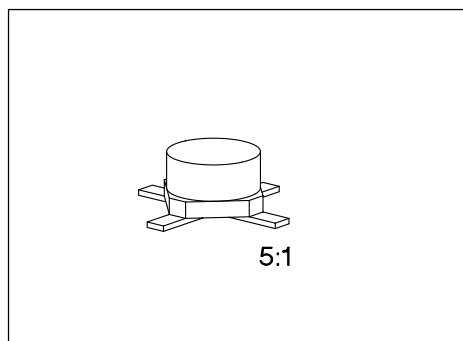# SIEMENS

NPN Silicon RF Transistor   BFQ 74

● For low-noise amplifiers in the GHz range,
  and broadband analog and digital applications
  in telecommunications systems at collector
  currents from 1 mA to 25 mA.

● Hermetically sealed ceramic package.

● HiRel/Mil screening available.

5:1

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

Type	Marking	Ordering Code (tape and reel)	Pin Configuration 1	2	3	4	Package[1)
BFQ 74	74	Q62702-F788	B	E	C	E	Cerec-X

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CE0}	16	V
Collector-emitter voltage, $V_{BE} = 0$	V_{CES}	25	
Collector-base voltage	V_{CB0}	25	
Emitter-base voltage	V_{EB0}	2	
Collector current	I_C	35	mA
Peak collector current, $f \geq 10$ MHz	I_{CM}	45	
Base current	I_B	5	
Total power dissipation, $T_S \leq 115\ ^{\circ}\mathrm{C}$[3)	P_{tot}	300	mW
Junction temperature	T_j	175	˚C
Ambient temperature range	T_A	− 65 … + 175	
Storage temperature range	T_{stg}	− 65 … + 175	

Thermal Resistance

Junction - ambient[2)	$R_{th\ JA}$	≤ 280	K/W
Junction - soldering point[3)	$R_{th\ JS}$	≤ 200	

[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

Parameter	Symbol	min.	typ.	max.	Unit
Collector-emitter breakdown voltage $I_C = 1\ mA$, $I_B = 0$	$V_{(BR)CE0}$	16	–	–	V
Collector-emitter cutoff current $V_{CE} = 25\ V$, $V_{BE} = 0$	I_{CES}	–	–	100	μA
Collector-base cutoff current $V_{CB} = 15\ V$, $I_E = 0$	I_{CB0}	–	–	50	nA
Emitter-base cutoff current $V_{EB} = 2\ V$, $I_C = 0$	I_{EB0}	–	–	10	μA
DC current gain $I_C = 5\ mA$, $V_{CE} = 10\ V$ $I_C = 15\ mA$, $V_{CE} = 10\ V$	h_{FE}	50 50	110 120	250 –	–
Collector-emitter saturation voltage $I_C = 30\ mA$, $I_B = 3\ mA$	V_{CEsat}	–	0.13	0.3	V
Base-emitter voltage $I_C = 10\ mA$, $V_{CE} = 10\ V$	V_{BE}	–	0.78	–	

Electrical Characteristics

at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	

AC Characteristics

Parameter	Symbol	min.	typ.	max.	Unit
Transition frequency I_C = 5 mA, V_{CE} = 10 V, f = 200 MHz I_C = 15 mA, V_{CE} = 10 V, f = 200 MHz	f_T	– –	4.4 6	– –	GHz
Collector-base capacitance V_{CB} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{cb}	–	0.3	0.4	pF
Collector-emitter capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{ce}	–	0.4	–	
Input capacitance V_{EB} = 0.5 V, I_C = i_c = 0, f = 1 MHz	C_{ibo}	–	1.35	–	
Output capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{obs}	–	0.7	–	
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 I_C = 10 mA, V_{CE} = 10 V, f = 2 GHz, Z_S = Z_{Sopt}	F	– – –	0.9 1.4 2.5	– – 2.9	dB
Power gain I_C = 15 mA, V_{CE} = 10 V, f = 2 GHz, Z_0 = 50 Ω I_C = 15 mA, V_{CE} = 10 V, f = 4 GHz, Z_0 = 50 Ω	G_{ma}[1]) G_{ms}[2])	– –	14 9.8	– –	
Transducer gain I_C = 15 mA, V_{CE} = 10 V, f = 2 GHz, Z_0 = 50 Ω	$\mid S_{21e}\mid^2$	–	9.8	–	
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	$V_{o1} = V_{o2}$	–	160	–	mV
Third order intercept point I_C = 25 mA, V_{CE} = 10 V, f = 800 MHz	IP_3	–	27	–	dBm

[1)] $\left| \dfrac{S_{21e}}{S_{12e}} \right| (k - \sqrt{k^2 - 1})$

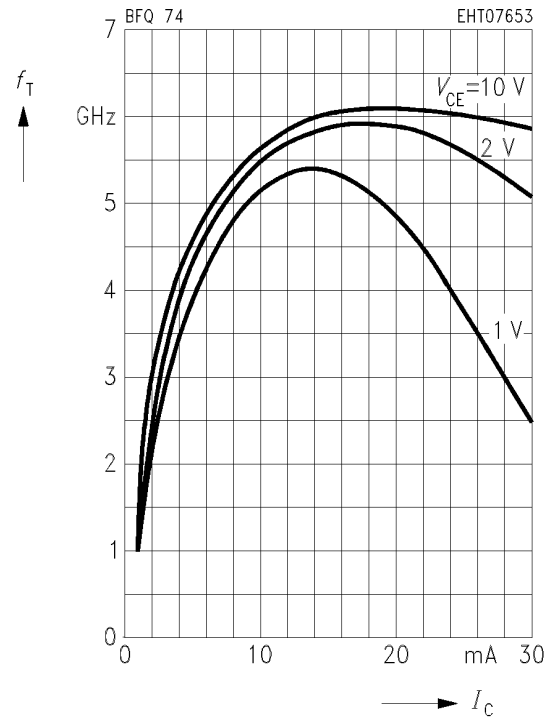[2)] $\left| \dfrac{S_{21e}}{S_{12e}} \right|$

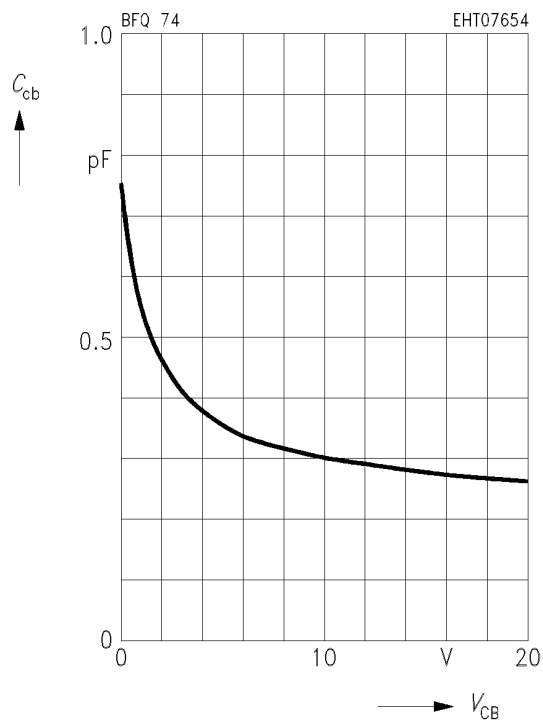**Total power dissipation $P_{tot} = f(T_A*; T_S)$**
*Package mounted on alumina
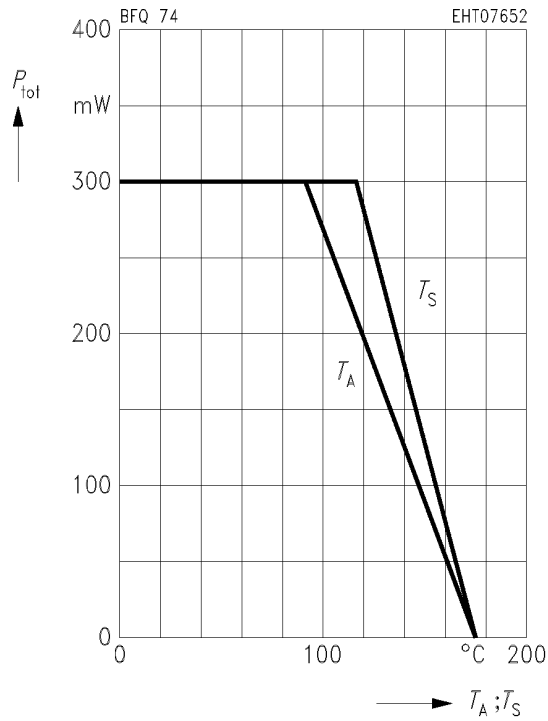
Transition frequency $f_T = f(I_C)$
f = 200 MHz

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

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**

$I_C = 3$ mA, $V_{CE} = 10$ V, $Z_0 = 50\ \Omega$

f	F_{min}	$G_p(F_{min})$	Γ_{opt}		R_N	N	$F_{50\,\Omega}$	$G_p(F_{50\Omega})$
0.01	0.7	–	(Z_S = 150 Ω)		–	–	1.2	–

$I_C = 10$ mA, $V_{CE} = 10$ V, $Z_0 = 50\ \Omega$

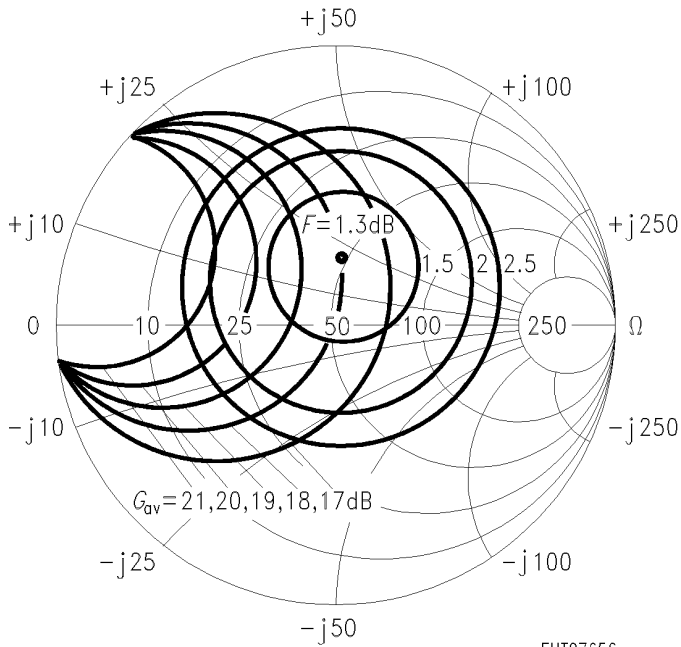| f	F_{min}	$G_p(F_{min})$	Γ_{opt}		R_N	N	$F_{50\,\Omega}$	$G_p(F_{50\Omega})$
0.01	1.05	–	(Z_S = 75 Ω)		–	–	1.2	–
0.8	1.3	17.5	0.22	82	11.5	0.20	1.4	16.8
2.0	2.5	11.5	0.20	137	23.5	0.60	2.7	10

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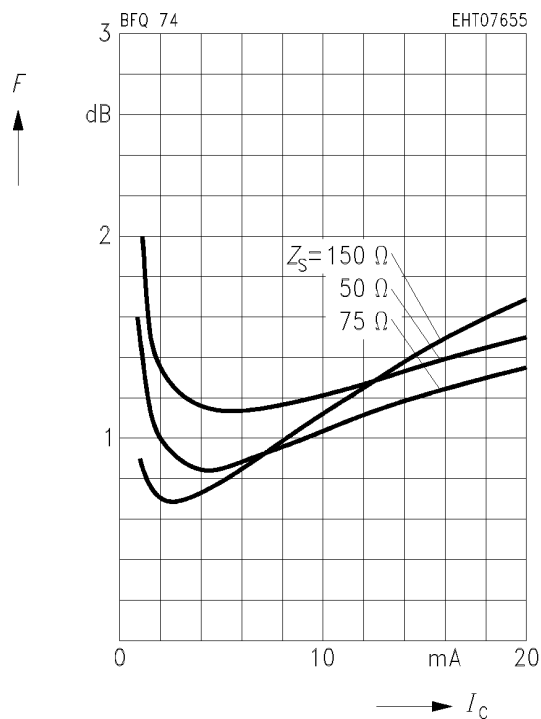
Circles of constant noise figure $F = f(Z_S)$ and available power gain $G_{av} = f(Z_S)$
$I_C = 10$ mA, $V_{CE} = 10$ V, $f = 800$ MHz

EHT07656

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

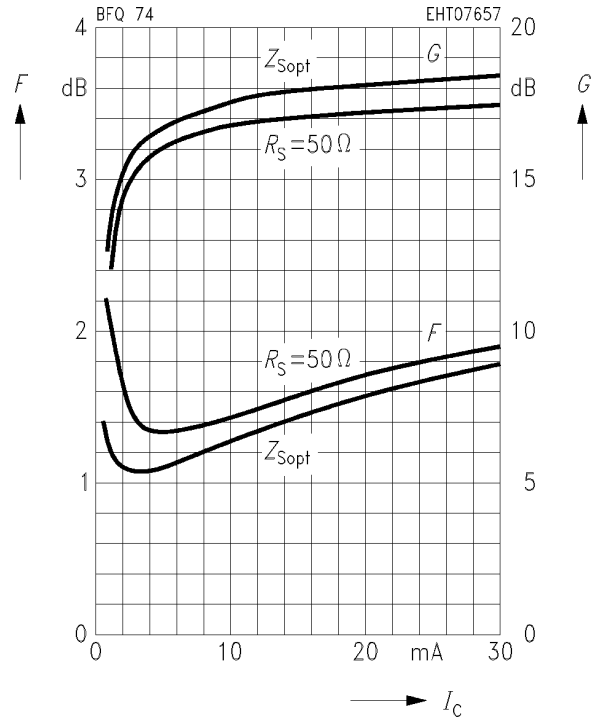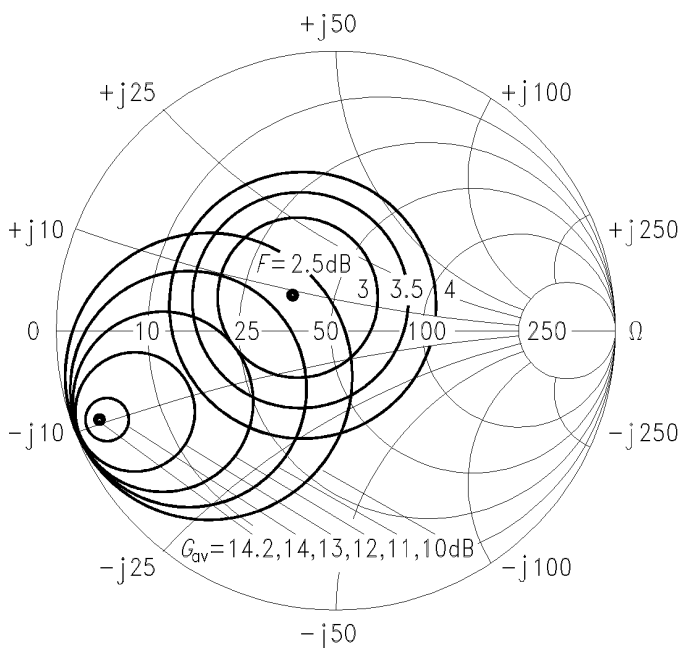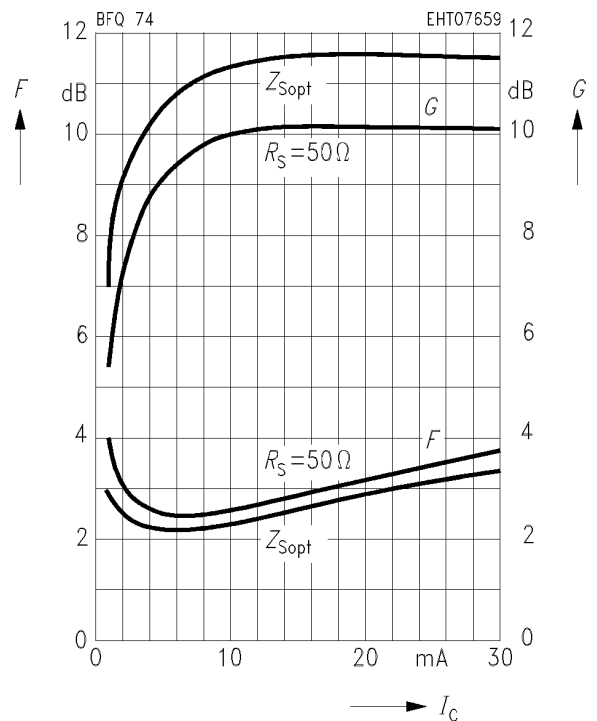**Circles of constant noise figure $F = f(Z_S)$ and available power gain $G_{av} = f(Z_S)$**
$I_C = 10$ mA, $V_{CE} = 10$ V, $f = 2$ GHz

EHT07658

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}, $|S_{21e}|^2 = f(I_C)$
$V_{CE} = 10$ V, $f = 1$ GHz, $Z_0 = 50$ Ω
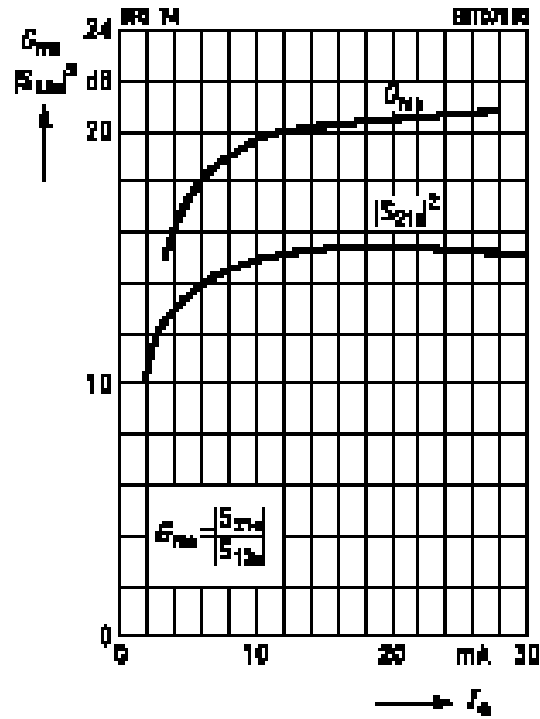
Power gain G_{ma}, $|S_{21e}|^2 = f(I_C)$
$V_{CE} = 10$ V, $f = 2$ GHz, $Z_0 = 50$ Ω

$$G_{ma} = \frac{|S_{21e}|}{|S_{12e}|}\left(k - \sqrt{k^2 - 1}\right)$$

Power gain G_{ms}, $|S_{21e}|^2 = f(I_C)$
$V_{CE} = 10$ V, $f = 4$ GHz, $Z_0 = 50$ Ω

$$G_{ms} = \frac{|S_{21e}|}{|S_{12e}|}$$
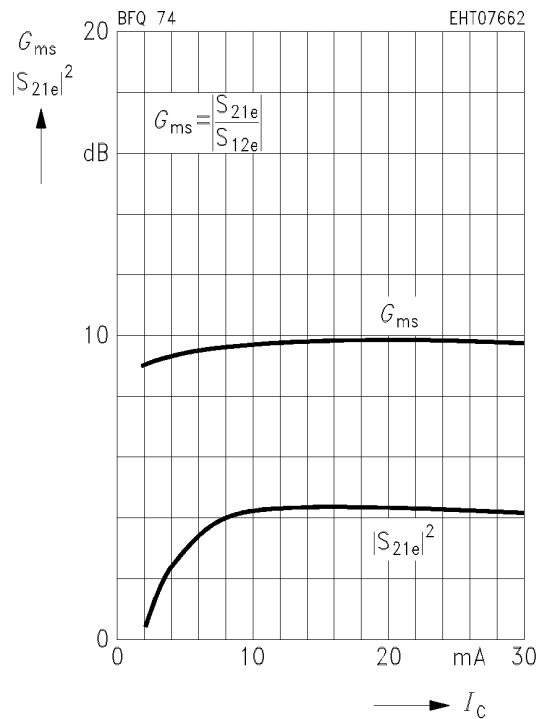
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
$I_C = 2$ mA, $V_{CE} = 10$ V, $Z_0 = 50\ \Omega$

BFQ 74   EHT07663
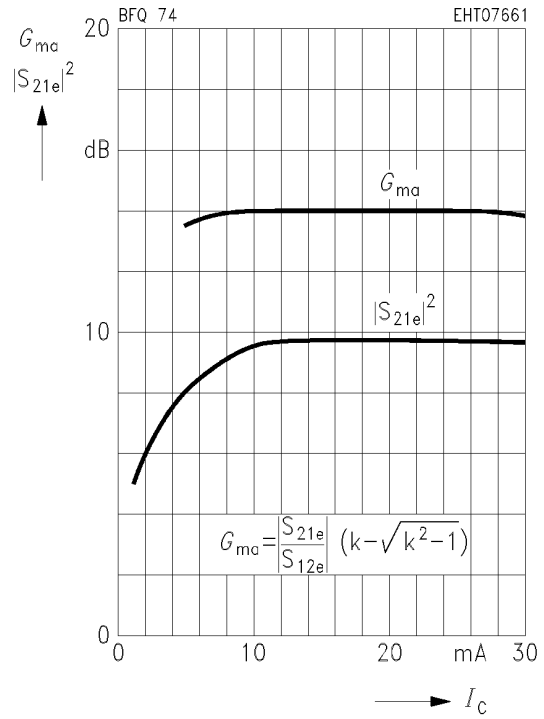
G_{ma}
G_{ms}
$|S_{21e}|^2$ dB

G_{ms}

$|S_{21e}|^2$

G_{ma}

$$G_{ms} = \left|\frac{S_{21e}}{S_{12e}}\right|$$

$$G_{ma} = \left|\frac{S_{21e}}{S_{12e}}\right| \cdot \left(k - \sqrt{k^2 - 1}\right)$$

0.1   0.2   0.5   1 GHz 2   4

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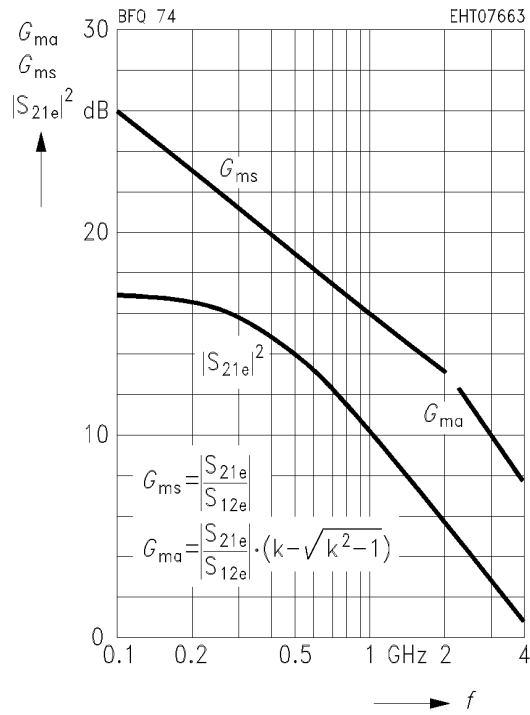
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
$I_C = 5$ mA, $V_{CE} = 10$ V, $Z_0 = 50\ \Omega$

BFQ 74   EHT07664

G_{ma}
G_{ms}
$|S_{21e}|^2$ dB

G_{ms}

$|S_{21e}|^2$

G_{ma}

G_{ms}

$$G_{ms} = \left|\frac{S_{21e}}{S_{12e}}\right|$$

$$G_{ma} = \left|\frac{S_{21e}}{S_{12e}}\right| \cdot \left(k - \sqrt{k^2 - 1}\right)$$

0.1   0.2   0.5   1 GHz 2   4

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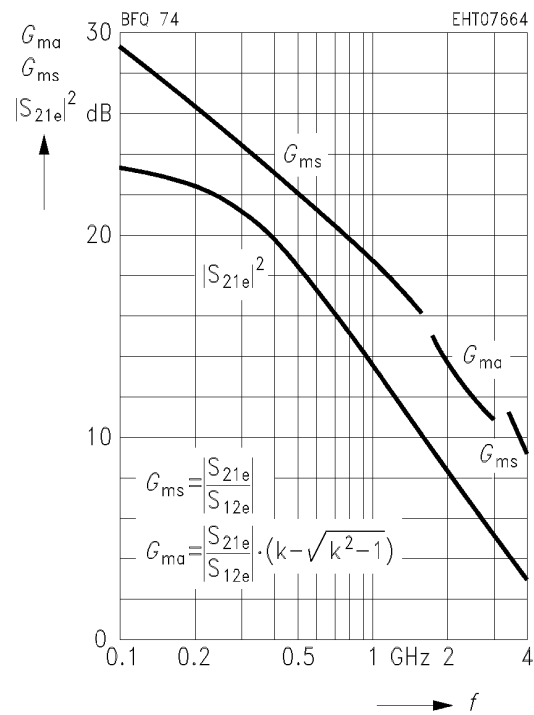
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
$I_C = 10$ mA, $V_{CE} = 10$ V, $Z_0 = 50\ \Omega$

BFQ 74   EHT07665

G_{ma}
G_{ms}
$|S_{21e}|^2$ dB

G_{ms}

$|S_{21e}|^2$

G_{ma}

G_{ms}

$$G_{ms} = \left|\frac{S_{21e}}{S_{12e}}\right|$$

$$G_{ma} = \left|\frac{S_{21e}}{S_{12e}}\right| \cdot \left(k - \sqrt{k^2 - 1}\right)$$

0.1   0.2   0.5   1 GHz 2   4

$\longrightarrow f$
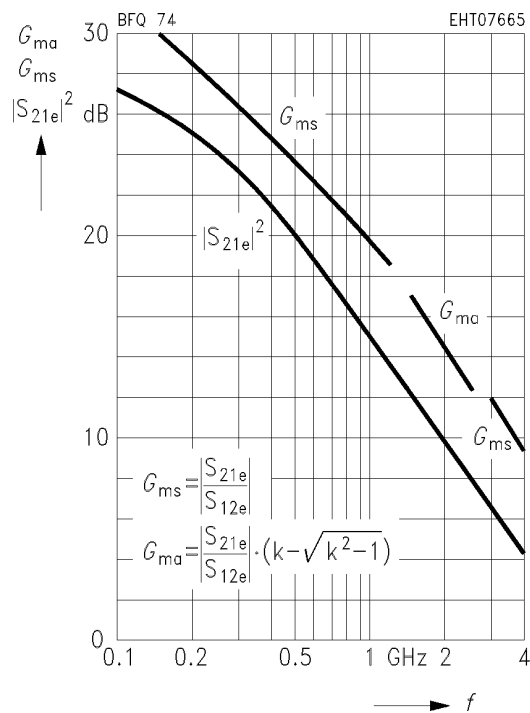
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
$I_C = 25$ mA, $V_{CE} = 10$ V, $Z_0 = 50\ \Omega$

BFQ 74   EHT07666

G_{ma}
G_{ms}
$|S_{21e}|^2$ dB

G_{ms}

$|S_{21e}|^2$

G_{ma}

G_{ms}

$$G_{ms} = \left|\frac{S_{21e}}{S_{12e}}\right|$$

$$G_{ma} = \left|\frac{S_{21e}}{S_{12e}}\right| \cdot \left(k - \sqrt{k^2 - 1}\right)$$

0.1   0.2   0.5   1 GHz 2   4

$\longrightarrow f$
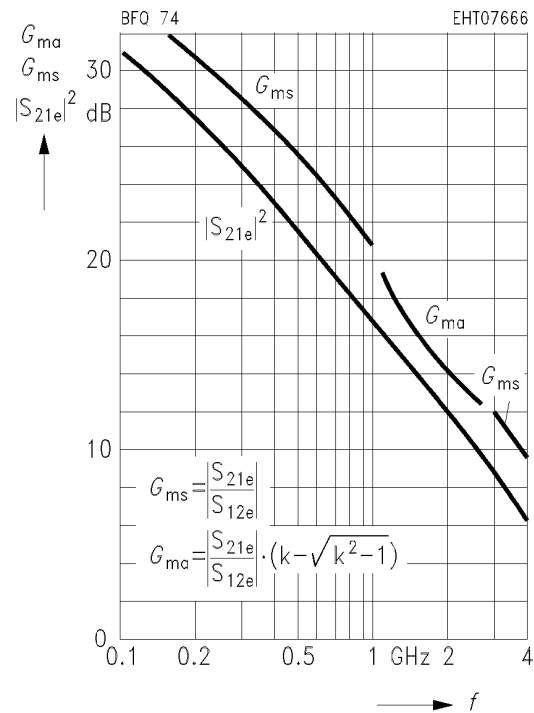
Common Emitter S Parameters

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG

I_C = 2 mA, V_{CE} = 10 V, Z_0 = 50 Ω

f	S_{11} MAG	S_{11} ANG	S_{21} MAG	S_{21} ANG	S_{12} MAG	S_{12} ANG	S_{22} MAG	S_{22} ANG
0.1	0.96	− 16	6.83	169	0.017	79	0.99	− 5
0.2	0.93	− 33	6.61	155	0.034	70	0.96	− 11
0.3	0.88	− 50	6.18	144	0.049	62	0.92	− 16
0.4	0.84	− 64	5.62	134	0.060	54	0.88	− 20
0.6	0.77	− 89	4.78	118	0.076	43	0.81	− 26
0.8	0.71	− 110	3.98	104	0.085	34	0.74	− 31
1.0	0.68	− 127	3.41	93	0.089	29	0.70	− 34
1.2	0.65	− 141	2.95	84	0.091	25	0.67	− 37
1.5	0.63	− 158	2.45	72	0.091	22	0.64	− 41
1.8	0.63	− 172	2.10	62	0.092	21	0.63	− 46
2.0	0.63	179	1.91	55	0.091	21	0.61	− 49
2.5	0.64	161	1.58	41	0.092	24	0.59	− 60
3.0	0.66	145	1.36	28	0.099	29	0.59	− 71
3.5	0.68	133	1.20	15	0.113	34	0.58	− 83
4.0	0.68	118	1.07	3	0.136	35	0.58	− 97
4.5	0.71	107	0.96	− 8	0.160	34	0.58	− 111
5.0	0.72	95	0.85	− 18	0.190	29	0.60	− 127

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

EHT07667
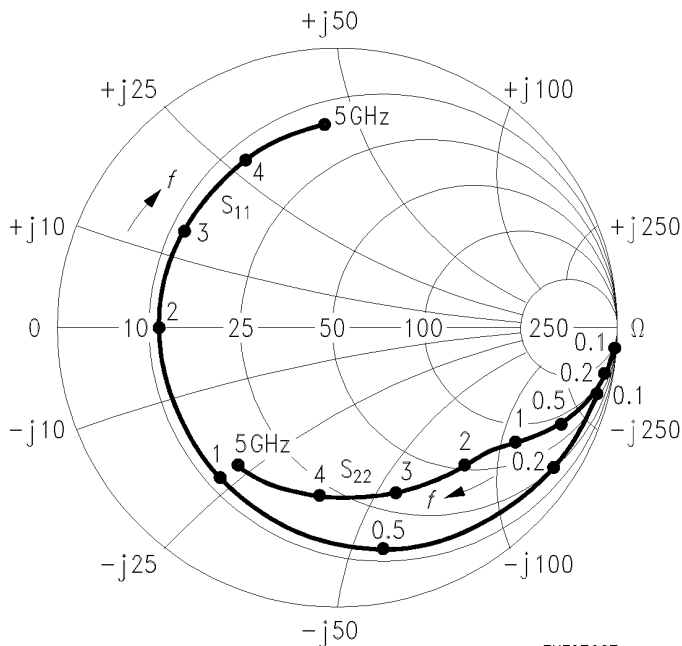
S_{12}, S_{21} = f (f)
I_C = 2 mA, V_{CE} = 10 V, Z_0 = 50 Ω

EHT07668

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 = 5 mA, V_{CE} = 10 V, Z_0 = 50 Ω								
0.1	0.91	− 25	14.67	163	0.017	78	0.97	− 9
0.2	0.83	− 51	13.37	145	0.031	63	0.89	− 18
0.3	0.75	− 72	11.62	131	0.040	54	0.80	− 24
0.4	0.70	− 89	9.90	121	0.047	47	0.73	− 28
0.6	0.63	− 115	7.61	105	0.056	41	0.64	− 32
0.8	0.58	− 135	5.97	94	0.061	37	0.58	− 34
1.0	0.57	− 150	4.92	85	0.064	36	0.54	− 36
1.2	0.56	− 162	4.18	77	0.068	36	0.52	− 37
1.5	0.55	− 176	3.40	68	0.073	37	0.50	− 41
1.8	0.56	173	2.87	59	0.080	38	0.49	− 45
2.0	0.57	166	2.60	53	0.084	39	0.47	− 48
2.5	0.59	152	2.13	41	0.098	41	0.46	− 58
3.0	0.61	138	1.83	29	0.116	41	0.45	− 68
3.5	0.63	128	1.61	17	0.135	41	0.44	− 80
4.0	0.64	114	1.44	5	0.161	37	0.45	− 94
4.5	0.68	104	1.29	− 6	0.183	33	0.44	− 108
5.0	0.68	93	1.16	− 16	0.209	27	0.46	− 124

$S_{11}, S_{22} = f(f)$
I_C = 5 mA, V_{CE} = 10 V, Z_0 = 50 Ω
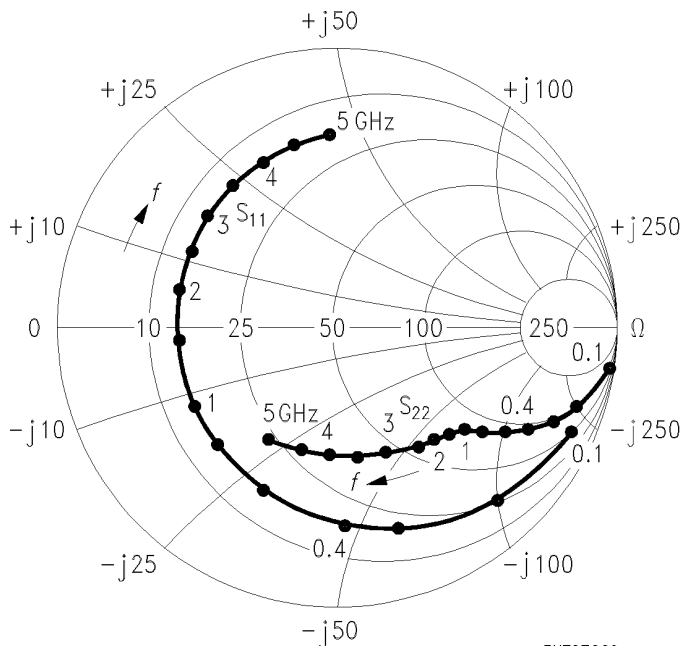
$S_{12}, S_{21} = f(f)$
I_C = 5 mA, V_{CE} = 10 V, Z_0 = 50 Ω

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EHT07670

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 = 10 mA, V_{CE} = 10 V, Z_0 = 50 Ω								
0.1	0.83	− 35	22.64	155	0.015	70	0.92	− 13
0.2	0.71	− 65	18.55	134	0.026	59	0.80	− 23
0.3	0.63	− 89	14.98	121	0.034	53	0.70	− 27
0.4	0.58	− 105	12.22	112	0.039	48	0.63	− 30
0.6	0.55	− 130	8.96	98	0.047	46	0.54	− 32
0.8	0.52	− 148	6.91	89	0.053	44	0.49	− 34
1.0	0.53	− 161	5.64	81	0.058	45	0.46	− 35
1.2	0.52	− 171	4.76	75	0.064	45	0.44	− 37
1.5	0.52	176	3.87	65	0.072	46	0.43	− 40
1.8	0.53	167	3.25	57	0.083	46	0.42	− 44
2.0	0.55	161	2.95	52	0.089	47	0.41	− 47
2.5	0.57	148	2.41	40	0.107	46	0.39	− 56
3.0	0.60	135	2.06	29	0.127	43	0.38	− 67
3.5	0.62	125	1.82	18	0.148	41	0.37	− 78
4.0	0.63	112	1.62	6	0.173	36	0.37	− 92
4.5	0.67	103	1.46	− 5	0.194	32	0.37	− 106
5.0	0.67	92	1.32	− 15	0.217	25	0.38	− 123

S_{11}, S_{22} = f (f)
I_C = 10 mA, V_{CE} = 10 V, Z_0 = 50 Ω
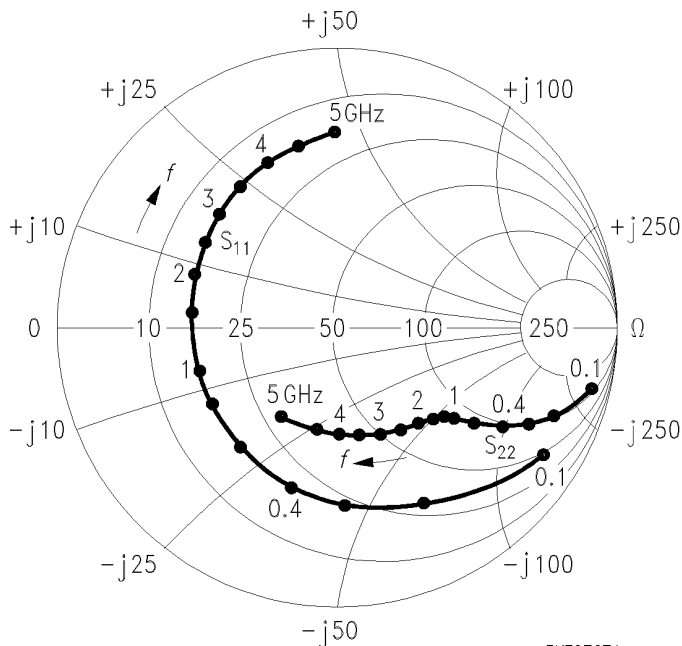
EHT07671

S_{12}, S_{21} = f (f)
I_C = 10 mA, V_{CE} = 10 V, Z_0 = 50 Ω
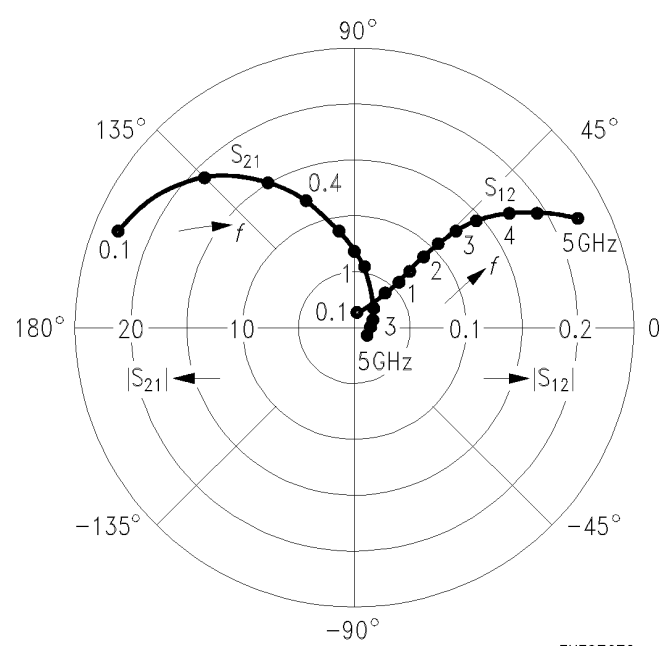
EHT07672

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 = 15 mA, V_{CE} = 10 V, Z_0 = 50 Ω								
0.1	0.79	− 44	29.12	151	0.015	66	0.89	− 17
0.2	0.66	− 81	22.58	128	0.023	56	0.73	− 27
0.3	0.59	− 107	17.37	115	0.028	50	0.61	− 30
0.4	0.55	− 123	13.71	106	0.033	48	0.55	− 31
0.6	0.52	− 145	9.66	93	0.039	48	0.48	− 31
0.8	0.51	− 161	7.32	85	0.045	50	0.44	− 32
1.0	0.52	− 171	5.92	78	0.051	51	0.42	− 33
1.2	0.51	179	4.97	72	0.058	52	0.41	− 34
1.5	0.51	169	4.02	63	0.068	53	0.40	− 37
1.8	0.53	161	3.36	56	0.080	53	0.39	− 42
2.0	0.54	156	3.04	51	0.087	52	0.38	− 45
2.5	0.56	145	2.49	39	0.107	51	0.37	− 54
3.0	0.59	133	2.12	28	0.128	47	0.36	− 65
3.5	0.62	123	1.87	17	0.151	44	0.35	− 77
4.0	0.63	111	1.67	6	0.176	38	0.35	− 91
4.5	0.66	102	1.50	− 5	0.198	33	0.35	− 106
5.0	0.67	91	1.35	− 15	0.222	26	0.36	− 122

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

EHT07673
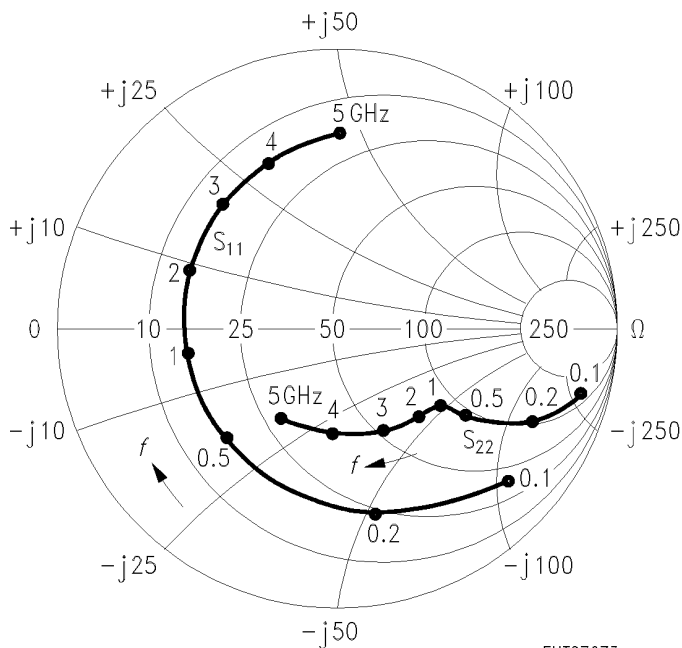
S_{12}, S_{21} = f (f)
I_C = 15 mA, V_{CE} = 10 V, Z_0 = 50 Ω

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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 = 20 mA, V_{CE} = 10 V, Z_0 = 50 Ω								
0.1	0.73	− 51	32.84	147	0.013	69	0.86	− 18
0.2	0.61	− 89	24.03	124	0.021	55	0.69	− 27
0.3	0.56	− 115	18.02	111	0.026	50	0.58	− 29
0.4	0.53	− 130	14.07	103	0.030	49	0.52	− 30
0.6	0.51	− 151	9.80	91	0.036	51	0.46	− 30
0.8	0.50	− 165	7.40	83	0.043	53	0.43	− 30
1.0	0.51	− 174	5.97	76	0.050	54	0.41	− 31
1.2	0.51	176	5.01	71	0.057	55	0.40	− 33
1.5	0.51	167	4.04	62	0.068	56	0.39	− 36
1.8	0.53	159	3.38	55	0.080	55	0.39	− 41
2.0	0.55	154	3.06	50	0.087	54	0.38	− 44
2.5	0.57	143	2.50	39	0.108	52	0.36	− 53
3.0	0.59	132	2.13	28	0.130	48	0.36	− 64
3.5	0.62	123	1.87	17	0.152	45	0.34	− 76
4.0	0.63	110	1.67	5	0.178	39	0.35	− 90
4.5	0.67	101	1.50	− 5	0.199	34	0.34	− 105
5.0	0.68	91	1.35	− 15	0.224	27	0.36	− 122

S_{11}, S_{22} = f (f)
I_C = 20 mA, V_{CE} = 10 V, Z_0 = 50 Ω
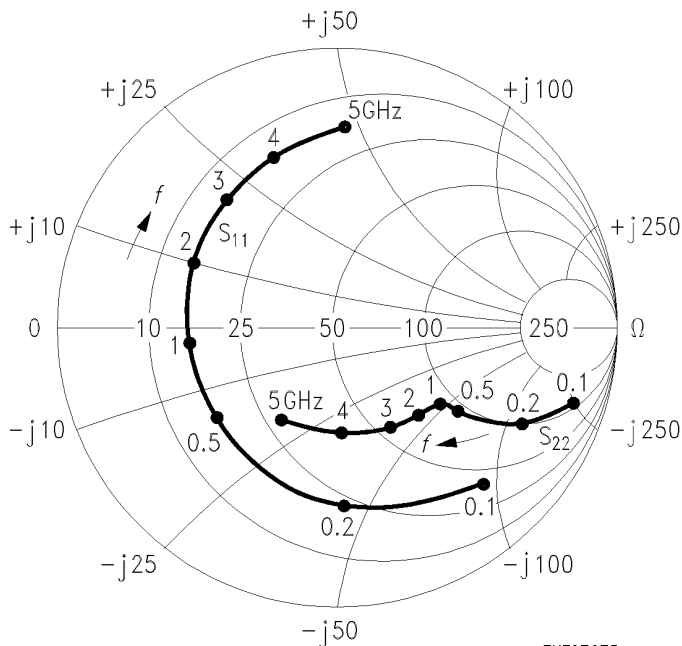
S_{12}, S_{21} = f (f)
I_C = 20 mA, V_{CE} = 10 V, Z_0 = 50 Ω
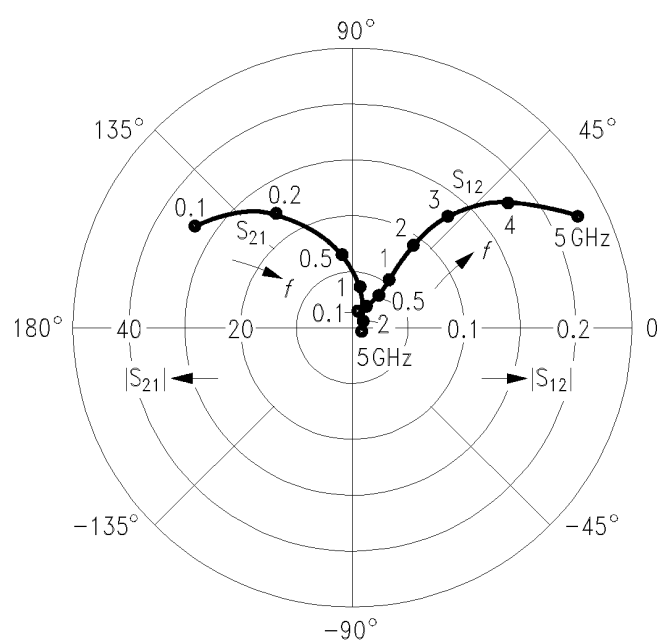
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Common Emitter S Parameters (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_C = 25 mA, V_{CE} = 10 V, Z_0 = 50 Ω								
0.1	0.69	− 55	34.86	143	0.013	66	0.83	− 19
0.2	0.59	− 94	24.49	121	0.020	55	0.66	− 27
0.3	0.54	− 120	18.09	109	0.025	50	0.56	− 29
0.4	0.51	− 135	14.03	101	0.029	50	0.51	− 28
0.6	0.51	− 154	9.73	90	0.035	52	0.45	− 28
0.8	0.50	− 167	7.33	82	0.042	54	0.43	− 29
1.0	0.52	− 176	5.90	76	0.049	56	0.41	− 30
1.2	0.51	175	4.96	70	0.057	57	0.40	− 32
1.5	0.52	165	4.00	62	0.068	57	0.40	− 35
1.8	0.53	158	3.34	54	0.080	56	0.39	− 40
2.0	0.55	153	3.02	50	0.087	55	0.38	− 43
2.5	0.57	143	2.47	38	0.108	53	0.36	− 52
3.0	0.60	131	2.10	27	0.130	49	0.36	− 63
3.5	0.62	122	1.85	16	0.152	46	0.35	− 75
4.0	0.64	110	1.65	5	0.179	40	0.36	− 90
4.5	0.67	101	1.48	− 6	0.200	34	0.35	− 105
5.0	0.68	90	1.33	− 16	0.224	27	0.36	− 122

S_{11}, S_{22} = f (f), Z-plane
I_C = 25 mA, V_{CE} = 10 V, Z_0 = 50 Ω
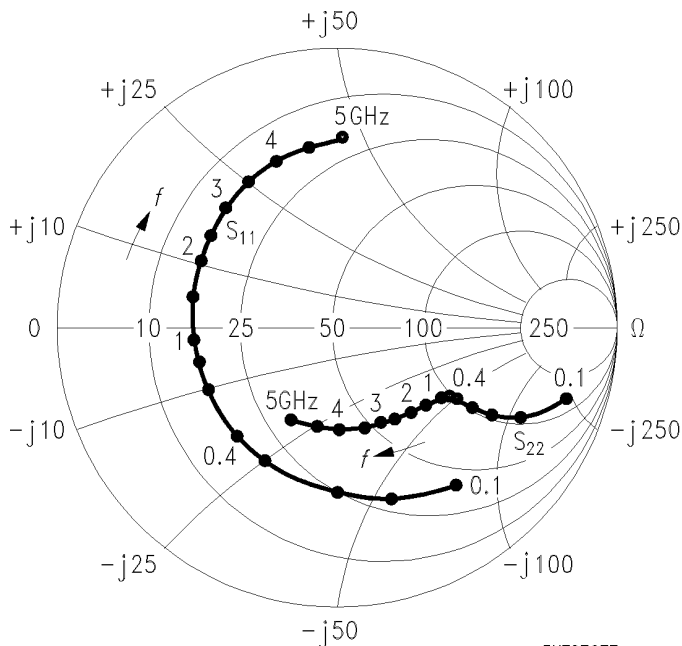
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S_{12}, S_{21} = f (f)
I_C = 25 mA, V_{CE} = 10 V, Z_0 = 50 Ω

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