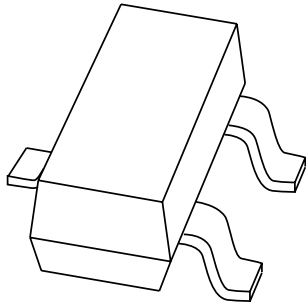


# DATA SHEET



## **PBR941** UHF wideband transistor

Product specification  
Supersedes data of 1998 May 08  
File under Discrete Semiconductors, SC14

1998 Aug 10

## UHF wideband transistor

## PBR941

## FEATURES

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

## APPLICATIONS

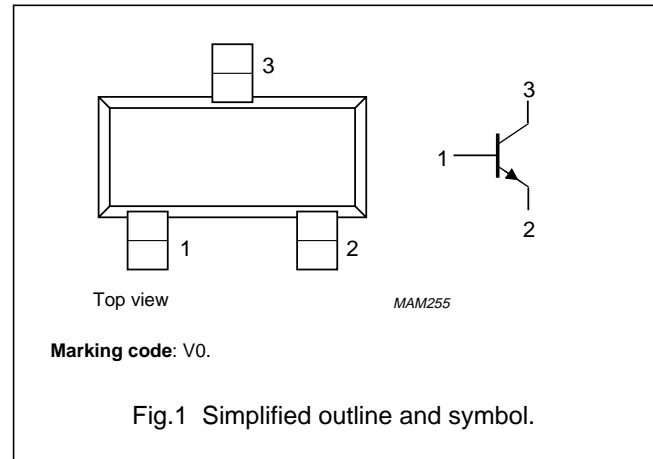
- Communication and instrumentation systems.

## 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.

## UHF wideband transistor

PBR941

**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
$T_{stg}$	storage temperature		–65	+150	°C
$T_j$	junction temperature		–	175	°C

**Note**

- $T_s$  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**

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

## UHF wideband transistor

## PBR941

**CHARACTERISTICS**

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

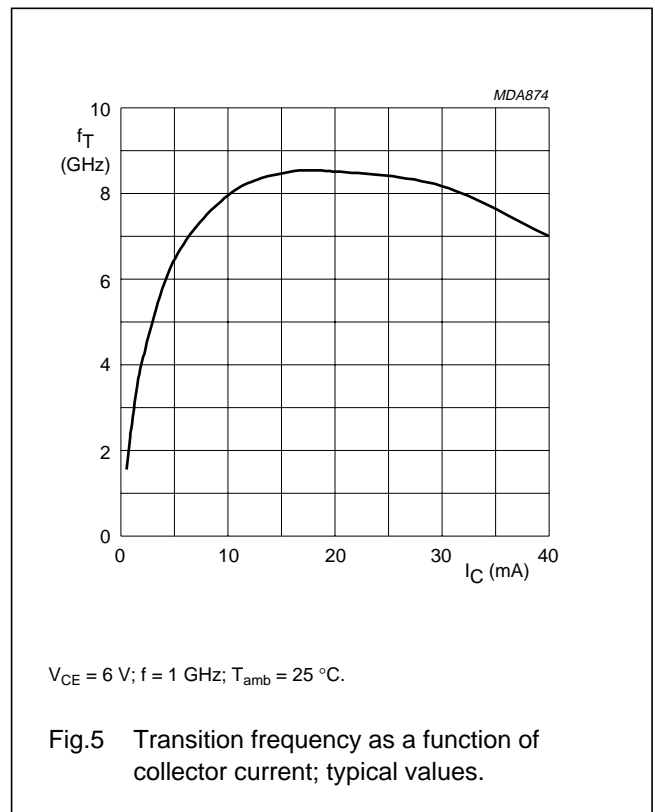
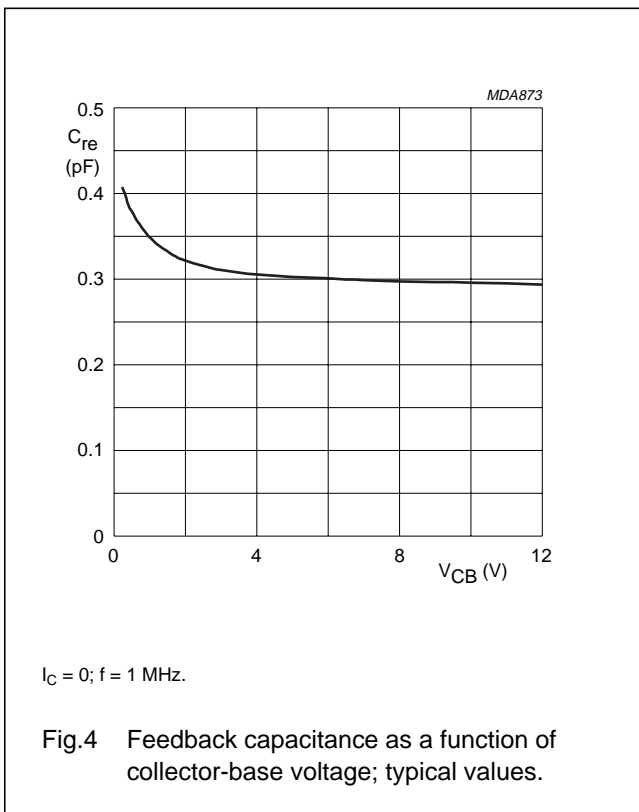
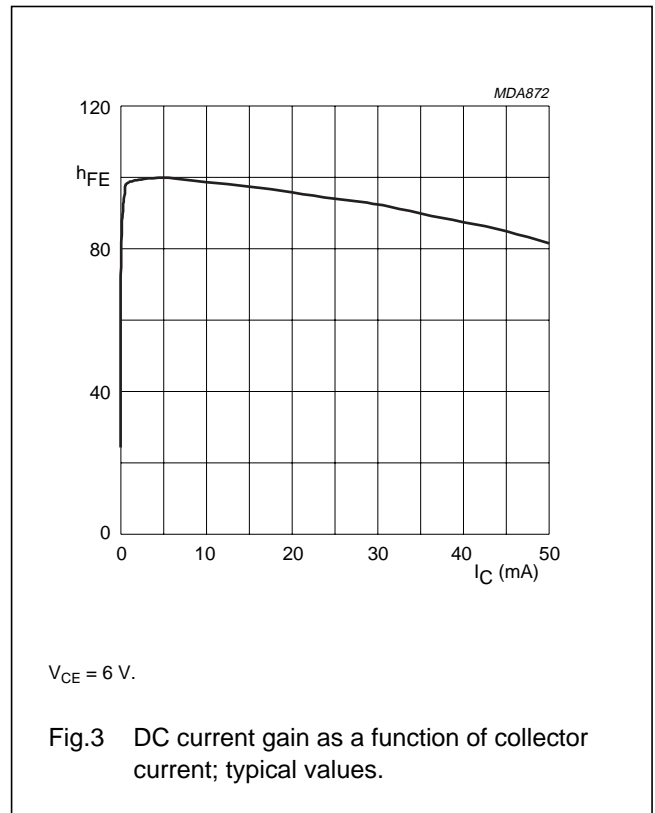
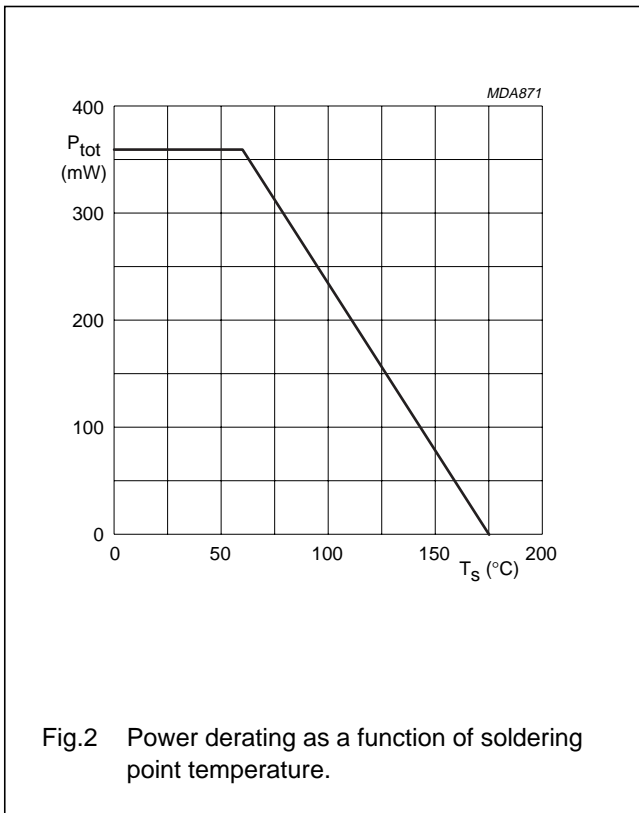
SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
<b>DC characteristics</b>						
$V_{(BR)CBO}$	collector-base breakdown voltage	$I_C = 100\ \mu\text{A}; I_E = 0$	20	–	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	$I_C = 100\ \mu\text{A}; I_B = 0$	10	–	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	$I_E = 10\ \mu\text{A}; I_C = 0$	1.5	–	–	V
$I_{CBO}$	collector-base leakage current	$V_{CB} = 10\ \text{V}; I_E = 0$	–	–	100	nA
$I_{EBO}$	emitter-base leakage current	$V_{EB} = 1\ \text{V}; I_C = 0$	–	–	100	nA
$h_{FE}$	DC current gain	$I_C = 5\ \text{mA}; V_{CE} = 6\ \text{V}$	50	100	200	
		$I_C = 15\ \text{mA}; V_{CE} = 6\ \text{V}$	–	100	–	
<b>AC characteristics</b>						
$C_{re}$	feedback capacitance	$I_C = 0; V_{CB} = 6\ \text{V}; f = 1\ \text{MHz}$	–	0.3	–	pF
$f_T$	transition frequency	$I_C = 15\ \text{mA}; V_{CE} = 6\ \text{V}; f = 1\ \text{GHz}$	–	8	–	GHz
$G_{UM}$	maximum unilateral power gain; note 1	$I_C = 15\ \text{mA}; V_{CE} = 6\ \text{V};$ $T_{amb} = 25\text{ °C}; f = 1\ \text{GHz}$	–	15	–	dB
		$I_C = 15\ \text{mA}; V_{CE} = 6\ \text{V};$ $T_{amb} = 25\text{ °C}; f = 2\ \text{GHz}$	–	9.5	–	dB
F	noise figure	$\Gamma_S = \Gamma_{opt}; I_C = 5\ \text{mA}; V_{CE} = 6\ \text{V};$ $f = 1\ \text{GHz}$	–	1.4	–	dB
		$\Gamma_S = \Gamma_{opt}; I_C = 5\ \text{mA}; V_{CE} = 6\ \text{V};$ $f = 2\ \text{GHz}$	–	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

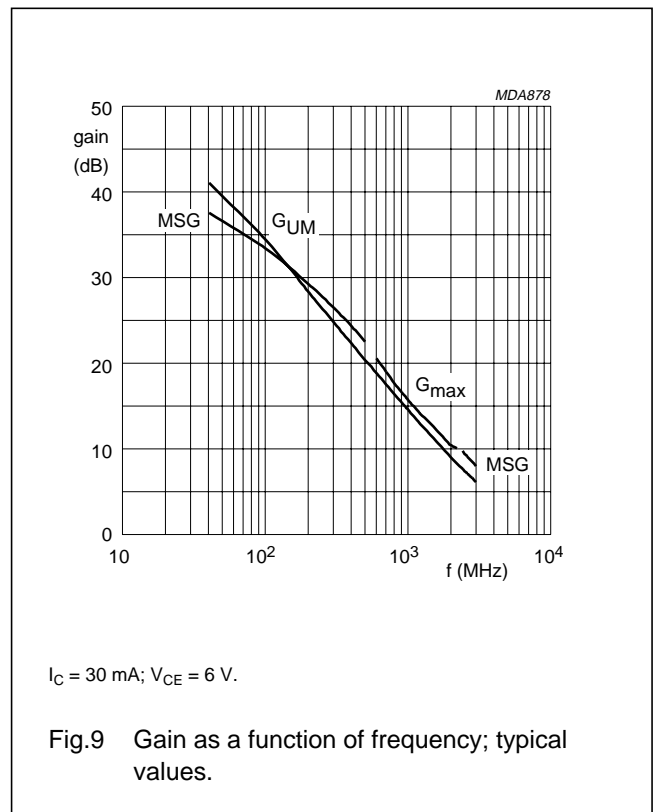
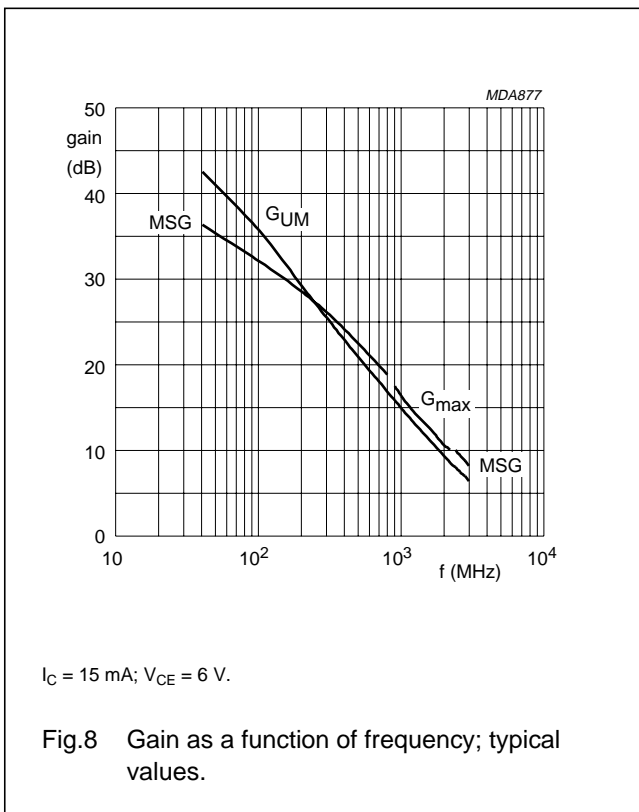
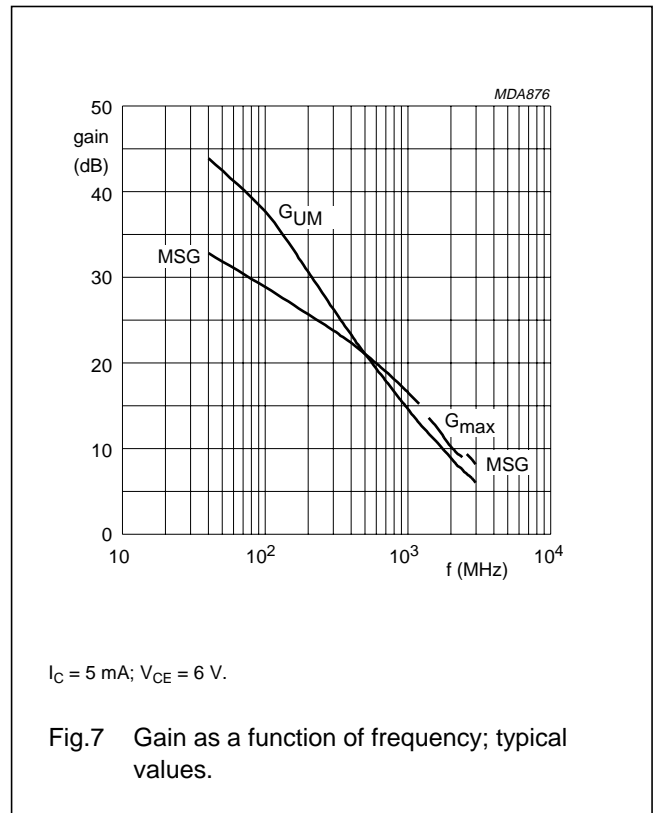
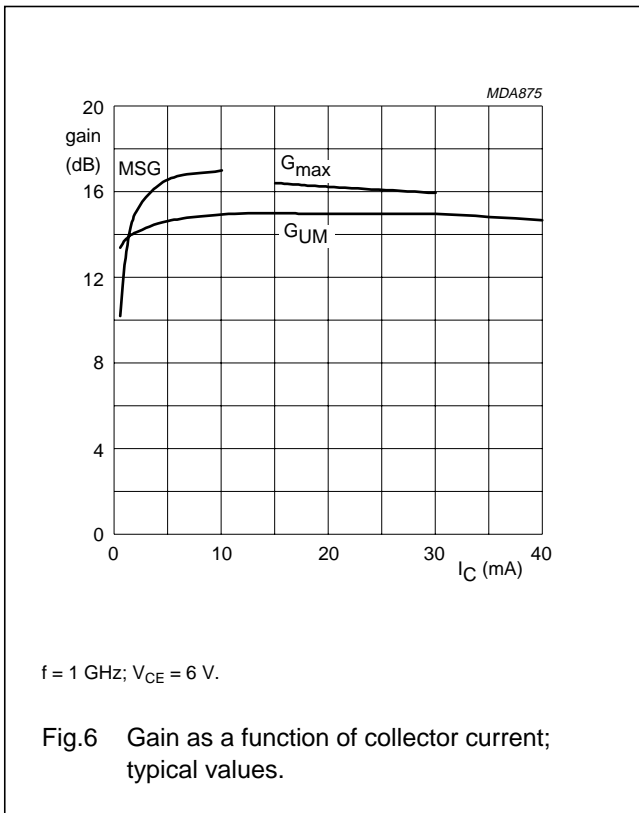
UHF wideband transistor

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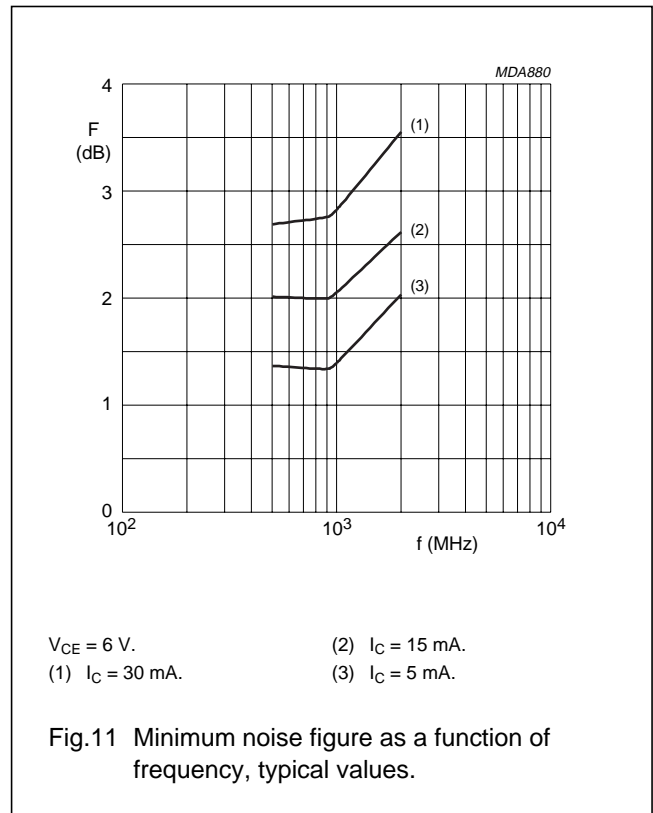
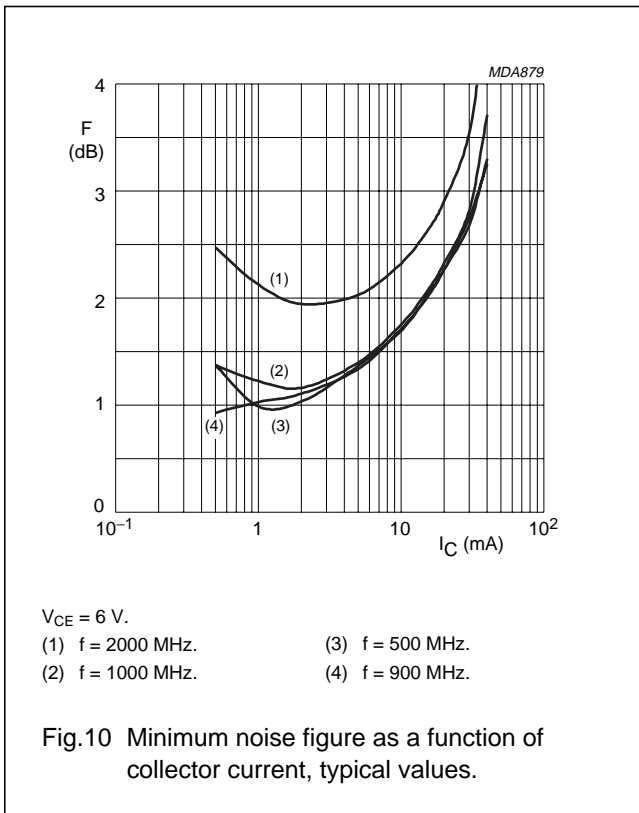
UHF wideband transistor

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UHF wideband transistor

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UHF wideband transistor

PBR941

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	μA
16	RBM	4.957	Ω
17	RE	0.597	Ω
18	RC	1.988	Ω
19 <sup>(1)</sup>	XTB	0.000	–
20 <sup>(1)</sup>	EG	1.110	eV
21 <sup>(1)</sup>	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 <sup>(1)</sup>	CJS	0.000	F
36 <sup>(1)</sup>	VJS	700.0	mV
37 <sup>(1)</sup>	MJS	0.000	–
38	FC	0.943	–

SEQUENCE No.	PARAMETER	VALUE	UNIT
39 <sup>(2)</sup>	C <sub>bpb</sub>	83.00	fF
40 <sup>(2)</sup>	C <sub>bpe</sub>	84.00	fF
41	AF	1.000	–
42	KF	4 x 10 <sup>-16</sup>	–

Notes

1. These parameters have not been extracted, the default values are shown.
2. C<sub>bpb</sub>, C<sub>bpe</sub>; base-bondpad and emitter-bondpad capacitance to collector.

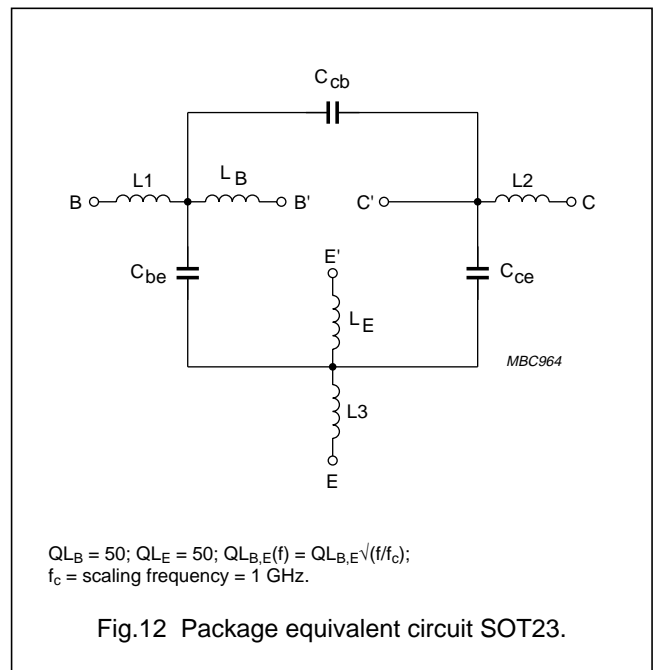


Fig.12 Package equivalent circuit SOT23.

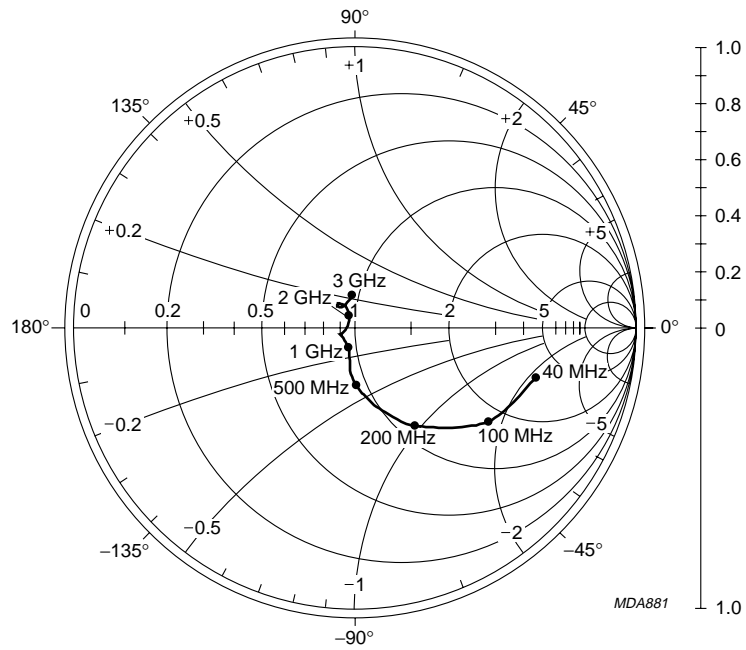
List of components (see Fig.12)

DESIGNATION	VALUE	UNIT
C <sub>be</sub>	7	fF
C <sub>cb</sub>	80	fF
C <sub>ce</sub>	80	fF
L1	0.35	nH
L2	0.17	nH
L3	0.35	nH
L <sub>B</sub>	0.40	nH
L <sub>E</sub>	0.83	nH



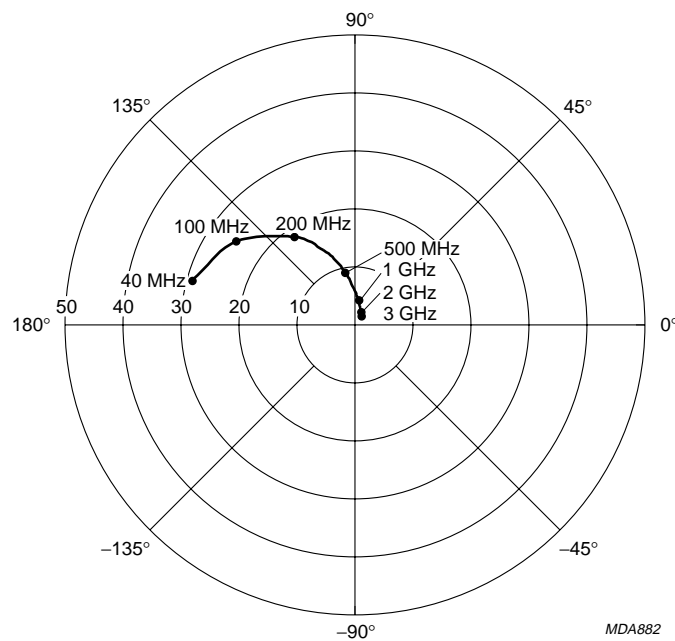
UHF wideband transistor

PBR941



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

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

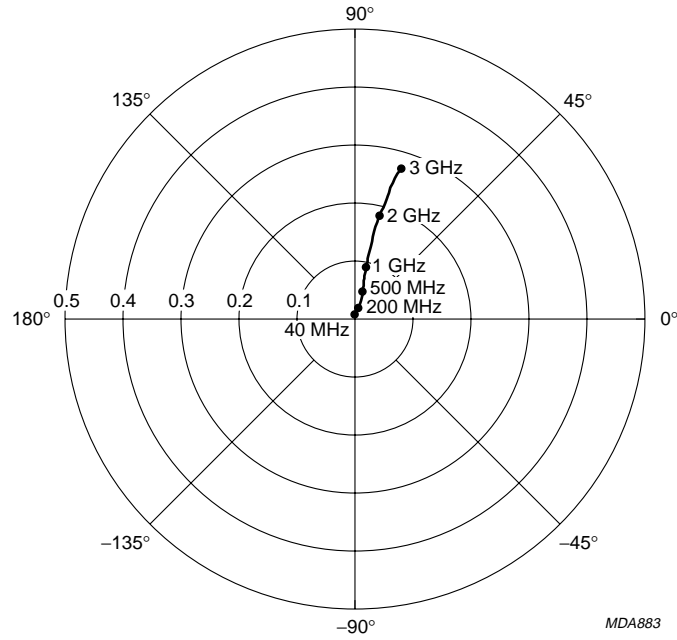


$V_{CE} = 6\text{ V}; I_C = 15\text{ mA}.$

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

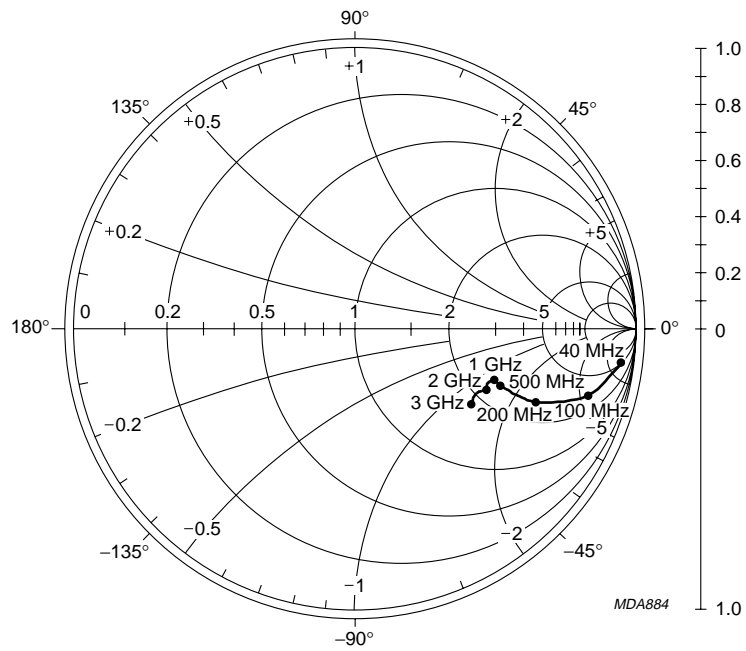
UHF wideband transistor

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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.

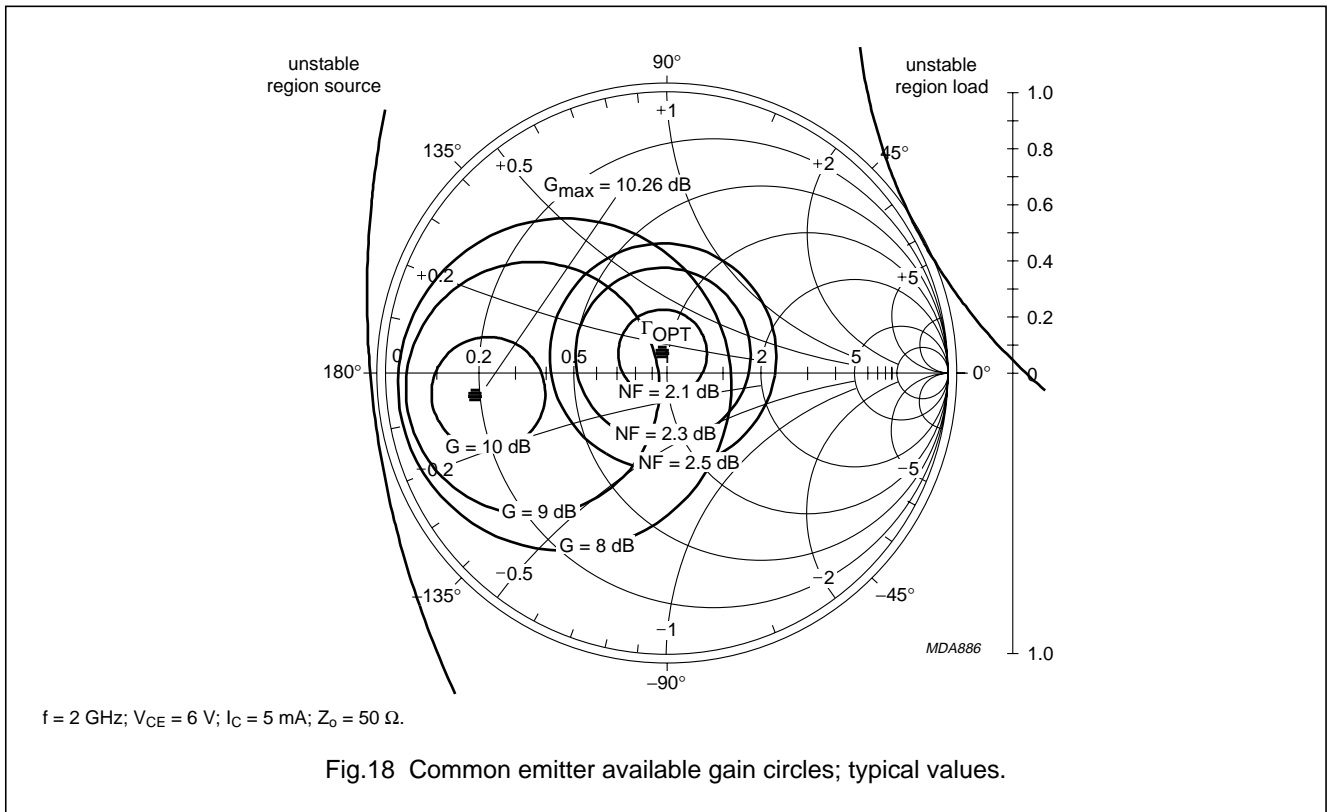
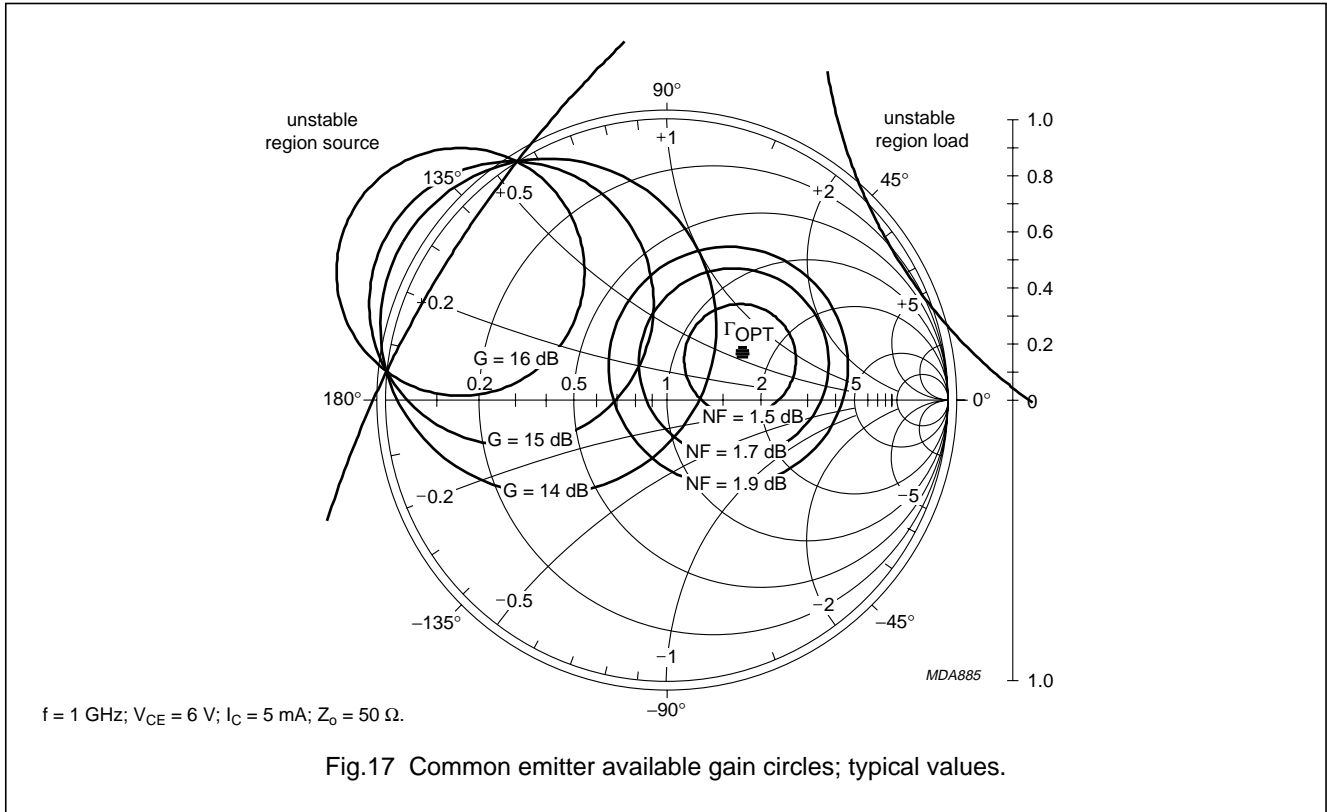


$V_{CE} = 6\text{ V}; I_C = 15\text{ mA}; Z_0 = 50\ \Omega$ .

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

UHF wideband transistor

PBR941



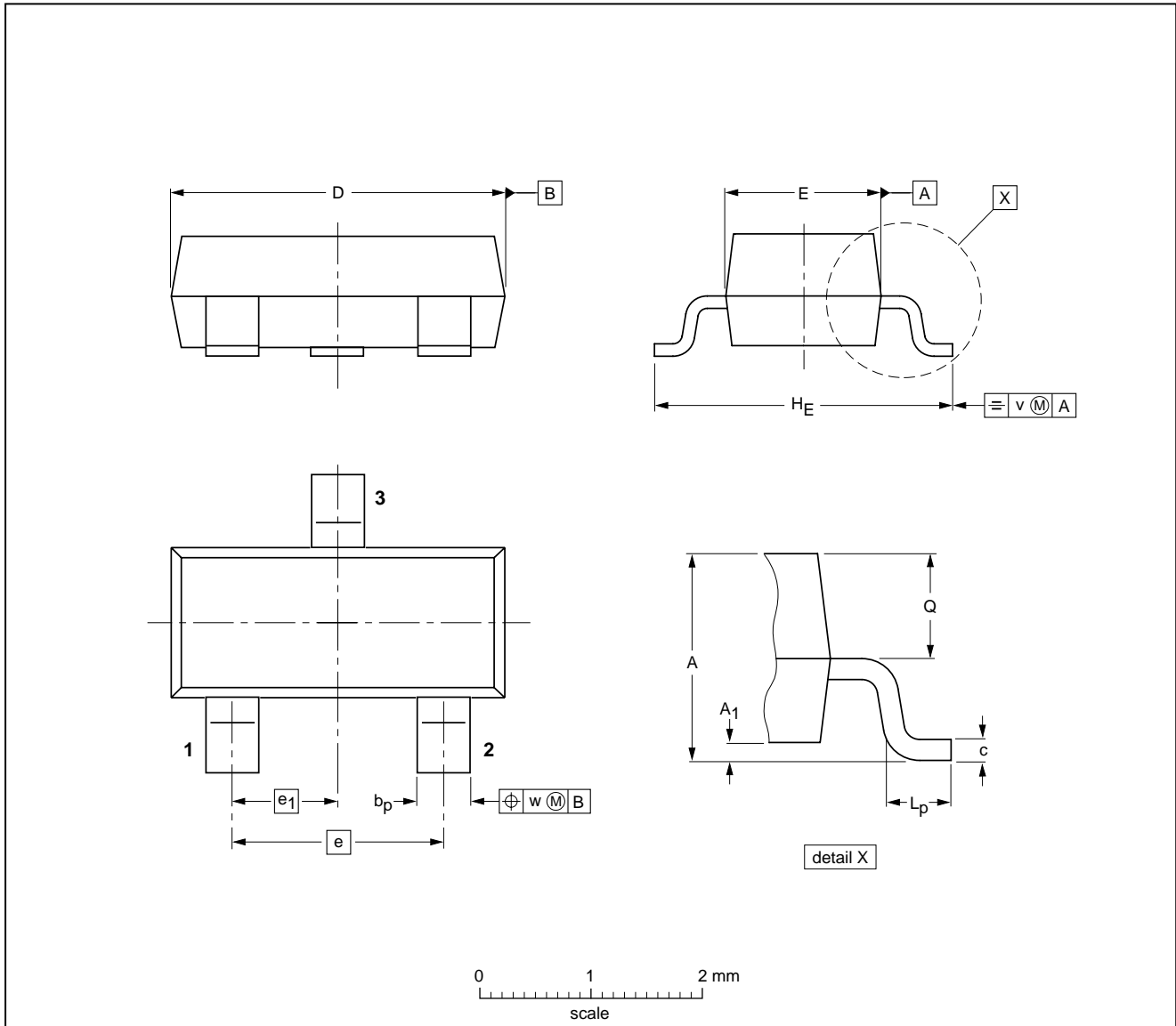
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PBR941

PACKAGE OUTLINE

Plastic surface mounted package; 3 leads

SOT23



DIMENSIONS (mm are the original dimensions)

UNIT	A	A <sub>1</sub> max.	b <sub>p</sub>	c	D	E	e	e <sub>1</sub>	H <sub>E</sub>	L <sub>p</sub>	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

## UHF wideband transistor

PBR941

**DEFINITIONS**

<b>Data sheet status</b>	
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.
<b>Limiting values</b>	
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.	
<b>Application information</b>	
Where application information is given, it is advisory and does not form part of the specification.	

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These products are not designed for use in life support appliances, devices, or systems where malfunction of these products can reasonably be expected to result in personal injury. Philips customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Philips for any damages resulting from such improper use or sale.

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**NOTES**

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**NOTES**

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