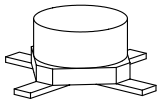
SIEMENS

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.



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, $T_S \leq 115$ °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					
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	–	

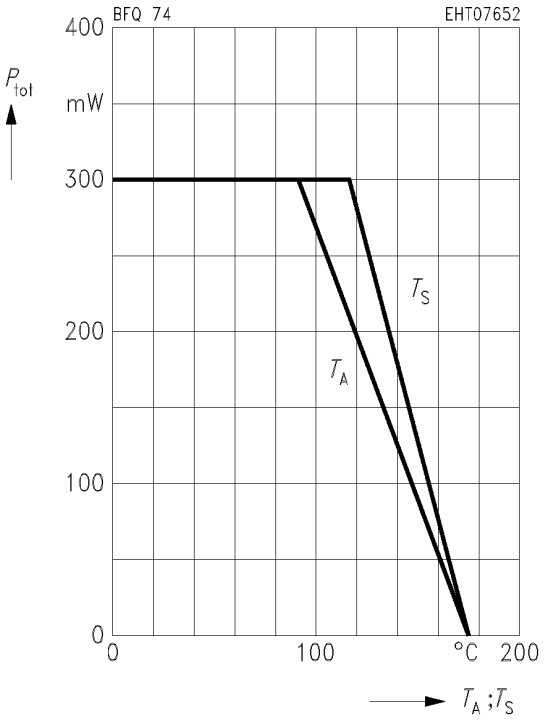
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
AC Characteristics					
Transition frequency	f_T				GHz
I_C = 5 mA, V_{CE} = 10 V, f = 200 MHz		–	4.4	–	
I_C = 15 mA, V_{CE} = 10 V, f = 200 MHz		–	6	–	
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	F				dB
I_C = 3 mA, V_{CE} = 10 V, f = 10 MHz, Z_S = 75 Ω		–	0.9	–	
I_C = 5 mA, V_{CE} = 10 V, f = 800 MHz, Z_S = 50 Ω		–	1.4	–	
I_C = 10 mA, V_{CE} = 10 V, f = 2 GHz, Z_S = Z_{Sopt}		–	2.5	2.9	
Power gain					
I_C = 15 mA, V_{CE} = 10 V, f = 2 GHz, Z_0 = 50 Ω	G_{ma}[1])	–	14	–	
I_C = 15 mA, V_{CE} = 10 V, f = 4 GHz, Z_0 = 50 Ω	G_{ms}[2])	–	9.8	–	
Transducer gain I_C = 15 mA, V_{CE} = 10 V, f = 2 GHz, Z_0 = 50 Ω	$\lvert S_{21e} \rvert^2$	–	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

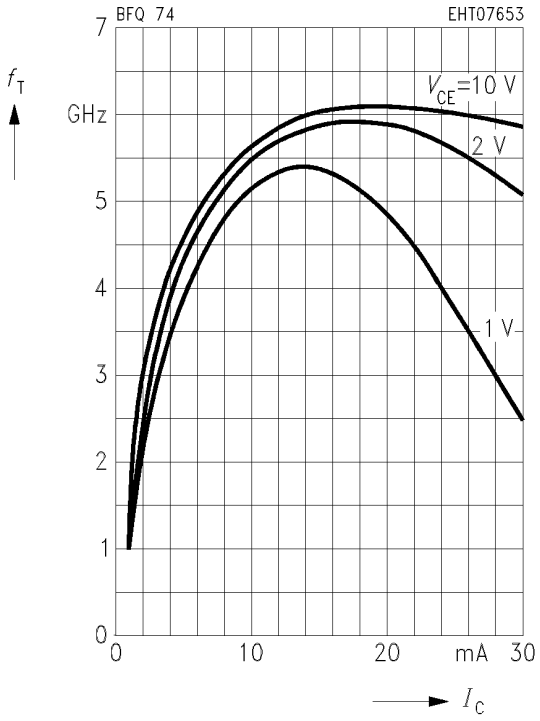
1) $\left| \frac{S_{21e}}{S_{12e}} \right| (k - \sqrt{k^2 - 1})$

2) $\left| \frac{S_{21e}}{S_{12e}} \right|$

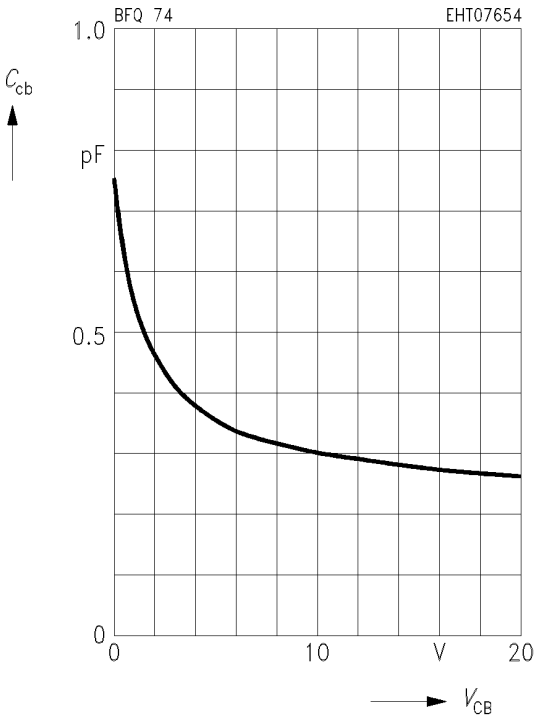
Total power dissipation $P_{tot} = f(T_A^*; T_S)$
*Package mounted on alumina



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

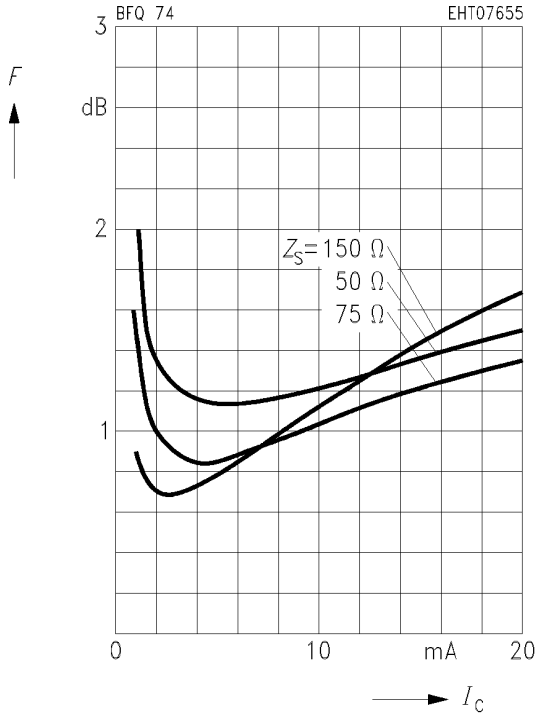


Common Emitter Noise Parameters

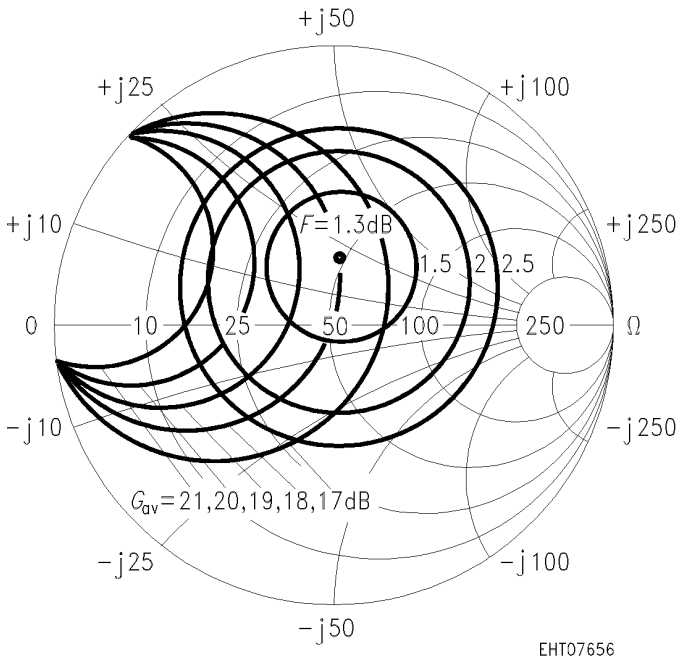
f	F_{min}	$G_p(F_{min})$	Γ_{opt}		R_N	N	$F_{50\,\Omega}$	$G_p(F_{50\Omega})$
GHz	**dB**	**dB**	**MAG**	**ANG**	Ω	–	**dB**	**dB**
I_C = 3 mA, V_{CE} = 10 V, Z_0 = 50 Ω								
0.01	0.7	–	(Z_S = 150 Ω)		–	–	1.2	–
I_C = 10 mA, V_{CE} = 10 V, Z_0 = 50 Ω								
0.01	1.05	–	(Z_S = 75 Ω)		–	–	1.2	–
0.8	1.3	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 $F = f(I_C)$

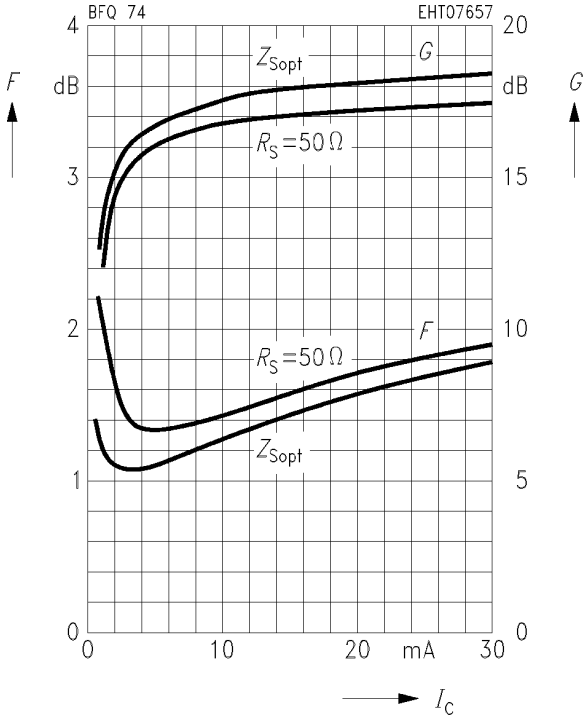
V_{CE} = 10 V, f = 10 MHz



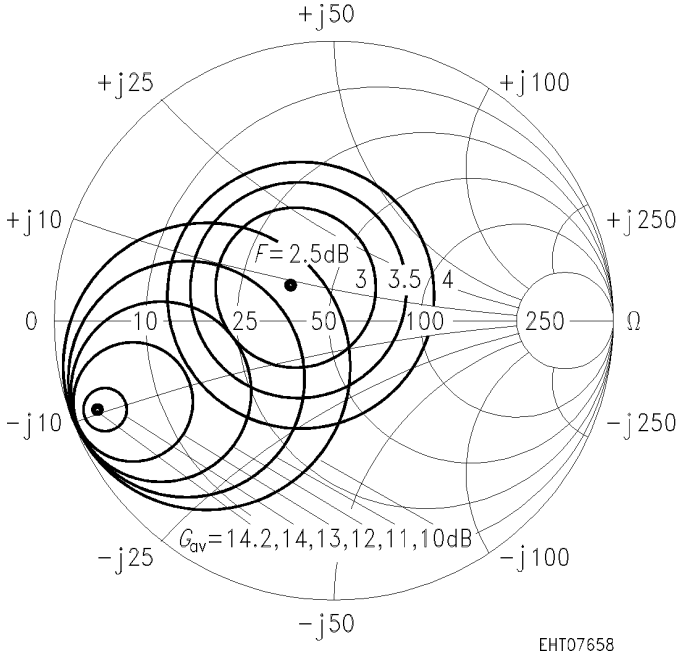
Circles of constant noise figure $F = f(Z_S)$ and available power gain $G_{av} = f(Z_S)$
I_C = 10 mA, V_{CE} = 10 V, f = 800 MHz



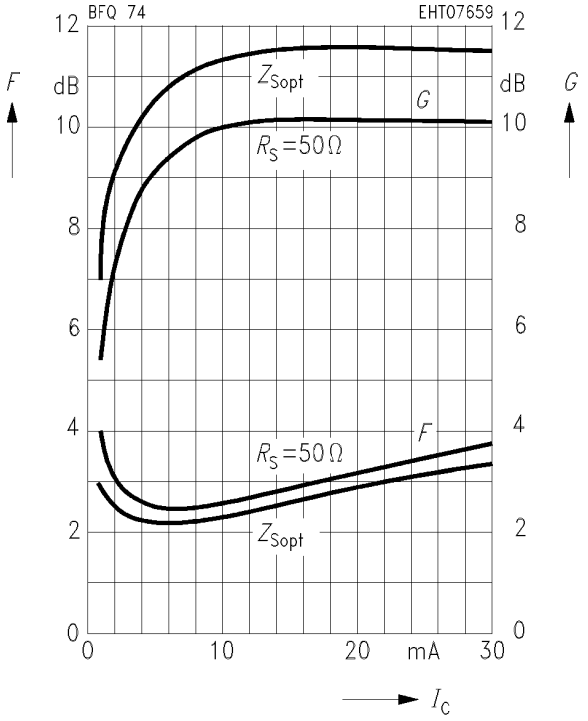
Noise figure $F = f(I_C)$
Power gain $G = f(I_C)$
V_{CE} = 10 V, f = 800 MHz, Z_{Lopt} (G)



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

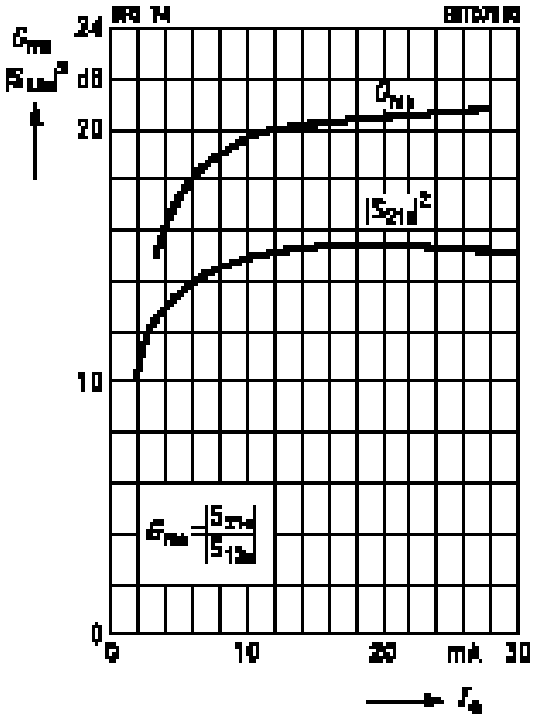


Noise figure $F = f(I_C)$
Power gain $G = f(I_C)$
V_{CE} = 10 V, f = 2 GHz, Z_{Lopt} (G)

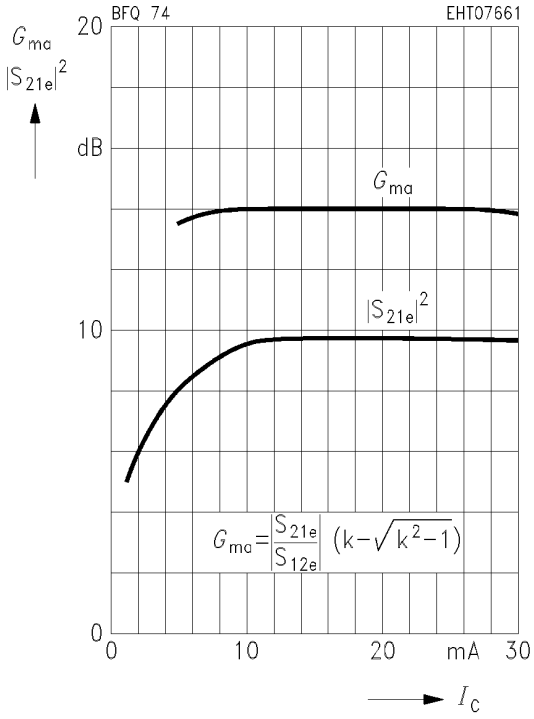


Common Emitter Power Gain

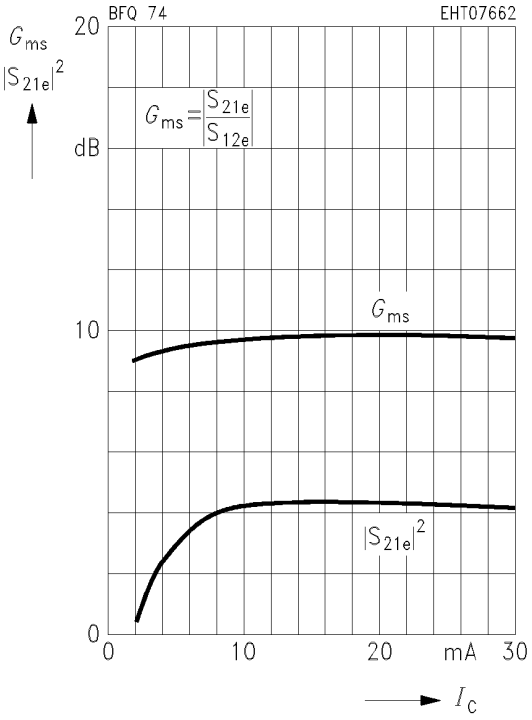
Power gain G_{ms}, $|S_{21e}|^2 = f(I_C)$
V_{CE} = 10 V, f = 1 GHz, Z_0 = 50 Ω



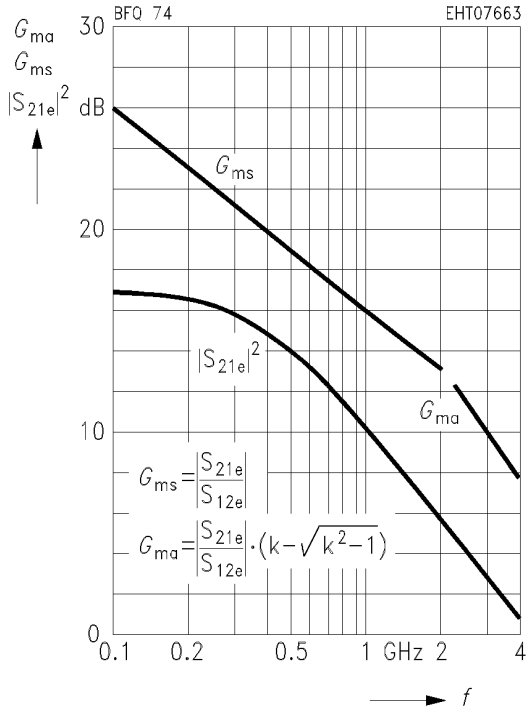
Power gain G_{ma}, $|S_{21e}|^2 = f(I_C)$
V_{CE} = 10 V, f = 2 GHz, Z_0 = 50 Ω



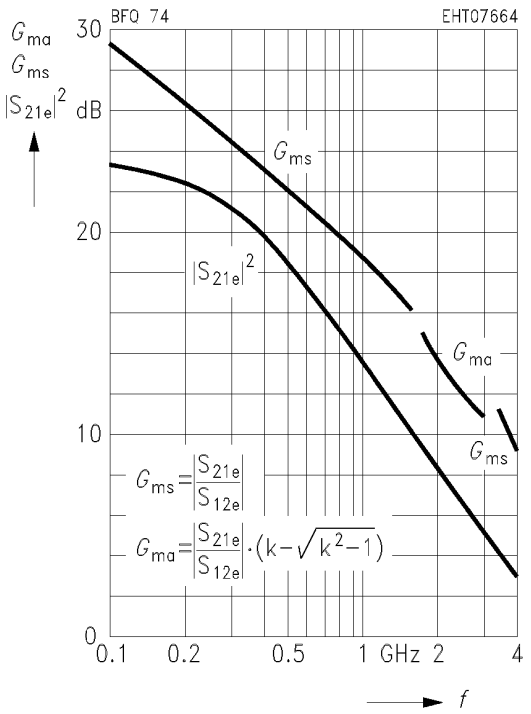
Power gain G_{ms}, $|S_{21e}|^2 = f(I_C)$
V_{CE} = 10 V, f = 4 GHz, Z_0 = 50 Ω



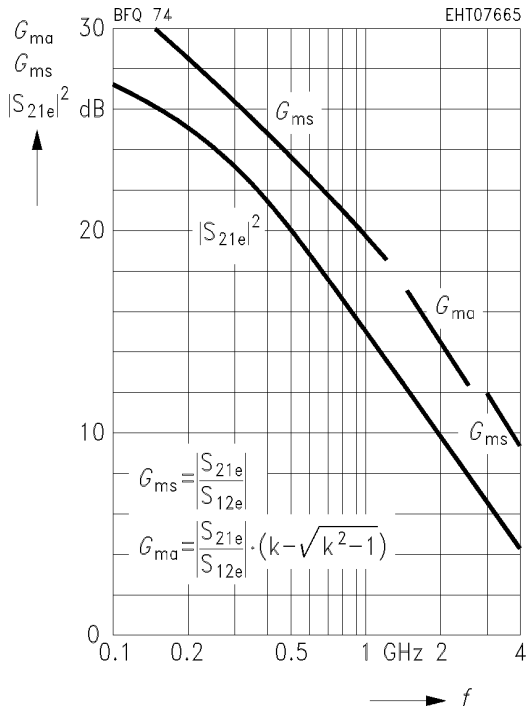
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
I_C = 2 mA, V_{CE} = 10 V, Z_0 = 50 Ω



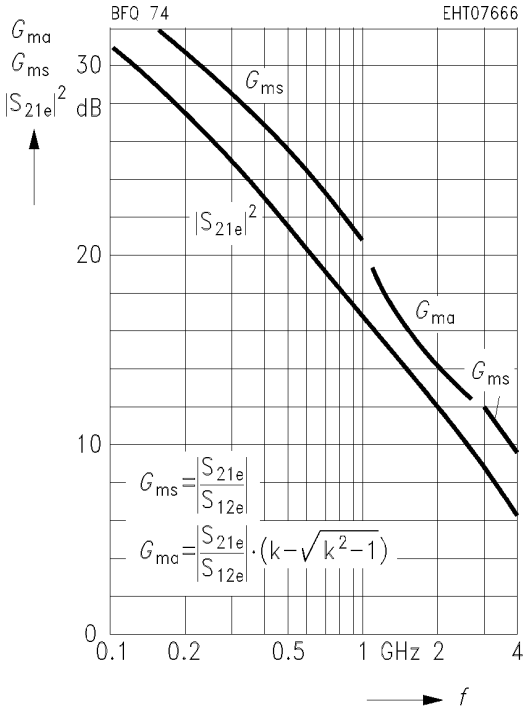
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
I_C = 5 mA, V_{CE} = 10 V, Z_0 = 50 Ω



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



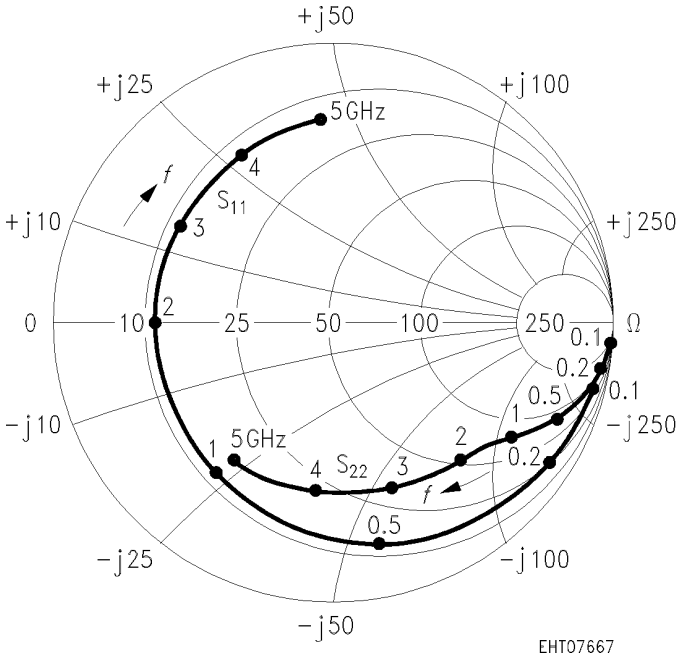
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
I_C = 25 mA, V_{CE} = 10 V, Z_0 = 50 Ω



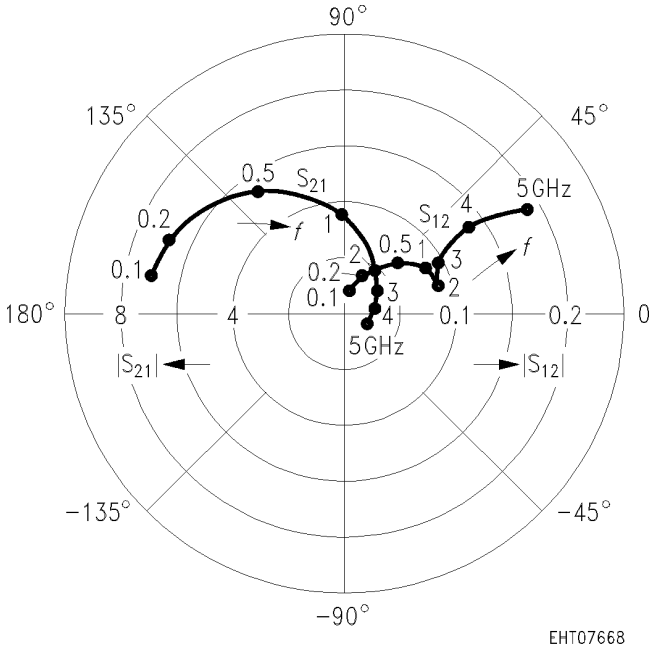
Common Emitter S Parameters

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								
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



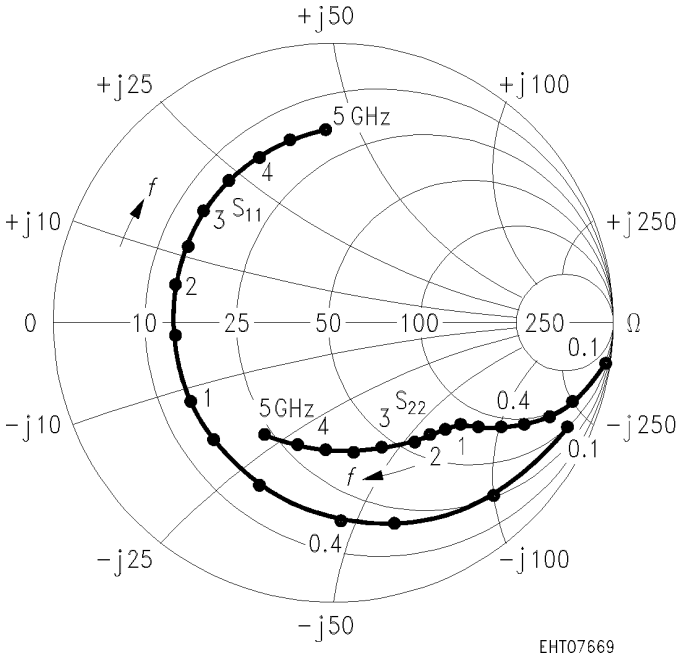
S_{12}, S_{21} = f (f)
I_C = 2 mA, V_{CE} = 10 V, Z_0 = 50 Ω



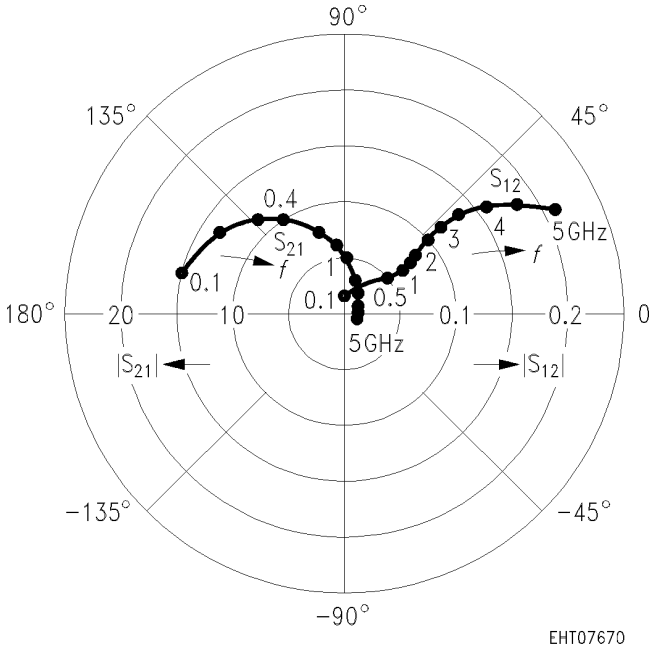
Common Emitter S Parameters (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**
I_C = 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



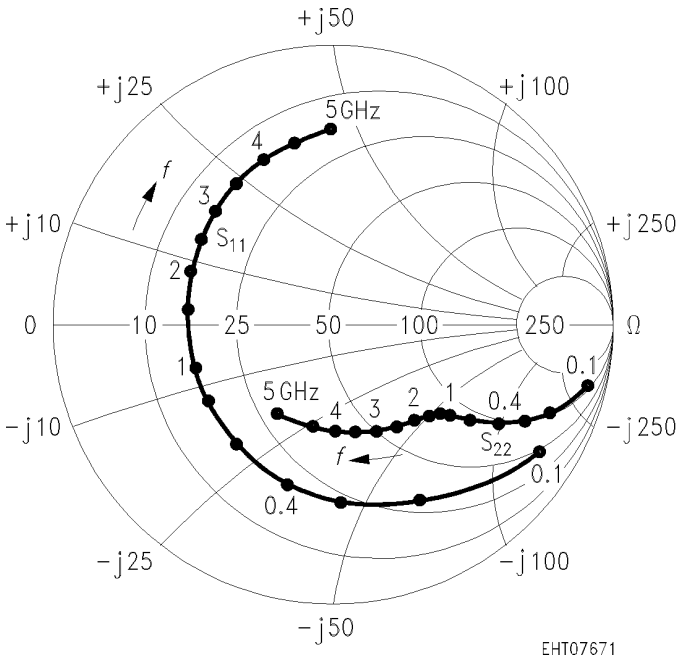
***S*₁₂, *S*₂₁ = *f* (*f*)**
I_C = 5 mA, V_{CE} = 10 V, Z_0 = 50 Ω



Common Emitter S Parameters (continued)

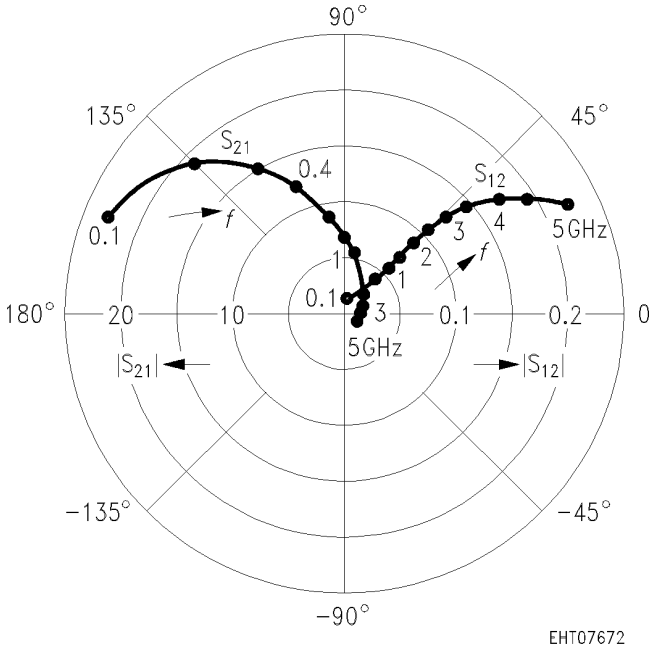
f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_C = 10 mA, V_{CE} = 10 V, Z_0 = 50 Ω								
0.1	0.83	– 35	22.64	155	0.015	70	0.92	– 13
0.2	0.71	– 65	18.55	134	0.026	59	0.80	– 23
0.3	0.63	– 89	14.98	121	0.034	53	0.70	– 27
0.4	0.58	– 105	12.22	112	0.039	48	0.63	– 30
0.6	0.55	– 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



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

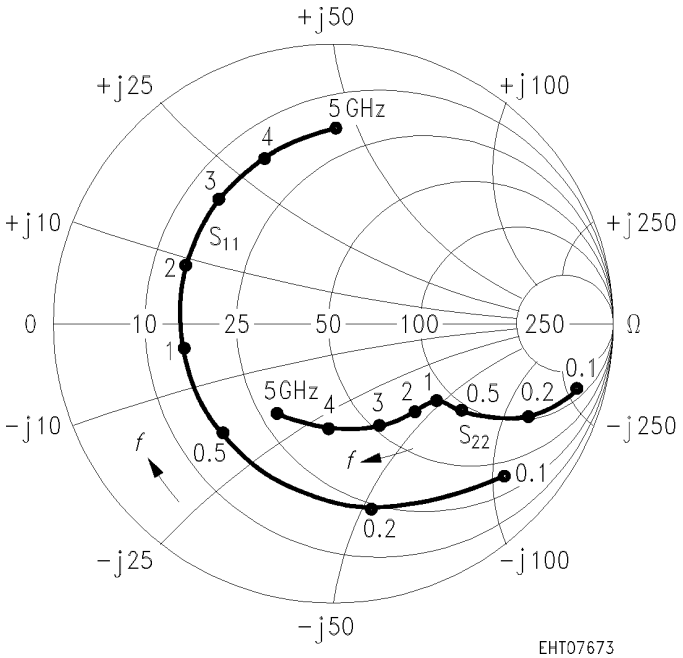


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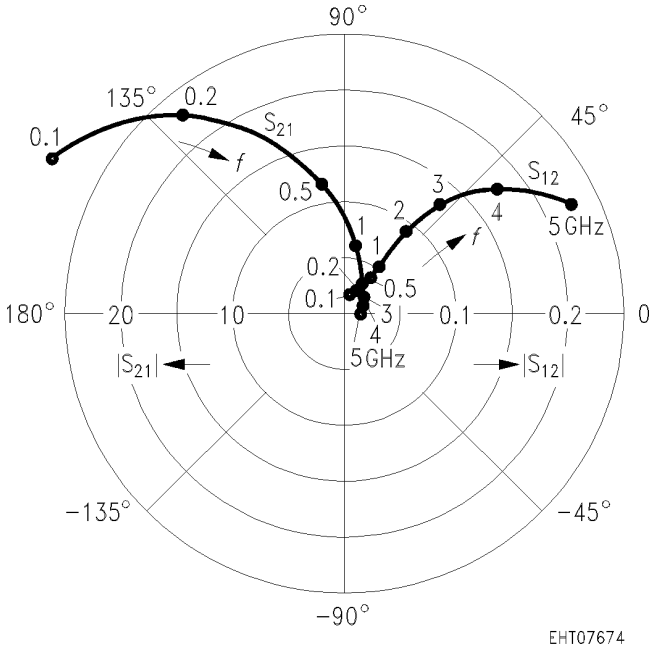
Common Emitter S Parameters (continued)

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



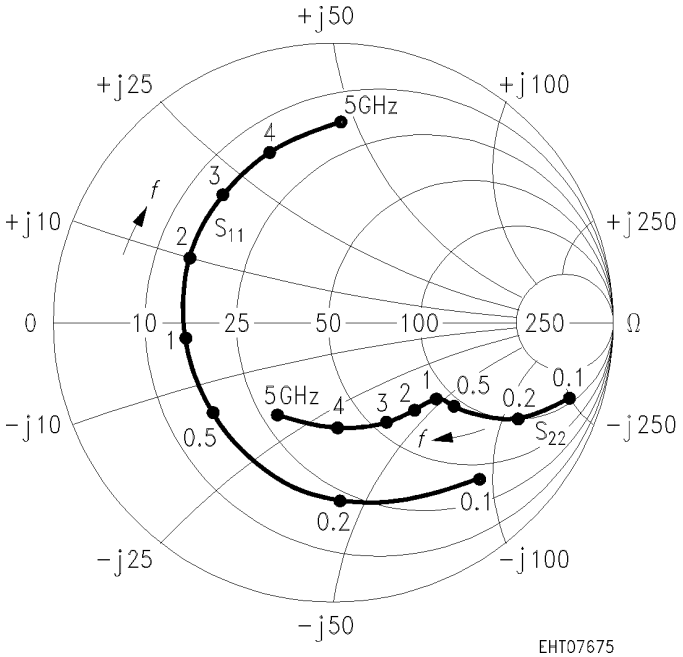
***S*₁₂, *S*₂₁ = *f* (*f*)**
I_C = 15 mA, V_{CE} = 10 V, Z_0 = 50 Ω



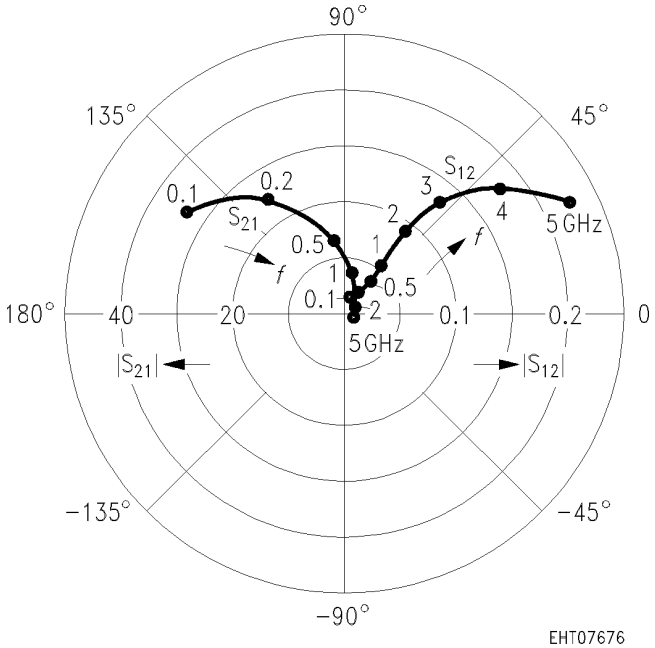
Common Emitter S Parameters (continued)

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



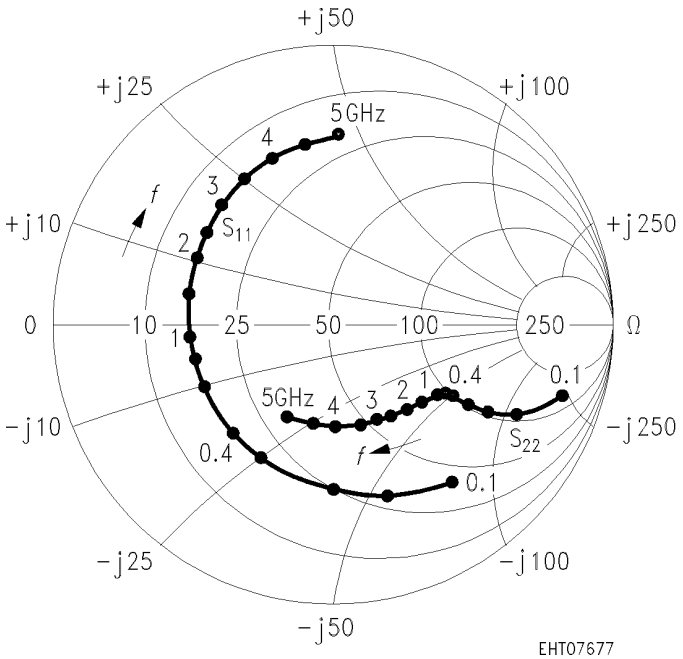
S_{12}, S_{21} = f (f)
I_C = 20 mA, V_{CE} = 10 V, Z_0 = 50 Ω



Common Emitter S Parameters (continued)

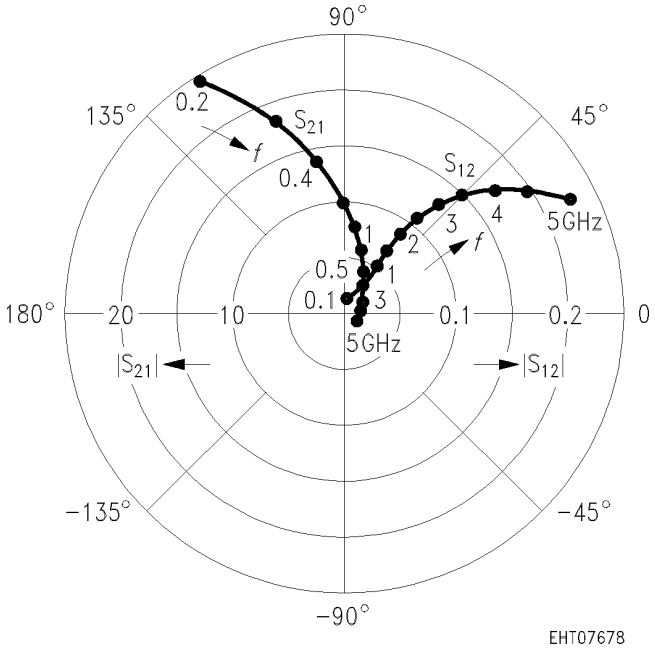
f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**
I_C = 25 mA, V_{CE} = 10 V, Z_0 = 50 Ω								
0.1	0.69	– 55	34.86	143	0.013	66	0.83	– 19
0.2	0.59	– 94	24.49	121	0.020	55	0.66	– 27
0.3	0.54	– 120	18.09	109	0.025	50	0.56	– 29
0.4	0.51	– 135	14.03	101	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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