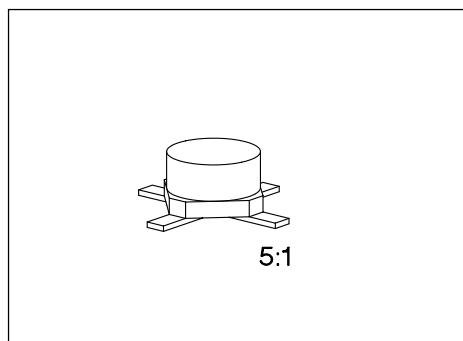# SIEMENS

NPN Silicon RF Transistor   BFQ 72

● For low-distortion broadband amplifiers up to 2 GHz
  at collector currents from 10 mA to 30 mA.

● Hermetically sealed ceramic package.

● HiRel/Mil screening available.

● CECC-type available: CECC 50002/263.

5:1

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

Type	Marking	Ordering Code (tape and reel)	Pin Configuration				Package[1]
			1	2	3	4	
BFQ 72	72	Q62702-F776	B	E	C	E	Cerec-X

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CE0}	15	V
Collector-emitter voltage, $V_{BE} = 0$	V_{CES}	20	
Collector-base voltage	V_{CB0}	20	
Emitter-base voltage	V_{EB0}	2.5	
Collector current	I_C	50	mA
Base current	I_B	10	
Total power dissipation, $T_S \leq 112\ ^{\circ}C$ [3]	P_{tot}	350	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]	$R_{th\ JA}$	≤ 260	K/W
Junction - soldering point [3]	$R_{th\ JS}$	≤ 180	

---

[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 $I_C = 1\ mA$, $I_B = 0$	$V_{(BR)CE0}$	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_{CB0}	–	–	50	nA
Emitter-base cutoff current $V_{EB} = 2\ V$, $I_C = 0$	I_{EB0}	–	–	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	–	

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 = 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	–	
Input capacitance V_{EB} = 0.5 V, I_C = i_c = 0, f = 1 MHz	C_{ibo}	–	2.1	–	
Output capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{obs}	–	0.95	1.5	
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	–	
Transducer gain I_C = 25 mA, V_{CE} = 8 V, f = 1 GHz, Z_0 = 50 Ω	$\lvert S_{21e} \rvert^2$	–	12.5	–	
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 $P_{tot} = f(T_A^*; T_S)$
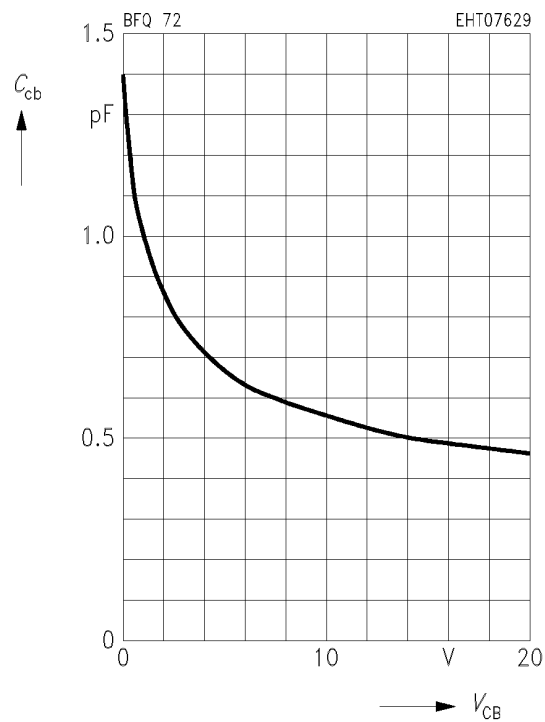*Package mounted on alumina
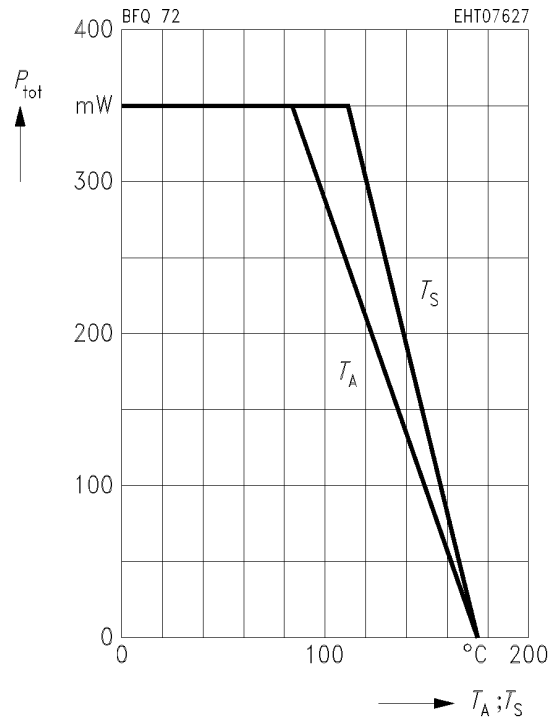
Transition frequency $f_T = f(I_C)$
$V_{CE} = 5$ V, $f = 200$ MHz
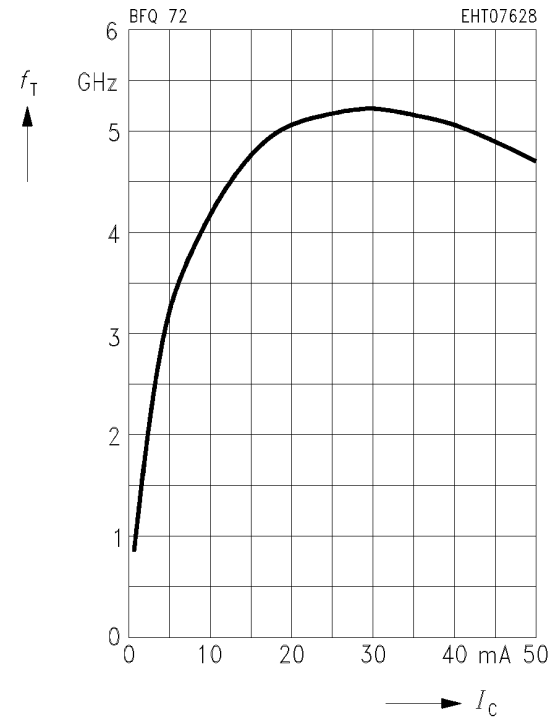
Collector-base capacitance $C_{cb} = f(V_{CB})$
$V_{BE} = v_{be} = 0, f = 1$ MHz

Common Emitter Noise Parameters

f	F_{min}	$G_p(F_{min})$	Γ_{opt}		R_N	N	$F_{50\,\Omega}$	$G_p(F_{50\,\Omega})$
GHz	**dB**	**dB**	**MAG**	**ANG**		**–**	**dB**	**dB**

$I_C = 2$ mA, $V_{CE} = 8$ 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	1.0	–	($Z_S = 150\ \Omega$)		–	–	1.6	–

$I_C = 10$ mA, $V_{CE} = 8$ 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	1.5	–	($Z_S = 90\ \Omega$)		–	–	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
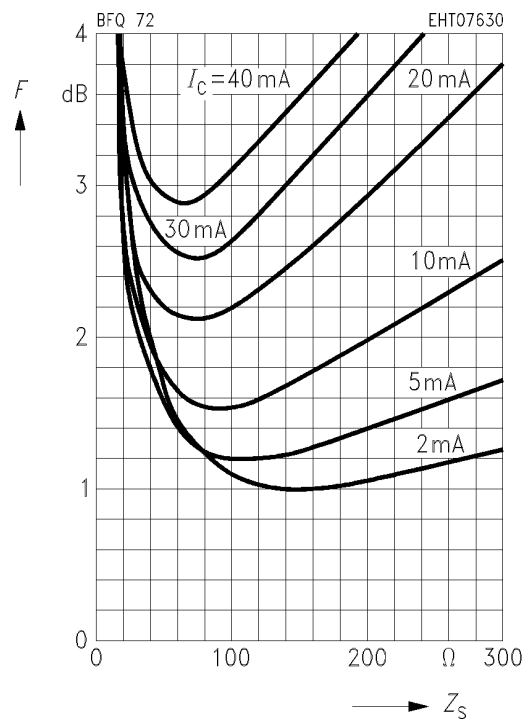
Circles of constant noise figure $F = f(Z_S)$
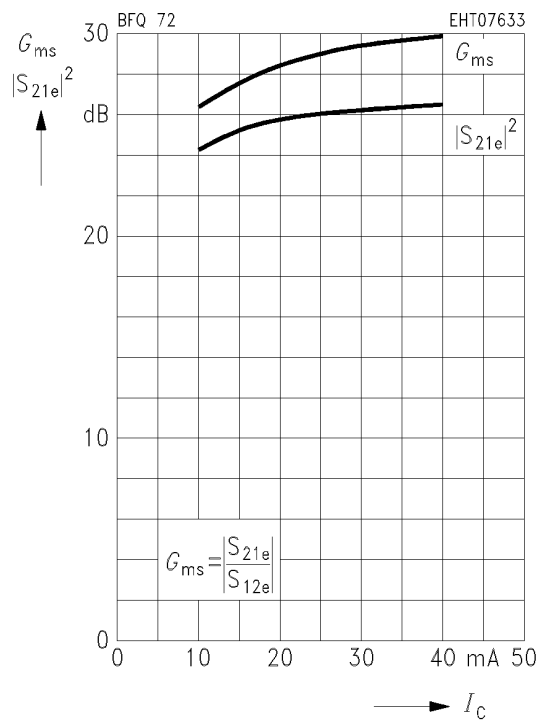in Z_S-plane, $I_C = 10$ mA, $V_{CE} = 8$ V,
$f = 800$ MHz
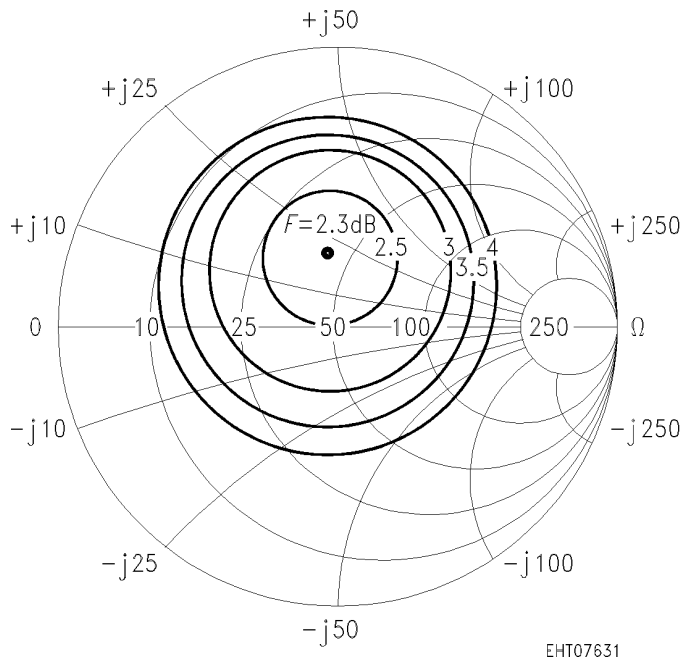
Noise figure $F = f(I_C)$
Power gain $G = f(I_C)$
$V_{CE} = 8$ V, $f = 800$ MHz, $Z_{Lopt}(G)$
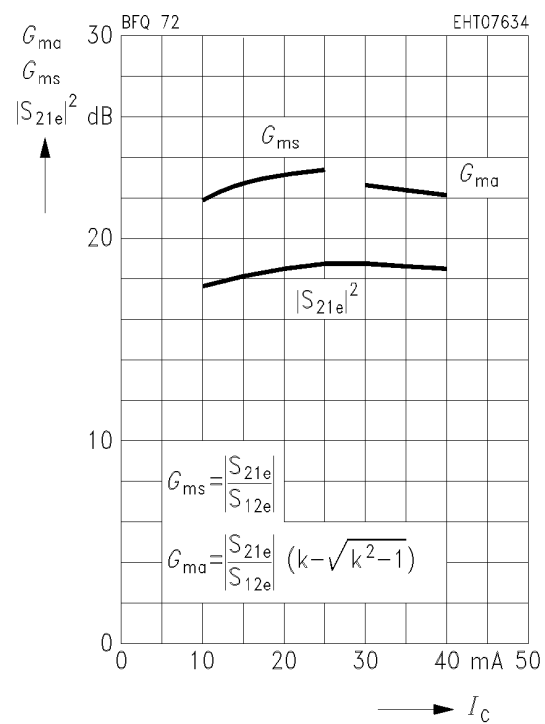

EHT07631
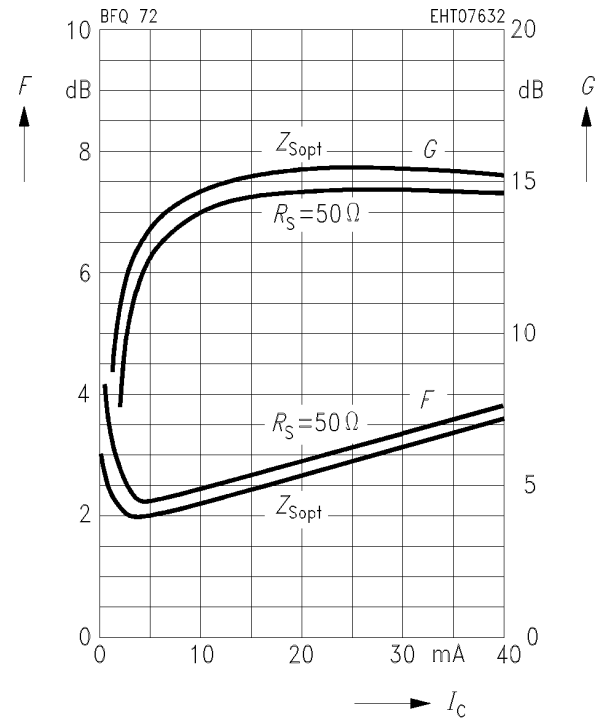
Common Emitter Power Gain

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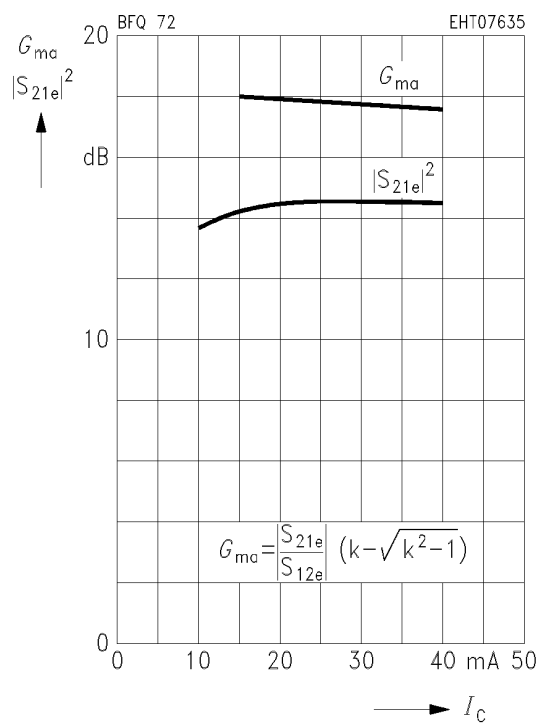$V_{CE} = 8$ V, $f = 200$ MHz, $Z_0 = 50$ Ω

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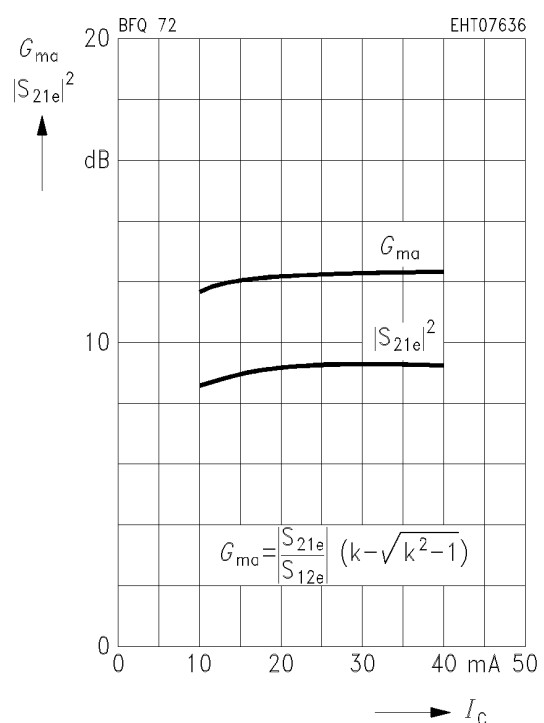$V_{CE} = 8$ V, $f = 500$ MHz, $Z_0 = 50$ Ω

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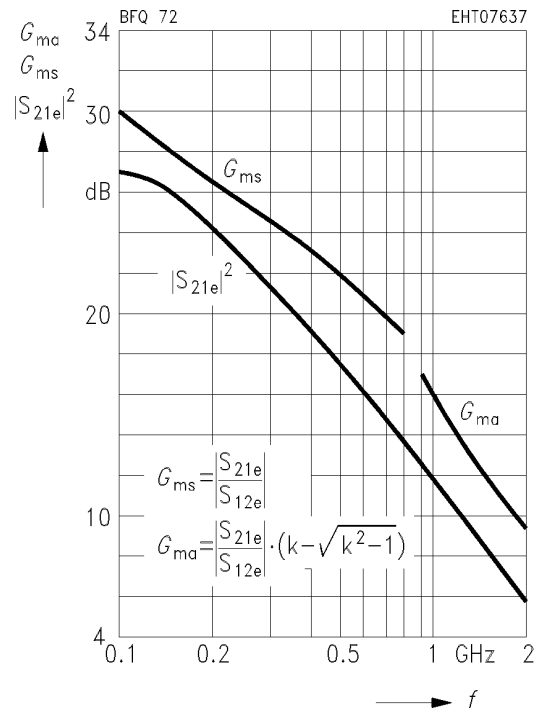$V_{CE} = 8$ V, $f = 800$ MHz, $Z_0 = 50$ Ω

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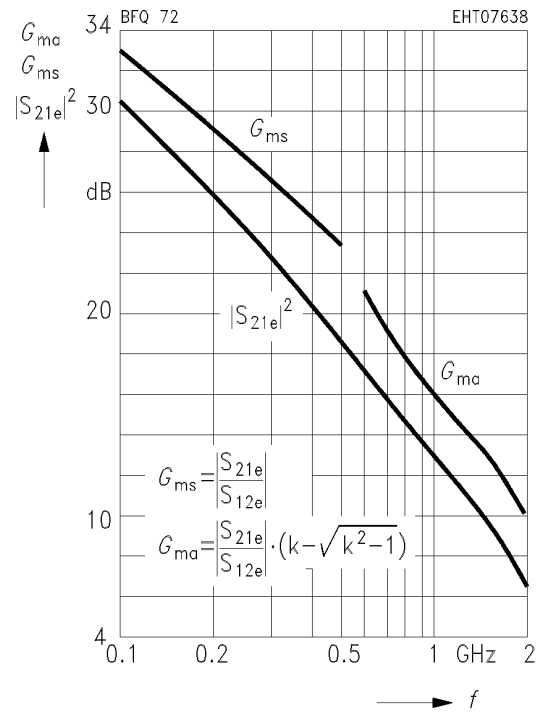$V_{CE} = 8$ V, $f = 1.5$ GHz, $Z_0 = 50$ Ω

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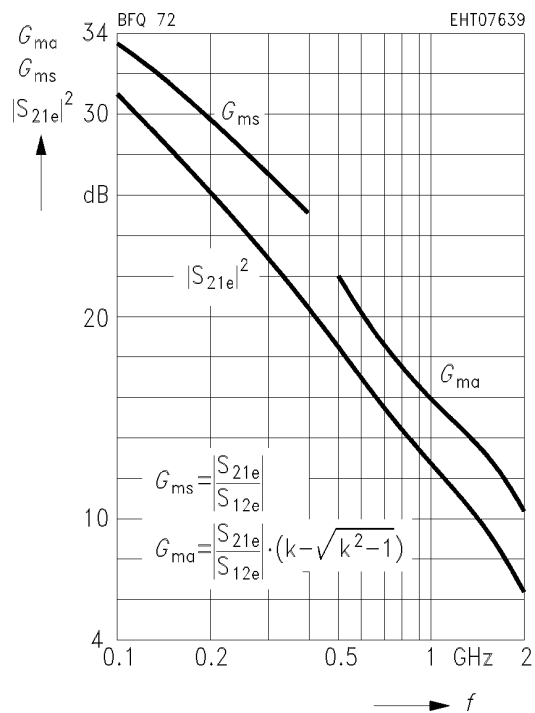$I_C = 10$ mA, $V_{CE} = 8$ V, $Z_0 = 50$ Ω

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

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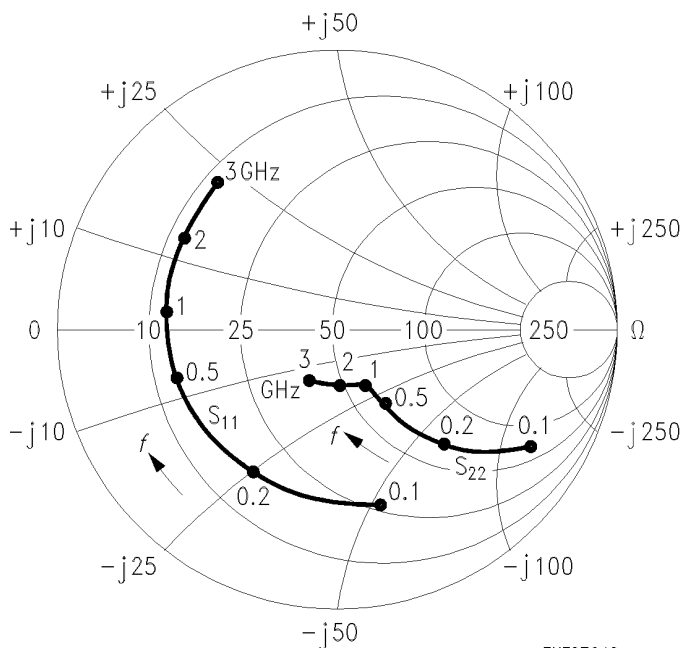
Common Emitter S Parameters

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_C = 15 mA, V_{CE} = 5 V, Z_0 = 50 Ω								
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

EHT07640

S_{12}, S_{21} = f (f)
I_C = 15 mA, V_{CE} = 5 V, Z_0 = 50 Ω
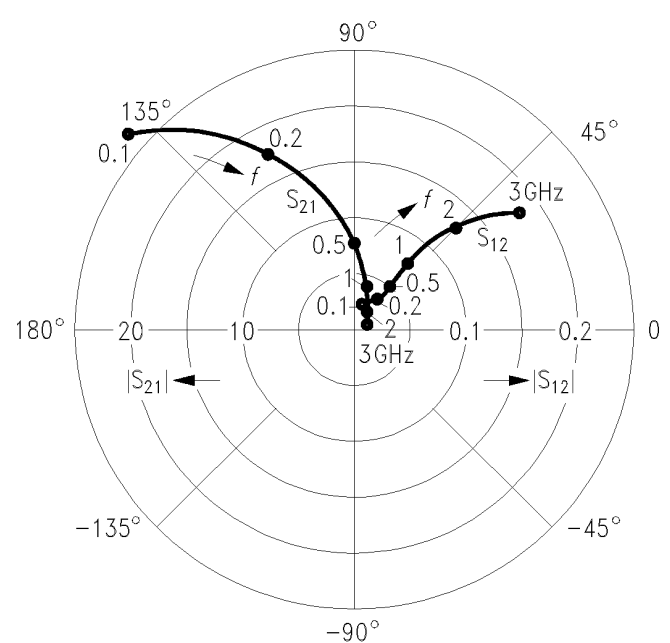
EHT07641

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} = 5 V, Z_0 = 50 Ω								
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
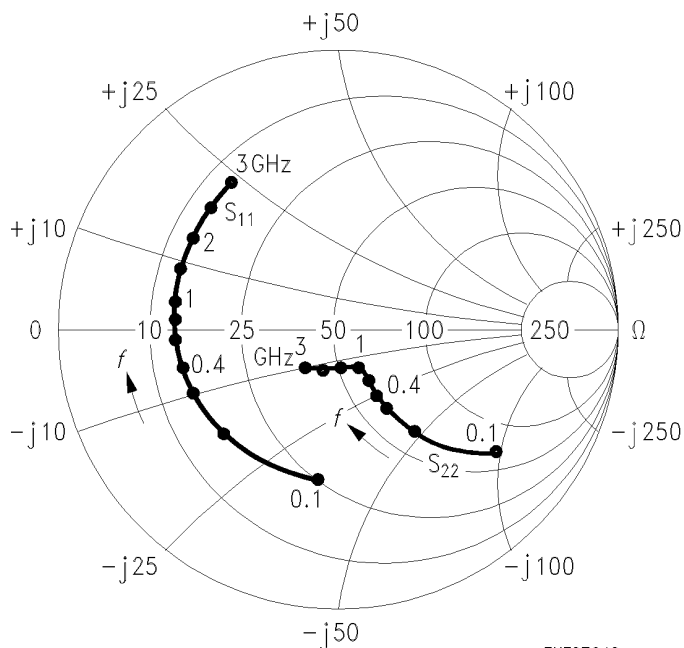
$S_{12}, S_{21} = f\,(f)$
I_C = 25 mA, V_{CE} = 5 V, Z_0 = 50 Ω
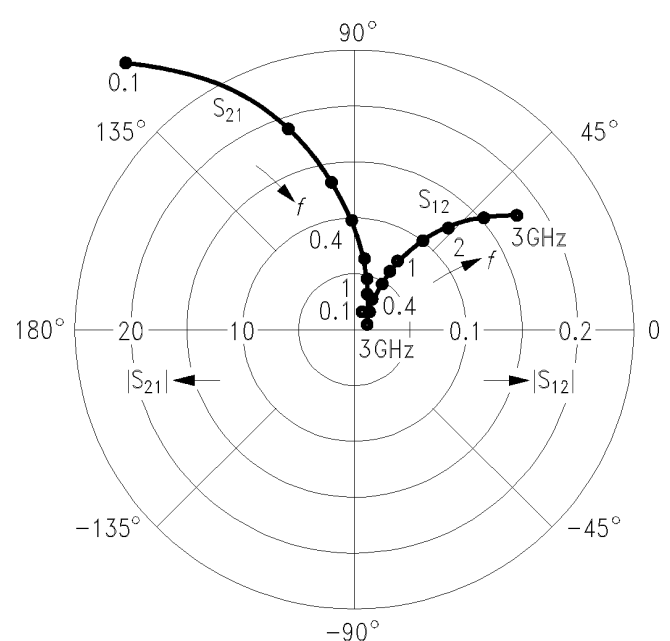
EHT07642

EHT07643

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 = 50 mA, V_{CE} = 5 V, Z_0 = 50 Ω								
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
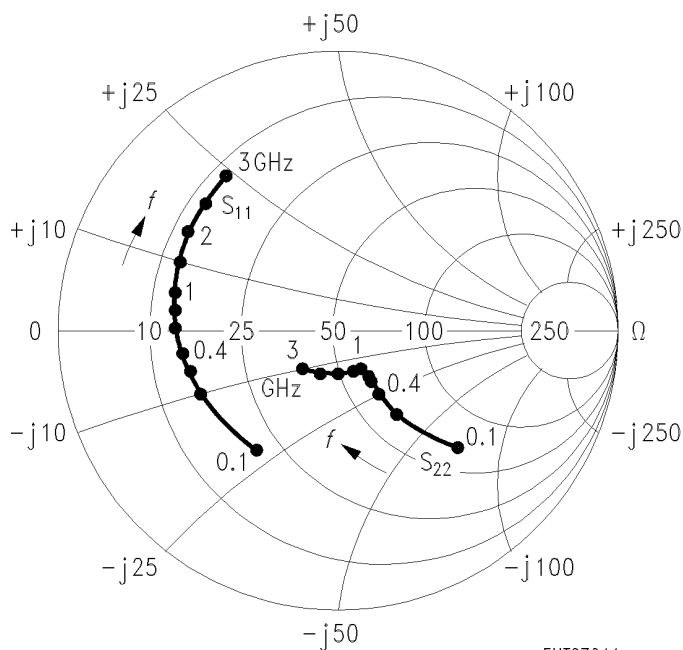
EHT07644

S_{12}, S_{21} = f (f)
I_C = 50 mA, V_{CE} = 5 V, Z_0 = 50 Ω
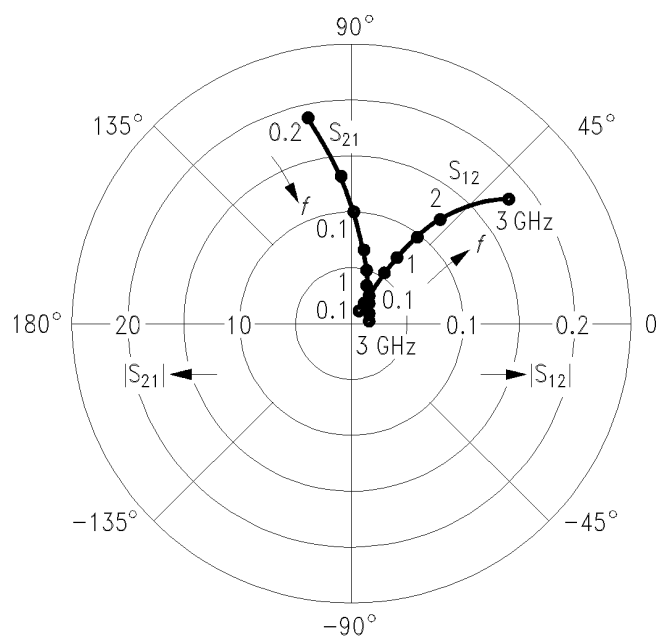
EHT07645

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} = 8 V, Z_0 = 50 Ω								
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
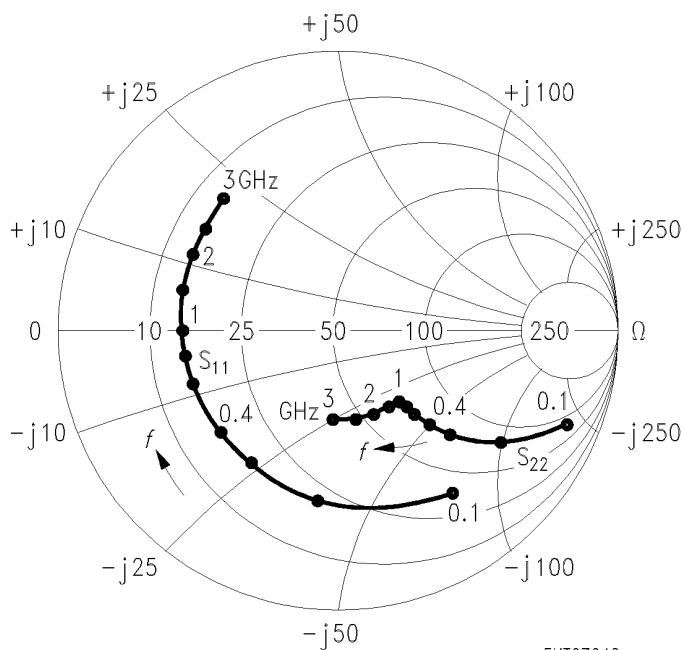
EHT07646

S_{12}, S_{21} = f (f)
I_C = 10 mA, V_{CE} = 8 V, Z_0 = 50 Ω
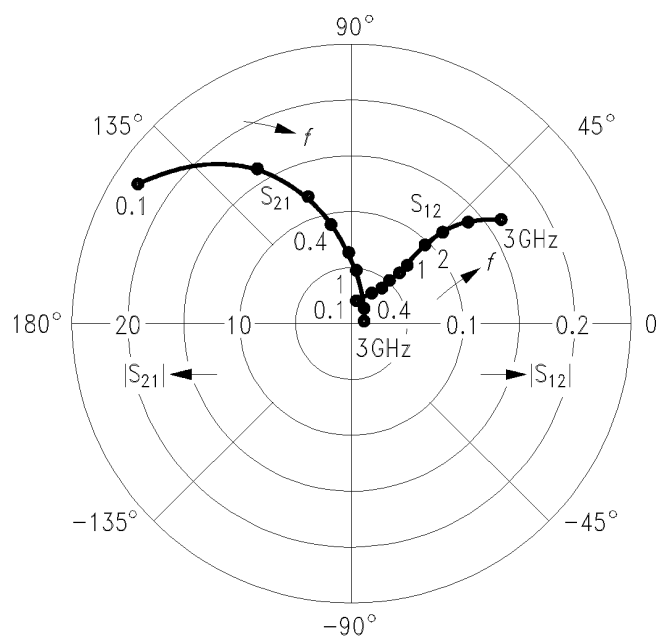
EHT07647

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} = 8 V, Z_0 = 50 Ω								
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
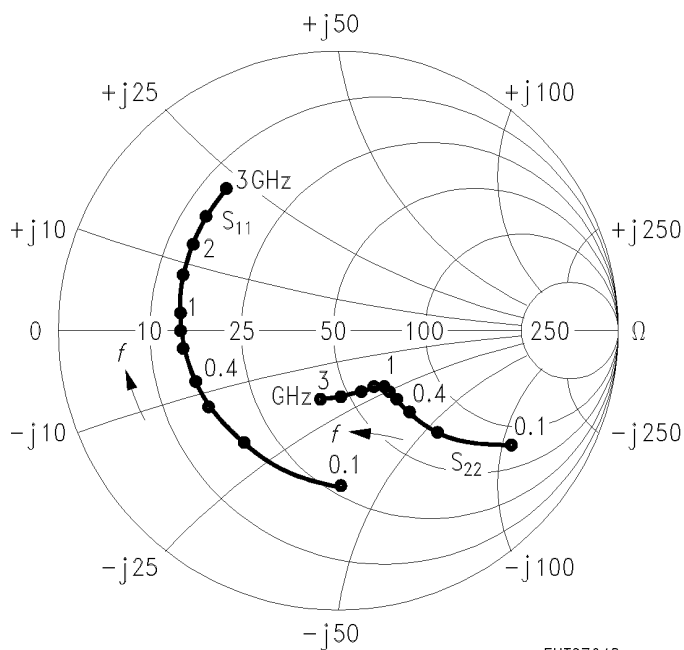
S_{12}, $S_{21} = f\,(f)$
I_C = 25 mA, V_{CE} = 8 V, Z_0 = 50 Ω
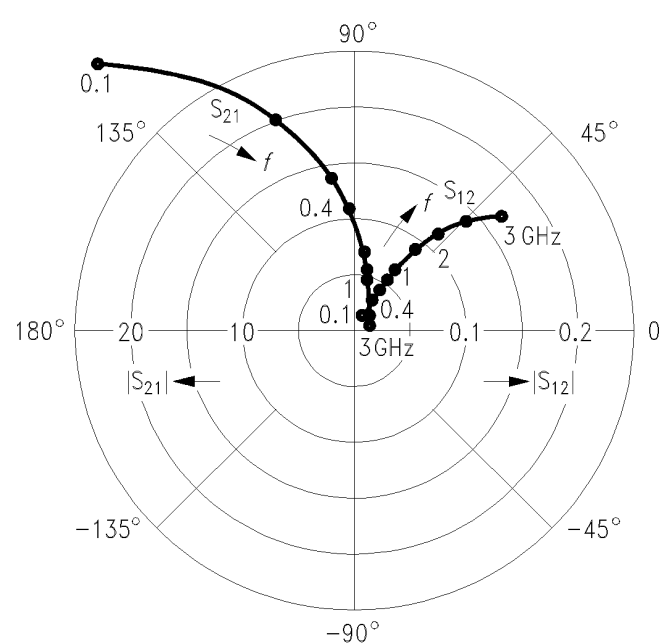
EHT07648

EHT07649

Common Emitter S Parameters (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
$I_C = 40$ mA, $V_{CE} = 8$ V, $Z_0 = 50$ Ω								
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
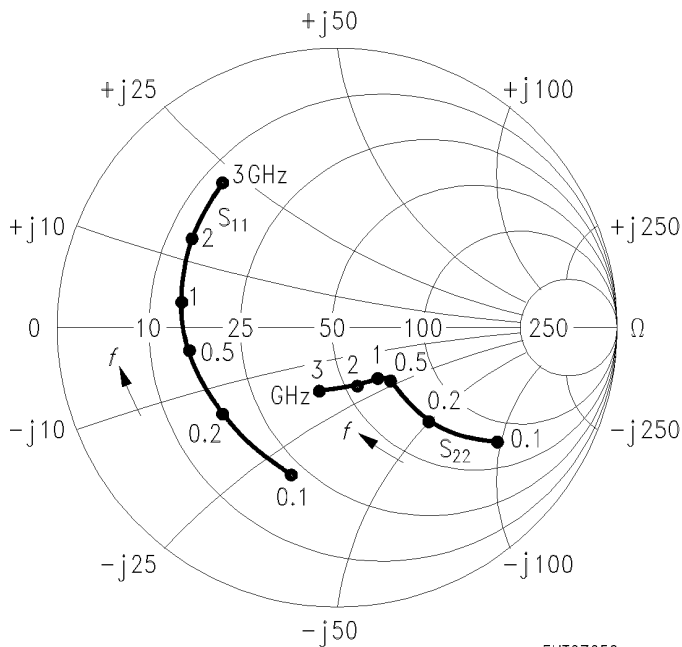
$S_{12}, S_{21} = f(f)$
$I_C = 40$ mA, $V_{CE} = 8$ V, $Z_0 = 50$ Ω

EHT07650

EHT07651