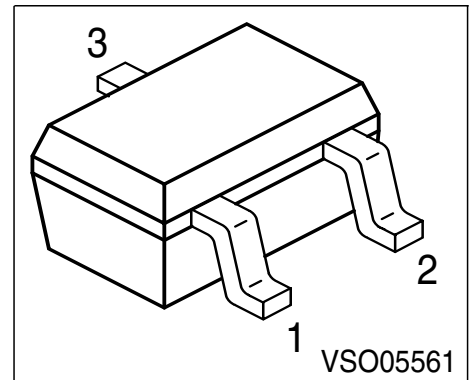


NPN Silicon RF Transistor

- For low distortion broadband amplifiers and oscillators up to 2 GHz at collector currents from 5 mA to 30 mA



ESD: Electrostatic discharge sensitive device, observe handling precaution!

Type	Marking	Pin Configuration			Package
BFR 93AW	R2s	1 = B	2 = E	3 = C	SOT-323

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CEO}	12	V
Collector-emitter voltage	V_{CES}	20	
Collector-base voltage	V_{CBO}	20	
Emitter-base voltage	V_{EBO}	2	
Collector current	I_C	50	mA
Base current	I_B	6	
Total power dissipation, $T_S \leq 104^\circ\text{C}$ (F)	P_{tot}	300	mW
Junction temperature	T_j	150	$^\circ\text{C}$
Ambient temperature	T_A	-65 ... 150	
Storage temperature	T_{stg}	-65 ... 150	

Thermal Resistance

Junction - soldering point	R_{thJS}	≤ 155	K/W
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¹ T_S is measured on the collector lead at the soldering point to the pcb

Electrical Characteristics at $T_A = 25^\circ\text{C}$, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC characteristics					
Collector-emitter breakdown voltage $I_C = 1\text{ mA}$, $I_B = 0$	$V_{(BR)CEO}$	12	-	-	V
Collector-emitter cutoff current $V_{CE} = 20\text{ V}$, $V_{BE} = 0$	I_{CES}	-	-	100	μA
Collector-base cutoff current $V_{CB} = 10\text{ V}$, $I_E = 0$	I_{CBO}	-	-	100	nA
Emitter-base cutoff current $V_{EB} = 2\text{ V}$, $I_C = 0$	I_{EBO}	-	-	10	μA
DC current gain $I_C = 30\text{ mA}$, $V_{CE} = 8\text{ V}$	h_{FE}	50	100	200	-

Electrical Characteristics at $T_A = 25^\circ\text{C}$, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
AC characteristics (verified by random sampling)					
Transition frequency $I_C = 30\text{ mA}$, $V_{CE} = 8\text{ V}$, $f = 500\text{ MHz}$	f_T	4.5	6	-	GHz
Collector-base capacitance $V_{CB} = 10\text{ V}$, $f = 1\text{ MHz}$	C_{cb}	-	0.62	0.9	pF
Collector-emitter capacitance $V_{CE} = 10\text{ V}$, $f = 1\text{ MHz}$	C_{ce}	-	0.28	-	
Emitter-base capacitance $V_{EB} = 0.5\text{ V}$, $f = 1\text{ MHz}$	C_{eb}	-	1.7	-	
Noise figure $I_C = 5\text{ mA}$, $V_{CE} = 8\text{ V}$, $Z_S = Z_{Sopt}$, $f = 900\text{ MHz}$ $f = 1.8\text{ GHz}$	F	- -	2 3.3	- -	dB
Power gain, maximum available ^{F)} $I_C = 30\text{ mA}$, $V_{CE} = 8\text{ V}$, $Z_S = Z_{Sopt}$, $Z_L = Z_{Lopt}$, $f = 900\text{ MHz}$ $f = 1.8\text{ GHz}$	G_{ma}	- -	15 10	- -	
Transducer gain $I_C = 30\text{ mA}$, $V_{CE} = 8\text{ V}$, $Z_S = Z_L = 50\Omega$, $f = 900\text{ MHz}$ $f = 1.8\text{ GHz}$	$ S_{21e} ^2$	- -	13 7.5	- -	

$$^1G_{ma} = |S_{21} / S_{12}| (k - (k^2 - 1)^{1/2})$$

SPICE Parameters (Gummel-Poon Model, Berkley-SPICE 2G.6 Syntax) :

Transistor Chip Data

IS =	8.6752	fA	BF =	137.63	-	NF =	0.93633	-
VAF =	20.011	V	IKF =	0.33395	A	ISE =	2619.3	fA
NE =	1.5466	-	BR =	59	-	NR =	0.88761	-
VAR =	26.834	V	IKR =	0.015129	A	ISC =	0.70823	fA
NC =	1.95	-	RB =	7.2326	Ω	IRB =	0.043806	mA
RBM =	3.4649	Ω	RE =	1.0075		RC =	0.13193	Ω
CJE =	3.1538	fF	VJE =	0.70393	V	MJE =	0.5071	-
TF =	33.388	ps	XTF =	0.28319	-	VTF =	0.17765	V
ITF =	2.5184	mA	PTF =	0	deg	CJC =	1039.5	fF
VJC =	0.72744	V	MJC =	0.34565	-	XCJC =	0.21422	-
TR =	1.1061	ns	CJS =	0	fF	VJS =	0.75	V
MJS =	0	-	XTB =	0	-	EG =	1.11	eV
XTI =	3	-	FC =	0.75935	-	TNOM	300	K

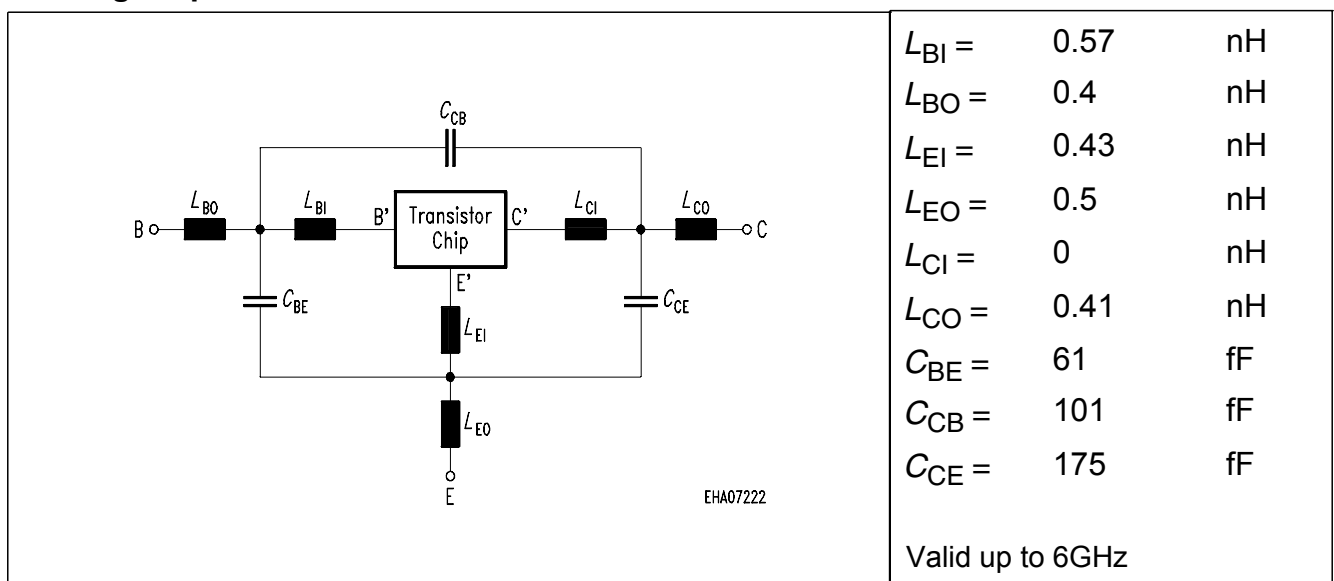
All parameters are ready to use, no scaling is necessary.

Extracted on behalf of SIEMENS Small Signal Semiconductors by:

Institut für Mobil-und Satellitentechnik (IMST)

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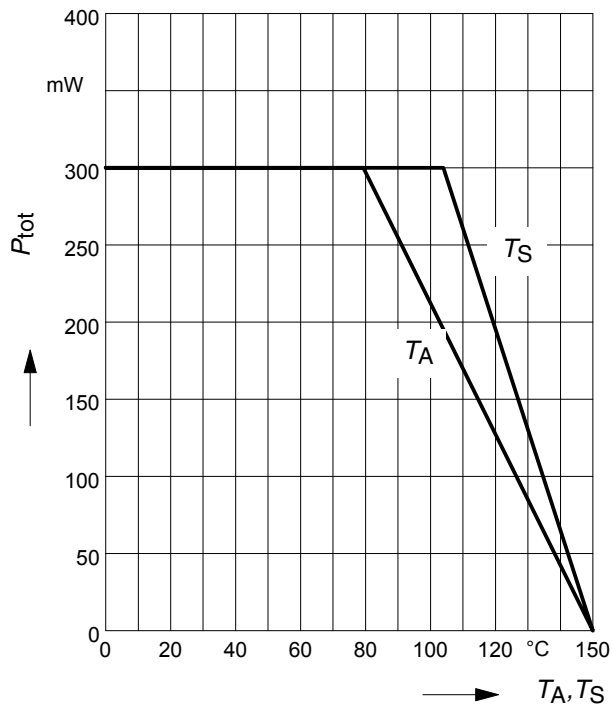
Package Equivalent Circuit:



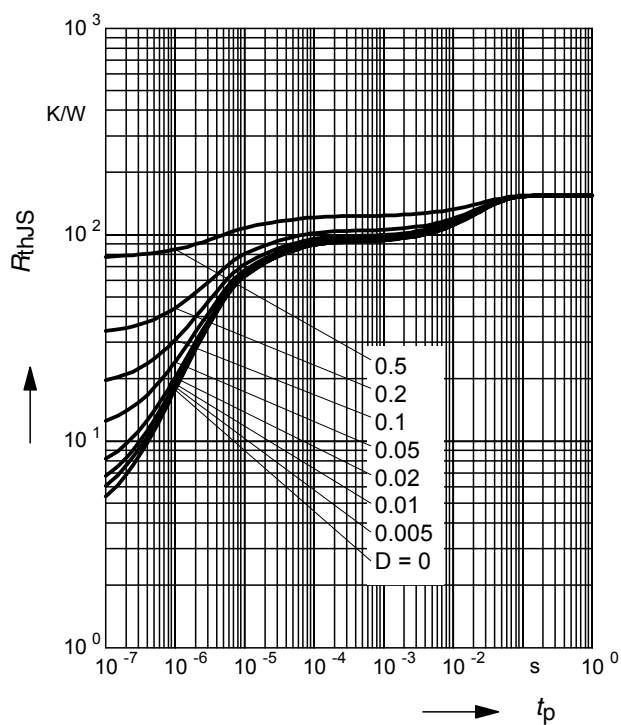
For examples and ready to use parameters please contact your local Infineon Technologies distributor or sales office to obtain a Infineon Technologies CD-ROM or see Internet: <http://www.infineon.com/products/discrete/index.htm>

Total power dissipation $P_{\text{tot}} = f(T_A^*, T_S)$

* Package mounted on epoxy

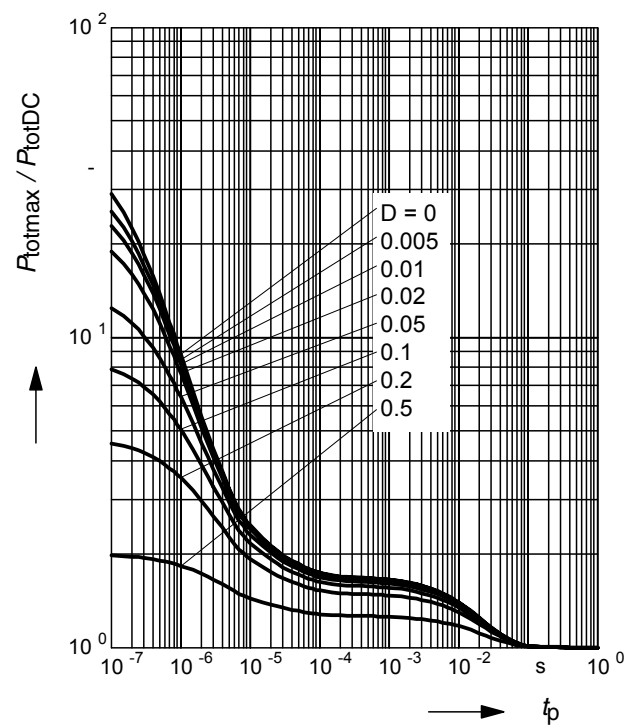


Permissible Pulse Load $R_{\text{thJS}} = f(t_p)$



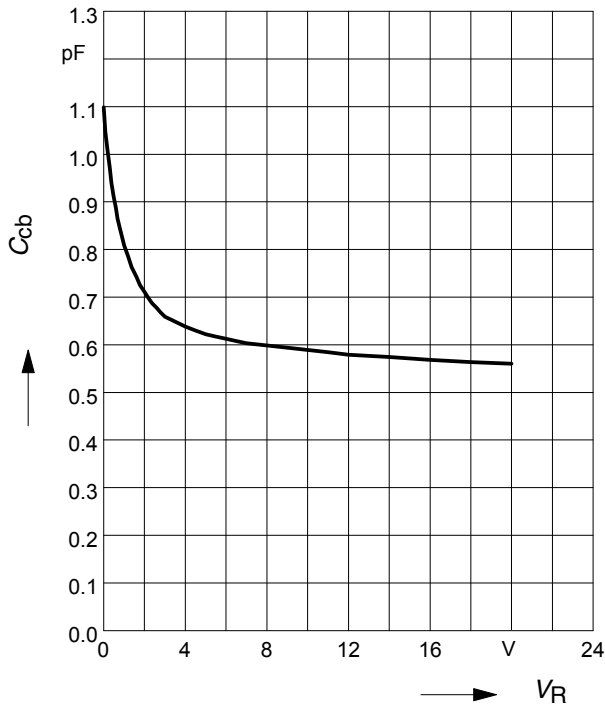
Permissible Pulse Load

$P_{\text{totmax}}/P_{\text{totDC}} = f(t_p)$



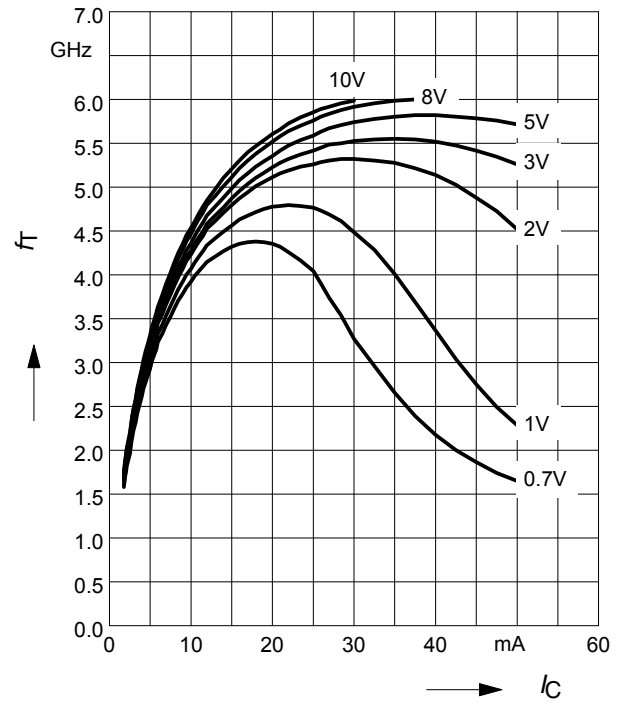
Collector-base capacitance $C_{cb} = f(V_{CB})$

$f = 1\text{MHz}$



Transition frequency $f_T = f(I_C)$

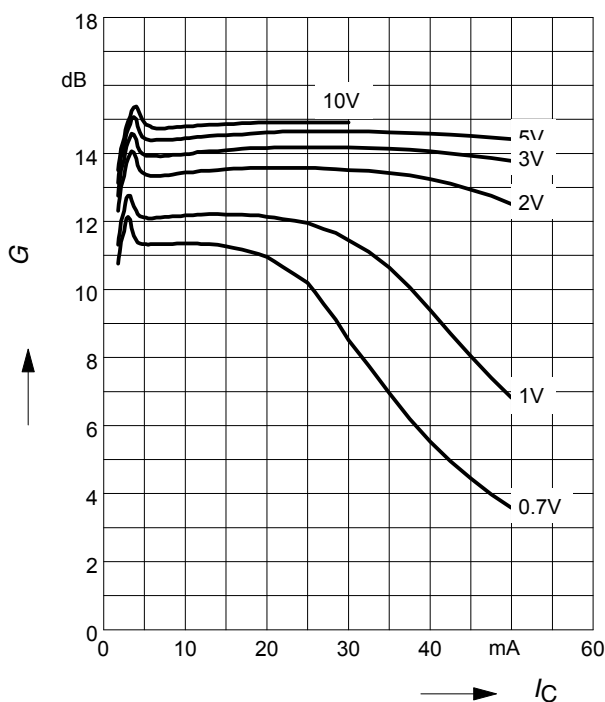
$V_{CE} = \text{Parameter}$



Power Gain $G_{ma}, G_{ms} = f(I_C)$

$f = 0.9\text{GHz}$

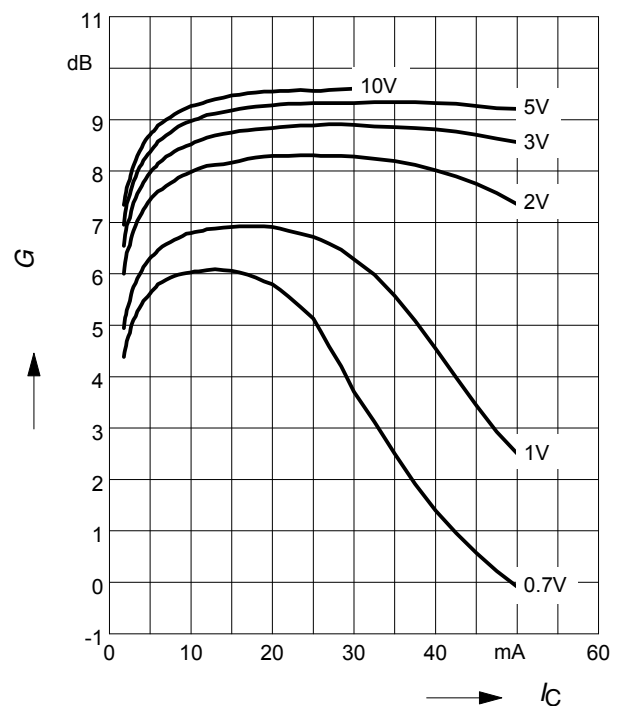
$V_{CE} = \text{Parameter}$



Power Gain $G_{ma}, G_{ms} = f(I_C)$

$f = 1.8\text{GHz}$

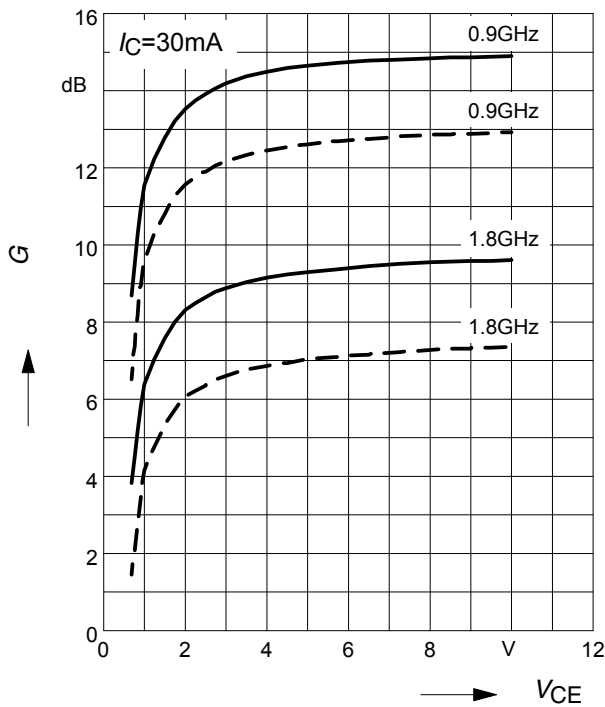
$V_{CE} = \text{Parameter}$



Power Gain $G_{ma}, G_{ms} = f(V_{CE})$:

$|S_{21}|^2 = f(V_{CE})$:

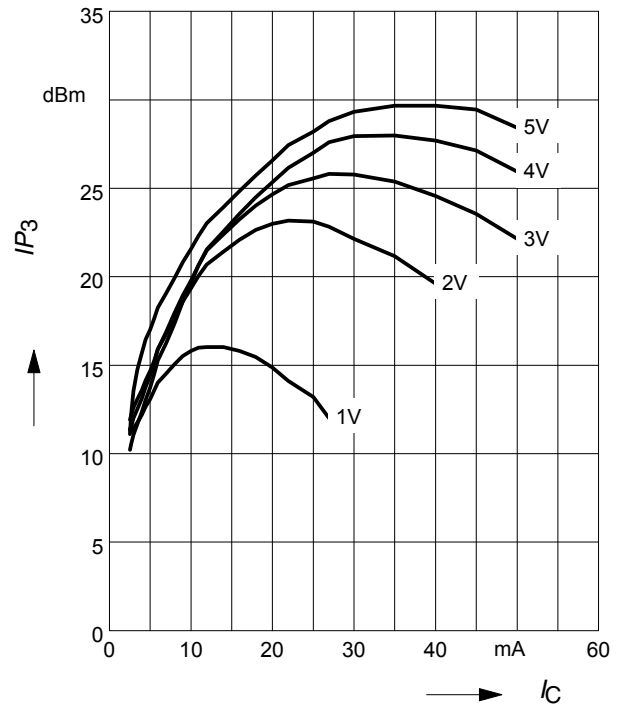
f = Parameter



Intermodulation Intercept Point $IP_3 = f(I_C)$

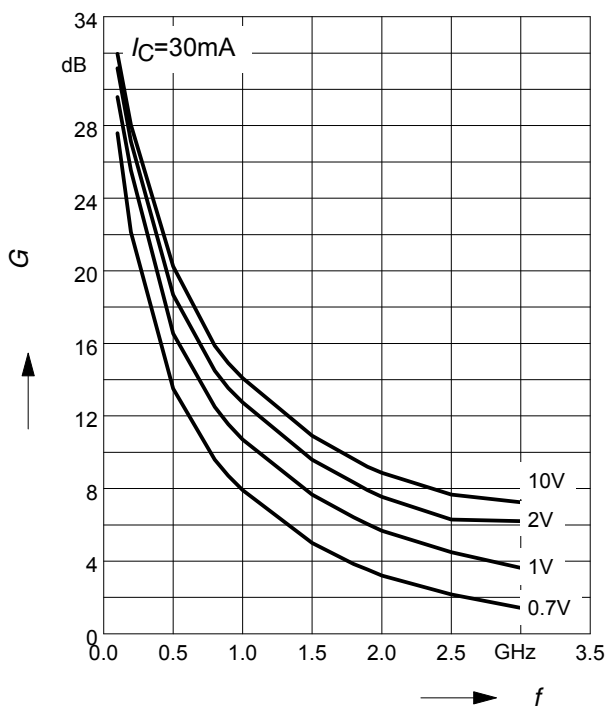
(3rd order, Output, $Z_S = Z_L = 50\Omega$)

V_{CE} = Parameter, $f = 900\text{MHz}$



Power Gain $G_{ma}, G_{ms} = f(f)$

V_{CE} = Parameter



Power Gain $|S_{21}|^2 = f(f)$

V_{CE} = Parameter

