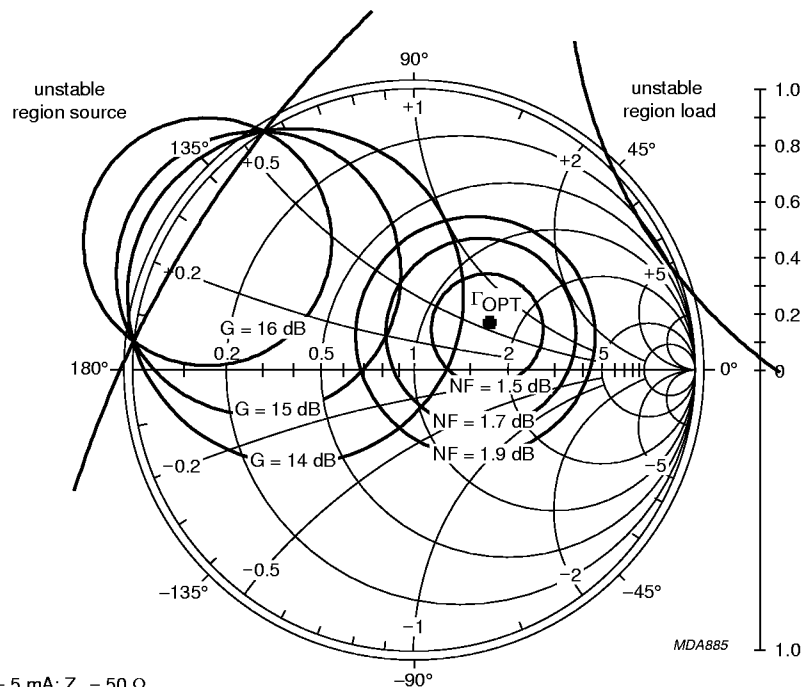


$V_{CE} = 6\text{ V}$; $I_C = 15\text{ mA}$; $Z_0 = 50\ \Omega$.

Fig.16 Common emitter output reflection coefficient (S_{22}); typical values.

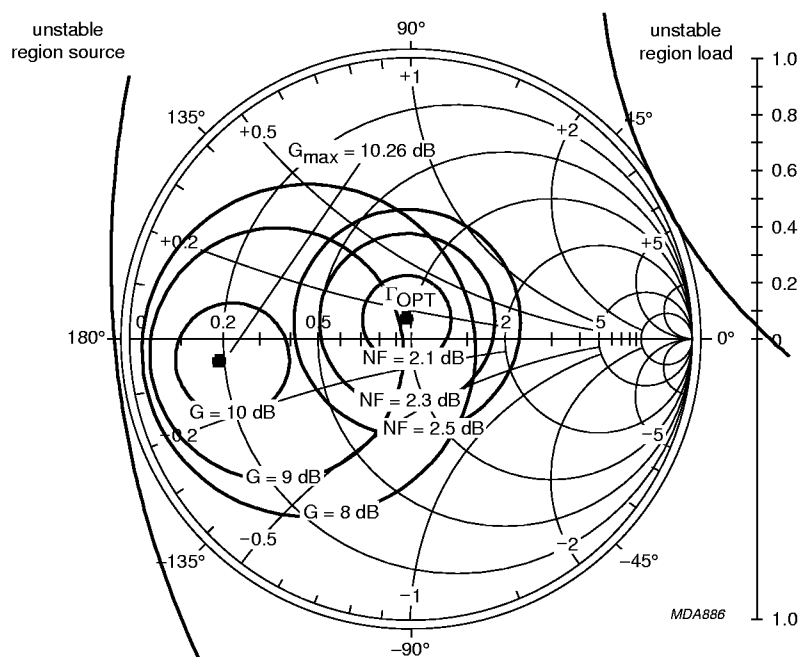
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$f = 1 \text{ GHz}$; $V_{CE} = 6 \text{ V}$; $I_C = 5 \text{ mA}$; $Z_0 = 50 \Omega$.

Fig.17 Common emitter available gain circles; typical values.



$f = 2 \text{ GHz}$; $V_{CE} = 6 \text{ V}$; $I_C = 5 \text{ mA}$; $Z_0 = 50 \Omega$.

Fig.18 Common emitter available gain circles; typical values.

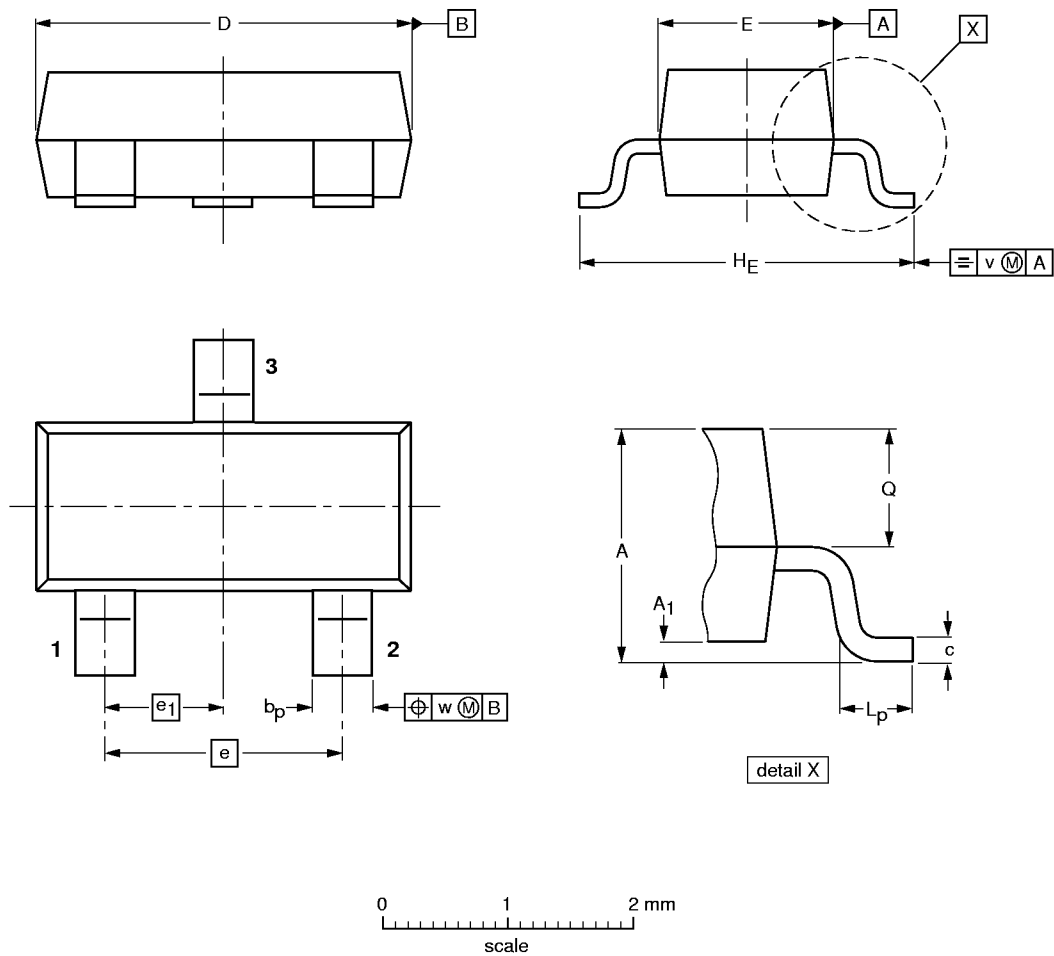
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PACKAGE OUTLINE

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