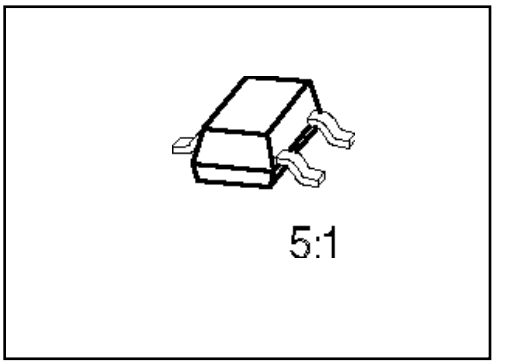
SIEMENS

NPN Silicon RF Transistor — BFR 93 A

- For low-distortion broadband amplifiers and oscillators up to 2 GHz at operating currents from 5 mA to 30 mA.
- CECC-type available: CECC 50002/256.



ESD: Electro**s**tatic **d**ischarge sensitive device, observe handling precautions!

Type	Marking	Ordering Code (tape and reel)	Pin Configuration 1	2	3	Package[1]
BFR 93 A	R2	Q62702-F1086	B	E	C	SOT-23

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CE0}	12	V
Collector-base voltage	V_{CB0}	15	
Emitter-base voltage	V_{EB0}	2	
Collector current	I_C	50	mA
Total power dissipation, $T_S \leq 63$ °C[3]	P_{tot}	300	mW
Junction temperature	T_j	150	°C
Ambient temperature range	T_A	– 65 … + 150	
Storage temperature range	T_{stg}	– 65 … + 150	

Thermal Resistance

Junction - ambient[2]	$R_{th\ JA}$	≤ 370	K/W
Junction - soldering point[3]	$R_{th\ JS}$	≤ 290	

1) For detailed dimensions see chapter Package Outlines.
2) Package mounted on alumina 15 mm × 16.7 mm × 0.7 mm.
3) T_S is measured on the collector lead at the soldering point to the pcb.

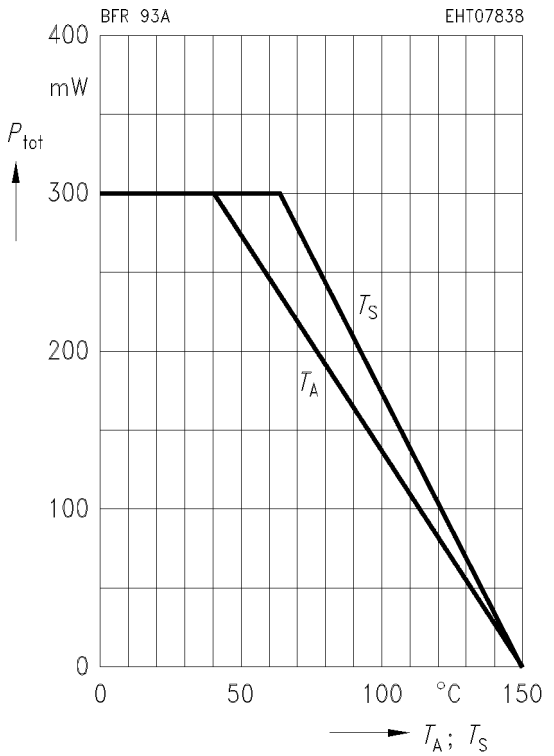
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CE0}$	12	–	–	V
Collector-base cutoff current V_{CB} = 5 V, I_E = 0	I_{CB0}	–	–	50	nA
Emitter-base cutoff current V_{EB} = 2 V, I_C = 0	I_{EB0}	–	–	10	µA
DC current gain I_C = 30 mA, V_{CE} = 5 V	h_{FE}	40	90	–	–
Collector-emitter saturation voltage I_C = 50 mA, I_B = 5 mA	V_{CEsat}	–	0.13	0.4	V

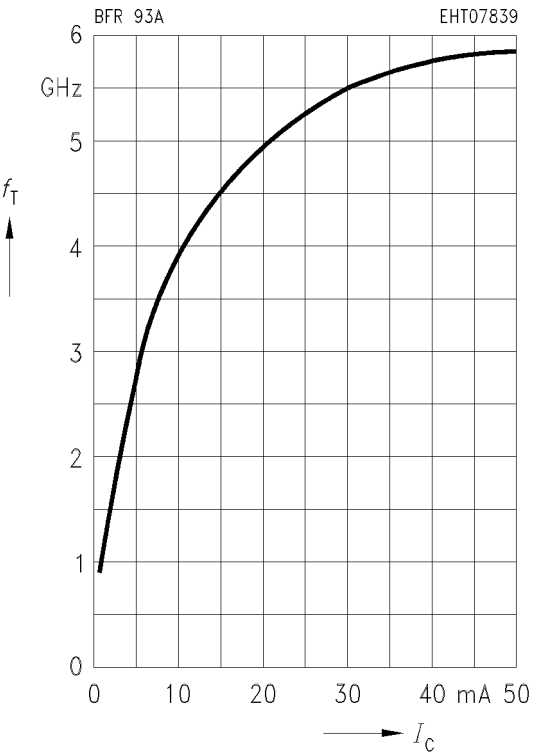
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
AC Characteristics					
Transition frequency I_C = 30 mA, V_{CE} = 5 V, f = 200 MHz	f_T	–	5.5	–	GHz
Collector-base capacitance V_{CB} = 5 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{cb}	–	0.55	–	pF
Collector-emitter capacitance V_{CE} = 5 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{ce}	–	0.28	–	
Input capacitance V_{EB} = 0.5 V, I_C = i_c = 0, f = 1 MHz	C_{ibo}	–	2.1	–	
Output capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{obs}	–	0.8	–	
Noise figure I_C = 5 mA, V_{CE} = 8 V, f = 10 MHz, Z_S = 50 Ω I_C = 5 mA, V_{CE} = 8 V, f = 800 MHz, Z_S = Z_{Sopt} I_C = 30 mA, V_{CE} = 8 V, f = 800 MHz, Z_S = Z_{Sopt}	F	 – – –	 1.1 1.7 2.6	 – – –	dB
Power gain I_C = 30 mA, V_{CE} = 8 V, f = 800 MHz, Z_S = Z_{Sopt}, Z_L = Z_{Lopt}	G_{pe}	–	13.5	–	
Transducer gain I_C = 30 mA, V_{CE} = 8 V, f = 1 GHz, Z_0 = 50 Ω	$\lvert S_{21e} \rvert^2$	–	11.5	–	
Linear output voltage two-tone intermodulation test I_C = 30 mA, V_{CE} = 8 V, d_{IM} = 60 dB f_1 = 806 MHz, f_2 = 810 MHZ, Z_S = Z_L = 50 Ω	V_{o1} = V_{o2}	–	280	–	mV
Third order intercept point I_C = 30 mA, V_{CE} = 8 V, f = 800 MHz	IP_3	–	32	–	dBm

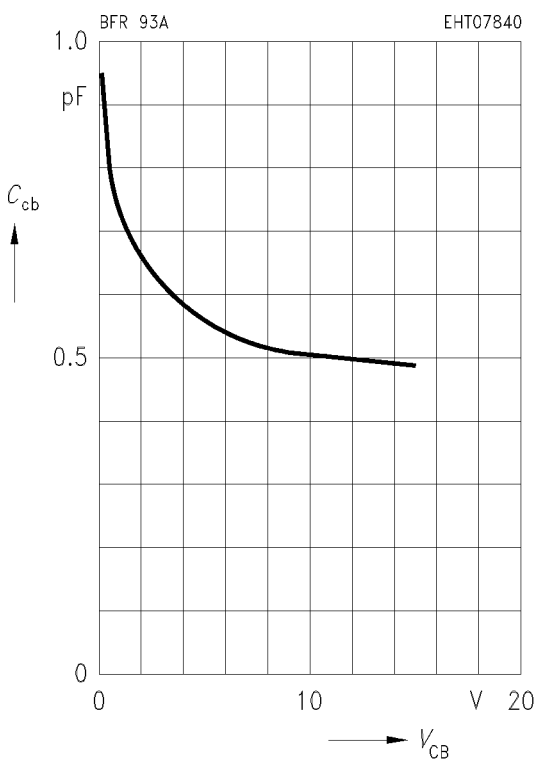
Total power dissipation $P_{tot} = f(T_A^*; T_S)$
*Package mounted on alumina



Transition frequency $f_T = f(I_C)$
V_{CE} = 5 V, f = 200 MHz



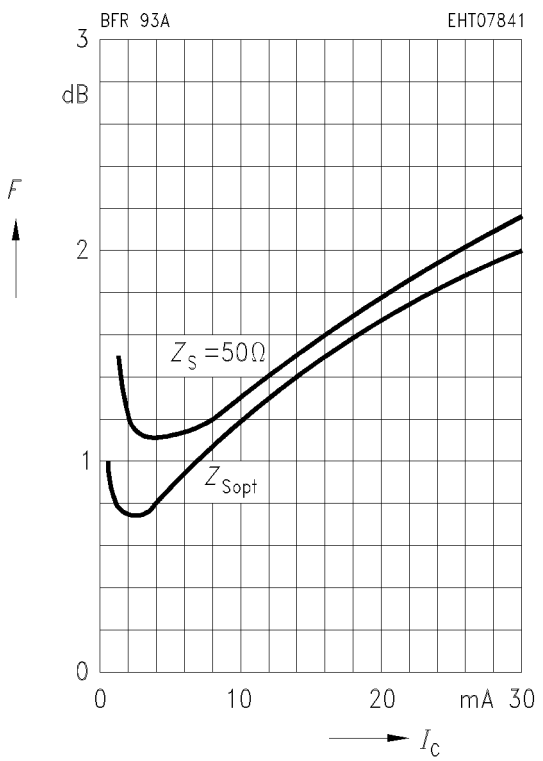
Collector-base capacitance $C_{cb} = f(V_{CB})$
$V_{BE} = v_{be} = 0$, f = 1 MHz



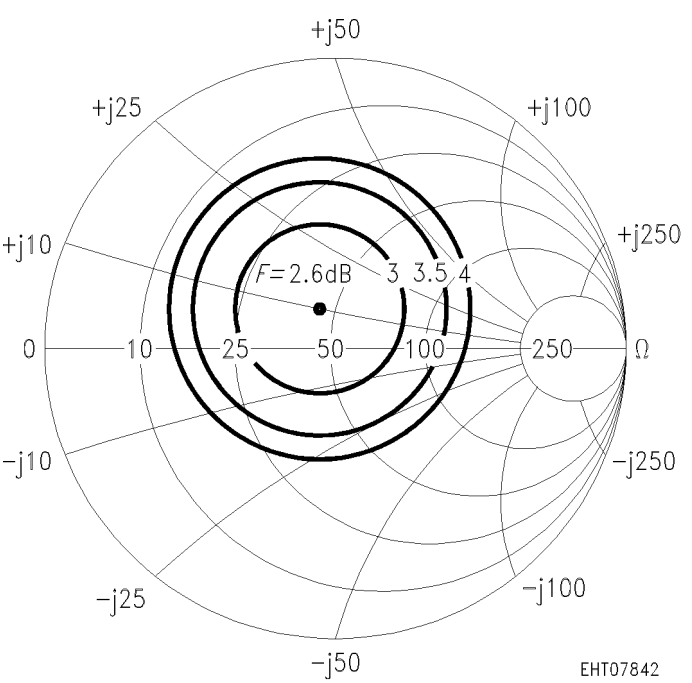
Common Emitter Noise Parameters

f	F_{min}	$G_p(F_{min})$	Γ_{opt}		R_N	N	$F_{50\,\Omega}$	$G_p(F_{50\Omega})$
GHz	**dB**	**dB**	**MAG**	**ANG**	**Ω**	**–**	**dB**	**dB**
I_C = 4 mA, V_{CE} = 8 V, Z_0 = 50 Ω								
0.01	0.8	–	(Z_S = 150 Ω)		–	–	1.1	–
I_C = 30 mA, V_{CE} = 8 V, Z_0 = 50 Ω								
0.01 0.8	2.0 2.6	– 13.5	(Z_S = 100 Ω) 0.13	 108	– 19.3	– 0.41	2.15 2.85	– 13

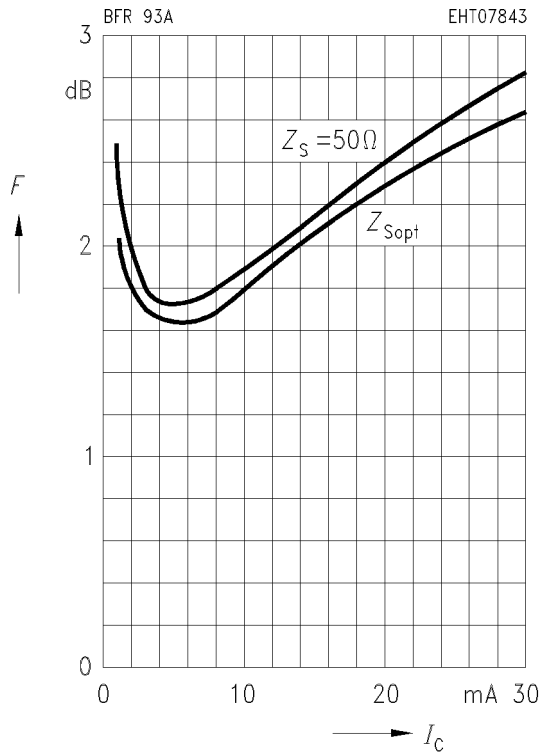
Noise figure $F = f(I_C)$
V_{CE} = 8 V, f = 10 MHz



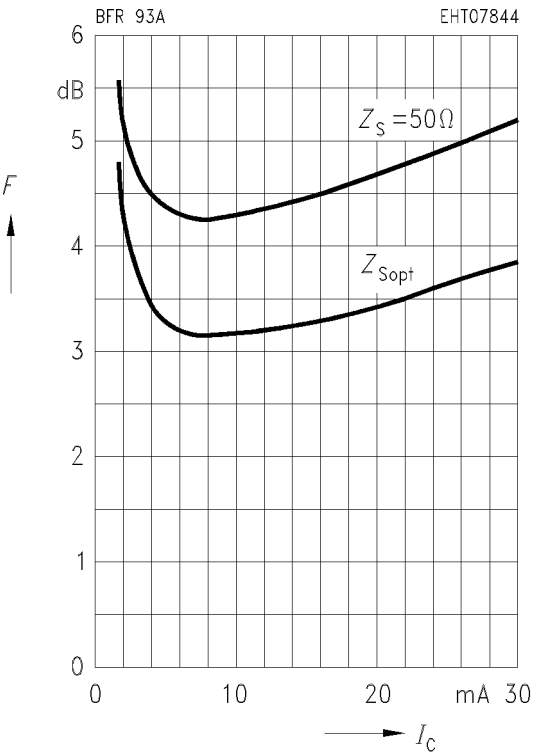
Circles of constant noise figure $F = f(Z_S)$
in Z_S-plane, I_C = 30 mA, V_{CE} = 8 V,
f= 800 MHz



Noise figure $F = f(I_C)$
V_{CE} = 8 V, f = 800 MHz, Z_{Lopt} (G)



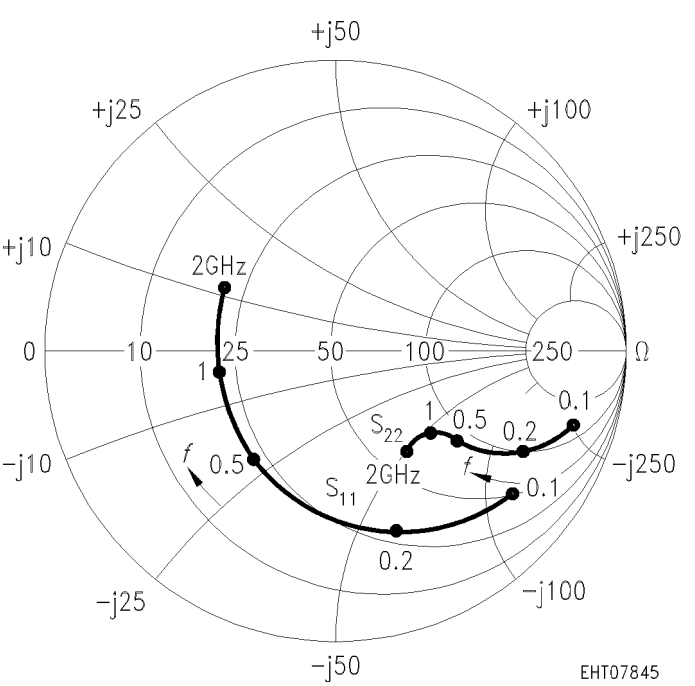
Noise figure $F = f(I_C)$
V_{CE} = 8 V, f = 2 GHz, Z_{Lopt} (G)



Common Emitter S Parameters

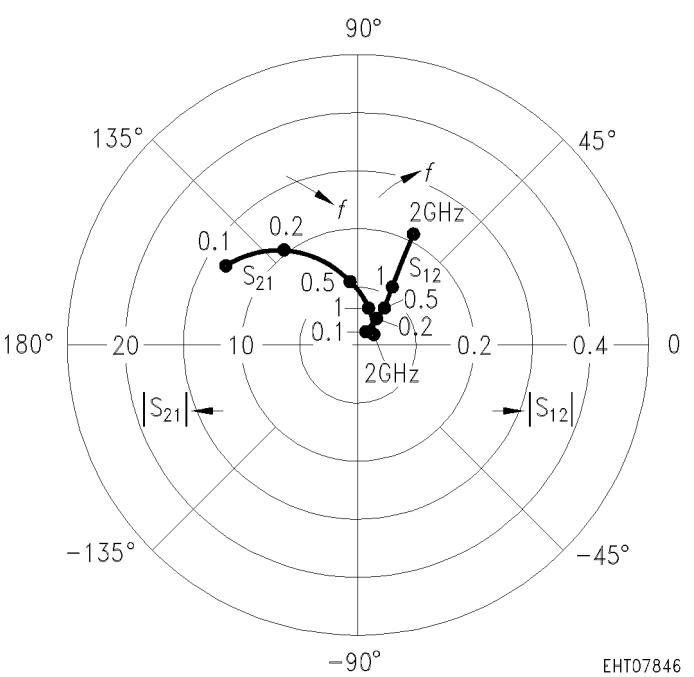
f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_C = 5 mA, V_{CE} = 8 V, Z_0 = 50 Ω								
0.1	0.74	– 45	13.5	150	0.033	69	0.93	– 21
0.2	0.64	– 81	10.5	129	0.052	57	0.73	– 30
0.5	0.49	– 132	5.6	101	0.078	53	0.50	– 56
0.8	0.45	– 158	3.7	86	0.097	57	0.41	– 37
1.0	0.44	– 169	3.0	79	0.113	61	0.39	– 39
1.2	0.43	– 179	2.6	73	0.127	64	0.38	– 40
1.5	0.41	169	2.1	65	0.145	66	0.42	– 45
2.0	0.40	160	1.7	54	0.194	71	0.44	– 48

S_{11}, S_{22} = f (f), Z-plane I_C = 5 mA, V_{CE} = 8 V, Z_0 = 50 Ω



S_{12}, S_{21} = f (f)

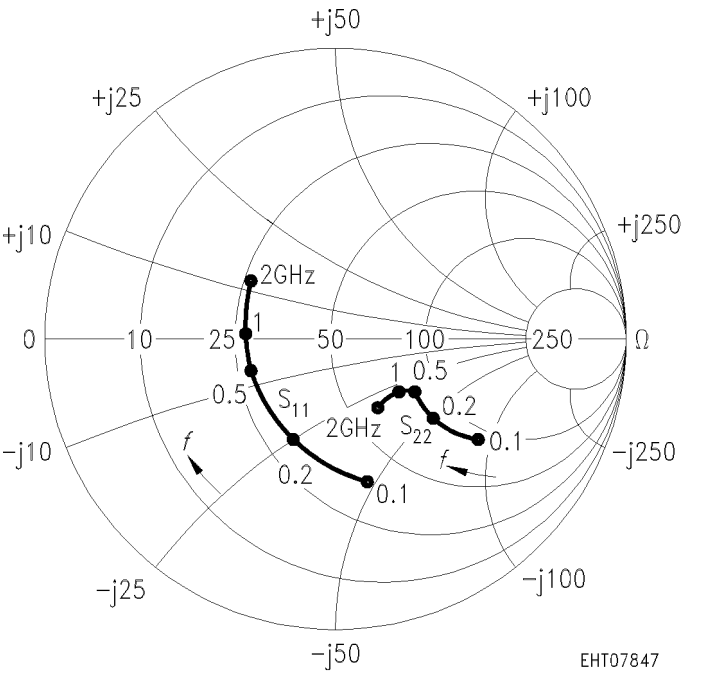
I_C = 5 mA, V_{CE} = 8 V, Z_0 = 50 Ω



Common Emitter S Parameters (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**
I_C = 30 mA, V_{CE} = 8 V, Z_0 = 50 Ω								
0.1	0.38	– 105	27.6	125	0.021	64	0.69	– 41
0.2	0.37	– 138	16.5	107	0.032	66	0.41	– 44
0.5	0.36	– 170	7.2	90	0.066	73	0.26	– 39
0.8	0.36	– 178	4.6	80	0.101	74	0.21	– 32
1.0	0.35	177	3.8	75	0.125	73	0.20	– 40
1.2	0.34	173	3.2	71	0.147	72	0.20	– 41
1.5	0.31	157	2.6	65	0.169	70	0.23	– 43
2.0	0.30	152	2.1	55	0.228	69	0.28	– 46

S_{11}, S_{22} = f (f), Z-plane
I_C = 30 mA, V_{CE} = 8 V, Z_0 = 50 Ω



S_{12}, S_{21} = f (f)
I_C = 30 mA, V_{CE} = 8 V, Z_0 = 50 Ω