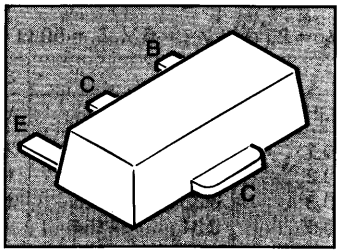
- For low-distortion broadband amplifiers in antenna and telecommunications systems at collector currents from 70 to 150 mA.



Type	Marking	Ordering code (tape and reel)	Package[1])
BFQ 64	FC	Q 62702 – F1061	SOT-89

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CEO}	20	V
Collector-base voltage	V_{CBO}	30	V
Emitter-base voltage	V_{EBO}	3	V
Collector current	I_C	200	mA
Peak collector current, $f \geq 1$ MHz	I_{CM}	250	mA
Base current	I_B	25	mA
Total power dissipation, $T_A \leq 25$ °C[2])	P_{tot}	1	W
Junction temperature	T_j	150	°C
Ambient temperature range	T_A	–65 ... +150	°C
Storage temperature range	T_{stg}	–65 ... +150	°C

Thermal Resistance

Junction – ambient[2])	R_{thJA}	≤125	K/W

1) For detailed dimensions see chapter Package Outlines.
2) Package mounted on alumina 15 mm x 16.7 mm x 0.7 mm.

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

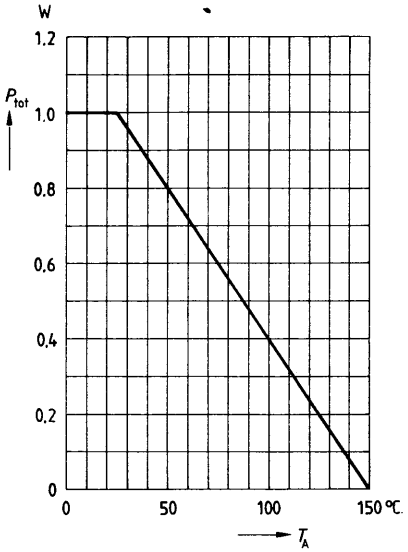
DC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
Collector-emitter cutoff current V_{CE} = 30 V, V_{BE} = 0	I_{CES}	–	–	1	mA
Collector-base cutoff current V_{CB} = 15 V, I_E = 0	I_{CBO}	–	–	200	nA
Emitter-base cutoff current V_{EB} = 2 V, I_C = 0	I_{EBO}	–	–	10	µA
DC current gain I_C = 120 mA, V_{CE} = 5 V	h_{FE}	25	–	–	–

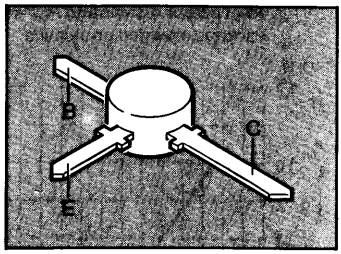
AC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
Transition frequency I_C = 100 mA, V_{CE} = 5 V, f = 200 MHz	f_T	–	3	–	GHz
Collector-base capacitance V_{CB} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{cb}	–	1	–	pF
Input capacitance V_{EB} = 0.5 V, I_C = i_c = 0, f = 1 MHz	C_{ibo}	–	11.5	–	pF
Power gain I_C = 100 mA, V_{CE} = 10 V, f = 800 MHz, Z_S = Z_{Sopt}, Z_L = Z_{Lopt}	G_{pe}	–	10	–	dB
Linear output voltage two-tone intermodulation test I_C = 100 mA, V_{CE} = 10 V, d_{IM} = 60 dB f_1 = 806 MHz, f_2 = 810 MHz, Z_S = Z_L = 50 Ω	V_{o1} = V_{o2}	–	600	–	mV
Third order intercept point I_C = 100 mA, V_{CE} = 10 V, f = 800 MHz	IP_3	–	38.5	–	dBm

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



- For low-noise broadband amplifiers in antenna and telecommunications systems at collector currents from 1 to 25 mA.



ESD: Electrostatic discharge sensitive device, observe handling precautions!

Type	Marking	Ordering code	Package[1])
BFQ 69	BFQ 69	Q 62702 – F780	T-plast

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CEO}	15	V
Collector-base voltage	V_{CBO}	25	V
Emitter-base voltage	V_{EBO}	2	V
Collector current	I_C	30	mA
Base current	I_B	4	mA
Total power dissipation, $T_A \leq 30$ °C[2])	P_{tot}	300	mW
Junction temperature	T_j	150	°C
Ambient temperature range	T_A	–65 ... +150	°C
Storage temperature range	T_{stg}	–65 ... +150	°C

Thermal Resistance

Junction – ambient[2])	R_{thJA}	≤400	K/W

1) For detailed dimensions see chapter Package Outlines.
2) Package mounted on glass epoxy 40 mm × 25 mm × 1.5 mm.

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

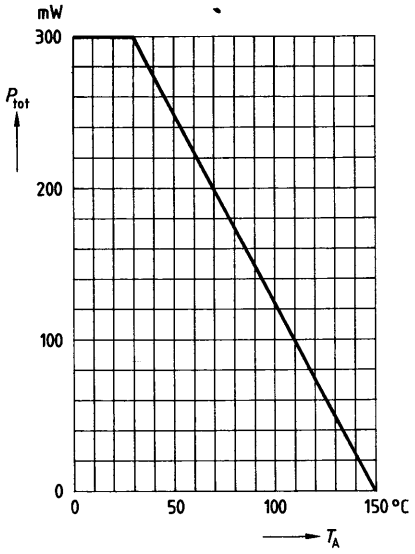
DC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CEO}$	15	–	–	V
Collector-emitter cutoff current V_{CE} = 25 V, V_{BE} = 0	I_{CES}	–	–	100	µA
Collector-base cutoff current V_{CB} = 10 V, I_E = 0	I_{CBO}	–	–	50	nA
Emitter-base cutoff current V_{EB} = 2 V, I_C = 0	I_{EBO}	–	–	100	µA
DC current gain I_C = 15 mA, V_{CE} = 10 V	h_{FE}	50	100	–	–

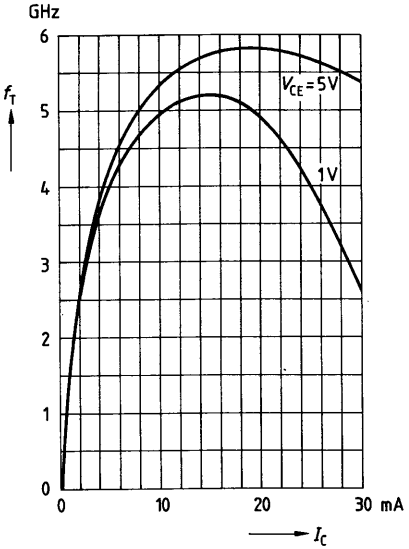
AC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
Transition frequency I_C = 15 mA, V_{CE} = 10 V, f = 200 MHz	f_T	–	5.8	–	GHz
Collector-base capacitance V_{CB} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{cb}	–	0.35	0.5	pF
Collector-emitter capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{ce}	–	0.29	–	pF
Output capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{obs}	–	0.65	–	pF
Noise figure I_C = 3 mA, V_{CE} = 10 V, f = 10 MHz, Z_S = 75 Ω I_C = 5 mA, V_{CE} = 10 V, f = 800 MHz, Z_S = 50 Ω	F	 – –	 0.9 1.4	 1.3 –	dB
Power gain I_C = 10 mA, V_{CE} = 10 V, f = 800 MHz, Z_S = 50 Ω, Z_L = Z_{Lopt}	G_{pe}	–	16.5	–	dB
Linear output voltage two-tone intermodulation test I_C = 25 mA, V_{CE} = 10 V, d_{IM} = 60 dB f_1 = 806 MHz, f_2 = 810 MHz, Z_S = Z_L = 50 Ω	$V_{o1} = V_{o2}$	–	170	–	mV
Third order intercept point I_C = 25 mA, V_{CE} = 10 V, f = 800 MHz	IP_3	–	27.5	–	dBm

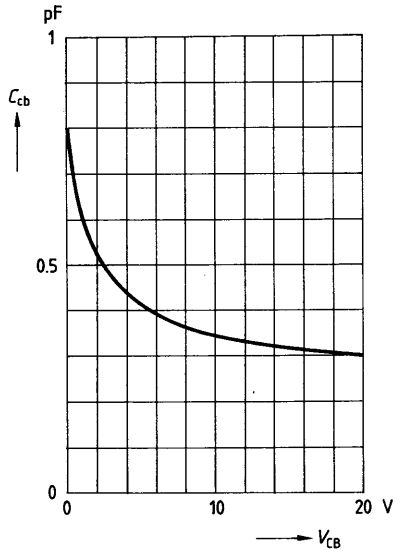
Total power dissipation $P_{tot} = f(T_A)$
Package mounted on glass epoxy



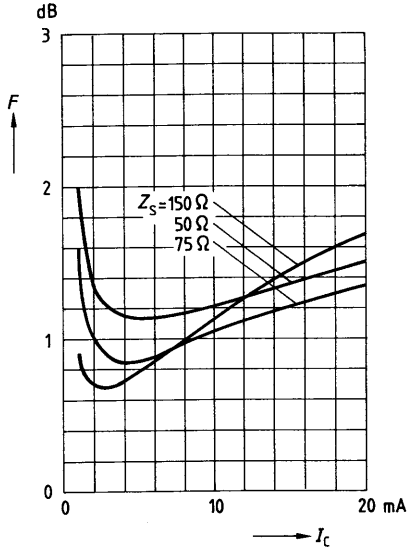
Transition frequency $f_T = f(I_C)$
$f = 200$ MHz



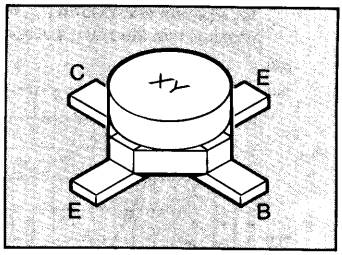
Collector-base capacitance $C_{cb} = f(V_{CB})$
$V_{BE} = v_{be} = 0$, $f = 1$ MHz



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



- For low-noise IF and broadband amplifiers in antenna and telecommunications systems at collector currents from 2 to 20 mA.
- Hermetically sealed ceramic package
- HiRel/Mil screening available.



ESD: Electrostatic discharge sensitive device, observe handling precautions!

Type	Marking	Ordering code (tape and reel)	Package[1])
BFQ 70	70	Q 62702 – F 774	Cerex-X

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CEO}	15	V
Collector-emitter voltage, $V_{BE} = 0$	V_{CES}	20	V
Collector-base voltage	V_{CBO}	20	V
Emitter-base voltage	V_{EBO}	2.5	V
Collector current	I_C	35	mA
Base current	I_B	4	mA
Total power dissipation, $T_A \leq 100$ °C[2])	P_{tot}	300	mW
Junction temperature	T_j	175	°C
Ambient temperature range	T_A	–65 ... +175	°C
Storage temperature range	T_{stg}	–65 ... +175	°C

Thermal Resistance

Junction – ambient[2])	R_{thJA}	≤250	K/W

1) For detailed dimensions see chapter Package Outlines.
2) Package mounted on alumina 16 mm × 25 mm × 0.7 mm.

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

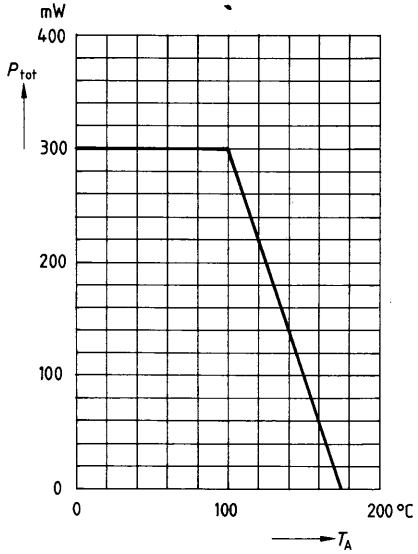
DC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CEO}$	15	–	–	V
Collector-base cutoff current V_{CB} = 10 V, I_E = 0	I_{CBO}	–	–	50	nA
Emitter-base cutoff current V_{EB} = 2 V, I_C = 0	I_{EBO}	–	–	10	µA
DC current gain I_C = 3 mA, V_{CE} = 6 V I_C = 10 mA, V_{CE} = 6 V	h_{FE}	 50 50	 – 130	 250 –	–
Collector-emitter saturation voltage I_C = 20 mA, I_B = 1 mA	V_{CEsat}	–	0.1	0.4	V
Base-emitter voltage I_C = 10 mA, V_{CE} = 6 V	V_{BE}	–	0.78	–	V

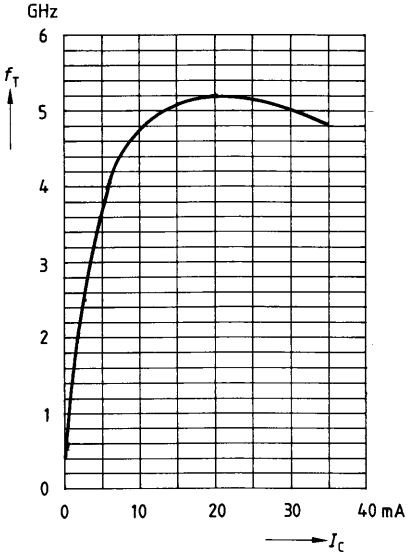
AC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
Transition frequency	f_T				GHz
I_C = 3 mA, V_{CE} = 6 V, f = 200 MHz		–	2.7	–	
I_C = 20 mA, V_{CE} = 6 V, f = 200 MHz		3.6	5	–	
Collector-base capacitance V_{CB} = 6 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{cb}	–	0.46	0.6	pF
Collector-emitter capacitance V_{CE} = 6 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{ce}	–	0.41	–	pF
Input capacitance V_{EB} = 0.5 V, I_C = i_c = 0, f = 1 MHz	C_{ibo}	–	2.2	–	pF
Output capacitance V_{CE} = 6 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{obs}	–	0.87	1.3	pF
Noise figure	F				dB
I_C = 3 mA, V_{CE} = 6 V, f = 10 MHz, Z_S = 75 Ω		–	0.9	1.2	
I_C = 4 mA, V_{CE} = 6 V, f = 800 MHz, Z_S = 50 Ω		–	1.5	–	
Power gain I_C = 20 mA, V_{CE} = 6 V, f = 800 MHz, Z_S = Z_{Sopt}, Z_L = Z_{Lopt}	G_{pe}	–	18	–	dB
Transducer gain I_C = 10 mA, V_{CE} = 6 V, f = 1 GHz, Z_0 = 50 Ω	$\lvert S_{21e}\rvert^2$	–	13	–	dB
Linear output voltage two-tone intermodulation test I_C = 20 mA, V_{CE} = 6 V, d_{IM} = 60 dB f_1 = 806 MHz, f_2 = 810 MHz, Z_S = Z_L = 50 Ω	V_{o1} = V_{o2}	–	170	–	mV
Third order intercept point I_C = 20 mA, V_{CE} = 6 V, f = 800 MHz	IP_3	–	27.5	–	dBm

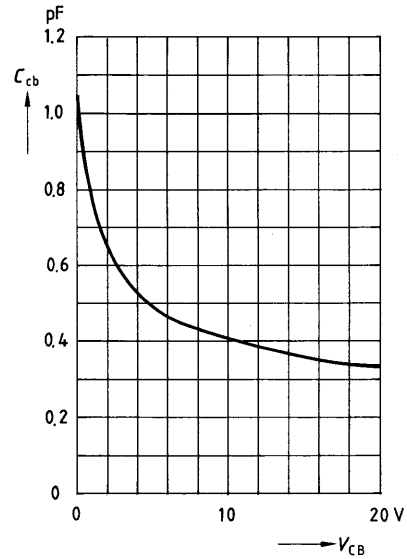
Total power dissipation $P_{tot} = f(T_A)$
Package mounted on alumina



Transition frequency $f_T = f(I_C)$
$V_{CE} = 6$ V, $f = 200$ MHz



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



Common Emitter Noise Parameters

I_C = 3 mA, V_{CE} = 6 V, Z_0 = 50 Ω

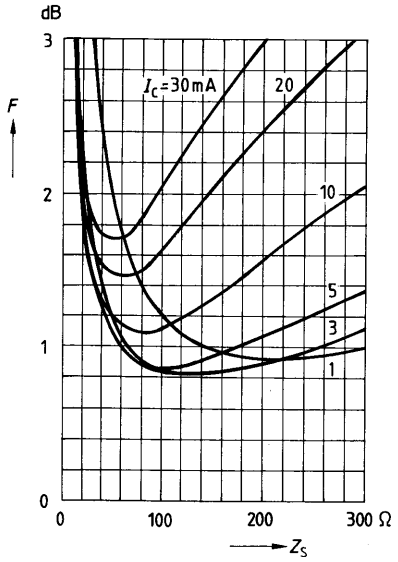
f	F_{min}	G_p (F_{min})	Γ_{opt}		R_N	N	$F_{50\,\Omega}$	G_p ($F_{50\,\Omega}$)
GHz	dB	dB	MAG	ANG	Ω	–	dB	dB
0.01	0.8	–	(Z_S = 150 Ω)		–	–	1.2	–

I_C = 5 mA, V_{CE} = 6 V, Z_0 = 50 Ω

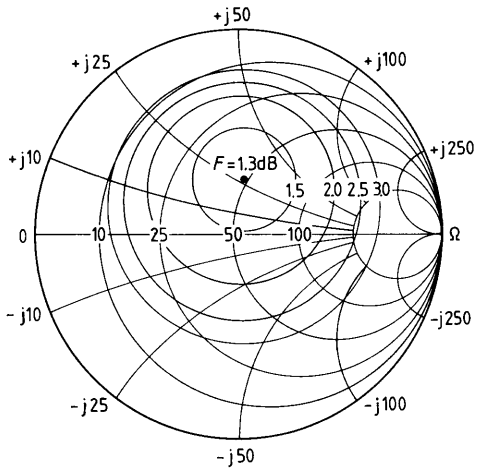
f	F_{min}	G_p (F_{min})	Γ_{opt}		R_N	N	$F_{50\,\Omega}$	G_p ($F_{50\,\Omega}$)
GHz	dB	dB	MAG	ANG	Ω	–	dB	dB
0.01	0.85	–	(Z_S = 100 Ω)		–	–	1.1	–
0.8	1.3	15.5	0.28	79	12	0.19	1.5	14.8

Noise figure $F = f(Z_S)$

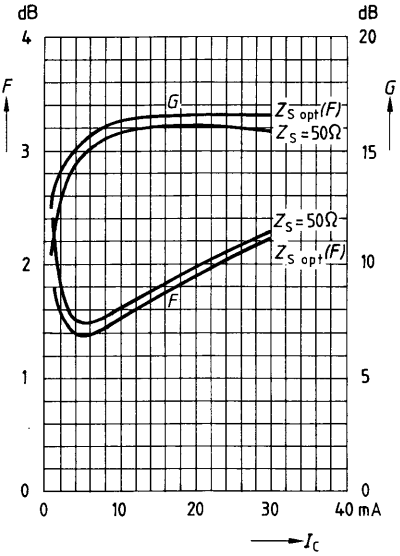
V_{CE} = 6 V, f = 10 MHz



Circles of constant noise figure $F = f(Z_S)$
in Z_S-plane, $I_C = 5$ mA, $V_{CE} = 6$ V, $f = 800$ MHz

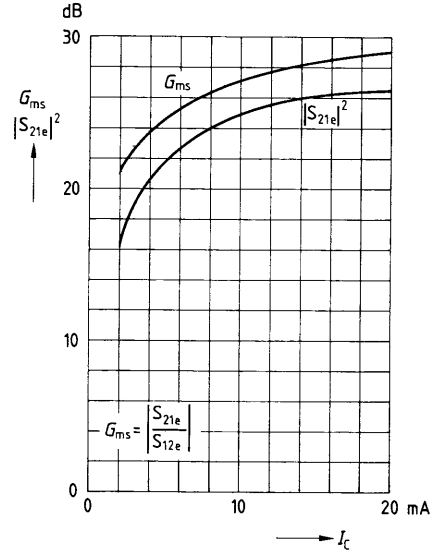


Noise figure $F = f(I_C)$
Power gain $G = f(I_C)$
$V_{CE} = 6$ V, $f = 800$ MHz, Z_{Lopt} (G)

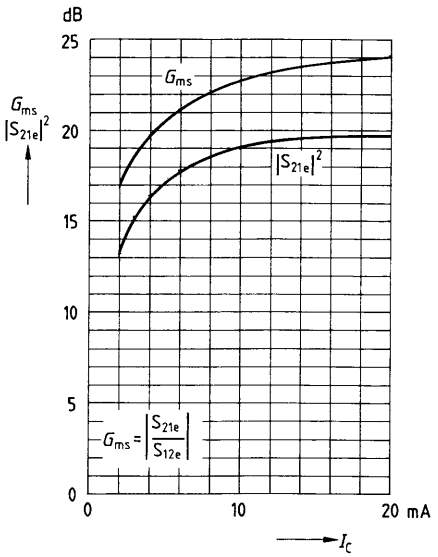


Common Emitter Power Gain

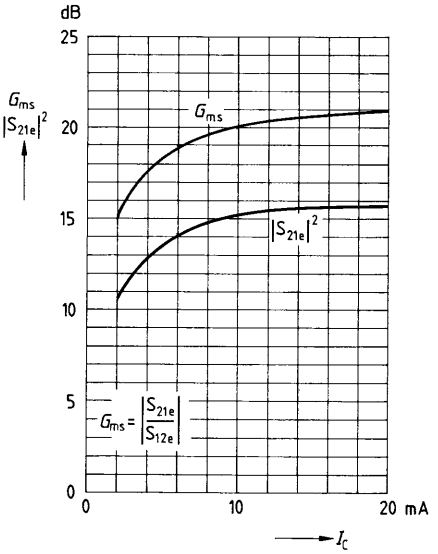
Power gain G_{ms}, $|S_{21e}|^2 = f(I_C)$
V_{CE} = 6 V, f = 200 MHz, Z_0 = 50 Ω



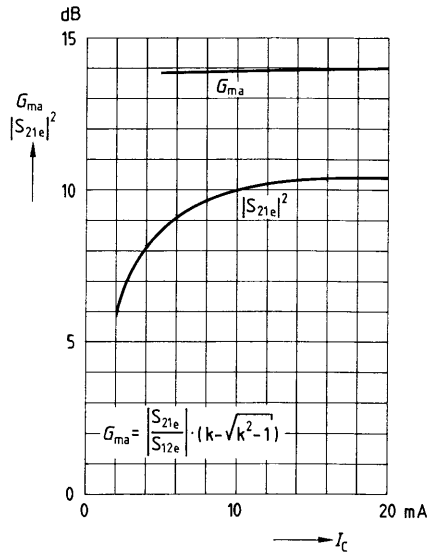
Power gain G_{ms}, $|S_{21e}|^2 = f(I_C)$
V_{CE} = 6 V, f = 500 MHz, Z_0 = 50 Ω



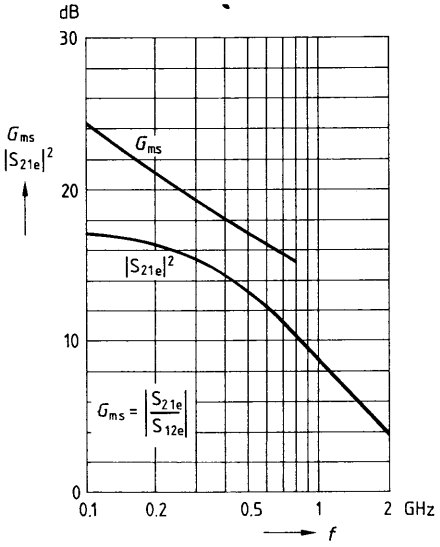
Power gain G_{ms}, $|S_{21e}|^2 = f(I_C)$
V_{CE} = 6 V, f = 800 MHz, Z_0 = 50 Ω



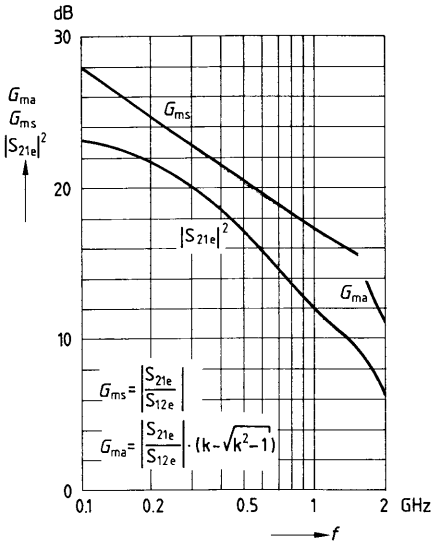
Power gain G_{ma}, $|S_{21e}|^2 = f(I_C)$
V_{CE} = 6 V, f = 1.5 GHz, Z_0 = 50 Ω



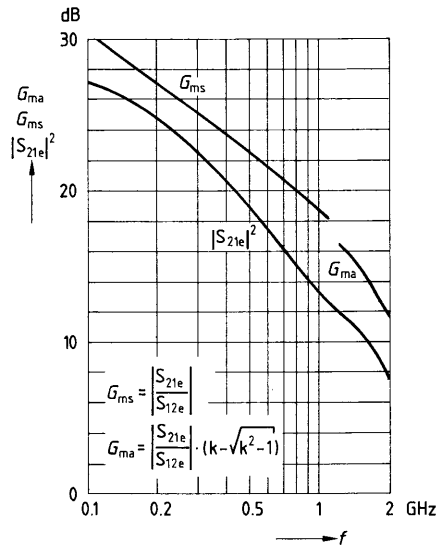
Power gain G_{ms}, $|S_{21e}|^2 = f(f)$
$I_C = 2$ mA, $V_{CE} = 6$ V, $Z_0 = 50\ \Omega$



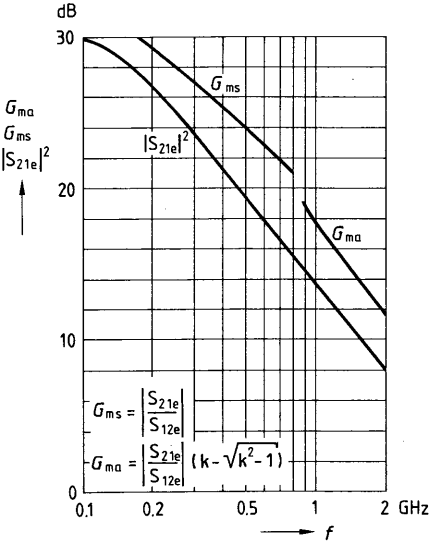
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
$I_C = 5$ mA, $V_{CE} = 6$ V, $Z_0 = 50\ \Omega$



Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
$I_C = 10$ mA, $V_{CE} = 6$ V, $Z_0 = 50\ \Omega$



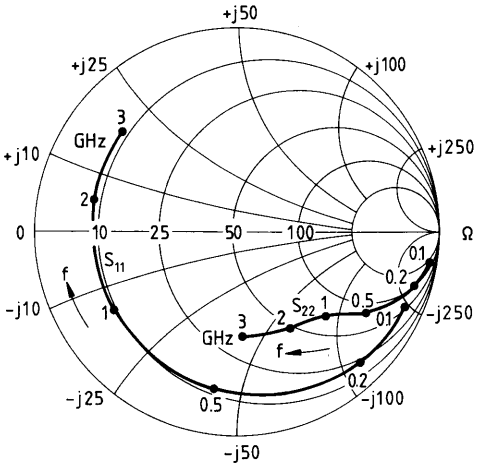
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
$I_C = 20$ mA, $V_{CE} = 6$ V, $Z_0 = 50\ \Omega$



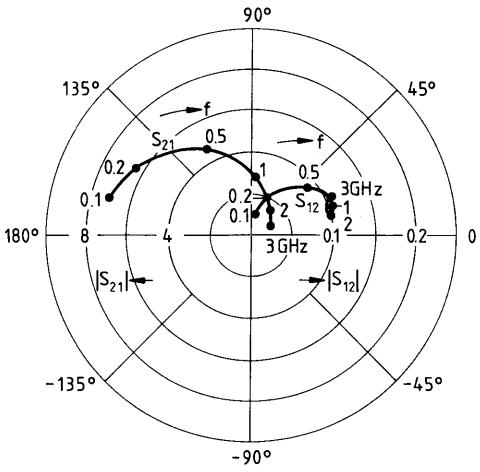
Common Emitter S Parameters
I_C = 2 mA, V_{CE} = 6 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.92	– 23	7.00	165	0.025	77	0.98	– 8
0.2	0.89	– 45	6.42	150	0.049	65	0.93	–16
0.3	0.84	– 65	5.74	137	0.068	55	0.87	–22
0.4	0.80	– 82	5.21	126	0.081	46	0.81	–28
0.6	0.74	–110	4.14	109	0.096	34	0.71	–34
0.8	0.71	–130	3.35	95	0.103	26	0.65	–38
1.0	0.69	–146	2.78	85	0.105	20	0.61	–41
1.2	0.68	–158	2.39	76	0.105	17	0.58	–44
1.5	0.67	–174	1.96	64	0.104	14	0.55	–49
1.8	0.68	174	1.66	53	0.102	13	0.54	–55
2.0	0.69	167	1.51	47	0.100	14	0.53	–60
2.5	0.70	152	1.24	33	0.100	19	0.51	–73
3.0	0.72	138	1.05	20	0.107	24	0.51	–87

***S*$_{11}$, *S*$_{22}$ = f (*f*)**
I_C = 2 mA, V_{CE} = 6 V, Z_0 = 50 Ω



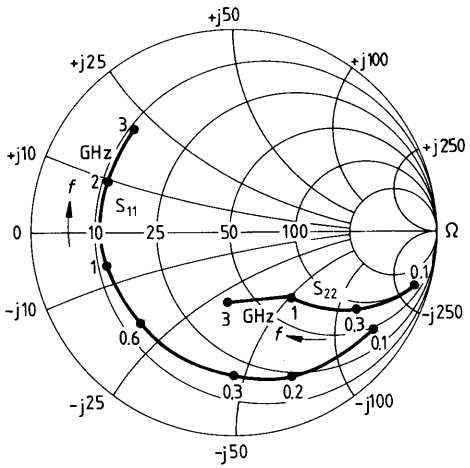
***S*$_{12}$, *S*$_{21}$ = f (*f*)**
I_C = 2 mA, V_{CE} = 6 V, Z_0 = 50 Ω



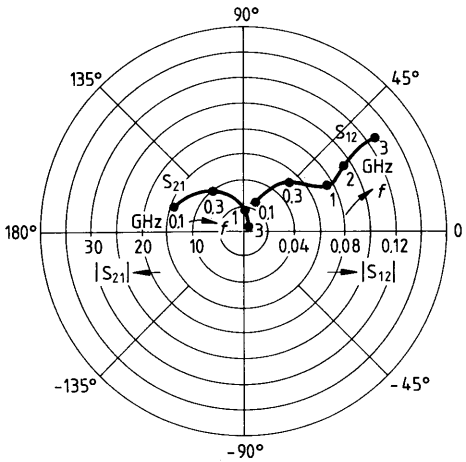
I_C = 5 mA, V_{CE} = 6 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.84	– 35	14.47	159	0.023	73	0.95	–14
0.2	0.78	– 66	12.38	139	0.042	58	0.83	–26
0.3	0.72	– 90	10.21	125	0.053	47	0.72	–33
0.4	0.69	–109	8.66	114	0.060	40	0.63	–37
0.6	0.65	–135	6.32	99	0.068	34	0.52	–42
0.8	0.63	–152	4.90	88	0.072	31	0.46	–44
1.0	0.63	–165	3.97	79	0.075	30	0.43	–45
1.2	0.63	–175	3.38	72	0.079	30	0.40	–47
1.5	0.63	173	2.74	62	0.083	31	0.38	–51
1.8	0.63	164	2.29	53	0.090	33	0.37	–56
2.0	0.65	158	2.07	48	0.095	34	0.36	–61
2.5	0.66	145	1.70	35	0.109	36	0.34	–73
3.0	0.69	133	1.44	23	0.127	36	0.34	–87

S_{11}, S_{22} = f (f)
I_C = 5 mA, V_{CE} = 6 V, Z_0 = 50 Ω



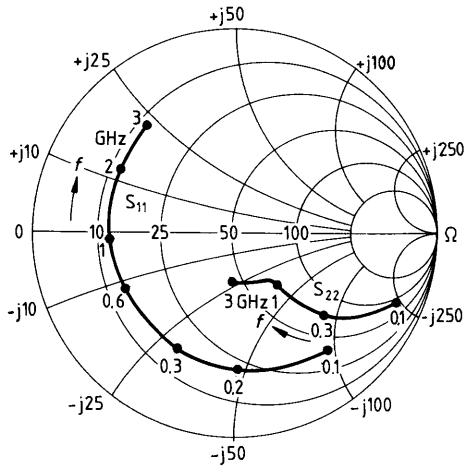
S_{12}, S_{21} = f (f)
I_C = 5 mA, V_{CE} = 6 V, Z_0 = 50 Ω



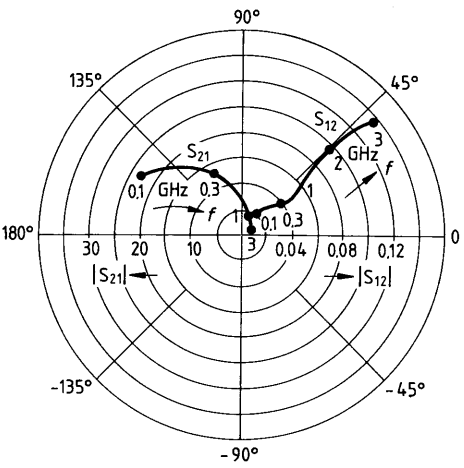
I_C = 10 mA, V_{CE} = 6 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.73	– 50	22.77	151	0.021	65	0.89	–21
0.2	0.67	– 89	17.57	129	0.034	52	0.71	–34
0.3	0.63	–114	13.44	115	0.041	43	0.57	–41
0.4	0.62	–132	10.84	105	0.045	41	0.49	–44
0.6	0.60	–153	7.56	92	0.051	39	0.39	–45
0.8	0.60	–167	5.75	83	0.057	40	0.35	–46
1.0	0.61	–177	4.62	76	0.062	41	0.32	–47
1.2	0.61	175	3.90	70	0.068	43	0.30	–48
1.5	0.61	165	3.15	60	0.078	44	0.29	–51
1.8	0.62	157	2.62	52	0.089	44	0.28	–56
2.0	0.64	152	2.37	47	0.096	44	0.27	–61
2.5	0.65	141	1.94	35	0.117	44	0.25	–73
3.0	0.68	130	1.65	24	0.138	41	0.25	–88

S_{11}, S_{22} = f (f)
I_C = 10 mA, V_{CE} = 6 V, Z_0 = 50 Ω



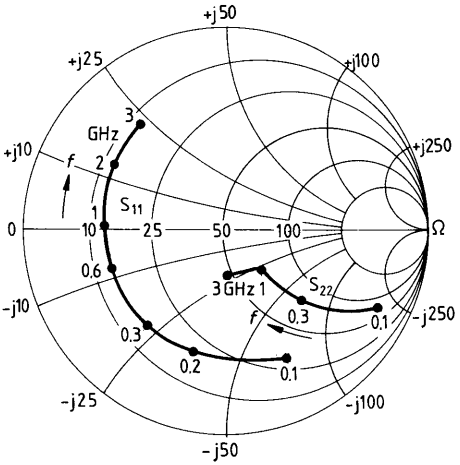
S_{12}, S_{21} = f (f)
I_C = 10 mA, V_{CE} = 6 V, Z_0 = 50 Ω



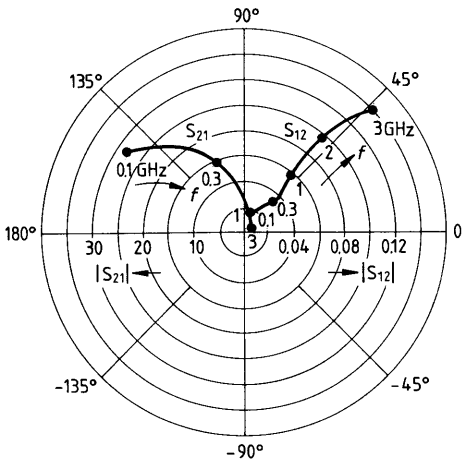
I_C = 15 mA, V_{CE} = 6 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.67	– 62	27.86	146	0.019	64	0.84	–25
0.2	0.62	–104	20.01	123	0.029	49	0.63	–38
0.3	0.59	–128	14.73	110	0.035	44	0.50	–43
0.4	0.60	–143	11.63	101	0.038	43	0.42	–44
0.6	0.59	–162	7.97	89	0.045	44	0.34	–45
0.8	0.59	–173	6.02	81	0.051	46	0.30	–45
1.0	0.60	178	4.82	75	0.058	48	0.28	–45
1.2	0.60	171	4.07	68	0.065	49	0.27	–47
1.5	0.61	162	3.28	60	0.077	50	0.25	–50
1.8	0.62	154	2.73	52	0.090	49	0.25	–55
2.0	0.63	150	2.47	47	0.097	49	0.24	–60
2.5	0.65	139	2.02	35	0.120	47	0.22	–72
3.0	0.68	128	1.71	24	0.142	43	0.22	–87

S_{11}, S_{22} = f (*f*)
I_C = 15 mA, V_{CE} = 6 V, Z_0 = 50 Ω



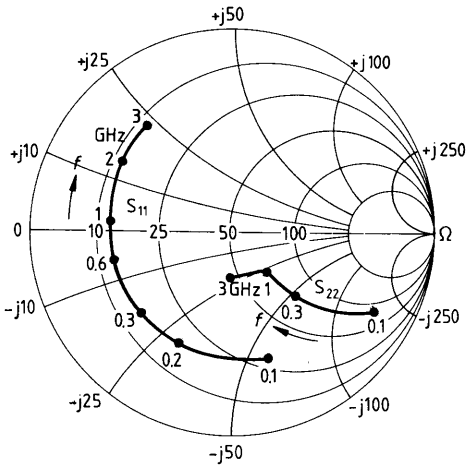
S_{12}, S_{21} = f (*f*)
I_C = 15 mA, V_{CE} = 6 V, Z_0 = 50 Ω



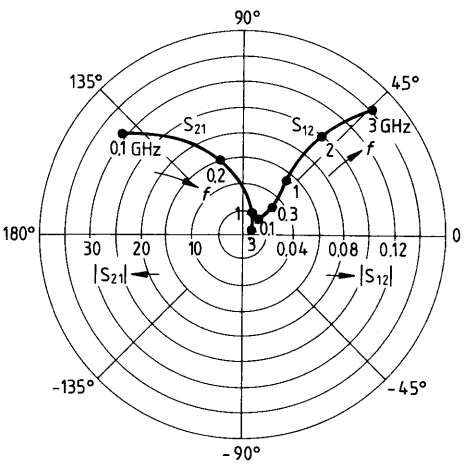
I_C = 20 mA, V_{CE} = 6 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.63	– 71	31.01	142	0.017	59	0.81	–28
0.2	0.60	–113	21.18	119	0.026	48	0.58	–40
0.3	0.58	–136	15.24	107	0.031	45	0.45	–43
0.4	0.59	–150	11.90	98	0.034	45	0.38	–44
0.6	0.59	–166	8.08	88	0.041	47	0.32	–43
0.8	0.59	–177	6.09	80	0.048	50	0.29	–43
1.0	0.60	175	4.87	74	0.056	52	0.27	–44
1.2	0.60	169	4.11	68	0.064	53	0.26	–45
1.5	0.61	160	3.31	59	0.076	53	0.25	–48
1.8	0.62	153	2.75	51	0.089	52	0.24	–54
2.0	0.64	149	2.49	47	0.098	51	0.23	–58
2.5	0.65	138	2.03	35	0.120	49	0.21	–70
3.0	0.68	128	1.72	24	0.143	44	0.21	–86

S_{11}, S_{22} = f (f)
I_C = 20 mA, V_{CE} = 6 V, Z_0 = 50 Ω



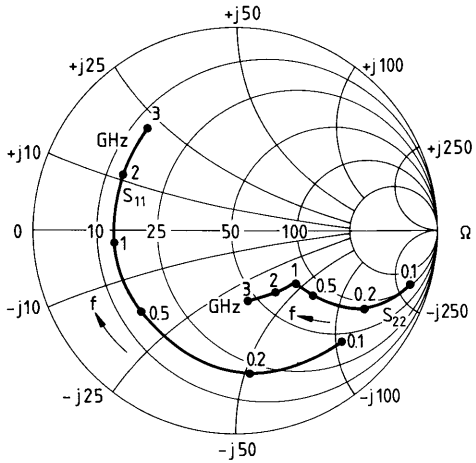
S_{12}, S_{21} = f (f)
I_C = 20 mA, V_{CE} = 6 V, Z_0 = 50 Ω



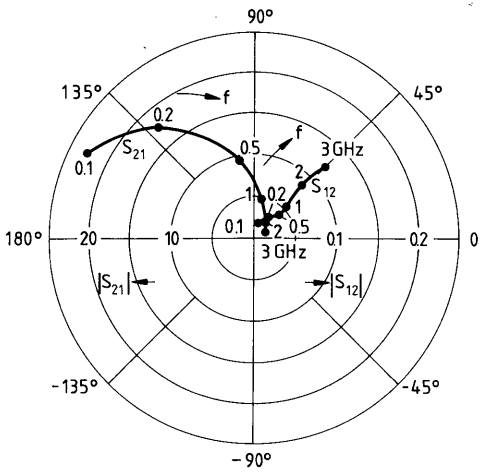
I_C = 10 mA, V_{CE} = 10 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.75	– 45	22.64	153	0.018	67	0.91	–18
0.2	0.69	– 83	17.84	131	0.030	53	0.75	–29
0.3	0.63	–109	13.82	117	0.037	45	0.63	–34
0.4	0.62	–127	11.23	107	0.041	42	0.55	–36
0.6	0.59	–149	7.88	93	0.046	40	0.46	–37
0.8	0.59	–164	6.01	84	0.051	41	0.42	–37
1.0	0.59	–174	4.83	77	0.056	43	0.40	–38
1.2	0.59	178	4.09	70	0.061	44	0.38	–40
1.5	0.59	167	3.29	61	0.070	46	0.37	–43
1.8	0.60	159	2.75	53	0.080	47	0.37	–48
2.0	0.62	153	2.49	48	0.087	47	0.36	–52
2.5	0.63	142	2.03	36	0.106	47	0.34	–62
3.0	0.66	131	1.73	25	0.126	45	0.33	–75

S_{11}, S_{22} = f (*f*)
I_C = 10 mA, V_{CE} = 10 V, Z_0 = 50 Ω

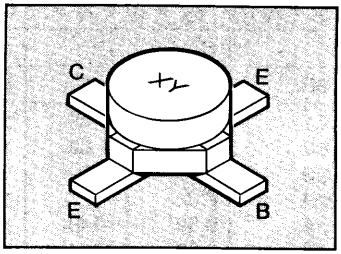


S_{12}, S_{21} = f (*f*)
I_C = 10 mA, V_{CE} = 10 V, Z_0 = 50 Ω



- For broadband amplifiers up to 2 GHz and fast non-saturated switches at collector currents from 1 to 20 mA.
- Hermetically sealed ceramic package.
- HiRel/Mil screening available.

CECC-type available: CECC 50002/260.



ESD: Electrostatic discharge sensitive device, observe handling precautions!

Type	Marking	Ordering code (tape and reel)	Package[1])
BFQ 71	71	Q 62702 – F775	Cerec-X

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CEO}	15	V
Collector-emitter voltage, $V_{BE} = 0$	V_{CES}	20	V
Collector-base voltage	V_{CBO}	20	V
Emitter-base voltage	V_{EBO}	2.5	V
Collector current	I_C	30	mA
Base current	I_B	4	mA
Total power dissipation, $T_A \leq 100$ °C[2])	P_{tot}	300	mW
Junction temperature	T_j	175	°C
Ambient temperature range	T_A	–65 ... +175	°C
Storage temperature range	T_{stg}	–65 ... +175	°C

Thermal Resistance

Junction – ambient[2])	R_{thJA}	≤250	K/W

1) For detailed dimensions see chapter Package Outlines.
2) Package mounted on alumina 16 mm × 25 mm × 0.7 mm.

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

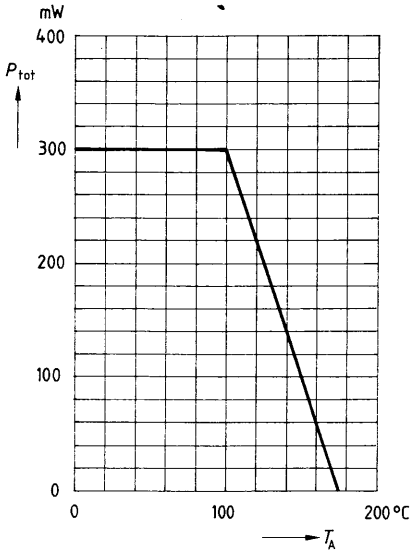
DC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CEO}$	15	–	–	V
Collector-base cutoff current V_{CB} = 10 V, I_E = 0	I_{CBO}	–	–	50	nA
Emitter-base cutoff current V_{EB} = 2 V, I_C = 0	I_{EBO}	–	–	10	µA
DC current gain I_C = 5 mA, V_{CE} = 6 V I_C = 20 mA, V_{CE} = 6 V	h_{FE}	 40 40	 90 100	 250 –	–
Collector-emitter saturation voltage I_C = 30 mA, I_B = 3 mA	V_{CEsat}	–	0.16	0.4	V
Base-emitter voltage I_C = 5 mA, V_{CE} = 6 V	V_{BE}	–	0.78	–	V

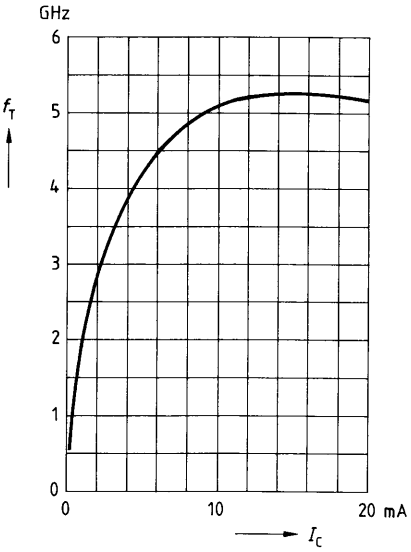
AC characteristics

Parameter	Symbol	Values min	Values typ	Values max	Unit
Transition frequency	f_T				GHz
I_C = 5 mA, V_{CE} = 6 V, f = 200 MHz		–	4.2	–	
I_C = 20 mA, V_{CE} = 6 V, f = 200 MHz		4	5.2	–	
Collector-base capacitance V_{CB} = 6 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{cb}	–	0.46	0.6	pF
Collector-emitter capacitance V_{CE} = 6 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{ce}	–	0.4	–	pF
Input capacitance V_{EB} = 0.5 V, I_C = i_c = 0, f = 1 MHz	C_{ibo}	–	1.2	–	pF
Output capacitance V_{CE} = 6 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{obs}	–	0.86	1.2	pF
Noise figure	F				dB
I_C = 5 mA, V_{CE} = 6 V, f = 10 MHz, Z_S = 75 Ω		–	1.4	2.2	
I_C = 2 mA, V_{CE} = 6 V, f = 800 MHz, Z_S = Z_{Sopt}		–	1.5	3	
I_C = 3 mA, V_{CE} = 10 V, f = 2 GHz, Z_S = Z_{Sopt}		–	3.2	–	
Power gain I_C = 2 mA, V_{CE} = 6 V, f = 800 MHz, Z_S = Z_{Sopt}, Z_L = Z_{Lopt}	G_{pe}	–	15	–	dB
Transducer gain I_C = 20 mA, V_{CE} = 6 V, f = 1 GHz, Z_0 = 50 Ω	$\lvert S_{21e}\rvert^2$	–	13.4	–	dB
Linear output voltage two-tone intermodulation test I_C = 15 mA, V_{CE} = 10 V, d_{IM} = 60 dB f_1 = 806 MHz, f_2 = 810 MHz, Z_S = Z_L = 50 Ω	V_{o1} = V_{o2}	–	110	–	mV
Third order intercept point I_C = 15 mA, V_{CE} = 10 V, f = 800 MHz	IP_3	–	23.5	–	dBm

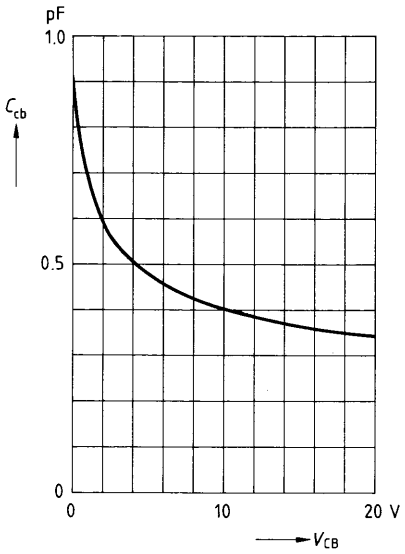
Total power dissipation $P_{tot} = f(T_A)$
Package mounted on alumina



Transition frequency $f_T = f(I_C)$
$V_{CE} = 6$ V, $f = 200$ MHz



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



Common Emitter Noise Parameters

I_C = 2 mA, V_{CE} = 6 V, Z_0 = 50 Ω

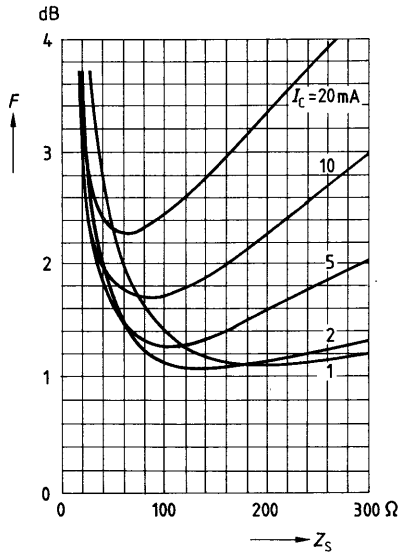
f	F_{min}	G_p (F_{min})	Γ_{opt}		R_N	N	$F_{50\,\Omega}$	G_p ($F_{50\,\Omega}$)
GHz	dB	dB	MAG	ANG	Ω	–	dB	dB
0.01	1.1	–	(Z_S = 150 Ω)		–	–	1.6	–

I_C = 5 mA, V_{CE} = 10 V, Z_0 = 50 Ω

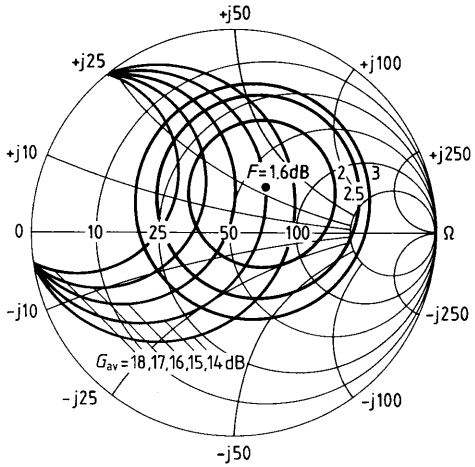
f	F_{min}	G_p (F_{min})	Γ_{opt}		R_N	N	$F_{50\,\Omega}$	G_p ($F_{50\,\Omega}$)
GHz	dB	dB	MAG	ANG	Ω	–	dB	dB
0.01	1.3	–	(Z_S = 100 Ω)		–	–	1.7	–
0.8	1.6	15.3	0.29	56	18.5	0.24	1.8	14.8
2.0	3.1	9	0.12	124.5	30	0.67	–	–

Noise figure $F = f(Z_S)$

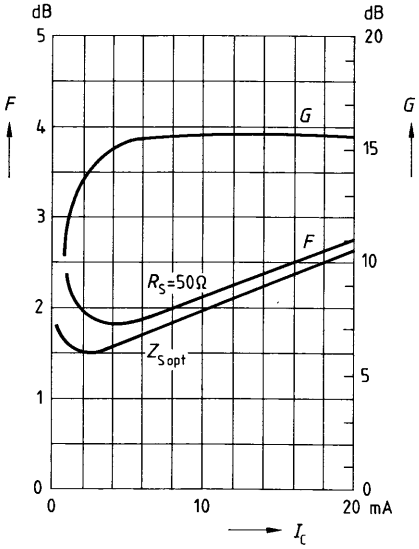
V_{CE} = 6 V, f = 10 MHz



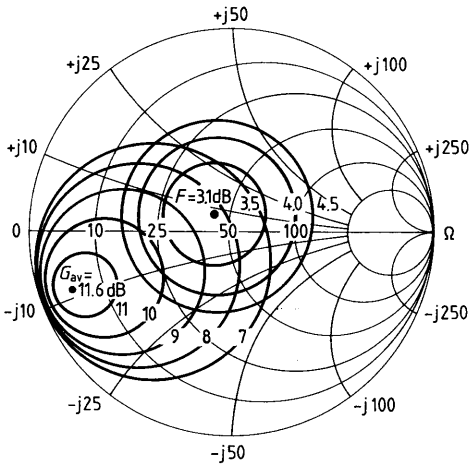
Circles of constant noise figure $F = f(Z_S)$ and available power gain $G_{av} = f(Z_S)$
$I_C = 5$ mA, $V_{CE} = 10$ V, $f = 800$ MHz



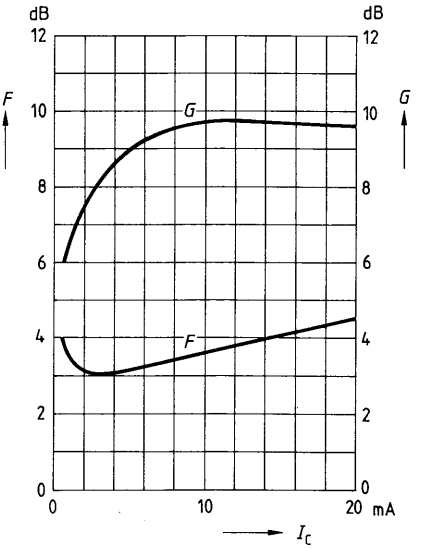
Noise figure $F = f(I_C)$
Power gain $G = f(I_C)$
$V_{CE} = 10$ V, $f = 800$ MHz, Z_{Lopt} (G)



Circles of constant noise figure $F = f(Z_S)$ and available power gain $G_{av} = f(Z_S)$
$I_C = 5$ mA, $V_{CE} = 10$ V, $f = 2$ GHz

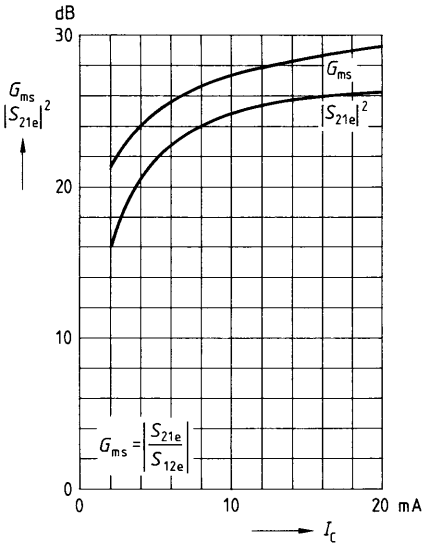


Noise figure $F = f(I_C)$
Power gain $G = f(I_C)$
$V_{CE} = 10$ V, $f = 2$ GHz, Z_{Lopt} (G)

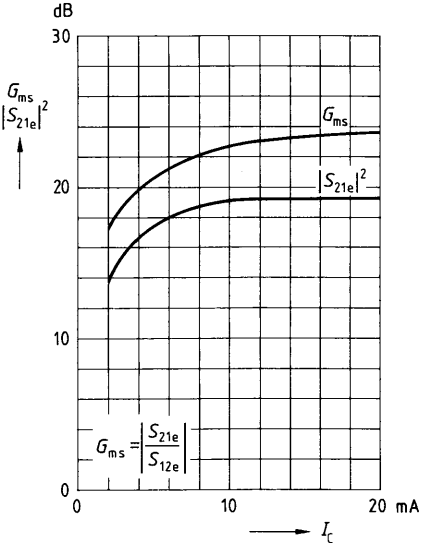


Common Emitter Power Gain

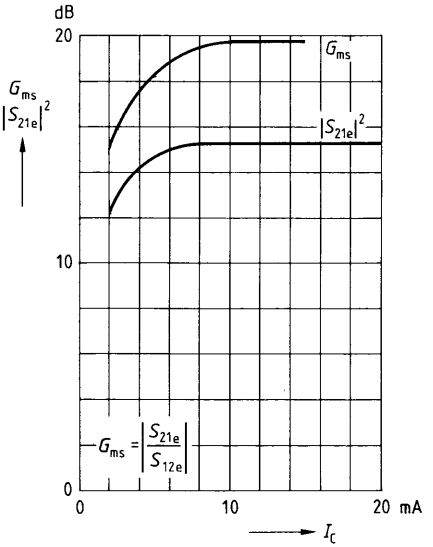
Power gain G_{ms}, $|S_{21e}|^2 = f(I_C)$
$V_{CE} = 6$ V, $f = 200$ MHz, $Z_0 = 50\ \Omega$



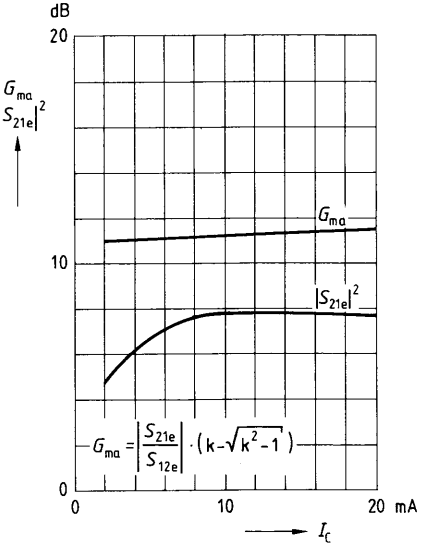
Power gain G_{ms}, $|S_{21e}|^2 = f(I_C)$
$V_{CE} = 6$ V, $f = 500$ MHz, $Z_0 = 50\ \Omega$



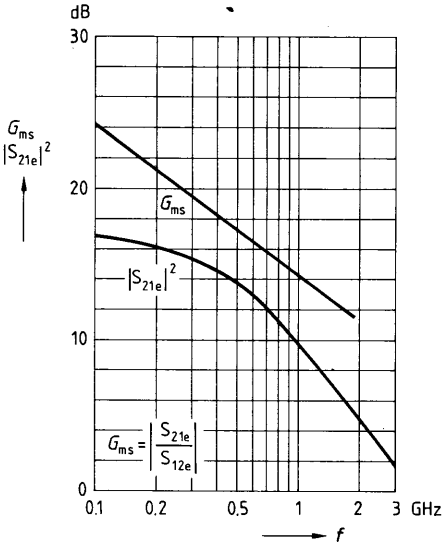
Power gain G_{ms}, $|S_{21e}|^2 = f(I_C)$
$V_{CE} = 6$ V, $f = 800$ MHz, $Z_0 = 50\ \Omega$



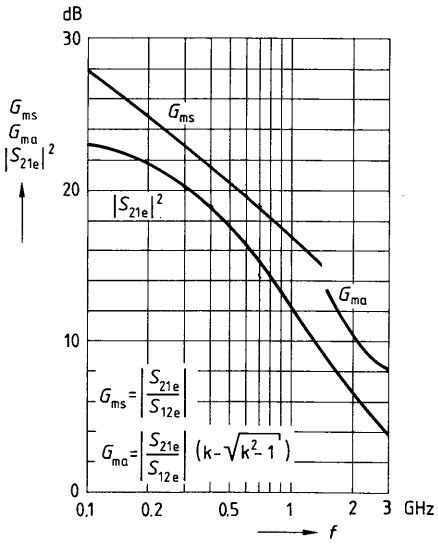
Power gain G_{ma}, $|S_{21e}|^2 = f(I_C)$
$V_{CE} = 6$ V, $f = 2$ GHz, $Z_0 = 50\ \Omega$



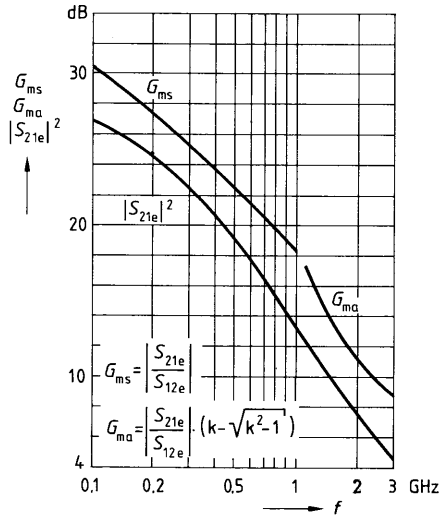
Power gain G_{ms}, $|S_{21e}|^2 = f(f)$
$I_C = 2$ mA, $V_{CE} = 6$ V, $Z_0 = 50\ \Omega$



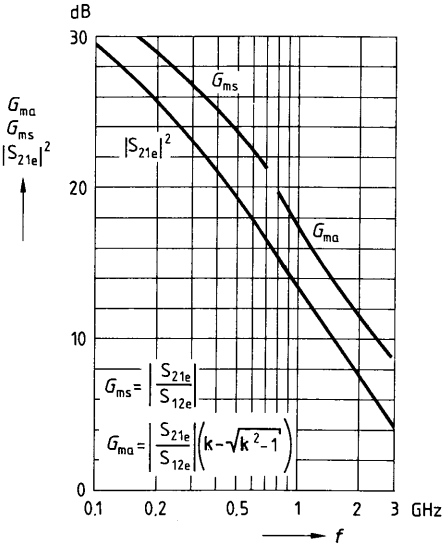
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
$I_C = 5$ mA, $V_{CE} = 6$ V, $Z_0 = 50\ \Omega$



Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
$I_C = 10$ mA, $V_{CE} = 6$ V, $Z_0 = 50\ \Omega$



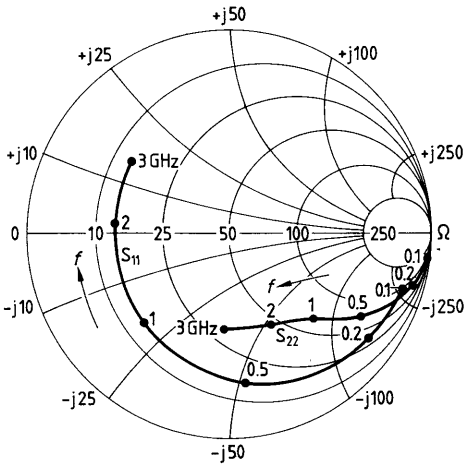
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
$I_C = 20$ mA, $V_{CE} = 6$ V, $Z_0 = 50\ \Omega$



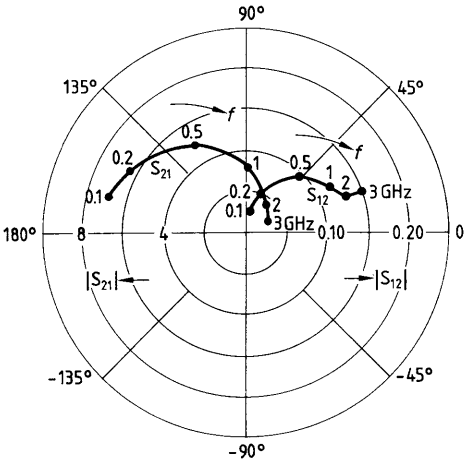
Common Emitter S Parameters
I_C = 2 mA, V_{CE} = 6 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.90	– 19	6.93	166	0.025	78	0.98	– 8
0.2	0.87	– 37	6.45	152	0.048	68	0.94	–16
0.3	0.81	– 55	5.85	140	0.068	59	0.88	–23
0.4	0.77	– 71	5.41	129	0.082	51	0.82	–28
0.6	0.69	– 97	4.41	112	0.101	40	0.73	–36
0.8	0.64	–118	3.64	98	0.112	33	0.65	–41
1.0	0.61	–134	3.06	87	0.118	28	0.60	–45
1.2	0.59	–147	2.64	79	0.121	25	0.57	–49
1.5	0.57	–163	2.19	66	0.125	22	0.54	–54
1.8	0.57	–176	1.87	56	0.129	20	0.52	–60
2.0	0.58	176	1.70	49	0.131	20	0.51	–65
2.5	0.59	159	1.41	34	0.138	20	0.49	–78
3.0	0.60	145	1.21	21	0.150	19	0.48	–92

S_{11}, S_{22} = f (f)
I_C = 2 mA, V_{CE} = 6 V, Z_0 = 50 Ω



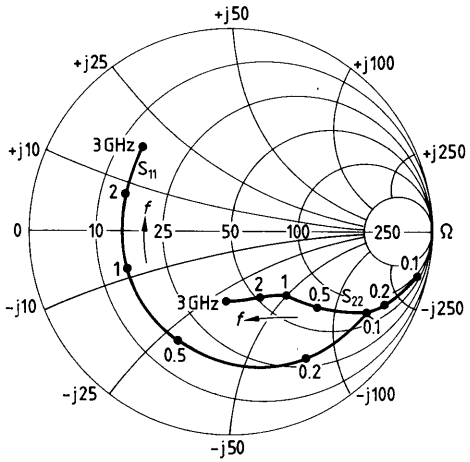
S_{12}, S_{21} = f (f)
I_C = 2 mA, V_{CE} = 6 V, Z_0 = 50 Ω



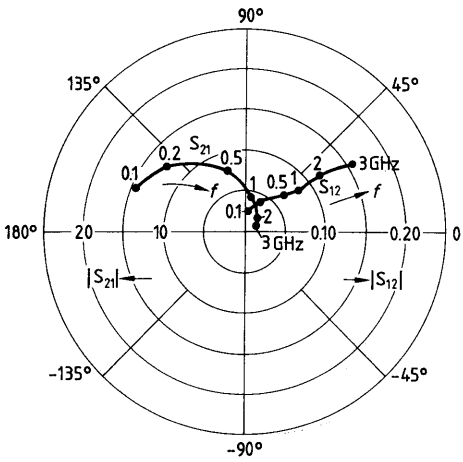
I_C = 5 mA, V_{CE} = 6 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.79	– 31	14.23	160	0.023	76	0.95	–14
0.2	0.73	– 59	12.37	151	0.040	61	0.84	–26
0.3	0.66	– 83	10.36	127	0.053	51	0.73	–33
0.4	0.62	–102	8.88	115	0.060	45	0.65	–38
0.6	0.57	–128	6.56	100	0.071	40	0.53	–43
0.8	0.55	–146	5.12	89	0.077	37	0.47	–46
1.0	0.54	–160	4.17	80	0.083	37	0.43	–48
1.2	0.54	–170	3.55	73	0.089	37	0.40	–51
1.5	0.54	178	2.89	63	0.099	37	0.38	–55
1.8	0.54	168	2.43	54	0.110	37	0.37	–61
2.0	0.56	162	2.20	48	0.117	36	0.36	–65
2.5	0.57	148	1.81	35	0.137	35	0.34	–78
3.0	0.59	136	1.55	23	0.158	32	0.34	–92

S_{11}, S_{22} = f (f)
I_C = 5 mA, V_{CE} = 6 V, Z_0 = 50 Ω



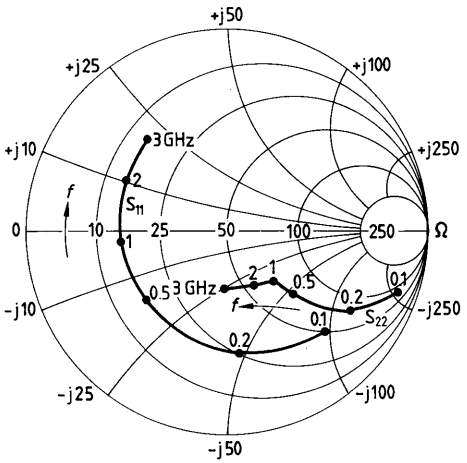
S_{12}, S_{21} = f (f)
I_C = 5 mA, V_{CE} = 6 V, Z_0 = 50 Ω



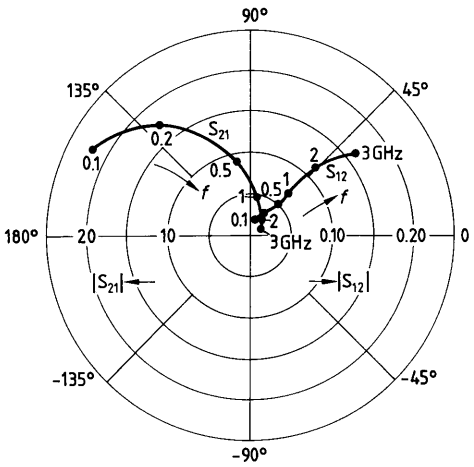
I_C = 10 mA, V_{CE} = 6 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.68	– 47	22.06	152	0.020	70	0.90	–20
0.2	0.60	– 85	17.31	130	0.032	56	0.73	–33
0.3	0.55	–111	13.39	116	0.040	49	0.59	–39
0.4	0.55	–128	10.84	106	0.045	46	0.51	–42
0.6	0.53	–150	7.60	93	0.053	46	0.41	–44
0.8	0.53	–164	5.80	83	0.061	46	0.37	–46
1.0	0.53	–174	4.67	76	0.069	47	0.34	–47
1.2	0.53	178	3.95	70	0.078	48	0.32	–49
1.5	0.53	168	3.19	60	0.091	48	0.31	–53
1.8	0.54	160	2.67	52	0.106	47	0.31	–59
2.0	0.56	155	2.42	47	0.114	46	0.30	–63
2.5	0.58	143	1.99	34	0.138	43	0.28	–76
3.0	0.60	132	1.69	23	0.163	38	0.28	–91

S_{11}, S_{22} = f (f)
I_C = 10 mA, V_{CE} = 6 V, Z_0 = 50 Ω



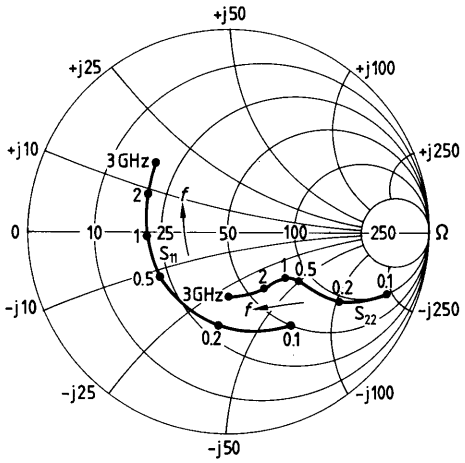
S_{12}, S_{21} = f (f)
I_C = 10 mA, V_{CE} = 6 V, Z_0 = 50 Ω



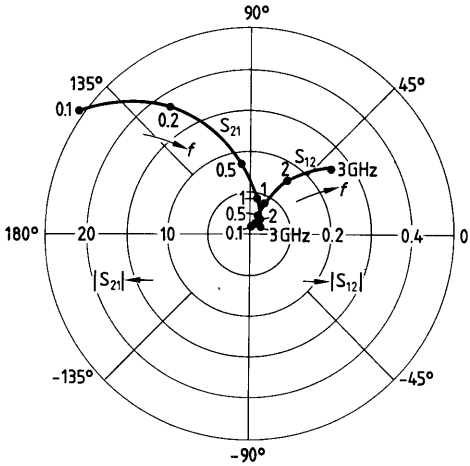
I_C = 15 mA, V_{CE} = 6 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.56	– 57	25.74	145	0.018	69	0.85	–23
0.2	0.47	– 96	18.17	122	0.028	58	0.65	–32
0.3	0.42	–121	13.28	109	0.035	56	0.54	–35
0.4	0.42	–137	10.48	100	0.042	57	0.47	–35
0.6	0.41	–156	7.19	89	0.054	59	0.41	–36
0.8	0.40	–168	5.46	81	0.068	60	0.39	–37
1.0	0.41	–177	4.39	74	0.082	60	0.37	–39
1.2	0.41	176	3.71	68	0.096	60	0.36	–41
1.5	0.41	169	3.01	59	0.118	58	0.35	–45
1.8	0.43	161	2.53	52	0.142	56	0.35	–52
2.0	0.44	156	2.31	47	0.158	53	0.34	–57
2.5	0.46	147	1.91	35	0.204	47	0.33	–70
3.0	0.50	137	1.65	24	0.255	38	0.32	–88

S_{11}, S_{22} = f (*f*)
I_C = 15 mA, V_{CE} = 6 V, Z_0 = 50 Ω



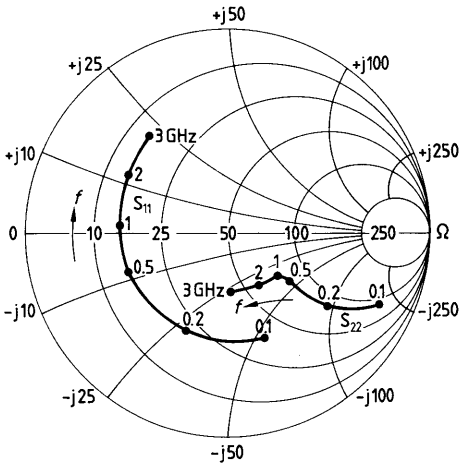
S_{12}, S_{21} = f (*f*)
I_C = 15 mA, V_{CE} = 6 V, Z_0 = 50 Ω



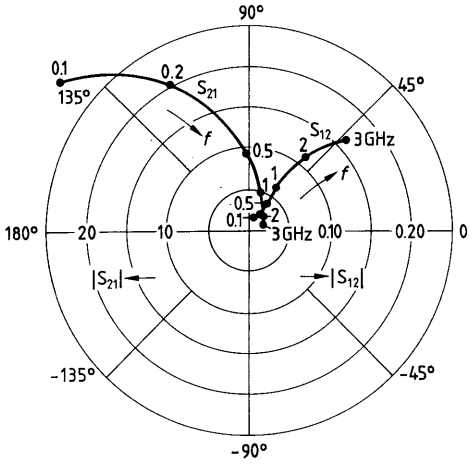
I_C = 20 mA, V_{CE} = 6 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.54	– 71	29.35	142	0.016	66	0.82	–25
0.2	0.52	–114	20.19	119	0.025	52	0.60	–36
0.3	0.51	–137	14.58	106	0.030	51	0.48	–39
0.4	0.52	–150	11.40	98	0.034	51	0.42	–39
0.6	0.52	–166	7.77	87	0.043	54	0.36	–38
0.8	0.53	–176	5.86	79	0.053	56	0.34	–39
1.0	0.54	176	4.69	73	0.062	56	0.32	–41
1.2	0.54	170	3.96	66	0.072	56	0.31	–43
1.5	0.54	161	3.19	57	0.087	55	0.30	–47
1.8	0.55	155	2.66	50	0.102	53	0.30	–54
2.0	0.58	150	2.41	45	0.112	52	0.30	–59
2.5	0.59	140	1.97	32	0.137	48	0.28	–72
3.0	0.62	130	1.68	21	0.162	42	0.28	–87

S_{11}, S_{22} = f (f)
I_C = 20 mA, V_{CE} = 6 V, Z_0 = 50 Ω



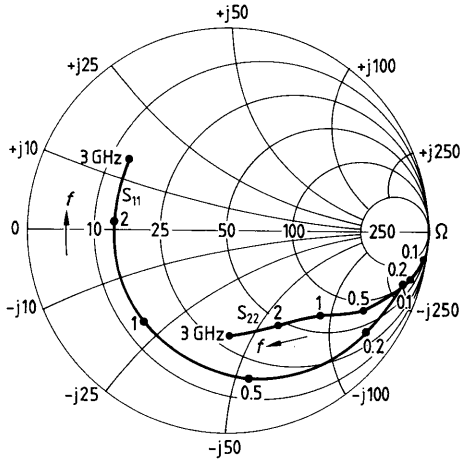
S_{12}, S_{21} = f (f)
I_C = 20 mA, V_{CE} = 6 V, Z_0 = 50 Ω



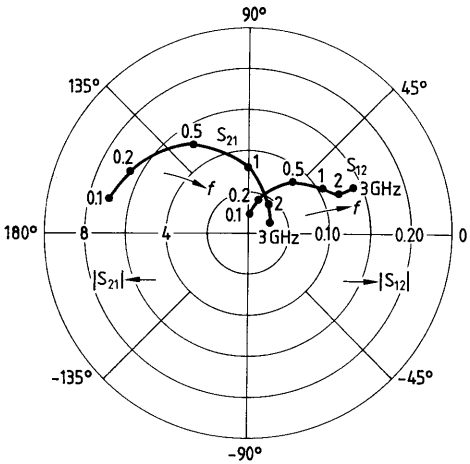
I_C = 2 mA, V_{CE} = 10 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.91	– 17	7.02	166	0.021	78	0.98	– 7
0.2	0.87	– 36	6.57	153	0.042	69	0.95	–14
0.3	0.82	– 53	5.98	141	0.060	60	0.90	–20
0.4	0.78	– 69	5.01	130	0.073	53	0.84	–25
0.6	0.70	– 94	4.54	113	0.090	42	0.75	–33
0.8	0.64	–115	3.76	100	0.100	35	0.69	–38
1.0	0.60	–132	3.17	89	0.106	30	0.64	–41
1.2	0.58	–145	2.74	80	0.109	27	0.61	–45
1.5	0.56	–161	2.28	68	0.113	24	0.58	–50
1.8	0.56	–174	1.94	57	0.118	23	0.56	–55
2.0	0.57	177	1.77	51	0.120	23	0.55	–60
2.5	0.58	160	1.47	36	0.127	23	0.53	–72
3.0	0.59	146	1.26	22	0.140	23	0.52	–85

S_{11}, S_{22} = f (f)
I_C = 2 mA, V_{CE} = 10 V, Z_0 = 50 Ω



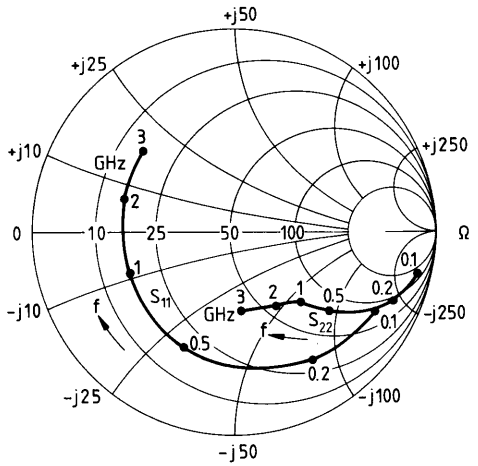
S_{12}, S_{21} = f (f)
I_C = 2 mA, V_{CE} = 10 V, Z_0 = 50 Ω



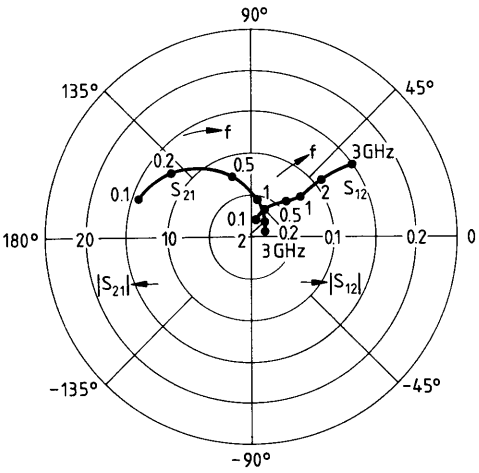
I_C = 5 mA, V_{CE} = 10 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.80	– 28	14.24	160	0.020	71	0.95	–13
0.2	0.73	– 57	12.50	142	0.036	61	0.86	–23
0.3	0.67	– 79	10.55	128	0.047	53	0.76	–29
0.4	0.63	– 98	9.10	117	0.055	47	0.68	–34
0.6	0.57	–125	6.78	101	0.064	41	0.58	–38
0.8	0.54	–143	5.31	90	0.071	39	0.52	–41
1.0	0.53	–157	4.33	81	0.076	38	0.48	–43
1.2	0.52	–168	3.69	74	0.082	38	0.46	–45
1.5	0.52	180	3.00	63	0.091	39	0.44	–49
1.8	0.53	170	2.52	54	0.101	39	0.43	–55
2.0	0.54	163	2.29	49	0.108	39	0.42	–59
2.5	0.56	150	1.89	36	0.127	38	0.40	–70
3.0	0.58	137	1.61	23	0.148	35	0.40	–84

S_{11}, S_{22} = f (*f*)
I_C = 5 mA, V_{CE} = 10 V, Z_0 = 50 Ω



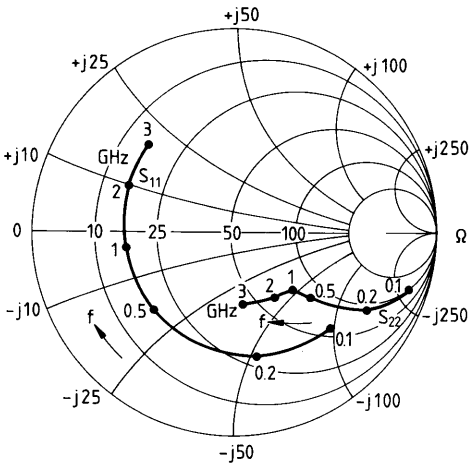
S_{12}, S_{21} = f (*f*)
I_C = 5 mA, V_{CE} = 10 V, Z_0 = 50 Ω



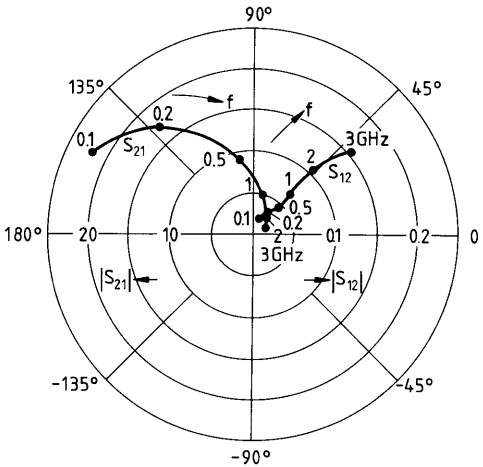
I_C = 10 mA, V_{CE} = 10 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.68	– 43	21.82	153	0.018	71	0.91	–17
0.2	0.60	– 78	17.39	131	0.030	58	0.76	–29
0.3	0.56	–105	13.60	117	0.037	50	0.64	–34
0.4	0.54	–123	11.10	107	0.042	47	0.56	–36
0.6	0.51	–146	7.83	94	0.050	46	0.47	–38
0.8	0.51	–161	5.99	84	0.057	47	0.43	–39
1.0	0.51	–171	4.83	77	0.064	48	0.41	–41
1.2	0.51	180	4.08	70	0.072	49	0.39	–43
1.5	0.51	170	3.30	61	0.084	49	0.38	–48
1.8	0.52	162	2.77	53	0.098	48	0.38	–52
2.0	0.54	156	2.51	48	0.106	47	0.37	–56
2.5	0.56	145	2.06	35	0.129	45	0.35	–67
3.0	0.58	134	1.75	23	0.152	40	0.35	–81

S_{11}, S_{22} = f (f)
I_C = 10 mA, V_{CE} = 10 V, Z_0 = 50 Ω



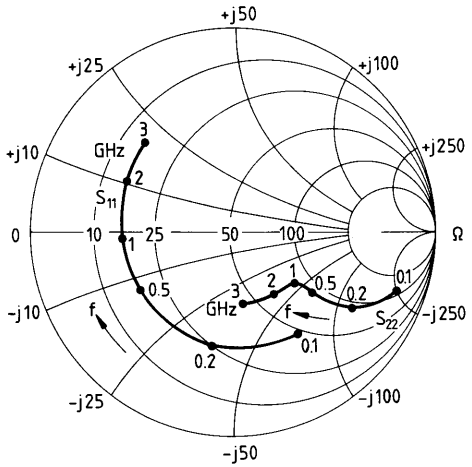
S_{12}, S_{21} = f (f)
I_C = 10 mA, V_{CE} = 10 V, Z_0 = 50 Ω



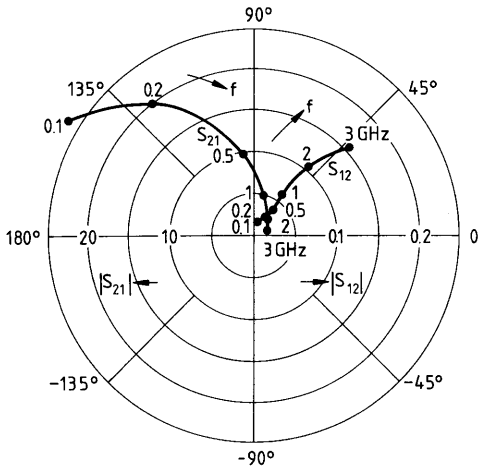
I_C = 15 mA, V_{CE} = 10 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.62	– 55	26.35	148	0.017	69	0.88	–20
0.2	0.55	– 94	19.54	125	0.026	55	0.69	–31
0.3	0.52	–119	14.64	112	0.031	50	0.57	–34
0.4	0.51	–136	11.66	102	0.036	50	0.50	–35
0.6	0.50	–156	8.06	90	0.044	51	0.44	–35
0.8	0.50	–169	6.12	82	0.052	52	0.41	–36
1.0	0.51	–178	4.91	75	0.061	53	0.39	–38
1.2	0.51	175	4.15	68	0.069	54	0.38	–40
1.5	0.51	166	3.35	59	0.082	53	0.37	–44
1.8	0.53	158	2.80	51	0.097	52	0.37	–50
2.0	0.54	153	2.53	47	0.106	51	0.36	–54
2.5	0.57	143	2.07	34	0.129	48	0.34	–65
3.0	0.59	132	1.77	23	0.153	43	0.34	–80

S_{11}, S_{22} = f (*f*)
I_C = 15 mA, V_{CE} = 10 V, Z_0 = 50 Ω



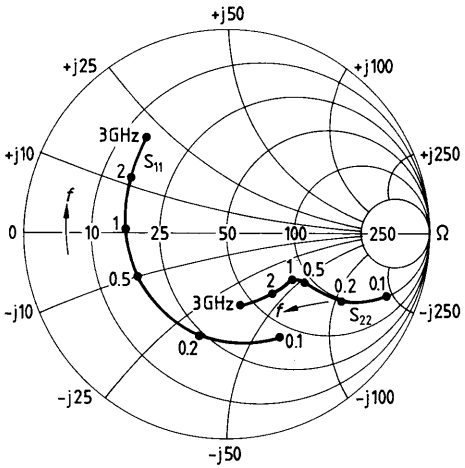
S_{12}, S_{21} = f (*f*)
I_C = 15 mA, V_{CE} = 10 V, Z_0 = 50 Ω



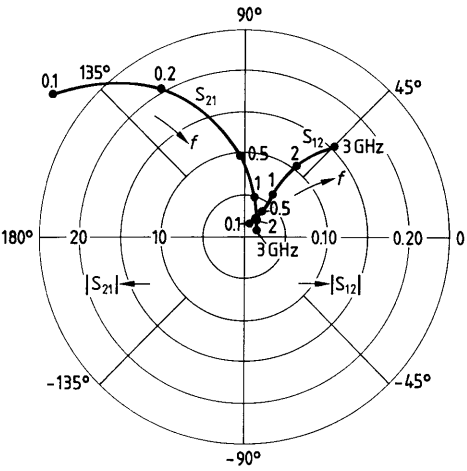
I_C = 20 mA, V_{CE} = 10 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.57	– 63	28.86	144	0.015	65	0.84	–21
0.2	0.52	–106	20.30	121	0.024	54	0.65	–30
0.3	0.50	–130	14.82	108	0.029	50	0.54	–32
0.4	0.51	–144	11.65	99	0.033	52	0.49	–32
0.6	0.50	–162	7.97	88	0.041	54	0.43	–32
0.8	0.51	–173	6.02	80	0.050	56	0.41	–33
1.0	0.52	179	4.83	73	0.058	56	0.40	–35
1.2	0.52	172	4.08	67	0.068	57	0.38	–38
1.5	0.52	163	3.29	58	0.081	56	0.38	–42
1.8	0.53	156	2.74	50	0.096	54	0.38	–48
2.0	0.55	152	2.49	46	0.104	53	0.37	–53
2.5	0.57	141	2.04	33	0.128	50	0.36	–64
3.0	0.60	131	1.73	22	0.152	44	0.36	–79

S_{11}, S_{22} = f (f)
I_C = 20 mA, V_{CE} = 10 V, Z_0 = 50 Ω

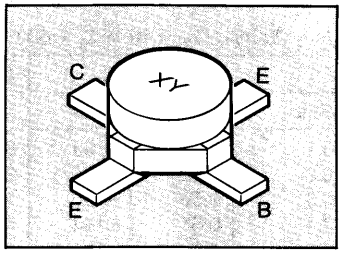


S_{12}, S_{21} = f (f)
I_C = 20 mA, V_{CE} = 10 V, Z_0 = 50 Ω



- For low-distortion broadband amplifiers up to 2 GHz at collector currents from 10 to 30 mA.
- Hermetically sealed ceramic package.
- HiRel/Mil screening available.

- CECC-type available: CECC 50002/263.



ESD: Electrostatic discharge sensitive device, observe handling precautions!

Type	Marking	Ordering code (tape and reel)	Package[1])
BFQ 72	72	Q 62702 – F776	Cerec-X

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CEO}	15	V
Collector-emitter voltage, $V_{BE} = 0$	V_{CES}	20	V
Collector-base voltage	V_{CBO}	20	V
Emitter-base voltage	V_{EBO}	2.5	V
Collector current	I_C	50	mA
Base current	I_B	10	mA
Total power dissipation, $T_A \leq 105$ °C[2])	P_{tot}	350	mW
Junction temperature	T_j	175	°C
Ambient temperature range	T_A	–65 ... +175	°C
Storage temperature range	T_{stg}	–65 ... +175	°C

Thermal Resistance

Junction – ambient[2])	R_{thJA}	≤200	K/W

1) For detailed dimensions see chapter Package Outlines.
2) Package mounted on alumina 16 mm × 25 mm × 0.7 mm.

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

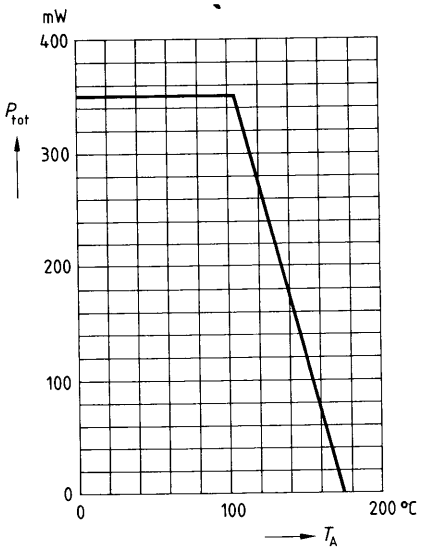
DC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CEO}$	15	–	–	V
Collector-emitter cutoff current V_{CE} = 20 V, V_{BE} = 0	I_{CES}	–	–	10	µA
Collector-base cutoff current V_{CB} = 10 V, I_E = 0	I_{CBO}	–	–	50	nA
Emitter-base cutoff current V_{EB} = 2 V, I_C = 0	I_{EBO}	–	–	10	µA
DC current gain I_C = 25 mA, V_{CE} = 5 V I_C = 50 mA, V_{CE} = 5 V	h_{FE}	 40 40	 90 –	 200 –	–
Collector-emitter saturation voltage I_C = 50 mA, I_B = 5 mA	V_{CEsat}	–	0.15	0.4	V
Base-emitter voltage I_C = 25 mA, V_{CE} = 5 V	V_{BE}	–	0.78	–	V

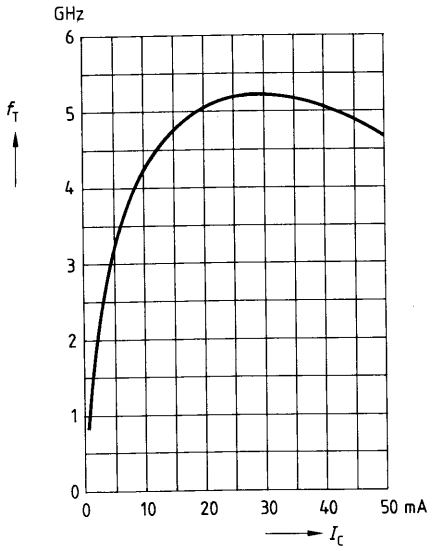
AC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
Transition frequency I_C = 25 mA, V_{CE} = 5 V, f = 200 MHz I_C = 50 mA, V_{CE} = 5 V, f = 200 MHz	f_T	 – –	 5.1 4.7	 – –	GHz
Collector-base capacitance V_{CB} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{cb}	–	0.55	0.7	pF
Collector-emitter capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{ce}	–	0.4	–	pF
Input capacitance V_{EB} = 0.5 V, I_C = i_c = 0, f = 1 MHz	C_{ibo}	–	2.1	–	pF
Output capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{obs}	–	0.95	1.5	pF
Noise figure I_C = 10 mA, V_{CE} = 8 V, f = 10 MHz, Z_S = 75 Ω I_C = 10 mA, V_{CE} = 8 V, f = 800 MHz, Z_S = 50 Ω	F	 – –	 1.7 2.5	 – –	dB
Power gain I_C = 25 mA, V_{CE} = 8 V, f = 800 MHz, Z_S = Z_{Sopt}, Z_L = Z_{Lopt}	G_{pe}	–	18	–	dB
Transducer gain I_C = 25 mA, V_{CE} = 8 V, f = 1 GHz, Z_0 = 50 Ω	$\lvert S_{21e}\rvert^2$	–	12.5	–	dB
Linear output voltage two-tone intermodulation test I_C = 25 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}	–	240	–	mV
Third order intercept point I_C = 25 mA, V_{CE} = 8 V, f = 800 MHz	IP_3	–	30.5	–	dBm

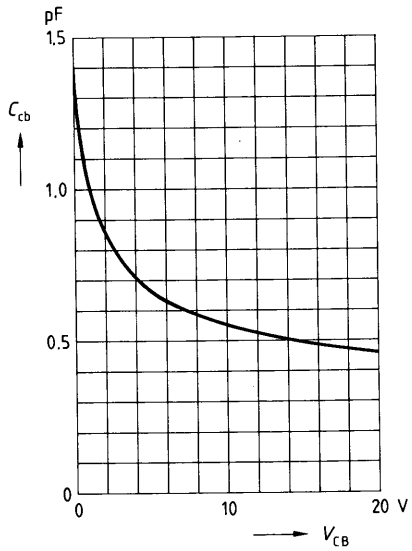
Total power dissipation $P_{tot} = f(T_A)$
Package mounted on alumina



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

I_C = 2 mA, V_{CE} = 8 V, Z_0 = 50 Ω

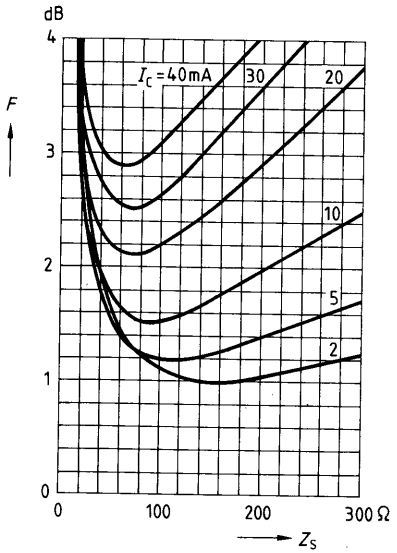
f	F_{min}	G_p (F_{min})	Γ_{opt}		R_N	N	$F_{50\,\Omega}$	G_p ($F_{50\,\Omega}$)
GHz	dB	dB	MAG	ANG	Ω	–	dB	dB
0.01	1.0	–	(Z_S = 150 Ω)		–	–	1.6	–

I_C = 10 mA, V_{CE} = 8 V, Z_0 = 50 Ω

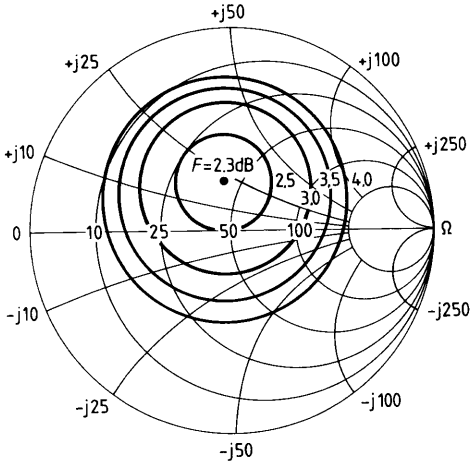
f	F_{min}	G_p (F_{min})	Γ_{opt}		R_N	N	$F_{50\,\Omega}$	G_p ($F_{50\,\Omega}$)
GHz	dB	dB	MAG	ANG	Ω	–	dB	dB
0.01	1.5	–	(Z_S = 90 Ω)		–	–	1.7	–
0.8	2.3	14.7	0.26	99.5	16.5	0.31	2.45	14

Noise figure $F = f(Z_S)$

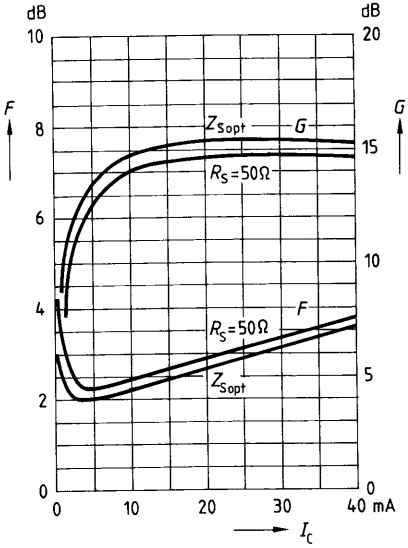
V_{CE} = 8 V, f = 10 MHz



Circles of constant noise figure $F = f(Z_S)$
in Z_S-plane, I_C = 10 mA, V_{CE} = 8 V,
f = 800 MHz

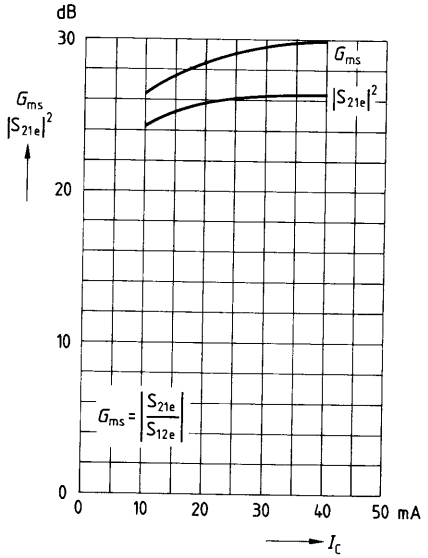


Noise figure $F = f(I_C)$
Power gain $G = f(I_C)$
V_{CE} = 8 V, f = 800 MHz, Z_{Lopt} (G)

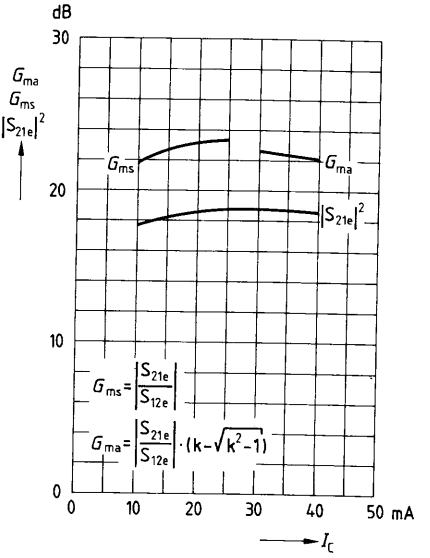


Common Emitter Power Gain

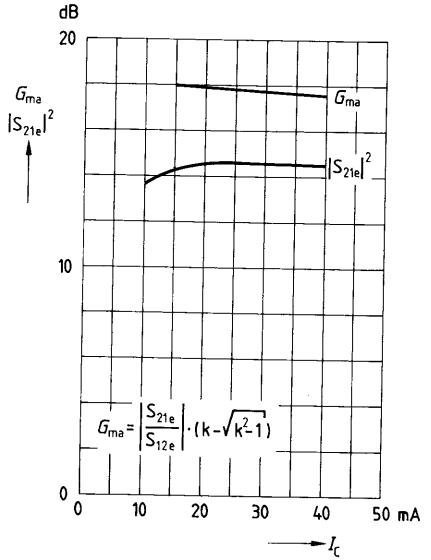
Power gain G_{ms}, $|S_{21e}|^2 = f(I_C)$
V_{CE} = 8 V, f = 200 MHz, Z_0 = 50 Ω



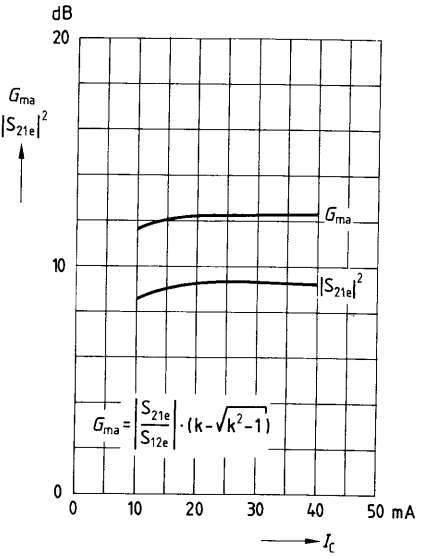
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(I_C)$
V_{CE} = 8 V, f = 500 MHz, Z_0 = 50 Ω



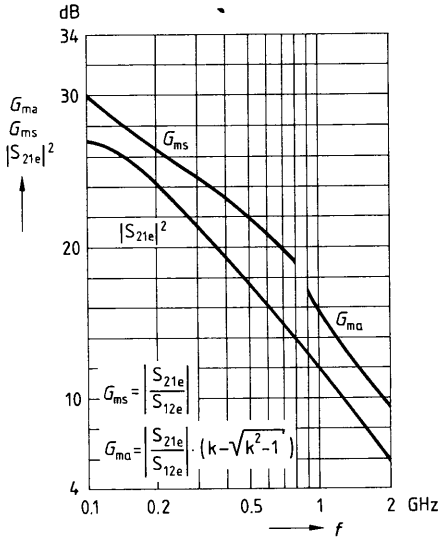
Power gain G_{ma}, $|S_{21e}|^2 = f(I_C)$
V_{CE} = 8 V, f = 800 MHz, Z_0 = 50 Ω



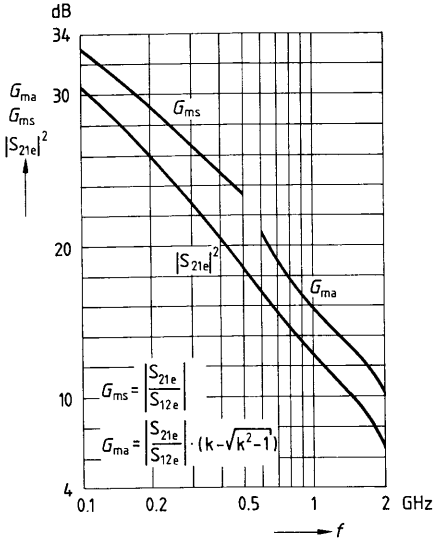
Power gain G_{ma}, $|S_{21e}|^2 = f(I_C)$
V_{CE} = 8 V, f = 1.5 GHz, Z_0 = 50 Ω



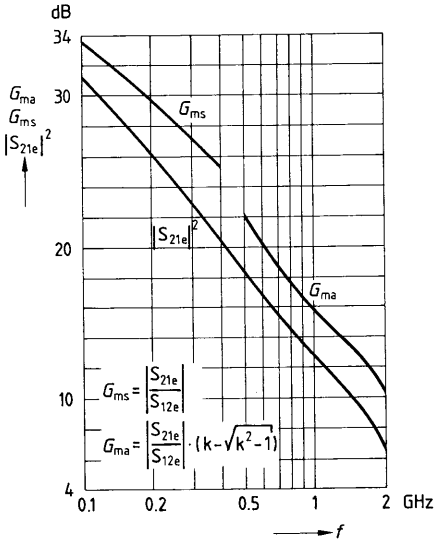
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
$I_C = 10$ mA, $V_{CE} = 8$ V, $Z_0 = 50\ \Omega$



Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
$I_C = 25$ mA, $V_{CE} = 8$ V, $Z_0 = 50\ \Omega$



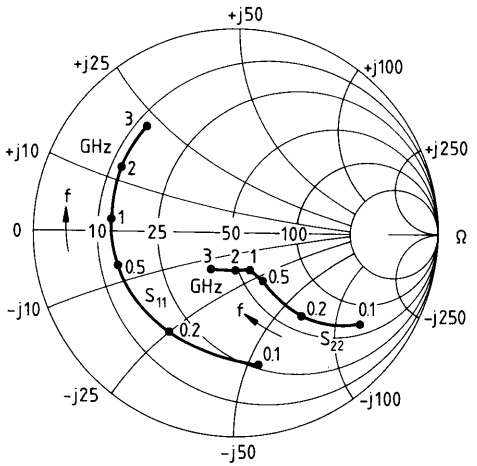
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
$I_C = 40$ mA, $V_{CE} = 8$ V, $Z_0 = 50\ \Omega$



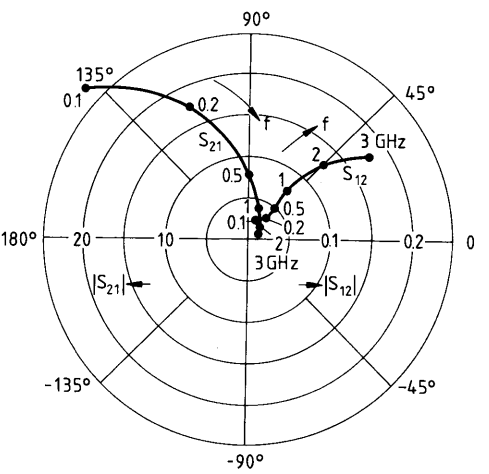
Common Emitter S Parameters
I_C = 15 mA, V_{CE} = 5 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.62	– 78	26.97	137	0.023	59	0.76	– 34
0.2	0.57	–121	17.54	114	0.032	47	0.51	– 50
0.3	0.56	–142	12.39	102	0.039	44	0.38	– 55
0.4	0.57	–155	9.59	94	0.043	45	0.31	– 56
0.6	0.57	–169	6.47	84	0.053	48	0.24	– 57
0.8	0.58	–179	4.86	76	0.064	50	0.21	– 59
1.0	0.58	174	3.89	69	0.075	50	0.19	– 60
1.2	0.59	167	3.28	63	0.086	50	0.18	– 63
1.5	0.59	159	2.64	54	0.102	48	0.17	– 67
1.8	0.61	153	2.20	46	0.119	46	0.17	– 75
2.0	0.63	149	1.99	41	0.128	44	0.17	– 82
2.5	0.64	138	1.63	28	0.153	40	0.17	–100
3.0	0.67	128	1.38	16	0.177	34	0.19	–119

S_{11}, S_{22} = f (f)
I_C = 15 mA, V_{CE} = 5 V, Z_0 = 50 Ω



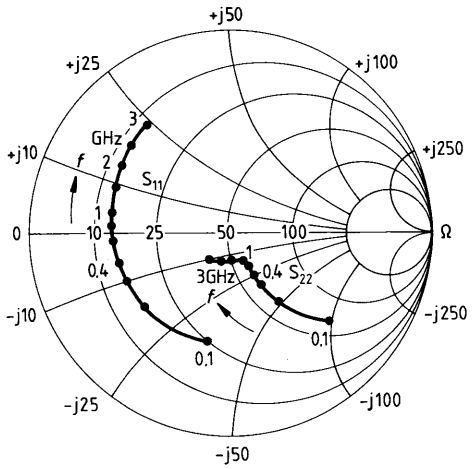
S_{12}, S_{21} = f (f)
I_C = 15 mA, V_{CE} = 5 V, Z_0 = 50 Ω



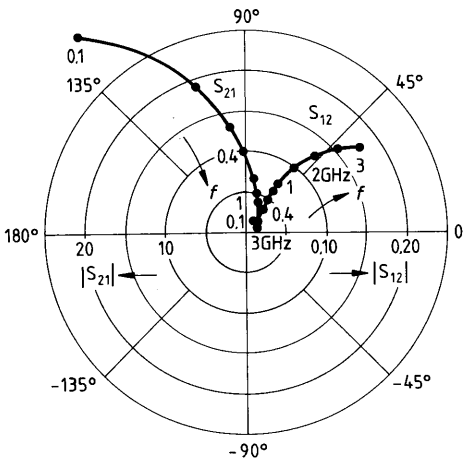
I_C = 25 mA, V_{CE} = 5 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.54	– 99	31.95	130	0.018	57	0.66	– 41
0.2	0.55	–137	19.18	108	0.027	48	0.42	– 55
0.3	0.55	–154	13.20	98	0.032	49	0.30	– 59
0.4	0.57	–164	10.09	91	0.037	52	0.24	– 60
0.6	0.57	–176	6.76	82	0.049	55	0.19	– 60
0.8	0.58	176	5.06	74	0.061	56	0.17	– 61
1.0	0.59	170	4.04	68	0.072	55	0.15	– 63
1.2	0.60	165	3.40	62	0.084	55	0.14	– 66
1.5	0.60	157	2.74	54	0.101	52	0.14	– 70
1.8	0.61	151	2.28	46	0.118	49	0.14	– 79
2.0	0.63	147	2.06	41	0.127	47	0.14	– 87
2.5	0.65	137	1.68	29	0.153	42	0.14	–106
3.0	0.68	127	1.42	17	0.177	36	0.17	–126

S_{11}, S_{22} = f (*f*)
I_C = 25 mA, V_{CE} = 5 V, Z_0 = 50 Ω



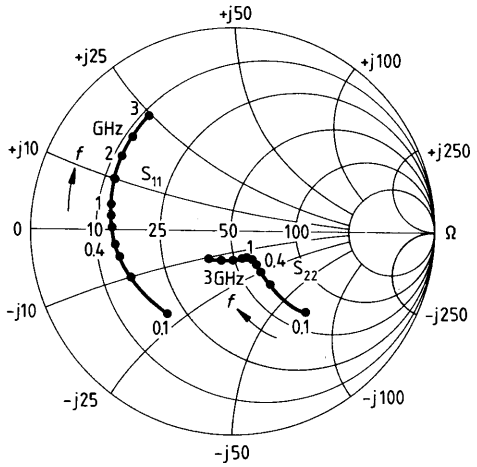
S_{12}, S_{21} = f (*f*)
I_C = 25 mA, V_{CE} = 5 V, Z_0 = 50 Ω



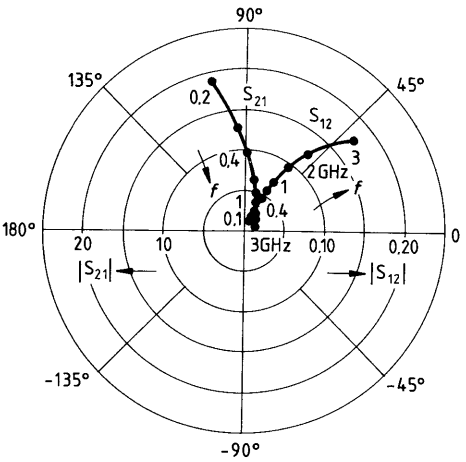
I_C = 50 mA, V_{CE} = 5 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.51	–126	34.20	121	0.014	54	0.55	– 46
0.2	0.55	–154	18.99	103	0.021	53	0.33	– 52
0.3	0.55	–166	12.81	94	0.026	57	0.25	– 52
0.4	0.58	–173	9.72	88	0.032	59	0.21	– 51
0.6	0.59	178	6.47	80	0.045	62	0.18	– 50
0.8	0.60	172	4.84	73	0.057	61	0.17	– 52
1.0	0.61	167	3.86	67	0.069	60	0.16	– 55
1.2	0.62	162	3.25	62	0.080	59	0.15	– 59
1.5	0.62	155	2.62	53	0.097	56	0.15	– 65
1.8	0.64	149	2.18	45	0.114	53	0.15	– 74
2.0	0.66	145	1.97	41	0.123	51	0.15	– 83
2.5	0.67	136	1.61	29	0.149	46	0.15	–104
3.0	0.70	126	1.37	18	0.174	40	0.17	–125

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



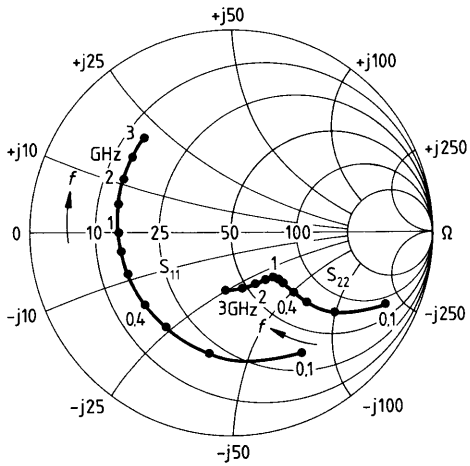
S_{12}, S_{21} = f (f)
I_C = 50 mA, V_{CE} = 5 V, Z_0 = 50 Ω



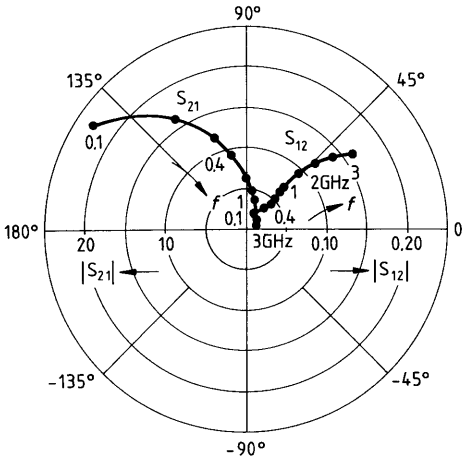
I_C = 10 mA, V_{CE} = 8 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.69	– 59	22.59	145	0.023	63	0.85	–24
0.2	0.61	–100	16.18	121	0.036	49	0.64	–37
0.3	0.57	–124	11.90	108	0.042	44	0.51	–41
0.4	0.56	–140	9.39	99	0.046	43	0.43	–43
0.6	0.55	–159	6.42	87	0.055	44	0.36	–43
0.8	0.55	–171	4.86	78	0.064	45	0.33	–44
1.0	0.56	–179	3.90	71	0.073	46	0.31	–46
1.2	0.56	173	3.29	65	0.082	46	0.30	–48
1.5	0.57	164	2.66	55	0.096	45	0.29	–52
1.8	0.58	157	2.21	46	0.110	44	0.29	–59
2.0	0.60	152	2.00	41	0.119	42	0.28	–64
2.5	0.62	141	1.64	28	0.141	39	0.28	–78
3.0	0.65	131	1.39	17	0.162	35	0.28	–95

S_{11}, S_{22} = f (f)
I_C = 10 mA, V_{CE} = 8 V, Z_0 = 50 Ω



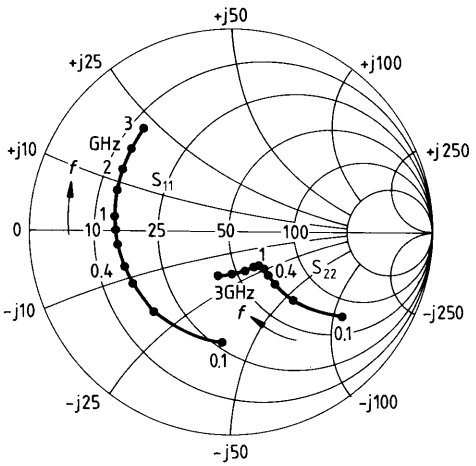
S_{12}, S_{21} = f (f)
I_C = 10 mA, V_{CE} = 8 V, Z_0 = 50 Ω



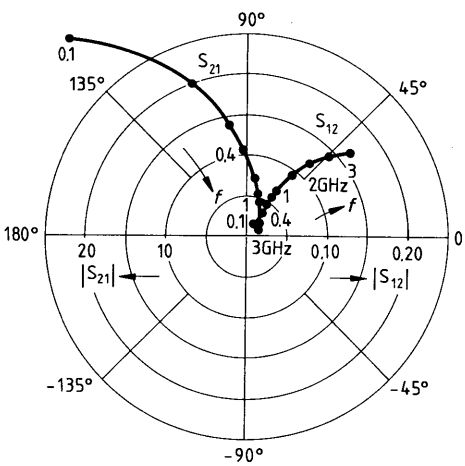
I_C = 25 mA, V_{CE} = 8 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.55	– 90	32.99	132	0.017	56	0.71	–35
0.2	0.53	–131	20.17	110	0.024	50	0.46	–44
0.3	0.52	–150	13.96	99	0.030	50	0.36	–45
0.4	0.54	–160	10.71	92	0.035	53	0.30	–44
0.6	0.54	–172	7.17	83	0.046	56	0.26	–43
0.8	0.55	179	5.38	75	0.057	57	0.24	–43
1.0	0.56	172	4.29	69	0.067	56	0.23	–45
1.2	0.56	167	3.62	63	0.078	55	0.22	–47
1.5	0.57	159	2.91	54	0.094	53	0.22	–51
1.8	0.59	153	2.42	47	0.109	50	0.22	–59
2.0	0.61	149	2.18	42	0.119	48	0.21	–65
2.5	0.62	139	1.78	30	0.142	44	0.21	–80
3.0	0.66	129	1.51	18	0.165	39	0.22	–98

S_{11}, S_{22} = f (*f*)
I_C = 25 mA, V_{CE} = 8 V, Z_0 = 50 Ω



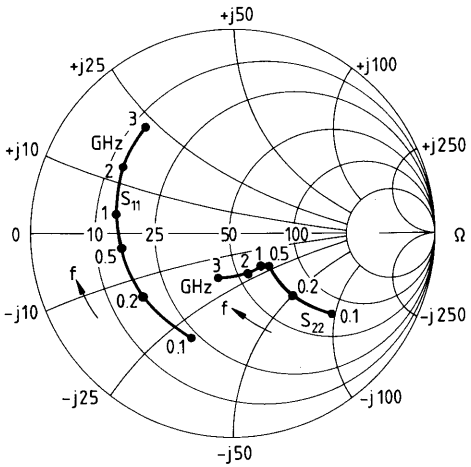
S_{12}, S_{21} = f (*f*)
I_C = 25 mA, V_{CE} = 8 V, Z_0 = 50 Ω



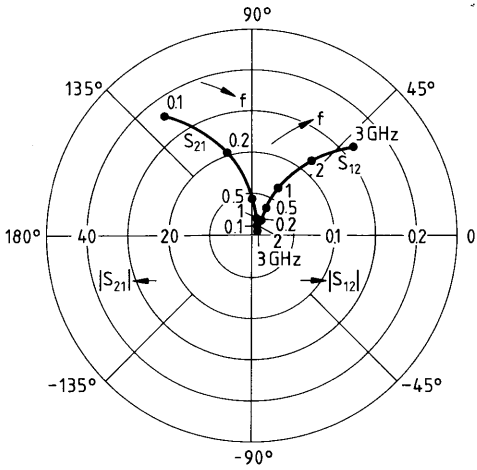
I_C = 40 mA, V_{CE} = 8 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.51	–108	35.70	126	0.016	57	0.64	–37
0.2	0.52	–144	20.53	105	0.021	52	0.41	–42
0.3	0.53	–159	13.96	96	0.027	55	0.32	–41
0.4	0.54	–167	10.64	90	0.032	57	0.28	–39
0.6	0.55	–177	7.10	81	0.043	60	0.25	–38
0.8	0.56	176	5.32	74	0.054	60	0.24	–39
1.0	0.57	170	4.24	68	0.066	59	0.23	–41
1.2	0.58	165	3.57	63	0.076	58	0.22	–44
1.5	0.59	157	2.87	54	0.092	56	0.22	–49
1.8	0.60	152	2.39	46	0.107	52	0.22	–57
2.0	0.62	148	2.16	42	0.116	51	0.21	–63
2.5	0.64	138	1.77	29	0.140	46	0.21	–79
3.0	0.67	128	1.50	18	0.163	41	0.22	–98

S_{11}, S_{22} = f (f)
I_C = 40 mA, V_{CE} = 8 V, Z_0 = 50 Ω

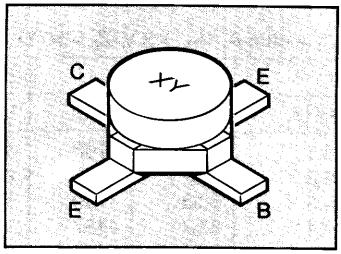


S_{12}, S_{21} = f (f)
I_C = 40 mA, V_{CE} = 8 V, Z_0 = 50 Ω



- For low-noise, low-distortion broadband amplifiers in antenna and telecommunications systems up to 2 GHz at collector currents from 10 to 70 mA.
- Hermetically sealed ceramic package.
- HiRel/Mil screening available.

CECC-type available: CECC 50002/261.



ESD: Electrostatic discharge sensitive device, observe handling precautions!

Type	Marking	Ordering code (tape and reel)	Package[1])
BFQ 73S	73S	Q 62702 – F1104	Cerec-X

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CEO}	15	V
Collector-base voltage	V_{CBO}	20	V
Emitter-base voltage	V_{EBO}	3	V
Collector current	I_C	100	mA
Total power dissipation, $T_A \leq 75$ °C[2])	P_{tot}	500	mW
Junction temperature	T_j	175	°C
Ambient temperature range	T_A	−65 ... +175	°C
Storage temperature range	T_{stg}	−65 ... +175	°C

Thermal Resistance

Junction – ambient[2])	R_{thJA}	≤200	K/W

1) For detailed dimensions see chapter Package Outlines.
2) Package mounted on alumina 16 mm × 25 mm × 0.7 mm.

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

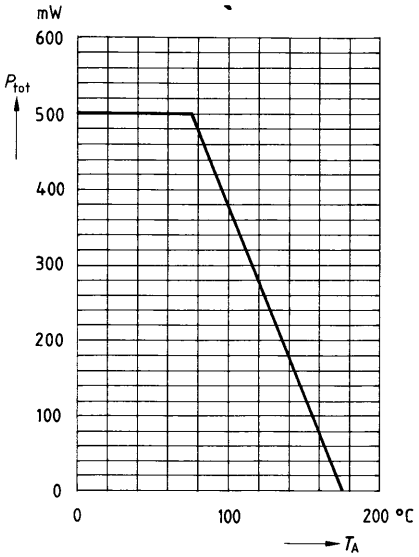
DC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CEO}$	15	–	–	V
Collector-base cutoff current V_{CB} = 10 V, I_E = 0	I_{CBO}	–	–	100	nA
Emitter-base cutoff current V_{EB} = 2 V, I_C = 0	I_{EBO}	–	–	10	µA
DC current gain I_C = 50 mA, V_{CE} = 5 V	h_{FE}	30	90	–	–
Collector-emitter saturation voltage I_C = 75 mA, I_B = 7.5 mA	V_{CEsat}	–	0.2	0.5	V

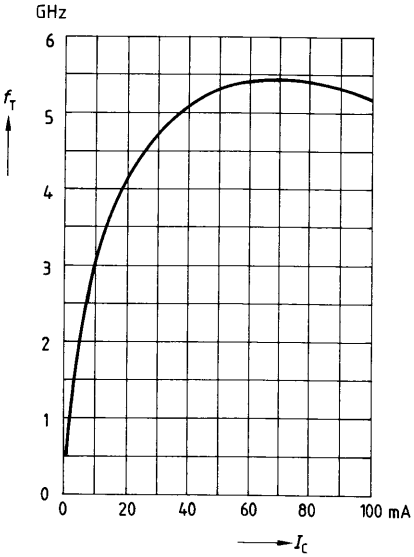
AC characteristics

Parameter	Symbol	Values min	typ	max	Unit
Transition frequency I_C = 50 mA, V_{CE} = 5 V, f = 200 MHz I_C = 75 mA, V_{CE} = 5 V, f = 200 MHz	f_T	 – –	 5.3 5.4	 – –	GHz
Collector-base capacitance V_{CB} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{cb}	–	0.9	–	pF
Collector-emitter capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{ce}	–	0.4	–	pF
Input capacitance V_{EB} = 0.5 V, I_C = i_c = 0, f = 1 MHz	C_{ibo}	–	5	–	pF
Output capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{obs}	–	1.3	–	pF
Noise figure I_C = 5 mA, V_{CE} = 10 V, f = 10 MHz, Z_S = 50 Ω I_C = 50 mA, V_{CE} = 5 V, f = 800 MHz, Z_S = Z_{Sopt}	F	 – –	 0.9 3	 – –	dB
Power gain I_C = 50 mA, V_{CE} = 5 V, f = 800 MHz, Z_S = Z_{Sopt}, Z_L = Z_{Lopt}	G_{pe}	–	15	–	dB
Transducer gain I_C = 50 mA, V_{CE} = 5 V, f = 1 GHz, Z_0 = 50 Ω	$\lvert S_{21e}\rvert^2$	–	10.5	–	dB
Linear output voltage two-tone intermodulation test I_C = 50 mA, V_{CE} = 10 V, d_{IM} = 60 dB f_1 = 806 MHz, f_2 = 810 MHz, Z_S = Z_L = 50 Ω	V_{o1} = V_{o2}	–	400	–	mV
Third order intercept point I_C = 50 mA, V_{CE} = 10 V, f = 800 MHz	IP_3	–	35	–	dBm

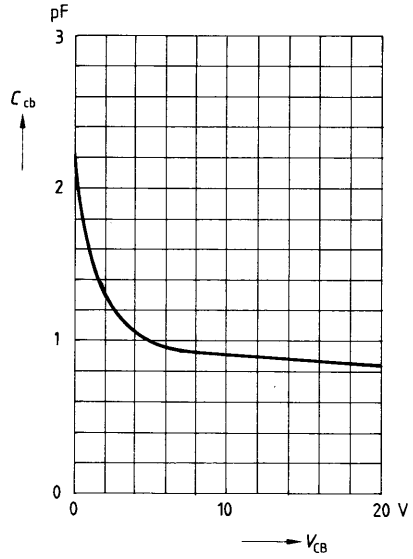
Total power dissipation $P_{tot} = f(T_A)$
Package mounted on alumina



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

I_C = 5 mA, V_{CE} = 5 V, Z_0 = 50 Ω

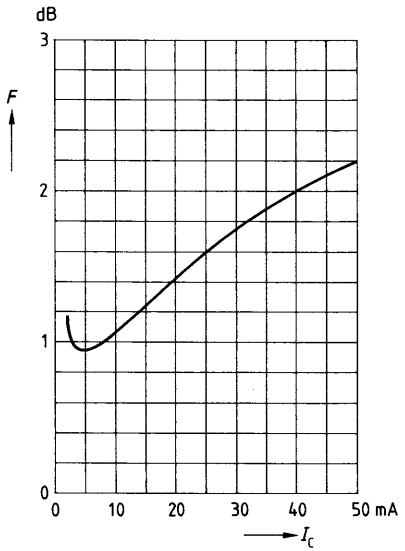
f	F_{min}	G_p (F_{min})	Γ_{opt}		R_N	N	$F_{50\,\Omega}$	G_p ($F_{50\,\Omega}$)
GHz	dB	dB	MAG	ANG	Ω	–	dB	dB
0.01	0.9	–	(Z_S = 50 Ω)		–	–	–	–

I_C = 50 mA, V_{CE} = 5 V, Z_0 = 50 Ω

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
0.01	2.0	–	(Z_S = 50 Ω)		–	–	–	–
0.8	3	14	0.41	168	9.5	0.43	3.8	–

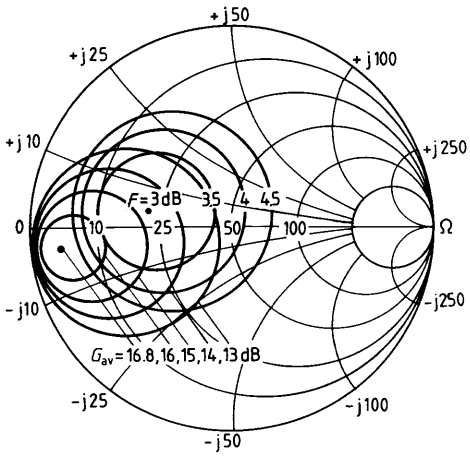
Noise figure $F = f(I_C)$

V_{CE} = 5 V, f = 10 MHz, Z_S = 50 Ω



Circles of constant noise figure $F = f(Z_S)$ and available power gain $G_{av} = f(Z_S)$

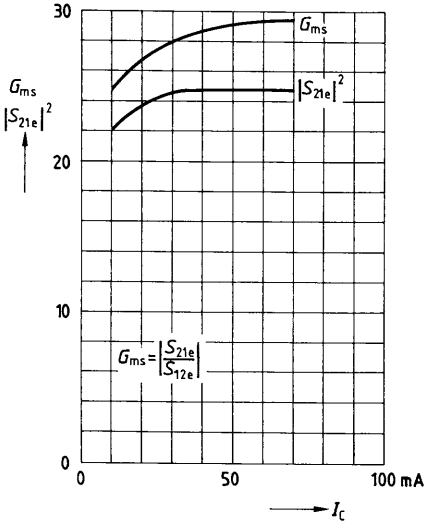
I_C = 50 mA, V_{CE} = 5 V, f = 800 MHz, Z_0 = 50 Ω



Common Emitter Power Gain

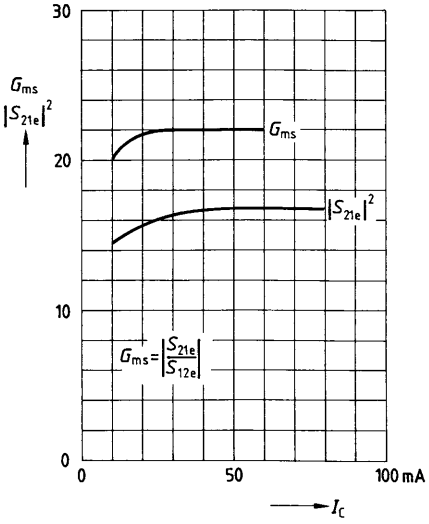
Power gain G_{ms}, $|S_{21e}|^2 = f(I_C)$

dB $V_{CE} = 5$ V, $f = 200$ MHz, $Z_0 = 50\ \Omega$



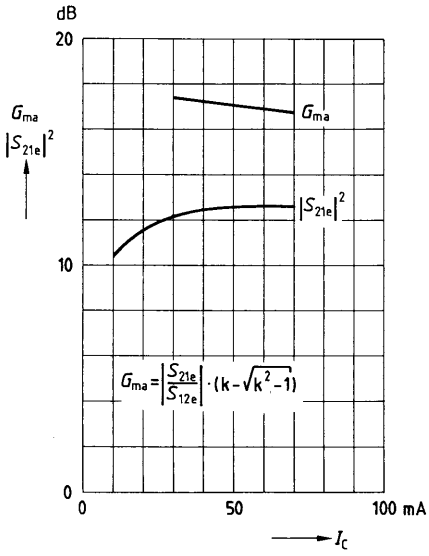
Power gain G_{ms}, $|S_{21e}|^2 = f(I_C)$

dB $V_{CE} = 5$ V, $f = 500$ MHz, $Z_0 = 50\ \Omega$



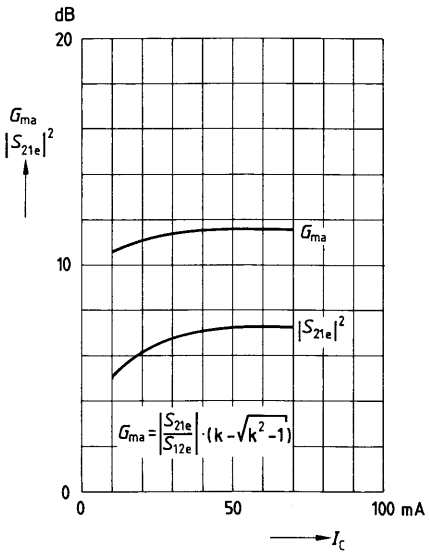
Power gain G_{ma}, $|S_{21e}|^2 = f(I_C)$

$V_{CE} = 5$ V, $f = 800$ MHz, $Z_0 = 50\ \Omega$

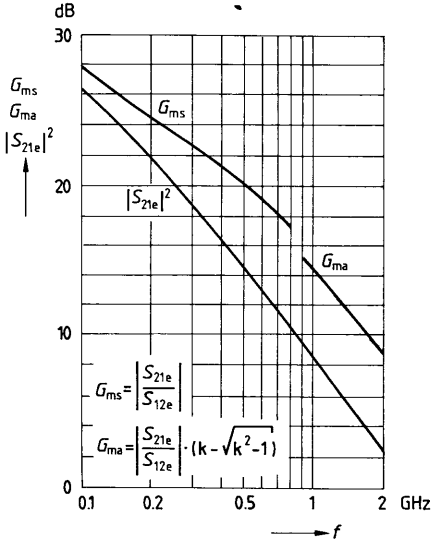


Power gain G_{ma}, $|S_{21e}|^2 = f(I_C)$

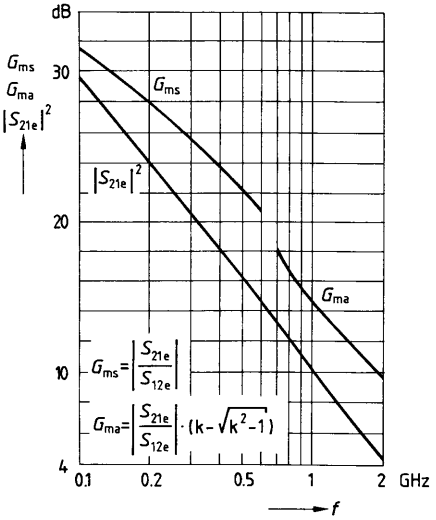
$V_{CE} = 5$ V, $f = 1.5$ GHz, $Z_0 = 50\ \Omega$



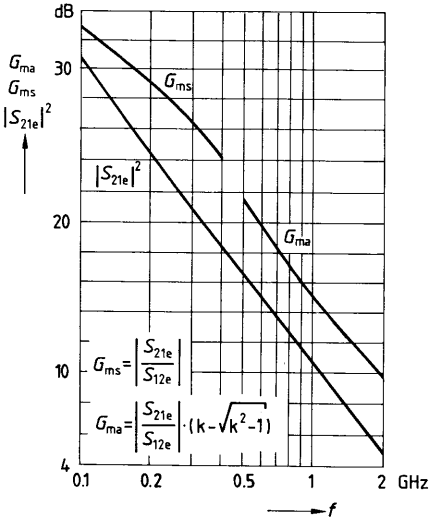
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
$I_C = 10$ mA, $V_{CE} = 5$ V, $Z_0 = 50\ \Omega$



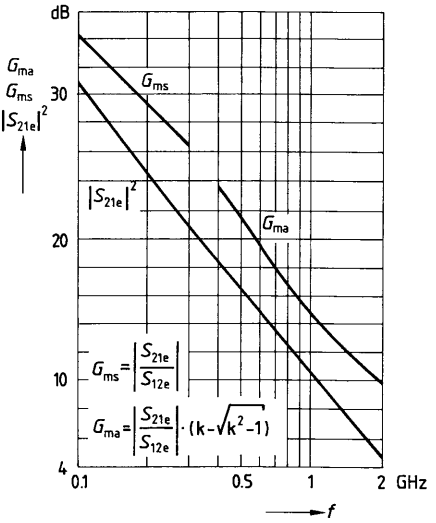
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
$I_C = 30$ mA, $V_{CE} = 5$ V, $Z_0 = 50\ \Omega$



Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
$I_C = 50$ mA, $V_{CE} = 5$ V, $Z_0 = 50\ \Omega$



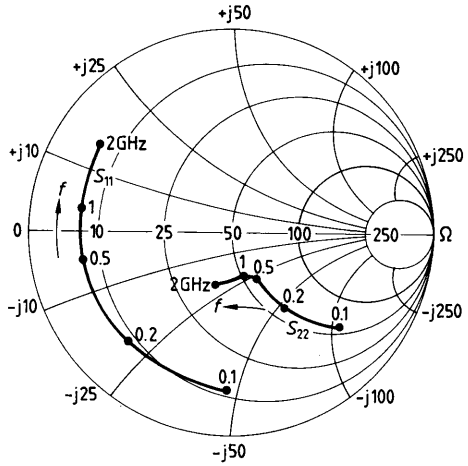
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
$I_C = 70$ mA, $V_{CE} = 5$ V, $Z_0 = 50\ \Omega$



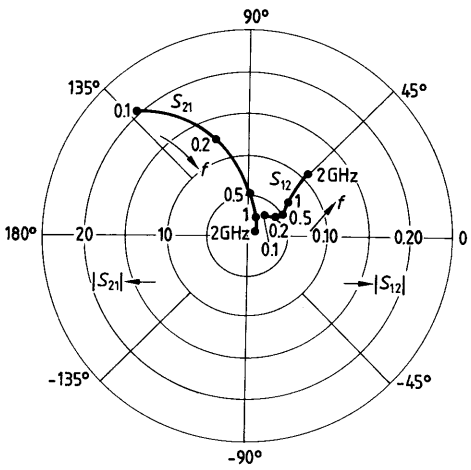
Common Emitter S Parameters
I_C = 10 mA, V_{CE} = 5 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.78	– 92	20.39	132	0.034	48	0.71	– 39
0.3	0.75	–152	8.63	97	0.047	30	0.34	– 57
0.5	0.75	–169	5.27	84	0.053	31	0.26	– 61
0.8	0.75	177	3.29	71	0.060	35	0.23	– 68
1.0	0.76	171	2.63	63	0.066	39	0.22	– 73
1.2	0.77	165	2.21	57	0.073	42	0.22	– 79
1.4	0.77	159	1.91	50	0.081	43	0.23	– 84
1.6	0.77	155	1.68	44	0.089	45	0.24	– 91
1.8	0.78	151	1.49	38	0.098	45	0.25	– 98
2.0	0.79	147	1.34	32	0.107	46	0.26	–106

S_{11}, S_{22} = f (f)
I_C = 10 mA, V_{CE} = 5 V, Z_0 = 50 Ω



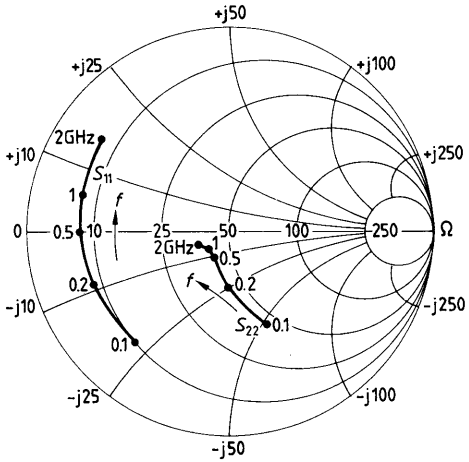
S_{12}, S_{21} = f (f)
I_C = 10 mA, V_{CE} = 5 V, Z_0 = 50 Ω



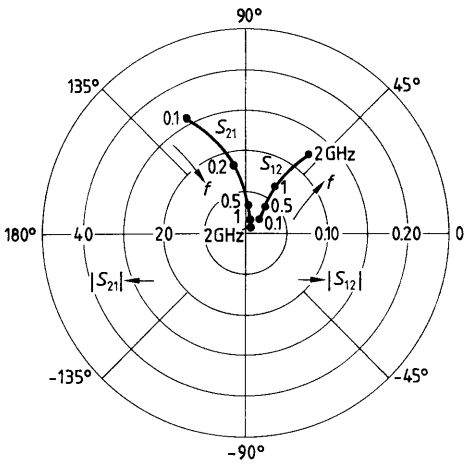
I_C = 30 mA, V_{CE} = 5 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.72	–130	31.12	117	0.022	44	0.49	– 66
0.3	0.73	–168	11.01	91	0.029	45	0.20	–103
0.5	0.74	–179	6.61	82	0.040	51	0.15	–119
0.8	0.73	170	4.10	71	0.056	55	0.14	–132
1.0	0.75	166	3.27	64	0.067	56	0.13	–139
1.2	0.75	161	2.75	59	0.079	56	0.13	–144
1.4	0.76	156	2.38	53	0.090	55	0.14	–146
1.6	0.75	152	2.09	47	0.102	54	0.14	–148
1.8	0.76	149	1.85	41	0.113	52	0.16	–152
2.0	0.78	145	1.67	36	0.123	51	0.17	–157

S_{11}, S_{22} = f (*f*)
I_C = 30 mA, V_{CE} = 5 V, Z_0 = 50 Ω



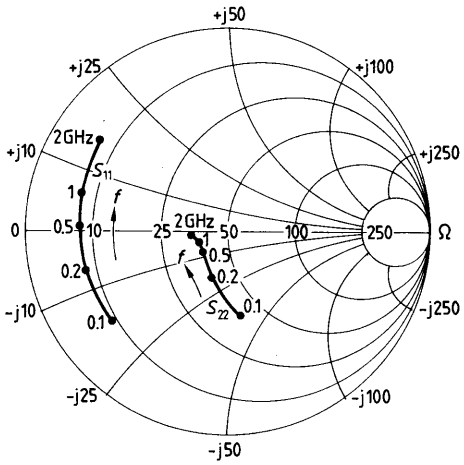
S_{12}, S_{21} = f (*f*)
I_C = 30 mA, V_{CE} = 5 V, Z_0 = 50 Ω



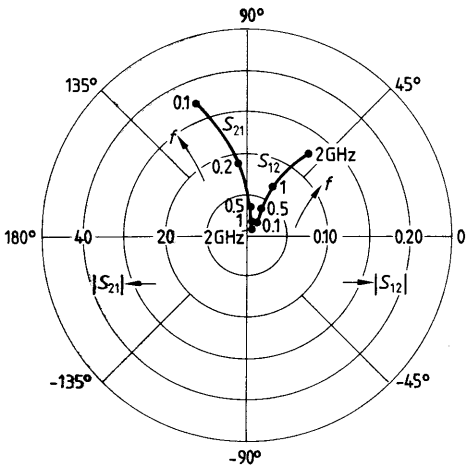
I_C = 50 mA, V_{CE} = 5 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.72	–142	33.86	111	0.018	43	0.42	– 79
0.3	0.73	–173	11.49	90	0.027	52	0.19	–122
0.5	0.73	177	6.87	81	0.038	58	0.16	–139
0.8	0.73	169	4.25	70	0.056	60	0.15	–152
1.0	0.75	165	3.39	64	0.068	60	0.15	–158
1.2	0.75	160	2.85	59	0.080	59	0.15	–162
1.4	0.75	155	2.46	53	0.092	58	0.15	–165
1.6	0.75	152	2.16	48	0.105	56	0.16	–166
1.8	0.76	148	1.92	42	0.116	53	0.17	–169
2.0	0.78	144	1.72	37	0.126	52	0.18	–172

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



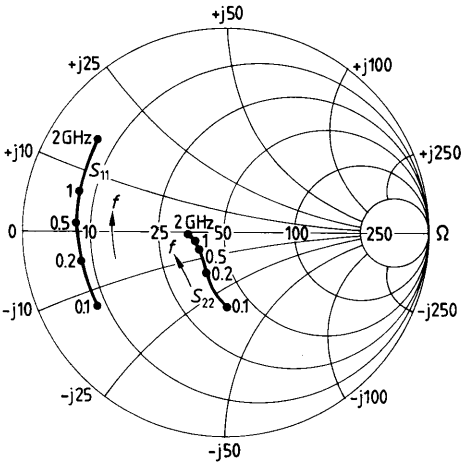
S_{12}, S_{21} = f (f)
I_C = 50 mA, V_{CE} = 5 V, Z_0 = 50 Ω



I_C = 70 mA, V_{CE} = 5 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.72	–149	34.51	108	0.014	42	0.37	– 87
0.3	0.73	–175	11.47	89	0.025	56	0.18	–130
0.5	0.73	176	6.84	80	0.037	62	0.16	–146
0.8	0.74	168	4.24	70	0.056	63	0.16	–157
1.0	0.75	164	3.38	64	0.069	62	0.16	–163
1.2	0.75	159	2.84	59	0.081	61	0.16	–167
1.4	0.76	155	2.45	53	0.093	59	0.16	–170
1.6	0.75	151	2.15	48	0.105	57	0.16	–171
1.8	0.77	148	1.91	42	0.177	54	0.17	–173
2.0	0.78	144	1.71	38	0.127	52	0.18	–177

S_{11}, S_{22} = f (f)
I_C = 70 mA, V_{CE} = 5 V, Z_0 = 50 Ω



S_{12}, S_{21} = f (f)
I_C = 70 mA, V_{CE} = 5 V, Z_0 = 50 Ω