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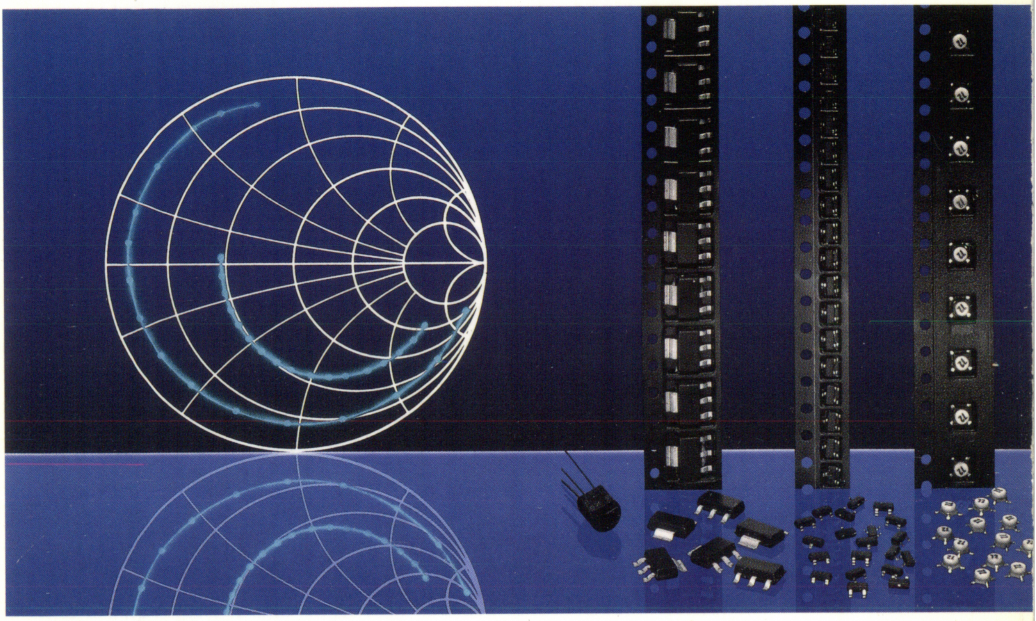

Einzelhalbleiter
Small-Signal Semiconductors

HF-Transistoren und Dioden
RF Transistors and Diodes

Datenbuch I

Data Book I

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1.1 Zero Bias

Type	Max. Ratings V_R V	I_F mA	Characteristics at T_A = 25°C V_{BR} V	C_T pF	V_F mV	r_f kΩ	Package	Page
Beam Lead Technology in Ceramic Package								
BAT 32	6.5	50	6.5	0.20	– 20	15	Cerec-X	246
Beam Lead								
BAT 30	6.5	50	6.5	0.14	– 20	15	S1	244

1.2 Low Barrier

Type	Max. Ratings V_R V	I_F mA	Characteristics at T_A = 25°C F_{SSB} dB	V_{BR} V	C_T pF	V_F V	r_f Ω	Package	Page
Ceramic Package									
BAT 15-014	3	100	5.5 (3 GHz)	3	0.25	0.26	3.0	T1	219
BAT 15-044	3	100	5.5 (6 GHz)	3	0.20	0.28	3.5	T1	219
BAT 15-074	3	50	5.5 (9.7 GHz)	3	0.17	0.29	4.5	T1	219
BAT 15-104	3	50	6.0 (16 GHz)	3	0.13	0.30	5.5	T1	219
BAT 15-124	3	50	9.0 (16 GHz)	3	0.10	0.31	8.0	T1	219
Beam Lead Technology in Ceramic Package									
BAT 15-022 R BAT 15-025 S BAT 15-025 D BAT 15-025 R	– 4 4 –	100	6.0 (3 GHz)	– 4 4 –	0.33 0.36 0.37 0.37	0.26	3.5	50 mil Cerec-X Cerec-X Cerec-X	217 225 221 223
BAT 15-052 R BAT 15-055 S BAT 15-055 D BAT 15-055 R	– 4 4 –	100	6.5 (6 GHz)	– 4 4 –	0.23 0.26 0.27 0.27	0.28	4.0	50 mil Cerec-X Cerec-X Cerec-X	217 225 221 223
BAT 15-092 R BAT 15-095 S BAT 15-095 D BAT 15-095 R	– 4 4 –	50	6.5 (9.3 GHz)	– 4 4 –	0.17 0.20 0.21 0.21	0.30	7.0	50 mil Cerec-X Cerec-X Cerec-X	217 225 221 223

Type	Max. Ratings		Characteristics at T_A = 25°C					Package	Page
	V_R V	I_F mA	F_{SSB} dB	V_{BR} V	C_T pF	V_F V	r_f Ω		
Beam Lead Technology in Ceramic Package (cont'd)									
BAT 15-112 R	–	50	7.0	–	0.13	0.31	10.0	50 mil	217
BAT 15-115 S	4		(16 GHz)	4	0.16			Cerec-X	225
BAT 15-115 D	4			4	0.17			Cerec-X	221
BAT 15-115 R	–			–	0.17			Cerec-X	223
Beam Lead									
BAT 15-020 S	4	100	6.0 (3 GHz)	4	0.30	0.26	3.5	S	215
BAT 15-020 D	4			4				D	211
BAT 15-020 R	–			–				R	213
BAT 15-050 S	4	100	6.5 (6 GHz)	4	0.20	0.28	4.0	S	215
BAT 15-050 D	4			4				D	211
BAT 15-050 R	–			–				R	213
BAT 15-090 S	4	50	6.5	4	0.14	0.30	7.0	S	215
BAT 15-090 D	4		(9.3 GHz)	4				D	211
BAT 15-090 R	–			–				R	213
BAT 15-110 S	4	50	7.0	4	0.10	0.31	10.0	S	215
BAT 15-110 D	4		(16 GHz)	4				D	211
BAT 15-110 R	–			–				R	213

1.3 Medium Barrier

Type	Max. Ratings		Characteristics at T_A = 25°C					Package	Page
	V_R V	I_F mA	F_{SSB} dB	V_{BR} V	C_T pF	V_F V	r_f Ω		
Ceramic Package									
BAT 14-014 BAT 14-034	3	100	5.5 (3 GHz) 6.5 (3 GHz)	3	0.25	0.42	3.0 4.0	T1	192 192
BAT 14-044 BAT 14-064	3	100	5.5 (6 GHz) 6.5 (6 GHz)	3	0.20	0.43	3.5 4.5	T1	192 192
BAT 14-074 BAT 14-094	3	50	5.5 (9.3 GHz) 6.5 (9.3 GHz)	3	0.17	0.44	4.5 5.5	T1	192 192
BAT 14-104 BAT 14-114	3	50	6.0 (16 GHz) 7.0 (16 GHz)	3	0.13	0.46	5.5 7.0	T1	192 192
BAT 14-124	3	50	9.0 (16 GHz)	3	0.10	0.47	8.0	T1	192
Beam Lead Technology in Ceramic Package									
BAT 14-022 R BAT 14-025 S BAT 14-025 D BAT 14-025 R	– 4 4 –	100	6.0 (3 GHz)	– 4 4 –	0.33 0.36 0.37 0.37	0.45	3.5	50 mil Cerec-X Cerec-X Cerec-X	190 199 195 197
BAT 14-052 R BAT 14-055 S BAT 14-055 D BAT 14-055 R	– 4 4 –	100	6.5 (6 GHz)	– 4 4 –	0.23 0.26 0.27 0.27	0.47	4.0	50 mil Cerec-X Cerec-X Cerec-X	190 199 195 197
BAT 14-092 R BAT 14-095 S BAT 14-095 D BAT 14-095 R	– 4 4 –	50	6.5 (9.3 GHz)	– 4 4 –	0.17 0.20 0.21 0.21	0.49	7.0	50 mil Cerec-X Cerec-X Cerec-X	190 199 195 197
BAT 14-112 R BAT 14-115 S BAT 14-115 D BAT 14-115 R	– 4 4 –	50	7.0 (16 GHz)	– 4 4 –	0.13 0.16 0.17 0.17	0.50	10.0	50 mil Cerec-X Cerec-X Cerec-X	190 199 195 197

Type	Max. Ratings V_R V	I_F mA	Characteristics at T_A = 25°C F_{SSB} dB	V_{BR} V	C_T pF	V_F V	r_f Ω	Package	Page
Beam Lead									
BAT 14-020 S	4	100	6.0 (3 GHz)	4	0.30	0.45	3.5	S	188
BAT 14-020 D	4			–				D	184
BAT 14-020 R	–			–				R	186
BAT 14-050 S	4	100	6.5 (6 GHz)	4	0.20	0.47	4.0	S	188
BAT 14-050 D	4			–				D	184
BAT 14-050 R	–			–				R	186
BAT 14-090 S	4	50	6.5	4	0.14	0.49	7.0	S	188
BAT 14-090 D	4		(9.3 GHz)	–				D	184
BAT 14-090 R	–			–				R	186
BAT 14-110 S	4	50	7.0	4	0.10	0.50	10.0	S	188
BAT 14-110 D	4		(16 GHz)	–				D	184
BAT 14-110 R	–			–				R	186

2. Schottky Diodes for General Purposes

2.1 Low Barrier

Type	Max. Ratings V_R V	I_F mA	Characteristics at T_A = 25°C V_{BR} V	V_F mV	C_T pF	$I_{R\,(max)}$ µA	Package	Page
SMD Plastic Package								
BAT 15-098	4	110	4	320	0.35	–	SOD-123	227
BAT 15-099	4		4		0.35		SOT-143	231
BAT 15-099 R	–		–		0.38		SOT-143	235
S BAT 62	40	20	–	580	0.35	10	SOT-143	248

2.2 Medium Barrier

SMD Plastic Package

BAS 125	25	100	–	370	1.1	10	SOT-23	179
BAS 125-04							SOT-23	179
BAS 125-05							SOT-23	179
BAS 125-06							SOT-23	179
BAS 125-07							SOT-143	180

S Preferred type: shortly available via the Semiconductor Distribution Center (Edition April 1991)

2.2 Medium Barrier (cont'd)

Type	Max. Ratings		Characteristics at T_A = 25°C				Package	Page
	V_R V	I_F mA	V_{BR} V	V_F mV	C_T pF	I_R µA		
SMD Plastic Package								
BAT 14-098	4	90	4	550	0.35	–	SOD-123	201
BAT 14-099	4		4	550	0.35		SOT-143	205
BAT 14-099 R	–		–	480	0.38		SOT-143	209
S BAT 17	4	130	4	350	1	0.25	SOT-23	237
S BAT 17-04							SOT-23	237
S BAT 17-05							SOT-23	237
S BAT 17-06							SOT-23	237
S BAT 17-07							SOT-143	238
S BAT 68	8	130	8	500	1	0.1	SOT-23	251
S BAT 68-04							SOT-23	251
S BAT 68-05							SOT-23	251
S BAT 68-06							SOT-23	251
S BAT 68-07							SOT-143	252

3. PIN Diodes for Professional Applications

3.1 Metal Ceramic Package

Type	Max. Ratings				Characteristics at T_A = 25°C				Package	Page
	V_R V	I_{FRM} mA	T_j °C	P_{tot} mW	C_T pF	r_f Ω	τ_L ns	t_s ns		
BXY 42BA-7	50	5000	175	350	0.2	1.5	40	4	Cerec-X	326
BXY 42BA-3				350	0.24		40		T1	320
BXY 42BA-5				800	0.24		–		C1	322
BXY 42BA-6				800	0.34		40		D	324
BXY 43A	150	10000	175	500	0.19	1.2	250	15	T1	328
BXY 43B		20000		600	0.25	1.0	350	20	T1	328
BXY 43C		20000		600	0.35	1.0	350	25	T1	328
BXY 44K	200	20000	175	600	0.4	3.5	500	50	T1	330

3.2 Beam Lead

Type	Max. Ratings		Characteristics at T_A = 25°C				Package	Page
	V_R V	T_j °C	$C_{T\,(max)}$ pF	$r_{f\,(typ)}$ Ω	τ_L ns	t_s ns		
BXY 42BA-S	50	175	0.08	1.8	30	3	S	317
BXY 42BB-S	30	175	0.15	1.3	20	2	S	317

S Preferred type: shortly available via the Semiconductor Distribution Center (Edition April 1991)

4. PIN Diodes for General Purposes

4.1 SMD Plastic Package

Type	Max. Ratings			Characteristics at T_A = 25˚C				Package	Page
	V_R V	P_{tot} mW	T_j ˚C	C_T pF	r_f Ω	τ_L µs	V_F V		
S BAR 14-1 **S** BAR 15-1 **S** BAR 16-1	100	250	150	0.25	7	1.0	1.05	SOT-23 SOT-23 SOT-23	169 169 169
S BAR 17	100	250	150	0.32	3.5	4	0.91	SOT-23	172
S BAR 60	100	250	150	0.25	7	1.0	1.25	SOT-143	175
S BAR 61	100	250	150	0.25	7	1.0	1.25	SOT-143	175

5. PIN Diodes for Tuner Applications

5.1 SMD Plastic Package

Type	Max. Ratings		Characteristics				Package	Page
	V_R V	I_F mA	I_R nA	C_T pF	r_f Ω	V_F V		
BA 585	50	50	≤ 50	0.28	22	≤ 1.1	SOD-123	155
BA 586	50	50	≤ 50	0.23	58	≤ 1.15	SOD-123	157
BA 595	50	50	≤ 20	0.26	21	≤ 1.1	SOD-323	161
BA 596	50	50	≤ 50	0.23	58	≤ 1.15	SOD-323	163
BA 885	50	50	≤ 50	0.28	22	≤ 1.1	SOT-23	165
BA 886	50	50	≤ 50	0.23	58	≤ 1.15	SOT-23	167

5.2 Glass Package

BA 389	30	50	≤ 50	0.55	≤ 40	≤ 1	DO-35 DHD	150

S Preferred type: shortly available via the Semiconductor Distribution Center (Edition April 1991)

6. Varactors for Professional Applications

6.1 Hyperabrupt Varactors

Type	Max. Ratings V_R V	T_j °C	Characteristics at T_A = 25°C C_T pF	C_{T4} / C_{T20} –	Q –	Package	Page
Metal Ceramic Package							
BBY 34C	22	175	1.7 … 3.4	–	400	D	311
BBY 34D	22	175	3.2 … 3.8	2.7	400	D	311
BBY 35F	22	175	8.5 … 10.0	3.5	250	T1	313

6.2 Abrupt Varactors

Type	Max. Ratings V_R V	T_j °C	Characteristics at T_A = 25°C I_R nA	C_T pF	C_{T0} / C_{T25}	C_{T0} / C_{T120}	Q –	Package	Page
Metal Ceramic Package									
BBY 24-S1	120	150	10	12 … 16	–	8.5	200	P	305
BBY 25-S1	120	150	10	16 … 20	–	9.0	200	P	305
BBY 26-S1	120	150	10	20 … 24	–	9.5	200	P	305
BBY 27-S2	140	150	10	36 … 40	–	9.5	200	P	305
BBY 33BB-2	27	175	5	0.9 … 1.5	3.0	–	4000	C1	307
BBY 33DA-2	30	175	5	1.7 … 2.1	3.0	–	3500	D	309

6.3 Charge Storage Varactors

Type	Characteristics at T_A = 25°C f GHz	P_{IN} mW	V_{BR} V	C_T pF	t_s ns	t_t ns	Package	Page
Metal Ceramic Package								
BXY 18A2	2 … 8	250	25	0.7 … 1.3	10	0.2	T	315
BXY 18AB2	2 … 12		25	1.1 … 1.6			T	315
BXY 18AB5	2 … 12		15	0.4 … 0.7			T	315
BXY 18AB6	1 … 18		15	0.25 … 0.5			T	315

7. Variable Capacitance Diodes for Tuner Applications

7.1 SMD Plastic Package

Type	Max. Ratings		Characteristics					Package	Page
	V_R V	I_R nA	C_T pF	V_R V	C_T/C_{T2} –	V_{R1}/V_{R2} –	r_s Ω		
BB 419	28	≤ 20	26 … 32	3	> 5	3:25	≤ 0.5	SOD-123	268
BB 439	28	≤ 20	26 … 32	3	> 5	3:25	≤ 0.5	SOD-323	270
BB 512	12	≤ 20	440…520	1	> 15	1:8	1.4	SOD-123	275
BB 515	30	≤ 10	1.9 … 2.3	28	8.2 … 9.8	1:28	0.5	SOD-123	278
BB 535	30	≤ 10	1.9 … 2.3	28	8.2 … 9.8	1:28	0.5	SOD-323	280
BB 619	30	≤ 10	2.4 … 2.9	28	> 13.5	1:28	0.6	SOD-123	284
BB 620	30	≤ 10	2.9 … 3.4	28	19.5 … 25	1:28	1.3	SOD-123	286
BB 639	30	≤ 10	2.4 … 2.9	28	> 13.5	1:28	0.6	SOD-323	288
BB 640	30	≤ 10	2.9 … 3.4	28	19.5 … 25	1:28	1.15	SOD-323	290
BB 804	18	≤ 20	42 … 47.5	2	1.7	2:8	0.25	SOT-23	292
BB 811	30	≤ 20	0.85…1.2	28	7.8 … 9.5	1:28	1	SOD-123	295
BB 813	30	≤ 20	0.6 … 0.9	28	> 11	1:28	1.8	SOD-123	297
BB 814	18	≤ 20	43 … 46.5	2	1.95…2.35	2:8	0.20	SOT-23	299
BB 831	30	≤ 20	0.85…1.2	28	7.8 … 9.5	1:28	1	SOD-323	301
BB 833	30	≤ 20	0.6 … 0.9	28	> 11	1:28	1.8	SOD-323	303

7.2 Plastic Package

BB 112	12	50	440…520	1	≥ 15	1:8	1.4	TO-92	256
BB 204 B BB 204 G	30	20	37 … 42 34 … 39	3 3	2.55 … 2.8 2.55 … 2.8	3:30 3:30	0.2	TO-92 TO-92	259 259
BB 304	30	20	42 … 47.5	2	1.65…1.75	2:8	0.2	TO-92	262

7.3 Glass Package

Type	Max. Ratings		Characteristics					Package	Page
	V_R	I_F	C_T	V_R	C_T/C_{T2}	V_{R1}/V_{R2}	r_s		
	V	mA	pF	V	–	–	Ω		
BB 409	28	20	4.5 … 5.6	25	5 … 6.5	3:25	0.3	DO-35 DHD	265
BB 505 B	28	20	1.85…2.25	28	7.7 … 9.4	1:28	0.7	DO-35 DHD	272
BB 505 G			1.8 … 2.4		7.5 … 9.5		1	DO-35 DHD	272
BB 609 A	30	20	2.5 … 3	28	12 … 15	1:28	0.7	DO-35 DHD	282
BB 609 B			2.8 … 3.2					DO-35 DHD	282

8. Switching Diodes

8.1 SMD Plastic Package

Type	Max. Ratings		Characteristics				Package	Page
	V_R	I_F	V_F	I_R	C_T	r_f		
	V	mA	V	nA	pF	Ω		
BAT 18	35	100	≤ 1.2	≤ 20	0.75	0.4	SOT-23	242
BAT 18-04							SOT-23	242
BAT 18-05							SOT-23	242
BAT 18-06							SOT-23	242
BA 582	35	100	≤ 1	≤ 20	0.92	0.50	SOD-123	153
BA 592	35	100	≤ 1	≤ 20	0.92	0.50	SOD-323	159

8.2 Glass Package

BA 243	35	100	≤ 1	≤ 50	≤ 2	≤ 1	DO-35 DHD	142
BA 243 S	35	100	≤ 1	≤ 50	≤ 1.5	≤ 0.7	DO-35 DHD	144
BA 244	35	100	≤ 1	≤ 50	≤ 2	≤ 0.5	DO-35 DHD	142
BA 244 S	35	100	≤ 1	≤ 50	≤ 1.5	≤ 0.5	DO-35 DHD	144
BA 282	35	100	≤ 1	≤ 50	≤ 1.2	≤ 0.5	DO-35 DHD	146
BA 283	35	100	≤ 1	≤ 50	≤ 1	≤ 0.9	DO-35 DHD	146
BA 284	35	100	≤ 1	≤ 50	≤ 1	≤ 0.6	DO-35 DHD	148

1. Silicon Bipolar Transistors

1.1 SMD Plastic Package

Type	Max. Ratings			Characteristics at T_A = 25°C				Package	Page
	V_{CEO} V	I_C mA	P_{tot} mW	h_{FE} –	F dB	f MHz	f_T GHz		
NPN									
BF 517	15	25	280	≥ 25	2.5	100	2.0	SOT-23	354
BF 554	20	30	280	≥ 60	1.2	1	0.25	SOT-23	372
BF 599	25	25	280	≥ 38	–	–	0.55	SOT-23	382
BF 770 A	12	50	300	≥ 40	–	–	5.5	SOT-23	393
BF 771	12	80	400	≥ 90	1.7	800	3.5	SOT-23	396
BF 772	12	80	580	≥ 90	1.6	800	3.5	SOT-143	399
BF 775	12	30	280	≥ 40	1.5	800	4.5	SOT-23	402
BF 775 A	16	30	280	≥ 50	1.4	800	4.2	SOT-23	405
BF 777	20	50	150	≥ 30	–	–	2.2	SOT-23	408
BF 799	20	35	280	≥ 35	3	100	1.1	SOT-23	411
BF 840	40	25	280	≥ 65	1.7	0.1	0.38	SOT-23	414
BF 841	40	25	280	≥ 35	1.7	0.1	0.38	SOT-23	414

1.1 SMD Plastic Package (cont'd)

Type	Max. Ratings V_{CE0} V	I_C mA	P_{tot} mW	Characteristics at T_A = 25°C f_T GHz	F dB	G dB	at f GHz	Package	Page
NPN									
S BFQ 29 P	15	30	280	5.0	1.5	14	0.8	SOT-23	677
S BFQ 81	16	30	280	5.8	1.4	15	0.8	SOT-23	773
S BFR 35 AP	12	30	280	4.9	1.5	14	0.8	SOT-23	860
S BFR 92 P	15	30	280	5.0	1.5	14	0.8	SOT-23	892
S BFR 93 A	12	50	300	5.5	1.7	13.5	0.8	SOT-23	909
S BFR 93 P	15	50	280	5.0	2.4	13	0.8	SOT-23	917
BFR 106	15	100	700	3.9	2.3	11.5	0.8	SOT-23	936
S BFR 180	8	4	30	6.2	2.1	14.5	0.9	SOT-23	945
S BFR 181	12	20	175	8	1.4	18	0.9	SOT-23	953
S BFR 182	12	35	250	8	1.3	18	0.9	SOT-23	961
S BFR 183	12	65	450	8	1.2	18.5	0.9	SOT-23	972
S BFR 193	12	80	580	8	1.7	13.5	0.8	SOT-23	981
S BFR 280	8	10	80	7	1.6	16.5	0.9	SOT-23	1001
S BFS 17 P	15	25	280	2.5	3.5	10	0.8	SOT-23	1009
S BFQ 19 S	15	75	1000	5.1	2.8	11.8	0.8	SOT-89	666
BFQ 64	20	200	1000	3.0	–	10	0.8	SOT-89	687
S BFQ 193	12	80	600	7.5	1.2	15	0.8	SOT-89	821
S BFP 81	16	30	280	5.8	1.25	16.5	0.8	SOT-143	560
S BFP 93 A	12	50	300	5.5	1.7	16.5	0.8	SOT-143	579
S BFP 180	8	4	30	6.2	2.1	16.5	0.9	SOT-143	594
S BFP 181	12	20	175	8	1.5	20	0.9	SOT-143	602
S BFP 182	12	35	250	8	1.3	22.5	0.9	SOT-143	610
S BFP 183	12	65	450	8	1.2	20	0.9	SOT-143	620
S BFP 193	12	80	580	8	1.6	15	0.8	SOT-143	629
S BFP 196	12	100	700	7.2	1.35	16	0.9	SOT-143	649
S BFP 280	8	10	80	7	1.6	20	0.9	SOT-143	658

S Preferred type: shortly available via the Semiconductor Distribution Center (Edition April 1991)

1.1 SMD Plastic Package (cont'd)

Type	Max. Ratings V_{CE0} V	I_C mA	P_{tot} mW	Characteristics at T_A = 25°C f_T GHz	F dB	G dB	at f GHz	Package	Page
NPN									
S BFG 19 S	15	100	1000	5.3	2.5	13	0.8	SOT-223	516
BFG 135 A	15	150	1000	5.9	3	–	0.9	SOT-223	525
S BFG 193	12	80	600	8	1.2	16	0.8	SOT-223	536
S BFG 196	12	100	800	7.2	1.35	18	0.9	SOT-223	548
BFG 235	12	300	2000	6	–	–	–	SOT-223	557

Type	Max. Ratings V_{CE0} V	I_C mA	P_{tot} mW	Characteristics h_{FE} –	F dB	f MHz	f_T GHz	Package	Page
PNP									
BF 550	40	25	280	≥ 50	2	0.1	0.35	SOT-23	367
BF 569	35	30	280	≥ 20	4.5	800	0.95	SOT-23	376
BF 579	20	30	280	≥ 20	4	800	1.6	SOT-23	379
BF 660	30	25	280	≥ 30	–	–	0.7	SOT-23	388

Type	Max. Ratings V_{CE0} V	I_C mA	P_{tot} mW	Characteristics at T_A = 25°C f_T GHz	F dB	G_{pe} dB	at f GHz	Package	Page
S BFT 92	15	25	200	5.0	2.4	18	0.5	SOT-23	1030
S BFT 93	12	35	200	5.0	2.4	16.5	0.5	SOT-23	1041
S BFR 194	15	100	700	5.0	2.4	16.5	0.5	SOT-23	998
S BFP 194	15	100	700	5.0	2.4	16.5	0.5	SOT-143	646
S BFG 194	15	100	1000	5.0	2.4	16.5	0.5	SOT-223	545

S Preferred type: shortly available via the Semiconductor Distribution Center (Edition April 1991)

1.2 Leaded Plastic Package

Type	Max. Ratings			Characteristics				Package	Page
	V_{CE0}	I_C I_{CM}*	P_{tot}	h_{FE}	I_{CB0}	V_{CEsat}	f_T		
	V	mA	mW	–	nA	V	MHz		
NPN									
BF 199	25	25	500	85 (≥ 38)	≤ 100	–	550	TO-92	334
BF 240	40	25	250	65 … 220	≤ 100	–	400	TO-92	338
BF 241	40	25	250	35 … 125	≤ 100	–	400	TO-92	338
BF 254	20	30	250	65 … 220	–	–	260	TO-92	341
BF 255	20	30	250	35 … 130	–	–	220	TO-92	341
BF 763	15	25	500	25 … 250	≤ 50	≤ 0.5	2000	TO-92	391
BF 959	20	100*	500	85 (≥ 40)	≤ 100	≤ 1	1100	TO-92	416

Type	Max. Ratings			Characteristics at T_A = 25˚C				Package	Page
	V_{CE0}	I_C	P_{tot}	f_T	F	G_{pe}	at f		
	V	mA	mW	GHz	dB	dB	GHz		
NPN									
S BFQ 69	15	30	300	5.8	1.4	16.5	0.8	T-plast	690
S BFR 34 A	12	30	280	5.0	2	14	0.8	T-plast	854
S BFR 90	15	30	280	5.0	2	14	0.8	T-plast	877
S BFR 91	15	50	400	5.0	1.9	17	0.5	T-plast	883
S BFR 91 A	12	35	400	6.2	1.6	14	0.8	T-plast	888
S BFR 96 S	15	100	700	5.5	2.9	11.5	0.8	T-plast	926
S BFT 65	15	50	400	5.0	2.8	12	0.8	T-plast	1022
S BFT 97	15	30	280	5.0	1.2	–	0.2	T-plast	1044
S BFT 98 T	20	150	800	3.2	–	12	0.8	T-plast	1051
S BFW 92	15	25	280	2.4	4.0	11	0.8	T-plast	1058

S Preferred type: shortly available via the Semiconductor Distribution Center (Edition April 1991)

1.2 Leaded Plastic Package (cont'd)

Type	Max. Ratings V_{CEO} V	I_C mA	P_{tot} mW	Characteristics h_{FE} –	I_{CBO} nA	f_T MHz	Package	Page
PNP								
BF 414	30	25	300	80 (≥ 30)	≤ 60	560	TO-92	344
BF 450	40	25	250	65 … 220	≤ 50	375	TO-92	346
BF 451	40	25	250	35 … 125	≤ 50	325	TO-92	346
BF 506	35	30	300	≥ 25	≤ 100	550	TO-92	352
BF 606 A	30	25	300	≥ 30	≤ 60	700	TO-92	386
BF 970	35	30	160	50 (≥ 25)	≤ 100	950	T-plast	449

1.3 Ceramic Package

Type	Max. Ratings V_{CEO} V	I_C mA	P_{tot} mW	Characteristics at T_A = 25°C f_T GHz	F dB	G_{pe} dB	at f GHz	Package	Page
NPN									
S BFQ 70	15	35	300	5.0	1.5	18	0.8	Cerec-X	693
S BFQ 71	15	30	300	5.2	1.5	15	0.8	Cerec-X	707
S BFQ 72	15	50	350	5.1	2.5	18	0.8	Cerec-X	725
S BFQ 73 S	15	100	500	5.4	2.5	15	0.8	Cerec-X	739
S BFQ 74	16	35	300	6.0	2.5	14	2.0	Cerec-X	752
S BFQ 82	12	80	500	8.0	2.3	11	2.0	Cerec-X	791
S BFQ 181	12	20	175	8.0	1.8	–	1.75	Cerec-X	809
BFQ 182	12	35	250	8.3	1.7	16	1.75	Cerec-X	817
BFQ 196	12	100	650	7.2	1.3	17.5	0.9	Cerec-X	834
S BFQ 645	12	40	400	9	1.9	11	2.0	Cerec-X	843
PNP									
BFQ 75	12	50	350	5.0	3.0	14	0.8	Cerec-X	766
BFQ 76	15	30	250	5.0	2.5	17	0.8	Cerec-X	769
BFQ 194	15	100	650	5.0	–	–	–	Cerec-X	831

S Preferred type: shortly available via the Semiconductor Distribution Center (Edition April 1991)

1.4 Metal Ceramic Package

Type	Max. Ratings			Characteristics at T_A = 25°C				Package	Page
	V_{CEO} V	I_C mA	P_{tot} mW	f_T GHz	F dB	G_{pe} dB	at f GHz		
NPN									
S BFT 98 BFT 98 B	20	200	2250	3.3	–	15	0.8	TO-117 TO-117	1047 1047
S BFT 99 BFT 99 A	20	350	4000	3.3	–	12	0.8	TO-117 TO-117	1054 1054

1.5 Metal Package

Type	Max. Ratings			Characteristics					Package	Page
	V_{CEO} V	I_C mA	P_{tot} mW	f_T GHz	F dB	f MHz	G_{pe} dB	f MHz		
NPN										
S BFR 15 A	12	30	200	4.5	3.0	800	12	800	TO-72	850
S BFS 55 A	15	50	250	4.5	2.9	800	10	800	TO-72	1018
S BFT 66	15	30	200	4.9	0.9	10	12	500	TO-72	1027
S BFX 59 S BFX 59 F	20	100	370	0.9 1.1	3.4	200	–	–	TO-72 TO-72	1061 1061
S BFX 60	25	25	370	0.5	5.0	200	–	–	TO-72	1064
S BFY 90	15	25	200	2.0	5.0	800	8	800	TO-72	1067

2. N-Channel MOSFET Triodes

2.1 SMD Plastic Package

Type	Max. Ratings			Characteristics				Package	Page
	V_{DS} V	I_D mA	P_{tot} mW	g_{fs} mS	G_p dB	F dB	f MHz		
BF 543	20	30	200	12	22	1	200	SOT-23	357
BF 544	20	30	200	12	22	1	200	TO-92	362
BF 999	20	30	200	16	25	1	200	SOT-23	511

2.2 Plastic Package

BF 987	20	30	300	16 (≥ 14)	25	1	200	TO-92	451

S Preferred type: shortly available via the Semiconductor Distribution Center (Edition April 1991)

3. N-Channel MOSFET Tetrodes

3.1 SMD Plastic Package

Type	Max. Ratings			Characteristics				Package	Page
	V_{DS} V	I_D mA	P_{tot} mW	g_{fs} mS	G_{ps} dB	F dB	f MHz		
BF 993	20	50	200	25	25	1.5	200	SOT-143	464
BF 994 S	20	30	200	18	25	1	200	SOT-143	471
BF 995	20	30	200	17	23	1.1	200	SOT-143	478
BF 996 S	20	30	200	18	25	1	200	SOT-143	488
BF 997	20	30	200	18	25	1	200	SOT-143	496
BF 998	12	30	200	24	28	0.6	200	SOT-143	503

3.2 Plastic Package

BF 961	20	30	200	17 (≥ 12)	23	1.1	200	X-plast	419
BF 963	20	50	200	25 (≥ 16)	25	1.5	200	X-plast	429
BF 964 S	20	30	200	18 (≥ 15)	25	1.0	200	X-plast	435
BF 965	20	30	200	18 (≥ 15)	25	1.0	200	X-plast	442
BF 988	12	30	200	24	28	0.6	200	X-plast	456

4. Dual Gate GaAs FETs

4.1 SMD Plastic Package

Type	Max. Ratings				Characteristics at T_A = 25°C				Package	Page
	V_{DS} V	$-V_{G1S}$ V	$-V_{G2S}$ V	I_D mA	I_{DSS} mA	F dB	G_{ps} dB	at f GHz		
S CF 739	10	6	6	80	10	1.8	17	1.75	SOT-143	1074

5. Single Gate GaAs FETs

5.1 SMD Plastic Package

Type	Max. Ratings			Characteristics at T_A = 25°C				Package	Page
	V_{DS} V	V_{GS} V	I_D mA	g_m mS	F dB	G_a dB	at f GHz		
S CFY 30	5	– 4 … + 0.5	80	30	1.4	11.5	4	SOT-143	1107
CFY 35-20 CFY 35-23	5	– 4 … 0	60	30	1.9 2.2	8.5	12	MW-4 MW-4	1117 1117

S Preferred type: shortly available via the Semiconductor Distribution Center (Edition April 1991)

5.2 Metal Ceramic Package

Type	Max. Ratings			Characteristics at T_A = 25°C				Package	Page
	V_{DS} V	V_{GS} V	I_D mA	g_m mS	F dB	G_a dB	at f GHz		
CFY 10	5	– 5 … + 0.5	100	45	< 1.8	> 9.5	6	100 mil	1086
$\boxed{\text{S}}$ CFY 19-18	6	– 5 … + 0.5	80	30	< 1.8	> 9.5	6	Cerec-X	1088
$\boxed{\text{S}}$ CFY 19-22				25	< 2.2	> 9.0		Cerec-X	1088
$\boxed{\text{S}}$ CFY 25-17	5	– 5 … 0	80	40	1.6	9.5	12	Micro-X	1096
$\boxed{\text{S}}$ CFY 25-20					1.9	9		Micro-X	1096
$\boxed{\text{S}}$ CFY 25-23					2.2	9		Micro-X	1096
CFY 25-20 E 7916	5	– 5 … 0	80	45	–	–	–	Cerec-XF	1102

6. HEMTs

6.1 SMD Plastic Package

Type	Max. Ratings			Characteristics at T_A = 25°C				Package	Page
	V_{DS} V	V_{GS} V	I_D mA	g_m mS	F dB	G_a dB	at f GHz		
CFY 75-13	4	– 3.0 … 0	70	40	1.2	10.5	12	MW-4	1128
CFY 75-15					1.4	10.0		MW-4	1128

6.2 Metal Ceramic Package

$\boxed{\text{S}}$ CFY 65-12	4	– 3.0 … 0	70	40	1.1	11.5	12	Micro-X	1123
$\boxed{\text{S}}$ CFY 65-14					1.3			Micro-X	1123

$\boxed{\text{S}}$ Preferred type: shortly available via the Semiconductor Distribution Center (Edition April 1991)

7. GaAs MMICs

7.1 Broadband Amplifiers/Mixer in SMD Plastic Package

Type	Characteristics at T_A = 25°C						Package	Page
	V_{DS} V	I_D mA	f MHz	G dB	F dB	IP_3 dBm		
S CGY 50	5.5 … 7.5	60	200 … 1800	8.5	3.0	31	SOT-143	1163
S CF 750	3 … 6	2	400 … 3000	11	1.6	10	SOT-143	1081
CGY 52	3 … 6	160	200 … 1800	17	4.8	32	MW-7	1173
CMY 90*	3 … 6	2.5	400 … 2500	17	4.1	10	MW-7	1175

* Mixer application

7.2 Broadband Amplifiers in Metal Ceramic Package

S CGY 40	3 … 5.5	60	200 … 1800	10.5	2.8	32	Cerec-X	1154

7.3 Broadband Amplifiers in Metal Package

S CGY 21	3 … 6	160	100 … 900	21	3.9	32.5	TO-12	1136
CGY 31	3 … 6	160	800 … 1800	18	4.0	32.5	TO-12	1145

S Preferred type: shortly available via the Semiconductor Distribution Center (Edition April 1991)

Reference Tables

1. Application Reference Table for Tuners

<table>
<tr><th colspan="2" rowspan="2">Application</th><th colspan="3">Tuner</th><th rowspan="2">IF amplifier</th></tr>
<tr><th>Input stage</th><th>Mixer</th><th>Oscillator</th></tr>
<tr><td rowspan="21">TV range</td><td rowspan="7">VHF</td><td>BA 582</td><td></td><td>BA 592</td><td></td></tr>
<tr><td colspan="3">BAT 18/-04/-05/-06</td><td></td></tr>
<tr><td>BB 419</td><td></td><td>BB 439</td><td></td></tr>
<tr><td>BF 961</td><td>BF 506</td><td>BF 506</td><td>BF 199</td></tr>
<tr><td>BF 995</td><td>BF 777</td><td>BF 606 A</td><td>BF 517</td></tr>
<tr><td>BF 998</td><td>BF 961</td><td>BF 660</td><td>BF 599</td></tr>
<tr><td></td><td>BF 995</td><td></td><td>BF 959</td></tr>
<tr><td rowspan="8">VHF (CATV/ Hyperband)</td><td>BB 619</td><td></td><td>BB 639</td><td></td></tr>
<tr><td>BB 620</td><td></td><td>BB 640</td><td></td></tr>
<tr><td>BF 964 S</td><td>BF 506</td><td>BF 506</td><td></td></tr>
<tr><td>BF 965</td><td>BF 777</td><td>BF 517</td><td></td></tr>
<tr><td>BF 994 S</td><td>BF 964 S</td><td>BF 606 A</td><td></td></tr>
<tr><td>BF 997</td><td>BF 965</td><td>BF 660</td><td></td></tr>
<tr><td>BF 998</td><td>BF 994 S</td><td>BF 763</td><td></td></tr>
<tr><td></td><td>BF 997</td><td></td><td></td></tr>
<tr><td rowspan="6">UHF</td><td>BB 515</td><td></td><td>BB 535</td><td></td></tr>
<tr><td></td><td colspan="2">BF 569</td><td></td></tr>
<tr><td>BF 998</td><td colspan="2">BF 970</td><td></td></tr>
<tr><td>BF 960</td><td>BF 579</td><td>BF 569</td><td></td></tr>
<tr><td>BF 966 S</td><td>BF 771</td><td>BF 777</td><td></td></tr>
<tr><td>BF 996 S</td><td>BF 775</td><td>BF 970</td><td></td></tr>
<tr><td rowspan="7">TV-sat</td><td rowspan="7">Indoor unit</td><td>BA 585</td><td>BA 595</td><td>BA 885</td><td></td></tr>
<tr><td>BA 595</td><td>BA 596</td><td>BA 886</td><td></td></tr>
<tr><td>BB 811</td><td></td><td>BB 831</td><td></td></tr>
<tr><td>BB 813</td><td>BF 775</td><td>BB 833</td><td>BF 770 A</td></tr>
<tr><td></td><td>BF 772</td><td></td><td></td></tr>
<tr><td colspan="2">CF 739</td><td>BFR 193</td><td>BF 998</td></tr>
<tr><td></td><td>BFP 183</td><td></td><td></td></tr>
</table>

1. Application Reference Table for Tuners (continued)

<table>
<tr><th colspan="2" rowspan="2">Application</th><th colspan="3">Tuner</th><th rowspan="2">IF amplifier</th></tr>
<tr><th>Input stage</th><th>Mixer</th><th>Oscillator</th></tr>
<tr><td rowspan="13">Radio range</td><td rowspan="13">AM
FM</td><td colspan="2">BB 112</td><td>BB 512</td><td></td></tr>
<tr><td colspan="2">BB 204</td><td>BB 804</td><td></td></tr>
<tr><td colspan="2">BB 304</td><td></td><td></td></tr>
<tr><td></td><td>BB 814</td><td></td><td></td></tr>
<tr><td>BF 255</td><td>BF 241</td><td>BF 241</td><td>BF 240</td></tr>
<tr><td>BF 414</td><td>BF 255</td><td>BF 255</td><td>BF 241</td></tr>
<tr><td>BF 961</td><td>BF 451</td><td>BF 451</td><td>BF 254</td></tr>
<tr><td>BF 963</td><td>BF 995</td><td></td><td>BF 255</td></tr>
<tr><td>BF 993</td><td></td><td></td><td>BF 450</td></tr>
<tr><td>BF 995</td><td></td><td></td><td>BF 451</td></tr>
<tr><td>BF 543</td><td></td><td></td><td></td></tr>
<tr><td>BF 987</td><td></td><td></td><td></td></tr>
<tr><td>BF 999</td><td></td><td></td><td></td></tr>
</table>

2. Cross Reference Table of Packages (Application-Oriented)

2.1 RF Transistors and Diodes for Tuner Applications

Package / Application	Conventional mounting TO-92	DO-35 DHD*	Surface mounting (SMD) SOT-23	SOT-143	SOD-123	SOD-323
1. Switching PIN diodes						
● VHF band switching		BA 243/S BA 244/S BA 282 BA 283 BA 284 BAT 18-…			BA 582	BA 592
● Current-controlled RF resistor, TV-sat antenna switch		BA 389	BA 885 BA 886		BA 585 BA 586	BA 595 BA 596
2. Tuning diodes						
● AM	BB 112				BB 512	
● FM	BB 204 BB 304		BB 804			
● Extended FM band			BB 814			
● VHF		BB 409 BB 609 A/B			BB 419 BB 619	BB 439 BB 639
● VHF (Hyperband)					BB 620	BB 640
● UHF/VHF		BB 505 B/G			BB 515	BB 535
● UHF/TV-sat					BB 811 BB 813	BB 831 BB 833
3. Bipolar transistors						
● TV IF	BF 199		BF 599			
● AM, FM	BF 254 BF 255 BF 414		BF 554 BF 660			
● IF stage (AM, FM)	BF 450 BF 451 BF 240 BF 241		BF 550 BF 772			

* Not for new design.

2.1 RF Transistors and Diodes for Tuner Applications (continued)

Application \ Package	Conventional mounting TO-92	T-plast	X-plast	Surface mounting (SMD) SOT-23	SOT-143
3. Bipolar transistors					
● VHF mixer/ oscillator	BF 506 BF 606 A			BF 660 BF 777	
● RF amplifier/ oscillator	BF 763			BF 517	
● SAW filter driver	BF 959			BF 799	
● UHF mixer/ oscillator		BF 970		BF 569 BF 579 BF 771	
● TV-sat				BF 775 BF 770 A	
4. MOSFET tetrodes					
● UHF preamplifier			BF 960 BF 966 S		BF 996 S
● VHF FM input stage/mixer			BF 961 BF 963 BF 964 S BF 965		BF 995 BF 993 BF 994 S BF 997
● UHF amplifier			BF 988		BF 998
5. MOSFET triodes					
● FM amplifier	BF 987			BF 543 BF 999	

2.2 RF Broadband Transistors in Plastic Packages

Applications	Packages T-plast	SOT-23	SOT-89	SOT-143	SOT-223	N = NPN P = PNP
Pager low current		BFR 180		BFP 180		N
I_C < 10 mA		BFR 280		BFP 280		
		BFR 181		BFP 181		
Low-noise		BFR 182		BFP 182		
front-end		BFR 183		BFP 183		
Small-signal	BFQ 69	BFQ 81		BFP 81		
amplifier	BFR 34 A	BFR 35 AP				
I_C < 30 mA	BFR 90	BFR 92 P				
	BFW 92	BFS 17 P				
		BFT 92				P
Driver stage	BFT 97	BFQ 29 P				N
I_C < 60 mA	BFT 65					
	BFR 91	BFR 93 P				
	BFR 91 A	BFR 93 A		BFP 93 A		
		BFR 193	BFQ 193	BFP 193	BFG 193	
		BFT 93				P
Driver stage	BFR 96		BFQ 19 P			N
I_C < 100 mA	BFR 96 S	BFR 106	BFQ 19 S			
		BFR 194		BFP 194	BFG 194	P
				BFP 196	BFG 196	N
Power stage	BFT 98 T		BFQ 64			
I_C < 160 mA			BFQ 17 P			
					BFG 135 A	
I_C < 260 mA					BFG 235	

2.3 RF Broadband Transistors in Metal Packages

Applications	Packages				N = NPN P = PNP
	TO-72	SMD-Cerec	TO-117	100/140/200 mil	
Pager low current $I_C < 10$ mA		BFQ 181			N
Low-noise front-end		BFQ 645			
Small-signal		BFQ 74		BFQ 57 BFQ 58	
$I_C < 30$ mA	BFR 15 A BFY 90 BFX 59 BFX 59 F BFX 60	BFQ 71		BFR 14 A	
		BFQ 76			P
Driver stage $I_C < 60$ mA		BFQ 75			
	BFT 66 BFS 55 A	BFQ 70 BFQ 72 BFQ 82		BFQ 59	N
Driver stage $I_C < 100$ mA		BFQ 73 BFQ 73 S			
		BFQ 194			P
		BFQ 196			N
Power stage $I_C < 160$ mA			BFT 98 BFT 98 B BFT 99 BFT 99 A		

3. Cross Reference Table of Plastic Packages (Conventional Devices to SMD)

SOD-123

Conventional Devices	SMD
BA 282	BA 582
BA 389	BA 585
BB 112	BB 512
BB 409	BB 419
BB 505	BB 515
BB 609	BB 619

SOD-323

BA 282	BA 592
BA 389	BA 595
BB 409	BB 439
BB 505	BB 535
BB 609	BB 639

SOT-23

BA 282	BAT 18
BA 389	BA 885
1N 4148	BAL 74
1N 4148	BAL 99
BAR 12-1	BAR 14-1
1N 4148	BAR 74
1N 4148	BAR 99
1N 4148	BAS 16
BAV 19	BAS 19
BAV 20	BAS 20
BAV 21	BAS 21
BAS 45	BAS 116
BAT 85	BAT 64
1N 4148 (2×)	BAV 70 (Dual)
1N 4148 (2×)	BAV 74 (Dual)
1N 4148 (2×)	BAV 99 (Dual)
BAS 45 (2×)	BAV 170 (Dual)
BAS 45 (2×)	BAV 199 (Dual)
1N 4148 (2×)	BAW 56 (Dual)
BAS 45 (2×)	BAW 156 (Dual)
1N 914	SMBD 914
BB 304	BB 804
BC 337	BC 817
BC 338	BC 818

SOT-23

Conventional Devices	SMD
BC 516	BCV 26
MPSA 63	SMBTA 63
MPSA 64	SMBTA 64
BC 516	BCV 46
BC 517	BCV 27
BC 546	BC 846
BC 547	BC 847
BC 548	BC 848
BC 549	BC 849
BC 550	BC 850
BC 556	BC 856
BC 557	BC 857
BC 558	BC 858
BC 559	BC 859
BC 560	BC 860
BC 618	BCV 47
BCX 58	BCW 60
BCX 59	BCX 70
BCX 78	BCW 61
BCX 79	BCX 71
BCX 73	BCW 65
BCX 74	BCW 66
BCX 75	BCW 67
BCX 76	BCW 68
BC 327	BC 807
BC 328	BC 808
BCX 22	BCX 41
BCX 23	BCX 42
MPS 2222	SMBT 2222
MPS 2222 A	SMBT 2222 A
MPS 2907	SMBT 2907
MPS 2907 A	SMBT 2907 A
2N 4126	SMBT 4126
MPSA 05	SMBTA 05
MPSA 06	SMBTA 06
MPSA 55	SMBTA 55
MPSA 56	SMBTA 56
BF 199	BF 599
BF 240	BF 840
BF 241	BF 841

3. Cross Reference Table of Plastic Packages (continued) (Conventional Devices to SMD)

SOT-23 (cont'd)

Conventional Devices	SMD
BF 254	BF 554
BF 422	BFN 22
BF 423	BFN 23
BF 450	BF 550
BF 506	BF 660
BF 544	BF 543
BF 763	BF 517
BF 959	BF 799
BF 970	BF 569
BF 979 S	BF 579
BF 987	BF 999
BFP 22	BFN 24
MPSA 43	SMBTA 43
BFP 23	BFN 25
MPSA 93	SMBTA 93
BFP 25	BFN 26
MPSA 42	SMBTA 42
BFP 26	BFN 27
MPSA 92	SMBTA 92
BFQ 23	BFT 93
BFQ 51	BFT 92
BFQ 69	BFQ 81
BFR 90	BFR 35 AP
BFR 90	BFR 92 P
BRF 91 A	BFR 93 A
BFR 91	BFR 93 P
BFR 96 S	BFR 106
BFW 92	BFS 17 P
MPSA 20	SMBTA 20
MPSA 13	SMBTA 13
MPSA 14	SMBTA 14

SOT-223

Conventional Devices	SMD
1N 4001	BAS 78 A
1N 4002	BAS 78 B
1N 4003	BAS 78 C
1N 4004	BAS 78 D
1N 4001 (2×)	BAS 79 A (Dual)
1N 4002 (2×)	BAS 79 B (Dual)
1N 4003 (2×)	BAS 79 C (Dual)
1N 4004 (2×)	BAS 79 D (Dual)
BC 368	BCP 68
BC 369	BCP 69
BC 516	BCP 28
BC 516	BCP 48
MPSA 63	PZTA 63
MPSA 64	PZTA 64
BC 517	BCP 29
MPSA 13	PZTA 13
BC 618	BCP 49
MPSA 14	PZTA 14
BC 635	BCP 54
BC 636	BCP 51
BC 637	BCP 55
BC 638	BCP 52
BC 639	BCP 56
BC 640	BCP 53
BC 875	BSP 50
BC 876	BSP 60
BC 877	BSP 51
BC 878	BSP 61
BC 879	BSP 52
BC 880	BSP 62
BF 420	BF 720
BF 421	BF 721
BF 422	BF 722
BF 423	BF 723
BFP 22	BFN 36
MPSA 43	PZTA 43
BFP 23	BFN 37
MPSA 93	PZTA 93
BFP 25	BFN 38
MPSA 92	PZTA 42

3. Cross Reference Table of Plastic Packages (continued) (Conventional Devices to SMD)

SOT-223 (cont'd)

Conventional Devices	SMD
BFP 26	BFN 39
MPSA 92	PZTA 92
MPS 2222	PZT 2222
MPS 2222 A	PZT 2222 A
MPS 2907	PZT 2907
MPS 2907 A	PZT 2907 A
MPS 3904	PZT 3904
MPS 3906	PZT 3906
BFR 96 S	BFG 19 S

SOT-143

1N 4148 (2×)	BAS 28 (Dual)
1N 4148 (2×)	BAW 100 (Dual)
BAV 21 (2×)	BAW 101 (Dual)
1N 4148 (4×)	BGX 50A (Bridge)
BF 961	BF 995
BF 963	BF 993
BF 964 S	BF 994 S
BF 965	BF 997
BF 966 S	BF 996 S
BF 988	BF 998
BFQ 69	BFP 81
BFR 91 A	BFP 93 A

SOT-89

BC 368	BCX 68
BC 369	BCX 69
BC 516	BCV 28
BC 516	BCV 48
BC 517	BCV 29
BC 618	BCV 49
BC 635	BCX 54
BC 636	BCX 51
BC 637	BCX 55
BC 638	BCX 52
BC 639	BCX 56
BC 640	BCX 53
BF 420	BFN 20
BF 421	BFN 21

SOT-89

Conventional Devices	SMD
BF 422	BF 622
BF 423	BF 623
BFP 22	BFN 16
BFP 23	BFN 17
BFP 25	BFN 18
BFP 26	BFN 19
BFR 96	BFQ 19 P
BFR 96 S	BFQ 19 S
BFW 16 A	BFQ 17 P
1N 4001	BAW 78 A
1N 4002	BAW 78 B
1N 4003	BAW 78 C
1N 4004	BAW 78 D
1N 4001 (2×)	BAW 79 A
1N 4002 (2×)	BAW 79 B
1N 4003 (2×)	BAW 79 C
1N 4004 (2×)	BAW 79 D

4. Table of Characteristics I

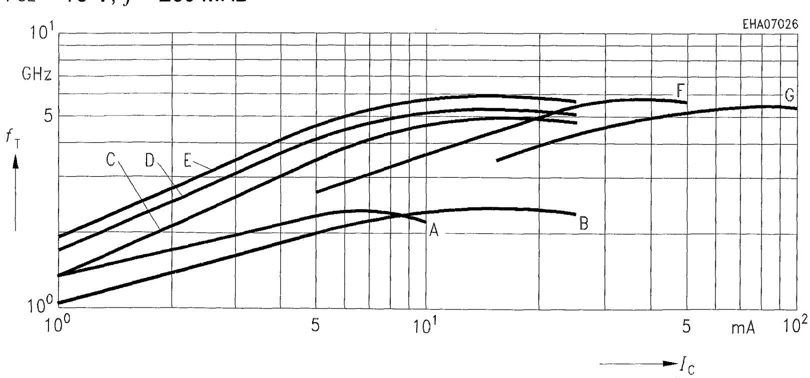
(for diagrams refer to next pages)

Type	Max. Ratings			Characteristics				Package
NPN	V_{CB0}	I_C	P_{tot}	R_{thJS}	f_T (200 MHz, 10 V)	F (800 MHz, 6 V)	G_{pe} (800 MHz, 6 V)	
	V	mA	mW	K/W	GHz	dB	dB	
Application: V_{CE} = 5 … 12 V, I_C = 1 … 8 mA, f = 0 … > 2 GHz frequency converter, local oscillator								
Curve A:								
BF 777	20	50	150	350	2.25	–	–	SOT-23
Application: V_{CE} = 1 … 10 V, I_C = 1 … 20 mA, f = 0 … > 2 GHz broadband amplifier								
Curve B:								
BFS 17P	15	25	280	340	2.5	–	–	SOT-23
BFW 92	15	25	280	175	2.5	–	–	T-plast
Application: V_{CE} = 3 … 10 V, I_C = 1 … 20 mA, f = 0 … > 2 GHz broadband amplifier								
Curve C:								
BFQ 29 P	15	30	280	305	5	1.3	14	SOT-23
BFQ 70	15	35	300	180	5	1.3	14	Cerec-X
BFT 97	15	30	280	140	5	1.3	14	T-plast
Application: V_{CE} = 1 … 10 V, I_C = 0.5 … 20 mA, f = 0 … > 2 GHz pre-amplifier								
Curve D:								
BFR 35 AP	12	30	280	365	5.5	1.2	15	SOT-23
BFR 92 P	15	30	280	365	5.5	1.2	15	SOT-23
BFQ 71	15	30	300	240	5.5	1.2	15	Cerec-X
BFR 34 A	12	30	280	200	5.5	1.2	15	T-plast
BFR 90	15	30	280	200	5.5	1.2	15	T-plast
Application: V_{CE} = 1 … 10 V, I_C = 0.5 … 20 mA, f = 0 … > 2 GHz amplifier								
Curve E:								
BFQ 81	16	35	280	325	6	1.2	16	SOT-23
BFP 81			280	275				SOT-143
BFQ 74			300	200				Cerec-X
BFQ 69			300	160				T-plast

Table of Characteristics I (continued)
(for diagrams refer to next page)

Type	Max. Ratings			Characteristics				Package
NPN	V_{CB0}	I_C	P_{tot}	R_{thJS}	f_T (200 MHz, 10 V)	F (800 MHz, 6 V)	G_{pe} (800 MHz, 6 V)	
	V	mA	mW	K/W	GHz	dB	dB	
Application: V_{CE} = 3 … 10 V, I_C = 5 … 40 mA, f = 0 … > 2 GHz low distortion output stage								
Curve F:								
BFR 93 A	12	50	300	290	6	1.6	16	SOT-23
BFP 93 A			300	240				SOT-143
BFR 91 A			400	125				T-plast
Application: V_{CE} = 3 … 10 V, I_C = 10 … 70 mA, f = 0 … > 2 GHz low distortion output stage								
Curve G:								
BFR 106	15	100	700	110	5.5	2.1	15	SOT-23
BFQ 73 S			500	130				Cerec-X
BFG 19 S			1000	75				SOT-223
BFQ 19 S			1000	65				SOT-89
BFR 96 S			700	90				T-plast

Characteristic Curves
Table I (NPN)
Transition frequency f_T versus collector current I_C.
(The curve numbers refer to the transistors in the preceding tables.)
V_{CE} = 10 V, f = 200 MHz



Characteristic Curves

Table I (NPN)

Collector-base capacitance C_{CB} versus collector-base voltage V_{CB}.
(The curve numbers refer to the transistors in the preceding tables.)
$V_{BE} = v_{be} = 0$, $f = 1$ MHz

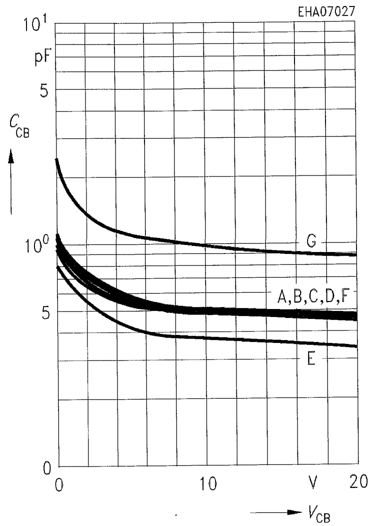


Table of Characteristics II
(for diagrams refer to next pages)

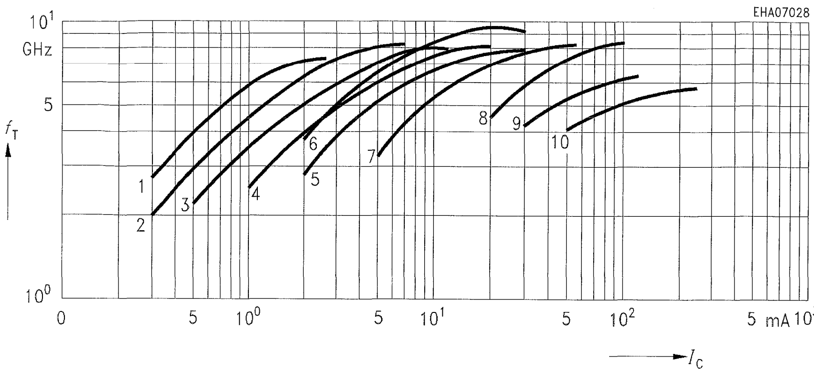
Type	Max. Ratings			Characteristics				Package
NPN	V_{CB0} V	I_C mA	P_{tot} mW	R_{thJS} K/W	f_T (500 MHz, 8 V) GHz	F (900 MHz, 8 V) dB	G_{pe} (900 MHz, 8 V) dB	
Application: V_{CE} = 1 … 3 V, I_C = 0.2 … 2.5 mA, f = 0 … > 3 GHz paging system								
Curve 1:								
BFR 180	8	4	30	780	7	2.1	16.5	SOT-23
BFP 180	8	4	30	775	7	2.1	16.5	SOT-143
Application: V_{CE} = 1 … 5 V, I_C = 0.2 … 8 mA, f = 0 … > 3 GHz low-noise pager								
Curve 2:								
BFR 280	8	10	80	425	7.5	1.6	18	SOT-23
BFP 280	8	10	80	420	7.5	1.6	18	SOT-143
Application: V_{CE} = 1 … 8 V, I_C = 0.5 … 10 mA, f = 0 … > 3 GHz low-noise pre-amplifier								
Curve 3:								
BFR 181	12	20	175	335	8	1.3	19	SOT-23
BFP 181	12	20	175	330	8	1.3	19	SOT-143
BFQ 181	12	20	175	355	8	1.3	19	Cerec-X
Application: V_{CE} = 1 … 8 V, I_C = 1 … 20 mA, f = 0 … > 3 GHz low-noise amplifier								
Curve 4:								
BFR 182	12	35	250	230	8	1.2	19	SOT-23
BFP 182	12	35	250	225	8	1.2	19	SOT-143
BFQ 182	12	35	250	250	8	1.2	19	Cerec-X
Application: V_{CE} = 1 … 8 V, I_C = 2 … 28 mA, f = 0 … > 3 GHz low-noise amplifier								
Curve 5:								
BFR 183	12	65	450	200	8	1.2	19	SOT-23
BFP 183	12	65	450	195	8	1.2	19	SOT-143

Table of Characteristics II (continued)
(for diagrams refer to next pages)

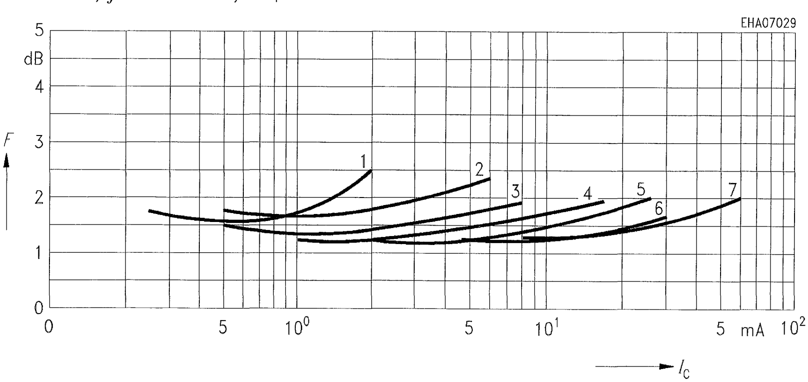
Type	Max. Ratings			Characteristics				Package
NPN	V_{CB0} V	I_C mA	P_{tot} mW	R_{thJS} K/W	f_T (500 MHz, 8 V) GHz	F (900 MHz, 8 V) dB	G_{pe} (900 MHz, 8 V) dB	
Application: V_{CE} = 1 … 8 V, I_C = 2 … 25 mA, f = 0 … > 3 GHz low-noise amplifier								
Curve 6:								
BFQ 645	12	65	400	245	9	1.1	20	Cerec-X
Application: V_{CE} = 3 … 8 V, I_C = 5 … 40 mA, f = 0 … > 3 GHz low-distortion output stage								
Curve 7:								
BFR 193	12	80	580	140	8	1.2	18	SOT-23
BFP 193	12	80	580	135	8	1.2	18	SOT-143
BFQ 82	12	80	400	160	8	1.2	18	Cerec-X
BFG 193	12	80	600	105	8	1.2	18	SOT-223
BFQ 193	12	80	600	95	8	1.2	18	SOT-89
Application: V_{CE} = 3 … 8 V, I_C = 30 … 100 mA, f = 0 … > 3 GHz low-distortion output stage								
Curve 8:								
BFP 196	12	100	700	105	7.5	1.3	18	SOT-143
BFQ 196	12	100	650	130	7.5	1.3	18	Cerec-X
BFG 196	12	100	800	75	7.5	1.3	18	SOT-223
Application: V_{CE} = 5 … 12 V, I_C = 7 … 130 mA, f = 0 … > 3 GHz low-distortion output stage								
Curve 9:								
BFG 135 A	15	150	1000	50	6	–	15	SOT-223
Application: V_{CE} = 5 … 12 V, I_C = 120 … 250 mA, f = 0 … > 3 GHz low-distortion output stage								
Curve 10:								
BFG 235	15	300	2000	35	6	–	14	SOT-223

Characteristic Curves
Table II (NPN)

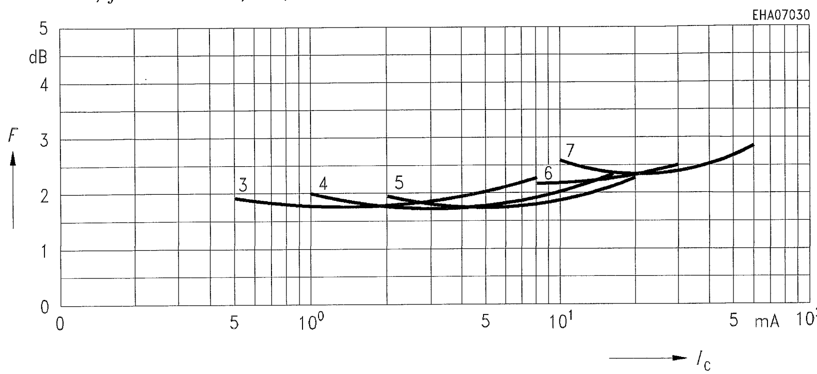
Transition frequency f_T versus collector current I_C.
(The curve numbers refer to the transistors in the preceding tables.)
V_{CE} = 8 V, f = 500 MHz



Noise figure F versus collector current I_C.
(The curve numbers refer to the transistors in the preceding tables.)
V_{CE} = 5 V, f = 900 MHz, Z_{Sopt}



Characteristic Curves
Table II (NPN) (continued)
Noise figure F versus collector current I_C.
(The curve numbers refer to the transistors in the preceding tables.)
V_{CE} = 5 V, f = 1.75 GHz, Z_{Sopt}



Collector-base capacitance C_{CB} versus collector-base voltage V_{CB}.
(The curve numbers refer to the transistors in the preceding tables.)
V_{BE} = v_{be} = 0, f = 1 MHz

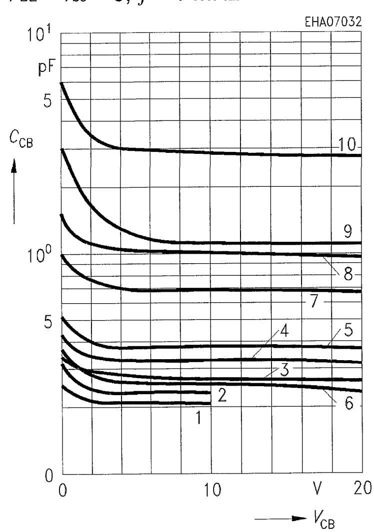
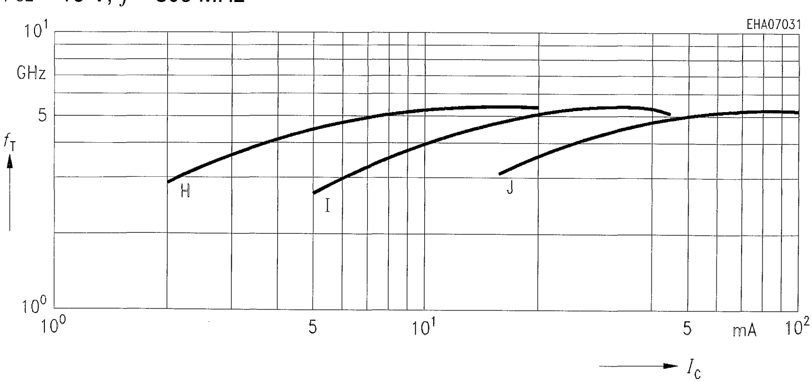


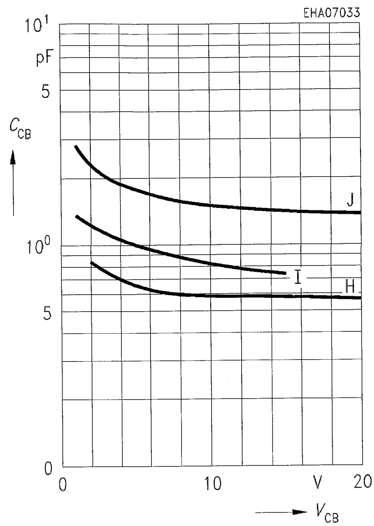
Table of Characteristics III
(for diagrams refer to the next page)

Type	Max. Ratings			Characteristics		Application	Package
PNP	V_{CB0}	I_C	P_{tot}	R_{thJS}	f_T (500 MHz, 10 V)	V_{CE}/I_C f = 0 … > 3 GHz	
	V	mA	mW	K/W	GHz	V/mA	
Curve H:							
BFT 92	12	25	200	360	5	1 … 10/1 … 20	SOT-23
BFQ 76	12	30	250	235	5	1 … 10/1 … 20	Cerec-X
Curve I:							
BFT 93	12	35	200	305	5	3 … 10/5 … 30	SOT-23
BFQ 75	12	50	350	180	5	3 … 10/5 … 30	Cerec-X
Curve J:							
BFR 194	15	100	700	110	5	3 … 10/20 … 80	SOT-23
BFP 194	15	100	700	105	5	3 … 10/20 … 80	SOT-143
BFG 194	15	100	1000	75	5	3 … 10/20 … 80	SOT-223
BFQ 194	15	100	650	130	5	3 … 10/20 … 80	Cerec-X

Characteristic Curves
Table III (PNP)
Transition frequency f_T versus collector current I_C.
(The curve numbers refer to the transistors in the preceding tables.)
V_{CE} = 10 V, f = 500 MHz



Characteristic Curves
Table III (PNP) (continued)
Collector-base capacitance C_{CB} versus collector-base voltage V_{CB}.
(The curve numbers refer to the transistors in the preceding tables.)
$V_{BE} = v_{be} = 0$, $f = 1$ MHz



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Ordering Codes

Ordering Codes
RF Transistors and Diodes

Type	Ordering code	Page
RF Diodes		
BA 243	Q62702-A521	142
BA 243S	Q62702-A607	144
BA 244	Q62702-A421	142
BA 244S	Q62702-A618	144
BA 282	Q62702-A428	146
BA 283	Q62702-A429	146
BA 284	Q62702-A632	148
BA 389	Q62702-A732	150
BA 582	Q62702-A829	153
BA 585	Q62702-A859	155
BA 586	Q62702-A930	157
BA 592	Q62702-A950	159
BA 595	Q62702-A952	161
BA 596	Q62702-A954	163
BA 885	Q62702-A608	165
BA 886	Q62702-A932	167
S BAR 14-1	Q62702-A772	169
S BAR 15-1	Q62702-A731	169
S BAR 16-1	Q62702-A773	169
S BAR 17	Q62702-A785	172
S BAR 60	Q62702-A786	175
S BAR 61	Q62702-A120	175
BAS 125	Q62702-D1316	179
BAS 125-04	Q62702-D1321	179
BAS 125-05	Q62702-D1322	179
BAS 125-06	Q62702-D1323	179
BAS 125-07	Q62702-D1327	180
BAT 14-014	Q62702-D1005	192
BAT 14-020D	Q62702-D1259	184
BAT 14-020R	Q62702-D1260	186
BAT 14-020S	Q62702-D1258	188
BAT 14-022R	Q62702-D411	190
BAT 14-025D	Q62702-A790	195
BAT 14-025R	Q62702-A791	197
BAT 14-025S	Q62702-A789	199
BAT 14-034	Q62702-D1019	192
BAT 14-044	Q62702-D1026	192
BAT 14-050D	Q62702-D1268	184
BAT 14-050R	Q62702-D1269	186

Type	Ordering code	Page
BAT 14-050S	Q62702-D1267	188
BAT 14-052R	Q62702-D412	190
BAT 14-055D	Q62702-A793	195
BAT 14-055R	Q62702-A794	197
BAT 14-055S	Q62702-A792	199
BAT 14-064	Q62702-D1036	192
BAT 14-074	Q62702-D1041	192
BAT 14-090D	Q62702-D1276	184
BAT 14-090R	Q62702-D1277	186
BAT 14-090S	Q62702-D1275	188
BAT 14-092R	Q62702-D413	190
BAT 14-094	Q62702-D1051	192
BAT 14-095D	Q62702-A797	195
BAT 14-095R	Q62702-A796	197
BAT 14-095S	Q62702-A795	199
BAT 14-098	Q62702-A0960	201
BAT 14-099	Q62702-A3461	205
BAT 14-099R	Q62702-A0042	209
BAT 14-104	Q62702-D1056	192
BAT 14-110D	Q62702-D1285	184
BAT 14-110R	Q62702-D1286	186
BAT 14-110S	Q62702-D1284	188
BAT 14-112R	Q62702-D414	190
BAT 14-114	Q62702-D1061	192
BAT 14-115D	Q62702-A800	195
BAT 14-115R	Q62702-A801	197
BAT 14-115S	Q62702-A799	199
BAT 14-124	Q62702-D1066	192
BAT 15-014	Q62702-D3429	219
BAT 15-020D	Q62702-D1263	211
BAT 15-020R	Q62702-D1264	213
BAT 15-020S	Q62702-D1262	215
BAT 15-022R	Q62702-D1265	217
BAT 15-025D	Q62702-A803	221
BAT 15-025R	Q62702-A804	223
BAT 15-025S	Q62702-A802	225
BAT 15-044	Q62702-D3431	219
BAT 15-050D	Q62702-D3450	211
BAT 15-050R	Q62702-D1272	213
BAT 15-050S	Q62702-D1271	215
BAT 15-052R	Q62702-D1273	217
BAT 15-055D	Q62702-A807	221
BAT 15-055R	Q62702-A806	223
BAT 15-055S	Q62702-A805	225

S Preferred type: shortly available via the Semiconductor Distribution Center (Edition April 1991)

Ordering Codes
RF Transistors and Diodes

Type	Ordering code	Page
BAT 15-074	Q62702-D3433	219
BAT 15-090D	Q62702-D1280	211
BAT 15-090R	Q62702-D1281	213
BAT 15-090S	Q62702-D1279	215
BAT 15-092R	Q62702-D1282	217
BAT 15-095D	Q62702-A798	221
BAT 15-095R	Q62702-A809	223
BAT 15-095S	Q62702-A808	225
BAT 15-098	Q62702-A0062	227
BAT 15-099	Q62702-A0066	231
BAT 15-099R	Q62702-A0043	235
BAT 15-104	Q62702-D3435	219
BAT 15-110D	Q62702-D1289	211
BAT 15-110R	Q62702-D1290	213
BAT 15-110S	Q62702-D1288	215
BAT 15-112R	Q62702-D1291	217
BAT 15-115D	Q62702-A811	221
BAT 15-115R	Q62702-A812	223
BAT 15-115S	Q62702-A810	225
BAT 15-124	Q62702-D3437	219
[S] BAT 17	Q62702-A504	237
[S] BAT 17-04	Q62702-A775	237
[S] BAT 17-05	Q62702-A776	237
[S] BAT 17-06	Q62702-A777	237
[S] BAT 17-07	Q62702-A918	238
BAT 18	Q62702-A787	242
BAT 18-04	Q62702-A938	242
BAT 18-05	Q62702-A940	242
BAT 18-06	Q62702-A942	242
BAT 30	Q62702-A764	244
BAT 32	Q62702-A826	246
[S] BAT 62	Q62702-A971	248
[S] BAT 68	Q62702-A926	251
[S] BAT 68-04	Q62702-A4	251
[S] BAT 68-05	Q62702-A15	251
[S] BAT 68-06	Q62702-A19	251
[S] BAT 68-07	Q62702-A44	252
BB 112	Q62702-B240	256
BB 204B	Q62702-B58-X6	259
BB 204G	Q62702-B57-X5	259
BB 304	Q62702-B118	262
BB 409	Q62702-B112	265
BB 419	Q62702-B499	268

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BB 439	Q62702-B577	270
BB 505B	Q62702-B37	272
BB 505G	Q62702-B270	272
BB 512	Q62702-B479	275
BB 515	Q62702-B607	278
BB 535	Q62702-B580	280
BB 609A	Q62702-B196	282
BB 609B	Q62702-B197	282
BB 619	Q62702-B570	284
BB 620	Q62702-B403	286
BB 639	Q62702-B586	288
BB 640	Q62702-B589	290
BB 804	Q62702-B372	292
BB 811	Q62702-B478	295
BB 813	Q62701-B623	297
BB 814	Q62702-B372	299
BB 831	Q62702-B592	301
BB 833	Q62702-B628	303
BBY 24-S1	Q62702-B20-S1	305
BBY 25-S1	Q62702-B21-S1	305
BBY 26-S1	Q62702-B22-S1	305
BBY 27-S2	Q62702-B23-S2	305
BBY 33BB-2	Q62702-B70	307
BBY 33DA-2	Q62702-B127	309
BBY 34C	Q62702-B257	311
BBY 34D	Q62702-B194	311
BBY 35F	Q62702-B195	313
BXY 18A2	Q62702-X140	315
BXY 18AB2	Q62702-X133	315
BXY 18AB5	Q62702-X136	315
BXY 18AB6	Q62702-X137	315
BXY 42BA-S	Q62702-X151	317
BXY 42BA-3	Q62702-X143	320
BXY 42BA-5	Q62702-X145	322
BXY 42BA-6	Q62702-X146	324
BXY 42BA-7	Q62702-X160	326
BXY 42BB-S	Q62702-X159	317
BXY 43A	Q62702-X116	328
BXY 43B	Q62702-X104	328
BXY 43C	Q62702-X105	328
BXY 44K	Q62702-X148	330

[S] Preferred type: shortly available via the Semiconductor Distribution Center (Edition April 1991)

Type	Ordering code	Page
RF Transistors		
BF 199	Q62702-F355	334
BF 240	Q62702-F302	338
BF 241	Q62702-F1241	338
BF 254	Q62702-F201	341
BF 255	Q62702-F202	341
BF 414	Q62702-F517	344
BF 450	Q62702-F312	346
BF 451	Q62702-F313	346
BF 506	Q62702-F534	352
BF 517	Q62702-F42	354
BF 543	Q62702-F1372	357
BF 544	Q62702-F1231	362
BF 550	Q62702-F944	367
BF 554	Q62702-F1042	372
BF 569	Q62702-F869	376
BF 579	Q62702-F971	379
BF 599	Q62702-F979	382
BF 606A	Q62702-F535	386
BF 660	Q62702-F982	388
BF 763	Q62702-F766	391
BF 770A	Q62702-F1124	393
BF 771	Q62702-F1225	396
BF 772	Q62702-F1222	399
BF 775	Q62702-F102	402
BF 775A	Q62702-F1250	405
BF 777	Q62702-F1426	408
BF 799	Q62702-F935	411
BF 840	Q62702-F1240	414
BF 841	Q62702-F1287	414
BF 959	Q62702-F640	416
BF 961	Q62702-F518	419
BF 963	Q62702-F904	429
BF 964S	Q62702-F446	435
BF 965	Q62702-F660	442
BF 966S	Q62702-F438	–
BF 970	Q62702-F650	449
BF 987	Q62702-F35	451
BF 988	Q62702-F36	456
BF 993	Q62702-F1018	464
BF 994S	Q62702-F1020	471
BF 995	Q62702-F936	478
BF 996S	Q62702-F1021	488

Type	Ordering code	Page
BF 997	Q62702-F1055	496
BF 998	Q62702-F1129	503
BF 999	Q62702-F1132	511
S BFG 19S	Q62702-F1359	516
BFG 135A	Q62702-F1322	525
S BFG 193	Q62702-F1291	536
S BFG 194	Q62702-F1321	545
S BFG 196	Q62702-F1292	548
BFG 235	Q62702-F1432	557
S BFP 81	Q62702-F1122	560
S BFP 93A	Q62702-F1144	579
S BFP 180	Q62702-F1297	594
S BFP 181	Q62702-F1317	602
S BFP 182	Q62702-F1318	610
S BFP 183	Q62702-F1319	620
S BFP 193	Q62702-F1282	629
S BFP 194	Q62702-F1347	646
S BFP 196	Q62702-F1320	649
S BFP 280	Q62702-F1300	658
S BFQ 19S	Q62702-F1088	666
S BFQ 29P	Q62702-F659	677
BFQ 64	Q62702-F1061	687
S BFQ 69	Q62702-F780	690
S BFQ 70	Q62702-F774	693
S BFQ 71	Q62702-F775	707
S BFQ 72	Q62702-F776	725
S BFQ 73S	Q62702-F1104	739
S BFQ 74	Q62702-F778	752
BFQ 75	Q62702-F803	766
BFQ 76	Q62702-F804	769
S BFQ 81	Q62702-F1049	773
S BFQ 82	Q62702-F1189	791
S BFQ 181	Q62702-F1295	809
BFQ 182	Q62702-F1355	817
S BFQ 193	Q62702-F1312	821
BFQ 194	Q62702-F1345	831
BFQ 196	Q62702-F1348	834
S BFQ 645	Q62702-F1283	843
S BFR 15A	Q62702-F460	850
S BFR 34A	Q62702-F346-S1	854

S Preferred type: shortly available via the Semiconductor Distribution Center (Edition April 1991)

Ordering Codes
RF Transistors and Diodes

Type	Ordering code	Page
S BFR 35AP	Q62702-F938	860
S BFR 90	Q62702-F560	877
S BFR 91	Q62702-F56l9	883
S BFR 91A	Q62702-F735	888
S BFR 92P	Q62702-F1050	892
S BFR 93A	Q62702-F1086	909
S BFR 93P	Q62702-F1051	917
S BFR 96S	Q68000-A5689	926
BFR 106	Q62702-F1219	936
S BFR 180	Q62702-F1296	945
S BFR 181	Q62702-F1314	953
S BFR 182	Q62702-F1315	961
S BFR 183	Q62702-F1316	972
S BFR 193	Q62702-F1218	981
BFR 194	Q62702-F1346	998
S BFR 280	Q62702-F1298	1001
S BFS 17P	Q62702-F940	1009
S BFS 55A	Q62702-F454	1018
S BFT 65	Q62702-F451	1022
S BFT 66	Q62702-F456	1027
S BFT 92	Q62702-F1062	1030
S BFT 93	Q62702-F1063	1041
S BFT 97	Q62702-F514	1044
S BFT 98	Q62702-F523	1047
BFT 98B	Q62702-F1084	1047
S BFT 98T	Q62702-F877	1051
S BFT 99	Q62702-F524	1054
BFT 99A	Q62702-F901	1054
S BFW 92	Q62702-F321	1058
S BFX 59	Q60206-X59	1061
S BFX 59F	Q60206-X59-S5	1061
S BFX 60	Q60206-X60	1064
S BFY 90	Q62702-F297	1067
S CF 739	Q62702-F1215	1074
S CF 750	Q62702-F1391	1081
CFY 10	Q62703-F11	1086
S CFY 19-18	Q62703-F14	1088

Type	Ordering code	Page
S CFY 19-22	Q62703-F3	1088
S CFY 25-17	Q62703-F106	1096
S CFY 25-20	Q62703-F107	1096
CFY 25-20 E7916	Q62703-F113	1102
S CFY 25-23	Q62703-F108	1096
S CFY 30	Q62703-F97	1107
CFY 35-20	Q62702-F1393	1117
CFY 35-23	Q62702-F1394	1117
S CFY 65-12	Q62703-F101	1123
S CFY 65-14	Q62703-F102	1123
CFY 75-13	Q62702-F1368	1128
CFY 75-15	Q62702-F1369	1128
S CGY 21	Q68000-A5953	1136
CGY 31	Q68000-A6887	1145
CGY 40	Q68000-A4444	1154
S CGY 50	Q68000-A8370	1163
CGY 52	Q68000-A8615	1173
CMY 90	Q62702-M1	1175

S Preferred type: shortly available via the Semiconductor Distribution Center (Edition April 1991)

Ordering Codes
AF Transistors and Diodes*)

Type	Ordering code
AF Diodes	
[S] BAL 74	Q62702-A718
BAL 99	Q62702-A687
BAR 74	Q62702-A704
BAR 99	Q62702-A388
[S] BAS 16	Q62702-A739
[S] BAS 19	Q62702-A95
[S] BAS 20	Q62702-A113
[S] BAS 21	Q62702-A79
[S] BAS 28	Q62702-A77
[S] BAS 40	Q62702-D339
[S] BAS 40-04	Q62702-D980
[S] BAS 40-05	Q62702-D979
[S] BAS 40-06	Q62702-D978
[S] BAS 40-07	Q62702-D1314
[S] BAS 70	Q62702-A118
[S] BAS 70-04	Q62702-A730
[S] BAS 70-05	Q62702-A711
[S] BAS 70-06	Q62702-A774
[S] BAS 70-07	Q62702-A846
[S] BAS 78A	Q62702-A910
[S] BAS 78B	Q62702-A911
[S] BAS 78C	Q62702-A912
[S] BAS 78D	Q62702-A913
[S] BAS 79A	Q62702-A914
[S] BAS 79B	Q62702-A915
[S] BAS 79C	Q62702-A916
[S] BAS 79D	Q62702-A917
BAS 116	Q62702-A919
[S] BAT 64	Q62702-A879
BAT 64-04	Q62702-A961
BAT 64-05	Q62702-A962
BAT 64-06	Q62702-A963
BAT 64-07	Q62702-A964
BAT 65	Q62702-A990
BAT 66-05	Q62702-A988
[S] BAV 70	Q68000-A6622
BAV 74	Q62702-A693
[S] BAV 99	Q68000-A549

Type	Ordering code
BAV 170	Q62702-A920
BAV 199	Q62702-A921
[S] BAW 56	62702-A688
BAW 78A	Q62702-A778
BAW 78B	Q62702-A779
BAW 78C	Q62702-A784
BAW 78D	Q62702-A109
BAW 79A	Q62702-A781
BAW 79B	Q62702-A782
BAW 79C	Q62702-A771
BAW 79D	Q62702-A733
BAW 100	Q62702-A376
[S] BAW 101	Q62702-A712
BAW 156	Q62702-A922
BGX 50A	Q62702-G38
SMBD 914	Q68000-A625
SMBD 2835	Q68000-A8547
SMBD 2836	Q68000-A8436
SMBD 2837	Q68000-A8487
SMBD 2838	Q68000-A8437
SMBD 6050	Q68000-A8439
SMBD 6100	Q68000-A8438
SMBD 7000	Q68000-A8440
AF Transistors	
BC 167	Q62702-C706
[S] BC 167A	Q62702-C74
[S] BC 167B	Q62702-C75
BC 168	Q62702-C707
BC 168A	Q62702-C76
BC 168B	Q62702-C77
BC 168C	Q62702-C78
BC 169	Q62702-C708
BC 169B	Q62702-C79
BC 169C	Q62702-C80
BC 182	Q62702-C455
BC 182A	Q62702-C372
BC 182B	Q62702-C373
BC 183	Q62702-C833

[S] Preferred type: shortly available via the Semiconductor Distribution Center (Edition April 1991)

*) See Data Book II

Ordering Codes
AF Transistors and Diodes*)

Type	Ordering code	Type	Ordering code
BC 183A	Q62702-C388	BC 328	Q62702-C312
BC 183B	Q62702-C387	BC 328-16	Q62702-C312-V3
BC 183C	Q62702-C524	[S] BC 328-25	Q62702-C312-V4
BC 212	Q62702-C242	[S] BC 328-40	Q62702-C312-V2
BC 212A	Q62702-C374-V1	BC 337	Q62702-C313
BC 212B	Q62702-C374-V2	[S] BC 337-16	Q62702-C313-V3
BC 213	Q62702-C564	[S] BC 337-25	Q62702-C313-V1
BC 213A	Q62702-C1159	[S] BC 337-40	Q62702-C313-V2
BC 213B	Q62702-C1160	BC 338	Q62702-C314
BC 213C	Q62702-C1158	BC 338-16	Q62702-C314-V1
BC 237	Q62702-C697	[S] BC 338-25	Q62702-C314-V2
[S] BC 237A	Q62702-C276	[S] BC 338-40	Q62702-C314-V3
[S] BC 237B	Q62702-C277	[S] BC 368	Q62702-C747
BC 238	Q62702-C698	[S] BC 369	Q62702-C748
BC 238A	Q62702-C278	BC 413	Q62702-C375
[S] BC 238B	Q62702-C279	BC 413B	Q62702-C375-V1
[S] BC 238C	Q62702-C280	BC 413C	Q62702-C375-V2
BC 239	Q62702-C699	BC 414	Q62702-C376
BC 239B	Q62702-C281	BC 414B	Q62702-C376-V1
[S] BC 239C	Q62702-C282	[S] BC 414C	Q62702-C376-V2
BC 257	Q62702-C700	BC 415	Q62702-C377
[S] BC 257A	Q62702-C184	BC 415A	Q62702-C377-V1
[S] BC 257B	Q62702-C206	BC 415B	Q62702-C377-V2
BC 258	Q62702-C701	[S] BC 415C	Q62702-C377-V3
BC 258A	Q62702-C187	BC 416	Q62702-C378
BC 258B	Q62702-C188	BC 416A	Q62702-C378-V1
BC 258C	Q62702-C438	BC 416B	Q62702-C378-V2
BC 259	Q62702-C702	[S] BC 416C	Q62702-C378-V3
BC 259B	Q62702-C192	[S] BC 516	Q62702-C944
BC 259C	Q62702-C439	[S] BC 517	Q62702-C825
BC 307	Q62702-C703	BC 546	Q62702-C687
[S] BC 307A	Q62702-C283	BC 546A	Q62702-C687-V1
[S] BC 307B	Q62702-C324	[S] BC 546B	Q62702-C687-V2
BC 308	Q62702-C704	BC 547	Q62702-C688
BC 308A	Q62702-C285	BC 547A	Q62702-C688-V1
[S] BC 308B	Q62702-C286	[S] BC 547B	Q62702-C688-V2
[S] BC 308C	Q62702-C393	BC 548	Q62702-C689
BC 309	Q62702-C705	BC 548A	Q62702-C689-V1
BC 309B	Q62702-C289	[S] BC 548B	Q62702-C689-V2
BC 309C	Q62702-C323	[S] BC 548C	Q62702-C689-V3
BC 327	Q62702-C311	BC 549	Q62702-C690
[S] BC 327-16	Q62702-C311-V3	BC 549B	Q62702-C690-V1
[S] BC 327-25	Q62702-C311-V4	[S] BC 549C	Q62702-C690-V2
[S] BC 327-40	Q62702-C311-V2	BC 550	Q62702-C691

[S] Preferred type: shortly available via the Semiconductor Distribution Center (Edition April 1991)

*) See Data Book II

Ordering Codes
AF Transistors and Diodes*)

Type	Ordering code	Type	Ordering code
BC 550B	Q62702-C691-V1	[S] BC 847C	Q62702-C1715
[S] BC 550C	Q62702-C691-V2	[S] BC 848A	Q62702-C1741
BC 556	Q62702-C692	[S] BC 848B	Q62702-C1704
BC 556A	Q62702-C692-V1	[S] BC 848C	Q62702-C1506
[S] BC 556B	Q62702-C692-V2	BC 849B	Q62702-C1727
BC 557	Q62702-C693	BC 849C	Q62702-C1713
BC 557A	Q62702-C693-V1	BC 850B	Q62702-C1885
[S] BC 557B	Q62702-C693-V2	BC 850C	Q62702-C1712
BC 558	Q62702-C694	[S] BC 856A	Q62702-C1773
BC 558A	Q62702-C694-V1	[S] BC 856B	Q62702-C1886
[S] BC 558B	Q62702-C694-V2	[S] BC 857A	Q62702-C1850
[S] BC 558C	Q62702-C694-V3	[S] BC 857B	Q62702-C1688
BC 559	Q62702-C695	[S] BC 857C	Q62702-C1851
BC 559A	Q62702-C695-V1	[S] BC 858A	Q62702-C1742
BC 559B	Q62702-C695-V2	[S] BC 858B	Q62702-C1698
[S] BC 559C	Q62702-C695-V3	[S] BC 858C	Q62702-C1507
BC 560	Q62702-C696	BC 859A	Q62702-C1887
BC 560A	Q62702-C696-V1	BC 859B	Q62702-C1774
[S] BC 560B	Q62702-C696-V2	BC 859C	Q62702-C1761
[S] BC 560C	Q62702-C696-V3	BC 860B	Q62702-C1888
BC 617	Q62702-C1137	BC 860C	Q62702-C1889
BC 618	Q62702-C1138	[S] BC 875	Q62702-C853
[S] BC 635	Q68000-A3360	[S] BC 876	Q62702-C943
[S] BC 636	Q68000-A3365	[S] BC 877	Q62702-C854
[S] BC 637	Q68000-A2285	[S] BC 878	Q62702-C942
[S] BC 638	Q68000-A3366	[S] BC 879	Q62702-C855
[S] BC 639	Q68000-A3361	[S] BC 880	Q62702-C941
[S] BC 640	Q68000-A3367		
[S] BC 807-16	Q62702-C1735	[S] BCP 28	Q62702-C2134
[S] BC 807-25	Q62702-C1689	[S] BCP 29	Q62702-C2136
[S] BC 807-40	Q62702-C1721	[S] BCP 48	Q62702-C2135
[S] BC 808-16	Q62702-C1736	[S] BCP 49	Q62702-C2137
[S] BC 808-25	Q62702-C1504	[S] BCP 51	Q62702-C2107
[S] BC 808-40	Q62702-C1692	[S] BCP 51-10	Q62702-C2109
[S] BC 817-16	Q62702-C1732	[S] BCP 51-16	Q62702-C2110
[S] BC 817-25	Q62702-C1690	[S] BCP 52	Q62702-C2146
[S] BC 817-40	Q62702-C1738	[S] BCP 52-10	Q62702-C2112
[S] BC 818-16	Q62702-C1739	[S] BCP 52-16	Q62702-C2113
[S] BC 818-25	Q62702-C1740	[S] BCP 53	Q62702-C2147
[S] BC 818-40	Q62702-C1505	[S] BCP 53-10	Q62702-C2115
[S] BC 846A	Q62702-C1772	[S] BCP 53-16	Q62702-C2116
BC 846B	Q62702-C1746	[S] BCP 54	Q62702-C2117
[S] BC 847A	Q62702-C1884	[S] BCP 54-10	Q62702-C2119
[S] BC 847B	Q62702-C1687	[S] BCP 54-16	Q62702-C2120

[S] Preferred type: shortly available via the Semiconductor Distribution Center (Edition April 1991)

*) See Data Book II

Ordering Codes
AF Transistors and Diodes*)

Type	Ordering code
S BCP 55	Q62702-C2148
S BCP 55-10	Q62702-C2122
S BCP 55-16	Q62702-C2123
S BCP 56	Q62702-C2149
S BCP 56-10	Q62702-C2125
S BCP 56-16	Q62702-C2106
S BCP 68	Q62702-C2126
S BCP 69	Q62702-C2130
S BCV 26	Q62702-C1493
S BCV 27	Q62702-C1474
BCV 28	Q62702-C1852
BCV 29	Q62702-C1853
S BCV 46	Q62702-C1475
S BCV 47	Q62702-C1501
S BCV 48	Q62702-C1854
S BCV 49	Q62702-C1832
BCV 61A	Q62702-C2155
BCV 61B	Q62702-C2156
BCV 61C	Q62702-C2157
BCV 62A	Q62702-C2158
BCV 62B	Q62702-C2159
BCV 62C	Q62702-C2160
S BCW 60A	Q62702-C1517
S BCW 60B	Q62702-C1497
S BCW 60C	Q62702-C1476
S BCW 60D	Q62702-C1477
BCW 60FF	Q62702-C1529
BCW 60FN	Q62702-C1567
S BCW 61A	Q62702-C452
S BCW 61B	Q62702-C1585
S BCW 61C	Q62702-C1478
S BCW 61D	Q62702-C1556
BCW 61FF	Q62702-C1890
BCW 61FN	Q62702-C1891
S BCW 65A	Q62702-C1516
S BCW 65B	Q62702-C1612
S BCW 65C	Q62702-C1479
S BCW 66F	Q62702-C1892
S BCW 66G	Q62702-C1526
S BCW 66H	Q62702-C1632
S BCW 67A	Q62702-C1560
S BCW 67B	Q62702-C1480

Type	Ordering code
S BCW 67C	Q62702-C1681
S BCW 68F	Q62702-C1893
S BCW 68G	Q62702-C1322
S BCW 68H	Q62702-C1555
BCX 12	Q62702-C25
BCX 13	Q62702-C26
S BCX 41	Q62702-C1659
S BCX 42	Q62702-C1485
BCX 51	Q62702-C1847
BCX 51-10	Q62702-C1831
BCX 51-16	Q62702-C1857
BCX 52	Q62702-C1743
BCX 52-10	Q62702-C1744
BCX 52-16	Q62702-C1900
BCX 53	Q62702-C905
BCX 53-10	Q62702-C1753
BCX 53-16	Q62702-C1502
BCX 54	Q62702-C954
BCX 54-10	Q62702-C1861
BCX 54-16	Q62702-C1731
BCX 55	Q62702-C1729
BCX 55-10	Q62702-C1730
BCX 55-16	Q62702-C1903
BCX 56	Q62702-C1614
BCX 56-10	Q62702-C1635
BCX 56-16	Q62702-C1613
BCX 58 VIII	Q62702-C619
BCX 58 IX	Q62702-C620
BCX 58 X	Q62702-C621
BCX 59 VIII	Q62702-C623
BCX 59 IX	Q62702-C624
BCX 59 X	Q62702-C625
BCX 68-10	Q62702-C1864
BCX 68-16	Q62702-C1865
BCX 68-25	Q62702-C1866
BCX 69-10	Q62702-C1867
BCX 69-16	Q62702-C1868
BCX 69-25	Q62702-C1869
S BCX 70G	Q62702-C1539
S BCX 70H	Q62702-C1481
S BCX 70J	Q62702-C1552
S BCX 70K	Q62702-C1571
S BCX 71G	Q62702-C1482

S Preferred type: shortly available via the Semiconductor Distribution Center (Edition April 1991)

*) See Data Book II

Ordering Codes
AF Transistors and Diodes*)

Type	Ordering code
S BCX 71H	Q62702-C1586
S BCX 71J	Q62702-C1554
S BCX 71K	Q62702-C1654
BCX 73	Q62702-C634
BCX 73-16	Q62702-C634-S1
BCX 73-25	Q62702-C634-S2
BCX 73-40	Q62702-C634-S3
BCX 74	Q62702-C635
BCX 74-16	Q62702-C635-S1
BCX 74-25	Q62702-C635-S2
BCX 74-40	Q62702-C635-S3
BCX 75	Q62702-C636
BCX 75-16	Q62702-C636-S1
BCX 75-25	Q62702-C636-S2
BCX 75-40	Q62702-C636-S3
BCX 76	Q62702-C637
BCX 76-16	Q62702-C637-S1
BCX 76-25	Q62702-C637-S2
BCX 76-40	Q62702-C637-S3
BCX 78	Q62702-C717
BCX 78 VII	Q62702-C626
BCX 78 VIII	Q62702-C627
BCX 78 IX	Q62702-C628
BCX 78 X	Q62702-C629
BCX 79	Q62702-C718
BCX 79 VII	Q62702-C630
BCX 79 VIII	Q62702-C631
BCX 79 IX	Q62702-C632
BCX 79 X	Q62702-C633
BD 825	Q62702-D1135
BD 825-6	Q62702-D149
BD 825-10	Q62702-D1213
BD 825-16	Q62702-D60
BD 826	Q62702-D1303
BD 826-6	Q62702-D1304
BD 826-10	Q62702-D1179
BD 826-16	Q62702-D1257
BD 827	Q62702-D1305
BD 827-6	Q62702-D1306
BD 827-10	Q62702-D1113
BD 828	Q62702-D1307
BD 828-6	Q62702-D1308
BD 828-10	Q62702-D61

Type	Ordering code
BD 829	Q62702-D1309
BD 829-6	Q62702-D1310
BD 829-10	Q62702-D1311
BD 830	Q62702-D1312
BD 830-6	Q62702-D1313
BD 830-10	Q62702-D1238
BF 420	Q62702-F531
BF 421	Q62702-F532
BF 422	Q62702-F495
BF 423	Q62702-F496
BF 622	Q62702-F1052
BF 623	Q62702-F1053
S BF 720	Q62702-F1238
S BF 721	Q62702-F1239
S BF 722	Q62702-F1306
S BF 723	Q62702-F1309
BF 857	Q62702-F784
BF 858	Q62702-F785
BF 859	Q62702-F786
BF 869	Q62702-F683
BF 870	Q62702-F685
BF 871	Q62702-F676
BF 872	Q62702-F677
BF 881	Q62702-F794
S BFN 16	Q62702-F885
S BFN 17	Q62702-F884
BFN 18	Q62702-F1056
BFN 19	Q62702-F1057
BFN 20	Q62702-F1058
BFN 21	Q62702-F1059
BFN 22	Q62702-F1024
BFN 23	Q62702-F1064
BFN 24	Q62702-F1065
BFN 25	Q62702-F1066
S BFN 26	Q62702-F976
S BFN 27	Q62702-F977
S BFN 36	Q62702-F1246
S BFN 37	Q62702-F1304
S BFN 38	Q62702-F1303
S BFN 39	Q62702-F1305
BFP 22	Q62702-F621

S Preferred type: shortly available via the Semiconductor Distribution Center (Edition April 1991)

*) See Data Book II

Ordering Codes
AF Transistors and Diodes*)

Type	Ordering code
BFP 23	Q62702-F622
BFP 25	Q62702-F721
BFP 26	Q62702-F722
S BSP 50	Q62702-P1163
S BSP 51	Q62702-P1164
S BSP 52	Q62702-P1165
S BSP 60	Q62702-P1166
S BSP 61	Q62702-P1167
S BSP 62	Q62702-P1168
BSS 63	Q62702-S534
BSS 64	Q62702-S535
BSS 79B	Q62702-S503
BSS 79C	Q62702-S501
BSS 80B	Q62702-S557
BSS 80C	Q62702-S492
BSS 81B	Q62702-S555
BSS 81C	Q62702-S605
BSS 82B	Q62702-S560
BSS 82C	Q62702-S482
MPSA 42	Q68000-A413
MPSA 43	Q68000-A4809
MPSA 92	Q68000-A5906
MPSA 93	Q68000-A4810
PZT 2222	Q62702-Z2026
PZT 2222A	Q62702-Z2027
PZT 2907	Q62702-Z2028
PZT 2907A	Q62702-Z2025
PZT 3904	Q62702-Z2029
PZT 3906	Q62702-Z2030
PZTA 13	Q62702-Z2033
PZTA 14	Q62702-Z2034
PZTA 42	Q62702-Z2035
PZTA 43	Q62702-Z2036
PZTA 63	Q62702-Z2031
PZTA 64	Q62702-Z2032
PZTA 92	Q62702-Z2037
PZTA 93	Q62702-Z2038
SMBT 2222	Q68000-A6481

Type	Ordering code
SMBT 2222A	Q68000-A6473
SMBT 2907	Q68000-A6501
SMBT 2907A	Q68000-A6474
SMBT 3904	Q68000-A4416
SMBT 3906	Q68000-A4417
SMBT 4124	Q68000-A8316
SMBT 4126	Q68000-A8549
SMBT 5086	Q62702-M0002
SMBT 5087	Q68000-A8319
SMBT 6427	Q68000-A8320
SMBT 6428	Q68000-A8321
SMBT 6429	Q68000-A8322
SMBTA 05	Q68000-A3430
SMBTA 06	Q68000-A3428
SMBTA 13	Q68000-A6475
SMBTA 14	Q68000-A6476
SMBTA 20	Q68000-A6477
SMBTA 42	Q68000-A6478
SMBTA 43	Q68000-A6482
SMBTA 55	Q68000-A3386
SMBTA 56	Q68000-A2882
SMBTA 63	Q68000-A2625
SMBTA 64	Q68000-A2485
SMBTA 70	Q62702-M0003
SMBTA 92	Q68000-A6479
SMBTA 93	Q68000-A6483
SXT 2222A	Q68000-A8330
SXT 2907A	Q68000-A8300
SXT 3904	Q68000-A8396
SXT 3906	Q68000-A8397
SXTA 42	Q68000-A8394
SXTA 43	Q68000-A8650
SXTA 92	Q68000-A8393
SXTA 93	Q68000-A865

S Preferred type: shortly available via the Semiconductor Distribution Center (Edition April 1991)

*) See Data Book II

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Marking Catalog

Marking	Type	Package
13	BAS 125	SOT-23
14	BAS 125-04	SOT-23
15	BAS 125-05	SOT-23
16	BAS 125-06	SOT-23
17	BAS 125-07	SOT-143
181	BFQ 181	Cerec-X
182	BFQ 182	Cerec-X
194	BFQ 194	Cerec-X
196	BFQ 196	Cerec-X
1A	SXT 3904	SOT-89
1As	BC 846 A	SOT-23
1Bs	BC 846 B	SOT-23
1D	SXTA 42	SOT-89
1E	SXTA 43	SOT-89
1Es	BC 847 A	SOT-23
1Fs	BC 847 B	SOT-23
1Gs	BC 847 C	SOT-23
1Js	BCV 61 A	SOT-143
1Js	BC 848 A	SOT-23
1Ks	BC 848 B	SOT-23
1Ks	BCV 61 B	SOT-143
1Ls	BC 848 C	SOT-23
1Ls	BCV 61 C	SOT-143
2	BB 439	SOD-323
2	BB 419	SOD-123
2A	SXT 3906	SOT-89
2Bs	BC 849 B	SOT-23
2Cs	BC 849 C	SOT-23
2D	SXTA 92	SOT-89
2E	SXTA 93	SOT-89
2F	SXT 2907 A	SOT-89
2Fs	BC 850 B	SOT-23
2Gs	BC 850 C	SOT-23
2P	SXT 2222 A	SOT-89
32	BAT 32	Cerec-X
3As	BC 856 A	SOT-23
3Bs	BC 856 B	SOT-23
3Es	BC 857 A	SOT-23
3Fs	BC 857 B	SOT-23
3Gs	BC 857 C	SOT-23
3Js	BCV 62 A	SOT-143
3Js	BC 858 A	SOT-23
3Ks	BC 858 B	SOT-23
3Ks	BCV 62 B	SOT-143
3Ls	BC 858 C	SOT-23
3Ls	BCV 62 C	SOT-143

Marking	Type	Package
41	BAT 14-115 R	SOT-143
41	BAT 14-115 S	Cerec-X
41D	BAT 14-115 D	Cerec-X
42	BAT 14-025 R	Cerec-X
42	BAT 14-025 R	Cerec-X
42	BAT 14-025 S	Cerec-X
42D	BAT 14-025 D	Cerec-X
43s	BAS 40	SOT-23
44s	BAS 40-04	SOT-23
45	BAT 14-055 R	Cerec-X
45	BAT 14-055 S	Cerec-X
45	BAT 14-055 R	Cerec-X
45D	BAT 14-055 D	Cerec-X
45s	BAS 40-05	SOT-23
46s	BAS 40-06	SOT-23
47s	BAS 40-07	SOT-143
49	BAT 14-095 R	Cerec-X
49	BAT 14-095 S	Cerec-X
49D	BAT 14-095 D	Cerec-X
4As	BC 859 A	SOT-23
4Bs	BC 859 B	SOT-23
4Cs	BC 859 C	SOT-23
4Fs	BC 860 B	SOT-23
4Gs	BC 860 C	SOT-23
51	BAT 15-115 R	Cerec-X
51	BAT 15-115 S	Cerec-X
51D	BAT 15-115 D	Cerec-X
51D	BAT 15-115 D	Cerec-X
52	BAT 15-025 S	Cerec-X
52	BAT 15-025 R	Cerec-X
52D	BAT 15-025 D	Cerec-X
53s	BAT 17	SOT-23
54s	BAT 17-04	SOT-23
55	BAT 15-055 R	Cerec-X
55	BAT 15-055 S	Cerec-X
55D	BAT 15-055 D	Cerec-X
55s	BAT 17-05	SOT-23
56s	BAT 17-06	SOT-23
59	BAT 15-095 R	Cerec-X
59	BAT 15-095 S	Cerec-X
59D	BAT 15-095 D	Cerec-X
5As	BC 807-16	SOT-23
5Bs	BC 807-25	SOT-23
5Cs	BC 807-40	SOT-23
5Es	BC 808-16	SOT-23
5Fs	BC 808-25	SOT-23

Marking	Type	Package
5Gs	BC 808-40	SOT-23
60s	BAR 60	SOT-143
61s	BAR 61	SOT-143
62s	BAT 62	SOT-143
63s	BAT 64	SOT-23
645	BFQ 645	Cerec-X
64s	BAT 64-04	SOT-23
65s	BAT 64-05	SOT-23
66s	BAT 64-06	SOT-23
67s	BAT 64-07	SOT-143
6As	BC 817-16	SOT-23
6Bs	BC 817-25	SOT-23
6Cs	BC 817-40	SOT-23
6Es	BC 818-16	SOT-23
6Fs	BC 818-25	SOT-23
6Gs	BC 818-40	SOT-23
70	BFQ 70	Cerec-X
71	BFQ 71	Cerec-X
72	BFQ 72	Cerec-X
73	BFQ 73	Cerec-X
73S	BFQ 73 S	Cerec-X
73s	BAS 70	SOT-23
74	BFQ 74	Cerec-X
74s	BAS 70-04	SOT-23
75	BFQ 75	Cerec-X
75s	BAS 70-05	SOT-23
76	BFQ 76	Cerec-X
76s	BAS 70-06	SOT-23
77s	BAS 70-07	SOT-143
82	BFQ 82	Cerec-X
83	BAT 68	SOT-23
84	BAT 68-04	SOT-23
85	BAT 68-05	SOT-23
86	BAT 68-06	SOT-23
87	BAT 68-07	SOT-143
A	BAT 14-098	SOD-123
A1	CFY 19-18	Cerec-X
A1s	BAW 56	SOT-23
A2	CFY 19-22	Cerec-X
A2s	CFY 30	SOT-143
A2s	BAT 18	SOT-23
A4s	BAV 70	SOT-23
A6s	BAS 16	SOT-23
A7s	BAV 99	SOT-23
AAs	BCW 60 A	SOT-23
AB	BCX 51-6	SOT-89

Marking	Type	Package
ABs	BCW 60 B	SOT-23
AC	BCX 51-10	SOT-89
ACs	BCW 60 C	SOT-23
AD	BCX 51-16	SOT-89
ADs	BCW 60 D	SOT-23
AF	BCX 52-6	SOT-89
AFs	BCW 60 FF	SOT-23
AG	BCX 52-10	SOT-89
AGs	BCX 70 G	SOT-23
AHs	BCX 70 H	SOT-23
AJ	BCX 53-6	SOT-89
AJs	BCX 70 J	SOT-23
AK	BCX 53-10	SOT-89
AKs	BCX 70 K	SOT-23
AL	BCX 53-16	SOT-89
AM	BCX 52-16	SOT-89
AMs	BSS 64	SOT-23
ANs	BCW 60 FN	SOT-23
ASs	BAT 18-05	SOT-23
ATs	BAT 18-06	SOT-23
AUs	BAT 18-04	SOT-23
B	BAT 15-098	SOD-123
BAs	BCW 61 A	SOT-23
BB	BCX 54-6	SOT-89
BBs	BCW 61 B	SOT-23
BC	BCX 54-10	SOT-89
BCs	BCW 61 C	SOT-23
BD	BCX 54-16	SOT-89
BDs	BCW 61 D	SOT-23
BF	BCX 55-6	SOT-89
BFs	BCW 61 FF	SOT-23
BG	BCX 55-10	SOT-89
BGs	BCX 71 G	SOT-23
BHs	BCX 71 H	SOT-23
BJ	BCX 56-6	SOT-89
BJs	BCX 71 J	SOT-23
BK	BCX 56-10	SOT-89
BKs	BCX 71 K	SOT-23
BL	BCX 56-16	SOT-89
BM	BCX 55-16	SOT-89
BMs	BSS 63	SOT-23
BNs	BCW 61 FN	SOT-23
C	BAT 65	SOD-123
C5	CFY 25-17	Micro-X
C6	CFY 25-20	Micro-X
C7	CFY 25-23	Micro-X

Marking	Type	Package
CB	BCX 68-10	SOT-89
CC	BCX 68-16	SOT-89
CCs	BF 554	SOT-23
CD	BCX 68-25	SOT-89
CDs	BSS 81 B	SOT-23
CEs	BSS 79 B	SOT-23
CF	BCX 69-10	SOT-89
CFs	BSS 79 C	SOT-23
CG	BCX 69-16	SOT-89
CGs	BSS 81 C	SOT-23
CH	BCX 69-25	SOT-89
CHs	BSS 80 B	SOT-23
CJs	BSS 80 C	SOT-23
CLs	BSS 82 B	SOT-23
CMs	BSS 82 C	SOT-23
DA	BF 622	SOT-89
DAs	BCW 67 A	SOT-23
DB	BF 623	SOT-89
DBs	BCW 67 B	SOT-23
DCs	BCW 67 C	SOT-23
DD	BFN 16	SOT-89
DE	BFN 18	SOT-89
DF	BFN 21	SOT-89
DFs	BCW 68 F	SOT-23
DG	BFN 17	SOT-89
DGs	BCW 68 G	SOT-23
DH	BFN 19	SOT-89
DHs	BCW 68 H	SOT-23
DKs	BCX 42	SOT-23
E	BAT 66	SOD-123
EAs	BCW 65 A	SOT-23
EBs	BCW 65 B	SOT-23
ECs	BCW 65 C	SOT-23
ED	BCV 28	SOT-89
EE	BCV 48	SOT-89
EF	BCV 29	SOT-89
EFs	BCW 66 F	SOT-23
EG	BCV 49	SOT-89
EGs	BCW 66 G	SOT-23
EHs	BCW 66 H	SOT-23
EKs	BCX 41	SOT-23
FAs	BFP 81	SOT-143
FDs	BCV 26	SOT-23
FEs	BFP 93 A	SOT-143
FEs J	BCV 46	SOT-23
FFs J	BCV 27	SOT-23

Marking	Type	Package
FG	BFQ 19 S	SOT-89
FGs	BCV 47	SOT-23
FHs	BFN 24	SOT-23
FJs	BFN 26	SOT-23
FKs	BFN 25	SOT-23
FLs	BFN 27	SOT-23
GA	BAW 78 A	SOT-89
GB	BAW 78 B	SOT-89
GC	BAW 78 C	SOT-89
GD	BAW 78 D	SOT-89
GE	BAW 79 A	SOT-89
GF	BAW 79 B	SOT-89
GFs	BFR 92 P/S	SOT-23
GG	BAW 79 C	SOT-89
GGs	BFR 93 P	SOT-23
GH	BAW 79 D	SOT-89
HA	CFY 65-12	Micro-X
HB	CFY 65-14	Micro-X
HBs	BFN 22	SOT-23
HCs	BFN 23	SOT-23
JAs	BAV 74	SOT-23
JBs	BAR 74	SOT-23
JCs	BAL 74	SOT-23
JFs	BAL 99	SOT-23
JGs	BAR 99	SOT-23
JPs	BAS 19	SOT-23
JPs	BAW 101	SOT-143
JRs	BAS 20	SOT-23
JSs	BAW 100	SOT-143
JSs	BAS 21	SOT-23
JTs	BAS 28	SOT-143
JVs	BAS 116	SOT-23
JXs	BAV 170	SOT-23
JYs	BAV 199	SOT-23
JZs	BAW 156	SOT-23
KCs	BFQ 29 P	SOT-23
L6s	BAR 17	SOT-23
L7s	BAR 14-1	SOT-23
L8s	BAR 15-1	SOT-23
L9s	BAR 16-1	SOT-23
LAs	BF 550	SOT-23
LBs	BF 999	SOT-23
LDs	BF 543	SOT-23
LEs	BF 660	SOT-23
LFs	BF 777	SOT-23
LGs	BF 775 A	SOT-23

Marking	Type	Package
LHs	BF 569	SOT-23
LJs	BF 579	SOT-23
LKs	BF 799	SOT-23
LOs	BF 775	SOT-23
LRs	BF 517	SOT-23
LSs	BF 770 A	SOT-23
M	BB 512	SOD-123
MCs	BFS 17 P	SOT-23
MGs	BF 994 S	SOT-143
MHs	BF 996 S	SOT-143
MKs	BF 997	SOT-143
MOs	BF 998	SOT-143
MSs	CF 739	SOT-143
MXs	CF 750	SOT-143
NBs	BF 599	SOT-23
NCs	BF 840	SOT-23
NDs	BF 841	SOT-23
P	BA 596	SOD-323
P	BA 586	SOD-123
PAs	BA 885	SOT-23
PCs	BA 886	SOT-23
R2s	BFR 93 A	SOT-23
R7s	BFR 106	SOT-23
RAs	BFQ 81	SOT-23
RAs	BF 772	SOT-143
RBs	BF 771	SOT-23
RC	BFQ 193	SOT-89
RCs	BFP 193	SOT-143
RCs	BFR 193	SOT-23
RDs	BFR 180	SOT-23
RDs	BFP 180	SOT-143
REs	BFP 280	SOT-143
REs	BFR 280	SOT-23
RFs	BFP 181	SOT-143
RFs	BFR 181	SOT-23
RGs	BFP 182	SOT-143
RGs	BFR 182	SOT-23
RHs	BFP 183	SOT-143
RHs	BFR 183	SOT-23
RIs	BFP 196	SOT-143
RIs	BFR 196	SOT-23
RKs	BFP 194	SOT-143
RKs	BFR 194	SOT-23
S	BA 592	SOD-323
S	BB 535	SOD-323
S	BB 639	SOD-323

Marking	Type	Package
S	BB 640	SOD-323
S	BA 582	SOD-123
S	BB 515	SOD-123
S	BB 619	SOD-123
S	BB 620	SOD-123
s1A	SMBT 3904	SOT-23
s1B	SMBT 2222	SOT-23
s1C	SMBTA 20	SOT-23
s1D	SMBTA 42	SOT-23
s1E	SMBTA 43	SOT-23
s1G	SMBTA 06	SOT-23
s1H	SMBTA 05	SOT-23
s1K	SMBT 6428	SOT-23
s1L	SMBT 6429	SOT-23
s1M	SMBTA 13	SOT-23
s1N	SMBTA 14	SOT-23
s1P	SMBT 2222 A	SOT-23
s1V	SMBT 6427	SOT-23
s2A	SMBT 3906	SOT-23
s2B	SMBT 2907	SOT-23
s2C	SMBTA 70	SOT-23
s2D	SMBTA 92	SOT-23
s2E	SMBTA 93	SOT-23
s2F	SMBT 2907 A	SOT-23
s2G	SMBTA 56	SOT-23
s2H	SMBTA 55	SOT-23
s2P	SMBT 5086	SOT-23
s2Q	SMBT 5087	SOT-23
s2U	SMBTA 63	SOT-23
s2V	SMBTA 64	SOT-23
s5A	SMBD 6050	SOT-23
s5B	SMBD 6100	SOT-23
s5C	SMBD 7000	SOT-23
s5D	SMBD 914	SOT-23
S5s	BAT 15-099	SOT-143
S6s	BAT 15-099 R	SOT-143
S9s	BAT 14-099	SOT-143
sA2	SMBD 2836	SOT-23
sA3	SMBD 2835	SOT-23
sA4	SMBD 2838	SOT-23
sA5	SMBD 2837	SOT-23
sC3	SMBT 4126	SOT-23
SF0	BB 804	SOT-23
SF1	BB 804	SOT-23
SF2	BB 804	SOT-23
SF3	BB 804	SOT-23

Marking	Type	Package
SF4	BB 804	SOT-23
SH1	BB 814	SOT-23
SH2	BB 814	SOT-23
sZC	SMBT 4124	SOT-23
T	BB 831	SOD-323
T	BB 811	SOD-123
T	BB 813	SOD-123
T	BB 833	SOD-323
U1s	BGX 50 A	SOT-143
W1s	BFT 92	SOT-23
X	SOT 143 Dummy	SOT-143
X1s	BFT 93	SOT-23
Y	SOT 23 Dummy	SOT-23
Z	SOT 143 Dummy	SOT-143
Z	SOT 23 Dummy	SOT-23

Technische Angaben

Technical Information

1. Typenbezeichnung nach Pro Electron

Dieses Typenbezeichnungssystem gilt für Einzelhalbleiter-Bauelemente – im Gegensatz zu integrierten Schaltungen –, Vielfache von solchen Bauelementen und Halbleiterchips.

Die Nummer des Grundtyps besteht aus zwei Buchstaben und einem laufenden Kennzeichen:

Erster Buchstabe

Der erste Buchstabe gibt Auskunft über das Ausgangsmaterial.

A. Germanium oder anderes Material mit Bandabstand 0,6 ... 1,0 eV
B. Silizium oder anderes Material mit Bandabstand 1,0 ... 1,3 eV
C. Gallium-Arsenid oder anderes Material mit Bandabstand 1,3 eV
R. Verbindungshalbleiter, z. B. Kadmium-Sulfid

Zweiter Buchstabe

Der zweite Buchstabe beschreibt die Hauptfunktion

A. Diode: Signal, kleine Leistungen
B. Diode: mit veränderlicher Kapazität
C. Transistor: kleine Leistungen, Tonfrequenzbereich
D. Transistor: Leistung, Tonfrequenzbereich
E. Diode: Tunneldiode
F. Transistor: kleine Leistungen, Hochfrequenzbereich
G. Vielfaches von nicht gleichen Typen – Diversen (z.B. Oszillator)
H. Diode: auf Magnetfelder ansprechend
L. Transistor: Leistung, Hochfrequenzbereich
N. Fotokopplungselement
P. Strahlungsempfindliches Element
Q. Strahlungserzeugendes Element
R. Kontrollelement, Schaltzwecke: (z. B. Thyristor), kleine Leistungen
S. Transistor: für kleine Leistungen, Schaltzwecke
T. Kontrollelement, Schaltzwecke: (z. B. Thyristor), Leistung
U. Transistor: Leistungsschalttransistor
X. Diode: Vervielfacher, z. B. Varaktor, step recovery
Y. Diode: Gleichrichter, Booster
Z. Diode: Referenzdiode, Spannungsreglerdiode, Spannungsbegrenzerdiode

Das laufende Kennzeichen der Bezeichnung besteht aus:

- einer 3stelligen Zahl (100 ... 999) für Bauelemente zur Verwendung in Rundfunk- und Fernsehempfängern usw.
- einem Buchstaben und einer 2stelligen Zahl für Bauelemente für professionelle Geräte und Anwendungen. Der Buchstabe hat keine fest zugeordnete Bedeutung.

2. Schreibweise der Symbole und Begriffe (DIN 41 785)

Die Kennzeichnung der Strom-, Spannungs-, Leistungs- (Wechselwerte, Gleich- bzw. Mittelwerte) und Widerstandsart (Wechsel- bzw. Gleichwerte) wird durch Groß- und Kleinschreibung der Symbole vorgenommen.

Kurzzeichen

Kurzzeichen für Größen

Für Augenblickswerte zeitlich veränderlicher Größen werden kleine Buchstaben verwendet.

Beispiele: i, v, p

Für Gleichwerte, Mittel- und Effektivwerte und für Scheitelwerte periodischer Funktionen des Stromes, der Spannung und der Leistung, d. h. für zeitlich konstante Größen, werden große Buchstaben verwendet.

Beispiele: I, V, P

Indizes für Kurzzeichen von Größen

Es werden folgende Indizes verwendet:

E, e	Emitter
B, b	Basis
C, c	Kollektor
F, f	Vorwärtsrichtung (Diode in Durchlaßrichtung)
R, r	Rückwärtsrichtung (Diode in Sperrichtung)
M, m	Scheitelwert
av	Mittelwert

Der Index für die Kennzeichnung von Scheitel- und Mittelwerten kann weggelassen werden, wenn eine Verwechslung nicht möglich ist.

Für Gesamtwerte vom Wert Null an gezählt werden Indizes mit großen Buchstaben verwendet, z. B. Augenblickswerte, Gleichwerte, Mittel-, Effektiv- und Scheitelwerte.

Beispiele: $i_{\mathrm{C}}, I_{\mathrm{C}}, v_{\mathrm{BE}}, V_{\mathrm{BE}}, p_{\mathrm{C}}, P_{\mathrm{C}}$

Für Werte der veränderlichen Komponenten werden Indizes mit kleinen Buchstaben verwendet, z. B. für Augenblickswerte, Scheitel- und Effektivwerte vom arithmetischen Mittelwert an gezählt.

Beispiele: $i_{\mathrm{c}}, I_{\mathrm{c}}, v_{\mathrm{be}}, V_{\mathrm{be}}, p_{\mathrm{c}}, P_{\mathrm{c}}$

Um Scheitel-, Mittel- und Effektivwerte voneinander zu unterscheiden, können weitere Indizes hinzugefügt werden. Als Abkürzungen werden empfohlen:

Scheitelwerte	M, m
Mittelwerte (arithmetische Mittelwerte)	Av, av

Beispiele: $I_{\mathrm{CM}}, I_{\mathrm{CAV}}, I_{\mathrm{cm}}, I_{\mathrm{cav}}$

Bei Scheitelwerten kann auch ein "$\wedge$" über dem Buchstaben verwendet werden.

Beispiele: $\hat{I}_{\mathrm{C}}, \hat{I}_{\mathrm{c}}$

3. Grenzwerte

Die angegebenen Grenzwerte sind eigenständige Absolutdaten der Belastbarkeit, bei deren Überschreiten eine Zerstörung des Bauelementes oder eine nachhaltige Beeinträchtigung seiner Daten bzw. Funktion zu erwarten ist. Bei Bauelementeprüfungen, etwa der Durchbruchsspannungen, wie auch in der Anwendung, muß deswegen mit entsprechenden Sicherungen das Überschreiten der Grenzwerte zuverlässig verhindert werden.

4. Kennwerte

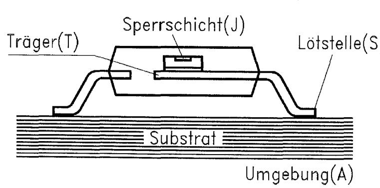
Typische Kennwerte charakterisieren den Bauelementetyp unter definierten Betriebsbedingungen in Zahlen und Diagrammen. Sie sind nicht als Daten jedes einzelnen Exemplars aufzufassen. Die aus wichtigen Qualitäts- oder Anwendungserfordernissen angegebenen Minimal- und Maximalwerte bezeichnen den tatsächlichen Streubereich der Kennwerte, in Diagrammen eingetragene Streukurven in der Regel den überwiegend zu erwartenden Streubereich. Die elektrischen Kennwerte sind fallweise nach Gleichstromwerte "statisch" und Wechselstromwerte "dynamisch" gruppiert. Als eng mit der Belastbarkeit gekoppelter Kennwert ist der Wärmewiderstand als oberer Streuwert unmittelbar nach den Grenzwerten angeordnet. Gehäusedaten sind durch Verweis auf Normenblätter oder bemaßte Zeichnung definiert.

5. Wärmewiderstände

Im Betrieb wird die am Bauteil abfallende Verlustleistung P_{tot} in Wärme umgesetzt, was eine Erhöhung der Bauteil-Temperatur zur Folge hat. Die entstehende Wärme wird von der Wärmequelle (Sperrschicht/Junction J bzw. Kanal/Channel Ch) über die Komponenten Chip, Gehäuse und Substrat (Leiterplatte) an die Wärmesenke (Umgebung/Ambient A) abgeführt. Die Sperrschichttemperatur T_J bei einer Umgebungstemperatur T_A ist bestimmt durch den Wärmewiderstand R_{thJA} und die abfallende Verlustleistung P_{tot} :

$$\boxed{T_J = T_A + P_{tot} \times R_{thJA}}$$

(R_{thJA} in K/W bzw. °C/W)



5.1 HF und NF-Transistoren und Dioden in SMD-Gehäusen

Bei SMD-Bauformen wird die Wärme im wesentlichen über die Anschlüsse abgeführt. Der Gesamtwärmewiderstand setzt sich hier aus folgenden Komponenten zusammen:

$$R_{thJA} = R_{thJT} + R_{thTS} + R_{thSA}$$
$$R_{thJS} = R_{thJT} + R_{thTS}$$

R_{thJA} = Wärmewiderst. zw. Sperrschicht und Umgebung (Gesamtwärmewiderstand)
R_{thJS} = Wärmewiderst. zw. Sperrschicht und Lötpunkt
R_{thJT} = Wärmewiderst. zw. Sperrschicht und Chipunters. (Chip-Gesamtwärmewiderstand)
R_{thTS} = Wärmewiderst. zw. Chipunterseite und Lötstelle (Gehäuse/Legierschicht)
R_{thSA} = Wärmewiderst. zw. Lötstelle und Umgebung (Substrat-Legierschicht)

Der R_{thJS} enthält alle typabhängigen Größen. Mit ihm kann bei vorgegebener Verlustleistung P_{tot} eine exakte Bestimmung der Bauteil-Temperatur vorgenommen werden, wenn die Temperatur T_S der wärmsten Lötstelle gemessen wird (bei bipolar Transistoren: typisch Kollektoranschluß, bei FETs: Source-Anschluß).

$$T_J = T_S + P_{tot} \times R_{thJS}$$

Die Lötstellentemperatur T_S ist anwendungspezifisch von Substrat, Fremderwärmung durch benachbarte Bauteile und die Umgebungstemperatur T_A vorgegeben. Diese Komponenten zusammen bilden den schaltungsabhängigen, durch Wärmeabfuhrmaßnahmen beeinflußbaren Substrat-Wärmewiderstand R_{thSA}.

$$T_S = T_A + P_{tot} \times R_{thSA}$$

Ist die Messung der Lötstellentemperatur T_S nicht möglich oder genügt eine Abschätzung der Sperrschicht-Temperatur, kann der R_{thSA} aus den folgenden Diagrammen abgelesen werden. Damit geben wir einen Anhaltswert des Wärmewiderstandes R_{thSA} zwischen der Lötstelle auf Epoxy- bzw. Keramiksubstrat und ruhender Luft als Funktion der Kollektoranschluß- bzw. Keramik-Fläche. Als Parameter wird die abgeführte Verlustleistung, d. h. die Erwärmung $T_S - T_A$ der Platine angegeben. In diesem Fall gilt für die Betriebs-Temperatur:

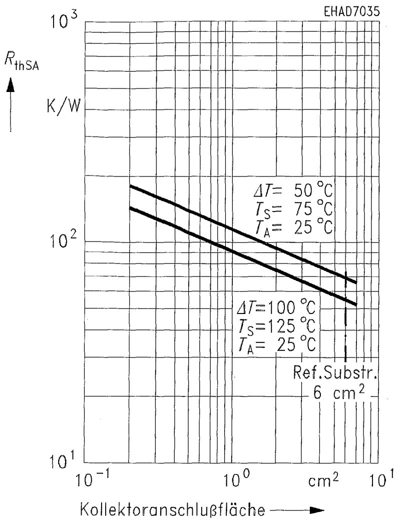
$$T_J = T_A + P_{tot} \times (R_{thJS} + R_{thSA})$$

In den Datenblättern ist R_{thJS} als thermische Bezugsgröße der Wärmeableitung angegeben. Zu Vergleichszwecken dient die Angabe des Gesamtwärmewiderstandes R_{thJA}. Dazu werden je nach typischer Bauteile-Anwendung Referenzsubstrate folgender Ausführungen zugrundegelegt:

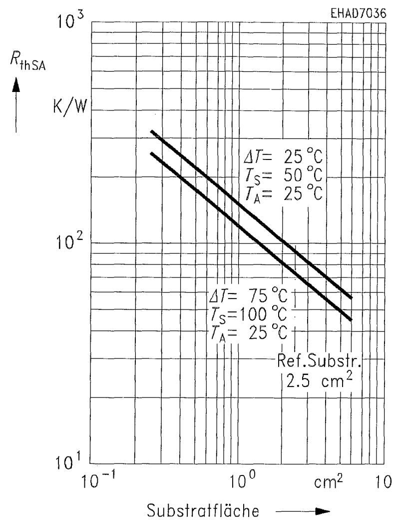
- NF-Anwendungen
  Epoxid-Leiterplatte: Kollektor-Anschlußfläch 6 cm² Cu, 35 µm Cu-Dicke
- HF-Anwendungen
  Keramik-Substrat: 15 mm × 16.7 mm × 0.7 mm

Die beiden Diagramme zeigen näherungsweise den Wärmewiderstand als Funktion der Substratfläche, wobei angenommen wird, daß sich der Prüfling in der Mitte des etwa quadratischen Substrates befindet.

Wärmeableitung von Platine an Umgebung
(Montagefläche: Cu 35 μm, Substrat: Epoxy 1,5 mm)



Wärmeableitung vom A 1203-Substrat an Umgebung
(Substrat in ruhender Luft, vertikal 0,6 mm Dicke)



5.2 HF und NF-Transistoren in konventionellen Gehäusen

Anstelle der Anschlußbänder übernimmt hier überwiegend das Gehäuse den Wärmetransport vom Bauteil an die Umgebung. In den vorherigen Formeln ist daher der Punkt "Lötstelle (Soldering point)" durch den Term "Gehäuse (Case)" zu ersetzen. Durch Anbringen von Kühlkörpern an der Gehäuseoberfläche kann der Wärmewiderstand zwischen Gehäuse und Luft erheblich verringert werden. Im Datenblatt sind daher die R_{th} Werte für den Einsatz mit und ohne Kühlkörper angegeben:

$$R_{thJA} = R_{thJT} + R_{thTC} + R_{thCA}$$
$$R_{thJC} = R_{thJT} + R_{thTC} + R_{thCA} \text{ (mit Kühlkörper)}$$

R_{thJA} = Wärmewiderstand zwischen Sperrschicht und Umgebung (ohne zusätzliche Kühlfläche). Die Sperrschicht-Temperatur ergibt sich aus der Verlustleistung P_{tot} und der Umgebungstemperatur) T_A (Luft):

$$T_J = T_A + P_{tot} \times R_{thJA}$$

R_{thJC} = Wärmewiderstand zwischen Sperrschicht und Umgebung bei Verwendung des Referenz-Kühlkörpers. Die Sperrschicht-Temperatur berechnet sich aus T_A (= Umgebungstemperatur) und P_{tot}:

$$\boxed{T_J = T_A + P_{tot} \times R_{thJC}}$$

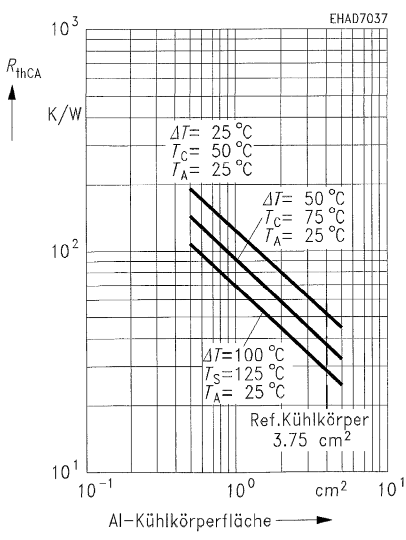
Die Datenblattangaben R_{thJC} gelten für einen Referenz-Kühlkörper: Al-Platte 15 mm × 25 mm × 0,5 mm, mit Epoxidharz-Kleber befestigt, R_{thCA} = 40 K/W

Für die Verwendung anders dimensionierter Kühlkörper dient die folgende Graphik, in der näherungsweise der R_{thCA} einer 0,5 mm dicken Al-Platte als Funktion der Plattenfläche abzulesen ist. Parameter ist die Temperaturdifferenz zwischen Kühlkörper und Umgebungsluft, die von der abgeführten Leistung abhängt. Der Referenz-Kühlkörper ist dort markiert.

Bei Verwendung eines anderen Kühlkörpers ist vom R_{thJC} der Wärmewiderstand des Referenz-Kühlkörpers R_{thCA} abzuziehen und durch den aus der Graphik ermittelten R_{thCA} des neuen Kühlkörpers zu ersetzen.

$$\boxed{R_{thJC} = R_{thJC\,ref} - R_{thCA\,ref} + R_{thCA}}$$

Abschätzung des Wärmewiderstands R_{thCA} einer 0,5 mm dicken Al-Platte. Positionierung des Transistors in Mitte der Platte.



5.3 Temperaturmeßmethoden der Bauelementeanschlüsse

Messen mit Temperaturindikatoren (z. B. Thermopapier)

Beim Messen mit Temperaturindikatoren kann die Temperatur ohne zusätzliche Wärmeableitung und somit fast fehlerfrei bestimmt werden. Der entsprechende Fehler ist praktisch nur durch die Abstufung der Temperaturindikatoren gegeben. Die Methode ist einfach durchzuführen, ausreichend genau und eignet sich besonders für Messungen auf Platinen.

Messen mit Thermoelementen

Dies wird nicht empfohlen, weil durch die elektrische Leitung die Funktion der Schaltung beeinflußt werden kann und Wärme von der Lötstelle abgeführt wird, was zu Falschmessungen führt, wenn nicht ein erheblicher Meßaufwand betrieben wird.

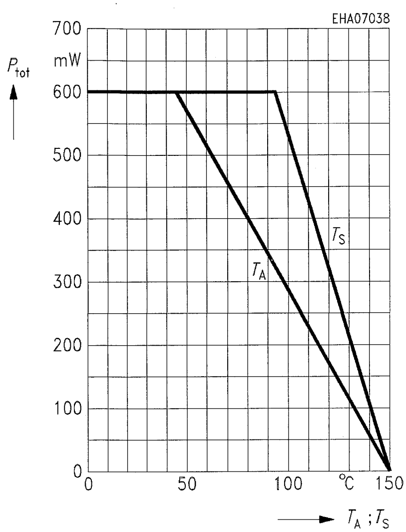
5.4 Zulässige Gesamtverlustleistung bei statischem Betrieb

Mit der Gesamtverlustleistung P_{tot} ist das max. Wärmegefälle im Bauteil festgelegt. Infolge der Erwärmung der Bauelemente ist die im Datenblatt angegebene max. Gesamtverlustleistung $P_{\mathrm{tot\,max}}$ nur bis zu Grenzwerten $T_{\mathrm{S\,max}}$ or $T_{\mathrm{A\,max}}$ erlaubt. Diese Grenztemperaturen beschreiben den Punkt, an dem die max. zulässige Sperrschichttemperatur $T_{\mathrm{J\,max}}$ erreicht wird. Die max. zulässige Umgebungs- bzw. Lötstellen-Temperatur wird nach folgender Formel berechnet:

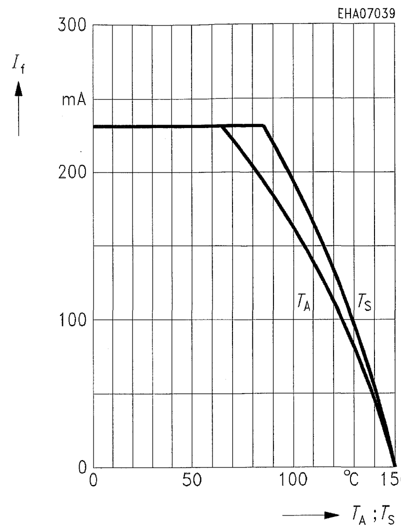
$$\boxed{\begin{array}{l} T_{\mathrm{S\,max}} = T_{\mathrm{J\,max}} - P_{\mathrm{tot\,max}} \times R_{\mathrm{thJS}} \\ T_{\mathrm{A\,max}} = T_{\mathrm{J\,max}} - P_{\mathrm{tot\,max}} \times R_{\mathrm{thJA}} \end{array}}$$

Bei Dioden wird die Verlustleistung weitgehend durch den Dioden-Bahnwiderstand verursacht. Daher ist das Diagramm praxisnah in die Form $I_{\mathrm{F}} = f\ (T_{\mathrm{S}};\ T_{\mathrm{A}})$ übertragen, woraus sich die gekrümmte Form des Kurvenverlaufes ergibt. Für R_{thJA} wurde jeweils das entsprechende Normsubstrat zugrunde gelegt. Die hier gezeigten Diagramme sind als Beispiele anzusehen. Im Anwendungsfall ist die im Datenblatt angegebene Kurve heranzuziehen. Eine Überschreitung der thermischen Grenzdaten ist nicht zulässig, weil dadurch eine nachhaltige Beeinträchtigung der Bauelemente-Kenndaten oder sogar eine Zerstörung des Bauelementes eintreten kann.

Max. Verlustleistung $P_{tot} = f\ (T_S;\ T_A{*})$
*Al_2O_3-Substrat 15 mm × 16,7 mm × 0,7 mm



Durchlaßstrom $I_F = f\ (T_S;\ T_A{*})$
*Al_2O_3-Substrat 15 mm × 16,7 mm × 0,7 mm



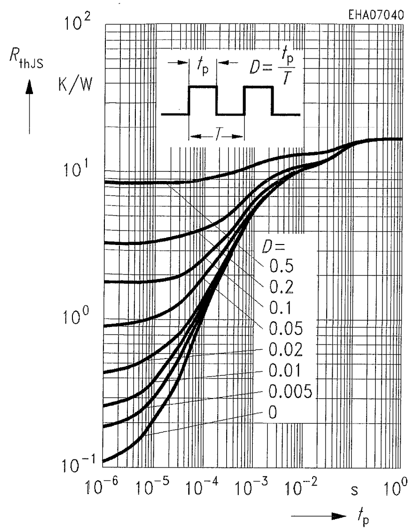
5.5 Zulässige Gesamtverlustleistung bei Pulsbetrieb

Im Pulsbetrieb können unter bestimmten Voraussetzungen höhere Gesamtverlustleistungen als im statischen Betrieb zugelassen werden. Dies ist der Fall, wenn die Impulsdauer t_p, d. h. die Dauer der Leistungszufuhr, klein gegenüber der thermischen Zeitkonstanten des Systems ist. Diese Zeitkonstante, d. h. die Dauer bis zum Erreichen der statischen Endtemperatur, ist abhängig von den Wärmekapazitäten und -widerständen der Komponenten Chip, Gehäuse und Substrat. Die im Bauteil ausgenutzte Wärmekapazität ist eine Funktion der Pulsdauer. Im vorliegenden Fall beschreiben wir dieses durch den transienten Wärmewiderstand. Der Pulsbetriebs-Wärmewiderstand bzw. die daraus ableitbare zulässige P_{tot}-Anhebung ist in den folgenden Kurven exemplarisch dargestellt. Für den Anwendungsfall ist das jeweilige Datenblatt heranzuziehen.

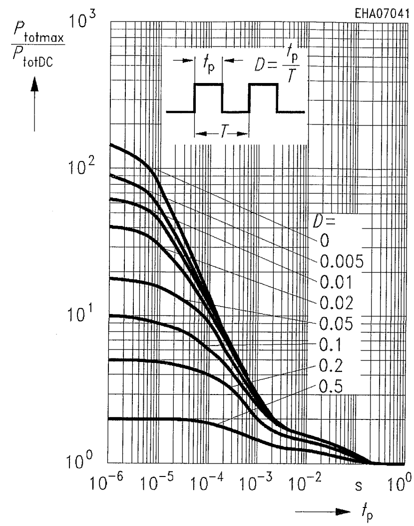
$$\boxed{P_{tot\ max}/P_{tot\ DC} = f\ (t_p):}$$

Für periodische Pulsbelastung der Periode T ist als Parameter das Tastverhältnis t_p/T angegeben. Für lange Impulsdauern nähert sich der Faktor $P_{tot\ max}/P_{tot\ DC}$ dem Wert 1, d. h. P_{tot} im Pulsbetrieb ist dem statischen Wert gleichzusetzen. Bei extrem geringen Pulsbreiten hingegen wird der pulsbedingte Temperaturanstieg (Restwelligkeit) vernachlässigbar und es stellt sich eine mittlere Temperatur des Systems ein, die einem statischen Betrieb bei mittlerer Pulsleistung entspricht.

Zulässige Pulsbelastbarkeit
$R_{thJS} = f\ (t_p)$



Zulässige Pulsbelastbarkeit
$P_{tot\,max}/P_{tot\,DC} = f\ (t_p)$



6. EGB (**E**lektrostatisch **G**efährdete **B**auelemente)

ESD (**E**lectro**s**tatic **D**ischarge)-empfindliche Bauelemente werden in "antistatischer" Verpackung geliefert. Das aufgedruckte Warnschild verweist auf die Notwendigkeit von Schutzmaßnahmen gegen unkontrollierte Überlastung der Bauelemente durch elektrische Entladungen, beginnend beim Öffnen der Packung.

7. Normen

Spezielle Einzelheiten entnehmen Sie bitte folgenden Unterlagen:
DIN 41 782: Dioden
DIN 41 785: Grenzwerte
DIN 41 791: Allgemeine Vorschriften
DIN 41 852: Halbleiter-Technologie
DIN 41 853: Begriffe für Dioden
DIN 41 854: Begriffe für Bipolartransistoren

1. Type Designation in Accordance with Pro Electron

This type designation applies to small-signal semiconductor components – in contrast to integrated circuits, multiples of these components and semiconductor chips.

The number of the basic type consists of:
two letters and a three-digit code.

First letter

gives information about the material.

A. Germanium or other material with a band gap of 0.6 ... 1.0 eV
B. Silicon or other material with a band gap of 1.0 ... 1.3 eV
C. Gallium-arsenide or other material with a band gap of 1.3 eV
R. Compound material, e.g. cadmium-sulfide

Second letter

indicates the function for which the device is primarily designed.

A. Diode: signal, low power
B. Diode: variable capacitance
C. Transistor: low power, audio frequency
D. Transistor: power, audio frequency
E. Diode: tunnel diode
F. Transistor: low power, high frequency
G. Multiple of dissimilar devices; miscellaneous devices (e. g. oscillator)
H. Diode: magnetic sensitive
L. Transistor: power, high frequency
N. Optocoupler
P. Radiation-sensitive semiconductor component
Q. Radiation-emitting semiconductor component
R. Control or switching device: low power (e. g. thyristor)
S. Transistor: low power, switching
T. Control or switching device: power (e. g. thyristor)
U. Transistor: power switching
X. Diode: multiplier, e.g. varactor, step recovery
Y. Diode: rectifier, booster
Z. Diode: voltage reference or regulator; transient voltage suppressor diode

The three-digit code of the type designation consists of:

- a three-digit number, running from 100 to 999, for devices primarily intended for consumer equipment etc.
- one letter and a two-digit number for devices primarily intended for industrial/professional equipment. This letter has no fixed meaning.

2. Notation of the Symbols and Terms Used (DIN 41 785)

The current, voltage, power (AC, DC, or average values) and resistance types (AC or DC values) are indicated by using capital and small letters for the symbols.

Symbols

The instantaneous data of values varying with time are indicated by small letters.

Examples: i, v, p

Capital letters are used for DC, average, rms, and peak values of periodical functions of the current, the voltage, and the power – i. e. for constant quantities.

Examples: I, V, P

Subscripts for the symbols

The following subscripts are used:

E, e	Emitter
B, b	Base
C, c	Collector
F, f	Forward direction (diode operated in forward direction)
R, r	Reverse direction (diode operated in reverse direction)
M, m	Peak value
av	Average value

The subscripts for peak and average values may be omitted, provided that a confusion with other values is impossible.

Total values (instantaneous values, DC values, average, rms, and peak values) referred to a zero point are indicated by subscripts with capital letters.

Examples: i_{C}, I_{C}, v_{BE}, V_{BE}, p_{C}, P_{C}

Subscripts with small letters are used for the values of variable components (e. g. for instantaneous values, peak, and rms values referred to an average value).

Examples: i_{c}, I_{c}, v_{be}, V_{be}, p_{c}, P_{c}

To distinguish between peak, average, and rms values, further subscripts may be added. The following abbreviations are recommended:

Peak values	M, m
Average values	Av, av

Examples: I_{CM}, I_{CAV}, I_{cm}, I_{cav}

Peak values may also be indicated by placing the symbol "$\wedge$" over the letter.

Examples: $\hat{I}_{\mathrm{C}}$, $\hat{I}_{\mathrm{c}}$

3. Maximum Ratings

The maximum ratings specified are absolute ratings which, if exceeded, may result in the destruction or permanent functional impairment of the component. When testing the component, as for example in respect to breakdown voltages, or during application, protection is to be provided in order to reliably ensure that maximum ratings are not exceeded.

4. Characteristics

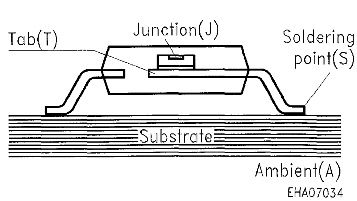
Typical characteristics describe the component behavior at defined operating conditions. The numerical values and diagrams pertain to the component type and shall not be considered as characteristics of an individual component. The minimum and maximum ratings stated for reasons of essential quality and application requirements describe the actual spread of the characteristics, whereas spread curves in diagrams usually specify the spread range which is to be expected. Electrical values are grouped into "static" DC values and "dynamic" AC values. The thermal resistance is closely related to the maximum ratings and, constituting the upper spread value, comes immediately after the maximum ratings. The component's case data is defined by reference to standard sheets and dimensional drawings.

5. Thermal Resistance

The heat caused by the power loss P_{tot} in the active semiconductor region during operation results in an increased temperature of the component. The heat is dissipated from its source (junction J or channel Ch) via the chip, the case and the substrate (pc board) to the heat sink (ambient A). The junction temperature T_J at an ambient temperature T_A is determined by the thermal resistance R_{thJA} and the power dissipation P_{tot} :

$$\boxed{T_J = T_A + P_{tot} \times R_{thJA}}$$

(with R_{thJA} in K/W or °C/W)



5.1 RF and AF Transistors and Diodes of SMD Packages

In SMD packages the heat is primarily dissipated via the pins. The total thermal resistance in this case is made up of the following components:

$$\boxed{\begin{aligned} R_{thJA} &= R_{thJT} + R_{thTS} + R_{thSA} \\ R_{thJS} &= R_{thJT} + R_{thTS} \end{aligned}}$$

R_{thJA} = thermal resistance between junction and ambient (total thermal resistance)
R_{thJS} = thermal resistance between junction and soldering point
R_{thJT} = thermal resistance between junction and chip base (chip thermal resistance)
R_{thTS} = thermal resistance between chip base and soldering point (package/alloy layer)
R_{thSA} = thermal resistance between soldering point and ambient (substrate thermal resistance)

R_{thJS} contains all type-dependent quantities. For a given power dissipation P_{tot} it is possible to use it to precisely determine the component temperature if the temperature T_S of the warmest soldering point is measured (for bipolar transistors typically the collector, for FETs the source lead).

$$\boxed{T_J = T_S + P_{tot} \times R_{thJS}}$$

The temperature of the soldering point T_S is determined by the application, i.e. by the substrate, heat produced by external components and the ambient temperature T_A. These components combine to form the substrate thermal resistance R_{thSA} that is circuit-dependent and can be influenced by heat dissipation measures.

$$\boxed{T_S = T_A + P_{tot} \times R_{thSA}}$$

If measurement of the temperature of the soldering point T_S is not possible, or if estimation of the junction temperature is sufficient, R_{thSA} can be read from diagrams below. Here we give an approximate value of the thermal resistance R_{thSA} between the soldering point on an epoxy or ceramic substrate and still air as a function of the area of the collector mounting or ceramic. The parameter is the dissipated power, i. e. the heat $T_S - T_A$ of the pc board. So in this case for the operating temperature:

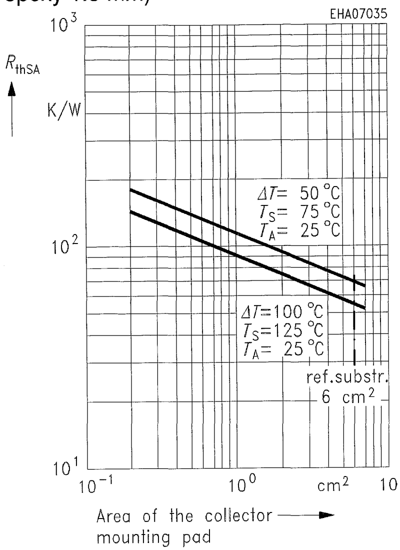
$$\boxed{T_J = T_A + P_{tot} \times (R_{thJS} + R_{thSA})}$$

In the data sheets R_{thJS} is stated as a thermal reference quantity of the heat dissipation. The total thermal resistance R_{thJA} is stated for comparison purposes. Depending on the typical component application, substrates of the following kinds are used for reference:

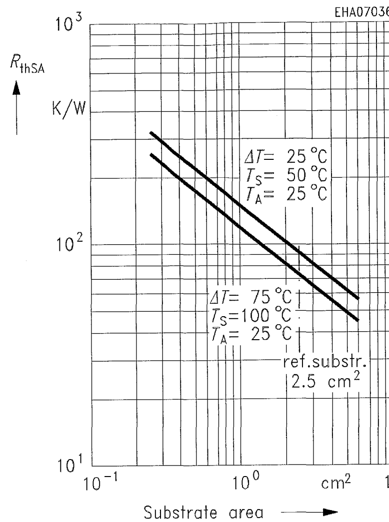
- AF applications
  epoxy circuit board: collector mounting area 6 cm^2 Cu, 35 µm Cu thickness
- RF applications
  ceramic substrate: 15 mm × 16.7 mm × 0.7 mm

The two diagrams below show, to an approximation, the thermal resistance as a function of the substrate area, assuming that the test device is located in the center of a virtually square substrate.

Heat dissipation from pc board to ambient air
(mounting pad Cu 35 µm/substrate: epoxy 1.5 mm)



Heat dissipation from A1203 – substrate to ambient air
(substrate in still air, vertical 0.6 mm thick)



5.2 RF and AF Transistors and Diodes of Conventional Packages

Here, instead of the pins, it is primarily the case that is responsible for heat transfer from the component to its environment. So, in the previous formulas, "S" for soldering point is replaced by "C" for case. The thermal resistance between the case and its ambient can be reduced substantially by attaching heat sinks to the case surface. In the data sheets the R_{th} values are consequently stated for use with and without heat sinks:

$$\boxed{\begin{array}{l} R_{thJA} = R_{thJT} + R_{thTC} + R_{thCA} \\ R_{thJC} = R_{thJT} + R_{thTC} \text{ (with heat sink)} \end{array}}$$

R_{thJA} = thermal resistance between junction and ambient (without extra cooling). The junction temperature is the result of the power dissipation P_{tot} and the ambient temperature (air) T_A:

$$\boxed{T_J = T_A + P_{tot} \times R_{thJA}}$$

R_{thJC} = thermal resistance between junction and ambient using the reference heat sink. The junction temperature is calculated from T_A (ambient temperature) and P_{tot}:

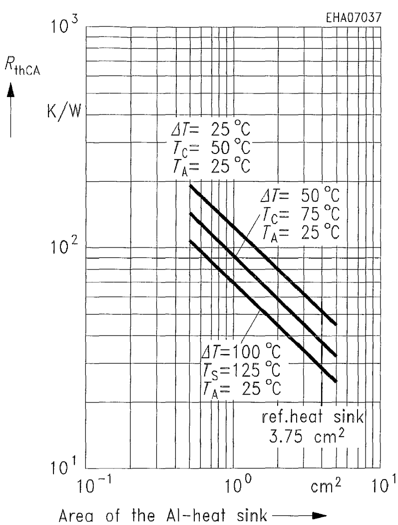
$$\boxed{T_J = T_A + P_{tot} \times R_{thJC}}$$

The data-sheet figures for R_{thJC} apply to a reference heat sink: Al plate 15 mm × 25 mm × 0.5 mm, attached with epoxy-resin adhesive, R_{thCA} = 40 K/W.

For the use of heat sinks of different dimensions refer to the following diagram, from which the approximate R_{thCA} of a 0.5-mm-thick Al plate can be read as a function of the plate area. The parameter is the difference in temperature between the heat sink and ambient air, which depends on the dissipated power. The reference heat sink is marked.

When a different heat sink is used, the thermal resistance of the reference heat sink R_{thCA} is to be subtracted from R_{thJC} and replaced by the R_{thCA} figure for the new heat sink that is deduced from the diagram.

$$\boxed{R_{thJC} = R_{thJC\,ref} - R_{thCA\,ref} + R_{thCA}}$$



Estimation of thermal resistance R_{thCA} of 0.5-mm-thick Al plate; position of transistor in center of plate.

5.3 Temperature Measuring of Components Leads

Measuring with temperature indicators (e. g. thermopaper)

Temperature indicators do not cause heat dissipation and thus allow an almost exact determination of temperature. A certain degree of deviations can only result from rough-grade indication of the temperature indicators. This method is quite easy and provides sufficient accuracy. It is particularly suitable for measurement on pc boards.

Measuring with thermocouple elements

Measurement with thermocouple elements is not advisable because the functioning of the circuit can be influenced by the electrical conduction and the heat dissipation by the soldering point. This corrupts the results of the measurement, unless measurement is carried out with appropriate effort.

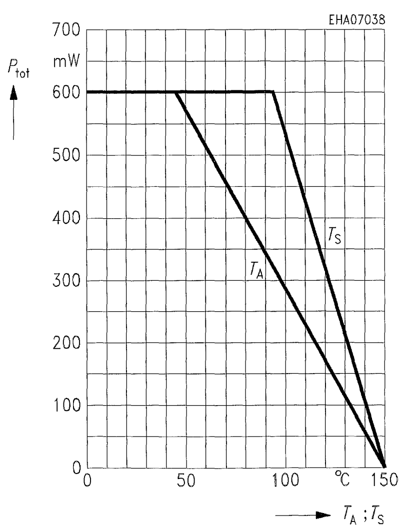
5.4 Permissible Total Power Dissipation in DC Operation

The total power dissipation P_{tot} defines the maximum thermal gradient in the component. As a result of the heating of components, the maximum total power dissipation $P_{tot\ max}$ stated in the data sheets is only permissible up to limits of $T_{S\ max}$ or $T_{A\ max}$. These critical temperatures describe the point at which the maximum permissible junction temperature $T_{J\ max}$ is reached. The maximum permissible ambient or soldering-point temperature is calculated as follows:

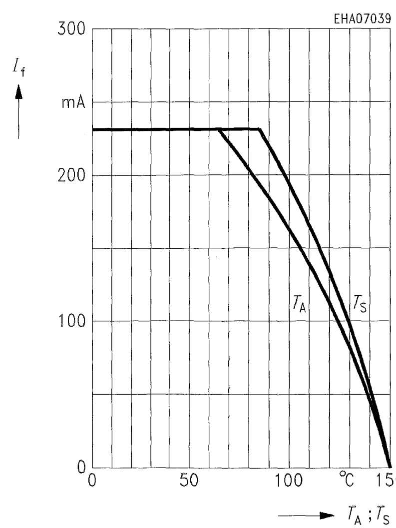
$$T_{S\ max} = T_{J\ max} - P_{tot\ max} \times R_{thJS}$$
$$T_{A\ max} = T_{J\ max} - P_{tot\ max} \times R_{thJA}$$

In diodes the power dissipation is for the most part caused by internal resistance. So the diagram has to be translated into the form $I_F = f\ (T_S;\ T_A)$, resulting in the bent shape of the curve. For R_{thJA} the appropriate standard substrate was taken in each case. The diagrams shown here are intended as examples. For the application the curve given in the data sheet is to be taken. Exceeding the thermal max. ratings is not permissible because this could mean lasting degradation of the component's characteristics or even its destruction.

Total power dissipation
$P_{tot} = f\ (T_S;\ T_A{}^*)$
*Package mounted on alumina
15 mm × 16.7 mm × 0.7 mm



Forward current
$I_F = f\ (T_S;\ T_A{}^*)$
*Package mounted on alumina
15 mm × 16.7 mm × 0.7 mm



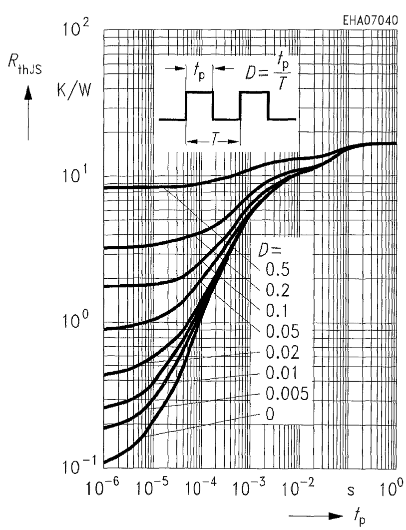
5.5 Permissible Total Power Dissipation in Pulse Operation

In pulse operation, under certain circumstances, higher total power dissipation than in DC operation can be permitted. This will be the case when the pulse duration t_p, i. e. the length of time that power is applied, is small compared to the thermal time constant of the system. This time constant, i. e. the time until the final temperature is reached, depends on the thermal capacitances and resistances of the components chip, case and substrate. The thermal capacitance utilized in the component is a function of the pulse duration. Here we describe this through the transient thermal resistance. The pulse-load thermal resistance, or the permissible increase in P_{tot} that can be derived from it, is shown by way of examples in the following curves. For the application the particular data sheet should be taken.

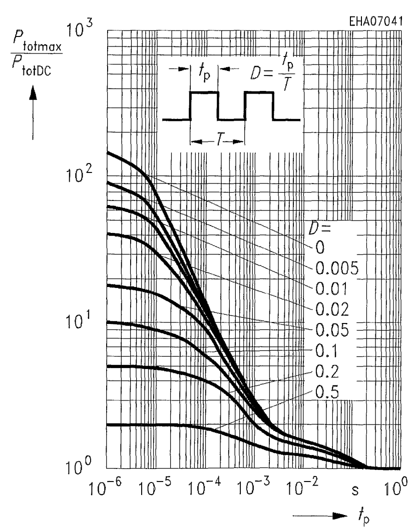
$$\boxed{P_{tot\ max}/P_{tot\ DC} = f\ (t_p):}$$

The duty factor t_p/T is given as a parameter for periodic pulse load with a period of T. For long pulse durations the factor $P_{tot\ max}/P_{tot\ DC}$ approaches a value of 1, i. e. P_{tot} in pulsed operation can be equated with the DC value. At extremely short pulse widths, on the other hand, the increase in temperature as a result of the pulse (residual ripple) becomes negligible and a mean temperature is created in the system that corresponds to DC operation with average pulse power.

Permissible pulse load
$R_{thJS} = f\ (t_p)$



Permissible pulse load
$P_{tot\ max}/P_{tot\ DC} = f\ (t_p)$



6. ESD (Electrostatic Discharge Sensitive Device)

ESD-sensitive components are supplied in anti-static packaging. The attached warning label calls your attention to the necessity of protecting the components against electrostatic discharge, beginning with the opening of the package.

7. Standards

For detailed information please refer to the following DIN literature:
DIN 41 782: Diodes
DIN 41 785: Maximum Ratings
DIN 41 791: General Instructions
DIN 41 852: Semiconductor Technology
DIN 41 853: Terms Relating to Diodes
DIN 41 854: Terms Relating to Bipolar Transistors

Qualitätslangaben

Quality Specification

1. Qualitätssicherung

Qualität liefern heißt für den Bereich Einzelhalbleiter:
Die derzeitigen und künftigen Erwartungen unserer Kunden erfüllen.

Dazu haben wir folgende Strategie:
Durch eine stetige Verbesserung der Anlieferqualität, haben wir das Null-Fehler Ziel weitgehend erreicht. Dafür haben wir außerordentlich hohe Investitionen zur Automatisierung der Fertigung, für eine computergestützte statistische Prozeßkontrolle (SPC) und eine doppelte 100% Prüfung aufgewendet.

Notwendige Voraussetzung dieser Strategie ist ein hohes Fertigungsvolumen technologisch ähnlicher Bauelemente. Von SMD-Bauelementen fertigen wir mehrere Milliarden Stück pro Jahr.

Durch ein aufwendiges Konzept der Vorserien und Serienfreigabe werden nur ausgereifte Produkte in den Fertigungsprozeß eingeschleust (**Bild 1**). Durch diese Maßnahme sowie durch eine aufwendige Prozeßüberwachung wurde ein Niveau der Auslieferungsqualität von:

> 10 ppm für elektrische Fehler und
> 20 ppm für mechanische Fehler erreicht.

Unseren Kunden bietet das niedrige ppm Niveau folgende Vorteile:

- Reduzierung oder Verzicht auf die Eingangsprüfung.
- Kostensenkung durch geringere Nacharbeit bei der Geräteherstellung.
- Kostenreduzierung durch geringere Reparaturkosten während der Gerätegarantiezeit.
- Unsere durchgängige statistische Prozeßkontrolle (SPC, **Bild 2**) verhindert Qualitätseinbrüche und sichert eine termingerechte Kundenbelieferung (Just-in-Time).

Bild 1
Qualitätssicherung in der Fertigung
Produkt-Ablaufdiagramm

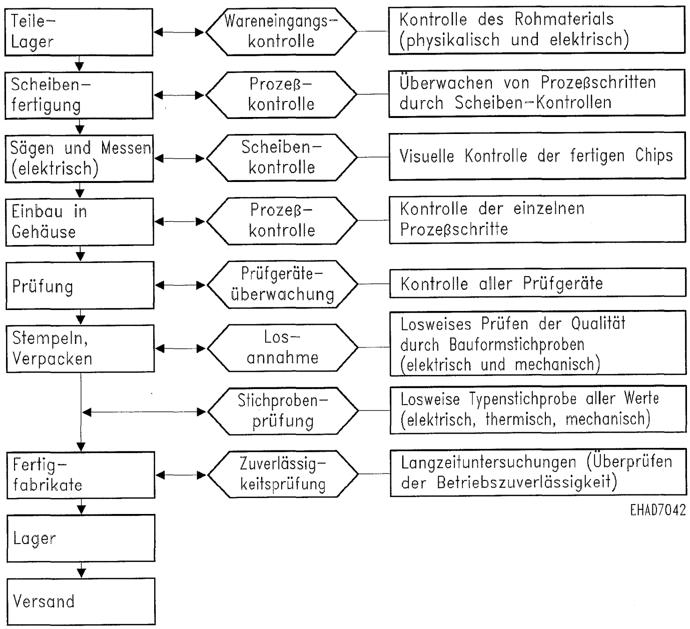
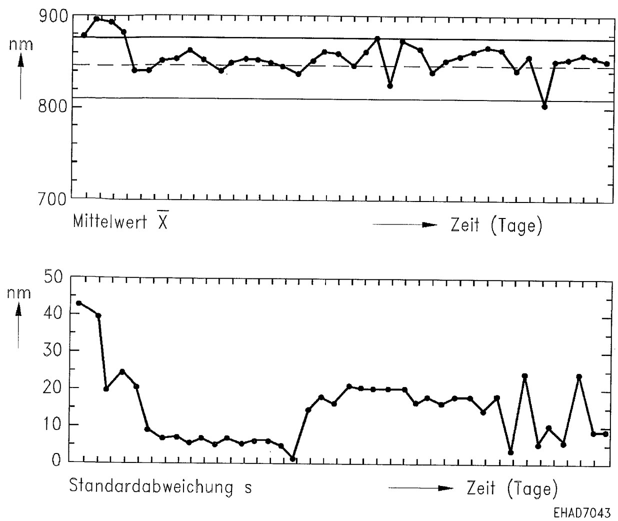


Bild 2
Statistische Prozeßkontrolle in der Montage.
Parameter: Nitriddicke



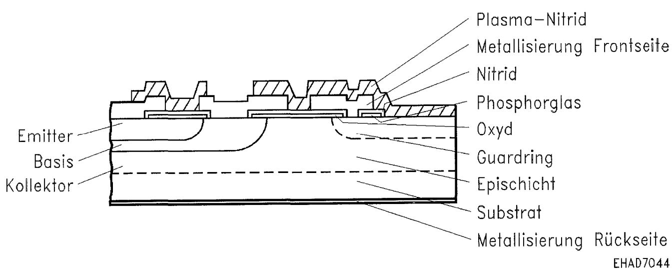
2. Zuverlässigkeit

Eine hohe Bauteilezuverlässigkeit wird erreicht durch:

- Konstruktive und technologische Maßnahmen, wobei erprobte Designregeln zur Entwicklung robuster Chips bei praktikablen Prozeßtoleranzen genutzt werden. (**Bild 3**)
- Verbesserungen werden vor Einführung durch sorgfältig abgestimmte Erprobungsversuche abgesichert. (**Bild 4**)
- Ableitung von Verbesserungsmaßnahmen an Hand von Fehleranalysen, welche aus gezielt durchgeführten Overstressversuchen stammen.

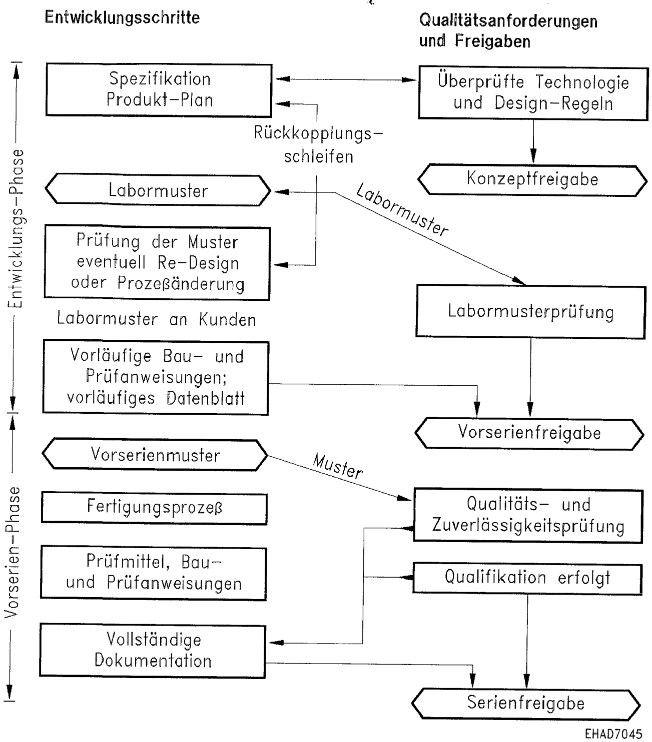
Bei geeigneter Schaltungsdimensionierung kann mit Siemens SMD-Bauelementen und einer Sperrschichttemperatur von kleiner 60 °C eine Ausfallrate λ von ca. 10 Fit erwartet werden.

Bild 3
Chipstruktur
Querschnitt durch einen NF-Transistortyp



Schicht	Wesentliche Schutzfunktionen
Plasma-Nitrid und Vorderseiten-Metallisierung	Kratz- und Korrosionsschutz sowie Schutz gegen unkontrollierten Ladungsaufbau
Hochtemperatur-Nitride	Sperre gegen Ionen-Diffusion
Phosphorglas	Getterung beweglicher Ionen im Oxyd
Oxyd	Schutzisolation der PN-Übergänge
Schutz(Guard)-Ring	verhindert Channelströme

Bild 4
Freigabeverfahren (Konzept-, Vorserien- und Serienfreigabe)
Entwicklungsschritte und Qualitätsfreigabe



2.1 Qualifizierungen

Die hohe Zuverlässigkeit kann nur durch aufwendige gestaffelte Erprobungsversuche ermittelt werden. Der Zuverlässigkeitsnachweis erfolgt an Leittypen nach internen Richtlinien. Ein Teil dieser Prüfungen erfolgt auch nach CECC Vorschriften. Unsere beiden Fertigungsstandorte Regensburg und Malacca (Malaysia) haben die CECC Anerkennung (Cenelec Electronic Components Committee) als Bauelementhersteller. Die Einbeziehung unseres gesamten SMD-Typenspektrums ist vorgesehen. Die Qualifikationen nach CECC umfassen neben den periodischen Qualifikationen der Bauelemente auch die Qualifikation der Scheibenfertigung, der Montagelinien und des für die Durchführung der Tests verantwortlichen Prüflabors.

3. Ship-to-Stock Vereinbarungen

Derartige Vereinbarungen werden von unseren Kunden in zunehmendem Maße gewünscht. Wesentlicher Bestandteil ist dabei die Qualitäts-Sicherungs-Vereinbarung (QSV), in welcher AQL-Werte, Ausfallkriterien, Ablauf bei Beanstandungen und gegenseitige Informationspflicht festgelegt werden können.

Weitere Angaben zur Qualität können der Themenschrift

Einzelhalbleiter
Qualitätssicherung, Qualität und Zuverlässigkeit

entnommen werden. (siehe Literaturverzeichnis)

1. Quality Assurance

For our small-signal semiconductor division supplying quality means satisfying our customers' present and future expectations.

Our strategic goal is the zero-defect principle, which we have largely achieved by a continuous improvement of the delivered quantity. Extremely high investments in the automation of manufacturing processes, computer-aided statistical process control (SPC) and a double 100% inspection helped up to ensure and significantly improve the quality.

A basic requirement for our strategy is a high output of components based on a similar technology. We manufacture e.g. several billion components in SMD technology per year. A large-scale concept of preproduction and production release allows only fully developed products to enter the manufacturing process (**Figure 1**).

This procedure as well as extensive process monitoring caused the level of delivery quality to increase to only:

> 10 ppm for electrical defects and
> 20 ppm for mechanical defects.

This low ppm level offers the following advantages to our customers:

- scaling down or doing without incoming inspections.
- reduced costs by minor refinishing of units in production.
- reduced cost of repairs for units under guarantee.
- Our universal statistical process control (SPC, **Figure 2**) prevents a decrease in quality and ensures the timely delivery to customers. (Just-in-Time).

Figure 1
Quality Assurance in Production
Product Flowchart

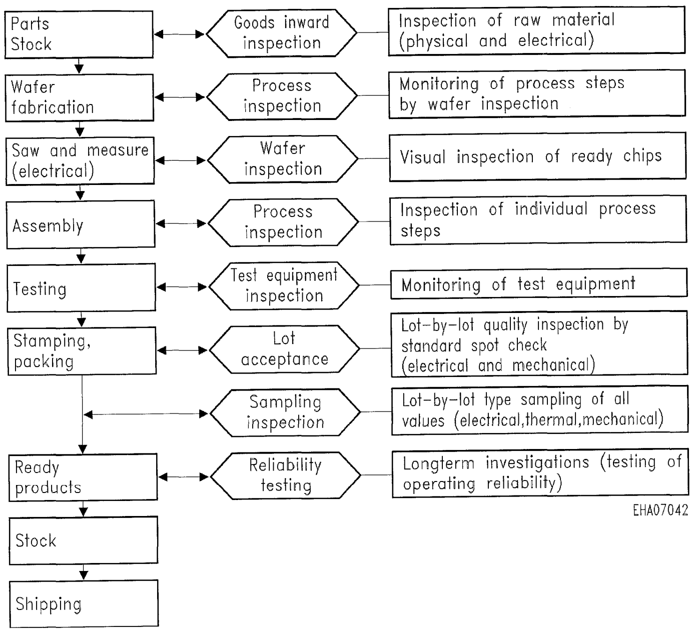
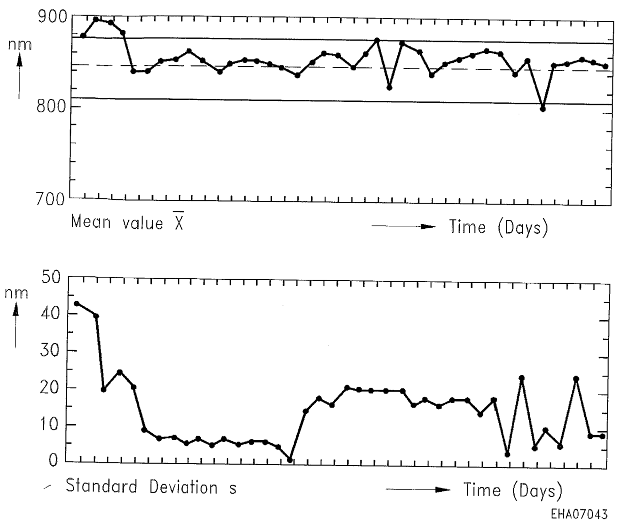


Figure 2
Statistical process control in wafer fabrication, parameter: nitride layer thickness



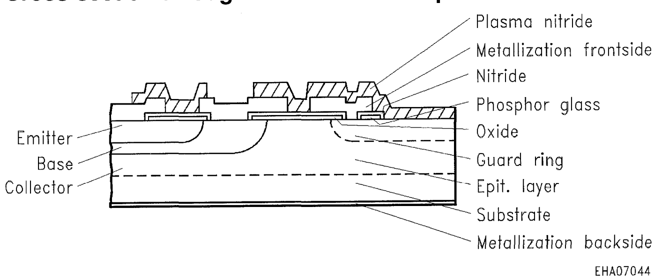
2. Reliability

High component reliability is attained by:

- constructive and technological procedures with the use of approved measures of design for the development of robust chips at practicable process tolerances (**Figure 3**).
- Careful inspection of improvements for conformity with requirements before their introduction (**Figure 4**).
- taking over improving procedures from fault analyses made in specific overstress tests.

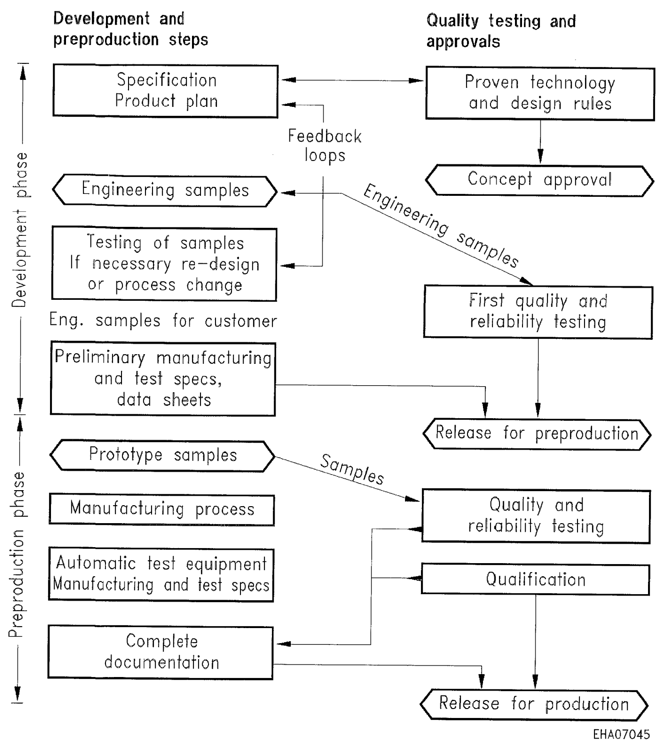
With appropriate circuit dimensioning, it is possible to achieve a failure rate λ of approx. 10 Fit for Siemens components at a junction temperature of less than 60 °C.

Figure 3
Chip structure
Cross-section through AF transistor chip



Layer	Major protective function
Plasma nitride and front metallization	Protection against scratching and corrosion as well as uncontrolled build-up of charge
High-temperature nitride	Guard against ion diffusion
Phosphor glass	Gettering of mobile ions in the oxide
Oxide	Protective isolation of pn junctions
Guard ring	Prevention of channel currents

Figure 4
Approval procedures (concept, preproduction and production release)
Development steps and quality approval procedures



2.1 Quality Assessment

The high reliability can only be determined by large-scale, graded testing. The verification of reliability is made for generic reference types according to internal standards. Some of these tests will be carried out in compliance with the CECC system of quality assessment. Both our production plants in Regensburg and Malacca (Malaysia) have already received CECC (Cenelec Electronic Components Committee) qualification as component manufacturer. We intend to include the whole range of our SMD types. Besides the periodic qualification the CECC qualification covers as well the qualification of the wafer fabrication, the assembly lines and the test lab that is responsible for conducting tests.

3. Ship-to Stock Agreements

There is a great demand for these agreements with our customers. The essential part of it is a quality-assurance contract (QSV) which can contain AQL values, failure criteria, the procedure with customer returns and mutual obligation to provide information.

For further information about quality please refer to our special-subject brochure:

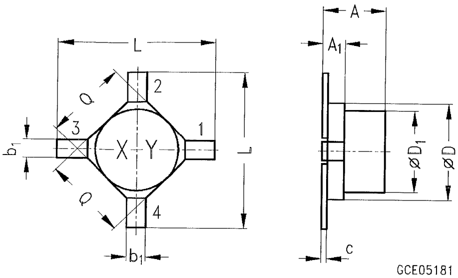
Discrete Semiconductors
Quality Assurance, Quality and Reliability
(see Literature Selector)

Gehäuse

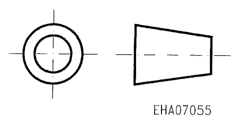
Package Outlines

All dimensions in mm, unless otherwise specified.

Cerec-X

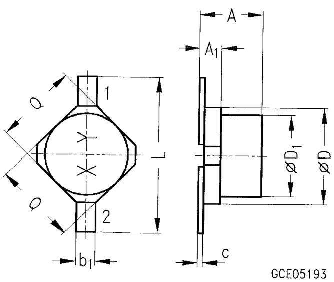


Approx. weight: 0.02 g

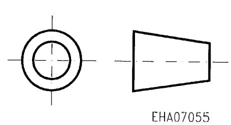


Dim.	min.	typ.	max.
A	–	–	1.6
A_1	–	0.6	–
b_1	0.45	0.5	0.55
c	0.1	0.15	0.2
D	2.35	2.55	2.75
D_1	–	2.1	–
L	4.0	4.2	–
Q	2.0	2.2	2.4

Cerec-X



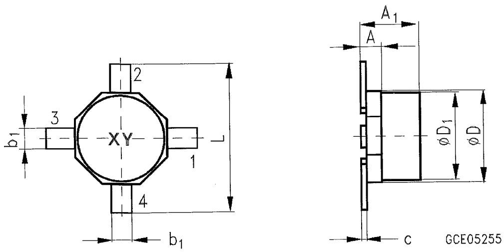
Approx. weight: 0.02 g



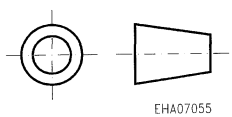
Dim.	min.	typ.	max.
A	–	–	1.6
A_1	–	0.6	–
b_1	0.45	0.5	0.55
c	0.1	0.15	0.2
D	2.35	2.55	2.75
D_1	–	2.1	–
L	4.0	4.2	–
Q	2.0	2.2	2.4

All dimensions in mm, unless otherwise specified.

Cerec-XF

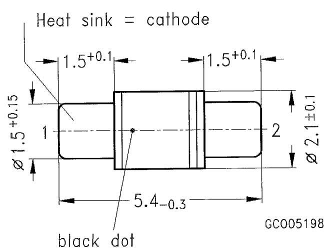


Dim.	min.	typ.	max.
A	0.45	0.48	0.50
A_1	1.0	1.5	–
b_1	0.40	0.5	0.60
c	0.08	0.1	0.16
D	–	1.78	–
$\varnothing D_1$	–	1.75	–
L	–	4.2	–



Approx. weight: 0.02 g

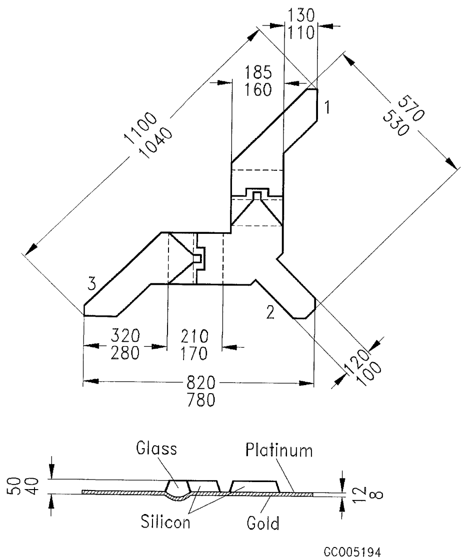
C1

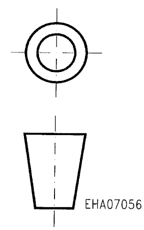


Approx. weight: 0.1 g

All dimensions in mm, unless otherwise specified.

D (Beam Lead)

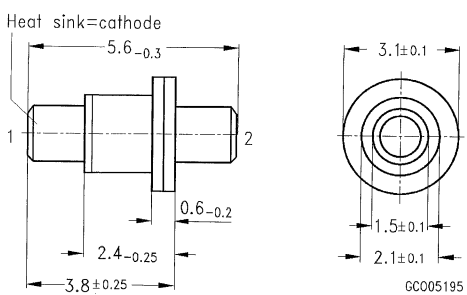


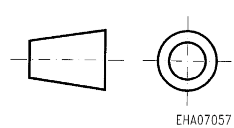


Dimensions in µm

Approx. weight: < 0.0001 g

D

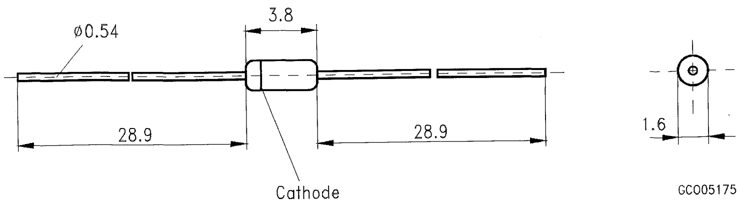




Approx. weight: 0.12 g

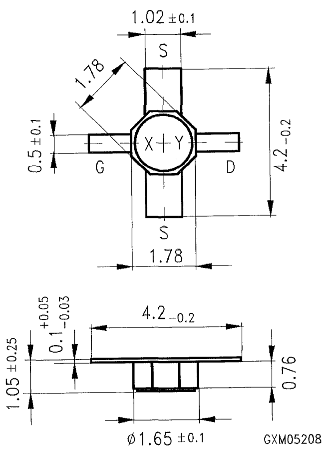
All dimensions in mm, unless otherwise specified.

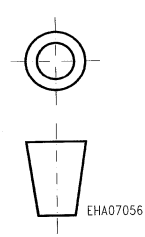
DO-35 DHD



Approx. weight: 0.1 g

Micro-X

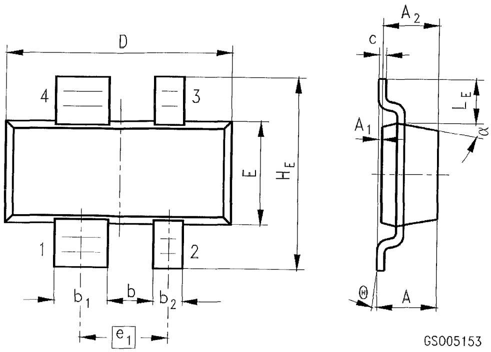


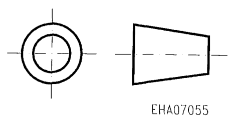


Approx. weight: 0.02 g

All dimensions in mm, unless otherwise specified.

MW-4





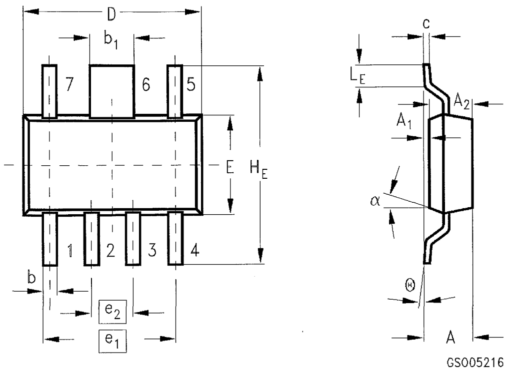
Approx. weight: 0.02 g

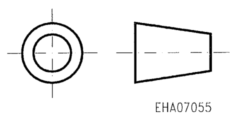
Dim.	min.	typ.	max.	Gradient
A	–	–	1.1	–
A_1	–	–	0.1	–
A_2	–	–	1.0	–
b	–	0.6	–	–
b_1	–	0.7	–	–
b_2	–	0.4	–	–
c	0.08	–	0.15	–
D	2.8	–	3.0	–
E	1.2	–	1.4	–
$\|e_1\|$	–	1.15	–	–
H_E	–	–	2.6	–
L_E	0.6	–	–	–
α*	–	–	–	max 10°
θ	–	–	–	2° … 30°

* Note: Applicable to all sides.

All dimensions in mm, unless otherwise specified.

MW-7



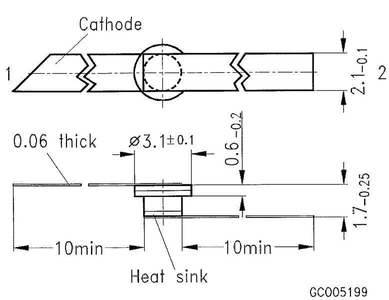


Approx. weight: 0.15 g

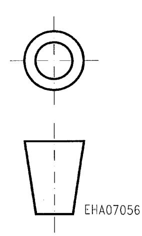
Dim.	min.	typ.	max.	Gradient
A	–	–	1.8	–
A_1	0	–	0.1	–
A_2	1.5	1.6	1.7	–
b	–	0.6	–	–
b_1	1.62	1.67	1.77	–
c	0.24	–	0.32	–
D	6.3	–	6.7	–
E	3.3	–	3.7	–
$\lvert e_1 \rvert$	–	3.81	–	–
$\lvert e_2 \rvert$	–	1.27	–	–
H_E	6.7	–	7.3	–
L_E	0.5	–	–	–
α*	–	–	–	max 15°
θ	–	–	–	10°

* Note: Applicable to all sides.

P

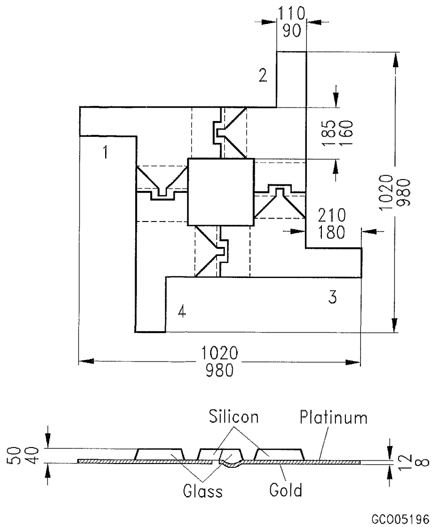


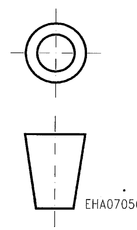
Approx. weight: 0.07 g



All dimensions in mm, unless otherwise specified.

R

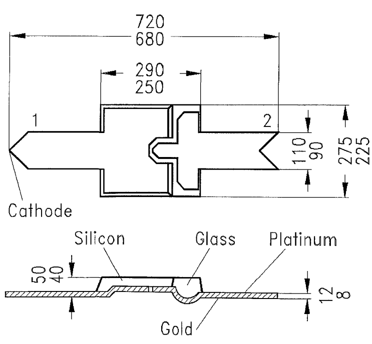


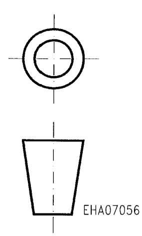


Dimensions in µm

Approx. weight: < 0.0001 g

S



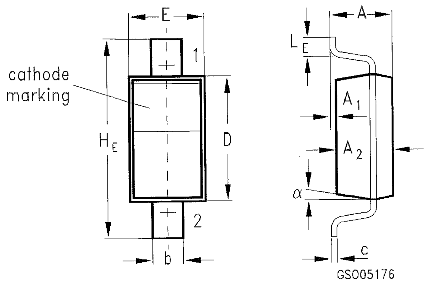


Dimensions in µm

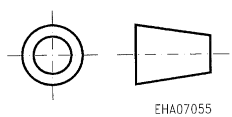
Approx. weight: < 0.0001 g

All dimensions in mm, unless otherwise specified.

SOD-123

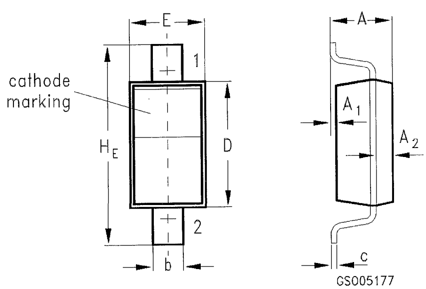


Dim.	min.	typ.	max.
A	–	–	1.35
A_1	–	–	0.1
A_2	0.95	1.1	1.25
b	0.5	0.6	0.7
c	–	0.15	–
D	2.55	2.7	2.85
E	1.4	1.55	1.7
H_E	3.55	3.7	3.85
L_E	0.25	–	–

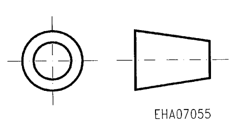


Approx. weight: 0.01 g

SOD-323



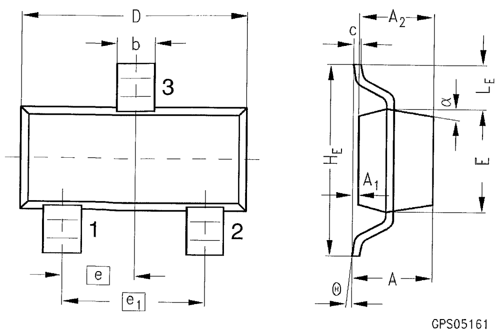
Dim.	min.	typ.	max.
A	–	–	1.1
A_1	0.05	0	0.05
A_2	–	–	0.2
b	0.25	0.3	0.4
c	–	0.15	–
D	1.6	1.7	1.9
E	1.15	1.25	1.45
H_E	2.3	2.5	2.7

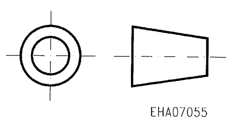


Approx. weight: 0.01 g

All dimensions in mm, unless otherwise specified.

SOT-23





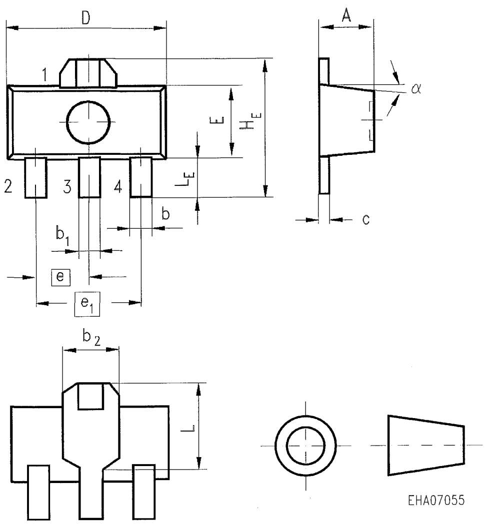
Approx. weight: 0.02 g

Dim.	min.	typ.	max.	Gradient
A	–	–	1.1	–
A_1	–	–	0.1	–
A_2	–	–	1.0	–
b	0.35	–	0.50	–
c	0.08	–	0.15	–
D	2.8	–	3.0	–
E	1.2	–	1.4	–
$\lvert e \rvert$	–	0.95	–	–
$\lvert e_1 \rvert$	–	1.9	–	–
H_E	–	–	2.6	–
L_E	0.6	–	–	–
α^*	–	–	–	max. 10°
θ	–	–	–	2°…30°

* Note: Applicable to all sides.

All dimensions in mm, unless otherwise specified.

SOT-89



GPS05162

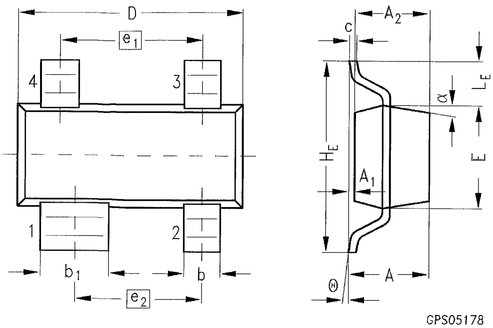
Approx. weight: 0.1 g

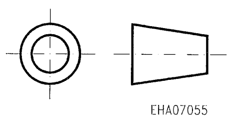
Dim.	min.	typ.	max.	Gradient
A	–	1.5	–	–
b	–	–	0.65	–
b_1	–	–	0.65	–
b_2	–	1.6	–	–
c	0.25	–	–	–
D	–	4.5	–	–
E	–	–	2.6	–
|e|	–	1.5	–	–
|e_1|	–	3	–	–
H_E	–	–	4.25	–
L	2.6	–	2.85	–
L_E	0.8	–	1.2	–
α*	–	–	–	max. 10°

* Note: Applicable to all sides.

All dimensions in mm, unless otherwise specified.

SOT-143





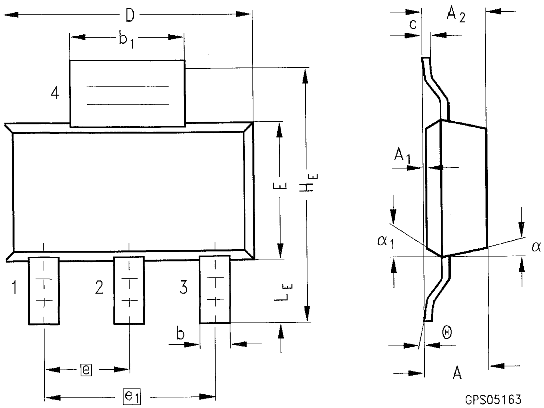
Approx. weight: 0.03 g

Dim.	min.	typ.	max.	Gradient
A	–	–	1.1	–
A_1	–	–	0.1	–
A_2	–	–	1.0	–
b	0.35	0.4	0.50	–
b_1	0.75	0.8	0.90	–
c	0.08	–	0.15	–
D	2.8	–	3.0	–
E	1.2	–	1.4	–
$\lvert e_1 \rvert$	–	1.9	–	–
$\lvert e_2 \rvert$	–	1.7	–	–
H_E	–	–	2.6	–
L_E	0.6	–	–	–
α*	–	–	–	max. 10°
θ	–	–	–	2°…30°

* Note: Applicable to all sides.

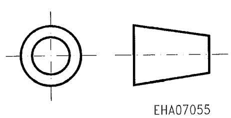
All dimensions in mm, unless otherwise specified.

SOT-223



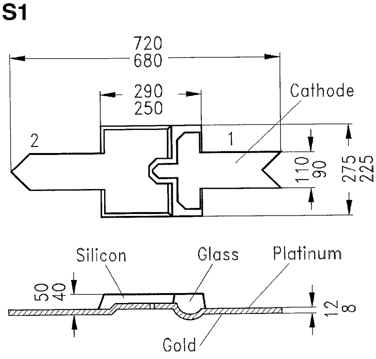
Dim.	min.	typ.	max.	Gradient
A	–	–	1.7	–
A_1	0.02	–	0.1	–
A_2	–	–	1.6	–
b	0.60	–	0.80	–
b_1	2.9	–	3.1	–
c	0.24	–	0.32	–
D	6.3	–	6.7	–
E	3.3	–	3.7	–
$\lvert e \rvert$	–	2.3	–	–
$\lvert e_1 \rvert$	–	4.6	–	–
H_E	6.7	–	7.3	–
L_E	–	1.7	–	
α*1	–	–	–	max. 16°
α_1*2	–	–	–	13°
θ	–	–	–	10°

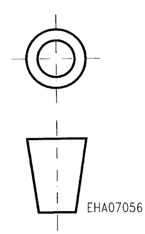
* Note 1: Applicable to case top
* Note 2: Applicable to case bottom



Approx. weight: 0.15 g

S1



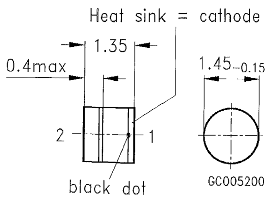


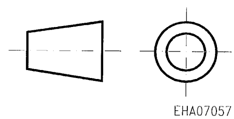
Dimensions in µm

Approx. weight: 0.0001 g

All dimensions in mm, unless otherwise specified.

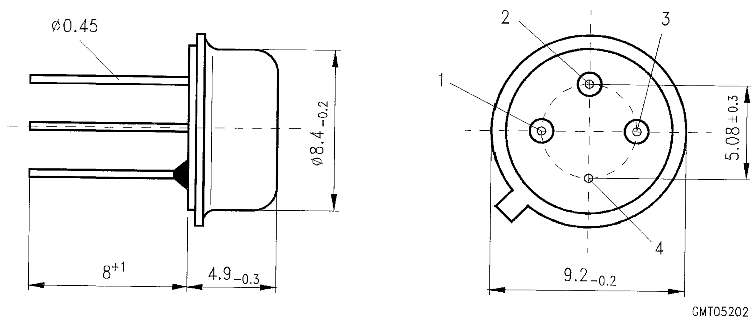
T

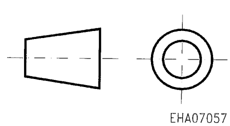




Approx. weight: 0.02 g

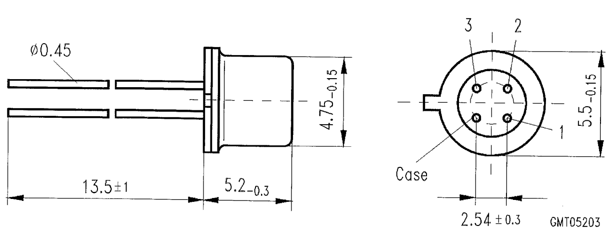
TO-12

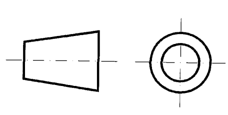




Approx. weight: 1 g

TO-72

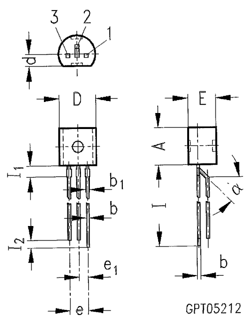


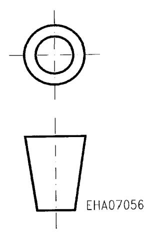


Approx. weight: 0.4 g

All dimensions in mm, unless otherwise specified.

TO-92 (off-set)

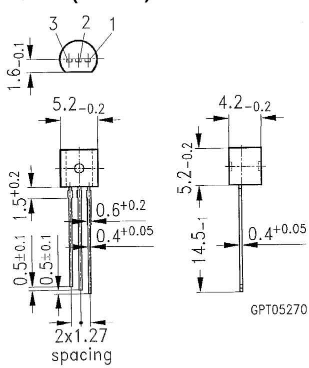


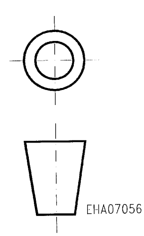


Approx. weight: 0.25 g

Dim.	min.	typ.	max.	Gradient
A	5.0	5.2	–	–
b	–	0.4	0.45	–
b_1	–	0.6	0.62	–
E	4.0	4.2	–	–
$\lvert e \rvert$	–	2.54	–	–
$\lvert e_1 \rvert$	–	1.27	–	–
D	5.0	5.2	–	–
d	1.5	1.6	–	–
l	13.5	14.5	–	–
l_1	–	1.5	1.7	–
l_2	0.9	1.0	1.1	–
α	–	–	–	45°

TO-92 (in-line)

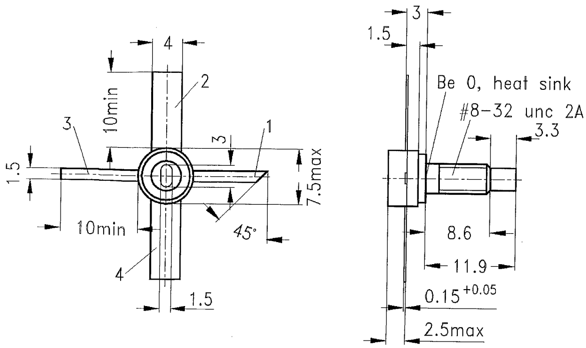




Approx. weight: 0.25 g

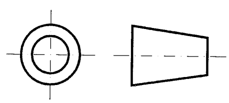
All dimensions in mm, unless otherwise specified.

TO-117



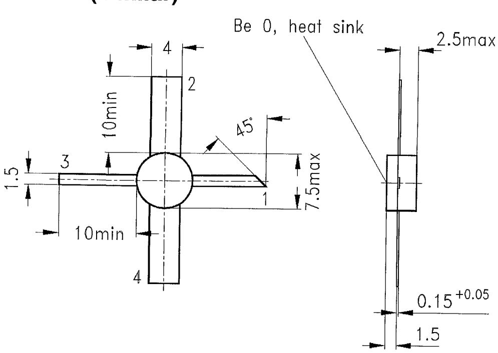
GMT05204

Approx. weight: 1.9 g



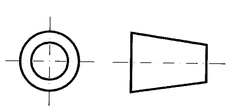
EHA07055

TO-117 (similar)



GMT05205

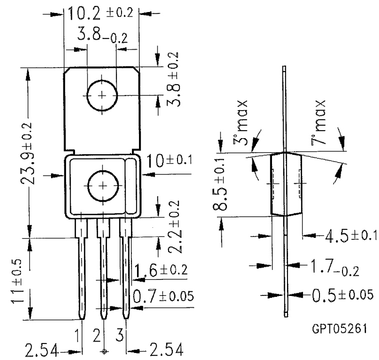
Approx. weight: 0.6 g

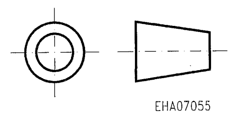


EHA07055

All dimensions in mm, unless otherwise specified.

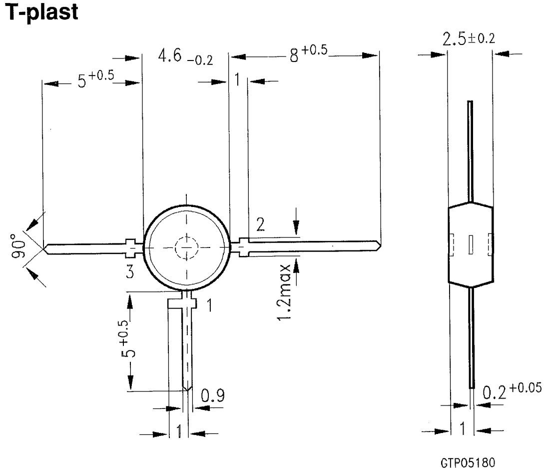
TO-202

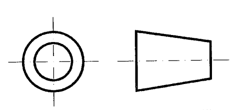




Approx. weight: 15 g

T-plast

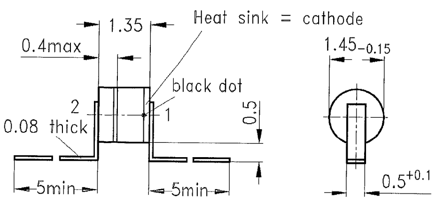




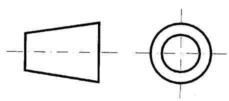
Approx. weight: 0.25 g

All dimensions in mm, unless otherwise specified.

T1



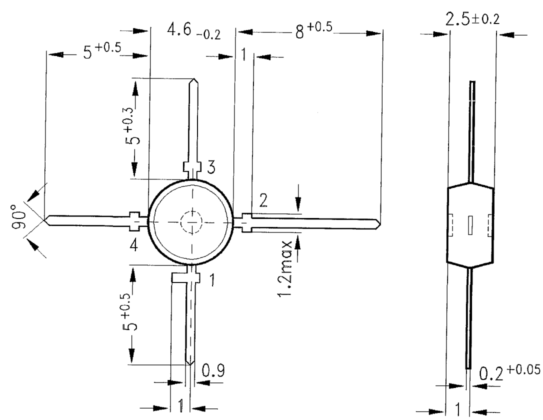
GC005201



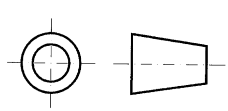
EHA07057

Approx. weight: 0.02 g

X-plast



GXP05179

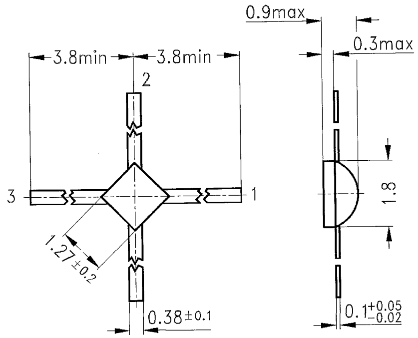


EHA07055

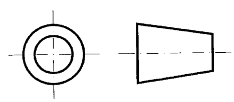
Approx. weight: 0.35 g

All dimensions in mm, unless otherwise specified.

50 mil



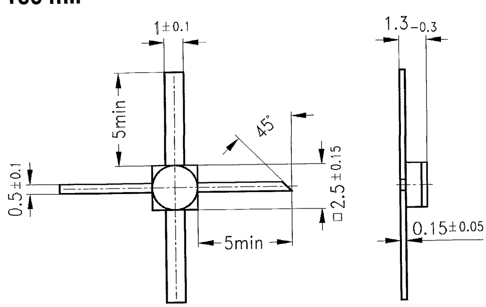
GC005206



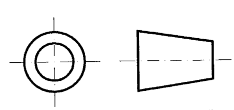
Approx. weight: 0.1 g

EHA07055

100 mil



GC005207



Approx. weight: 0.5 g

EHA07055

Verarbeitungshinweise

Mounting Instructions

1. Mechanische Beanspruchung

Die Einbaulage der Bauelemente ist beliebig. SMD-Bauteile sind für die automatische Bestückung gegurtet. Daher sind Zug- oder Biegebeanspruchungen der Anschlußbänder unzulässig soweit diese über die Bestückungskräfte hinausgehen.

Für konventionelle, bedrahtete Bauelemente wie TO-12, TO-72, TO-92, T-Plast, TO-117, T1, Cerec X, 50 und 100 mil gilt:

- Biegebeanspruchungen der Anschlußbänder sind nur zulässig, wenn eine mechanische Entlastung zwischen Biegestelle und Gehäuse vorgenommen wird. Das gleiche gilt auch für das Kürzen der Anschlußbänder.
- Bandförmige Anschlüsse dürfen nicht in der Bandebene gebogen werden.
- Wiederholtes Biegen ist unzulässig.

2. Thermische Beanspruchung

Jedes Halbleiterbauelement ist empfindlich gegen Überschreiten der höchstzulässigen Sperrschichttemperatur. Die max. zulässige Lagertemperatur darf daher nur für den Lötprozeß überschritten werden.

3. Lötangaben

Bei Lötung der SMD-Bauteile ist möglichst das genormte Verfahren nach CECC 00802 anzuwenden. Die Schwallötung ist das in der Flachbaugruppentechnik am häufigsten eingesetzte maschinelle Lötverfahren. Dazu sind die Bauteile zwischen Unterseite und Auflageseite zu fixieren, wobei der Abstand 0,3 mm nicht übersteigen darf. Die Lötflächen dürfen dabei mit dem Kleber nicht in Berührung kommen. Die Lötbadtemperatur kann max. 260 °C betragen.
Eine Verweildauer von 8 sec darf dabei nicht überschritten werden. Erfolgt eine Vorwärmung auf ca. 100 °C so ist die Lötzeit auf max. 5 sec zu vermindern. Hinweise über Reinigungsverfahren sind ebenfalls dem CECC 00802 Leitfaden zu entnehmen.

Gehäuse	**SOT-23**	**SOT-143 MW-4**	**SOT-89**	**SOD-123 SOD-323**	**SOT-223 MW-7**	**Cerec-X/XF**
Wellenlötung	X	X	O	X	X	O
Reflowlötung	X	X	X	X	X	X

Lötverfahren: X = geeignet O = ungeeignet

4. Konventionell bedrahtete Bauelemente

Bei der Lötung ist auf verspannungsfreie Fixierung der Bauelemente zu achten. Bei Kolbenlötung ist darauf zu achten, daß das Gehäuse nicht mit dem Lötkolben berührt wird.

Folgende Lötzeiten dürfen abhängig von der Anschlußlänge L nicht überschritten werden:

Anschlußlänge L (mm)	**0.5**	**1.5**	**5**
Löttemperatur 245 °C (s)	4	5	10
Löttemperatur 265 °C (s)	3	4	8
Löttemperatur 300 °C (s)	2	3	5

Der Lötabstand L wird zwischen Lötstelle und Gehäuse gemessen, bei durchmetallisierter Bohrung ist der Abstand zur Plattenunterseite zu subtrahieren.

I1. Mechanical Stress

The mounting position of the component is optional. SMD components are taped for automatic assembly. Therefore, it must be ensured that the leads are not subjected to mechanical stress exceeding that of the placement machine.

With conventional, leaded components as TO-12, TO-72, TO-92, T-plast, TO-117, T1, Cerec-X, 50 and 100 mil

- bending of the leads always requires mechanical relief between the point of bending and the package. The same applies to the cutting of the leads.
- band-shaped leads are not to be bent in the mounting plane.
- avoid repeated bending at the same point.

2. Thermal Stress

Each semiconductor component is sensitive to an exceeding of the maximum permissible junction temperature. Consequently the maximum permissible storage temperature may only be exceeded in the soldering process.

3. Soldering Specifications

For soldering SMD components it is recommended to use the standardized CECC 00802-process. Wave soldering is the most widely used automated solder method in the manufacture of pcb assemblies. The components must be attached with their bottom side to the mounting area without exceeding a distance of 0.3 mm.

It must be ensured that the metallization areas are free from any adhesive. With a maximum solder bath temperature of 260 °C, the soldering time of 8 s should not be exceeded. In case of a preheating to approx. 100 °C the soldering time can be reduced to max. 5 s. For cleaning methods please refer to CECC 00802 as well.

Package	**SOT-23**	**SOT-143 MW-4**	**SOT-89**	**SOD-123 SOD-323**	**SOT-223 MW-7**	**Cerec-X/XF**
Wave soldering	X	X	O	X	X	O
Reflow soldering	X	X	X	X	X	X

Soldering methods: X = suitable O = unsuitable

4. Conventional Components

Before starting the soldering, make sure the component is attached to the pcb in a way that does not exert undue mechanical stress on the leads. With Iron soldering it must be avoided to damage the package with the iron.

The following soldering times must not be exceeded depending on the lead length L:

Lead length L (mm)	**0.5**	**1.5**	**5**
Soldering temperature 245 °C (s)	4	5	10
Soldering temperature 265 °C (s)	3	4	8
Soldering temperature 300 °C (s)	2	3	5

The lead length L is measured from soldering point to package. With through-plated holes the distance to the plate bottom must be subtracted.

Verpackungshinweise

Packaging Instructions

Verpackungshinweise

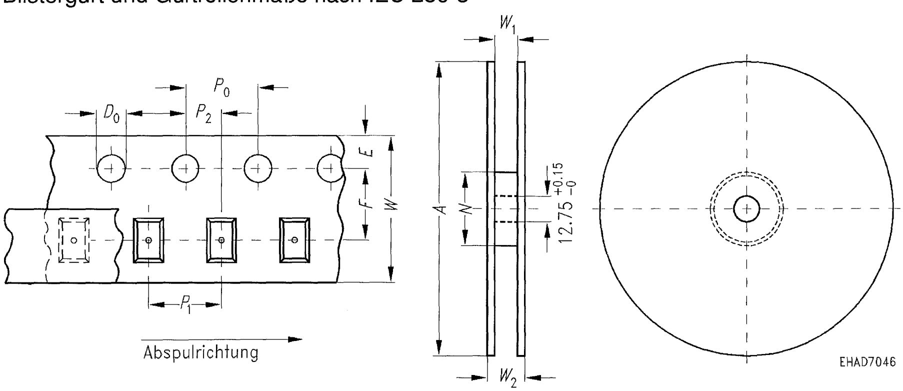
Jede Verpackungseinheit regulärer Lieferungen trägt Aufdrucke mit Informationen über Hersteller, Typ, Anzahl, Herstelldatum und -ort, Loszugehörigkeit, ESD-Empfindlichkeit, Paarung usw. Diese für den Inhalt verbindlichen Angaben kennzeichnen im Klartext insbesondere Typen, deren Bauformen keine ausführliche Bestempelung zulassen. Außerdem sind sie zur Rückmeldung wichtig, sollten einmal Reklamationen nötig sein.

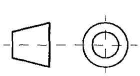
Schüttgut ist die allgemeine ungerichtete Verpackungsform ("bulk packaging"), die eine ungehinderte Einzelentnahme ermöglicht, bei automatischer Gerätebestückung aber richtungsorientierende Zufuhrstationen erfordert. Sie gilt, insbesondere bei T-plast und X-plast-Bauelementen, als normale Verpackungsform. Gurtung ist in standardisierten Versionen bei SMD-Gehäusen vorgesehen.

Die folgende Zusammenstellung gibt einen Überblick über die derzeitigen Gurtformen. Zu Einzelheiten über Maßtoleranzen oder Variationen der Orientierung erbitten wir Ihre Anfrage.

1. Gurtung

Blistergurt und Gurtrollenmaße nach IEC 286-3





Gurtmaße (mm)

W	P_0	P_1	P_2	D_0	E	F
8 ± 0,3	4 ± 0,1	4 ± 0,1	2 ± 0,05	$1,5^{+0.1}_{-0}$	1,75 ± 0,1	3,5 ± 0,05
12 ± 0,3	4 ± 0,1	8 ± 0,1	2 ± 0,05	$1,5^{+0.1}_{-0}$	1,75 ± 0,1	5,5 ± 0,05

Gurtrollenmaße (mm)

A	N	W_1	$W_{2\,max}$
180/330	62 ± 1,5	$8,4^{+1.5}_{-0}$	14,4
180/330	62 ± 1,5	$12,4^{+2}_{-0}$	18,4

SMD-Verpackungseinheiten

Gehäuse / Zusatzkennung	SOT-23	SOT-143 MW-4	SOT-89 SOT 223 MW-7	SOD-123 SOD-323
E6327 (18 cm Rollen- durchmesser)	3000	3000	1000	3000
E6433 (33 cm Rollen- durchmesser)	10000	10000	4000	10000

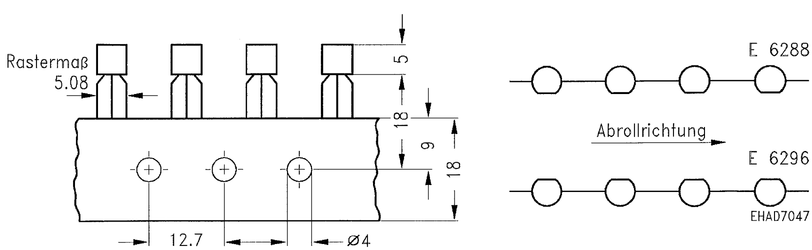
TO-202-Kunststoffgehäuse

Wird als Schüttgut in Pappschachteln geliefert. Gehäuse mit gebogenem Anschlußblech sind auf Anfrage lieferbar.

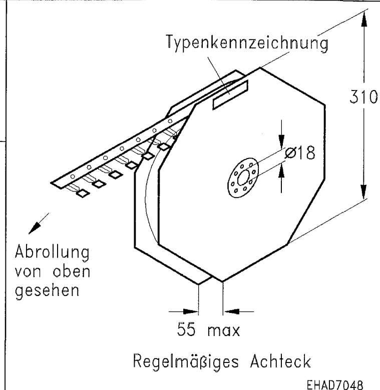
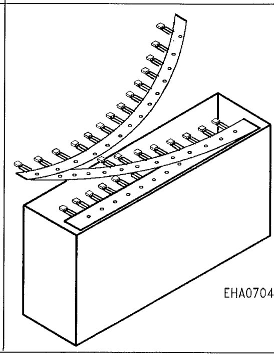
TO-92-Kunststoffgehäuse

Neben der Schüttgutverpackung wird das TO-92-Gehäuse gegurtet geliefert. Die zusätzlichen Bestellbezeichnungen sind aus der nachfolgenden Tabelle zu entnehmen.

Die Gurtmaße entsprechen den DIN-IEC-Normen-Vorschlägen. Die Anschlüsse sind symmetrisch entsprechend dem in-line-Rastermaß 200 mil, auf 5 mm gekröpft (äußere Anschlüsse)



Verpackungshinweise

Zusatzkennung	Verpackungseinheit		Karton
E6288	1500 Stück (pro Rolle)	3000 Stück (pro Karton, = 2 Rollen)	
E6296	1500 Stück (pro Rolle)	3000 Stück (pro Karton, = 2 Rollen)	
E6325	Ammopack (Zick-Zack-Lagen)	100 Stück (pro Karton)	

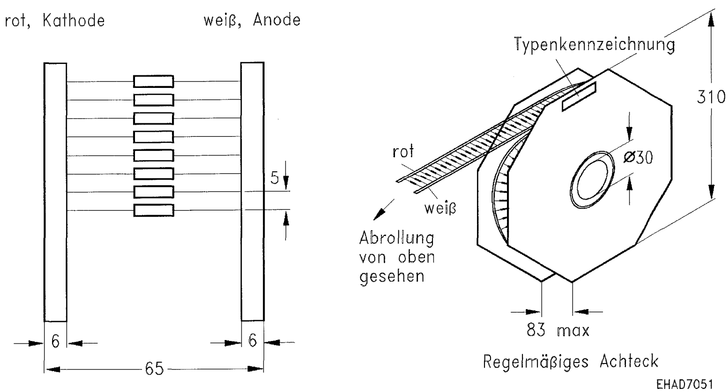
DO-35-Gehäuse
Gurtung von Bauelementen mit „axialen Anschlüssen“

Standardlieferform ist der auf achteckige Pappe-Kunststoffrollen gewickelte doppelt geführte Gurt gemäß DIN IEC 52.133, EIA RS 481 mit einer maximalen Füllmenge von 15000 Stück je Rolle.

Die Faltverpackung des Gurtes im Karton wird nur für kleine Mustermengen oder nach besonderer Vereinbarung verwendet; ebenso bedarf die Beifügung einer Schutzpapierbahn zwischen den Gurtlagen einer vertraglichen Regelung.

Die Dioden sind polaritätsorientiert gegurtet; das farbige (in der Regel rote) Klebeband weist zur Kathodenseite, das weiße Klebeband zur Anode.

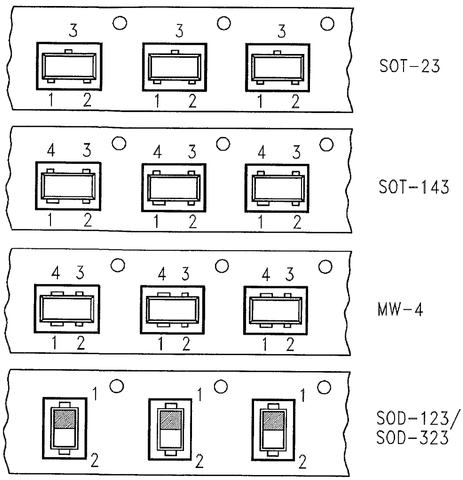
Die Trennung von – unter Datenblattbedingungen nicht mischbaren Paarungsgruppen (etwa bei gleichlaufsortierten Kapazitätsdioden) erfolgt durch 6 Leerstellen. Die Aufrollung wird mit einer Lage Wellpappe fixiert.



2. Polarität und Lage der Bauelemente im Gurt

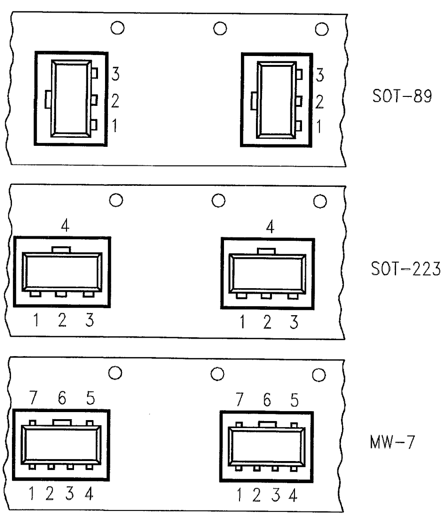
Ansicht Oberseite

8-mm-Gurt



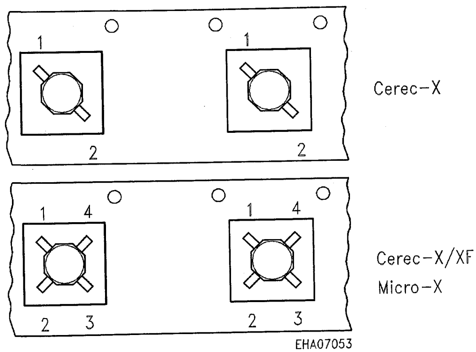
EHA07052

12-mm-Gurt



EHA07054

12-mm-Gurt



GaAs FET
1: D
2/4: S
3: G

Si-Tr.
1: B
2/4: E
3: C

Packaging Instructions

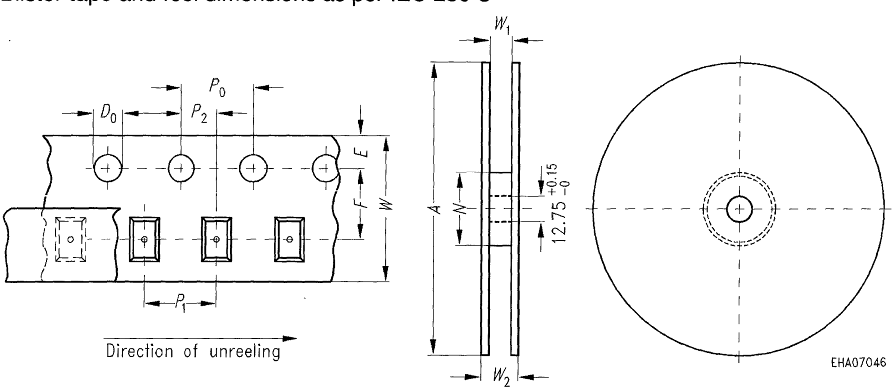
Each packaging unit of regular deliveries is marked with information about the manufacturer, type, quantity, date and place of manufacture, lot, ESD sensitivity, matching, etc. These details on the contents are mandatory and characterize in uncoded form particularly those types whose size does not permit the full marking. In addition, it is important for possible claims.

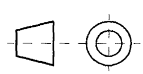
Bulk is the general loose form of packaging that enables components to be removed singly, but appropriate stations are needed to direct their supply for automatic placement. This is the normal form of packaging, especially for T-plast and X-plast devices. Taping is available in standardized versions for SMD packages.

Below, the current forms of taping are summarized. Please inquire for details of dimensional tolerances or variations on how the components are oriented.

1. Tape Packaging

Blister tape and reel dimensions as per IEC 286-3





Tape dimensions (mm)

W	P_0	P_1	P_2	D_0	E	F
8 ± 0.3	4 ±0.1	4 ± 0.1	2 ± 0.05	$1.5^{+0.1}_{-0}$	1.75 ± 0.1	3.5 ± 0.05
12 ± 0.3	4 ± 0.1	8 ± 0.1	2 ± 0.05	$1.5^{+0.1}_{-0}$	1.75 ± 0.1	5.5 ± 0.05

Reel dimensions (mm)

A	N	W_1	$W_{2\,max}$
180/330	62 ± 1.5	$8.4^{+1.5}_{-0}$	14.4
180/330	62 ± 1.5	12.4^{+2}_{-0}	18.4

SMD Packaging Units

Additional type designation \ Package	SOT-23	SOT-143 MW-4	SOT-89 SOT 223 MW-7	SOD-123 SOD-323
E6327 (18 cm ø reel)	3000	3000	1000	3000
E6433 (33 cm ø reel)	10000	10000	4000	10000

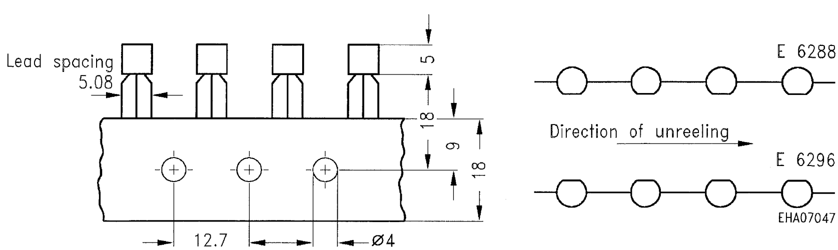
TO-202 plastic package

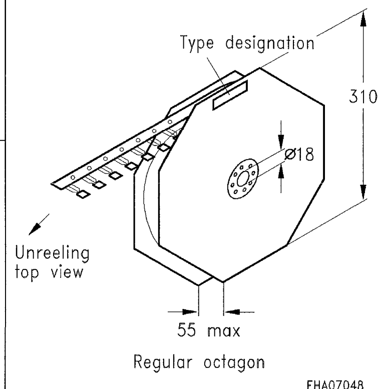
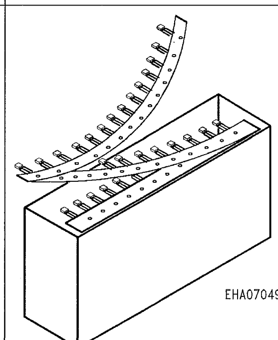
is supplied in bulk in cardboard boxes. Packages with bent pins are available upon request.

TO-92 plastic package

In addition to the bulk packing, the TO-92 package is also available on tape. For the supplementary code added to the type designation refer to the table shown below. The ordering codes are available upon request.

The tape dimensions correspond to the DIN-IEC-standard recommendations. The terminals are symmetric according to the in-line lead spacing 200 mil, spaced 5 mm apart (external terminals).



Supplementary code	Packaging unit		Cardboard box
E6288	1500 items (per reel)	3000 items (per card-board box, = 2 reels)	
E6296	1500 items (per reel)	3000 items (per card-board box, = 2 reels)	
E6325	Ammopack (placed in zigzag)	2000 items (per card-board box)	

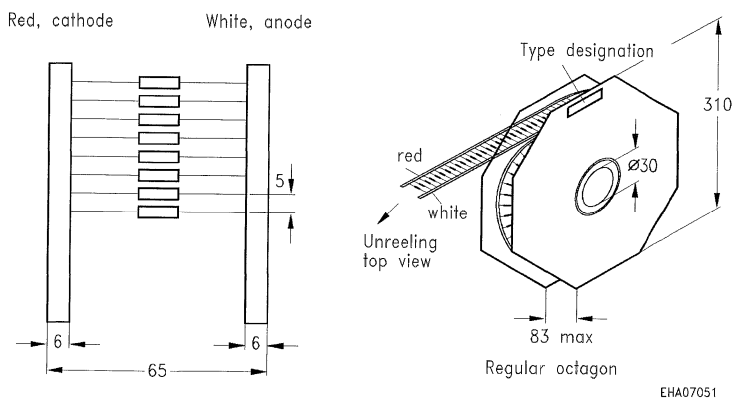
DO-35 package
Taping of components with axial leads

The standard form is a twin tape wound on octagonal cardboard or plastic reels according to DIN IEC 52.133, EIA RS 481 with a maximum complement of 15000 pieces/reel.

Fanfolding of the tape in a carton (AMMO pack) is only used for small sample quantities or by special arrangement; likewise the inclusion of a protective paper layer between the tape layers must be specially contracted for.

The diodes are taped according to polarity; the colored (usually red) adhesive tape marks the cathode end and the white adhesive tape the anode end.

Groups of matched units that should not be mixed (e.g. as in the case of diodes sorted for capacitance tracking) are separated by six empty spaces. The reel is held by a layer of corrugated cardboard.

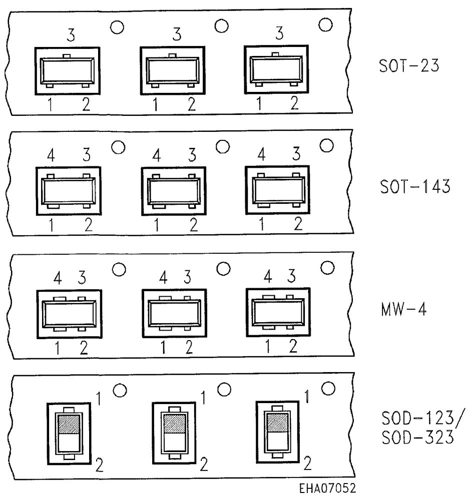


Dimensions in mm

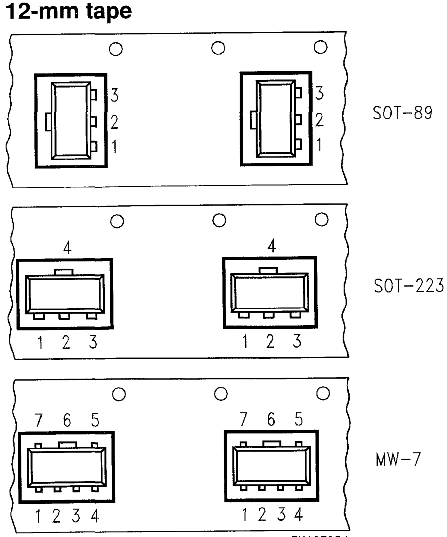
2. Polarity and Orientation of Taped Components

View top

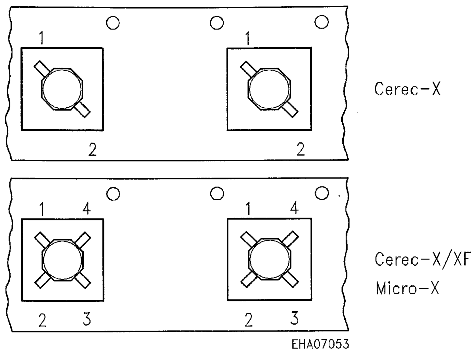
8-mm tape



12-mm tape



12-mm tape (continued)



GaAs FET
1: D
2/4: S
3: G

Si-Tr.
1: B
2/4: E
3: C

HF-Dioden

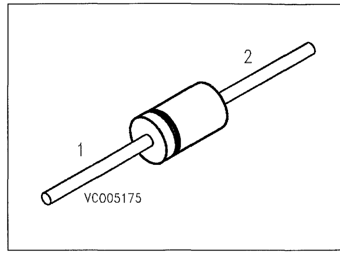
RF Diodes

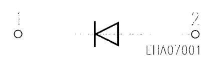
SIEMENS

Silicon RF Switching Diodes

BA 243
BA 244

- For VHF band switching in TV tuners
- Not for new design



Type	Marking	Ordering Code	Pin Configuration	Package[1)]
BA 243	yellow	Q62702-A521		DO-35 DHD
BA 244		Q62702-A421		

Maximum Ratings

Parameter	Symbol	Values	Unit
Reverse voltage	V_R	35	V
Forward current, $T_A \leq 60$ °C	I_F	100	mA
Junction temperature	T_j	150	°C
Storage temperature range	T_{stg}	– 55 ... + 150	

Thermal Resistance

Junction - ambient	$R_{th\,JA}$	≤ 400	K/W

1) For detailed information see chapter Package Outlines.

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

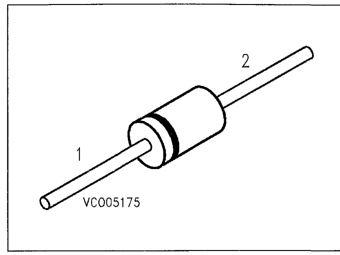
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Forward voltage I_F = 100 mA	V_F	–	–	1	V
Reverse current V_R = 15 V	I_R	–	–	50	nA
Diode capacitance V_R = 15 V, f = 1 MHz	C_T	–	1.3	2	pF
Forward resistance I_F = 10 mA, f = 100 MHz BA 243 BA 244	r_f	 – –	 0.5 0.4	 1 0.5	Ω
Reverse resistance V_R = 1 V, f = 100 MHz	$1/g_p$	–	100	–	kΩ
Series inductance	L_S	–	2.5	–	nH

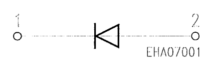
SIEMENS

Silicon RF Switching Diodes

BA 243 S
BA 244 S

- For VHF band switching in TV tuners
- Low forward resistance and low diode capacitance
- Not for new design



Type	Marking	Ordering Code	Pin Configuration	Package[1]
BA 243 S	yellow	Q62702-A607		DO-35 DHD
BA 244 S		Q62702-A618		

Maximum Ratings

Parameter	Symbol	Values	Unit
Reverse voltage	V_R	35	V
Forward current, $T_A \leq 60$ ˚C	I_F	100	mA
Junction temperature	T_j	150	˚C
Storage temperature range	T_{stg}	– 55 … + 150	

Thermal Resistance

Junction - ambient	$R_{th\,JA}$	≤ 400	K/W

[1] For detailed information see chapter Package Outlines.

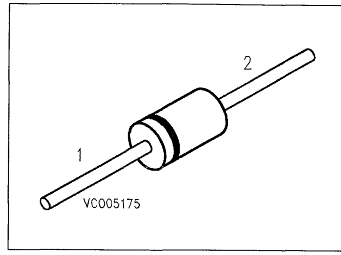
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Forward voltage I_F = 100 mA	V_F	–	–	1	V
Reverse current V_R = 15 V	I_R	–	–	50	nA
Diode capacitance f = 1 MHz V_R = 15 V V_R = 5 V V_R = 1 V	C_T	 – – –	 1.3 – 1.85	 – 1.5 –	pF
Forward resistance f = 100 MHz BA 243 S: I_F = 10 mA I_F = 2 mA BA 244 S: I_F = 10 mA I_F = 2 mA	r_f	 – – – –	 – – – 1	 0.7 2 0.5 –	Ω
Reverse resistance V_R = 1 V, f = 100 MHz	$1/g_p$	–	100	–	kΩ
Series inductance	L_S	–	2.5	–	nH

Silicon RF Switching Diodes

BA 282
BA 283

- For low-loss VHF band switching in TV tuners
- Not for new design



Type	Marking	Ordering Code	Pin Configuration	Package[1)]
BA 282	yellow	Q62702-A428		DO-35 DHD
BA 283		Q62702-A429		

Maximum Ratings

Parameter	Symbol	Values	Unit
Reverse voltage	V_R	35	V
Forward current, $T_A \leq 60$ ˚C	I_F	100	mA
Junction temperature	T_j	150	˚C
Storage temperature range	T_{stg}	– 55 … + 150	

Thermal Resistance

Junction - ambient	$R_{th\,JA}$	≤ 400	K/W

1) For detailed information see chapter Package Outlines.

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

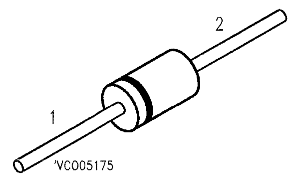
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Forward voltage I_F = 100 mA	V_F	–	–	1	V
Reverse current V_R = 20 V	I_R	–	–	50	nA
Diode capacitance f = 1 MHz BA 282: V_R = 1 V V_R = 3 V BA 283: V_R = 1 V V_R = 3 V	C_T	 – – – –	 – – – –	 1.5 1.2 1.5 1	pF
Forward resistance f = 100 MHz BA 282: I_F = 3 mA I_F = 10 mA BA 283: I_F = 3 mA I_F = 10 mA	r_f	 – – – –	 – – – –	 0.7 0.5 1.2 0.9	Ω
Reverse resistance V_R = 1 V, f = 100 MHz	$1/g_p$	–	100	–	kΩ
Series inductance	L_S	–	2.5	–	nH

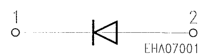
SIEMENS

Silicon Switching Diode

BA 284

- Low-loss RF switch for use at frequencies above 10 MHz, especially in TV tuners
- Not for new design



Type	Marking	Ordering Code	Pin Configuration	Package[1)]
BA 284	yellow	Q62702-A632		DO-35 DHD

Maximum Ratings

Parameter	Symbol	Values	Unit
Reverse voltage	V_R	35	V
Forward current, $T_A \leq 60$ °C	I_F	100	mA
Junction temperature	T_j	150	°C
Storage temperature range	T_{stg}	– 65 … + 150	

Thermal Resistance

Junction - ambient	$R_{th\,JA}$	≤ 400	K/W

1) For detailed information see chapter Package Outlines.

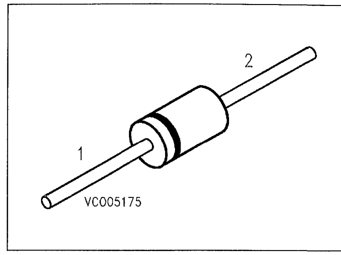
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

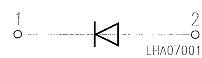
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Forward voltage I_F = 100 mA	V_F	–	–	1	V
Reverse current V_R = 20 V	I_R	–	–	50	nA
Diode capacitance f = 1 MHz V_R = 1 V V_R = 20 V	C_T	 – –	 1 0.8	 – 1	pF
Forward resistance f = 100 MHz I_F = 3 mA I_F = 10 mA	r_f	 – –	 0.75 0.45	 – 0.6	Ω
Reverse resistance V_R = 1 V f = 1 MHz f = 100 MHz	$1/g_p$	 1 –	 – 100	 – –	 MΩ kΩ
Series inductance	L_S	–	2.5	–	nH

SIEMENS

Silicon PIN Diode **BA 389**

- Current-controlled RF resistor
  for switching and attenuating applications
- Frequency range
  1 MHz … 1 GHz
- Not for new design



Type	Marking	Ordering Code	Pin Configuration	Package[1)]
BA 389	yellow	Q62702-A732		DO-35 DHD

Maximum Ratings

Parameter	Symbol	Values	Unit
Reverse voltage	V_R	30	V
Forward current	I_F	50	mA
Junction temperature	T_j	150	˚C
Storage temperature range	T_{stg}	– 65 … + 150	

Thermal Resistance

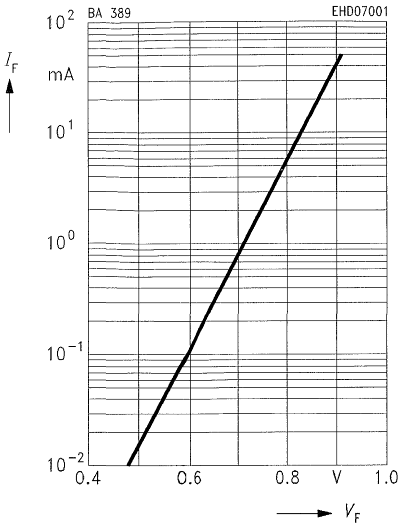
Junction - ambient	$R_{th\,JA}$	≤ 400	K/W

1) For detailed information see chapter Package Outlines.

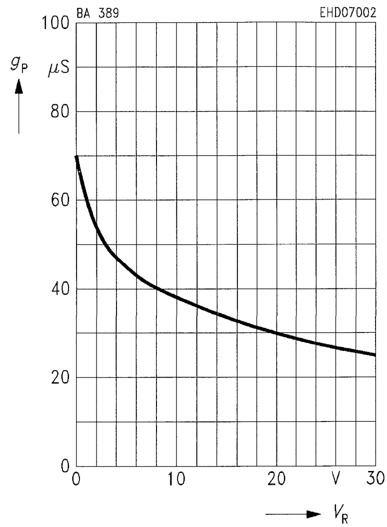
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Forward voltage I_F = 50 mA	V_F	–	–	1	V
Reverse current V_R = 30 V	I_R	–	–	50	nA
Diode capacitance V_R = 10 V, f = 1 MHz V_R = 0 V, f = 100 MHz	C_T	 – –	 0.55 0.35	 – 0.5	pF
Forward resistance f = 100 MHz I_F = 1.5 mA I_F = 10 mA	r_f	 – –	 25 5	 40 7.5	Ω
Zero bias conductance V_R = 0 V, f = 100 MHz	g_p	–	70	–	µS
Series inductance	L_S	–	2.5	–	nH

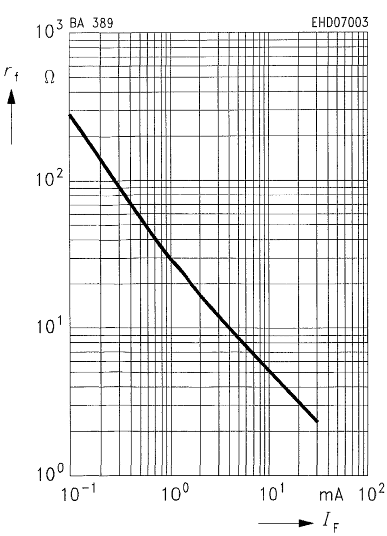
Forward characteristics $I_F = f(V_F)$



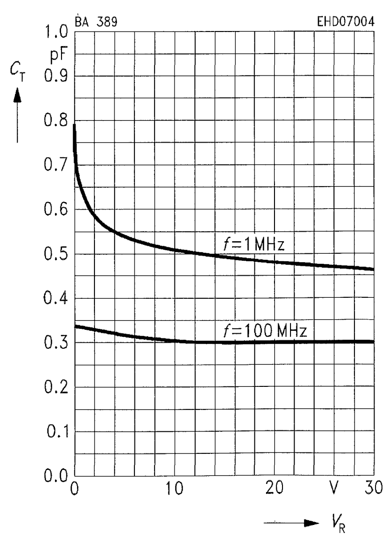
Parallel conductance $g_P = f(V_R)$



Forward resistance $r_f = f(I_F)$
f = 100 MHz



Diode capacitance $C_T = f(V_R)$

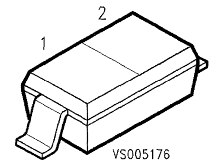


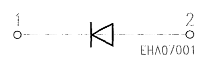
SIEMENS

Silicon RF Switching Diode

BA 582

- For low-loss VHF band switching in TV/VTR tuners



Type	Marking	Ordering Code	Pin Configuration	Package[1]
BA 582	blue S	Q62702-A829		SOD-123

Maximum Ratings

Parameter	Symbol	Values	Unit
Reverse voltage	V_R	35	V
Forward current, $T_A \leq 60$ °C	I_F	100	mA
Operation temperature range	T_{op}	– 55 ... + 125	°C
Storage temperature range	T_{stg}	– 55 ... + 150	

Thermal Resistance

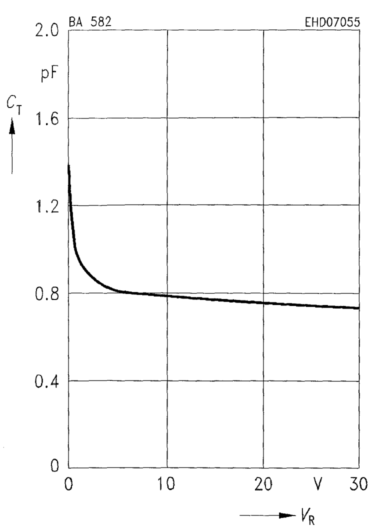
Junction - ambient	$R_{th\,JA}$	≤ 600	K/W

[1] For detailed information see chapter Package Outlines.

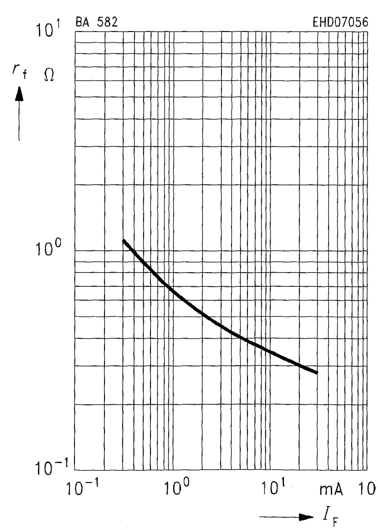
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Forward voltage I_F = 100 mA	V_F	–	–	1	V
Reverse current V_R = 20 V	I_R	–	–	20	nA
Diode capacitance f = 1 MHz V_R = 1 V V_R = 3 V	C_T	 – 0.6	 0.92 0.85	 1.4 1.1	pF
Forward resistance f = 100 MHz I_F = 3 mA I_F = 10 mA	r_f	 – –	 0.45 0.38	 0.7 0.5	Ω
Reverse resistance V_R = 1 V, f = 100 MHz	$1/g_p$	–	100	–	kΩ
Series inductance	L_S	–	2.8	–	nH

Diode capacitance $C_T = f(V_R)$
f = 1 MHz



Forward resistance $r_f = f(I_F)$
f = 100 MHz

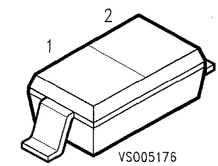


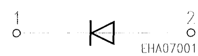
SIEMENS

Silicon PIN Diode

BA 585

- Current-controlled RF resistor for switching and attenuating applications.
- Frequency range 1 MHz ... 2 GHz



Type	Marking	Ordering Code (tape and reel)	Pin Configuration	Package[1)]
BA 585	white R	Q62702-A859		SOD-123

Maximum Ratings

Parameter	Symbol	Values	Unit
Reverse voltage	V_R	50	V
Forward current	I_F	50	mA
Operation temperature range	T_{op}	– 55 ... + 125	°C
Storage temperature range	T_{stg}	– 55 ... + 150	

Thermal Resistance

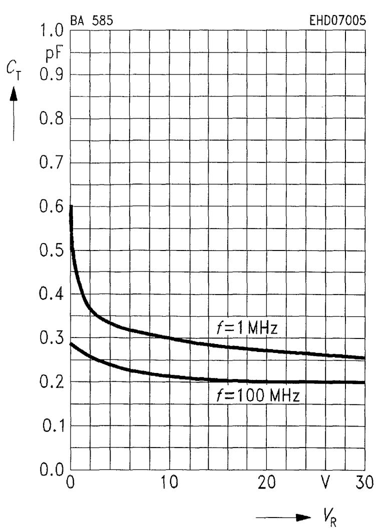
Junction - ambient	$R_{th\,JA}$	≤ 450	K/W

1) For detailed information see chapter Package Outlines.

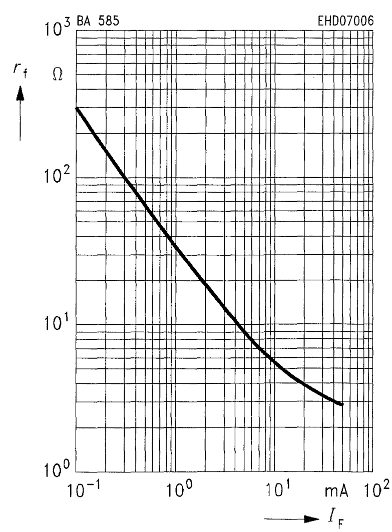
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Forward voltage I_F = 50 mA	V_F	–	–	1.1	V
Reverse current V_R = 30 V	I_R	–	–	50	nA
Diode capacitance f = 1 MHz, V_R = 10 V f = 100 MHz, V_R = 0 V	C_T	 – –	 0.28 0.23	 0.6 0.4	pF
Forward resistance f = 100 MHz I_F = 1.5 mA I_F = 10 mA	r_f	 – –	 22 5	 40 7	Ω
Zero bias conductance f = 100 MHz, V_R = 0 V	g_p	–	70	–	µS
Series inductance	L_S	–	2.8	–	nH

Diode capacitance $C_T = f(V_R)$
f = 1 MHz / f = 100 MHz



Forward resistance $r_f = f(I_F)$
f = 100 MHz



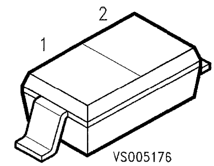
SIEMENS

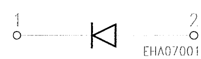
Silicon PIN Diode

BA 586

Preliminary Data

- Current-controlled RF resistor for switching and attenuating applications.
- Frequency range above 1 MHz
- Designed for low IM distortion



Type	Marking	Ordering Code (tape and reel)	Pin Configuration	Package[1)]
BA 586	white P	Q62702-A930		SOD-123

Maximum Ratings

Parameter	Symbol	Values	Unit
Reverse voltage	V_R	50	V
Forward current	I_F	50	mA
Operating temperature range	T_{op}	– 55 … + 125	˚C
Storage temperature range	T_{stg}	– 55 … + 150	

Thermal Resistance

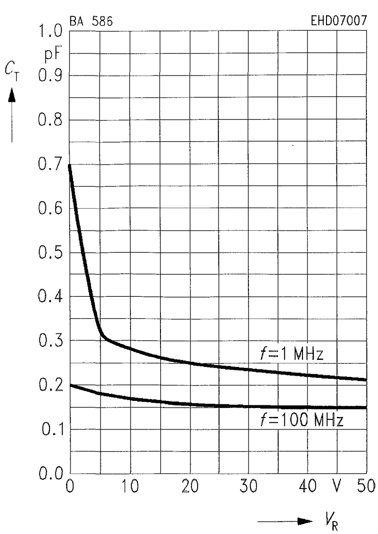
Junction - ambient	$R_{th\,JA}$	≤ 450	K/W

1) For detailed information see chapter Package Outlines.

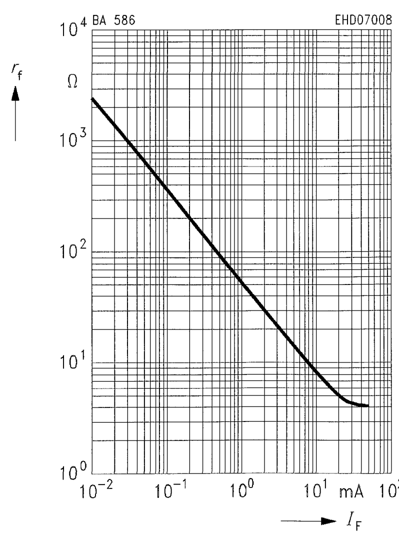
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Forward voltage I_F = 50 mA	V_F	–	–	1.15	V
Reverse current V_R = 50 V	I_R	–	–	50	nA
Diode capacitance f = 1 MHz, V_R = 50 V f = 100 MHz, V_R = 0 V	C_T	 – –	 0.23 0.2	 0.35 –	pF
Forward resistance f = 100 MHz I_F = 10 µA I_F = 1 mA I_F = 10 mA	r_f	 – – 6.5	 2400 58 7.8	 – – 10	Ω
Zero bias conductance f = 100 MHz, V_R = 0 V	g_P	–	40	–	µS
Series inductance	L_S	–	2	–	nH

Diode capacitance $C_T = f(V_R)$
f = 1 MHz / f = 100 MHz



Forward resistance $r_f = f(I_F)$
f = 100 MHz

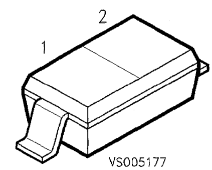


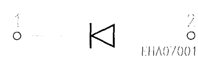
SIEMENS

Silicon RF Switching Diode — BA 592

Preliminary Data

- For VHF band switching in TV/VTR tuners
- Low forward resistance, small capacitance, small inductance



Type	Marking	Ordering Code (tape and reel)	Pin Configuration	Package[1)]
BA 592	blau S	Q62702-A950		SOD-323

Maximum Ratings

Parameter	Symbol	Values	Unit
Reverse voltage	V_R	35	V
Forward current	I_F	100	mA
Operating temperature range	T_{op}	– 55 ... + 125	˚C
Storage temperature range	T_{stg}	– 55 ... + 150	

Thermal Resistance

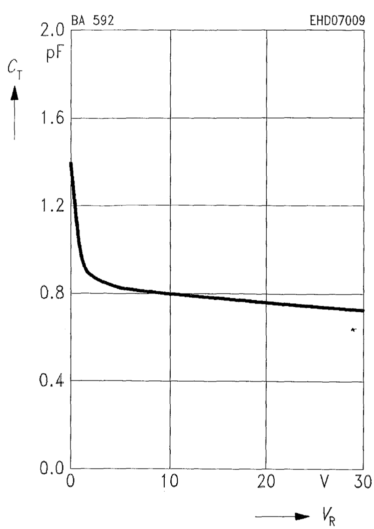
Junction - ambient	$R_{th\,JA}$	≤ 450	K/W

1) For detailed information see chapter Package Outlines.

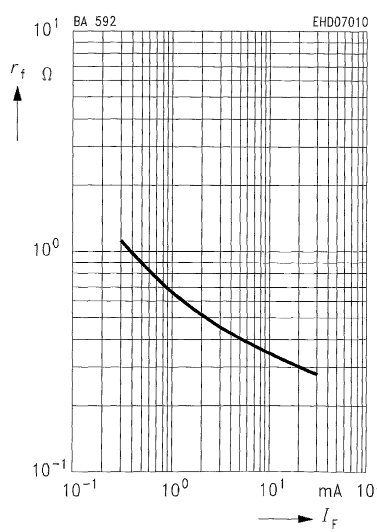
Electrical Characteristics
at T_A = 25 ˚C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Forward voltage I_F = 1000 mA	V_F	–	–	1	V
Reverse current V_R = 20 V	I_R	–	–	20	nA
Diode capacitance f = 1 MHz V_R = 1 V V_R = 3 V	C_T	 – 0.6	 0.92 0.85	 1.4 1.1	pF
Forward resistance f = 100 MHz I_F = 3 mA I_F = 10 mA	r_f	 – –	 0.45 0.36	 0.7 0.5	Ω
Zero bias conductance V_R = 1 V, f = 100 MHz	$1/g_p$	–	100	–	µS
Series inductance	L_S	–	2	–	nH

Diode capacitance $C_T = f(V_R)$
f = 1 MHz



Forward resistance $r_f = f(I_F)$
f = 100 MHz



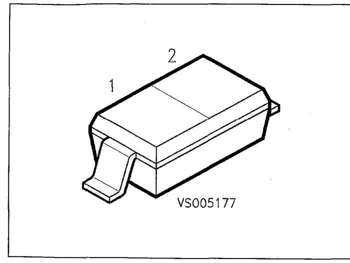
SIEMENS

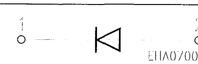
Silicon PIN Diode

BA 595

Preliminary Data

- Current-controlled RF resistor for RF attenuators
- Frequency range 1 MHz … 2 GHz
- Especially useful as antenna switch in TV-sat tuners



Type	Marking	Ordering Code (tape and reel)	Pin Configuration	Package[1)]
BA 595	white R	Q62702-A952		SOD-323

Maximum Ratings

Parameter	Symbol	Values	Unit
Reverse voltage	V_R	50	V
Forward current	I_F	50	mA
Operating temperature range	T_{op}	– 55 … + 125	˚C
Storage temperature range	T_{stg}	– 55 … + 150	

Thermal Resistance

Junction - ambient	$R_{th\,JA}$	≤ 450	K/W

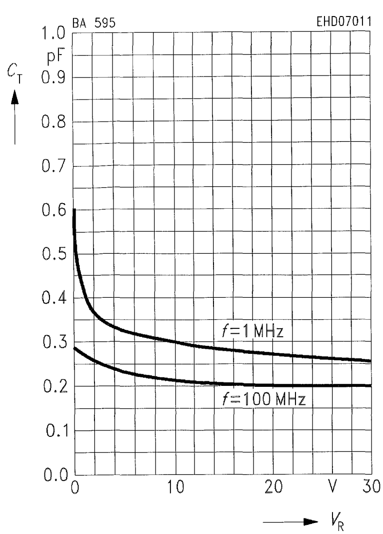
1) For detailed information see chapter Package Outlines.

Electrical Characteristics

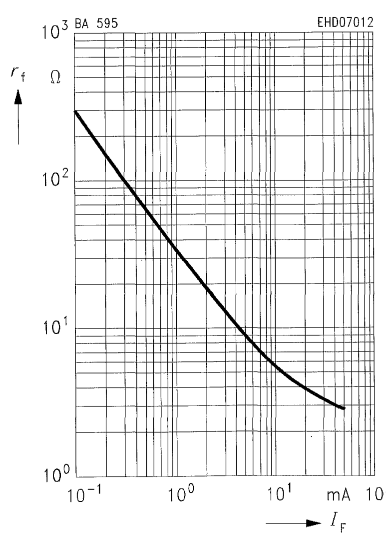
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Forward voltage I_F = 50 mA	V_F	–	–	1.1	V
Reverse current V_R = 30 V	I_R	–	–	20	nA
Diode capacitance V_R = 10 V, f = 1 MHz V_R = 0 V, f = 100 MHz	C_T	 – –	 0.26 0.22	 0.6 0.4	pF
Forward resistance f = 100 MHz I_F = 1.5 mA I_F = 10 mA	r_f	 – –	 21 4.5	 40 7	Ω
Zero bias conductance V_R = 0 V, f = 100 MHz	g_p	–	55	–	µS
Series inductance	L_S	–	2	–	nH

Diode capacitance $C_T = f(V_R)$
f = 1 MHz, f = 100 MHz



Forward resistance $r_f = f(I_F)$
f = 100 MHz

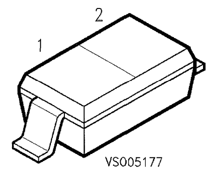


SIEMENS

Silicon PIN Diode

BA 596

Preliminary Data



- Current-controlled RF resistor for switching and attenuating applications.
- Frequency range above 1 MHz
- Designed for low IM distortion

Type	Marking	Ordering Code (tape and reel)	Pin Configuration	Package[1]
BA 596	white P	Q62702-A954		SOD-323

Maximum Ratings

Parameter	Symbol	Values	Unit
Reverse voltage	V_R	50	V
Forward current	I_F	50	mA
Operating temperature range	T_{op}	– 55 ... + 125	˚C
Storage temperature range	T_{stg}	– 55 ... + 150	

Thermal Resistance

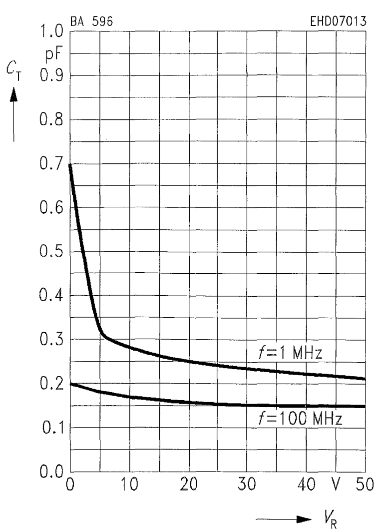
Junction - ambient	$R_{th\ JA}$	≤ 450	K/W

[1] For detailed information see chapter Package Outlines.

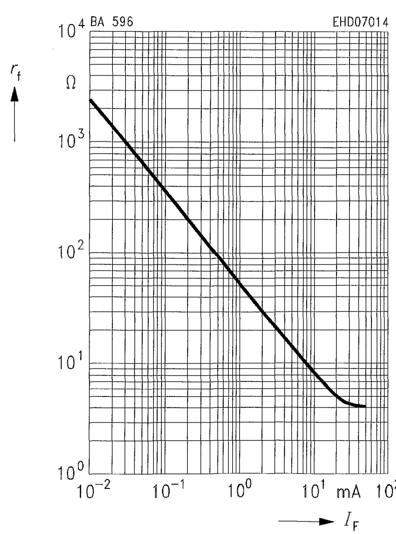
Electrical Characteristics
at T_A = 25 ˚C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Forward voltage I_F = 50 mA	V_F	–	–	1.15	V
Reverse current V_R = 50 V	I_R	–	–	50	nA
Diode capacitance f = 1 MHz, V_R = 50 V f = 100 MHz, V_R = 0 V	C_T	 – –	 0.23 0.2	 0.35 –	pF
Forward resistance f = 100 MHz I_F = 10 µA I_F = 1 mA I_F = 10 mA	r_f	 – – 6.5	 2400 58 7.8	 – – 10	Ω
Zero bias conductance f = 100 MHz, V_R = 0 V	g_P	–	40	–	µS
Series inductance	L_S	–	2	–	nH

Diode capacitance $C_T = f(V_R)$
f = 1 MHz / f = 100 MHz



Forward resistance $r_f = f(I_F)$
f = 100 MHz

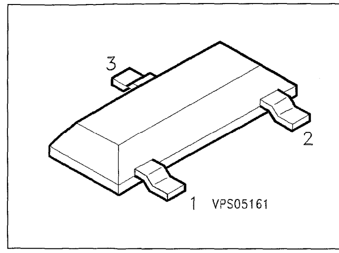


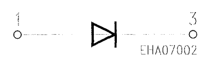
SIEMENS

Silicon PIN Diode

BA 885

- Current-controlled RF resistor for switching and attenuating applications
- Frequency range 1 MHz … 2 GHz
- Especially useful as antenna switch in TV-sat tuners



Type	Marking	Ordering Code (tape and reel)	Pin Configuration	Package[1]
BA 885	PA	Q62702-A608		SOT-23

Maximum Ratings

Parameter	Symbol	Values	Unit
Reverse voltage	V_R	50	V
Forward current	I_F	50	mA
Operating temperature range	T_{op}	– 55 … + 125	˚C
Storage temperature range	T_{stg}	– 55 … + 150	

Thermal Resistance

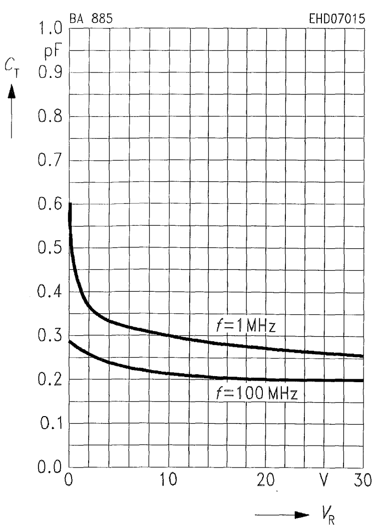
Junction - ambient[2]	$R_{th\,JA}$	≤ 450	K/W

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

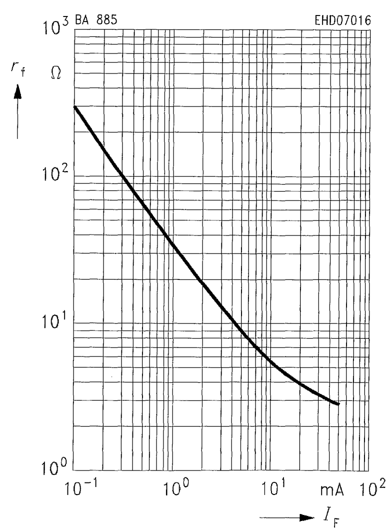
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Forward voltage I_F = 50 mA	V_F	–	–	1.1	V
Reverse current V_R = 30 V	I_R	–	–	50	nA
Diode capacitance V_R = 10 V, f = 1 MHz V_R = 0 V, f = 100 MHz	C_T	 – –	 0.28 0.23	 0.6 0.4	pF
Forward resistance f = 100 MHz I_F = 1.5 mA I_F = 10 mA	r_f	 – –	 22 5	 40 7	Ω
Zero bias conductance V_R = 0 V, f = 100 MHz	g_P	–	70	–	µS
Series inductance	L_S	–	2	–	nH

Diode capacitance $C_T = f(V_R)$
f = 1 MHz / 100 MHz



Forward resistance $r_f = f(I_F)$
f = 100 MHz



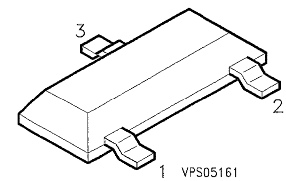
SIEMENS

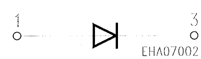
Silicon PIN Diode

BA 886

Preliminary Data

- Current-controlled RF resistor for switching and attenuating applications
- Frequency range above 1 MHz
- Designed for low IM distortion



Type	Marking	Ordering Code (tape and reel)	Pin Configuration	Package[1]
BA 886	PC	Q62702-A932		SOT-23

Maximum Ratings

Parameter	Symbol	Values	Unit
Reverse voltage	V_R	50	V
Forward current	I_F	50	mA
Operating temperature range	T_{op}	– 55 ... + 125	°C
Storage temperature range	T_{stg}	– 55 ... + 150	

Thermal Resistance

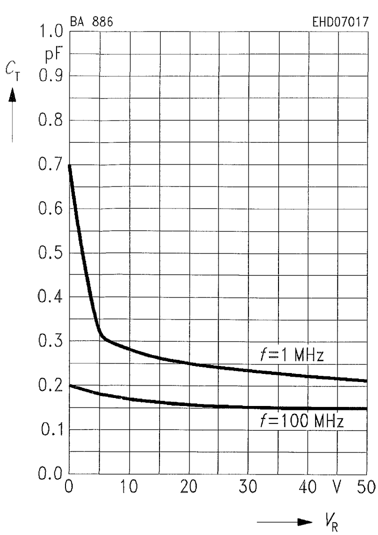
Junction - ambient[2]	$R_{th\,JA}$	$\leq$ 450	K/W

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

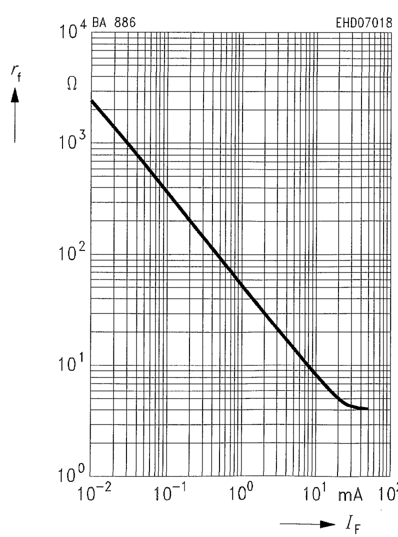
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Forward voltage I_F = 50 mA	V_F	–	–	1.15	V
Reverse current V_R = 50 V	I_R	–	–	50	nA
Diode capacitance f = 1 MHz, V_R = 50 V f = 100 MHz, V_R = 0 V	C_T	 – –	 0.23 0.2	 0.35 –	pF
Forward resistance f = 100 MHz I_F = 10 µA I_F = 1 mA I_F = 10 mA	r_f	 – – 6.5	 2400 58 7.8	 – – 10	Ω
Zero bias conductance f = 100 MHz, V_R = 0 V	g_p	–	40	–	µS
Series inductance	L_S	–	2	–	nH

Diode capacitance $C_T = f(V_R)$
f = 1 MHz / f = 100 MHz



Forward resistance $r_f = f(I_F)$
f = 100 MHz

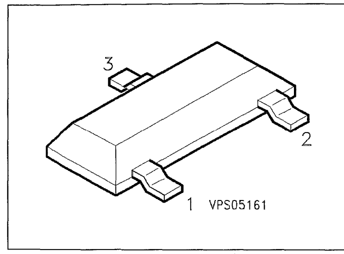


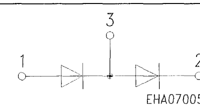
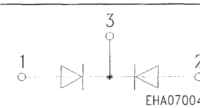
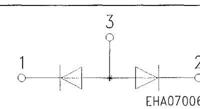
SIEMENS

Silicon PIN Diodes

BAR 14-1
... BAR 16-1

- RF switch
- RF attenuator for frequencies above 10 MHz
- Low distortion factor
- Long-term stability of electrical characteristics



Type	Marking	Ordering Code (tape and reel)	Pin Configuration	Package[1)]
BAR 14-1	L7	Q62702-A772		SOT-23
BAR 15-1	L8	Q62702-A731		
BAR 16-1	L9	Q62702-A773		

Maximum Ratings per Diode

Parameter	Symbol	Values	Unit
Reverse voltage	V_R	100	V
Forward current	I_F	140	mA
Total power dissipation, $T_S \leq 65$ °C[3)]	P_{tot}	250	mW
Junction temperature	T_j	150	°C
Storage temperature range	T_{stg}	– 55 ... + 150	
Operating temperature range	T_{op}	– 55 ... + 150	

Thermal Resistance

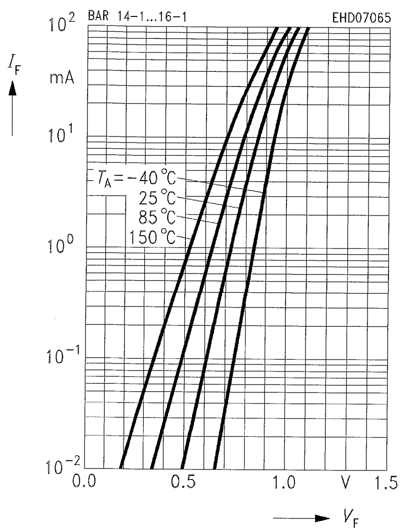
Junction - ambient[2)]	$R_{th\,JA}$	≤ 500	K/W
Junction - soldering point	$R_{th\,JS}$	≤ 340	

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

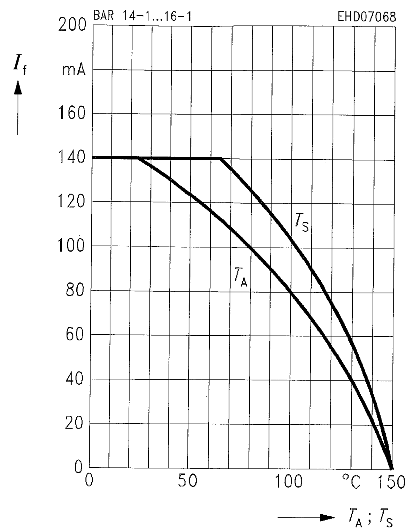
Electrical Characteristics per Diode
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Reverse current	I_R				
V_R = 50 V		–	–	100	nA
V_R = 100 V		–	–	1	µA
Forward voltage I_F = 100 mA	V_F	–	1.05		V
Diode capacitance	C_T				pF
V_R = 50 V, f = 1 MHz		–	0.25	0.5	
V_R = 0, f = 100 MHz		–	0.2	–	
Forward resistance	r_f				Ω
f = 100 MHz, I_F = 0.01 mA		–	2800	–	
I_F = 0.10 mA		–	380	–	
I_F = 1 mA		–	45	–	
I_F = 10 mA		–	7	–	
Zero bias conductance V_R = 0, f = 100 MHz	g_P	–	50	–	µS
Charge carrier life time I_F = 10 mA, I_R = 6 mA	τ_L	0.7	1	–	µs

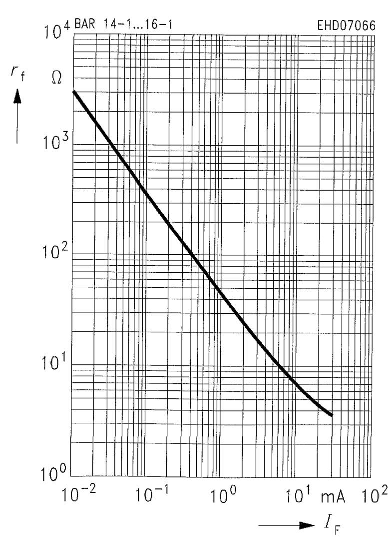
Forward current $I_F = f(V_F)$



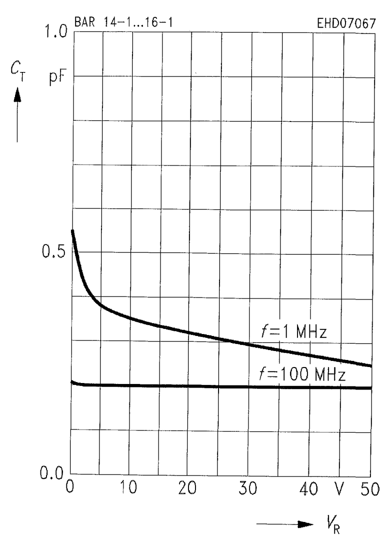
Forward current $I_F = f(T_S; T_A{}^*)$
*Package mounted on aluminia



Forward resistance $r_f = f(I_F)$
f = 100 MHz



Diode capacitance $C_T = f(V_R)$

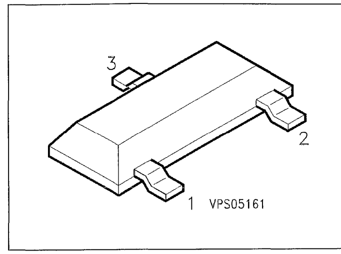


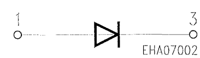
SIEMENS

Silicon PIN Diode

BAR 17

- RF switch
- RF attenuator for frequencies above 1 MHz
- Low distortion factor
- Long-term stability of electrical characteristics



Type	Marking	Ordering Code (tape and reel)	Pin Configuration	Package[1)]
BAR 17	L6	Q62702-A785		SOT-23

Maximum Ratings

Parameter	Symbol	Values	Unit
Reverse voltage	V_R	100	V
Forward current	I_F	140	mA
Total power dissipation, $T_S \leq 95$ ˚C[2)]	P_{tot}	250	mW
Junction temperature	T_j	150	˚C
Storage temperature range	T_{stg}	– 55 … + 150	
Operating temperature range	T_{op}	– 55 … + 150	

Thermal Resistance

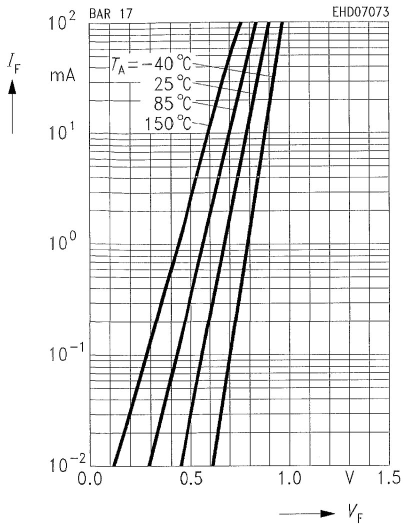
Junction - ambient[2)]	$R_{th JA}$	≤ 295	K/W
Junction - soldering point	$R_{th JS}$	≤ 215	

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

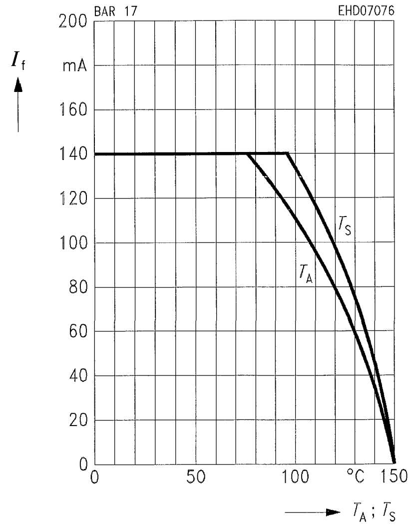
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Reverse current	I_R				
V_R = 50 V		–	–	50	nA
V_R = 100 V		–	–	1	µA
Forward voltage I_F = 100 mA	V_F	–	0.91	1	V
Diode capacitance	C_T				pF
V_R = 50 V, f = 1 MHz		–	0.32	0.55	
V_R = 0, f = 100 MHz		–	0.37	–	
Charge carrier life time I_F = 10 mA, I_R = 6 mA	τ_L	–	4	–	µs
Forward resistance	r_f				Ω
f = 100 MHz, I_F = 0.01 mA		–	1150	–	
I_F = 0.1 mA		–	160	–	
I_F = 1.0 mA		–	23	–	
I_F = 10 mA		–	3.5	–	

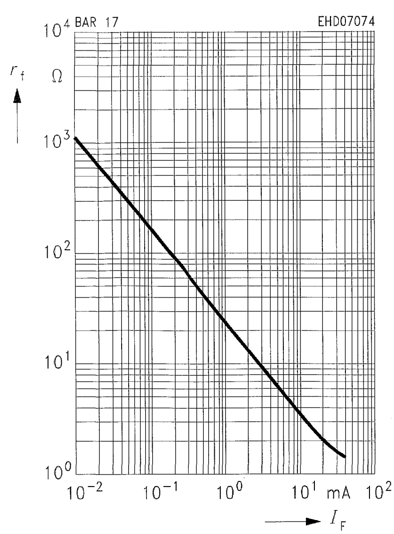
Forward current $I_F = f(V_F)$



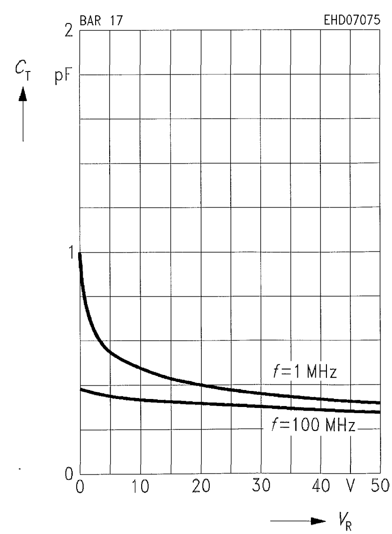
Forward current $I_F = f(T_S; T_A$*)
*Package mounted on alumina



Forward resistance $r_f = f(I_F)$
f = 100 MHz



Diode capacitance $C_T = f(V_R)$

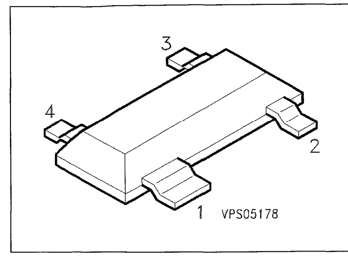


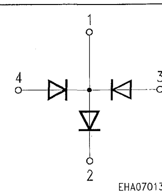
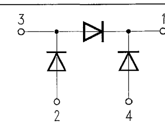
SIEMENS

Silicon PIN Diodes

BAR 60
BAR 61

- RF switch
- RF attenuator for frequencies above 10 MHz



Type	Marking	Ordering Code (tape and reel)	Pin Configuration	Package[1]
BAR 60	60	Q62702-A786		SOT-143
BAR 61	61	Q62702-A120		

Maximum Ratings per Diode

Parameter	Symbol	Values	Unit
Reverse voltage	V_R	100	V
Forward current	I_F	140	mA
Total power dissipation, $T_S \leq 65$ °C[2]	P_{tot}	250	mW
Junction temperature	T_j	150	°C
Storage temperature range	T_{stg}	– 55 ... + 150	
Operating temperature range	T_{op}	– 55 ... + 150	

Thermal Resistance

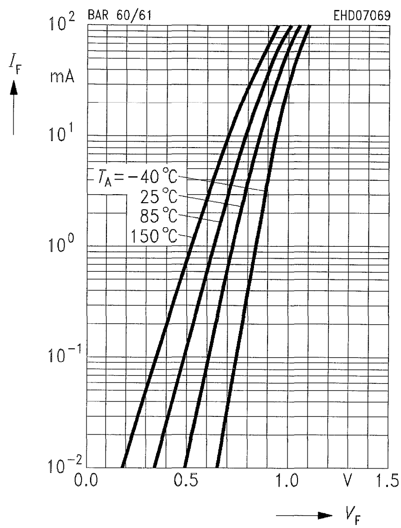
Junction - ambient[2]	$R_{th\,JA}$	≤ 580	K/W
Junction - soldering point	$R_{th\,JS}$	≤ 340	

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

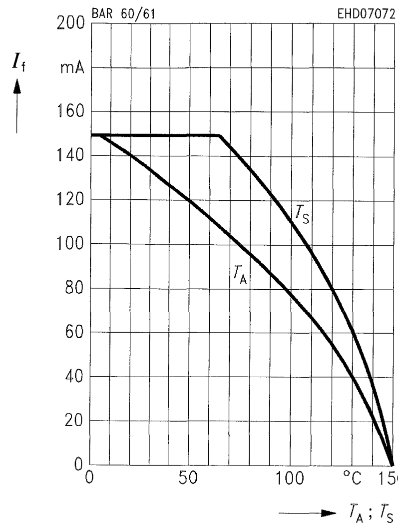
Electrical Characteristics per Diode
at T_A = 25 ˚C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC/AC Characteristics					
Reverse current	I_R				
V_R = 50 V		–	–	100	nA
V_R = 100 V		–	–	1	µA
Forward voltage I_F = 100 mA	V_F	–	–	125	V
Diode capacitance	C_T				pF
V_R = 50 V, f = 1 MHz		–	0.25	0.5	
V_R = 0, f = 100 MHz		–	0.2	–	
Zero bias conductance V_R = 0, f = 100 MHz	g_P	–	50	–	µS
Charge carrier life time I_F = 10 mA, I_R = 6 mA	τ_L	–	1	–	µs
Differential forward resistance	r_f				Ω
f = 100 MHz, I_F = 0.01 mA		–	2800	–	
I_F = 0.1 mA		–	380	–	
I_F = 1.0 mA		–	45	–	
I_F = 10 mA		–	7	–	

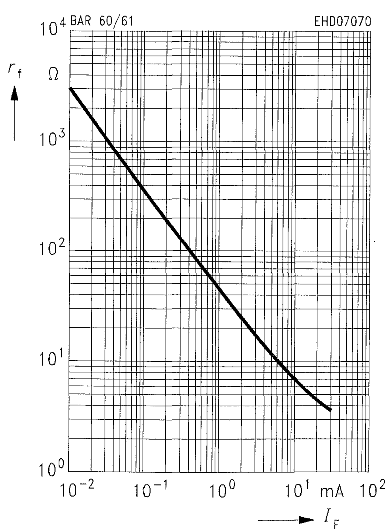
Forward current $I_F = f(V_F)$



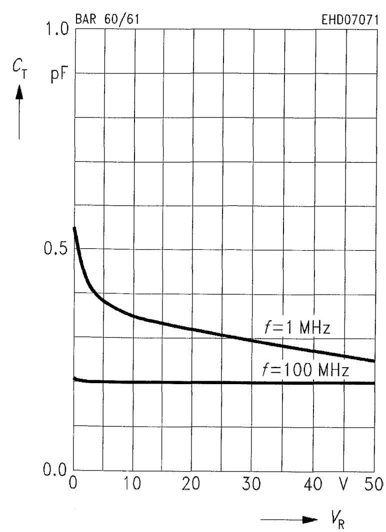
Forward current $I_F = f(T_S; T_A{}^*)$
*Package mounted on alumina



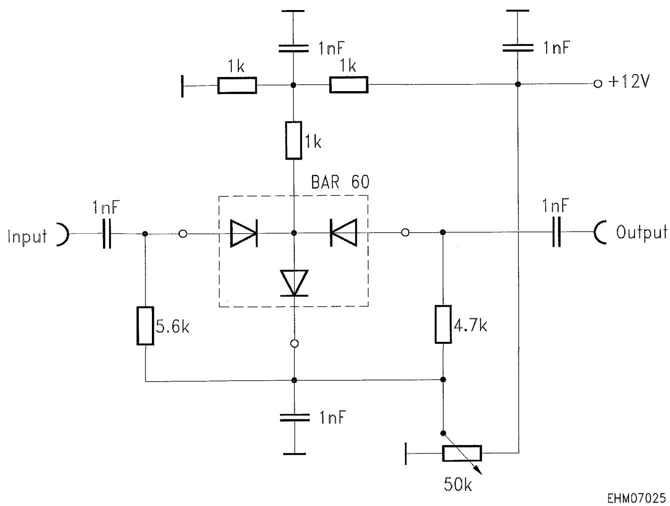
Forward resistance $r_f = f(I_F)$
f = 100 MHz



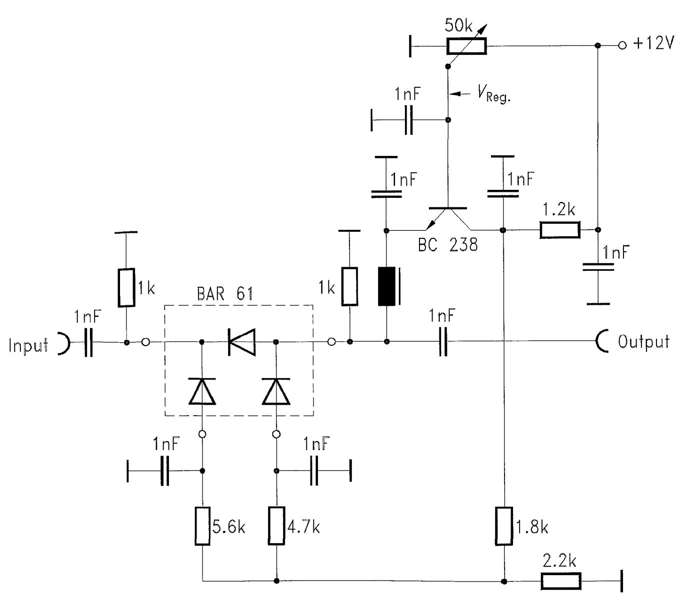
Diode capacitance $C_T = f(V_R)$



Application circuit for attenuation networks with diode BAR 60



Application circuit for attenuation networks with diode BAR 61



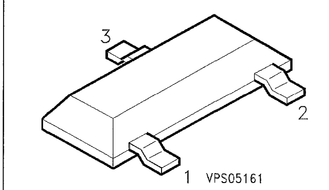
SIEMENS

Silicon Schottky Diodes

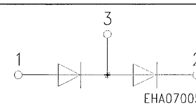
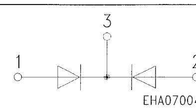
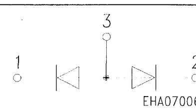
BAS 125 ...

Preliminary Data

- For low-loss, fast-recovery, meter protection, bias isolation and clamping applications
- Integrated diffused guard ring
- Low forward voltage

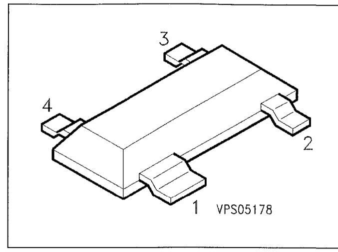


ESD: **E**lectro**s**tatic **d**ischarge sensitive device, observe handling precautions!

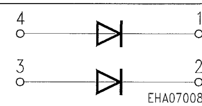
Type	Marking	Ordering Code (tape and reel)	Pin Configuration	Package[1)]
BAS 125	13	Q62702-D1316		SOT-23
BAS 125-04	14	Q62702-D1321		
BAS 125-05	15	Q62702-D1322		
BAS 125-06	16	Q62702-D1323		

1) For detailed information see chapter Package Outlines.

- For low-loss, fast-recovery, meter protection, bias isolation and clamping applications
- Integrated diffused guard ring
- Low forward voltage



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

Type	Marking	Ordering Code (tape and reel)	Pin Configuration	Package[1]
BAS 125-07	17	Q62702-D1327		SOT-143

Maximum Ratings per Diode

Parameter	Symbol	Values	Unit
Reverse voltage	V_R	25	V
Forward current	I_F	100	mA
Surge forward current, $t \leq 10$ ms	I_{FSM}	500	
Total power dissipation, $T_S \leq 25$ ˚C[3]	P_{tot}	250	mW
Junction temperature	T_j	150	˚C
Storage temperature range	T_{stg}	– 55 … + 150	

Thermal Resistance

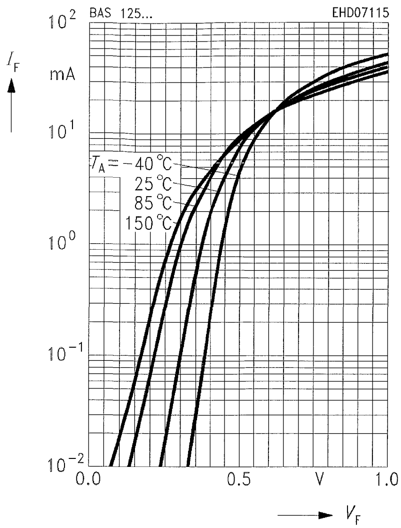
Junction - ambient[2]	$R_{th\,JA}$	≤ 725	K/W
Junction - soldering point	$R_{th\,JS}$	≤ 565	

1) For detailed information see chapter Package Outlines.
2) Package mounted on alumina 15 mm × 16.7 mm × 0.7 mm.
3) 450 mW per package.

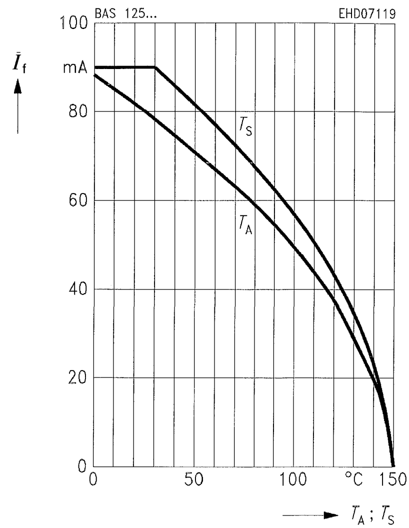
Electrical Characteristics per Diode
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Reverse current	I_R				µA
V_R = 20 V		–	–	1	
V_R = 25 V		–	–	10	
Forward voltage	V_F				mV
I_F = 1 mA		–	370	400	
I_F = 10 mA		–	530	–	
I_F = 35 mA		–	850	950	
Diode capacitance V_R = 0, f = 1 MHz	C_T	–	–	1.1	pF
Differential forward resistance I_F = 5 mA, f = 10 kHz	r_f	–	16	–	Ω

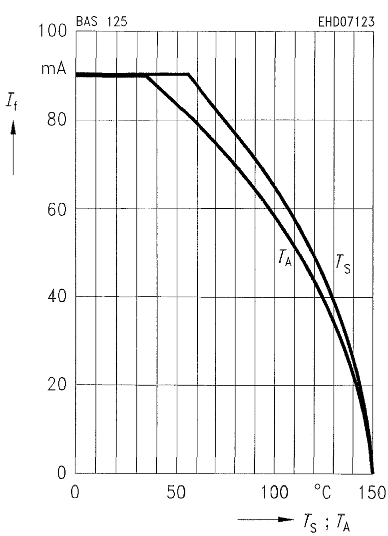
Forward current $I_F = f(V_F)$



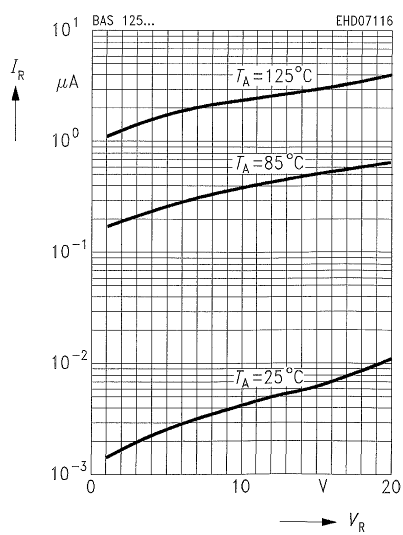
Forward current $I_F = f(T_S; T_A^*)$
*Package mounted on alumina
BAT 125-04, -05, -06, -07



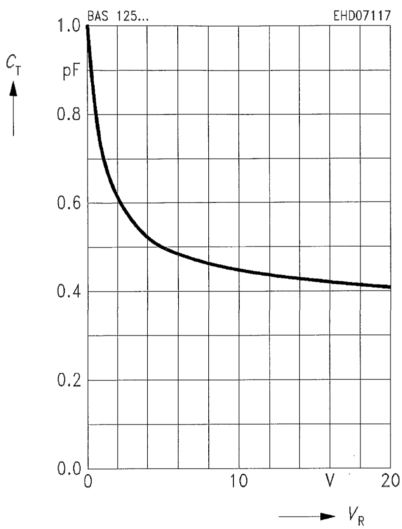
Forward current $I_F = f(T_S; T_A^*)$
*Package mounted on alumina
BAT 125



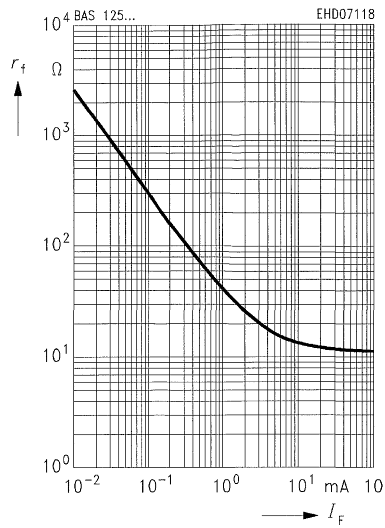
Reverse current $I_R = f(V_R)$



Diode capacitance $C_T = f(V_R)$
f = 1 MHz



Differential forward resistance $r_f = f(I_F)$
f = 10 kHz

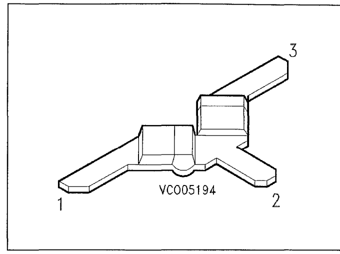


SIEMENS

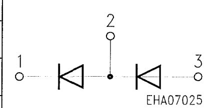
Silicon Schottky Diodes

BAT 14- ... D

- Beam lead technology
- Low dimension
- High performance
- Medium barrier



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

Type	Marking	Ordering Code	Pin Configuration	Package[1)]
BAT 14-020 D	–	Q62702-D1259		D
BAT 14-050 D		Q62702-D1268		
BAT 14-090 D		Q62702-D1276		
BAT 14-110 D		Q62702-D1285		

Maximum Ratings

Parameter	Symbol	Values		Unit
		BAT 14-020 D **BAT 14-050 D**	**BAT 14-090 D** **BAT 14-110 D**	
Reverse voltage	V_R	4	4	V
Forward current	I_F	100	50	mA
Junction temperature	T_j	175		˚C
Storage temperature range	T_{stg}	– 65 ... + 150		
Operating temperature range	T_{op}	– 65 ... + 150		

1) For detailed information see chapter Package Outlines.

Electrical Characteristics

at T_A = 25 °C, unless otherwise specified.

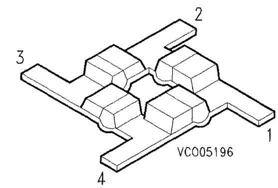
Parameter		Symbol	Values			Unit
			min.	typ.	max.	
DC Characteristics						
Breakdown voltage I_R = 10 µA		$V_{(BR)}$	4	–	–	V
Diode capacitance V_R = 0, f = 1 MHz	BAT 14-020 D	C_T	–	0.30	0.35	pF
	BAT 14-050 D		–	0.20	0.25	
	BAT 14-090 D		–	0.14	0.15	
	BAT 14-110 D		–	0.10	0.12	
Forward voltage I_F = 1 mA	BAT 14-020 D	V_F	–	0.45	–	V
	BAT 14-050 D		–	0.47	–	
	BAT 14-090 D		–	0.49	–	
	BAT 14-110 D		–	0.50	–	
I_F = 10 mA	BAT 14-020 D		–	0.55	–	
	BAT 14-050 D		–	0.57	–	
	BAT 14-090 D		–	0.60	–	
	BAT 14-110 D		–	0.65	–	
Single sideband noise figure F_{IF} = 1.5 dB, P_{LO} = 0 dBm, f_{IF} = 10.7 MHz		F_{SSB}				dB
f = 3.0 GHz	BAT 14-020 D		–	6.0	–	
f = 6.0 GHz	BAT 14-050 D		–	6.5	–	
f = 9.3 GHz	BAT 14-090 D		–	6.5	–	
f = 16 GHz	BAT 14-110 D		–	7.0	–	
Differential forward resistance I_F = 10 mA	BAT 14-020 D	r_f	–	3.5	–	Ω
	BAT 14-050 D		–	4.0	–	
I_F = 50 mA	BAT 14-090 D		–	7.0	–	
	BAT 14-110 D		–	10.0	–	

SIEMENS

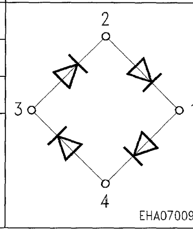
Silicon Schottky Diodes

BAT 14- ... R

- Beam lead technology
- Low dimension
- High performance
- Medium barrier



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

Type	Marking	Ordering Code	Pin Configuration	Package[1)]
BAT 14-020 R	–	Q62702-D1260		R
BAT 14-050 R		Q62702-D1269		
BAT 14-090 R		Q62702-D1277		
BAT 14-110 R		Q62702-D1286		

Maximum Ratings

Parameter	Symbol	Values		Unit
		BAT 14-020 R **BAT 14-050 R**	**BAT 14-090 R** **BAT 14-110 R**	
Forward current	I_F	100	50	mA
Junction temperature	T_j	175		˚C
Storage temperature range	T_{stg}	– 65 ... + 150		
Operating temperature range	T_{op}	– 65 ... + 150		

1) For detailed information see chapter Package Outlines.

Electrical Characteristics

at T_A = 25 °C, unless otherwise specified.

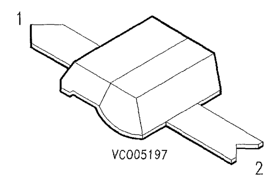
Parameter		Symbol	Values			Unit
			min.	typ.	max.	
DC Characteristics						
Diode capacitance		C_T				pF
V_R = 0, f = 1 MHz	BAT 14-020 R		–	0.30	0.35	
	BAT 14-050 R		–	0.20	0.25	
	BAT 14-090 R		–	0.14	0.15	
	BAT 14-110 R		–	0.10	0.12	
Forward voltage		V_F				V
I_F = 1 mA	BAT 14-020 R		–	0.45	–	
	BAT 14-050 R		–	0.47	–	
	BAT 14-090 R		–	0.49	–	
	BAT 14-110 R		–	0.50	–	
I_F = 10 mA	BAT 14-020 R		–	0.55	–	
	BAT 14-050 R		–	0.57	–	
	BAT 14-090 R		–	0.60	–	
	BAT 14-110 R		–	0.65	–	
Single sideband noise figure		F_{SSB}				dB
F_{IF} = 1.5 dB, P_{LO} = 0 dBm, f_{IF} = 10.7 MHz						
f = 3.0 GHz	BAT 14-020 R		–	6.0	–	
f = 6.0 GHz	BAT 14-050 R		–	6.5	–	
f = 9.3 GHz	BAT 14-090 R		–	6.5	–	
f = 16 GHz	BAT 14-110 R		–	7.0	–	
Differential forward resistance		r_f				Ω
I_F = 10 mA	BAT 14-020 R		–	3.5	–	
	BAT 14-050 R		–	4.0	–	
I_F = 50 mA	BAT 14-090 R		–	7.0	–	
	BAT 14-110 R		–	10.0	–	

SIEMENS

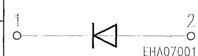
Silicon Schottky Diodes

BAT 14- … S

- Beam lead technology
- Low dimension
- High performance
- Medium barrier



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

Type	Marking	Ordering Code	Pin Configuration	Package[1]
BAT 14-020 S	–	Q62702-D1258		S
BAT 14-050 S		Q62702-D1267	Pointed cathode	
BAT 14-090 S		Q62702-D1275		
BAT 14-110 S		Q62702-D1284		

Maximum Ratings

Parameter	Symbol	Values		Unit
		BAT 14-020 S **BAT 14-050 S**	**BAT 14-090 S** **BAT 14-110 S**	
Reverse voltage	V_R	4	4	V
Forward current	I_F	100	50	mA
Junction temperature	T_j	175		˚C
Storage temperature range	T_{stg}	– 65 … + 150		
Operating temperature range	T_{op}	– 65 … + 150		

[1] For detailed information see chapter Package Outlines.

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

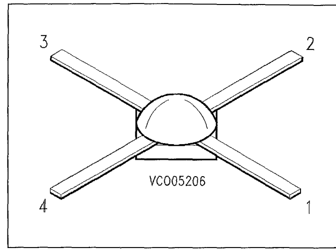
Parameter		Symbol	Values			Unit
			min.	typ.	max.	
DC Characteristics						
Breakdown voltage I_R = 10 µA		$V_{(BR)}$	4	–	–	V
Diode capacitance V_R = 0, f = 1 MHz	BAT 14-020 S	C_T	–	0.30	0.35	pF
	BAT 14-050 S		–	0.20	0.25	
	BAT 14-090 S		–	0.14	0.15	
	BAT 14-110 S		–	0.10	0.12	
Forward voltage I_F = 1 mA	BAT 14-020 S	V_F	–	0.45	–	V
	BAT 14-050 S		–	0.47	–	
	BAT 14-090 S		–	0.49	–	
	BAT 14-110 S		–	0.50	–	
I_F = 10 mA	BAT 14-020 S		–	0.55	–	
	BAT 14-050 S		–	0.57	–	
	BAT 14-090 S		–	0.60	–	
	BAT 14-110 S		–	0.65	–	
Single sideband noise figure F_{IF} = 1.5 dB, P_{LO} = 0 dBm, f_{IF} = 10.7 MHz f = 3.0 GHz	BAT 14-020 S	F_{SSB}	–	6.0	–	dB
f = 6.0 GHz	BAT 14-050 S		–	6.5	–	
f = 9.3 GHz	BAT 14-090 S		–	6.5	–	
f = 16 GHz	BAT 14-110 S		–	7.0	–	
Differential forward resistance I_F = 10 mA	BAT 14-020 S	r_f	–	3.5	–	Ω
	BAT 14-050 S		–	4.0	–	
I_F = 50 mA	BAT 14-090 S		–	7.0	–	
	BAT 14-110 S		–	10.0	–	

SIEMENS

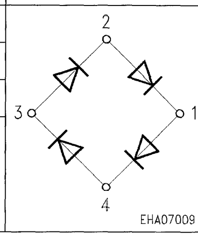
Silicon Schottky Diodes

BAT 14- … 2 R

- Beam lead technology
- Low dimension
- High performance
- Medium barrier



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

Type	Marking	Ordering Code	Pin Configuration	Package[1)]
BAT 14-022 R	–	Q62702-D411		50 mil
BAT 14-052 R		Q62702-D412		
BAT 14-092 R		Q62702-D413		
BAT 14-112 R		Q62702-D414		

Maximum Ratings

Parameter	Symbol	Values		Unit
		BAT 14-022 R **BAT 14-052 R**	**BAT 14-092 R** **BAT 14-112 R**	
Forward current	I_F	100	50	mA
Junction temperature	T_j	175		°C
Storage temperature range	T_{stg}	– 55 … + 150		
Operating temperature range	T_{op}	– 55 … + 150		

1) For detailed information see chapter Package Outlines.

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

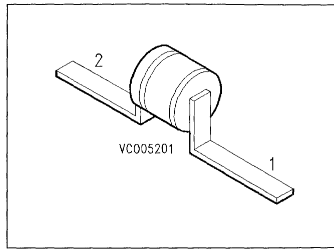
Parameter		Symbol	Values			Unit
			min.	typ.	max.	
Diode capacitance		C_T				pF
V_R = 0, f = 1 MHz	BAT 14-022 R		–	0.33	0.38	
	BAT 14-052 R		–	0.23	0.28	
	BAT 14-092 R		–	0.17	0.18	
	BAT 14-112 R		–	0.13	0.15	
Forward voltage		V_F				V
I_F = 1 mA	BAT 14-022 R		–	0.45	–	
	BAT 14-052 R		–	0.47	–	
	BAT 14-092 R		–	0.49	–	
	BAT 14-112 R		–	0.50	–	
I_F = 10 mA	BAT 14-022 R		–	0.55	–	
	BAT 14-052 R		–	0.57	–	
	BAT 14-092 R		–	0.60	–	
	BAT 14-112 R		–	0.65	–	
Single sideband noise figure		F_{SSB}				dB
F_{IF} = 1.5 dB, P_{LO} = 0 dBm, f_{IF} = 10.7 MHz						
f = 3 GHz	BAT 14-022 R		–	6.0	–	
f = 6 GHz	BAT 14-052 R		–	6.5	–	
f = 9.3 GHz	BAT 14-092 R		–	6.5	–	
f = 16 GHz	BAT 14-112 R		–	7.0	–	
Differential forward resistance		r_f				Ω
I_F = 10/50 mA	BAT 14-022 R		–	3.5	–	
	BAT 14-052 R		–	4.0	–	
	BAT 14-092 R		–	7.0	–	
	BAT 14-112 R		–	10.0	–	

SIEMENS

Silicon Schottky Diodes

BAT 14- ... 4

- Medium barrier diodes for detector and mixer applications
- Hermetical ceramic package
- For frequencies up to 40 GHz



ESD: Electrostatic discharge sensitive device, observe handling precautions!

Type	Frequency band (GHz)	Ordering Code	Pin Configuration	Package[1]
BAT 14-014 BAT 14-034	... 4 (S)	Q62702-D1005 Q62702-D1019	Cathode: black dot, heat sink 	T1
BAT 14-044 BAT 14-064	... 8 (C)	Q62702-D1026 Q62702-D1036		
BAT 14-074 BAT 14-094	... 12 (X)	Q62702-D1041 Q62702-D1051		
BAT 14-104 BAT 14-114	... 18 (Ku)	Q62702-D1056 Q62702-D1061		
BAT 14-124	... 40 (Ka)	Q62702-D1066		

Maximum Ratings

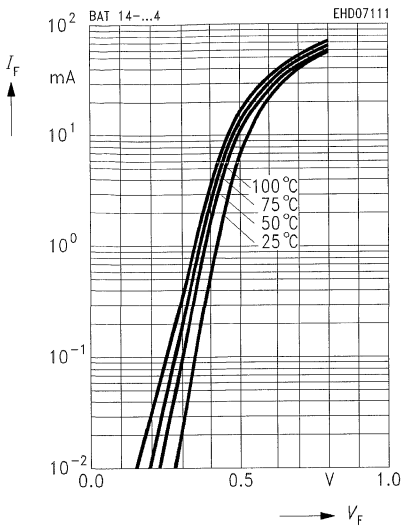
Parameter	Symbol	Values	Unit
Reverse voltage	V_R	3	V
Forward current BAT 14-014 ... BAT 14-064 BAT 14-074 ... BAT 74-124	I_F	100 50	mA
Junction temperature	T_j	175	°C
Storage temperature range	T_{stg}	– 65 ... + 150	
Operating temperature range	T_{op}	– 65 ... + 150	

[1] For detailed information see chapter Package Outlines.

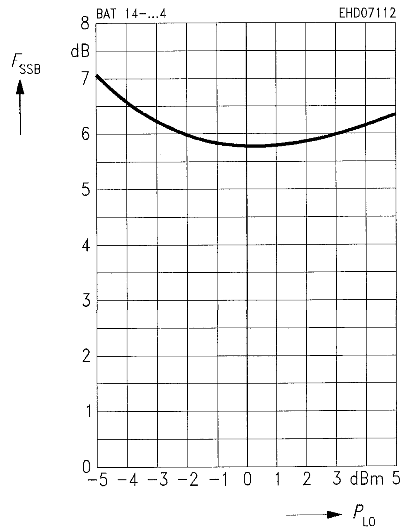
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter		Symbol	Values			Unit
			min.	typ.	max.	
Breakdown voltage I_R = 10 µA		$V_{(BR)}$	3	–	–	V
Forward voltage		V_F				
I_F = 1 mA	BAT 14-014/-034		–	0.42	–	
	BAT 14-044/-064		–	0.43	–	
	BAT 14-074/-094		–	0.44	–	
	BAT 14-104/-114		–	0.46	–	
	BAT 14-124		–	0.47	–	
I_F = 10 mA	BAT 14-014/-034		–	0.5	–	
	BAT 14-044/-064		–	0.53	–	
	BAT 14-074/-094		–	0.55	–	
	BAT 14-104/-114		–	0.58	–	
	BAT 14-124		–	0.63	–	
Diode capacitance		C_T				pF
f = 1 MHz, V_R = 0	BAT 14-014/-034		–	0.25	0.35	
	BAT 14-044/-064		–	0.2	0.25	
	BAT 14-074/-094		–	0.17	0.2	
	BAT 14-104/-114		–	0.13	0.15	
	BAT 14-124		–	0.1	0.12	
Case capacitance		C_C	–	0.1	–	
Noise figure (single sideband) IF amplifier noise F_{IF} = 1.5 dB, P_{LO} = 3 dBm, f_{IF} = 10.7 MHZ		F_{SSB}				dB
f = 3 GHz	BAT 14-014		–	5.5	–	
	BAT 14-034		–	6.5	–	
f = 6 GHz	BAT 14-044		–	5.5	–	
	BAT 14-064		–	6.5	–	
f = 9.3 GHz	BAT 14-074		–	5.5	–	
	BAT 14-094		–	6.5	–	
f = 16 GHz	BAT 14-104		–	6.0	–	
	BAT 14-114		–	7.0	–	
	BAT 14-124		–	9.0	–	
Differential forward resistance		r_f				Ω
I_F = 10/50 mA	BAT 14-014		–	3	–	
	BAT 14-034		–	4	–	
	BAT 14-044		–	3.5	–	
	BAT 14-064		–	4.5	–	
	BAT 14-074		–	4.5	–	
	BAT 14-094		–	5.5	–	
	BAT 14-104		–	5.5	–	
	BAT 14-114		–	7	–	
	BAT 14-124		–	8	–	

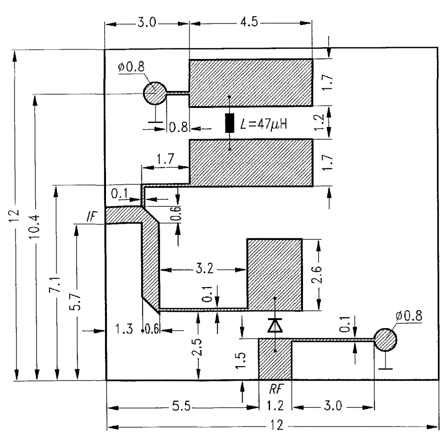
Forward current $I_F = f(V_F)$
of BAT 14-094



Single sideband noise $F_{SSB} = f(P_{LO})$
f_{LO} = 9.375 GHz, f_{IF} = 10.7 MHZ at
F_{IF} = 1.5 dB



Measuring circuit for IF amplifier noise



Ceramic p. c. board for noise measurement at 9.375 GHz (material = alumina; E_R = 9.94; thickness = 0.635 mm)

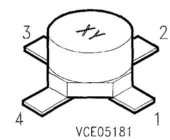
Dimensions in mm

SIEMENS

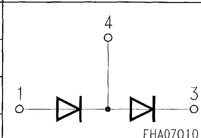
Silicon Schottky Diodes

BAT 14- ... 5 D

- Beam lead technology
- Low dimension
- High performance
- Medium barrier



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

Type	Marking	Ordering Code	Pin Configuration	Package[1]
BAT 14-025 D	42 D	Q62702-A790		Cerec-X
BAT 14-055 D	45 D	Q62702-A793		
BAT 14-095 D	49 D	Q62702-A797		
BAT 14-115 D	41 D	Q62702-A800		

Maximum Ratings

Parameter	Symbol	Values		Unit
		BAT 14-025 D BAT 14-055 D	**BAT 14-095 D BAT 14-115 D**	
Reverse voltage	V_R	4	4	V
Forward current	I_F	100	50	mA
Junction temperature	T_j	175		˚C
Storage temperature range	T_{stg}	– 55 ... + 150		
Operating temperature range	T_{op}	– 55 ... + 150		

1) For detailed information see chapter Package Outlines.

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

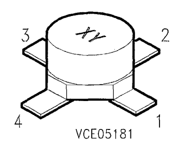
Parameter		Symbol	Values			Unit
			min.	typ.	max.	
Breakdown voltage I_R = 10 µA		$V_{(BR)}$	4	–	–	V
Diode capacitance V_R = 0, f = 1 MHz	BAT 14-025 D	C_T	–	0.37	0.42	pF
	BAT 14-055 D		–	0.27	0.32	
	BAT 14-095 D		–	0.21	0.22	
	BAT 14-115 D		–	0.17	0.19	
Forward voltage I_F = 1 mA	BAT 14-025 D	V_F	–	0.45	–	V
	BAT 14-055 D		–	0.47	–	
	BAT 14-095 D		–	0.49	–	
	BAT 14-115 D		–	0.50	–	
I_F = 10 mA	BAT 14-025 D		–	0.55	–	
	BAT 14-055 D		–	0.57	–	
	BAT 14-095 D		–	0.60	–	
	BAT 14-115 D		–	0.65	–	
Single sideband noise figure F_{IF} = 1.5 dB, P_{LO} = 0 dBm, f_{IF} = 10.7 MHz f = 3 GHz	BAT 14-025 D	F_{SSB}	–	6.0	–	dB
f = 6 GHz	BAT 14-055 D		–	6.5	–	
f = 9.3 GHz	BAT 14-095 D		–	6.5	–	
f = 16 GHz	BAT 14-115 D		–	7.0	–	
Differential forward resistance I_F = 10/50 mA	BAT 14-025 D	r_f	–	3.5	–	Ω
	BAT 14-055 D		–	4.0	–	
	BAT 14-095 D		–	7.0	–	
	BAT 14-115 D		–	10.0	–	

SIEMENS

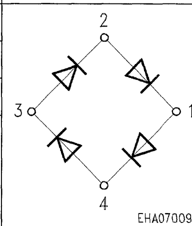
Silicon Schottky Diodes

BAT 14- ... 5 R

- Beam lead technology
- Low dimension
- High performance
- Medium barrier



ESD: Electro**st**atic **d**ischarge sensitive device, observe handling precautions

Type	Marking	Ordering Code	Pin Configuration	Package[1)]
BAT 14-025 R	42	Q62702-A791		Cerec-X
BAT 14-055 R	45	Q62702-A794		
BAT 14-095 R	49	Q62702-A796		
BAT 14-115 R	41	Q62702-A801		

Maximum Ratings

Parameter	Symbol	Values		Unit
		BAT 14-025 R **BAT 14-055 R**	**BAT 14-095 R** **BAT 14-115 R**	
Forward current	I_F	100	50	mA
Junction temperature	T_j	175		˚C
Storage temperature range	T_{stg}	– 55 ... + 150		
Operating temperature range	T_{op}	– 55 ... + 150		

1) For detailed information see chapter Package Outlines.

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

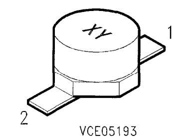
Parameter		Symbol	Values			Unit
			min.	typ.	max.	
Diode capacitance		C_T				pF
V_R = 0, f = 1 MHz	BAT 14-025 R		–	0.37	0.42	
	BAT 14-055 R		–	0.27	0.32	
	BAT 14-095 R		–	0.21	0.22	
	BAT 14-115 R		–	0.17	0.19	
Forward voltage		V_F				V
I_F = 1 mA	BAT 14-025 R		–	0.45	–	
	BAT 14-055 R		–	0.47	–	
	BAT 14-095 R		–	0.49	–	
	BAT 14-115 R		–	0.50	–	
I_F = 10 mA	BAT 14-025 R		–	0.55	–	
	BAT 14-055 R		–	0.57	–	
	BAT 14-095 R		–	0.60	–	
	BAT 14-115 R		–	0.65	–	
Single sideband noise figure		F_{SSB}				dB
F_{IF} = 1.5 dB, P_{LO} = 0 dBm, f_{IF} = 10.7 MHz						
f = 3 GHz	BAT 14-025 R		–	6.0	–	
f = 6 GHz	BAT 14-055 R		–	6.5	–	
f = 9.3 GHz	BAT 14-095 R		–	6.5	–	
f = 16 GHz	BAT 14-115 R		–	7.0	–	
Differential forward resistance		r_f				Ω
I_F = 10/50 mA	BAT 14-025 R		–	3.5	–	
	BAT 14-055 R		–	4.0	–	
	BAT 14-095 R		–	7.0	–	
	BAT 14-115 R		–	10.0	–	

SIEMENS

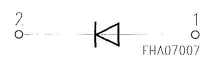
Silicon Schottky Diodes

BAT 14- ... 5 S

- Beam lead technology
- Low dimension
- High performance
- Medium barrier



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

Type	Marking	Ordering Code	Pin Configuration	Package[1)]
BAT 14-025 S	42	Q62702-A789		Cerec-X
BAT 14-055 S	45	Q62702-A792		
BAT 14-095 S	49	Q62702-A795		
BAT 14-115 S	41	Q62702-A799		

Maximum Ratings

Parameter	Symbol	Values		Unit
		BAT 14-025 S **BAT 14-055 S**	**BAT 14-095 S** **BAT 14-115 S**	
Reverse voltage	V_R	4	4	V
Forward current	I_F	100	50	mA
Junction temperature	T_j	175		°C
Storage temperature range	T_{stg}	– 55 ... + 150		
Operating temperature range	T_{op}	– 55 ... + 150		

1) For detailed information see chapter Package Outlines.

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

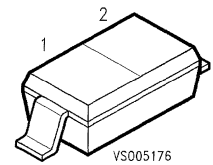
Parameter		Symbol	Values			Unit
			min.	typ.	max.	
Breakdown voltage I_R = 10 µA		$V_{(BR)}$	4	–	–	V
Diode capacitance		C_T				pF
V_R = 0, f = 1 MHz	BAT 14-025 S		–	0.36	0.41	
	BAT 14-055 S		–	0.26	0.31	
	BAT 14-095 S		–	0.20	0.21	
	BAT 14-115 S		–	0.16	0.18	
Forward voltage		V_F				V
I_F = 1 mA	BAT 14-025 S		–	0.45	–	
	BAT 14-055 S		–	0.47	–	
	BAT 14-095 S		–	0.49	–	
	BAT 14-115 S		–	0.50	–	
I_F = 10 mA	BAT 14-025 S		–	0.55	–	
	BAT 14-055 S		–	0.57	–	
	BAT 14-095 S		–	0.60	–	
	BAT 14-115 S		–	0.65	–	
Single sideband noise figure		F_{SSB}				dB
F_{IF} = 1.5 dB, P_{LO} = 0 dBm, f_{IF} = 10.7 MHz						
f = 3.0 GHz	BAT 14-025 S		–	6.0	–	
f = 6.0 GHz	BAT 14-055 S		–	6.5	–	
f = 9.3 GHz	BAT 14-095 S		–	6.5	–	
f = 16 GHz	BAT 14-115 S		–	7.0	–	
Differential forward resistance		r_f				Ω
I_F = 10 / 50 mA	BAT 14-025 S		–	3.5	–	
	BAT 14-055 S		–	4.0	–	
	BAT 14-095 S		–	7.0	–	
	BAT 14-115 S		–	10.0	–	

SIEMENS

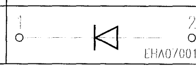
Silicon Schottky Diode — BAT 14-098

Preliminary Data

- DBS mixer application to 12 GHz
- Low noise figure
- Medium barrier type



ESD: Electrostatic discharge sensitive device, observe handling precautions!

Type	Marking	Ordering Code (tape and reel)	Pin Configuration	Package[1]
BAT 14-098	white A	Q62702-A0960		SOD-123

Maximum Ratings

Parameter	Symbol	Values	Unit
Reverse voltage	V_R	4	V
Forward current	I_F	90	mA
Power dissipation, $T_S \leq 80$ °C	P_{tot}	100	mW
Storage temperature range	T_{stg}	– 55 ... + 150	°C
Operating temperature range	T_{op}	– 55 ... + 150	

Thermal Resistance

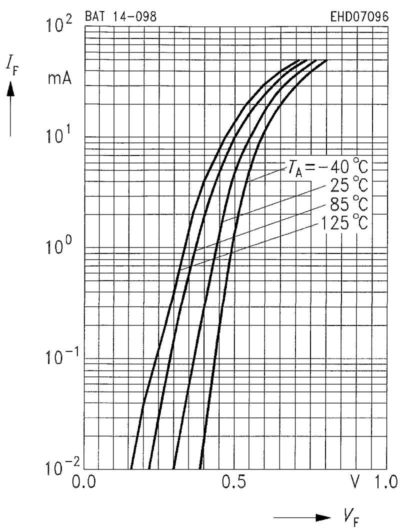
Junction – ambient[2]	$R_{th\,JA}$	≤ 770	K/W
Junction – soldering point	$R_{th\,JS}$	≤ 690	

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

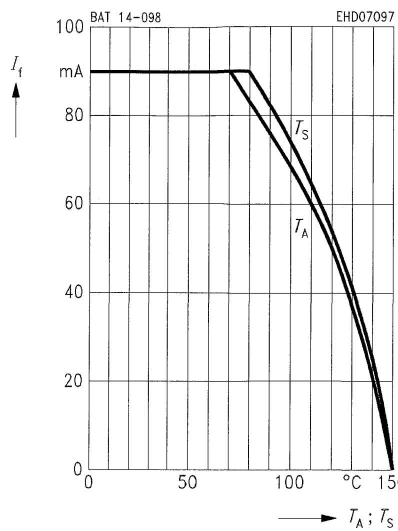
Electrical Characteristics per Diode
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Breakdown voltage I_R = 5 µA	V_{BR}	4	–	–	V
Forward voltage I_F = 1 mA I_F = 10 mA	V_F	 – –	 0.43 0.55	 – –	
Forward voltage matching I_F = 10 mA	ΔV_F	–	–	10	mV
Diode capacitance V_R = 0, f = 1 MHz	C_T	–	–	0.35	pF
Forward resistance I_F = 10 mA / 50 mA	R_F	–	5.5	–	Ω

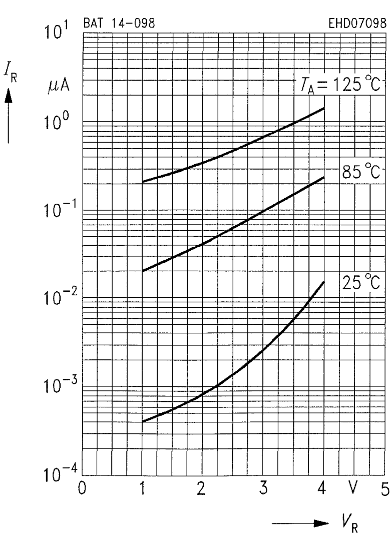
Forward current $I_F = f(V_F)$



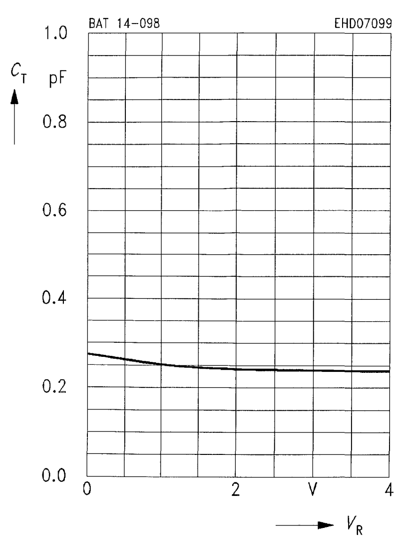
Forward current $I_F = f(T_S; T_A^*)$
*Package mounted on alumina



Reverse current $I_R = f(V_R)$



Diode capacitance $C_T = f(V_R)$
f = 1 MHz

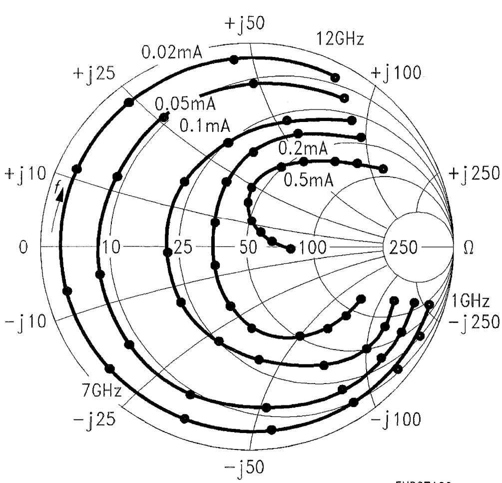


S_{11}-Parameters

Typical impedance characteristics (with external bias I and $Z_0 = \Omega$)

f	I = 0.02 mA		I = 0.05 mA		I = 0.1 mA		I = 0.2 mA		I = 0.5 mA	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
1	0.95	– 12.5	0.87	– 12.7	0.77	– 12.8	0.58	– 12.5	0.20	– 3.4
2	0.94	– 26.0	0.87	– 26.3	0.78	– 26.5	0.58	– 25.7	0.16	– 5.0
3	0.93	– 42.3	0.85	– 43.0	0.73	– 43.2	0.53	– 42.4	0.12	– 0.1
4	0.92	– 61.0	0.82	– 62.2	0.68	– 63.2	0.44	– 62.1	0.07	27.5
5	0.90	– 84.9	0.79	– 86.8	0.64	– 88.8	0.38	– 91.6	0.09	79.8
6	0.88	– 110.4	0.76	– 113.6	0.59	– 117.2	0.31	– 125.3	0.19	85.0
7	0.85	– 139.0	0.72	– 143.2	0.55	– 148.5	0.28	– 165.1	0.26	80.1
8	0.84	– 167.2	0.73	– 172.1	0.56	– 179.3	0.32	157.8	0.33	71.5
9	0.84	159.8	0.71	153.9	0.55	145.4	0.37	121.1	0.41	61.3
10	0.86	128.7	0.75	122.9	0.62	114.7	0.46	93.6	0.49	49.5
11	0.88	95.4	0.79	90.3	0.69	83.7	0.57	69.0	0.58	38.5
12	0.92	67.3	0.86	63.9	0.78	59.4	0.69	49.7	0.67	28.6

$S_{11} = f(f, I)$



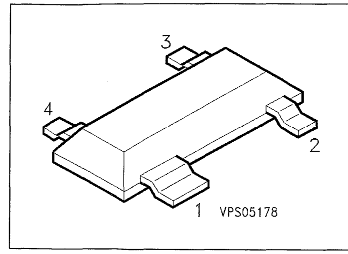
SIEMENS

Silicon Dual Schottky Diode

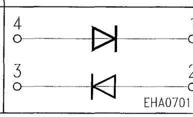
BAT 14-099

Preliminary Data

- DBS mixer application to 12 GHz
- Low noise figure
- Medium barrier type



ESD: Electrostatic discharge sensitive device, observe handling precautions!

Type	Marking	Ordering Code (tape and reel)	Pin Configuration	Package[1]
BAT 14-099	S9	Q62702-A3461		SOT-143

Maximum Ratings per Diode

Parameter	Symbol	Values	Unit
Reverse voltage	V_R	4	V
Forward current	I_F	90	mA
Power dissipation, $T_S \leq 55$ °C	P_{tot}	100	mW
Storage temperature range	T_{stg}	– 55 ... + 150	°C
Operating temperature range	T_{op}	– 55 ... + 150	

Thermal Resistance

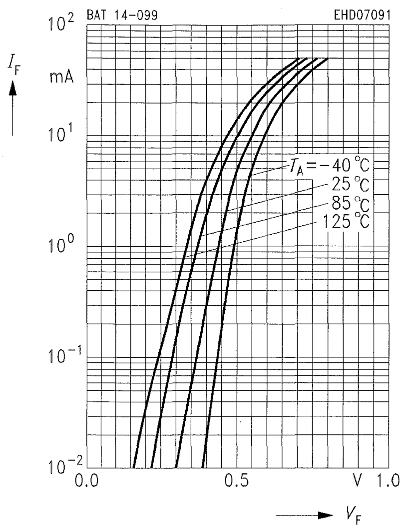
Junction – ambient[2]	$R_{th\,JA}$	≤ 1090	K/W
Junction – soldering point	$R_{th\,JS}$	≤ 930	

[1] For detailed information see chapter Package Outlines.
[2] Package mounted on alumina 15 mm × 16.7 mm to 0.7 mm.

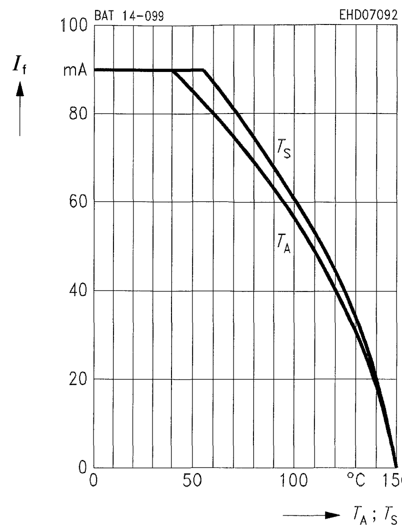
Electrical Characteristics per Diode
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Breakdown voltage I_R = 5 µA	V_{BR}	4	–	–	V
Forward voltage I_F = 1 mA I_F = 10 mA	V_F	 – –	 0.43 0.55	 – –	
Forward voltage matching I_F = 10 mA	ΔV_F	–	–	10	mV
Diode capacitance V_R = 0, f = 1 MHz	C_T	–	–	0.35	pF
Forward resistance I_F = 10 mA / 50 mA	R_F	–	5.5	–	Ω

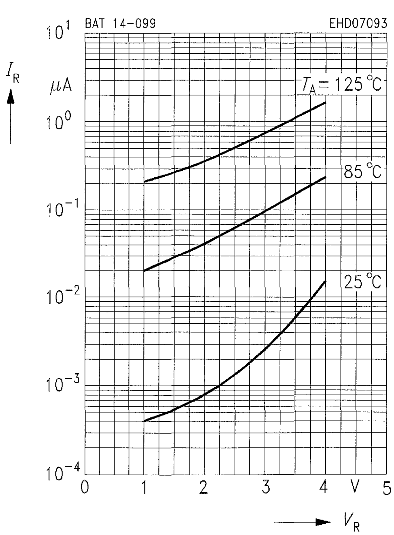
Forward current $I_F = f(V_F)$



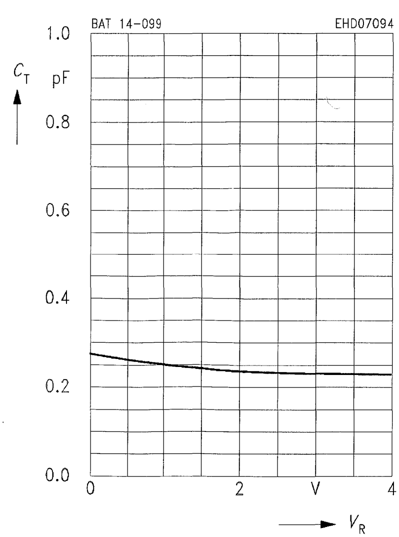
Forward current $I_F = f(T_S; T_A^*)$
*Package mounted on alumina



Reverse current $I_R = f(V_R)$



Diode capacitance $C_T = f(V_R)$
f = 1 MHz

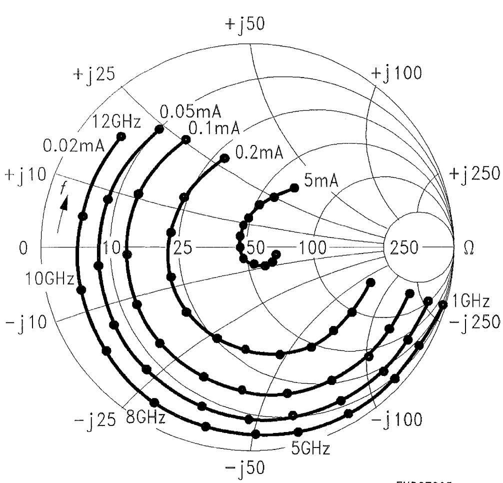


S_{11}-Parameters

Typical impedance characteristics (with external bias I and $Z_0 = \Omega$)

f	I = 0.02 mA		I = 0.05 mA		I = 0.1 mA		I = 0.2 mA		I = 0.5 mA	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
1	0.99	– 15.89	0.91	– 16.40	0.79	– 16.40	0.57	– 16.60	0.13	– 17.30
2	0.96	– 30.40	0.88	– 30.80	0.76	– 31.09	0.56	– 30.70	0.13	– 28.40
3	0.95	– 45.30	0.87	– 46.20	0.75	– 47.30	0.55	– 47.00	0.11	– 43.99
4	0.93	– 59.60	0.86	– 61.60	0.73	– 62.40	0.53	– 62.40	0.10	– 54.40
5	0.93	– 74.80	0.85	– 77.10	0.72	– 78.70	0.51	– 78.70	0.07	– 80.70
6	0.91	– 89.50	0.83	– 93.10	0.69	– 95.70	0.48	– 95.70	0.04	– 102.30
7	0.89	– 106.60	0.80	– 110.50	0.66	– 112.70	0.45	– 114.00	0.02	158.01
8	0.88	– 123.40	0.79	– 129.40	0.64	– 132.40	0.43	– 135.40	0.06	118.40
9	0.86	– 143.20	0.76	– 150.20	0.62	– 154.20	0.40	– 161.20	0.12	96.20
10	0.83	– 166.10	0.72	– 174.10	0.58	– 179.10	0.37	171.10	0.19	72.10
11	0.82	168.10	0.71	158.10	0.59	153.80	0.39	140.80	0.25	62.60
12	0.80	138.20	0.72	127.20	0.60	121.20	0.44	108.20	0.33	49.20

$S_{11} = f\,(f, I)$

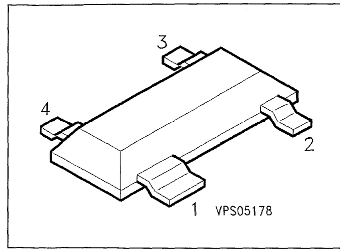


SIEMENS

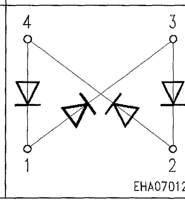
Silicon Crossover Ring Quad Schottky Diode — BAT 14-099R

Preliminary Data

- Medium barrier diode for double balanced mixers, phase detectors and modulators



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

Type	Marking	Ordering Code (tape and reel)	Pin Configuration	Package[1]
BAT 14-099R	S8	Q62702-A0042		SOT-143

Maximum Ratings per Diode

Parameter	Symbol	Values	Unit
Forward current	I_F	90	mA
Power dissipation, $T_S \leq 70$ °C	P_{tot}	100	mW
Storage temperature range	T_{stg}	– 55 ... + 150	°C
Operating temperature range	T_{op}	– 55 ... + 150	

Thermal Resistance per Diode

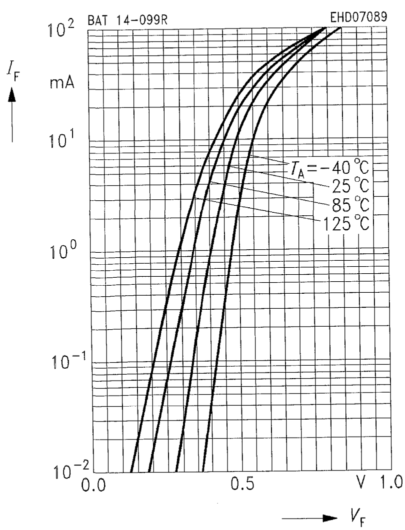
Junction – ambient[2]	$R_{th\,JA}$	≤ 1020	K/W
Junction – soldering point	$R_{th\,JS}$	≤ 780	

[1] For detailed information see chapter Package Outlines.
[2] Package mounted on alumina 15 mm × 16.7 mm to 0.7 mm.

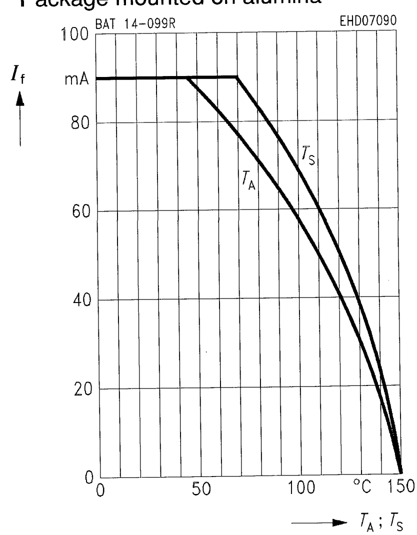
Electrical Characteristics per Diode
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Forward voltage I_F = 1 mA I_F = 10 mA	V_F	 – –	 0.4 0.48	 – –	V
Forward voltage matching [1] I_F = 10 mA	ΔV_F	–	–	20	mV
Diode capacitance V_R = 0, f = 1 MHz	C_T	–	0.38	–	pF
Forward resistance I_F = 10 mA / 50 mA	R_F	–	5.5	–	Ω

Forward current $I_F = f(V_F)$



Forward current $I_F = f(T_S; T_A$*)
*Package mounted on alumina



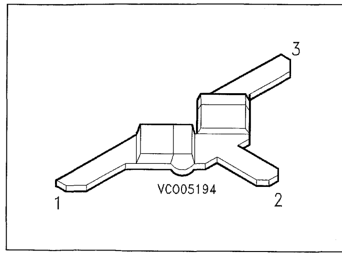
1) ΔV_F is the difference between the lowest and the highest V_F in the component.

SIEMENS

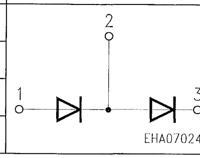
Silicon Schottky Diodes

BAT 15- … D

- Beam lead technology
- Low dimension
- High performance
- Low barrier



ESD: Electrostatic discharge sensitive device, observe handling precautions!

Type	Marking	Ordering Code	Pin Configuration	Package[1)]
BAT 15-020 D	–	Q62702-D1263		D
BAT 15-050 D		Q62702-D3450		
BAT 15-090 D		Q62702-D1280		
BAT 15-110 D		Q62702-D1289		

Maximum Ratings

Parameter	Symbol	Values		Unit
		BAT 15-020 D BAT 15-050 D	BAT 15-090 D BAT 15-110 D	
Reverse voltage	V_R	4	4	V
Forward current	I_F	100	50	mA
Junction temperature	T_j	175		°C
Storage temperature range	T_{stg}	– 65 … + 150		
Operating temperature range	T_{op}	– 65 … + 150		

1) For detailed information see chapter Package Outlines.

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

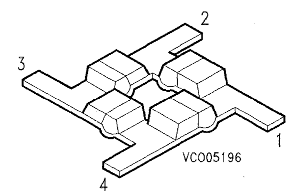
Parameter		Symbol	Values			Unit
			min.	typ.	max.	
DC Characteristics						
Breakdown voltage I_R = 10 µA		$V_{(BR)}$	4	–	–	V
Diode capacitance		C_T				pF
V_R = 0, f = 1 MHz	BAT 15-020 D		–	0.30	0.35	
	BAT 15-050 D		–	0.20	0.25	
	BAT 15-090 D		–	0.14	0.15	
	BAT 15-110 D		–	0.10	0.12	
Forward voltage		V_F				V
I_F = 1 mA	BAT 15-020 D		–	0.26	–	
	BAT 15-050 D		–	0.28	–	
	BAT 15-090 D		–	0.30	–	
	BAT 15-110 D		–	0.31	–	
I_F = 10 mA	BAT 15-020 D		–	0.35	–	
	BAT 15-050 D		–	0.39	–	
	BAT 15-090 D		–	0.44	–	
	BAT 15-110 D		–	0.45	–	
Single sideband noise figure		F_{SSB}				dB
F_{IF} = 1.5 dB, P_{LO} = 0 dBm, f_{IF} = 10.7 MHz						
f = 3.0 GHz	BAT 15-020 D		–	6.0	–	
f = 6.0 GHz	BAT 15-050 D		–	6.5	–	
f = 9.3 GHz	BAT 15-090 D		–	6.5	–	
f = 16 GHz	BAT 15-110 D		–	7.0	–	
Differential forward resistance		r_f				Ω
I_F = 10 mA	BAT 15-020 D		–	3.5	–	
	BAT 15-050 D		–	4.0	–	
I_F = 50 mA	BAT 15-090 D		–	7.0	–	
	BAT 15-110 D		–	10.0	–	

SIEMENS

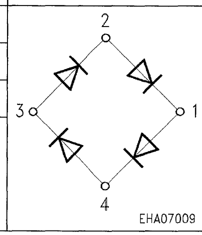
Silicon Schottky Diodes

BAT 15- … R

- Beam lead technology
- Low dimension
- High performance
- Low barrier



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

Type	Marking	Ordering Code	Pin Configuration	Package1)
BAT 15-020 R	–	Q62702-D1264		R
BAT 15-050 R		Q62702-D1272		
BAT 15-090 R		Q62702-D1281		
BAT 15-110 R		Q62702-D1290		

Maximum Ratings

Parameter	Symbol	Values		Unit
		BAT 15-020 R BAT 15-050 R	**BAT 15-090 R BAT 15-110 R**	
Forward current	I_F	100	50	mA
Junction temperature	T_j	175		°C
Storage temperature range	T_{stg}	– 65 … + 150		
Operating temperature range	T_{op}	– 65 … + 150		

1) For detailed information see chapter Package Outlines.

Electrical Characteristics

at T_A = 25 °C, unless otherwise specified.

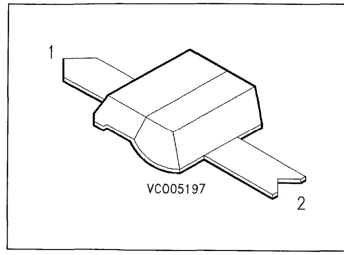
Parameter		Symbol	Values			Unit
			min.	typ.	max.	
DC Characteristics						
Diode capacitance		C_T				pF
V_R = 0, f = 1 MHz	BAT 15-020 R		–	0.30	0.35	
	BAT 15-050 R		–	0.20	0.25	
	BAT 15-090 R		–	0.14	0.15	
	BAT 15-110 R		–	0.10	0.12	
Forward voltage		V_F				V
I_F = 1 mA	BAT 15-020 R		–	0.26	–	
	BAT 15-050 R		–	0.28	–	
	BAT 15-090 R		–	0.30	–	
	BAT 15-110 R		–	0.31	–	
I_F = 10 mA	BAT 15-020 R		–	0.35	–	
	BAT 15-050 R		–	0.39	–	
	BAT 15-090 R		–	0.44	–	
	BAT 15-110 R		–	0.45	–	
Single sideband noise figure		F_{SSB}				dB
F_{IF} = 1.5 dB, P_{LO} = 0 dBm, f_{IF} = 10.7 MHz						
f = 3.0 GHz	BAT 15-020 R		–	6.0	–	
f = 6.0 GHz	BAT 15-050 R		–	6.5	–	
f = 9.3 GHz	BAT 15-090 R		–	6.5	–	
f = 16 GHz	BAT 15-110 R		–	7.0	–	
Differential forward resistance		r_f				Ω
I_F = 10 mA	BAT 15-020 R		–	3.5	–	
	BAT 15-050 R		–	4.0	–	
I_F = 50 mA	BAT 15-090 R		–	7.0	–	
	BAT 15-110 R		–	10.0	–	

SIEMENS

Silicon Schottky Diodes

BAT 15- ... S

- Beam lead technology
- Low dimension
- High performance
- Low barrier



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

Type	Marking	Ordering Code	Pin Configuration	Package[1)]
BAT 15-020 S	–	Q62702-D1262	Pointed cathode 	S
BAT 15-050 S		Q62702-D1271		
BAT 15-090 S		Q62702-D1279		
BAT 15-110 S		Q62702-D1288		

Maximum Ratings

Parameter	Symbol	Values		Unit
		BAT 15-020 S **BAT 15-050 S**	**BAT 15-090 S** **BAT 15-110 S**	
Reverse voltage	V_R	4	4	V
Forward current	I_F	100	50	mA
Junction temperature	T_j	175		˚C
Storage temperature range	T_{stg}	– 65 ... + 150		
Operating temperature range	T_{op}	– 65 ... + 150		

1) For detailed information see chapter Package Outlines.

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

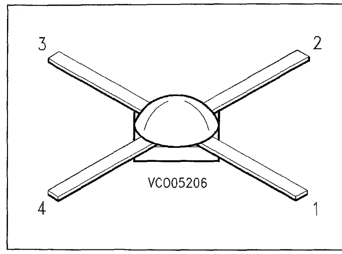
Parameter		Symbol	Values			Unit
			min.	typ.	max.	
DC Characteristics						
Breakdown voltage I_R = 10 µA		$V_{(BR)}$	4	–	–	V
Diode capacitance		C_T				pF
$V_R = 0, f$ = 1 MHz	BAT 15-020 S		–	0.30	0.35	
	BAT 15-050 S		–	0.20	0.25	
	BAT 15-090 S		–	0.14	0.15	
	BAT 15-110 S		–	0.10	0.12	
Forward voltage		V_F				V
I_F = 1 mA	BAT 15-020 S		–	0.26	–	
	BAT 15-050 S		–	0.28	–	
	BAT 15-090 S		–	0.30	–	
	BAT 15-110 S		–	0.31	–	
I_F = 10 mA	BAT 15-020 S		–	0.35	–	
	BAT 15-050 S		–	0.39	–	
	BAT 15-090 S		–	0.44	–	
	BAT 15-110 S		–	0.45	–	
Single sideband noise figure		F_{SSB}				dB
F_{IF} = 1.5 dB, P_{LO} = 0 dBm, f_{IF} = 10.7 MHz						
f = 3.0 GHz	BAT 15-020 S		–	6.0	–	
f = 6.0 GHz	BAT 15-050 S		–	6.5	–	
f = 9.3 GHz	BAT 15-090 S		–	6.5	–	
f = 16 GHz	BAT 15-110 S		–	7.0	–	
Differential forward resistance		r_f				Ω
I_F = 10 mA	BAT 15-020 S		–	3.5	–	
	BAT 15-050 S		–	4.0	–	
I_F = 50 mA	BAT 15-090 S		–	7.0	–	
	BAT 15-110 S		–	10.0	–	

SIEMENS

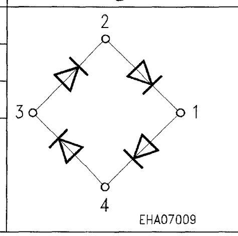
Silicon Schottky Diodes

BAT 15- … 2 R

- Beam lead technology
- Low dimension
- High performance
- Low barrier



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

Type	Marking	Ordering Code	Pin Configuration	Package[1)]
BAT 15-022 R	–	Q62702-D1265		50 mil
BAT 15-052 R		Q62702-D1273		
BAT 15-092 R		Q62702-D1282		
BAT 15-112 R		Q62702-D1291		

Maximum Ratings

Parameter	Symbol	Values		Unit
		BAT 15-022 R **BAT 15-052 R**	**BAT 15-092 R** **BAT 15-112 R**	
Forward current	I_F	100	50	mA
Junction temperature	T_j	175		°C
Storage temperature range	T_{stg}	– 55 … + 150		
Operating temperature range	T_{op}	– 55 … + 150		

1) For detailed information see chapter Package Outlines.

Electrical Characteristics
at $T_A = 25\ ^\circ C$, unless otherwise specified.

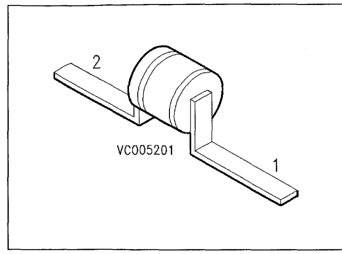
Parameter		Symbol	Values			Unit
			min.	typ.	max.	
Diode capacitance		C_T				pF
$V_R = 0, f = 1$ MHz	BAT 15-022 R		–	0.33	0.38	
	BAT 15-052 R		–	0.23	0.28	
	BAT 15-092 R		–	0.17	0.18	
	BAT 15-112 R		–	0.13	0.15	
Forward voltage		V_F				V
$I_F = 1$ mA	BAT 15-022 R		–	0.26	–	
	BAT 15-052 R		–	0.28	–	
	BAT 15-092 R		–	0.30	–	
	BAT 15-112 R		–	0.31	–	
$I_F = 10$ mA	BAT 15-022 R		–	0.35	–	
	BAT 15-052 R		–	0.39	–	
	BAT 15-092 R		–	0.44	–	
	BAT 15-112 R		–	0.45	–	
Single sideband noise figure		F_{SSB}				dB
$F_{IF} = 1.5$ dB, $P_{LO} = 0$ dBm, $f_{IF} = 10.7$ MHz						
$f = 3$ GHz	BAT 15-022 R		–	6.0	–	
$f = 6$ GHz	BAT 15-052 R		–	6.5	–	
$f = 9.3$ GHz	BAT 15-092 R		–	6.5	–	
$f = 16$ GHz	BAT 15-112 R		–	7.0	–	
Differential forward resistance		r_f				Ω
$I_F = 10/50$ mA	BAT 15-022 R		–	3.5	–	
	BAT 15-052 R		–	4.0	–	
	BAT 15-092 R		–	7.0	–	
	BAT 15-112 R		–	10.0	–	

SIEMENS

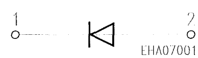
Silicon Schottky Diodes

BAT 15- ... 4

- Low barrier diodes
- For mixer applications
- Hermetically sealed ceramic packages
- For frequencies up to 40 GHz



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

Type	Frequency band (GHz)	Ordering Code	Pin Configuration	Package[1]
BAT 15-014	... 4 (S)	Q62702-D3429	Cathode: black dot, heat sink 	T1
BAT 15-044	... 8 (C)	Q62702-D3431		
BAT 15-074	... 12.4 (X)	Q62702-D3433		
BAT 15-104	... 18 (Ku)	Q62702-D3435		
BAT 15-124	... 40 (Ka)	Q62702-D3437		

Maximum Ratings

Parameter	Symbol	Values	Unit
Reverse voltage	V_R	3	V
Forward current BAT 15-014 ... BAT 15-044 BAT 15-074 ... BAT 15-124	I_F	100 50	mA
Junction temperature	T_j	175	°C
Storage temperature range	T_{stg}	– 65 ... + 150	
Operating temperature range	T_{op}	– 65 ... + 150	

1) For detailed information see chapter Package Outlines.

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

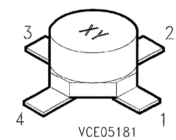
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Breakdown voltage I_R = 10 µA	$V_{(BR)}$	3	–	–	V
Forward voltage I_F = 1 mA	V_F				V
BAT 15-014		–	0.26	–	
BAT 15-044		–	0.28	–	
BAT 15-074		–	0.29	–	
BAT 15-104		–	0.30	–	
BAT 15-124		–	0.31	–	
I_F = 10 mA					
BAT 15-014		–	0.35	–	
BAT 15-044		–	0.39	–	
BAT 15-074		–	0.42	–	
BAT 15-104		–	0.44	–	
BAT 15-124		–	0.45	–	
Diode capacitance f = 1 MHz, V_R = 0	C_T				pF
BAT 15-014		–	0.25	0.35	
BAT 15-044		–	0.20	0.25	
BAT 15-074		–	0.17	0.20	
BAT 15-104		–	0.13	0.15	
BAT 15-124		–	0.10	0.12	
Case capacitance	C_C	–	0.1	–	
Noise figure (single sideband) IF amplifier noise F_{IF} = 1.5 dB, P_{LO} = 3 dBm, f_{IF} = 10.7 MHz	F_{SSB}				dB
f = 3 GHz BAT 15-014		–	5.5	–	
f = 6 GHz BAT 15-044		–	5.5	–	
f = 9.7 GHz BAT 15-074		–	5.5	–	
f = 16 GHz BAT 15-104		–	6.0	–	
BAT 15-124		–	9.0	–	
Differential forward resistance I_F = 10/50 mA	r_f				Ω
BAT 15-014		–	3.0	–	
BAT 15-044		–	3.5	–	
BAT 15-074		–	4.5	–	
BAT 15-104		–	5.5	–	
BAT 15-124		–	8.0	–	

SIEMENS

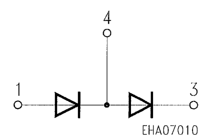
Silicon Schottky Diodes

BAT 15- ... 5 D

- Beam lead technology
- Low dimension
- High performance
- Low barrier



ESD: Electrostatic discharge sensitive device, observe handling precautions!

Type	Marking	Ordering Code	Pin Configuration	Package[1)]
BAT 15-025 D	52 D	Q62702-A803		Cerec-X
BAT 15-055 D	55 D	Q62702-A807		
BAT 15-095 D	59 D	Q62702-A798		
BAT 15-115 D	51 D	Q62702-A811		

Maximum Ratings

Parameter	Symbol	Values		Unit
		BAT 15-025 D BAT 15-055 D	BAT 15-095 D BAT 15-115 D	
Reverse voltage	V_R	4	4	V
Forward current	I_F	100	50	mA
Junction temperature	T_j	175		°C
Storage temperature range	T_{stg}	– 55 ... + 150		
Operating temperature range	T_{op}	– 55 ... + 150		

1) For detailed information see chapter Package Outlines.

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

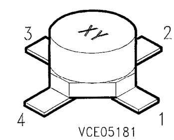
Parameter		Symbol	Values			Unit
			min.	typ.	max.	
Breakdown voltage I_R = 10 µA		$V_{(BR)}$	4	–	–	V
Diode capacitance V_R = 0, f = 1 MHz	BAT 15-025 D	C_T	–	0.37	0.42	pF
	BAT 15-055 D		–	0.27	0.32	
	BAT 15-095 D		–	0.21	0.22	
	BAT 15-115 D		–	0.17	0.19	
Forward voltage I_F = 1 mA	BAT 15-025 D	V_F	–	0.26	–	V
	BAT 15-055 D		–	0.28	–	
	BAT 15-095 D		–	0.30	–	
	BAT 15-115 D		–	0.31	–	
I_F = 10 mA	BAT 15-025 D		–	0.35	–	
	BAT 15-055 D		–	0.39	–	
	BAT 15-095 D		–	0.44	–	
	BAT 15-115 D		–	0.45	–	
Single sideband noise figure F_{IF} = 1.5 dB, P_{LO} = 0 dBm, f_{IF} = 10.7 MHz		F_{SSB}				dB
f = 3 GHz	BAT 15-025 D		–	6.0	–	
f = 6 GHz	BAT 15-055 D		–	6.5	–	
f = 9.3 GHz	BAT 15-095 D		–	6.5	–	
f = 16 GHz	BAT 15-115 D		–	7.0	–	
Differential forward resistance I_F = 10/50 mA	BAT 15-025 D	r_f	–	3.5	–	Ω
	BAT 15-055 D		–	4.0	–	
	BAT 15-095 D		–	7.0	–	
	BAT 15-115 D		–	10.0	–	

SIEMENS

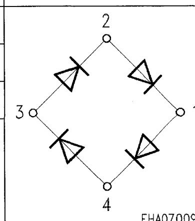
Silicon Schottky Diodes

BAT 15- … 5 R

- Beam lead technology
- Low dimension
- High performance
- Low barrier



ESD: Electrostatic discharge sensitive device, observe handling precautions!

Type	Marking	Ordering Code	Pin Configuration	Package[1)]
BAT 15-025 R	52	Q62702-A804		Cerec-X
BAT 15-055 R	55	Q62702-A806		
BAT 15-095 R	59	Q62702-A809		
BAT 15-115 R	51	Q62702-A812		

Maximum Ratings

Parameter	Symbol	Values		Unit
		BAT 15-025 R **BAT 15-055 R**	**BAT 15-095 R** **BAT 15-115 R**	
Forward current	I_F	100	50	mA
Junction temperature	T_j	175		°C
Storage temperature range	T_{stg}	– 55 … + 150		
Operating temperature range	T_{op}	– 55 … + 150		

1) For detailed information see chapter Package Outlines.

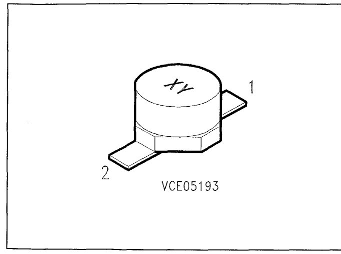
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter		Symbol	Values			Unit
			min.	typ.	max.	
Diode capacitance		C_T				pF
V_R = 0, f = 1 MHz	BAT 15-025 R		–	0.37	0.42	
	BAT 15-055 R		–	0.27	0.32	
	BAT 15-095 R		–	0.21	0.22	
	BAT 15-115 R		–	0.17	0.19	
Forward voltage		V_F				V
I_F = 1 mA	BAT 15-025 R		–	0.26	–	
	BAT 15-055 R		–	0.28	–	
	BAT 15-095 R		–	0.30	–	
	BAT 15-115 R		–	0.31	–	
I_F = 10 mA	BAT 15-025 R		–	0.35	–	
	BAT 15-055 R		–	0.39	–	
	BAT 15-095 R		–	0.44	–	
	BAT 15-115 R		–	0.45	–	
Single sideband noise figure		F_{SSB}				dB
F_{IF} = 1.5 dB, P_{LO} = 0 dBm, f_{IF} = 10.7 MHz						
f = 3 GHz	BAT 15-025 R		–	6.0	–	
f = 6 GHz	BAT 15-055 R		–	6.5	–	
f = 9.3 GHz	BAT 15-095 R		–	6.5	–	
f = 16 GHz	BAT 15-115 R		–	7.0	–	
Differential forward resistance		r_f				Ω
I_F = 10/50 mA	BAT 15-025 R		–	3.5	–	
	BAT 15-055 R		–	4.0	–	
	BAT 15-095 R		–	7.0	–	
	BAT 15-115 R		–	10.0	–	

SIEMENS

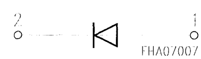
Silicon Schottky Diodes

BAT 15- ... 5 S



- Beam lead technology
- Low dimension
- High performance
- Low barrier

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

Type	Marking	Ordering Code	Pin Configuration	Package[1]
BAT 15-025 S	52	Q62702-A802		Cerec-X
BAT 15-055 S	55	Q62702-A805		
BAT 15-095 S	59	Q62702-A808		
BAT 15-115 S	51	Q62702-A810		

Maximum Ratings

Parameter	Symbol	Values		Unit
		BAT 15-025 S BAT 15-055 S	BAT 15-095 S BAT 15-115 S	
Reverse voltage	V_R	4	4	V
Forward current	I_F	100	50	mA
Junction temperature	T_j	175		°C
Storage temperature range	T_{stg}	– 55 ... + 150		
Operating temperature range	T_{op}	– 55 ... + 150		

1) For detailed information see chapter Package Outlines.

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

Parameter		Symbol	Values			Unit
			min.	typ.	max.	
Breakdown voltage I_R = 10 µA		$V_{(BR)}$	4	–	–	V
Diode capacitance V_R = 0, f = 1 MHz	BAT 15-025 S	C_T	–	0.36	0.41	pF
	BAT 15-055 S		–	0.26	0.31	
	BAT 15-095 S		–	0.20	0.21	
	BAT 15-115 S		–	0.16	0.18	
Forward voltage I_F = 1 mA	BAT 15-025 S	V_F	–	0.26	–	V
	BAT 15-055 S		–	0.28	–	
	BAT 15-095 S		–	0.30	–	
	BAT 15-115 S		–	0.31	–	
I_F = 10 mA	BAT 15-025 S		–	0.35	–	
	BAT 15-055 S		–	0.39	–	
	BAT 15-095 S		–	0.44	–	
	BAT 15-115 S		–	0.45	–	
Single sideband noise figure F_{IF} = 1.5 dB, P_{LO} = 0 dBm, f_{IF} = 10.7 MHz		F_{SSB}				dB
f = 3.0 GHz	BAT 15-025 S		–	6.0	–	
f = 6.0 GHz	BAT 15-055 S		–	6.5	–	
f = 9.3 GHz	BAT 15-095 S		–	6.5	–	
f = 16 GHz	BAT 15-115 S		–	7.0	–	
Differential forward resistance I_F = 10 / 50 mA	BAT 15-025 S	r_f	–	3.5	–	Ω
	BAT 15-055 S		–	4.0	–	
	BAT 15-095 S		–	7.0	–	
	BAT 15-115 S		–	10.0	–	

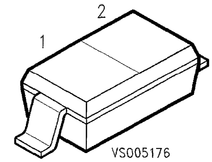
SIEMENS

Silicon Schottky Diode

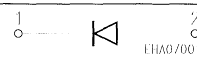
BAT 15-098

Preliminary Data

- DBS mixer application to 10 GHz
- Low noise figure
- Low barrier type



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

Type	Marking	Ordering Code (tape and reel)	Pin Configuration	Package[1)]
BAT 15-098	white B	Q62702-A0062		SOD-123

Maximum Ratings

Parameter	Symbol	Values	Unit
Reverse voltage	V_R	4	V
Forward current	I_F	110	mA
Power dissipation, $T_S \leq 80$ °C	P_{tot}	100	mW
Storage temperature range	T_{stg}	– 55 ... + 150	°C
Operating temperature range	T_{op}	– 55 ... + 150	

Thermal Resistance

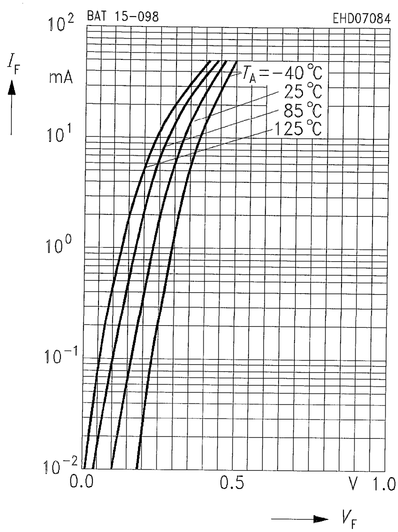
Junction - ambient[2)]	$R_{th\,JA}$	≤ 770	K/W
Junction - soldering point	$R_{th\,JS}$	≤ 690	

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

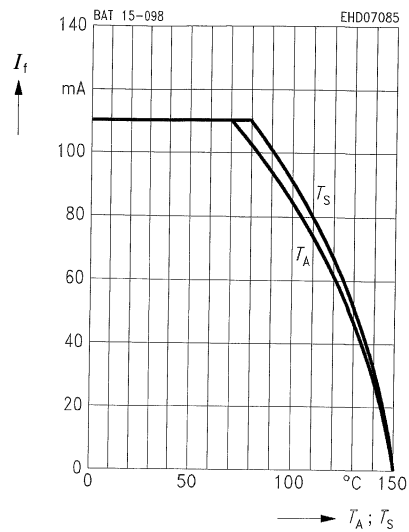
Electrical Characteristics per Diode
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Breakdown voltage I_R = 5 µA	$V_{(BR)}$	4	–	–	V
Forward voltage I_F = 1 mA I_F = 10 mA	V_F	 – –	 0.23 0.32	 – –	
Forward voltage matching I_F = 10 mA	ΔV_F	–	–	20	mV
Diode capacitance V_R = 0, f = 1 MHz	C_T	–	–	0.35	pF
Forward resistance I_F = 10 mA/50 mA	R_F	–	5.5	–	Ω

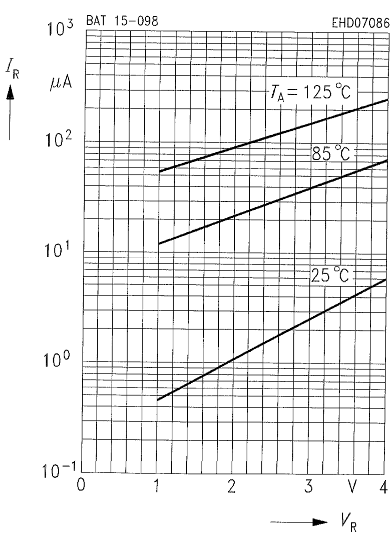
Forward current $I_F = f(V_F)$



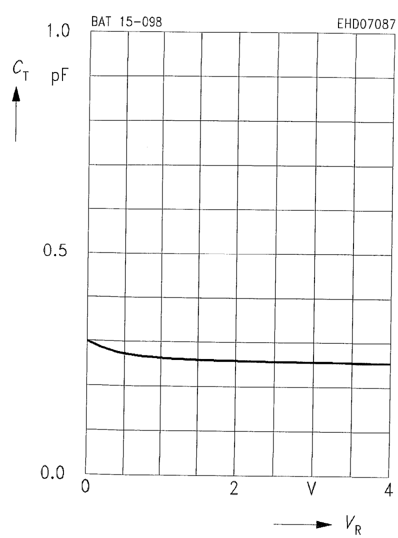
Forward current $I_F = f(T_S; T_A{*})$
*Package mounted on alumina



Reverse current $I_R = f(V_R)$



Diode capacitance $C_T = f(V_R)$
f = 1 MHz

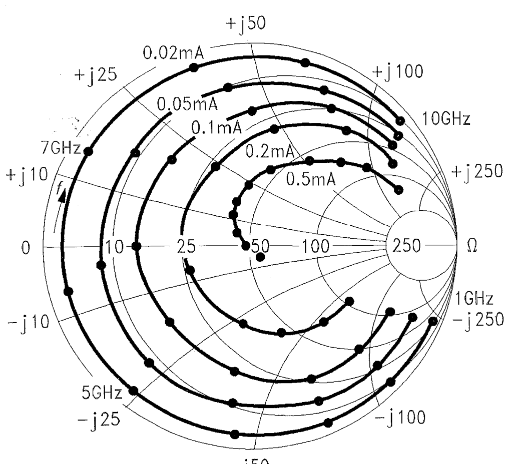


S_{11}-Parameters

Typical impedance characteristics (with external bias I and $Z_0 = \Omega$)

f	I = 0.02 mA		I = 0.05 mA		I = 0.1 mA		I = 0.2 mA		I = 0.5 mA	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
1	0.96	– 22.19	0.83	– 24.20	0.71	– 24.59	0.71	– 24.59	0.06	– 36.11
2	0.95	– 44.30	0.82	– 46.30	0.68	– 46.70	0.68	– 46.70	0.04	– 53.72
3	0.94	– 68.60	0.80	– 71.30	0.65	– 72.30	0.65	– 72.30	0.03	– 94.30
4	0.91	– 96.40	0.76	– 100.00	0.61	– 101.50	0.61	– 101.50	0.09	122.49
5	0.88	– 127.50	0.74	– 133.50	0.57	– 138.50	0.57	– 138.50	0.18	101.50
6	0.87	– 165.30	0.72	– 174.30	0.55	– 151.30	0.55	– 151.30	0.29	81.30
7	0.86	– 150.50	0.72	141.50	0.60	133.70	0.60	133.70	0.41	65.70
8	0.89	109.60	0.78	101.70	0.68	94.70	0.68	94.70	0.52	49.50
9	0.91	75.20	0.84	68.89	0.77	63.90	0.77	63.90	0.61	33.50
10	0.93	45.10	0.88	41.10	0.83	38.40	0.83	38.40	0.71	19.49

$S_{11} = f(f, I)$



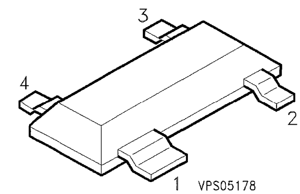
EHD07088

SIEMENS

Silicon Dual Schottky Diode

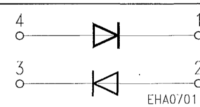
BAT 15-099

Preliminary Data



- DBS mixer application to 12 GHz
- Low noise figure
- Low barrier type

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

Type	Marking	Ordering Code (tape and reel)	Pin Configuration	Package[1]
BAT 15-099	S5	Q62702-A0066		SOT-143

Maximum Ratings

Parameter	Symbol	Values	Unit
Reverse voltage	V_R	4	V
Forward current	I_F	110	mA
Power dissipation, $T_S \leq 55$ °C	P_{tot}	100	mW
Storage temperature range	T_{stg}	– 55 ... + 150	°C
Operating temperature range	T_{op}	– 55 ... + 150	

Thermal Resistance

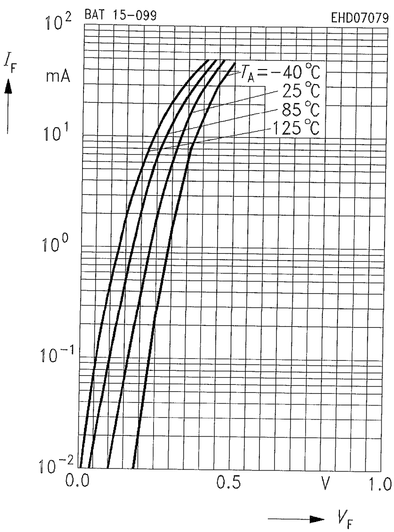
Junction - ambient[2]	$R_{th\,JA}$	$\leq$ 1090	K/W
Junction - soldering point	$R_{th\,JS}$	$\leq$ 930	

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

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

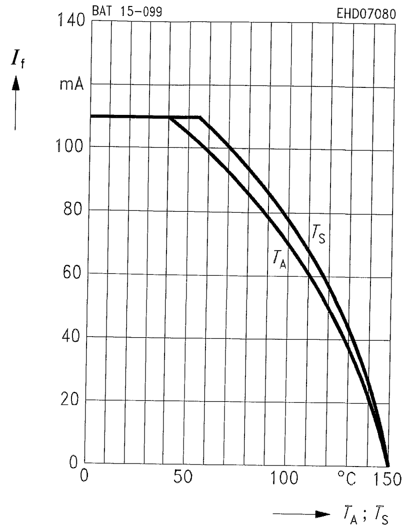
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Breakdown voltage I_R = 5 µA	$V_{(BR)}$	4	–	–	V
Forward voltage I_F = 1 mA I_F = 10 mA	V_F	 – –	 0.23 0.32	 – –	
Forward voltage matching I_F = 10 mA	ΔV_F	–	–	20	mV
Diode capacitance V_R = 0, f = 1 MHz	C_T	–	–	0.35	pF
Forward resistance I_F = 10 mA/50 mA	R_F	–	5.5	–	Ω

Forward current $I_F = f(V_F)$

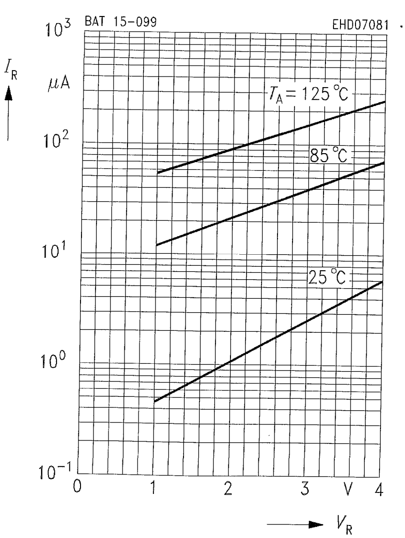


Forward current $I_F = f(T_S; T_A^*)$

*Package mounted on alumina

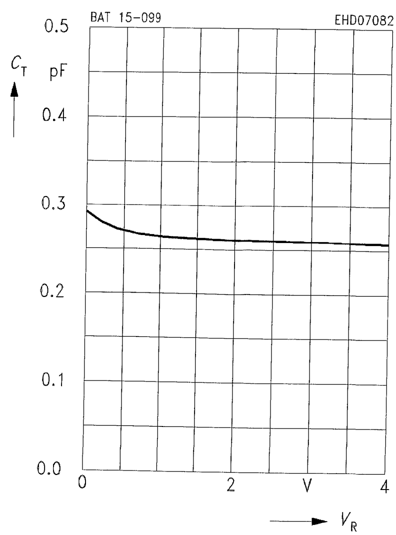


Reverse current $I_R = f(V_R)$



Diode capacitance $C_T = f(V_R)$

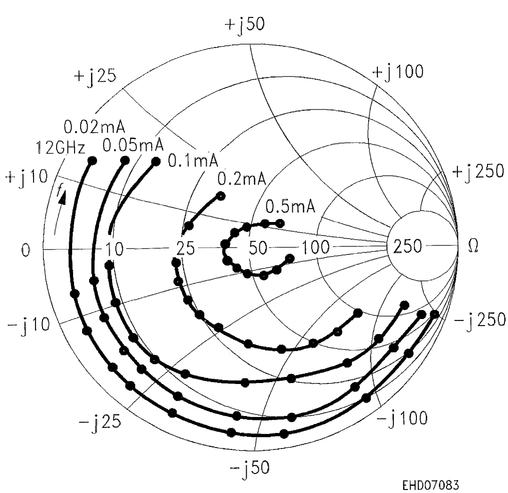
$f = 1$ MHz



S_{11}-Parameters
Typical impedance characteristics (with external bias I and $Z_0 = \Omega$)

f	I = 0.02 mA		I = 0.05 mA		I = 0.1 mA		I = 0.2 mA		I = 0.5 mA	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
1	0.94	– 16.4	0.87	– 16.6	0.77	– 16.4	0.59	– 17.2	0.29	– 16.7
2	0.93	– 33.8	0.88	– 33.8	0.77	– 34.5	0.58	– 35.2	0.15	– 36.1
3	0.92	– 53.8	0.86	– 54.5	0.75	– 54.1	0.58	– 56.1	0.13	– 64.8
4	0.91	– 74.3	0.84	– 75.3	0.72	– 76.4	0.51	– 78.4	0.11	– 104.8
5	0.91	– 96.6	0.84	– 97.6	0.72	– 99.1	0.53	– 102.3	0.15	– 135.7
6	0.91	– 115.4	0.84	– 116.7	0.73	– 118.7	0.53	– 122.9	0.18	– 160.9
7	0.91	– 131.0	0.84	– 132.3	0.73	– 134.1	0.54	– 138.1	0.20	– 168.8
8	0.91	– 143.0	0.84	– 144.5	0.73	– 146.8	0.55	– 150.5	0.81	+ 179.4
9	0.91	– 155.6	0.83	– 150.2	0.71	– 159.7	0.53	– 163.9	0.18	+ 179.4
10	0.90	– 167.3	0.83	– 169.7	0.71	– 178.8	0.51	– 175.8	0.14	+ 151.2
11	0.89	+ 175.5	0.80	+ 172.6	0.70	+ 170.0	0.45	+ 164.9	0.09	+ 105.5
12	0.88	+ 175.5	0.76	+ 146.5	0.62	+ 142.8	0.39	+ 134.2	0.14	+ 43.6

$S_{11} = f(f, I)$



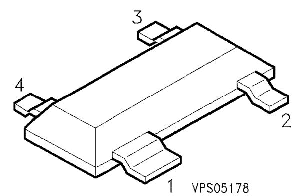
SIEMENS

Silicon Crossover Ring Quad Schottky Diode

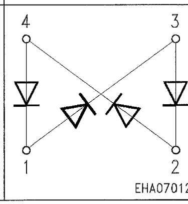
BAT 15-099R

Preliminary Data

- Low barrier diode for double balanced mixers, phase detectors and modulators



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

Type	Marking	Ordering Code (tape and reel)	Pin Configuration	Package[1)]
BAT 15-099R	S6	Q62702-A0043 ·		SOT-143

Maximum Ratings per Diode

Parameter	Symbol	Values	Unit
Forward current	I_F	110	mA
Power dissipation, $T_S \leq 70$ °C	P_{tot}	100	mW
Storage temperature range	T_{stg}	– 55 … + 150	°C
Operating temperature range	T_{op}	– 55 … + 150	

Thermal Resistance per Diode

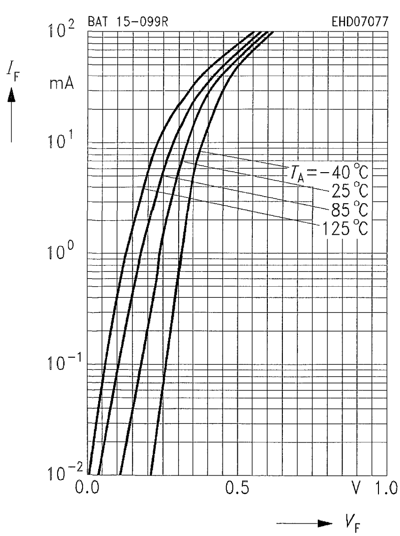
Junction – ambient[2)]	$R_{th\,JA}$	≤ 1020	K/W
Junction – soldering point	$R_{th\,JS}$	≤ 780	

1) For detailed information see chapter Package Outlines.
2) Package mounted on alumina 15 mm × 16.7 mm to 0.7 mm.

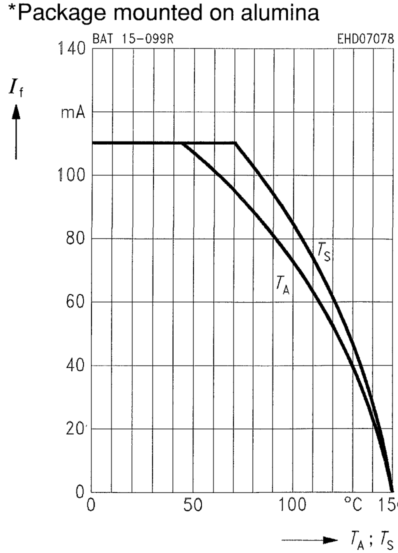
Electrical Characteristics per Diode
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Forward voltage I_F = 1 mA I_F = 10 mA	V_F	 – –	 0.230 0.320	 – –	V
Forward voltage matching [1] I_F = 10 mA	ΔV_F	–	–	20	mV
Diode capacitance V_R = 0, f = 1 MHz	C_T	–	0.38	–	pF
Forward resistance I_F = 10 mA / 50 mA	R_F	–	5.5	–	Ω

Forward current $I_F = f(V_F)$



Forward current $I_F = f(T_S; T_A^*)$
*Package mounted on alumina



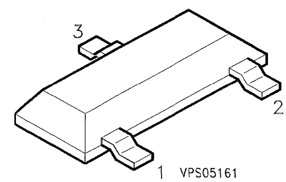
1) ΔV_F is the difference between the lowest and the highest V_F in the component.

SIEMENS

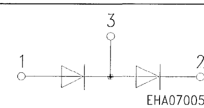
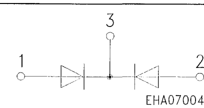
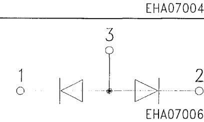
Silicon Schottky Diodes

BAT 17 ...

- For mixer applications in the VHF/UHF range
- For high-speed switching

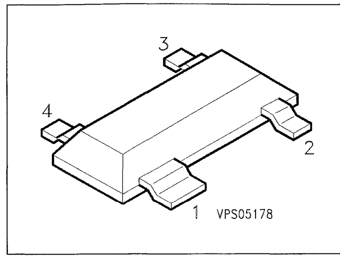


ESD: **E**lectro**s**tatic **d**ischarge sensitive device, observe handling precautions!

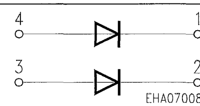
Type	Marking	Ordering Code (tape and reel)	Pin Configuration	Package[1)]
BAT 17	53	Q62702-A504		SOT-23
BAT 17-04	54	Q62702-A775		
BAT 17-05	55	Q62702-A776		
BAT 17-06	56	Q62702-A777		

1) For detailed information see chapter Package Outlines.

- For mixer applications in the VHF/UHF range
- For high-speed switching



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

Type	Marking	Ordering Code (tape and reel)	Pin Configuration	Package[1]
BAT 17-07	57	Q62702-A918		SOT 143

Maximum Ratings per Diode

Parameter	Symbol	Values	Unit
Reverse voltage	V_R	4	V
Forward current	I_F	130	mA
Power dissipation, $T_S \leq 60$ °C	P_{tot}	150	mW
Junction temperature	T_j	150	°C
Storage temperature range	T_{stg}	– 55 ... + 150	
Operating temperature range	T_{op}	– 55 ... + 150	

Thermal Resistance

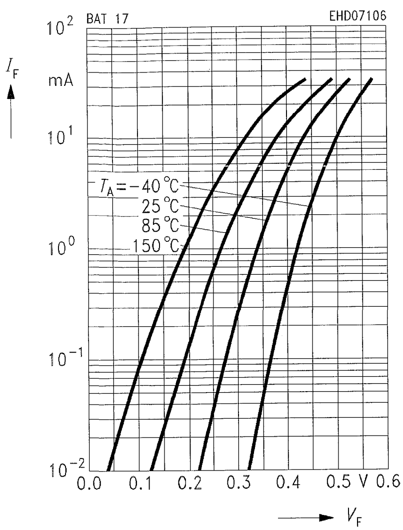
Parameter	Symbol	Values	Unit
Junction - ambient[2]	$R_{th JA}$	≤ 750	K/W
Junction - soldering point	$R_{th JS}$	≤ 590	

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

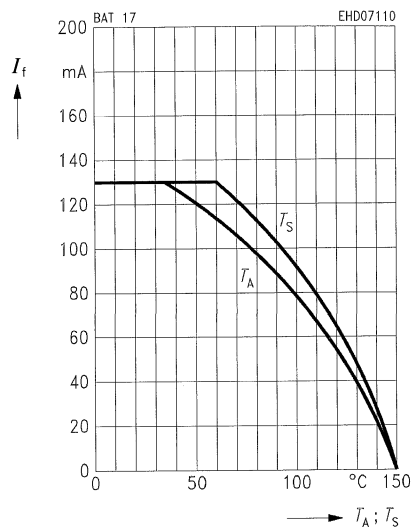
Electrical Characteristics per Diode
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Breakdown voltage I_R = 10 µA	$V_{(BR)}$	4	–	–	V
Reverse current V_R = 3 V V_R = 3 V, T_A = 60 °C V_R = 4 V	I_R	 – – –	 – – –	 0.25 1.25 10	µA
Forward voltage I_F = 0.1 mA I_F = 1 mA I_F = 10 mA	V_F	 200 – 350	 275 340 425	 350 450 600	mV
Diode capacitance V_R = 0, f = 1 MHz	C_T	–	0.75	1	pF
Differential forward resistance I_F = 5 mA, f = 10 kHz	r_f	–	8	15	Ω
Noise figure I_F = 2 mA, f = 900 MHz IF noise figure: F = 1.5 dB, f = 35 MHz	F	–	5.8	7	dB

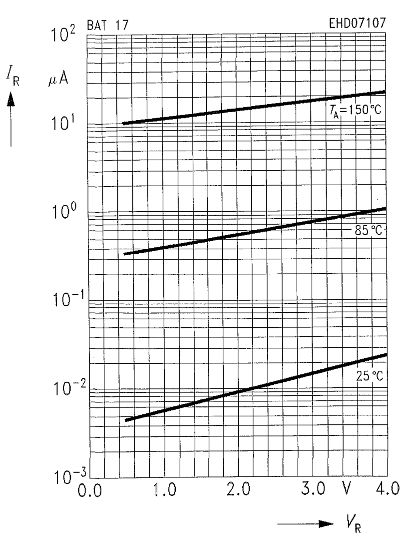
Forward current $I_F = f(V_F)$



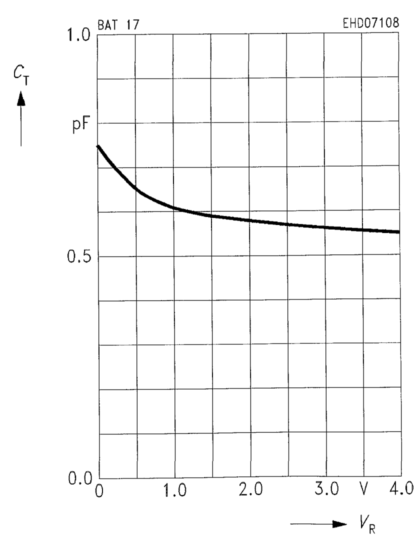
Forward current $I_F = f(T_S, T_A^*)$
*Package mounted on alumina



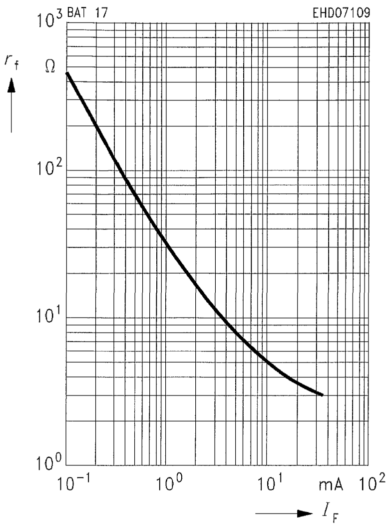
Reverse current $I_R = f(V_R)$



Diode capacitance $C_T = f(V_R)$
f = 1 MHz



Differential forward resistance $r_f = f(I_F)$
f = 10 kHz

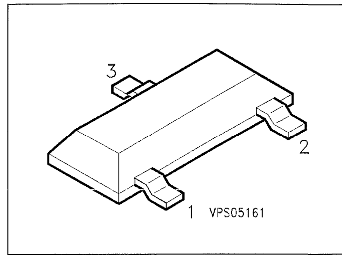


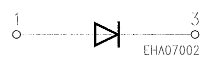
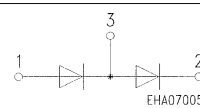
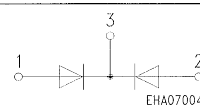
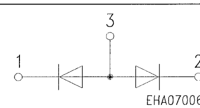
SIEMENS

Silicon RF Switching Diode

BAT 18 ...

- Low-loss VHF/UHF switch above 10 MHz
- Pin diode with low forward resistance



Type	Marking	Ordering Code	Pin Configuration	Package[1]
BAT 18	A2	Q62702-A787		SOT 23
BAT 18-04	AU	Q62702-A938		
BAT 18-05	AS	Q62702-A940		
BAT 18-06	AT	Q62702-A942		

Maximum Ratings per Diode

Parameter	Symbol	Values	Unit
Reverse voltage	V_R	35	V
Forward current	I_F	100	mA
Operating and storage temperature range	T_{op} T_{stg}	– 55 ... + 150	°C

Thermal Resistance

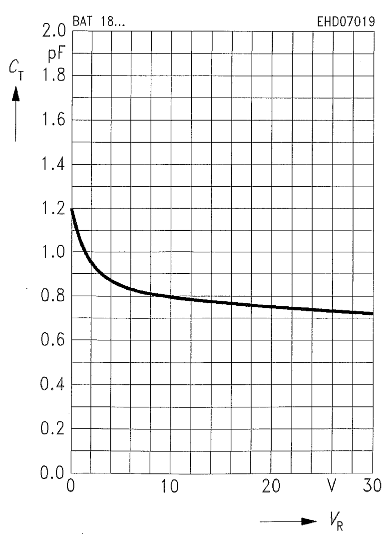
Junction - ambient	$R_{th\,JA}$	≤ 450	K/W

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

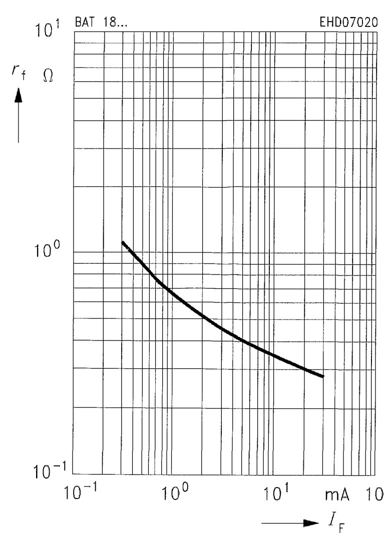
Electrical Characteristics per Diode
at T_A = 25 ˚C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Forward voltage I_F = 100 mA	V_F	–	0.38	1.2	V
Reverse current V_R = 20 V V_R = 20 V, T_A = 60 ˚C	I_R	 – –	 – –	 20 200	nA
Diode capacitance V_R = 20 V, f = 1 MHz	C_T	–	0.75	1	pF
Forward resistance I_F = 5 mA, f = 100 MHz	r_f	–	0.4	0.7	Ω
Series inductance	L_S	–	2	–	nH

Diode capacitance $C_T = f(V_R)$
f = 1 MHz



Forward resistance $r_f = f(I_F)$
f = 100 MHz

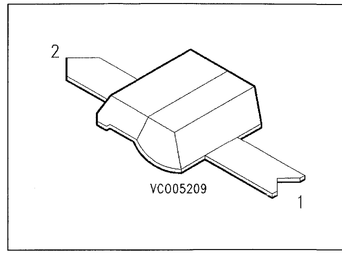


SIEMENS

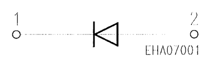
Silicon Schottky Diode

BAT 30

- RF detector
- Low-power mixer
- Zero bias
- Very low capacitance
- For frequencies up to 25 GHz



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

Type	Frequency band (GHz)	Ordering Code	Pin Configuration	Package[1)]
BAT 30	… 25 (I, K)	Q62702-A764	Pointed anode 	S1

Maximum Ratings

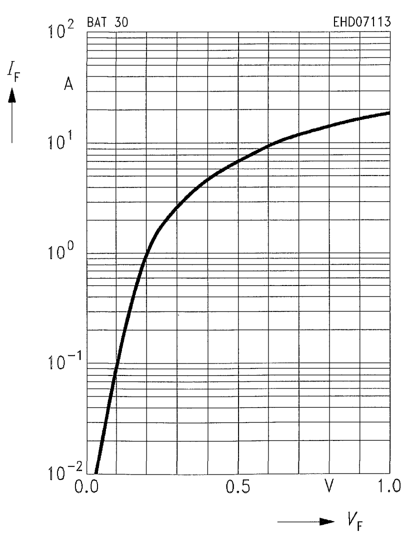
Parameter	Symbol	Values	Unit
Reverse voltage	V_R	6.5	V
Forward current	I_F	50	mA
Junction temperature	T_j	150	˚C
Storage temperature range	T_{stg}	– 55 … + 150	
Operating temperature range	T_{op}	– 55 … + 150	

1) For detailed information see chapter Package Outlines.

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

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Breakdown voltage I_R = 1 μA	$V_{(BR)}$	6.5	–	–	V
Forward voltage I_F = 1 mA I_F = 10 mA	V_F	 – –	 0.2 0.6	 – –	mV
Diode capacitance V_R = 0.15, f = 1 MHz	C_T	–	0.14	0.18	pF
Differential resistance V_F = 0, f = 10 kHz	r_f	–	15	–	kΩ

Forward current $I_F = f\,(V_F)$

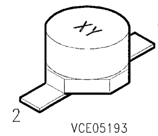


SIEMENS

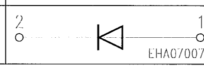
Silicon Schottky Diode

BAT 32

- RF detector
- Low-power mixer
- Zero bias
- Very low capacitance
- For frequencies up to 18 GHz
- HiRel/Mil-tested diodes available



ESD: Electro**st**atic **d**ischarge sensitive device, observe handling precautions!

Type	Frequency band (GHz)	Marking	Ordering Code (tape and reel)	Pin Configuration	Package[1)]
BAT 32	… 18 (X, Ku)	32	Q62702-A826		Cerec-X

Maximum Ratings

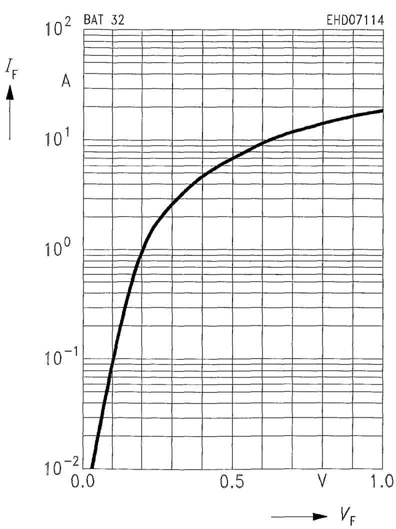
Parameter	Symbol	Values	Unit
Reverse voltage	V_R	6.5	V
Forward current	I_F	50	mA
Junction temperature	T_j	150	°C
Storage temperature range	T_{stg}	– 55 … + 150	
Operating temperature range	T_{op}	– 55 … + 150	

1) For detailed information see chapter Package Outlines.

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

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Breakdown voltage I_R = 1 mA	$V_{(BR)}$	6.5	–	–	V
Forward voltage I_F = 1 mA I_F = 10 mA	V_F	 – –	 0.2 0.6	 – –	mV
Diode capacitance V_R = 0.15, f = 1 MHz	C_T	–	0.20	0.24	pF
Differential resistance V_F = 0, f = 10 kHz	r_F	–	15	–	kΩ

Forward current $I_F = f\,(V_F)$



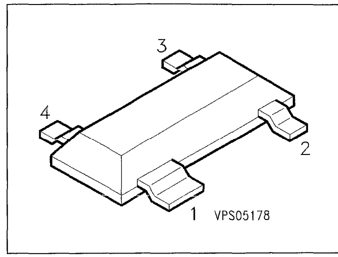
SIEMENS

Silicon Schottky Diode

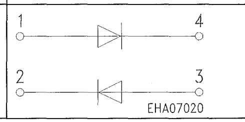
BAT 62

Preliminary Data

- Low barrier diode for detectors up to GHz frequencies.



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

Type	Marking	Ordering Code (tape and reel)	Pin Configuration	Package[1]
BAT 62	62	Q62702-A971		SOT-143

Maximum Ratings per Diode

Parameter	Symbol	Values	Unit
Reverse voltage	V_R	40	V
Forward current	I_F	20	mA
Total power dissipation, $T_S \leq 85$ ˚C	P_{tot}	100	mW
Junction temperature	T_j	150	˚C
Storage temperature range	T_{stg}	– 55 ... + 150	

Thermal Resistance

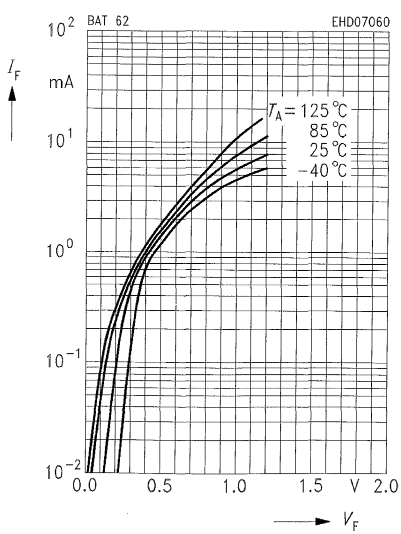
Junction - ambient[2]	$R_{th\,JA}$	≤ 810	K/W
Junction - soldering point	$R_{th\,JS}$	≤ 650	

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

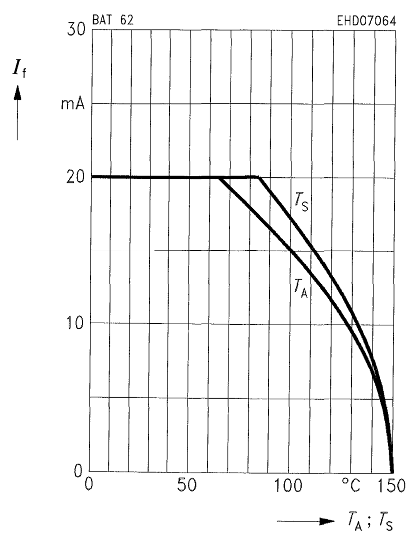
Electrical Characteristics per Diode
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Reverse current V_R = 40 V	I_R	–	–	10	μA
Forward voltage I_F = 2 mA	V_F	–	0.58	1	V
Diode capacitance V_R = 0, f = 1 MHz	C_T	–	0.35	0.6	pF
Case capacitance	C_C	–	0.1	–	
Differential resistance V_R = 0, f = 10 kHz	R_0	–	225	–	kΩ
Series inductance	L_S	–	2	–	nH

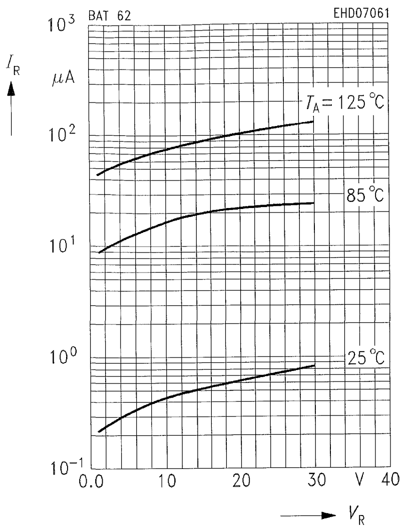
Forward current $I_F = f(V_F)$



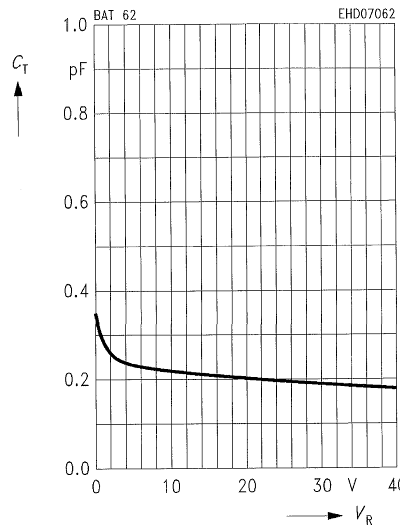
Forward current $I_F = f(T_S; T_A$*)
*Package mounted on alumina



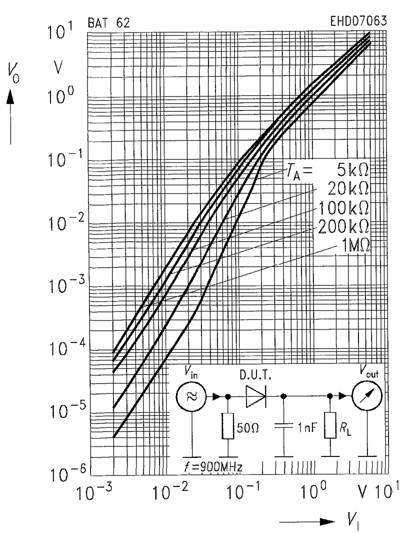
Reverse current $I_R = f(V_R)$
f = 1 MHz



Diode capacitance $C_T = f(V_R)$
f = 1 MHz



Rectifier voltage $V_0 = f(V_i)$
f = 900 MHz



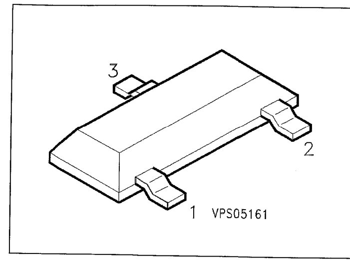
SIEMENS

Silicon Schottky Diodes

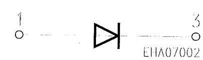
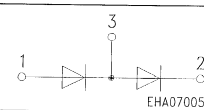
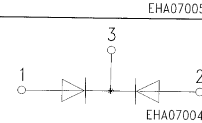
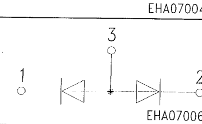
BAT 68 ...

Preliminary Data

- For mixer applications in the VHF/UHF range
- For high-speed switching

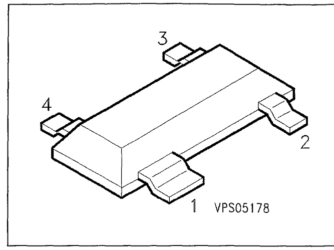


ESD: **E**lectro**s**tatic **d**ischarge sensitive device, observe handling precautions!

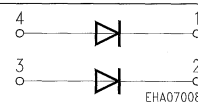
Type	Marking	Ordering Code (tape and reel)	Pin Configuration	Package1)
BAT 68	83	Q62702-A926		SOT-23
BAT 68-04	84	Q62702-A4		
BAT 68-05	85	Q62702-A15		
BAT 68-06	86	Q62702-A19		

1) For detailed information see chapter Package Outlines.

- For mixer applications in the VHF/UHF range
- For high-speed switching



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

Type	Marking	Ordering Code (tape and reel)	Pin Configuration	Package[1]
BAT 68-07	87	Q62702-A44		SOT-143

Maximum Ratings per Diode

Parameter	Symbol	Values	Unit
Reverse voltage	V_R	8	V
Forward current	I_F	130	mA
Power dissipation, $T_S \leq 60$ ˚C	P_{tot}	150	mW
Junction temperature	T_j	150	˚C
Storage temperature range	T_{stg}	– 55 … + 150	

Thermal Resistance

Junction - ambient[2]	$R_{th\,JA}$	≤ 750	K/W
Junction - soldering point	$R_{th\,JS}$	≤ 590	

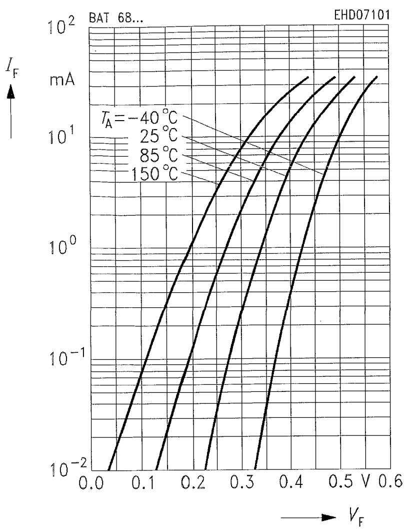
1) For detailed information see chapter Package Outlines.
2) Package mounted on alumina 15 mm × 16.7 mm × 0.7 mm.

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

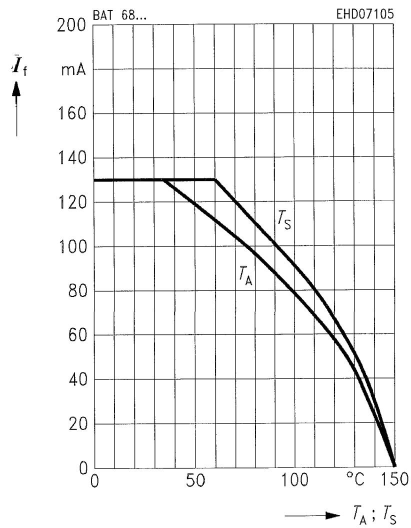
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Breakdown voltage I_R = 10 µA	V_{BR}	8	–	–	V
Reverse current V_R = 1 V V_R = 1 V, T_A = 60 °C	I_R	 – –	 – –	 0.1 1.2	µA
Forward voltage[1)] I_F = 1 mA I_F = 10 mA	V_F	 – –	 – –	 340 500	mV
Diode capacitance V_R = 0, f = 1 MHz	C_T	–	–	1	pF
Differential forward resistance I_F = 5 mA, f = 10 kHz	r_f	–	–	10	Ω

1) Forward voltage matching, types -04, -05, -06, -07 I_F = 10 mA, ΔV_F = 20 mV max.

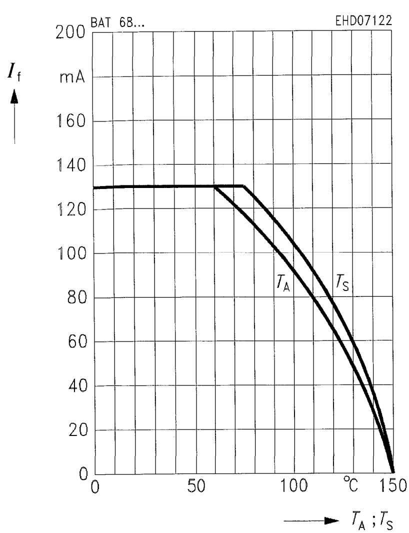
Forward current $I_F = f(V_F)$



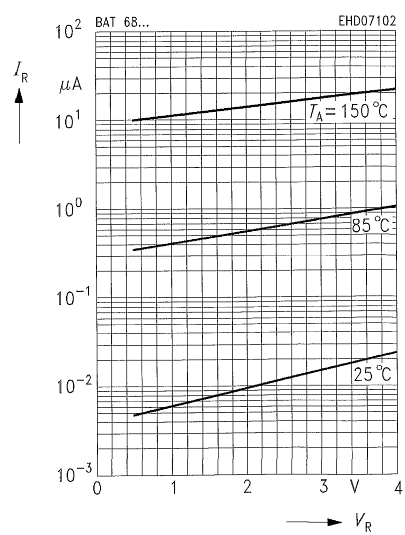
Forward current $I_F = f(T_S, T_A*)$
*Package mounted on alumina
BAT 68-04, -05, -06, -07



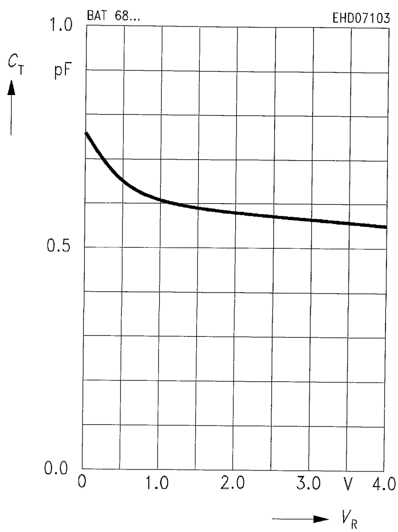
Forward current $I_F = f(T_S; T_A*)$
*Package mounted on alumina
BAT 68



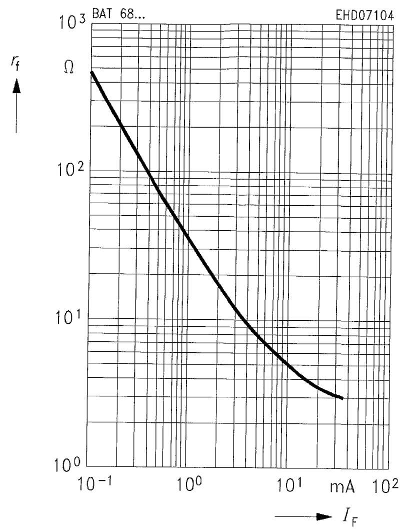
Reverse current $I_R = f(V_R)$



Diode capacitance $C_T = f(V_R)$
f = 1 MHz



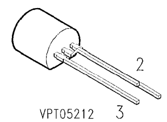
Differential forward resistance $r_f = f(I_F)$
f = 10 kHz

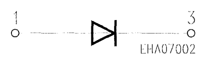


Silicon Variable Capacitance Diode

BB 112

- For AM tuning applications
- Specified tuning range
  1 ... 8.0 V



Type	Marking	Ordering Code	Pin Configuration	Package[1)]
BB 112	–	Q62702-B240		TO-92

Maximum Ratings

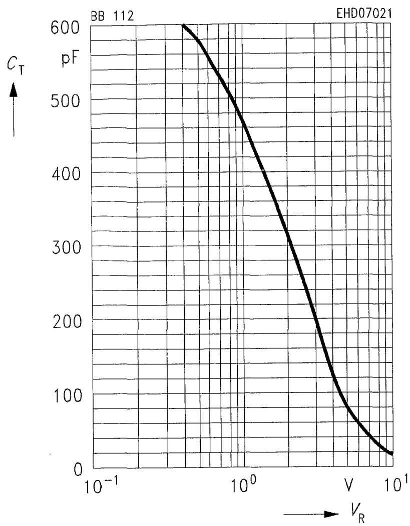
Parameter	Symbol	Values	Unit
Reverse voltage	V_R	12	V
Forward current, $T_A \leq 60$ °C	I_F	50	mA
Operating temperature range	T_{op}	– 55 ... + 85	°C

1) For detailed information see chapter Package Outlines.

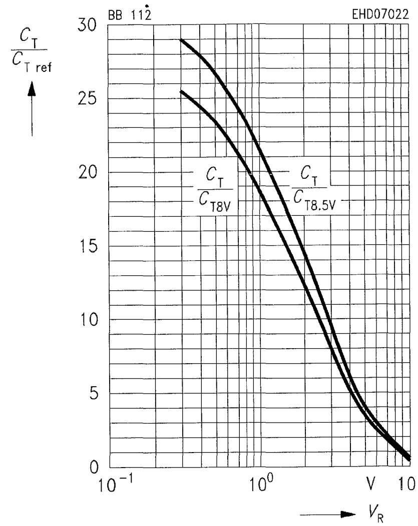
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Reverse current V_R = 10 V V_R = 10 V, T_A = 60 °C	I_R	 – –	 – –	 50 200	nA
Diode capacitance, f = 1 MHz V_R = 1 V V_R = 8 V	C_T	 440 17.5	 470 –	 520 34	pF
Capacitance ratio V_R = 1 V/8 V	$\frac{C_{T1}}{C_{T8}}$	15	–	–	–
Series resistance V_R = 1 V, f = 0.5 MHz	r_s	–	1.4	–	Ω
Q factor V_R = 1 V, f = 0.5 MHz	Q	–	480	–	–
Temperature coefficient of diode capacitance V_R = 1 V, f = 1 MHz	TC_C	–	500	–	ppm/K
Capacitance matching V_R = 1 … 8 V	$\frac{\Delta C_T}{C_T}$	–	–	3	%

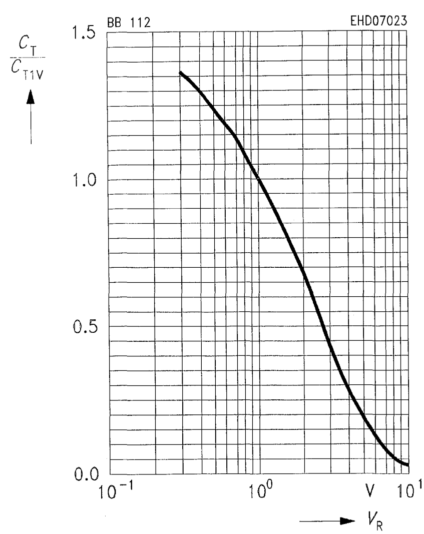
Diode capacitance $C_T = f(V_R)$



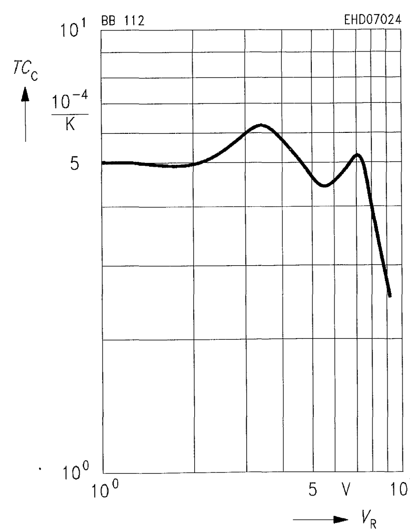
Capacitance ratio $C_T/C_{Tref} = f(V_R)$



Capacitance ratio $C_T/C_{T1V} = f(V_R)$



Temperature coefficient of junction capacitance $TC_C = f(V_R)$

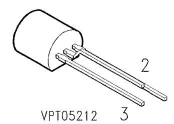


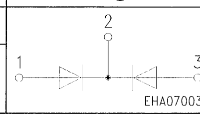
SIEMENS

Silicon Variable Capacitance Diode

BB 204 B
BB 204 G

- For FM tuners
- Monolithic chip with common cathode for perfect tracking of both diodes
- Uniform "square law" characteristics
- Ideal Hifi tuning device when used in low-distortion, back-to-back configuration
- Capacitance subgroups available (see Characteristics)



Type	Marking	Ordering Code	Pin Configuration	Package[1)]
BB 204 B	blue	Q62702-B58-X6		TO-92
BB 204 G	green	Q62702-B57-X5		

Maximum Ratings

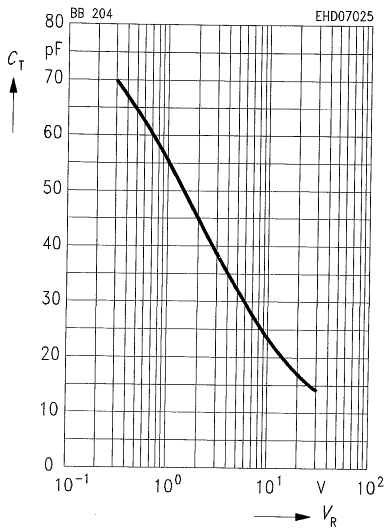
Parameter	Symbol	Values	Unit
Reverse voltage	V_R	30	V
Peak reverse voltage	V_{RM}	32	
Forward current, $T_A \leq 60$ °C	I_F	50	mA
Storage temperature range	T_{stg}	– 55 ... + 100	°C

1) For detailed information see chapter Package Outlines.

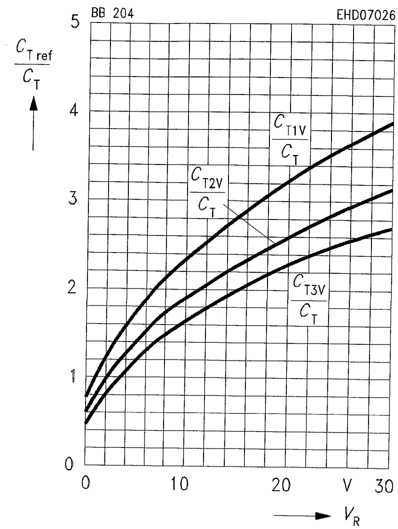
Electrical Characteristics per Diode
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Breakdown voltage I_R = 10 μA	$V_{(BR)}$	32	–	–	V
Reverse current V_R = 30 V V_R = 30 V, T_A = 60 °C	I_R	 – –	 – –	 20 0.2	 nA μA
Diode capacitance, f = 1 MHz V_R = 3 V, green V_R = 3 V, blue V_R = 30 V, green V_R = 30 V, blue	C_T	 34 37 – –	 – – 13.7 14.4	 39 42 – –	pF
Capacitance ratio, f = 1 MHz V_R = 3 V, 30 V	$\frac{C_{T3}}{C_{T30}}$	2.55	2.7	2.8	–
Series resistance C_T = 38 pF, f = 100 MHz	r_S	–	0.2	0.4	Ω
Q factor C_T = 38 pF, f = 100 MHz	Q	100	200	–	–
Temperature coefficient of diode capacitance V_R = 3 V, f = 1 MHz	TC_C	–	300	–	ppm/K

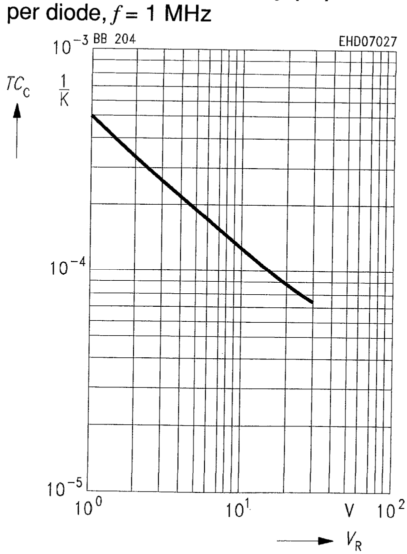
Diode capacitance $C_T = f(V_R)$
per diode, f = 1 MHz



Capacitance ratio $C_{Tref}/C_T = f(V_R)$
per diode; V_{ref} = 1 V, 2 V, 3 V; f = 1 MHz



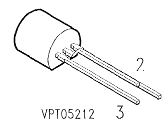
Temperature coefficient of diode capacitance $TC_C = f(V_R)$
per diode, f = 1 MHz

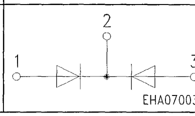


SIEMENS

Silicon Variable Capacitance Diode — BB 304

- For FM tuners
- Monolithic chip with common cathode for perfect tracking of both diodes
- Uniform "square law" characteristics
- Ideal Hifi tuning device when used in low-distortion, back-to-back configuration
- Color-coded capacitance subgroups available (see Characteristics)



Type	Marking	Ordering Code	Pin Configuration	Package[1]
BB 304	–	Q62702-B118		TO-92

Maximum Ratings per Diode

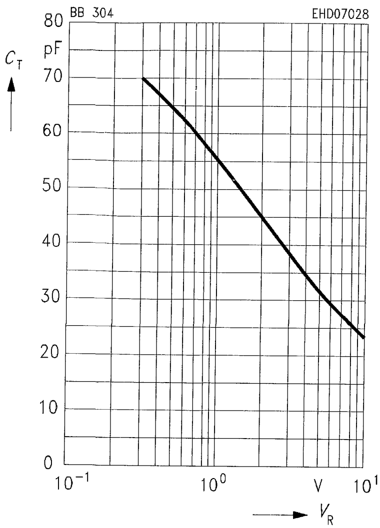
Parameter	Symbol	Values	Unit
Reverse voltage	V_R	30	V
Peak reverse voltage	V_{RM}	32	
Forward current, $T_A \leq 60$ °C	I_F	50	mA
Storage temperature range	T_{stg}	– 55 … + 100	°C

[1] For detailed information see chapter Package Outlines.

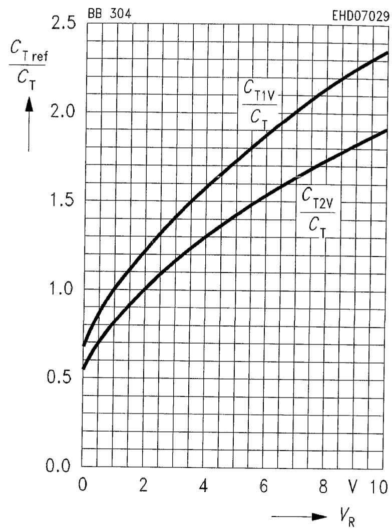
Electrical Characteristics per Diode
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Reverse current	I_R				
V_R = 30 V		–	–	20	nA
V_R = 30 V, T_A = 60 °C		–	–	0.2	µA
Diode capacitance V_R = 2 V, f = 1 MHz	C_T	42	–	47.5	pF
Capacitance ratio V_R = 3 V, 8 V, f = 1 MHz	$\frac{C_{T2}}{C_{T8}}$	1.65	–	1.75	–
Series resistance C_T = 38 pF, f = 100 MHz	r_s	–	0.2	0.4	Ω
Q factor C_T = 38 pF, f = 100 MHz	Q	100	200	–	–
Diode capacitance V_R = 2 V, f = 1 MHz	C_T				pF
Subgroups: red		42	–	43.5	
yellow		43	–	44.5	
white		44	–	45.5	
green		45	–	46.5	
blue		46	–	47.5	

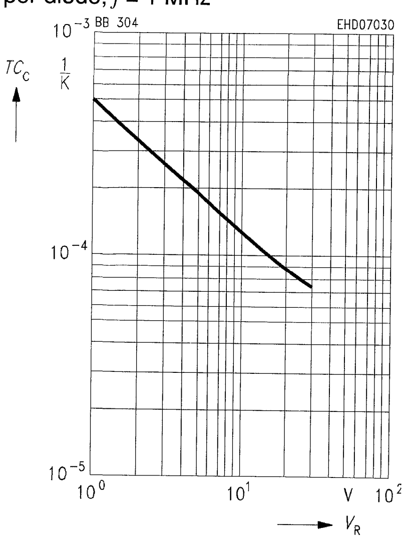
Diode capacitance $C_T = f(V_R)$
per diode, f = 1 MHz



Capacitance ratio $C_{Tref}/C_T = f(V_R)$
per diode; V_{ref} = 1 V, 2 V; f = 1 MHz



Temperature coefficient of diode capacitance $TC_C = f(V_R)$
per diode, f = 1 MHz

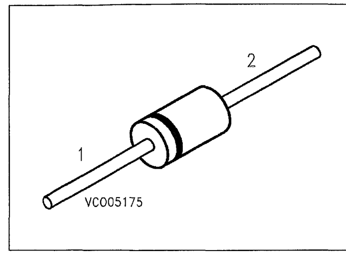


SIEMENS

Silicon Variable Capacitance Diode

BB 409

- For VHF tuners
- Not for new design



Type	Marking	Ordering Code	Pin Configuration	Package[1]
BB 409	green	Q62702-B112		DO-35 DHD

Maximum Ratings

Parameter	Symbol	Values	Unit
Reverse voltage	V_R	28	V
Peak reverse voltage	V_{RM}	30	
Forward current, $T_A \le 60$ °C	I_F	20	mA
Storage temperature range	T_{stg}	– 55 ... + 150	°C

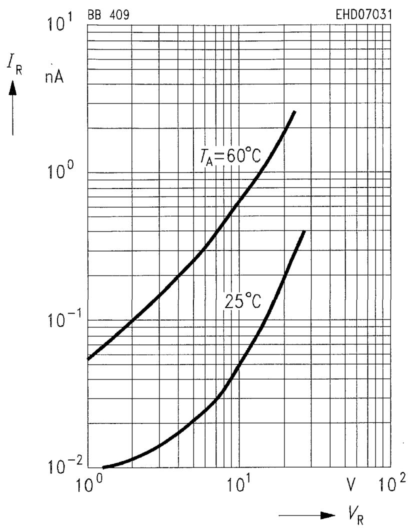
[1] For detailed information see chapter Package Outlines.

Electrical Characteristics

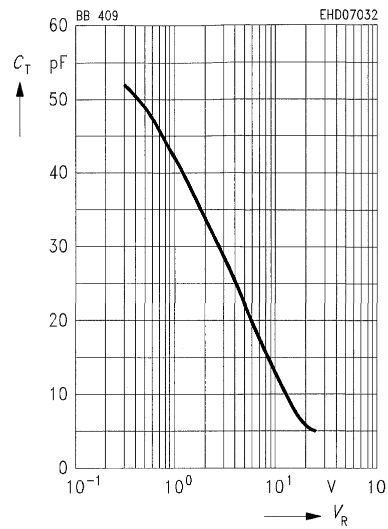
at T_A = 25 ˚C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Reverse current	I_R				
V_R = 28 V		–	–	50	nA
V_R = 28 V, T_A = 60 ˚C		–	–	0.5	µA
Diode capacitance, f = 1 MHz	C_T				pF
V_R = 3 V		26	–	32	
25 V		4.5	–	5.6	
Capacitance ratio V_R = 3 V, 25 V, f = 1 MHz	$\frac{C_{T3}}{C_{T25}}$	5	–	6.5	–
Capacitance matching V_R = 1 V ... 28 V	$\frac{\Delta C_T}{C_T}$	–	–	3	%
Series resistance C_T = 12 pF, f = 100 MHz	r_s	–	0.3	–	Ω
Q factor	Q				–
V_R = 3 V, f = 50 MHz		–	280	–	
V_R = 25 V, f = 200 MHz		–	600	–	
Series inductance	L_s	–	3	–	nH
Temperature coefficient of diode capacitance, f = 1 MHz	TC_C				1/K
V_R = 3 V		–	$2.5 \cdot 10^{-4}$	–	
V_R = 25 V		–	$0.8 \cdot 10^{-4}$	–	

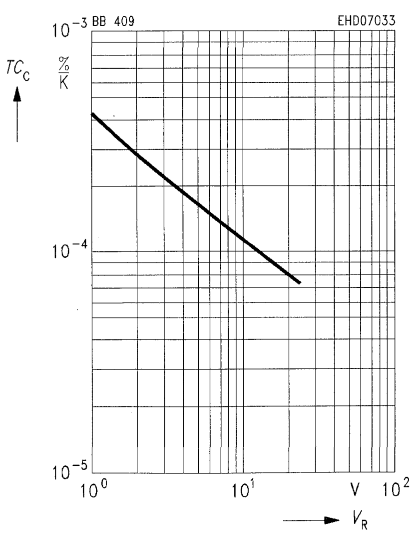
Reverse current $I_R = f(V_R)$



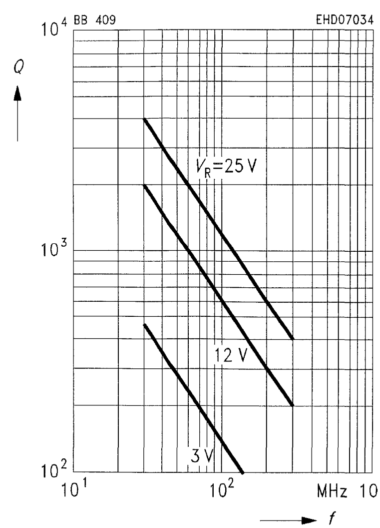
Diode capacitance $C_T = f(V_R)$



Temperature coefficient of diode capacitance $TC_C = f(V_R)$



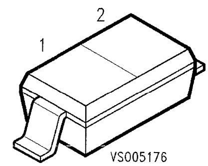
Q factor $Q = f(f)$
V_R = Parameter

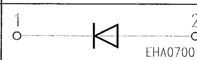


Silicon Variable Capacitance Diode

BB 419

- For VHF tuned circuit applications



Type	Marking	Ordering Code (tape and reel)	Pin Configuration	Package[1]
BB 419	white 2	Q62702-B499		SOD-123

Maximum Ratings

Parameter	Symbol	Values	Unit
Reverse voltage	V_R	28	V
Peak reverse voltage	V_{RM}	30	
Forward current, $T_A \leq 60$ °C	I_F	20	mA
Operating temperature range	T_{op}	– 55 ... + 125	°C
Storage temperature range	T_{stg}	– 55 ... + 150	

Thermal Resistance

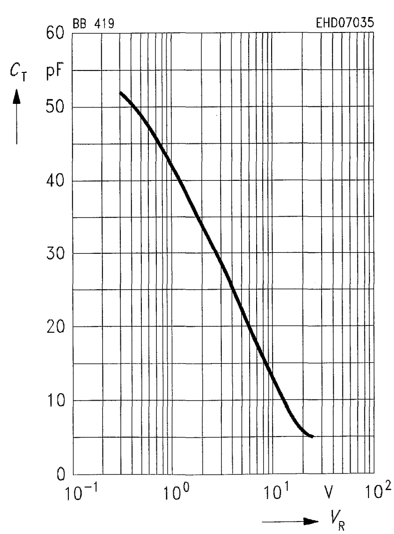
Junction - ambient	$R_{th\,JA}$	≤ 450	K/W

[1] For detailed information see chapter Package Outlines.

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

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Reverse current V_R = 28 V V_R = 28 V, T_A = 60 °C	I_R	 – –	 – –	 20 200	nA
Diode capacitance, f = 1 MHz V_R = 3 V V_R = 25 V	C_T	 26 4.3	 – –	 32 6	pF
Capacitance ratio f = 1 MHz, V_R = 3 V / 25 V	C_{T3} / C_{T25}	5	–	6.5	–
Capacitance matching V_R = 3 V ... 25 V	ΔC_T / C_T	–	–	3	%
Series resistance f = 100 MHz, C_T = 12 pF	r_s	–	0.35	0.5	Ω
Figure of merit f = 50 MHz, V_R = 3 V f = 200 MHz, V_R = 25 V	Q	 –	 280 600	 –	–

Diode capacitance $C_T = f(V_R)$



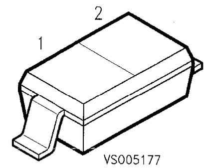
SIEMENS

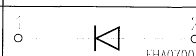
Silicon Variable Capacitance Diode

BB 439

Preliminary Data

- For VHF tuned circuit applications
- High figure of merit



Type	Marking	Ordering Code (tape and reel)	Pin Configuration	Package[1)]
BB 439	white 2	Q62702-B577		SOD-323

Maximum Ratings

Parameter	Symbol	Values	Unit
Reverse voltage	V_R	28	V
Peak reverse voltage	V_{RM}	30	
Forward current	I_F	20	mA
Operating temperature range	T_{op}	– 55 … + 125	˚C
Storage temperature range	T_{stg}	– 55 … + 150	

Thermal Resistance

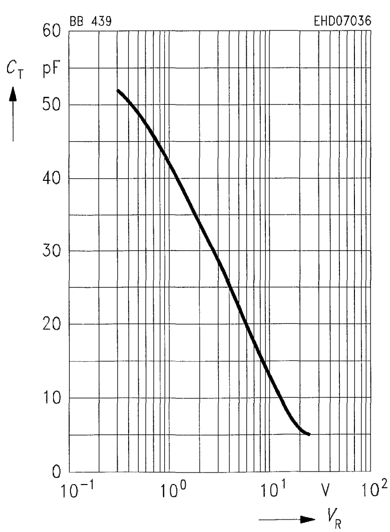
Junction - ambient	$R_{th\,JA}$	≤ 450	K/W

1) For detailed information see chapter Package Outlines.

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

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Reverse current	I_R				nA
V_R = 28 V		–	–	20	
V_R = 28 V, T_A = 60 °C		–	–	200	
Diode capacitance, f = 1 MHz	C_T				pF
V_R = 3 V		26	–	32	
V_R = 25 V		4.3	–	6	
Capacitance ratio, f = 1 MHz V_R = 3 V / 25 V	C_{T3} / C_{T25}	5	–	6.5	–
Capacitance matching V_R = 3 V ... 25 V, f = 1 MHz	ΔC_T / C_T	–	–	3	%
Series resistance f = 100 MHz, C_T = 12 pF	r_s	–	0.35	0.5	Ω
Figure of merit	Q				–
f = 50 MHz, V_R = 3 V		–	280	–	
f = 200 MHz, V_R = 25 V		–	600	–	

Diode capacitance $C_T = f(V_R)$
f = 1 MHz

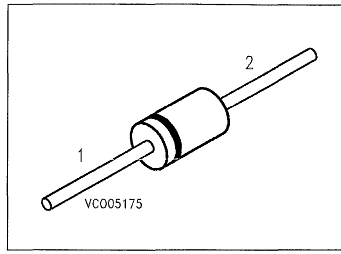


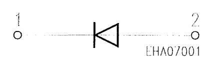
SIEMENS

Silicon Variable Capacitance Diodes

BB 505 B
BB 505 G

- For UHF and VHF tuners
- Not for new design



Type	Marking	Ordering Code	Pin Configuration	Package[1)]
BB 505 B	orange	Q62702-B37		DO-35 DHD
BB 505 G		Q62702-B270		

Maximum Ratings

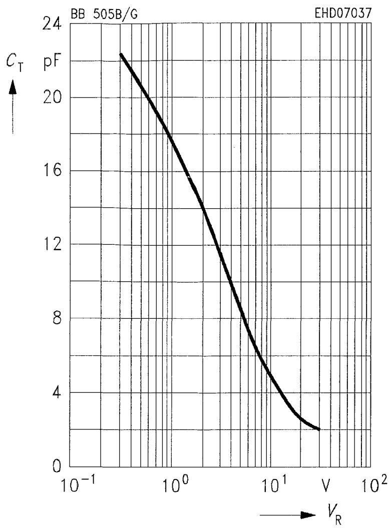
Parameter	Symbol	Values	Unit
Reverse voltage	V_R	28	V
Peak reverse voltage	V_{RM}	30	
Forward current, $T_A \leq 60$ °C	I_F	20	mA
Operating temperature range	T_{op}	– 55 … + 100	°C
Storage temperature range	T_{stg}	– 55 … + 150	

1) For detailed information see chapter Package Outlines.

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

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Reverse current	I_R				
V_R = 28 V		–	–	20	nA
V_R = 28 V, T_A = 60 °C		–	–	0.5	µA
Diode capacitance, f = 1 MHz	C_T				pF
BB 505 B: V_R = 1 V		–	17.5	–	
V_R = 28 V		1.85	–	2.25	
BB 505 G: V_R = 1 V		–	17.5	–	
V_R = 28 V		1.8	–	2.4	
Capacitance ratio, V_R = 1 V, 28 V; f = 1 MHz	$\frac{C_{T1}}{C_{T28}}$				–
BB 505 B		7.7	–	9.4	
BB 505 G		7.5	–	9.5	
Capacitance matching V_R = 0.5 V … 28 V	$\frac{\Delta C_T}{C_T}$	–	–	3	%
Series resistance, C_T = 9 pF, f = 470 MHz	r_s				Ω
BB 505 B		–	–	0.7	
BB 505 G		–	–	1	
Series inductance	L_s	–	3	–	nH
Temperature coefficient of diode capacitance V_R = 1 V, f = 1 MHz	TC_C	–	480	–	ppm/K

Diode capacitance $C_T = f(V_R)$
f = 1 MHz

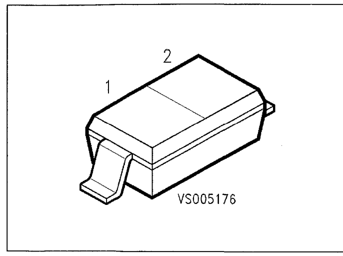


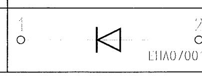
SIEMENS

Silicon Variable Capacitance Diode

BB 512

- For AM tuning applications
- Specified tuning range 1 … 8 V



Type	Marking	Ordering Code (tape and reel)	Pin Configuration	Package[1)]
BB 512	white M	Q62702-B479		SOD-123

Maximum Ratings

Parameter	Symbol	Values	Unit
Reverse voltage	V_R	12	V
Forward current, $T_A \leq 60$ °C	I_F	50	mA
Operating temperature range	T_{op}	– 55 … + 125	°C
Storage temperature range	T_{stg}	– 55 … + 150	

Thermal Resistance

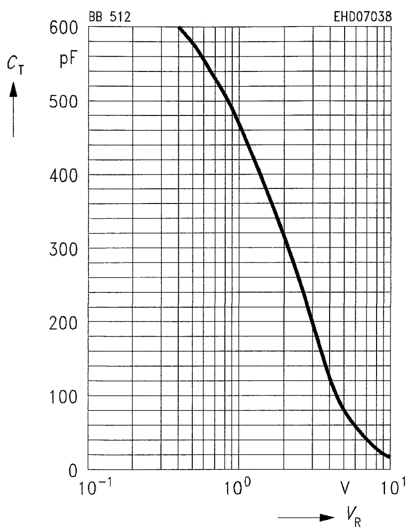
Junction - ambient	$R_{th\,JA}$	≤ 600	K/W

1) For detailed information see chapter Package Outlines.

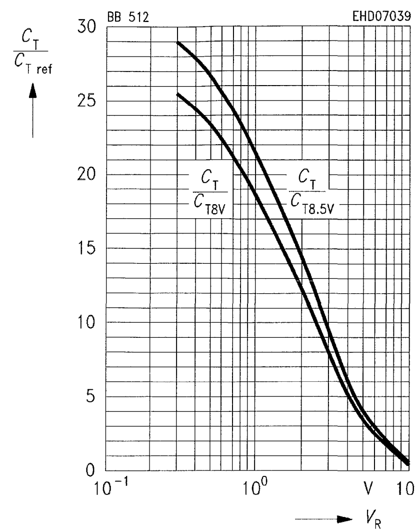
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Reverse current	I_R				nA
V_R = 10 V		–	–	20	
V_R = 10 V, T_A = 60 °C		–	–	200	
Diode capacitance, f = 1 MHz	C_T				pF
V_R = 1 V		440	470	520	
V_R = 8 V		17.5	–	34	
Capacitance ratio V_R = 1 V / 8 V	$\frac{C_{T1}}{C_{T8}}$	15	–	–	–
Series resistance f = 0.5 MHz, V_R = 1 V	r_s	–	1.4	–	Ω
Figure of merit f = 0.5 MHz, V_R = 1 V	Q	–	480	–	–
Temperature coefficient of diode capacitance f = 1 MHz, V_R = 1 V	TC_C	–	500	–	ppm/K
Capacitance matching V_R = 1 ... 8 V	$\frac{\Delta C_T}{C_T}$	–	–	3	%

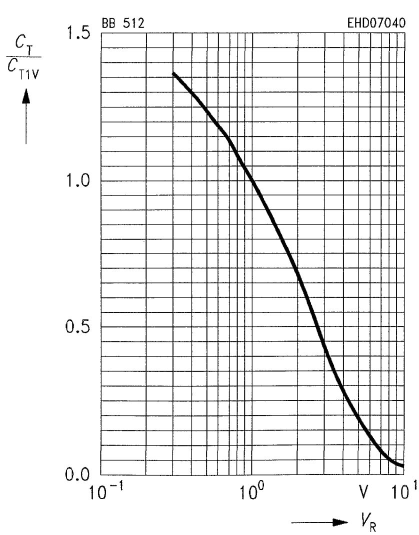
Diode capacitance $C_T = f\ (V_R)$



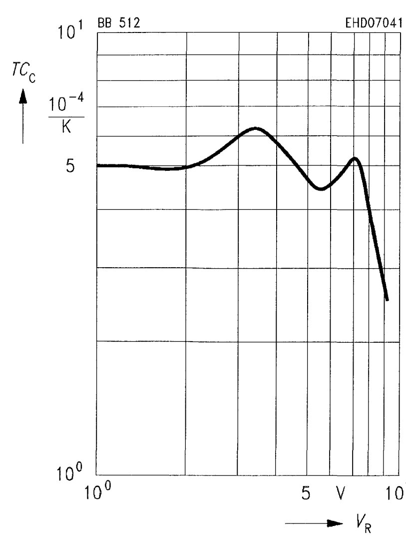
Capacitance ratio $C_T/C_{Tref} = f\ (V_R)$



Capacitance ratio $C_T/C_{T1V} = f\ (V_R)$



Temperature coefficient of junction capacitance $TC_C = f\ (V_R)$

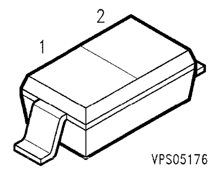


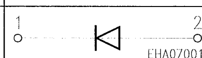
SIEMENS

Silicon Variable Capacitance Diode

BB 515

- For UHF and VHF TV/VTR tuners
- Large capacitance ratio
- Low series resistance



Type	Marking	Ordering Code (tape and reel)	Pin Configuration	Package[1]
BB 515	white S	Q62702-B607		SOD-123

Maximum Ratings

Parameter	Symbol	Values	Unit
Reverse voltage	V_R	30	V
Forward current, $T_A \leq 60$ ˚C	I_F	20	mA
Operating temperature range	T_{op}	– 55 … + 125	˚C
Storage temperature range	T_{stg}	– 55 … + 150	

Thermal Resistance

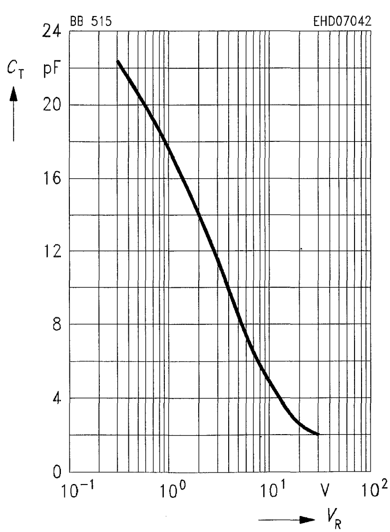
Junction - ambient	$R_{th\,JA}$	≤ 450	K/W

[1] For detailed information see chapter Package Outlines.

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

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Reverse current	I_R				nA
V_R = 30 V		–	–	10	
V_R = 30 V, T_A = 85 ˚C		–	–	200	
Diode capacitance, f = 1 MHz	C_T				pF
V_R = 1 V		17.5	18.7	20	
V_R = 28 V		1.9	2.1	2.3	
Capacitance ratio V_R = 1 V, 28 V; f = 1 MHz	$\frac{C_{T1}}{C_{T28}}$	8.2	8.9	9.8	–
Capacitance matching V_R = 1 V … 28 V; f = 1 MHz	$\frac{\Delta C_T}{C_T}$	–	–	2.5	%
Series resistance C_T = 9 pF, f = 470 MHz	r_s	–	0.5	–	Ω
Series inductance	L_s	–	2	–	nH

Diode capacitance $C_T = f(V_R)$
f = 1 MHz



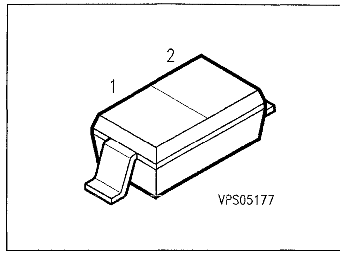
SIEMENS

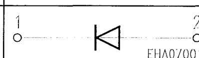
Silicon Variable Capacitance Diode

BB 535

Preliminary Data

- For UHF and VHF TV/VTR tuners
- Large capacitance ratio, low series resistance



Type	Marking	Ordering Code (tape and reel)	Pin Configuration	Package[1)]
BB 535	white S	Q62702-B580		SOD-323

Maximum Ratings

Parameter	Symbol	Values	Unit
Reverse voltage	V_R	30	V
Forward current	I_F	20	mA
Operating temperature range	T_{op}	– 55 … + 125	°C
Storage temperature range	T_{stg}	– 55 … + 150	

Thermal Resistance

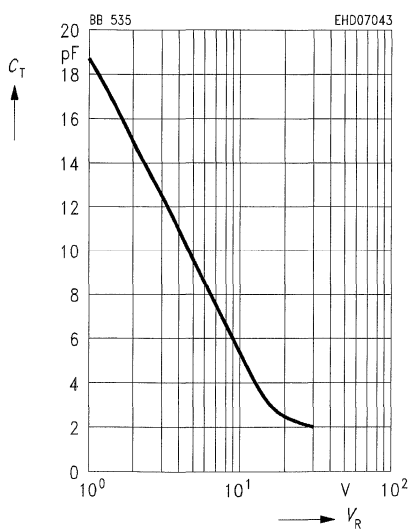
Junction - ambient	$R_{th\,JA}$	≤ 450	K/W

1) For detailed information see chapter Package Outlines.

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

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Reverse current V_R = 30 V V_R = 30 V, T_A = 85 °C	I_R	 – –	 – –	 10 200	nA
Diode capacitance f = 1 MHz V_R = 1 V V_R = 28 V	C_T	 17.5 1.9	 18.7 2.1	 20 2.3	pF
Capacitance ratio f = 1 MHz V_R = 1 V, 28 V	$\frac{C_{T1}}{C_{T28}}$	8.2	8.9	9.8	–
Capacitance matching V_R = 1 V … 28 V, f = 1 MHz	$\frac{\Delta C_T}{C_T}$	–	–	2.5	%
Series resistance C_T = 9 pF, f = 470 MHz	r_S	–	0.5	–	Ω
Series inductance	L_S	–	2	–	nH

Diode capacitance $C_T = f(V_R)$
f = 1 MHz

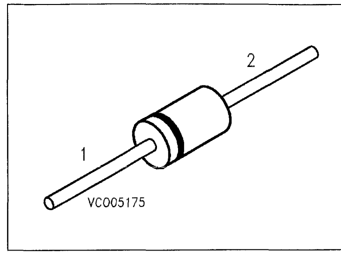


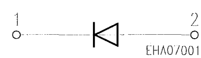
SIEMENS

Silicon Variable Capacitance Diodes

BB 609 A
BB 609 B

- Especially for tuning of extended frequency bands in VHF and CATV tuners
- Not for new design



Type	Marking	Ordering Code	Pin Configuration	Package[1)]
BB 609 A	white	Q62702-B196		DO-35 DHD
BB 609 B		Q62702-B197		

Maximum Ratings

Parameter	Symbol	Values	Unit
Peak reverse voltage	V_{RM}	30	V
Forward current, $T_A \leq 60$ °C	I_F	20	mA
Operating temperature range	T_{op}	– 55 … + 100	°C
Storage temperature range	T_{stg}	– 55 … + 150	

1) For detailed information see chapter Package Outlines.

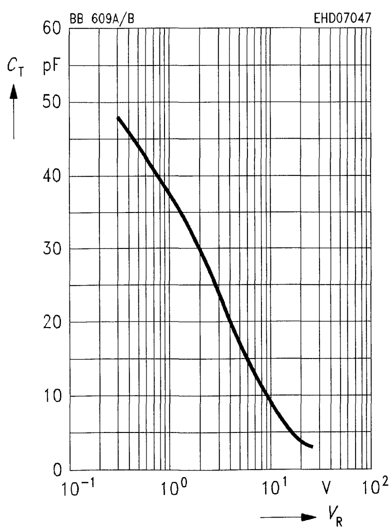
Electrical Characteristics

at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Reverse current V_R = 30 V V_R = 30 V, T_A = 60 °C	I_R	 – –	 – –	 20 200	nA
Diode capacitance, f = 1 MHz BB 609 A: V_R = 1 V V_R = 28 V BB 609 B: V_R = 1 V V_R = 28 V	C_T	 32.5 2.5 33.5 2.8	 – – – –	 – 3 – 3.2	pF
Capacitance ratio V_R = 1 V, 28 V; f = 1 MHz	$\frac{C_{T1}}{C_{T28}}$	12	–	15	–
Capacitance matching V_R = 1 V … 28 V, f = 1 MHz	$\frac{\Delta C_T}{C_T}$	–	–	2.5	%
Series resistance C_T = 12 pF, f = 100 MHz	r_S	–	0.7	1	Ω
Series inductance	L_S	–	3	–	nH

Diode capacitance $C_T = f(V_R)$

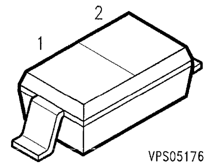
f = 1 MHz

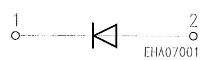


SIEMENS

Silicon Variable Capacitance Diode **BB 619**

- For tuning of extended frequency bands in VHF TV/VTR tuners



Type	Marking	Ordering Code (tape and reel)	Pin Configuration	Package[1)]
BB 619	yellow S	Q62702-B570		SOD-123

Maximum Ratings

Parameter	Symbol	Values	Unit
Reverse voltage	V_R	30	V
Forward current	I_F	20	mA
Operating temperature range	T_{op}	– 55 … + 125	˚C
Storage temperature range	T_{stg}	– 55 … + 150	

Thermal Resistance

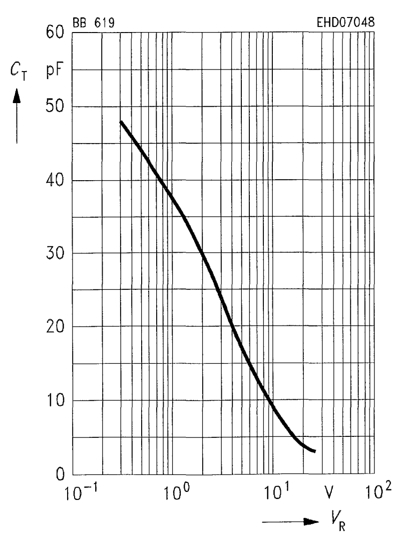
Junction - ambient	$R_{th\,JA}$	≤ 450	K/W

1) For detailed information see chapter Package Outlines.

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

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Reverse current	I_R				nA
V_R = 30 V		–	–	10	
V_R = 30 V, T_A = 85 °C		–	–	200	
Diode capacitance, f = 1 MHz	C_T				pF
V_R = 1 V		36	38.7	42	
V_R = 28 V		2.4	2.6	2.9	
Capacitance ratio V_R = 1 V, 28 V; f = 1 MHz	$\frac{C_{T1}}{C_{T28}}$	13.5	14.9	–	–
Capacitance matching V_R = 1 V ... 28 V; f = 1 MHz	$\frac{\Delta C_T}{C_T}$	–	–	2.5	%
Series resistance C_T = 12 pF, f = 100 MHz	r_s	–	0.6	–	Ω
Series inductance	L_s	–	2	–	nH

Diode capacitance $C_T = f(V_R)$
f = 1 MHz

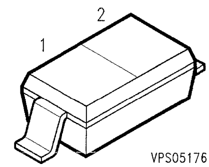


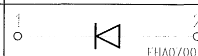
SIEMENS

Silicon Variable Capacitance Diode

BB 620

- For Hyperband TV/VTR tuners, Bd I



Type	Marking	Ordering Code (tape and reel)	Pin Configuration	Package[1]
BB 620	red S	Q62702-B403		SOD-123

Maximum Ratings

Parameter	Symbol	Values	Unit
Reverse voltage	V_R	30	V
Forward current	I_F	20	mA
Operating temperature range	T_{op}	– 55 … + 125	˚C
Storage temperature range	T_{stg}	– 55 … + 150	

Thermal Resistance

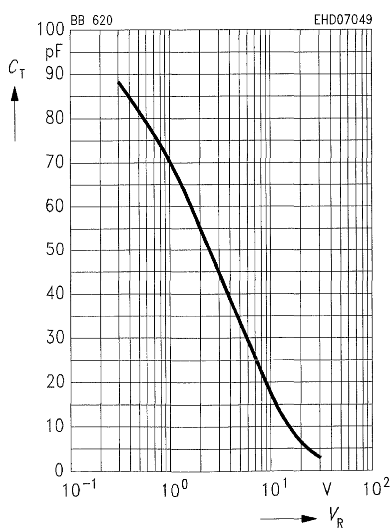
Junction - ambient	$R_{th\,JA}$	≤ 450	K/W

[1] For detailed information see chapter Package Outlines.

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

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Reverse current	I_R				nA
V_R = 30 V		–	–	10	
V_R = 30 V, T_A = 85 ˚C		–	–	200	
Diode capacitance f = 1 MHz	C_T				pF
V_R = 1 V		62	–	76	
V_R = 28 V		2.9	–	3.4	
Capacitance ratio V_R = 1 V, 28 V; f = 1 MHz	$\frac{C_{T1}}{C_{T28}}$	19.5	–	25	–
Capacitance matching V_R = 1 V ... 28 V, f = 1 MHz	$\frac{\Delta C_T}{C_T}$	–	–	2.5	%
Series resistance C_T = 30 pF; f = 100 MHz	r_S	–	1.3	–	Ω
Series inductance	L_S	–	2.8	–	nH

Diode capacitance $C_T = f(V_R)$
f = 1 MHz



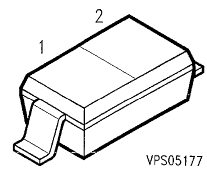
SIEMENS

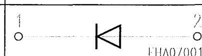
Silicon Variable Capacitance Diode

BB 639

Preliminary Data

- For tuning of extended frequency bands in VHF TV/VTR tuners



Type	Marking	Ordering Code (tape and reel)	Pin Configuration	Package¹⁾
BB 639	yellow S	Q62702-B586		SOD-323

Maximum Ratings

Parameter	Symbol	Values	Unit
Reverse voltage	V_R	30	V
Forward current	I_F	20	mA
Operating temperature range	T_{op}	– 55 ... + 125	˚C
Storage temperature range	T_{stg}	– 55 ... + 150	

Thermal Resistance

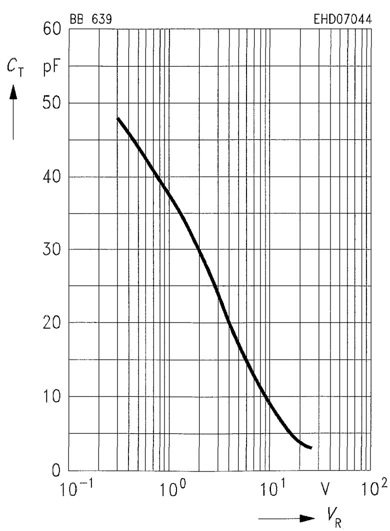
Junction - ambient	$R_{th\,JA}$	≤ 450	K/W

1) For detailed information see chapter Package Outlines.

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

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Reverse current V_R = 30 V V_R = 30 V, T_A = 85 °C	I_R	 – –	 – –	 10 200	nA
Diode capacitance f = 1 MHz V_R = 1 V V_R = 28 V	C_T	 36 2.4	 38.7 2.6	 42 2.9	pF
Capacitance ratio V_R = 1 V, 28 V, f = 1 MHz	$\frac{C_{T1}}{C_{T28}}$	13.5	14.9	–	–
Capacitance matching V_R = 1 V ... 28 V, f = 1 MHz	$\frac{\Delta C_T}{C_T}$	–	–	2.5	%
Series resistance C_T = 12 pF, f = 100 MHz	r_S	–	0.6	–	Ω
Series inductance	L_S	–	2	–	nH

Diode capacitance $C_T = f(V_R)$
f = 1 MHz

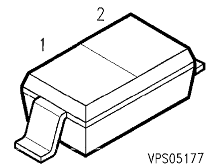


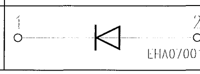
SIEMENS

Silicon Variable Capacitance Diode **BB 640**

Preliminary Data

- For Hyperband TV/VTR tuners, Bd I



Type	Marking	Ordering Code (tape and reel)	Pin Configuration	Package[1)]
BB 640	red S	Q62702-B589		SOD-323

Maximum Ratings

Parameter	Symbol	Values	Unit
Reverse voltage	V_R	30	V
Forward current	I_F	20	mA
Operating temperature range	T_{op}	– 55 … + 125	˚C
Storage temperature range	T_{stg}	– 55 … + 150	

Thermal Resistance

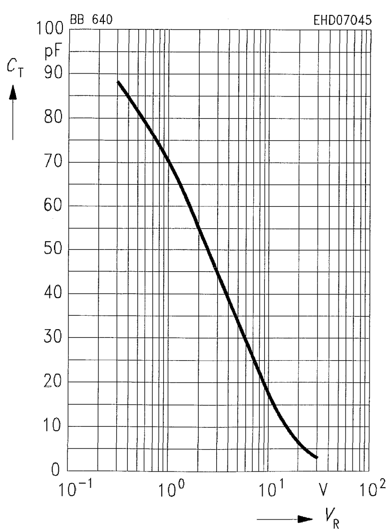
Junction - ambient	$R_{th\,JA}$	≤ 450	K/W

1) For detailed information see chapter Package Outlines.

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

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Reverse current V_R = 30 V V_R = 30 V, T_A = 85 °C	I_R	 – –	 – –	 10 200	nA
Diode capacitance, f = 1 MHz V_R = 1 V V_R = 28 V	C_T	 62 2.9	 – –	 7.6 3.4	pF
Capacitance ratio V_R = 1 V, 28 V, f = 1 MHz	$\frac{C_{T1}}{C_{T28}}$	19.5	–	25	–
Capacitance matching V_R = 1 V … 28 V, f = 1 MHz	$\frac{\Delta C_T}{C_T}$	–	–	2.5	%
Series resistance C_T = 30 pF, f = 100 MHz	r_s	–	1.15	–	Ω
Series inductance	L_S	–	2	–	nH

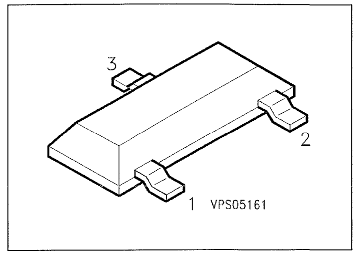
Diode capacitance $C_T = f(V_R)$
f = 1 MHz

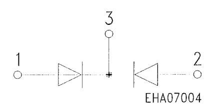


SIEMENS

Silicon Variable Capacitance Diode — BB 804

- For FM tuners
- Monolithic chip with common cathode for perfect tracking of both diodes
- Uniform "square law" characteristics
- Ideal Hifi tuning device when used in low-distortion, back-to-back configuration



Type	Marking	Ordering Code (tape and reel)	Pin Configuration	Package[1)]
BB 804	SF (see Characteristics for marking of capacitance subgroups)	Q62702-B372		SOT-23

Maximum Ratings per Diode

Parameter	Symbol	Values	Unit
Reverse voltage	V_R	18	V
Peak reverse voltage	V_{RM}	20	
Forward current, $T_A \leq 60$ °C	I_F	50	mA
Operating temperature	T_{op}	100	°C
Storage temperature range	T_{stg}	– 65 ... + 150	

Thermal Resistance

Junction - ambient	$R_{th JA}$	≤ 600	K/W

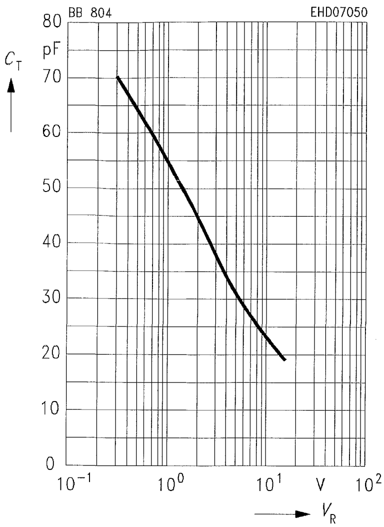
1) For detailed information see chapter Package Outlines.

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

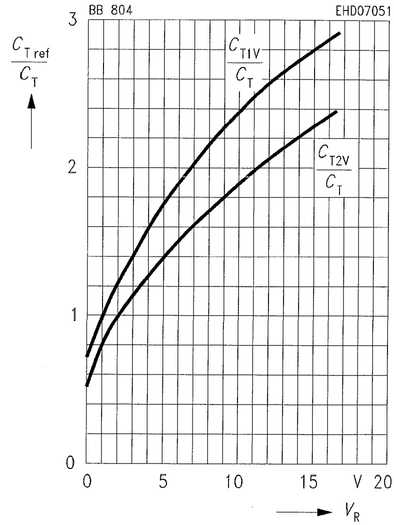
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Reverse current	I_R				nA
V_R = 16 V		–	–	20	
V_R = 16 V, T_A = 60 °C		–	–	200	
Diode capacitance V_R = 2 V, f = 1 MHz	C_T	42	–	47.5	pF
Capacitance ratio V_R = 2 V, 8 V, f = 1 MHz	$\frac{C_{T2}}{C_{T8}}$	1.65	1.71	–	–
Series resistance C_T = 38 pF, f = 100 MHz	r_s	–	0.25	–	Ω
Q factor C_T = 38 pF, f = 100 MHz	Q	–	170	–	–
Temperature coefficient of diode capacitance V_R = 2 V, f = 1 MHz	TC_C	–	330	–	ppm/K
Diode capacitance[1)] V_R = 2 V, f = 1 MHz	C_T				pF
Subgroups: 0		42	–	43.5	
1		43	–	44.5	
2		44	–	45.5	
3		45	–	46.5	
4		46	–	47.5	

1) The capacitance subgroup is marked by the subgroup number printed on the component and the package label. A packaging unit (e.g. 8-mm tape) contains diodes of one subgroup only. Delivery of different capacitance subgroups requires a special agreement.

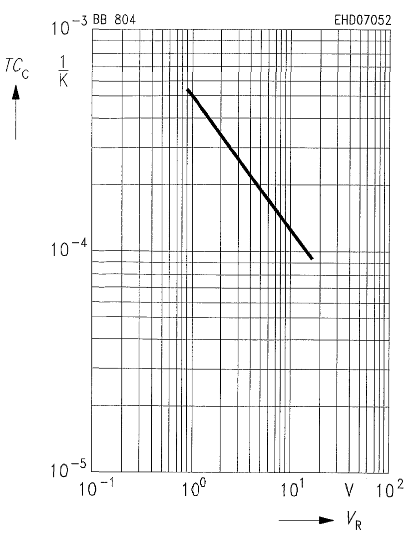
Diode capacitance $C_T = f(V_R)$
per diode, f = 1 MHz



Capacitance ratio $C_{Tref} / C_T = f(V_R)$
per diode; V_{ref} = 1 V, 2 V, f = 1 MHz



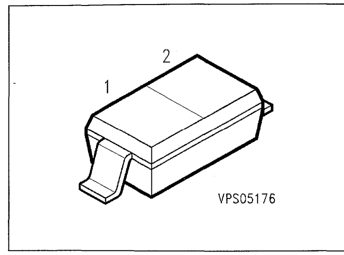
Temperature coefficient $TC_C = f(V_R)$
per diode, f = 1 MHz

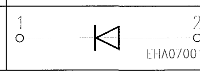


SIEMENS

Silicon Variable Capacitance Diode **BB 811**

- Frequency range up to 2 GHz;
  special design for use in TV-sat indoor units



Type	Marking	Ordering Code (tape and reel)	Pin Configuration	Package[1)]
BB 811	white T	Q62702-B478		SOD-123

Maximum Ratings

Parameter	Symbol	Values	Unit
Reverse voltage	V_R	30	V
Forward current, $T_A \leq 60$ °C	I_F	20	mA
Operating temperature range	T_{op}	– 55 ... + 125	°C
Storage temperature range	T_{stg}	– 55 ... + 150	

Thermal Resistance

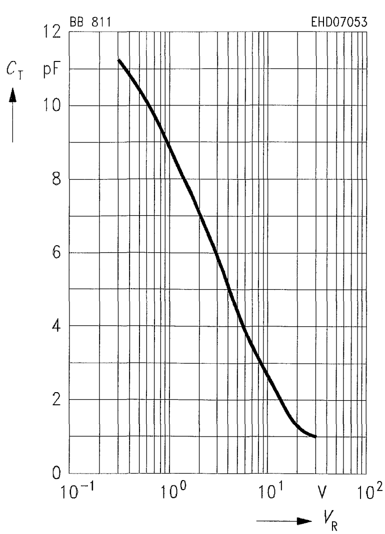
Junction - ambient	$R_{th\,JA}$	≤ 450	K/W

1) For detailed information see chapter Package Outlines.

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

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Reverse current V_R = 30 V V_R = 30 V, T_A = 85 ˚C	I_R	 – –	 – –	 20 500	nA
Diode capacitance, f = 1 MHz V_R = 1 V V_R = 28 V	C_T	 7.8 0.85	 8.8 1.02	 9.8 1.2	pF
Capacitance ratio f = 1 MHz, V_R = 1 V/28 V	$\frac{C_{T1}}{C_{T28}}$	7.8	8.6	9.5	–
Series resistance f = 100 MHz, C_T = 9 pF	r_S	–	1	–	Ω
Case capacitance f = 1 MHz	C_C	–	0.1	–	pF
Capacitance matching f = 1 MHz, V_R = 0.5 … 28 V	$\frac{\Delta C_T}{C_T}$	–	–	3	%
Series inductance	L_S	–	2.8	–	nH

Diode capacitance $C_T = f(V_R)$
f = 1 MHz

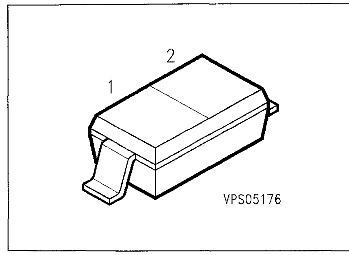


SIEMENS

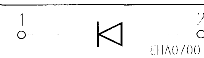
Silicon Tuning Diode

BB 813

Preliminary Data



- Extented frequency range up to 2.5 GHz; special design for use in TV-sat indoor units
- High capacitance ratio

Type	Marking	Ordering Code (tape and reel)	Pin Configuration	Package[1)]
BB 813	white X	Q62702-B623		SOD-123

Maximum Ratings

Parameter	Symbol	Values	Unit
Reverse voltage	V_R	30	V
Forward current	V_F	20	mA
Operation temperature range	T_{op}	– 55 … + 125	˚C
Storage temperature range	T_{stg}	– 55 … + 150	

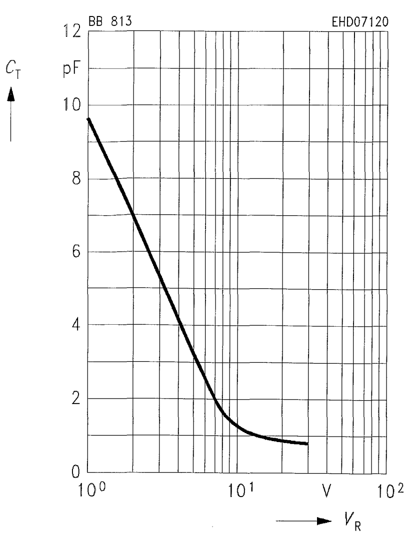
1) For detailed information see chapter Package Outlines.

Electrical Characteristics

at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Reverse current	I_R				nA
V_R = 30 V		–	–	20	
V_R = 30 V, T_A = 85 °C		–	–	500	
Diode capacitance	C_T				pF
f = 1 MHz, V_R = 1 V		8.5	9.3	10	
V_R = 28 V		0.6	0.75	0.9	
Capacitance ratio f = 1 MHz, V_R = 1 V, 28 V	$\frac{C_{T1}}{C_{T28}}$	11	12.4	–	–
Capacitance matching f = 1 MHz, V_R = 1 V ... 28 V	$\frac{\Delta C_T}{C_T}$	–	–	3	%
Series resistance C_T = 9 pF, f = 470 MHz	r_s	–	1.8	–	Ω
Series inductance	L_s	–	–	–	nH

Diode capacitance $C_T = f(V_R)$
f = 1 MHz

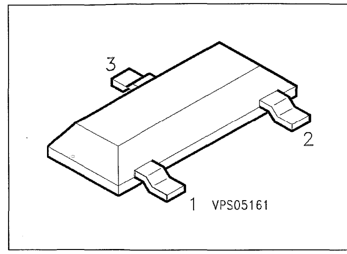


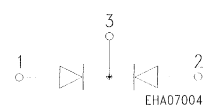
SIEMENS

Silicon Variable Capacitance Diode

BB 814

- For FM radio tuners with extended frequency band
- High tuning ratio at low supply voltage (car radio)
- Monolithic chip (common cathode) for perfect dual diode tracking
- Coded capacitance groups and group matching available



Type	Marking	Ordering Code (tape and reel)	Pin Configuration	Package[1]
BB 814	SF (see Characteristics for marking of capacitance subgroups)	tape: Q62702-B372		SOT-23

Maximum Ratings per Diode

Parameter	Symbol	Values	Unit
Reverse voltage	V_R	18	V
Peak reverse voltage	V_{RM}	20	
Forward current, $T_A \leq 60$ °C	I_F	50	mA
Operating temperature range	T_{op}	– 55 … + 125	°C
Storage temperature range	T_{stg}	– 55 … + 150	

Thermal Resistance

Junction - ambient	$R_{th\,JA}$	≤ 600	K/W

[1] For detailed information see chapter Package Outlines.

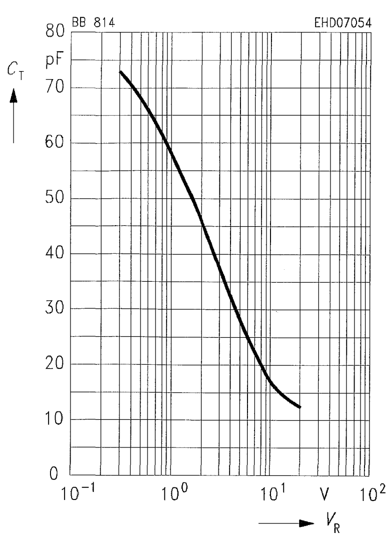
Electrical Characteristics per Diode
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Reverse current V_R = 16 V V_R = 16 V, T_A = 60 °C	I_R	 – –	 – –	 20 200	nA
Diode capacitance f = 1 MHz[1)] V_R = 2 V V_R = 8 V	C_T	 43 18.2	 44.75 20.8	 46.5 24	pF
Capacitance ratio V_R = 2 V, 8 V, f = 1 MHz	$\frac{C_{T2}}{C_{T8}}$	1.95	2.15	2.35	–
Capacitance matching V_R = 2 V, 8 V	$\frac{\Delta C_T}{C_T}$	–	–	3	%

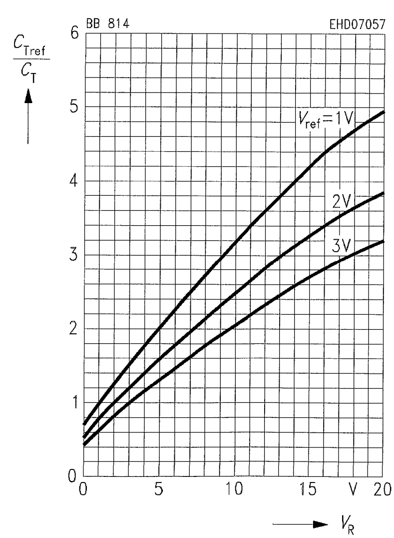
1) Capacitance groups, coded 1, 2

Code	$C_{T\,(2\,V)}$	$C_{T\,(8\,V)}$
1	43 ...45	19.1 ...21.95 pF
2	44.5 ...46.5	19.75 ...22.7 pF

Diode capacitance $C_T = f(V_R)$
per diode, f = 1 MHz



Capacitance ratio $C_{Tref}/C_T = f(V_R)$
per diode, V_{ref} = 1 V, 2 V, 3 V, f = 1 MHz



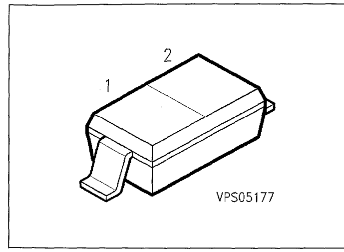
SIEMENS

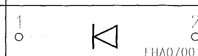
Silicon Variable Capacitance Diode

BB 831

Preliminary Data

- Frequency range up to 2 GHz;
  special design for use in TV-sat indoor units



Type	Marking	Ordering Code (tape and reel)	Pin Configuration	Package[1]
BB 831	white T	Q62702-B592		SOD-323

Maximum Ratings

Parameter	Symbol	Values	Unit
Reverse voltage	V_R	30	V
Forward current	I_F	20	mA
Operating temperature range	T_{op}	– 55 ... + 125	˚C
Storage temperature range	T_{stg}	– 55 ... + 150	

Thermal Resistance

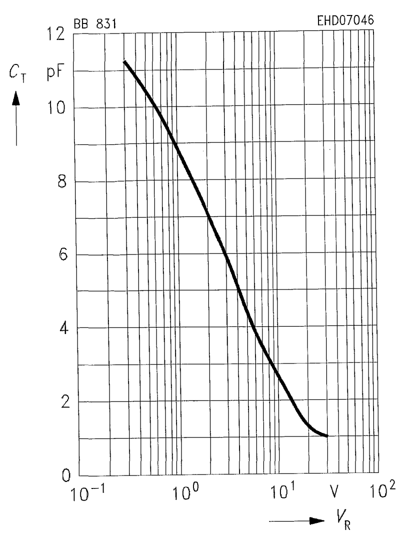
Junction - ambient	$R_{th\,JA}$	≤ 450	K/W

[1] For detailed information see chapter Package Outlines.

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

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Reverse current V_R = 30 V V_R = 30 V, T_A = 85 °C	I_R	 – –	 – –	 20 500	nA
Diode capacitance f = 1 MHz V_R = 1 V V_R = 28 V	C_T	 7.8 0.85	 8.9 1.06	 9.8 1.2	pF
Capacitance ratio f = 1 MHz, V_R = 1 V, 28 V	$\frac{C_{T1}}{C_{T28}}$	7.8	8.4	9.5	–
Capacitance matching V_R = 1 V ... 28 V, f = 1 MHz	$\frac{\Delta C_T}{C_T}$	–	–	3	%
Series resistance C_T = 9 pF, f = 470 MHz	r_S	–	1	–	Ω
Series inductance	L_S	–	2	–	nH

Diode capacitance $C_T = f(V_R)$
f = 1 MHz



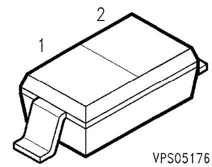
SIEMENS

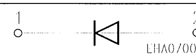
Silicon Tuning Diode

BB 833

Preliminary Data

- Extented frequency range up to 2.5 GHz; special design for use in TV-sat indoor units
- High capacitance ratio



Type	Marking	Ordering Code (tape and reel)	Pin Configuration	Package1)
BB 833	white X	Q62702-B628		SOD-323

Maximum Ratings

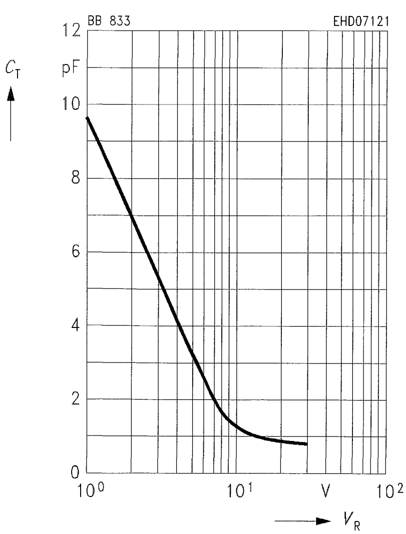
Parameter	Symbol	Values	Unit
Reverse voltage	V_R	30	V
Forward current	V_F	20	mA
Operation temperature range	T_{op}	– 55 ... + 125	°C
Storage temperature range	T_{stg}	– 55 ... + 150	

1) For detailed information see chapter Package Outlines.

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

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Reverse current V_R = 30 V V_R = 30 V, T_A = 85 °C	I_R	 – –	 – –	 20 500	nA
Diode capacitance f = 1 MHz, V_R = 1 V V_R = 28 V	C_T	 8.5 0.6	 9.3 0.75	 10 0.9	pF
Capacitance ratio f = 1 MHz, V_R = 1 V, 28 V	$\frac{C_{T1}}{C_{T28}}$	11	12.4	–	–
Capacitance matching f = 1 MHz, V_R = 1 V ... 28 V	$\frac{\Delta C_T}{C_T}$	–	–	3	%
Series resistance C_T = 9 pF, f = 470 MHz	r_s	–	1.8	–	Ω
Series inductance	L_s	–	–	–	nH

Diode capacitance $C_T = f(V_R)$
f = 1 MHz

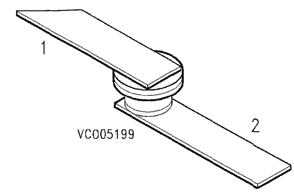


SIEMENS

Silicon Tuning Varactors

BBY 24 ... BBY 27

- Abrupt junction tuning diode
- Tuning range 120 V



Type	Marking	Ordering Code	Pin Configuration	Package[1]
BBY 24-S1	–	Q62702-B20-S1		P
BBY 25-S1		Q62702-B21-S1		
BBY 26-S1		Q62702-B22-S1		
BBY 27-S2		Q62702-B23-S2		

Maximum Ratings

Parameter	Symbol	Values		Unit
		BBY 24 ... 26	BBY 27	
Reverse voltage	V_R	120	140	V
Junction temperature	T_j	175		˚C
Storage temperature range	T_{stg}	– 55 ... + 150		
Operating temperature range	T_{op}	– 55 ... + 150		

[1] For detailed information see chapter Package Outlines.

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

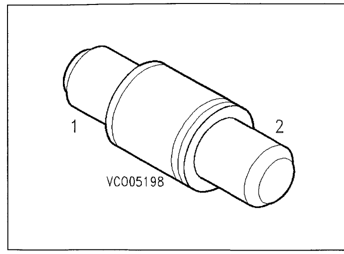
Parameter		Symbol	Values			Unit
			min.	typ.	max.	
Reverse current V_R = 100 V		I_R	–	–	10	nA
Diode capacitance V_R = 0, f = 1 MHz		C_T				pF
	BBY 24		12	–	16	
	BBY 25		16	–	20	
	BBY 26		20	–	24	
	BBY 27		36	–	40	
Capacitance ratio V_{R1} = 0, V_{R2} = 120 V		$\frac{C_{T0}}{C_{T120}}$				–
	BBY 24		8.5	–	–	
	BBY 25		9.0	–	–	
	BBY 26		9.5	–	–	
	BBY 27		9.5	–	–	
Figure of merit V_R = 4 V, f = 50 MHz		Q	200	–	–	–
Slope of characteristics V_{R1} = 0, V_{R2} = 120 V		n	2	–	2.15	–

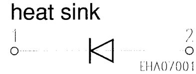
SIEMENS

Silicon Tuning Varactor

BBY 33 BB-2

- Tuning varactor in passivated Mesa technology (epitaxial design)



Type	Marking	Ordering Code	Pin Configuration	Package[1]
BBY 33 BB-2	–	Q62702-B70	Cathode: black dot, heat sink 	C 1

Maximum Ratings

Parameter	Symbol	Values	Unit
Reverse voltage	V_R	27	V
Forward current	I_F	200	mA
Junction temperature	T_j	175	°C
Storage temperature range	T_{stg}	– 55 … + 150	
Operating temperature range	T_{op}	– 55 … + 150	

1) For detailed information see chapter Package Outlines.

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

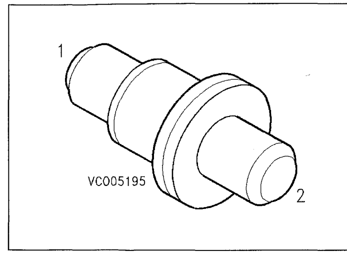
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Forward voltage I_F = 200 mA	V_F	–	–	1.1	V
Reverse current V_R = 15 V	I_R	–	–	5	nA
Diode capacitance V_R = 0	C_T	0.9	–	1.5	pF
Capacitance ratio V_R = 0, V_R = 25 V	$\frac{C_{T0}}{C_{T25}}$	–	3.0	–	–
Figure of merit V_R = 4 V, f = 50 MHz	$Q_{(min)}$	4000	–	–	–

SIEMENS

Silicon Tuning Varactor

BBY 33 DA-2

- Abrupt junction tuning diode
- Tuning range 25 V
- High figure of merit



Type	Marking	Ordering Code (tape and reel)	Pin Configuration	Package[1)]
BBY 33 DA-2	–	Q62702-B127		D

Maximum Ratings

Parameter	Symbol	Values	Unit
Reverse voltage	V_R	30	V
Junction temperature	T_j	175	°C
Storage temperature range	T_{stg}	– 55 ... + 150	
Operating temperature range	T_{op}	– 55 ... + 150	

1) For detailed information see chapter Package Outlines.

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

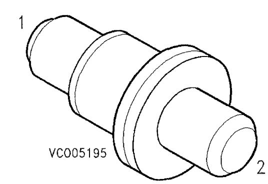
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Reverse current V_R = 20 V	I_R	–	–	5	nA
Diode capacitance V_R = 4 V, f = 1 MHz	C_T	1.7	–	2.1	pF
Capacitance ratio V_{R1} = 0, V_{R2} = 25 V	$\frac{C_{T0}}{C_{T25}}$	3.0	–	–	–
Figure of merit V_R = 4 V, f = 50 MHz	Q	3500	–	–	–

SIEMENS

Silicon Tuning Varactors

BBY 34 C
BBY 34 D

- Hyperabrupt junction tuning diode
- Frequency linear tuning range 4 … 12 V
- High figure of merit



Type	Marking	Ordering Code	Pin Configuration	Package[1)]
BBY 34 C	–	Q62702-B257		D
BBY 34 D		Q62702-B194		

Maximum Ratings

Parameter	Symbol	Values	Unit
Reverse voltage	V_R	22	V
Forward current	I_F	400	mA
Junction temperature	T_j	175	°C
Storage temperature range	T_{stg}	– 55 … + 150	
Operating temperature range	T_{op}	– 55 … + 150	

1) For detailed information see chapter Package Outlines.

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

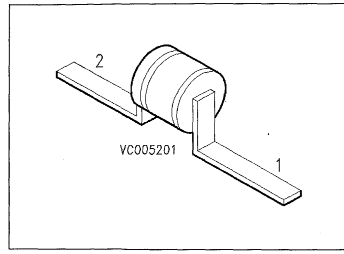
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
BBY 34 C					
Reverse current V_R = 20 V	I_R	–	–	10	nA
Diode capacitance V_R = 2 V, f = 1 MHz V_R = 10 V, f = 1 MHz	C_T	 3.4 –	 – –	 – 1.7	pF
Capacitance ratio V_{R1} = 2 V, V_{R2} = 20 V	$\frac{C_{T2}}{C_{T20}}$	4.3	–	–	–
Figure of merit V_R = 4 V, f = 50 MHz	Q	400	–	–	–
BBY 34 D					
Reverse current V_R = 20 V	I_R	–	–	10	nA
Diode capacitance V_R = 4 V, f = 1 MHz	C_T	3.2	–	3.8	pF
Capacitance ratio V_{R1} = 4 V, V_{R2} = 20 V	$\frac{C_{T4}}{C_{T20}}$	2.7	–	–	–
Figure of merit V_R = 4 V, f = 50 MHz	Q	400	–	–	–

SIEMENS

Silicon Tuning Varactor

BBY 35 F

- Hyperabrupt junction tuning diode
- Frequency linear tuning range 4 … 12 V
- High figure of merit



Type	Marking	Ordering Code	Pin Configuration	Package[1)]
BBY 35 F	–	Q62702-B195	Cathode: black dot, heat sink 1 2 FHA07001	T1

Maximum Ratings

Parameter	Symbol	Values	Unit
Reverse voltage	V_R	22	V
Forward current	I_F	400	mA
Junction temperature	T_j	175	˚C
Storage temperature range	T_{stg}	– 55 … + 150	
Operating temperature range	T_{op}	– 55 … + 150	

1) For detailed information see chapter Package Outlines.

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

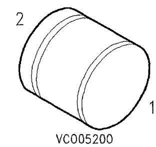
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Breakdown voltage I_R = 10 µA	$V_{(BR)}$	22	–	–	V
Reverse current V_R = 20 V	I_R	–	–	10	nA
Diode capacitance V_{R1} = 4 V, f = 1 MHz V_{R2} = 20 V, f = 1 MHz	C_T	 8.5 2.1	 – –	 10 2.4	pF
Capacitance ratio V_{R1} = 4 V, V_{R2} = 20 V	$\frac{C_{T4}}{C_{T20}}$	3.5	–	–	–
Figure of merit V_R = 4 V, f = 50 MHz	Q	250	350	–	–

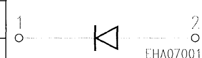
SIEMENS

Silicon Charge Storage Varactors

BXY 18 ...

- Multiplier diode for high frequencies up to 18 GHz



Type	Marking	Ordering Code	Pin Configuration	Package[1]
BXY 18A2	–	Q62702-X140	Cathode: black dot,	T
BXY 18AB2		Q62702-X133		
BXY 18AB5		Q62702-X136		
BXY 18AB6		Q62702-X137		

Maximum Ratings

Parameter	Symbol	Values		Unit
		BXY 18A2 BXY 18AB2	BXY 18AB5 BXY 18AB6	
Reverse voltage	V_R	25	15	V
Junction temperature	T_j	175		°C
Storage temperature range	T_{stg}	– 55 ... + 150		
Operating temperature range	T_{op}	– 55 ... + 150		

Thermal Resistance

Junction – case	$R_{th\,JC}$	110	K/W

[1] For detailed information see chapter Package Outlines.

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

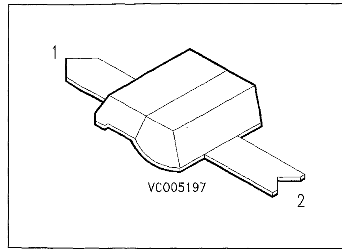
Parameter		Symbol	Values			Unit
			min.	typ.	max.	
Breakdown voltage I_R = 10 µA	BXY 18A2 BXY 18AB2 BXY 18AB5 BXY 18AB6	$V_{(BR)}$	25 25 15 15	– – – –	– – – –	V
Diode capacitance V_R = 0, f = 1 MHz V_R = 6 V, f = 1 MHz	BXY 18A2 BXY 18AB2 BXY 18AB5 BXY 18AB6	C_T	0.7 1.1 0.4 0.25	– – – –	1.3 1.6 0.7 0.5	pF
Storage time I_F = 50 mA, I_R = 100 mA		t_s	–	–	10	ns
Transition time I_F = 50 mA, I_R = 100 mA		t_t	–	–	0.2	
Input power		P_{IN}	–	250	–	mW

SIEMENS

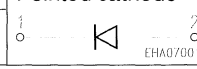
Silicon PIN Diodes

BXY 42BA-S
BXY 42BB-S

- Beam lead version
- Fast switching



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

Type	Marking	Ordering Code	Pin Configuration	Package1)
BXY 42BA-S	–	Q62702-X151	Pointed cathode	S
BXY 42BB-S		Q62702-X159		

Maximum Ratings

Parameter	Symbol	Values		Unit
		BXY 42BA-S	BXY 42BB-S	
Reverse voltage	V_R	50	30	V
Junction temperature	T_j	175		°C
Storage temperature range	T_{stg}	– 55 … + 150		
Operating temperature range	T_{op}	– 55 … + 150		

1) For detailed information see chapter Package Outlines.

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

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Breakdown voltage I_R = 10 μA	$V_{(BR)}$	50	–	–	V
Forward voltage I_F = 50 mA	V_F	–	1.0	–	
Reverse current V_R = 40 V	I_R	–	–	5	nA
Storage time I_F = 10 mA, V_R = 10 V	t_s	–	3	–	ns
Diode capacitance V_R = 30 V, f = 1 MHz	C_T	–	–	0.08	pF
Charge carrier life time I_F = 10 mA, I_R = 6 mA	τ_L	–	30	–	ns
Forward resistance f = 100 MHz, I_F = 10 mA	r_f	–	1.8	–	Ω

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

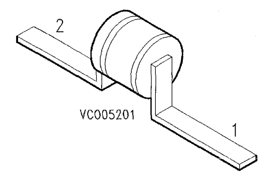
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Breakdown voltage I_R = 10 µA	$V_{(BR)}$	30	–	–	V
Forward voltage I_F = 50 mA	V_F	–	1.1	–	
Reverse current V_R = 20 V	I_R	–	–	5	nA
Storage time I_F = 10 mA, V_R = 10 V	t_s	–	2	–	ns
Diode capacitance V_R = 20 V, f = 1 MHz	C_T	–	–	0.15	pF
Charge carrier life time I_F = 10 mA, I_R = 6 mA	τ_L	–	20	–	ns
Forward resistance f = 100 MHz, I_F = 10 mA	r_f	–	1.3	–	Ω

SIEMENS

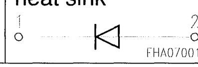
Silicon PIN Diode

BXY 42BA-3

- Fast switching
- In stripline package other lead configurations available



ESD: **E**lectro**st**atic **d**ischarge sensitive device, observe handling precautions!

Type	Marking	Ordering Code	Pin Configuration	Package[1)]
BXY 42BA-3	–	Q62702-X143	Cathode: black dot, heat sink 	T1

Maximum Ratings

Parameter	Symbol	Values	Unit
Reverse voltage	V_R	50	V
Peak forward current, t_p =1 µs	I_{FRM}	5	A
Total power dissipation	P_{tot}	350	mW
Junction temperature	T_j	175	˚C
Storage temperature range	T_{stg}	– 55 ... + 150	
Operating temperature range	T_{op}	– 55 ... + 150	

Thermal Resistance

Junction - ambient	$R_{th\,JA}$	≤ 450	K/W

1) For detailed information see chapter Package Outlines.

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

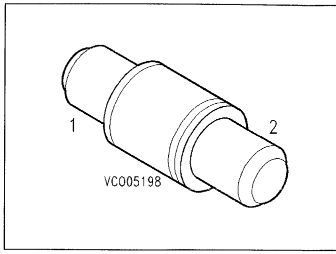
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Breakdown voltage I_R = 10 µA	$V_{(BR)}$	50	–	–	V
Reverse current V_R = 40 V	I_R	–	–	5	nA
Storage time I_F = 10 mA, V_R = 10 V	t_s	–	4	–	ns
Diode capacitance V_R = 20 V, f = 1 MHz	C_T	–	–	0.24	pF
Charge carrier life time I_F = 10 mA, I_R = 6 mA	τ_L	–	40	–	ns
Forward resistance f = 100 MHz, I_F = 10 mA	r_f	–	1.5	–	Ω

SIEMENS

Silicon PIN Diode

BXY 42BA-5

- Fast switching
- Coax package



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

Type	Marking	Ordering Code	Pin Configuration	Package[1]
BXY 42BA-5	–	Q62702-X145	Cathode: black dot, heat sink 	C1

Maximum Ratings

Parameter	Symbol	Values	Unit
Reverse voltage	V_R	50	V
Peak forward current, t_p =1 µs	I_{FRM}	5	A
Total power dissipation	P_{tot}	800	mW
Junction temperature	T_j	175	˚C
Storage temperature range	T_{stg}	– 55 ... + 150	
Operating temperature range	T_{op}	– 55 ... + 150	

1) For detailed information see chapter Package Outlines.

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

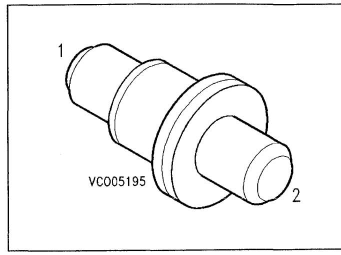
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Breakdown voltage I_R = 10 µA	$V_{(BR)}$	50	–	–	V
Reverse current V_R = 40 V	I_R	–	–	5	nA
Storage time I_F = 10 mA, V_R = 10 V	t_s	–	4	–	ns
Diode capacitance V_R = 20 V, f = 1 MHz	C_T	–	–	0.24	pF
Forward resistance f = 100 MHz, I_F = 10 mA	r_f	–	1.5	–	Ω

SIEMENS

Silicon PIN Diode

BXY 42BA-6

- Fast switching
- Coax package



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

Type	Marking	Ordering Code	Pin Configuration	Package[1)]
BXY 42BA-6	–	Q62702-X146	1 o—▷|—o 2 EHA07001	D

Maximum Ratings

Parameter	Symbol	Values	Unit
Reverse voltage	V_R	50	V
Peak forward current, t_p =1 µs	I_{FRM}	5	A
Total power dissipation	P_{tot}	800	mW
Junction temperature	T_j	175	°C
Storage temperature range	T_{stg}	– 55 ... + 150	
Operating temperature range	T_{op}	– 55 ... + 150	

1) For detailed information see chapter Package Outlines.

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

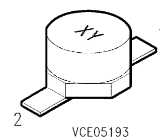
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Breakdown voltage I_R = 10 µA	$V_{(BR)}$	50	–	–	V
Reverse current V_R = 40 V	I_R	–	–	5	nA
Storage time I_F = 10 mA, V_R = 10 V	t_s	–	4	–	ns
Diode capacitance V_R = 20 V, f = 1 MHz	C_T	–	–	0.34	pF
Charge carrier life time I_F = 10 mA, I_R = 6 mA	τ_L	–	40	–	ns
Forward resistance f = 100 MHz, I_F = 10 mA	r_f	–	1.5	–	Ω

SIEMENS

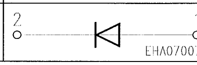
Silicon PIN Diode

BXY 42BA-7

- Fast switching



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

Type	Marking	Ordering Code	Pin Configuration	Package[1]
BXY 42BA-7	27	Q62702-X160		Cerec-X

Maximum Ratings

Parameter	Symbol	Values	Unit
Reverse voltage	V_R	50	V
Peak forward current, t_p = 1 µs	I_{FRM}	5	A
Total power dissipation	P_{tot}	350	mW
Junction temperature	T_j	175	˚C
Storage temperature range	T_{stg}	– 55 … + 150	
Operating temperature range	T_{op}	– 55 … + 150	

Thermal Resistance

Junction – ambient[2]	$R_{th\,JA}$	≤ 450	K/W

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

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

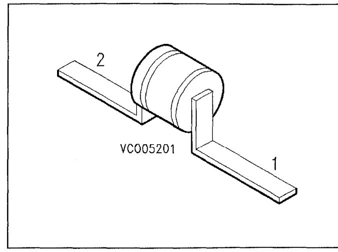
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Breakdown voltage I_R = 10 µA	$V_{(BR)}$	50	–	–	V
Reverse current V_R = 40 V	I_R	–	–	5	nA
Storage time I_F = 10 mA, V_R = 10 V	t_s	–	4	–	ns
Diode capacitance V_R = 20 V, f = 1 MHz	C_T	–	–	0.2	pF
Charge carrier life time I_F = 10 mA, I_R = 6 mA	τ_L	–	40	–	ns
Forward resistance f = 100 MHz, I_F = 10 mA	r_f	–	1.5	–	Ω

SIEMENS

Silicon PIN Diodes

BXY 43

- High-speed switching
- Phase shifting up to 10 GHz
- Power splitter



Type	Marking	Ordering Code	Pin Configuration	Package[1]
BXY 43A	–	Q62702-X116	Cathode: black dot,	T1
BXY 43B		Q62702-X104		
BXY 43C		Q62702-X105		

Maximum Ratings

Parameter	Symbol	Values			Unit
		BXY 43A	BXY 43B	BXY 43C	
Breakdown voltage	$V_{(BR)}$	150	150	150	V
Forward current	I_F	400	500	500	mA
Peak forward current, $t_p = 1\ \mu s$	I_{FRM}	10	20	20	A
Total power dissipation	P_{tot}	500	600	600	mW
Junction temperature	T_j	175			˚C
Storage temperature range	T_{stg}	– 55 ... + 150			
Operating temperature range	T_{op}	– 55 ... + 150			

Thermal Resistance

Junction - case	$R_{th\,JC}$	80	70	70	K/W

[1] For detailed information see chapter Package Outlines.

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

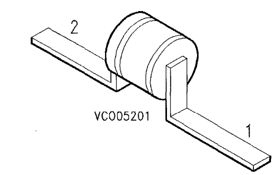
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Reverse current V_R = 100 V	I_R	–	5	–	nA
Forward voltage I_F = 100 mA	V_F	–	1	–	V
AC Characteristics					
Diode capacitance V_R = 50 V, f = 1 MHz	C_T				pF
BXY 43A		–	0.19	0.20	
BXY 43B		–	0.25	0.28	
BXY 43C		–	0.35	0.40	
Forward resistance I_F = 10 mA, f = 100 MHz	r_f				Ω
BXY 43A		–	1.2	–	
BXY 43B		–	1.0	–	
BXY 43C		–	1.0	–	
Charge carrier life time I_F = 10 mA, I_R = 6 mA	τ_L				ns
BXY 43A		–	250	–	
BXY 43B		–	350	–	
BXY 43C		–	350	–	
Storage time I_F = 10 mA, V_R = 10 V	t_s				
BXY 43A		–	15	–	
BXY 43B		–	20	–	
BXY 43C		–	25	–	
Case series inductance	L_s	–	0.3	–	nH
Preaging at forward current for 168 hours	I_L				A
BXY 43A		–	0.2	–	
BXY 43B		–	0.2	–	
BXY 43C		–	0.5	–	
Gross and fine leakage test	–	–	10^{-8}	–	$\frac{\text{torr.1}}{\text{– s}}$

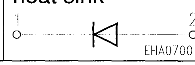
SIEMENS

Silicon PIN Diode

BXY 44K

- Microwave attenuator diode
- Linear RF characteristic



Type	Marking	Ordering Code	Pin Configuration	Package[1]
BXY 44K	–	Q62702-X148	Cathode: black dot, heat sink 	T1

Maximum Ratings

Parameter	Symbol	Values	Unit
Reverse voltage	V_R	200	V
Forward current	I_F	0.5	A
Peak forward current, t_p =1 µs	I_{FRM}	20	
Total power dissipation	P_{tot}	600	mW
Junction temperature	T_j	175	˚C
Storage temperature range	T_{stg}	– 65 … + 150	
Operating temperature range	T_{op}	– 65 … + 150	

[1] For detailed information see chapter Package Outlines.

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

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Breakdown voltage I_R = 10 µA	$V_{(BR)}$	200	–	–	V
Forward voltage I_R = 100 mA	V_F	–	–	1	
Reverse current V_R = 100 V	I_R	–	–	10	nA
Storage time I_F = 10 mA, V_R = 10 V	t_s	–	50	–	ns
Diode capacitance V_R = 50 V, f = 1 MHz	C_T	–	–	0.4	pF
Case capacitance	C_C	–	0.1	–	
Charge carrier life time I_F = 10 mA, I_R = 6 mA	τ_L	–	0.5	–	µs
Forward resistance f = 100 MHz, I_F = 10 µA f = 100 MHz, I_F = 1 mA f = 100 MHz, I_F = 10 mA	r_f	 – – –	 1000 25 3.5	 – – –	Ω

HF-Transistoren

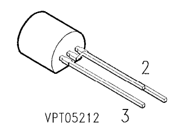
RF Transistors

SIEMENS

NPN Silicon RF Transistor

BF 199

- For common emitter IF TV amplifier stages
- Low feedback capacitance due to shield diffusion



Type	Marking	Ordering Code	Pin Configuration 1	2	3	Package[1)]
BF 199	–	Q62702-F355	C	E	B	TO-92

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CE0}	25	V
Collector-base voltage	V_{CB0}	40	
Emitter-base voltage	V_{EB0}	4	
Collector current	I_C	25	mA
Base current	I_B	2	
Total power dissipation, $T_A \leq 25$ °C	P_{tot}	500	mW
Junction temperature	T_j	150	°C
Storage temperature range	T_{stg}	– 55 … + 150	

Thermal Resistance

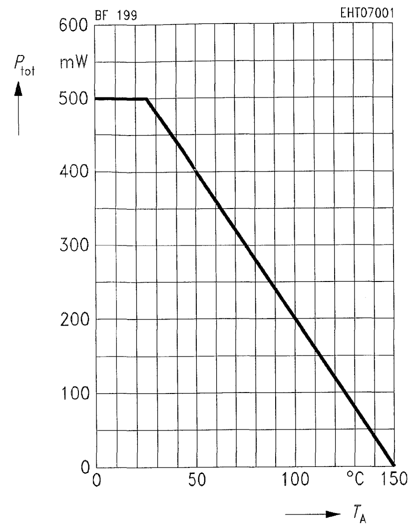
Junction - ambient	$R_{th\,JA}$	≤ 250	K/W

1) For detailed information see chapter Package Outlines.

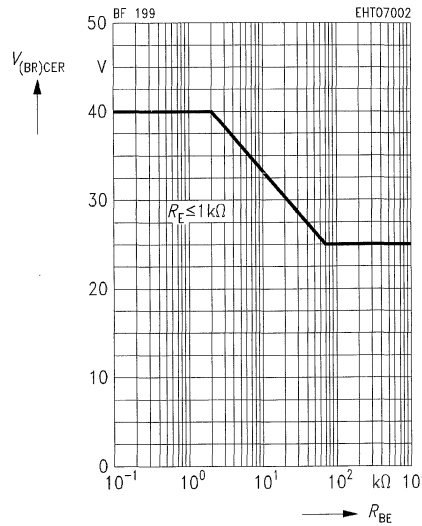
Electrical Characteristics
at T_A = 25 ˚C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector cutoff current V_{CB} = 40 V	I_{CBO}	–	–	100	nA
DC current gain I_C = 7 mA, V_{CE} = 10 V	h_{FE}	38	85	–	–
Base-emitter voltage I_C = 7 mA, V_{CE} = 10 V	V_{BE}	–	780	–	mV
AC Characteristics					
Transition frequency I_C = 5 mA, V_{CE} = 10 V, f = 100 MHz	f_T	–	550	–	MHz
Collector-base capacitance V_{CE} = 10 V, V_{BE} = 0, f = 1 MHz	C_{cb}	–	0.32	–	pF
Optimum power gain I_C = 7 mA, V_{CE} = 10 V, f = 35 MHz	$G_{pe\ opt}$	–	43	–	dB
Y parameters, common emitter I_C = 7 mA, V_{CE} = 10 V, f = 35 MHz	g_{11e} C_{11e} $\|y_{12e}\|$ φ_{12e} $\|y_{21e}\|$ φ_{21e} g_{22e} C_{22e}	– – – – – – – –	4.8 45 70 – 95 175 – 25 80 1.7	– – – – – – – –	mS pF µS deg mS deg µS pF

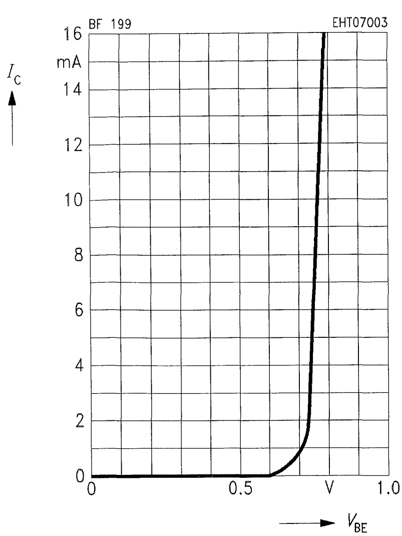
Total power dissipation $P_{tot} = f(T_A)$



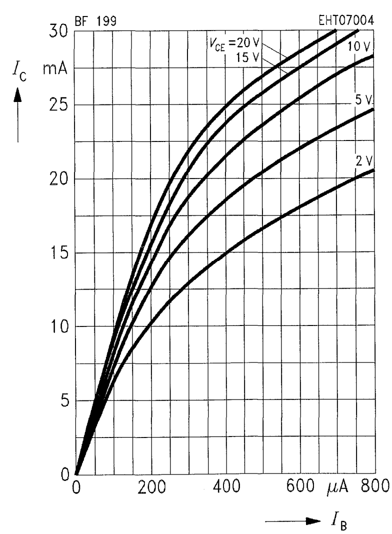
Collector-emitter breakdown voltage $V_{(BR)CER} = f(R_{BE})$



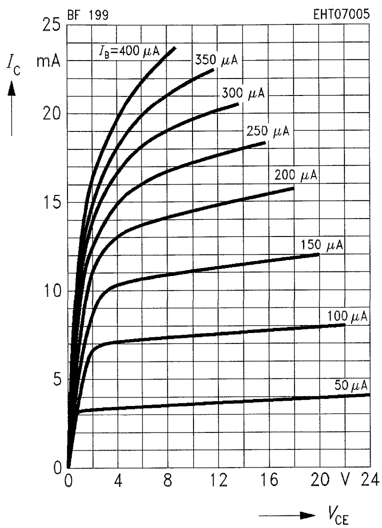
Collector current $I_C = f(V_{BE})$



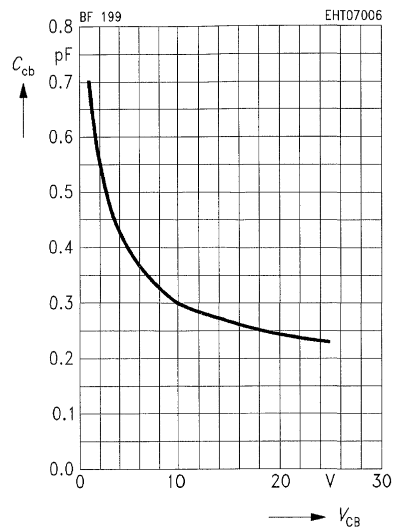
Collector current $I_C = f(I_B)$



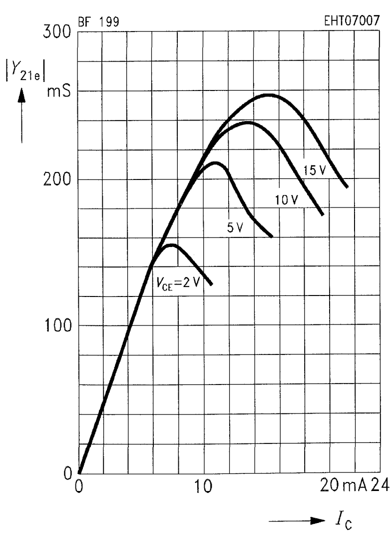
Output characteristics $I_C = f(V_{CE})$



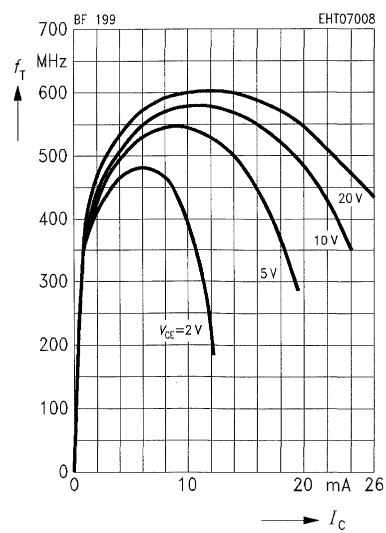
Collector-base capacitance $C_{cb} = f(V_{CB})$
f = 1 MHz



Forward transfer admittance $y_{21e} = f(I_C)$
f = 35 MHz



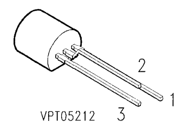
Transition frequency $f_T = f(I_C)$
f = 100 MHz



NPN Silicon RF Transistors

BF 240
BF 241

- For AM and FM stages
- Low feedback capacitance due to shield diffusion
- Low output conductance



Type	Marking	Ordering Code	Pin Configuration 1	2	3	Package[1]
BF 240 BF 241	–	Q62702-F302 Q62702-F1241	C	E	B	TO-92

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CEO}	40	V
Collector-base voltage	V_{CBO}	40	
Emitter-base voltage	V_{EBO}	4	
Collector current	I_C	25	mA
Base current	I_B	2	
Total power dissipation, $T_A \leq 45$ ˚C	P_{tot}	250	mW
Junction temperature	T_j	150	˚C
Storage temperature range	T_{stg}	– 55 ... + 150	

Thermal Resistance

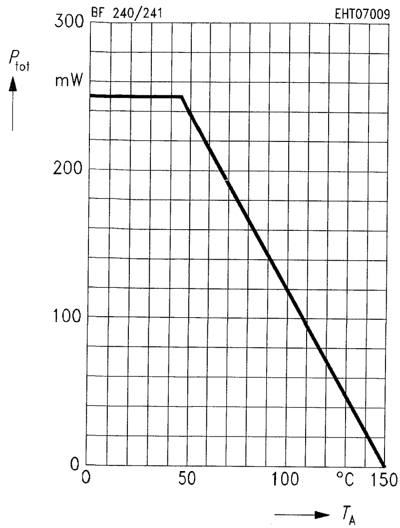
Junction - ambient	$R_{th JA}$	≤ 420	K/W

[1] For detailed information see chapter Package Outlines.

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

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-base breakdown voltage I_C = 10 µA	$V_{(BR)\,CB0}$	40	–	–	V
Emitter-base breakdown voltage I_E = 10 µA	$V_{(BR)\,EB0}$	4	–	–	
Collector cutoff current V_{CB} = 20 V	I_{CB0}	–	–	100	nA
Base-emitter voltage I_C = 1 mA, V_{CE} = 10 V	V_{BE}	–	700	–	mV
DC current gain I_C = 1 mA, V_{CE} = 10 V BF 240 BF 241	h_{FE}	 65 35	 – –	 220 125	–
AC Characteristics					
Transition frequency I_C = 1 mA, V_{CE} = 10 V	f_T	–	400	–	MHz
Collector-base capacitance V_{CE} = 10 V, V_{BE} = 0 V, f = 1 MHz	C_{cb}	–	0.3	–	pF
Noise figure I_C = 1 mA, V_{CE} = 10 V, f = 100 kHz R_S = 300 Ω	F	–	1.7	–	dB
Output conductance I_C = 1 mA, V_{CE} = 10 V, f = 10.7 MHz 0.5 MHz	g_{22e}	 – –	 – –	 10.5 8.3	µS

Total power dissipation $P_{tot} = f(T_A)$

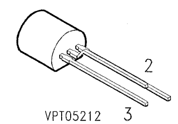


SIEMENS

NPN Silicon RF Transistors

BF 254
BF 255

- For AM and FM stages



Type	Marking	Ordering Code	Pin Configuration 1	2	3	Package[1]
BF 254 BF 255	–	Q62702-F201 Q62702-F202	C	E	B	TO-92

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CE0}	20	V
Collector-base voltage	V_{CES}	30	
Emitter-base voltage	V_{EB0}	5	
Collector current	I_C	30	mA
Total power dissipation, $T_A \leq 45$ ˚C	P_{tot}	250	mW
Junction temperature	T_j	150	˚C
Storage temperature range	T_{stg}	– 65 … + 150	

Thermal Resistance

Junction - ambient	$R_{th\,JA}$	≤ 420	K/W

[1] For detailed information see chapter Package Outlines.

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

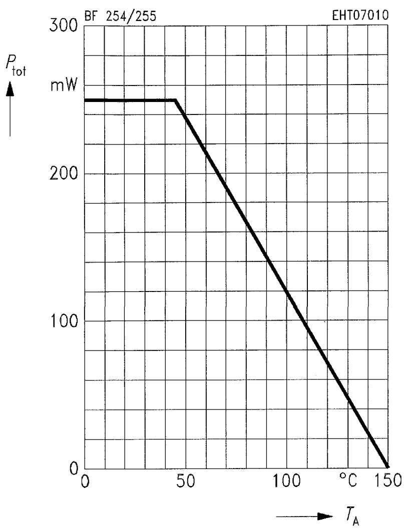
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
DC current gain I_C = 1 mA, V_{CE} = 10 V BF 254 BF 255	h_{FE}	 65 35	 – –	 220 130	–
Base-emitter voltage I_C = 1 mA, V_{CE} = 10 V	V_{BE}	–	0.68	–	V
AC Characteristics					
Transition frequency I_C = 1 mA, V_{CE} = 10 V, f = 100 MHz BF 254 BF 255	f_T	 – –	 260 220	 – –	MHz
Collector-base capacitance V_{CB} = 10 V, V_{BE} = 0 V, f = 1 MHz	C_{cb}	–	0.6	–	pF
Collector-emitter capacitance V_{CE} = 10 V, V_{BE} = 0 V, f = 1 MHz	C_{ce}	–	0.6	–	
Noise figure I_C = 1 mA, V_{CE} = 10 V f = 1 MHz, g_s = 1.5 mS[1)] f = 100 MHz, g_s = 10 mS[1)]	F	 – –	 1.2 3.8	 – –	dB

Y parameters, typical values, I_C = 10 V

f MHz		g_{11} mS	b_{11} mS	$\|y_{12}\|$ µS	φ_{12} deg.	$\|y_{21}\|$ mS	φ_{21} deg.	g_{22} µS	b_{22} µS
Common emitter									
0.45	BF 254	0.3	0.06	1.7	– 90	38	0	3.2	3.4
	BF 255	0.45	0.08	1.7	– 90	38	0	2.7	3.4
10.7	BF 254	0.4	1.5	41	– 90	37	– 10	4	8.1
	BF 255	0.5	1.75	41	– 90	37	– 10	3.8	8.1
Common base									
100	BF 255	34	– 3.5	250	– 85	33	150	18	700

1) g_s = generator conductance

Total power dissipation $P_{tot} = f(T_A)$

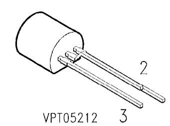


SIEMENS

NPN Silicon RF Transistor

BF 414

- For low-noise, common base VHF and FM stages



Type	Marking	Ordering Code	Pin Configuration 1	2	3	Package[1)]
BF 414	–	Q62702-F517	C	B	E	TO-92

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CEO}	30	V
Collector-base voltage	V_{CBO}	40	
Emitter-base voltage	V_{EBO}	4	
Collector current	I_C	25	mA
Base current	I_B	3	
Total power dissipation, $T_A \leq 45$ °C	P_{tot}	300	mW
Junction temperature	T_j	150	°C
Storage temperature range	T_{stg}	– 55 … + 150	

Thermal Resistance

Junction - ambient	$R_{th\,JA}$	≤ 350	K/W

1) For detailed information see chapter Package Outlines.

Electrical Characteristics

at T_A = 25 °C, unless otherwise specified.

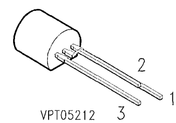
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-emitter breakdown voltage I_C = 2 mA, I_B = 0	$V_{(BR)\,CE0}$	30	–	–	V
Collector-base breakdown voltage I_C = 10 µA, I_E = 0	$V_{(BR)\,CB0}$	40	–	–	
Emitter-base breakdown voltage I_E = 10 µA	$V_{(BR)\,EB0}$	4	–	–	
Collector cutoff current V_{CB} = 20 V	I_{CB0}	–	–	60	nA
DC current gain I_C = 4 mA, V_{CE} = 10 V	h_{FE}	30	80	–	–
AC Characteristics					
Transition frequency I_C = 1 mA, V_{CE} = 10 V, f = 100 MHz I_C = 5 mA, V_{CE} = 10 V, f = 100 MHz	f_T	 – –	 400 560	 – –	MHz
Collector-emitter capacitance V_{CE} = 10 V, V_{BE} = 0 V, f = 1 MHz	C_{ce}	–	0.1	–	pF
Noise figure I_C = 5 mA, V_{CE} = 10 V, f = 100 MHz R_S = 60 Ω	F	–	3	–	dB

SIEMENS

PNP Silicon RF Transistors

BF 450
BF 451

- For common emitter AM and FM stages
- Low feedback capacitance due to shield diffusion



Type	Marking	Ordering Code	Pin Configuration			Package1)
			1	2	3	
BF 450 BF 451	–	Q62702-F312 Q62702-F313	C	E	B	TO-92

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CEO}	40	V
Collector-base voltage	V_{CBO}	40	
Emitter-base voltage	V_{EBO}	4	
Collector current	I_C	25	mA
Base current	I_B	5	
Total power dissipation, $T_A \leq 45$ ˚C	P_{tot}	250	mW
Junction temperature	T_j	150	˚C
Storage temperature range	T_{stg}	– 55 ... + 150	

Thermal Resistance

Junction - ambient	$R_{th\,JA}$	≤ 420	K/W

1) For detailed information see chapter Package Outlines.

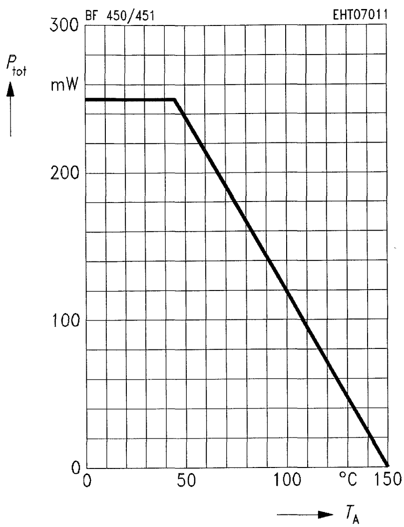
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-emitter breakdown voltage I_C = 2 mA	$V_{(BR)\,CEO}$	40	–	–	V
Collector-base breakdown voltage I_C = 10 µA	$V_{(BR)\,CBO}$	40	–	–	
Emitter-base breakdown voltage I_E = 10 µA	$V_{(BR)\,EBO}$	4	–	–	
Collector cutoff current V_{CB} = 30 V	I_{CBO}	–	–	50	nA
DC current gain I_C = 1 mA, V_{CE} = 10 V BF 450 BF 451	h_{FE}	 65 35	 – –	 220 125	–
Base-emitter voltage I_C = 1 mA, V_{CE} = 10 V	V_{BE}	–	0.72	–	V

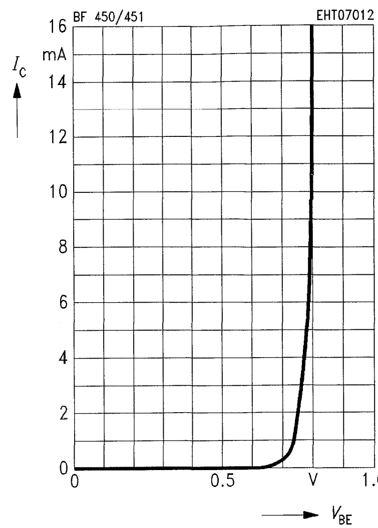
Electrical Characteristics (continued)
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
AC Characteristics					
Transition frequency I_C =1 mA, V_{CE} =10 V, f =100 MHz BF 450 BF 451	f_T	 – –	 375 325	 – –	MHz
Collector-base capacitance V_{CE} =10 V, V_{BE} = 0 V, f =1 MHz	C_{cb}	–	0.32	–	pF
Noise figure V_{CE} = 10 V I_C = 1 mA, f = 100 kHz, R_S = 300 Ω I_C = 2 mA, f = 100 MHz, R_S = 60 Ω	F	 – –	 2 3	 – –	dB
Y parameters, common emitter I_C = 1 mA, V_{CE} = 10 V f = 0.45 ... 10 MHz					
BF 450 BF 451	g_{11e}	– –	0.5 0.8	– –	mS mS
BF 450 BF 451	C_{11e}	– –	17 19	– –	pF pF
	$\|y_{21e}\|$	–	35	–	mS
	C_{22e}	–	1.4	–	pF
 f = 500 kHz f = 10 MHz	g_{22e}	 – –	 – –	 8 10	 µS µS

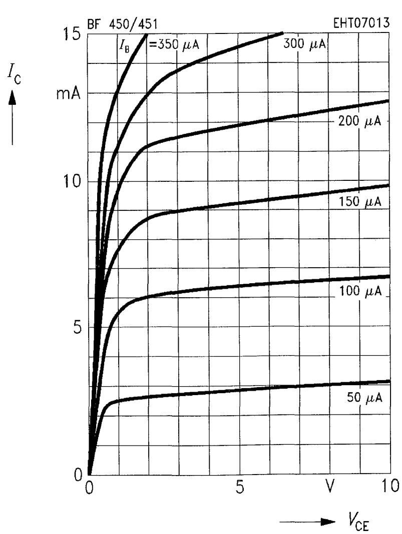
Total power dissipation $P_{tot} = f(T_A)$



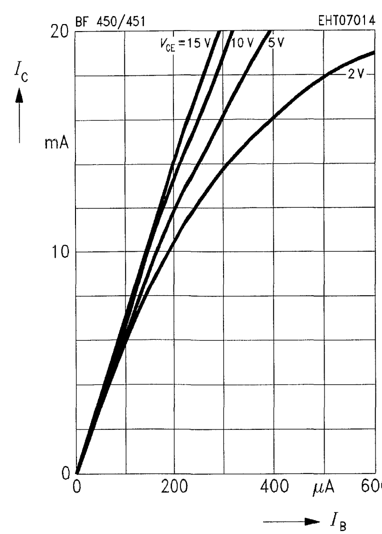
Input characteristics $I_C = f(V_{BE})$
$V_{CE} = 10$ V



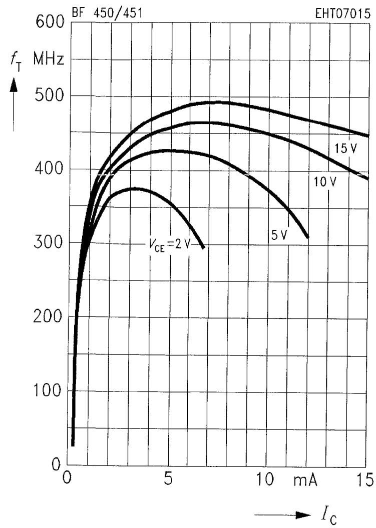
Output characteristics $I_C = f(V_{CE})$



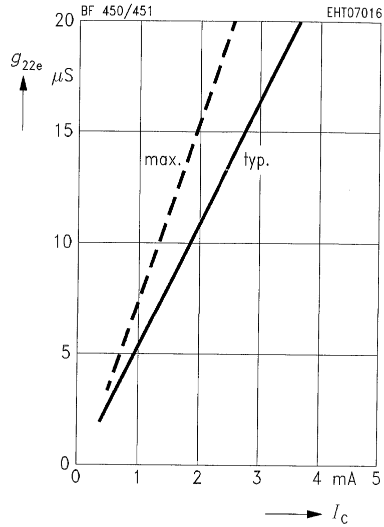
Collector current $I_C = f(I_B)$



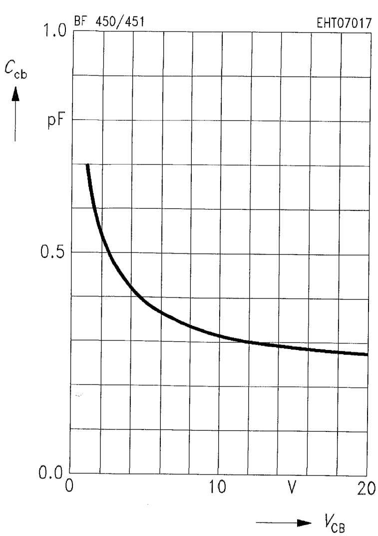
Transition frequency $f_T = f(I_C)$
f = 100 MHz



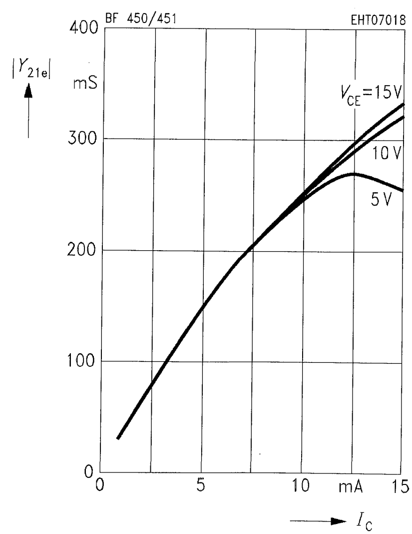
Output conductance $g_{22e} = f(I_C)$
V_{CE} = 10 V, f = 500 kHz



Collector-base capacitance $C_{cb} = f(V_{CB})$
f = 1 MHz

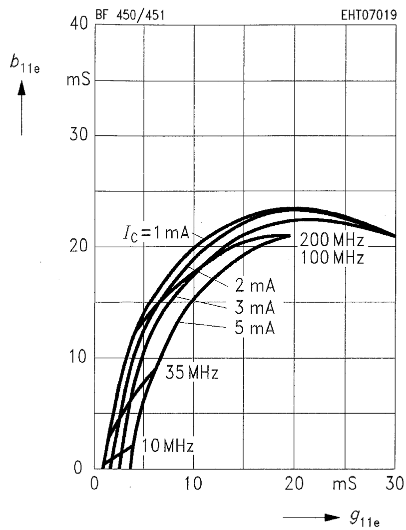


Forward transfer admittance
$|y_{21e}| = f(I_C)$, f = 10.7 MHz



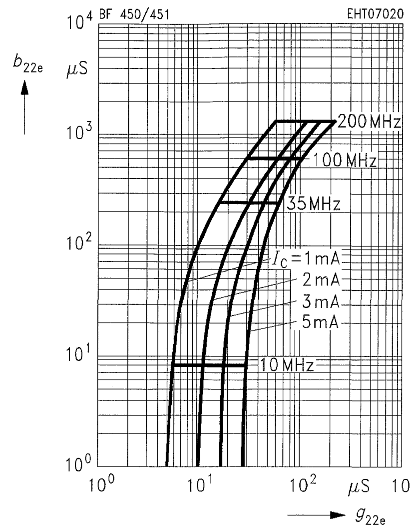
Input admittance y_{11e}

$V_{CE} = 10$ V



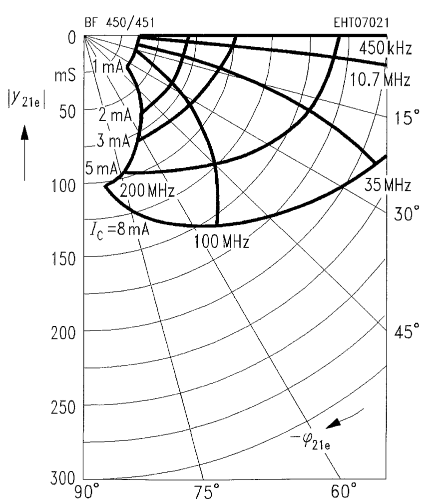
Output admittance y_{22e}

$V_{CE} = 10$ V



Forward transfer admittance y_{21e}

$V_{CE} = 10$ V

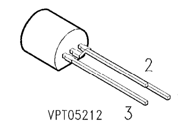


SIEMENS

PNP Silicon RF Transistor

BF 506

- For VHF mixer and oscillator stages



Type	Marking	Ordering Code	Pin Configuration 1	2	3	Package[1)]
BF 506	–	Q62702-F534	C	B	E	TO-92

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CEO}	35	V
Collector-base voltage	V_{CBO}	40	
Emitter-base voltage	V_{EBO}	4	
Collector current	I_C	30	mA
Base current	I_B	5	
Total power dissipation, $T_A \leq 45$ ˚C	P_{tot}	300	mW
Junction temperature	T_j	150	˚C
Storage temperature range	T_{stg}	– 55 … + 150	

Thermal Resistance

Junction - ambient	$R_{th\,JA}$	≤ 350	K/W

1) For detailed information see chapter Package Outlines.

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

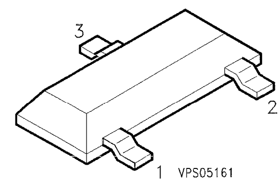
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-emitter breakdown voltage I_C = 2 mA	$V_{(BR)\,CE0}$	35	–	–	V
Collector-base breakdown voltage I_C = 10 µA	$V_{(BR)\,CB0}$	40	–	–	
Emitter-base breakdown voltage I_E = 10 µA	$V_{(BR)\,EB0}$	4	–	–	
Collector cutoff current V_{CB} = 20 V	I_{CB0}	–	–	100	nA
DC current gain I_C = 3 mA, V_{CE} = 10 V	h_{FE}	25	–	–	–
AC Characteristics					
Transition frequency I_C = 2 mA, V_{CE} = 10 V, f = 100 MHz	f_T	–	550	–	MHz
Collector-emitter capacitance V_{CB} = 10 V, V_{BE} = 0 V, f = 1 MHz	C_{ce}	–	0.12	–	V
Noise figure I_C = 2 mA, V_{CB} = 10 V, f = 200 MHz R_S = 60 Ω	F	–	3	–	dB

SIEMENS

NPN Silicon RF Transistor

BF 517

- For amplifier and oscillator applications in TV-tuners



ESD: Electrostatic discharge sensitive device, observe handling precautions!

Type	Marking	Ordering Code (tape and reel)	Pin Configuration 1	2	3	Package[1]
BF 517	LR	Q62702-F42	B	E	C	SOT-23

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CE0}	15	V
Collector-base voltage	V_{CB0}	20	
Emitter-base voltage	V_{EB0}	3	
Collector current	I_C	25	mA
Base current	I_B	5	
Total power dissipation, $T_S \leq 55$ °C[3]	P_{tot}	280	mW
Junction temperature	T_j	150	°C
Storage temperature range	T_{stg}	– 65 … + 150	
Ambient temperature range	T_A	– 65 … + 150	

Thermal Resistance

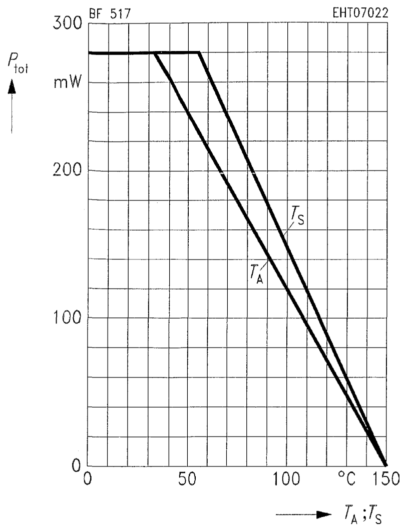
Parameter	Symbol	Values	Unit
Junction - ambient[2]	$R_{th\,JA}$	≤ 420	K/W
Junction - soldering point[3]	$R_{th\,JS}$	≤ 340	

1) For detailed information 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.

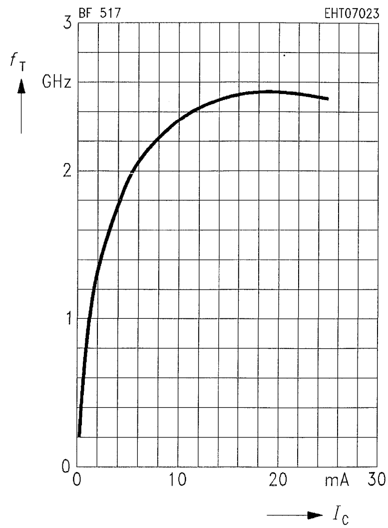
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CE0}$	15	–	–	V
Collector-base cutoff current V_{CB} = 15 V, I_E = 0	I_{CB0}	–	–	50	nA
DC current gain I_C = 5 mA, V_{CE} = 10 V	h_{FE}	25	–	250	–
Collector-emitter saturation voltage I_C = 10 mA, I_B = 1 mA	$V_{CE\,sat}$	–	0.1	0.5	V
AC Characteristics					
Transition frequency I_C = 5 mA, V_{CE} = 10 V, f = 200 MHz	f_T	1	2	–	GHz
Collector-base capacitance V_{CB} = 10 V, V_{BE} = v_{be} = 0 V, f = 1 MHz	C_{cb}	0.3	0.5	0.75	pF
Collector-emitter capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0 V, f = 1 MHz	C_{ce}	–	0.26	0.4	
Input capacitance V_{EB} = 0.5 V, I_C = i_c = 0, f = 1 MHz	C_{ibo}	–	1.2	–	
Output capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{obs}	–	0.8	–	
Noise figure I_C = 5 mA, V_{CE} = 10 V, f = 100 MHz, Z_S = 75 Ω	F	–	2.5	–	dB

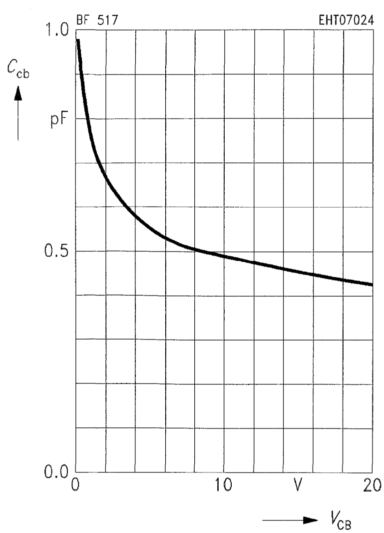
Total power dissipation $P_{tot} = f(T_A^*; T_S)$
*Package mounted on alumina



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

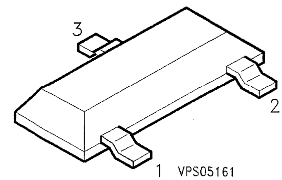


SIEMENS

Silicon N Channel MOS FET Triode — BF 543

Preliminary Data

- For RF stages up to 300 MHz preferably in FM applications
- I_{DSS} = 4 mA, g_{fs} = 12 mS



ESD: Electrostatic discharge sensitive device, observe handling precautions!

Type	Marking	Ordering Code (tape and reel)	Pin Configuration 1	2	3	Package[1)]
BF 543	LD	Q62702-F1372	G	D	S	SOT-23

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	20	V
Drain current	I_D	30	mA
Gate-source peak current	$\pm I_{GSM}$	10	
Total power dissipation, $T_A \leq 60$ °C	P_{tot}	200	mW
Storage temperature range	T_{stg}	– 55 ... + 150	°C
Channel temperature	T_{ch}	150	
Ambient temperature range	T_A	– 55 ... + 150	

Thermal Resistance

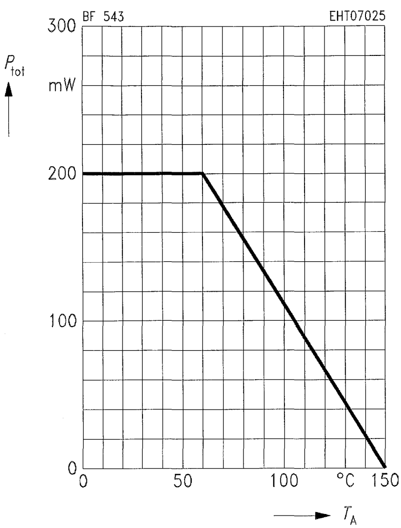
Junction - ambient[2)]	$R_{th\,JA}$	≤ 450	K/W

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

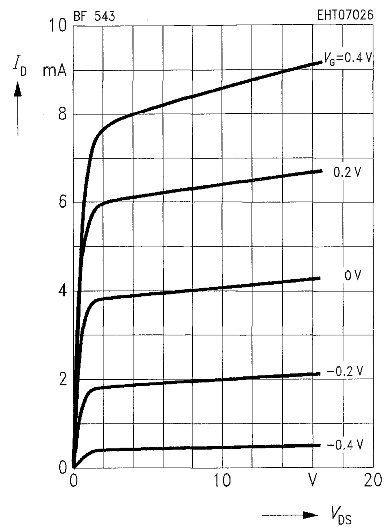
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Drain-source breakdown voltage I_D = 10 µA, $-V_{GS}$ = 4 V	$V_{(BR)DS}$	20	–	–	V
Gate-source breakdown voltage $\pm I_{GS}$ = 10 mA, V_{DS} = 0	$\pm V_{(BR)GSS}$	7	–	12	
Gate cutoff current $\pm V_{GS}$ = 6 V, V_{DS} = 0	$\pm I_{GSS}$	–	–	50	nA
Drain current V_{DS} = 10 V, V_{GS} = 0	I_{DSS}	2.0	4	6.0	mA
Gate-source pinch-off voltage V_{DS} = 10 V, I_D = 20 µA	$-V_{GS(p)}$	–	0.7	1.5	V
AC Characteristics					
Forward transconductance V_{DS} = 10 V, I_D = 4 mA, f = 1 kHz	g_{fs}	9.5	12	–	mS
Gate-1 input capacitance V_{DS} = 10 V, I_D = 4 mA, f = 1 MHz	C_{gss}	–	2.7	–	pF
Reverse transfer capacitance V_{DS} = 10 V, I_D = 4 mA, f = 1 MHz	C_{dg}	–	18	–	fF
Output capacitance V_{DS} = 10 V, I_D = 4 mA, f = 1 MHz	C_{dss}	–	0.9	–	pF
Power gain (test circuit) V_{DS} = 10 V, I_D = 4 mA, f = 200 MHz G_G = 2 mS, G_L = 0.5 mS	G_p	–	22	–	dB
Noise figure (test circuit) V_{DS} = 10 V, I_D = 4 mA, f = 200 MHz G_G = 2 mS, G_L = 0.5 mS	F	–	1	–	

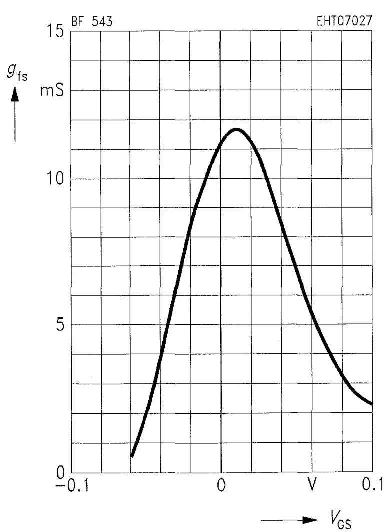
Total power dissipation $P_{tot} = f(T_A)$



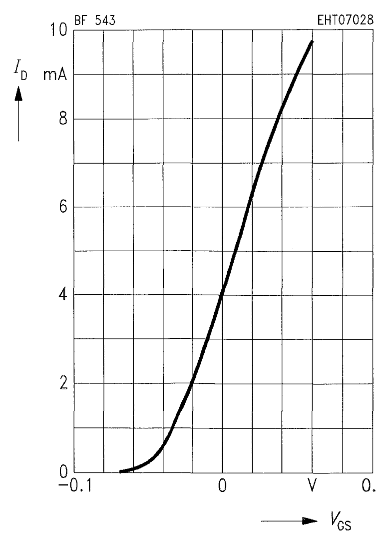
Typ. output characteristics $I_D = f(V_{DS})$



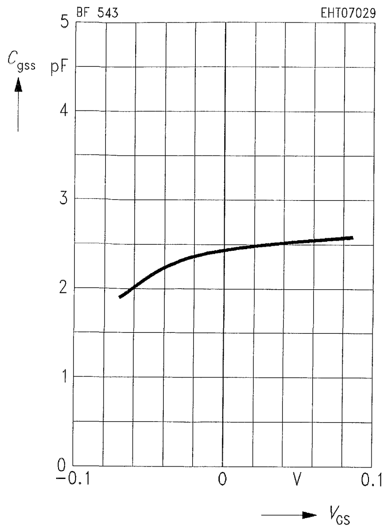
Gate transconductance $g_{fs} = f(V_{GS})$
V_{DS} = 10 V, I_{DSS} = 4 mA, f = 1 kHz



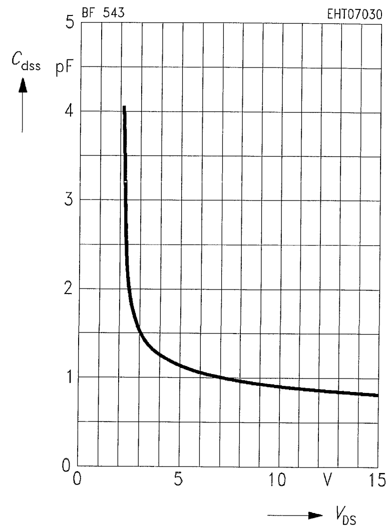
Drain current $I_D = f(V_{GS})$
V_{DS} = 10 V



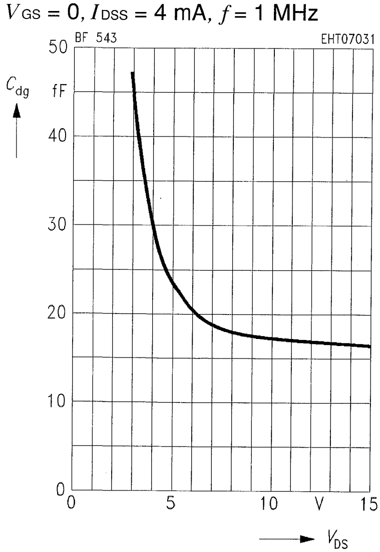
Gate input capacitance $C_{gss} = f(V_{GS})$
V_{DS} = 10 V, I_{DSS} = 4 mA, f = 1 MHz



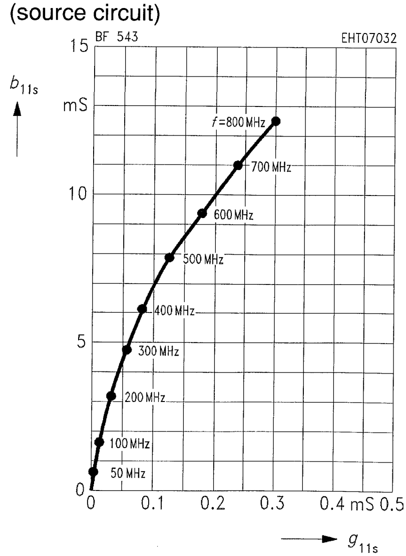
Output capacitance $C_{dss} = f(V_{DS})$
V_{GS} = 0, I_{DSS} = 4 mA, f = 1 MHz



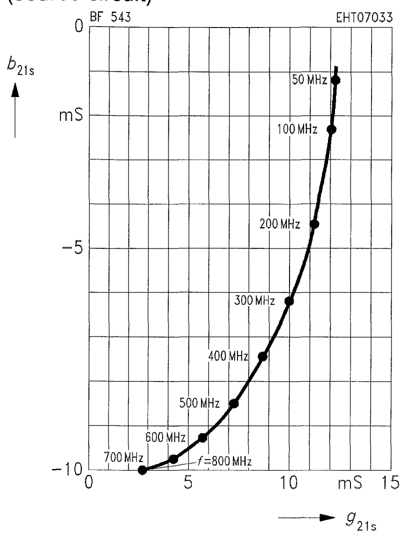
Reverse transfer capacitance
$C_{dg} = f(V_{DS})$
V_{GS} = 0, I_{DSS} = 4 mA, f = 1 MHz



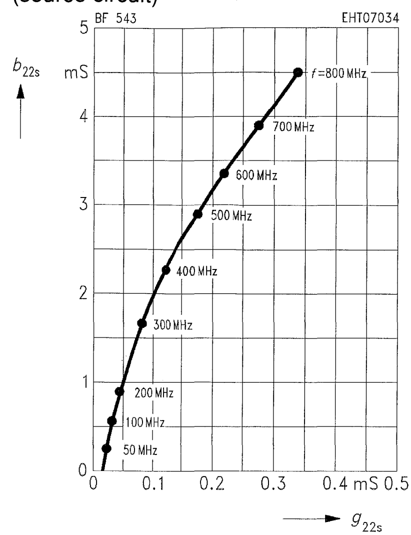
Gate 1 input admittance y_{11s}
V_{DS} = 10 V, I_{DSS} = 4 mA, V_{GS} = 0
(source circuit)



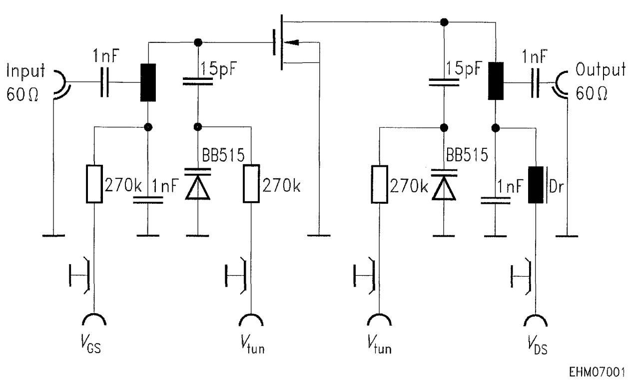
Gate 1 transconductance y_{21s}
V_{DS} = 10 V, I_{DSS} = 4 mA, V_{GS} = 0
(source circuit)



Output admittance y_{22s}
V_{DS} = 10 V, I_{DSS} = 10 mA, V_{GS} = 0
(source circuit)



Test circuit for power gain G_p and noise figure F
f = 200 MHz, G_G = 2 mS, G_L = 0.5 mS

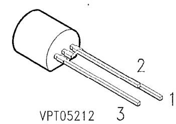


Silicon N Channel MOS FET Triode

BF 544

Preliminary Data

- For RF stages up to 300 MHz preferably in FM applications
- I_{DSS} = 4 mA, g_{fs} = 12 mS



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

Type	Marking	Ordering Code (tape and reel)	Pin Configuration 1	2	3	Package[1)]
BF 544	BF 544	Q62702-F1231	D	S	G	TO-92

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	20	V
Drain current	I_D	30	mA
Gate-source peak current	$\pm I_{GSM}$	10	
Total power dissipation, $T_A \leq 60$ ˚C	P_{tot}	200	mW
Storage temperature range	T_{stg}	– 55 … + 150	˚C
Channel temperature	T_{ch}	150	
Ambient temperature range	T_A	– 55 … + 150	

Thermal Resistance

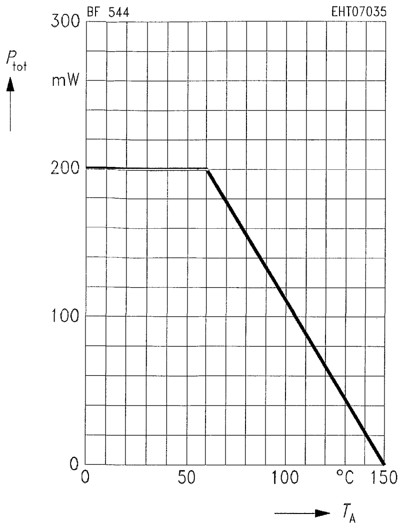
Junction - ambient	$R_{th\,JA}$	≤ 450	K/W

1) For detailed information see chapter Package Outlines.

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

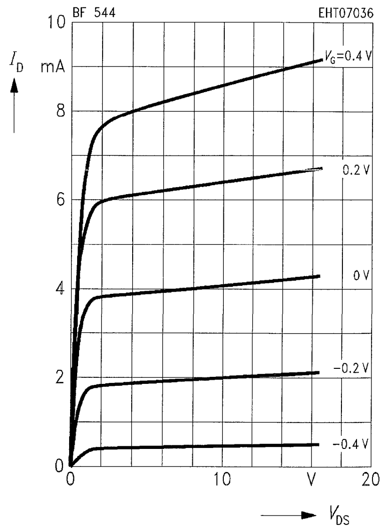
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Drain-source breakdown voltage I_D = 10 µA, – V_{GS} = 4 V	$V_{(BR)DS}$	20	–	–	V
Gate-source breakdown voltage ± I_{GS} = 10 mA, V_{DS} = 0	± $V_{(BR)GSS}$	7	–	12	
Gate cutoff current ± V_{GS} = 6 V, V_{DS} = 0	± I_{GSS}	–	–	50	nA
Drain current V_{DS} = 10 V, V_{GS} = 0	I_{DSS}	2.0	4	6.0	mA
Gate-source pinch-off voltage V_{DS} = 10 V, I_D = 20 µA	– $V_{GS(p)}$	–	0.7	1.5	V
AC Characteristics					
Forward transconductance V_{DS} = 10 V, I_D = 4 mA, f = 1 kHz	g_{fs}	9.5	12	–	mS
Gate-1 input capacitance V_{DS} = 10 V, I_D = 4 mA, f = 1 MHz	C_{gss}	–	2.8	–	pF
Reverse transfer capacitance V_{DS} = 10 V, I_D = 4 mA, f = 1 MHz	C_{dg}	–	35	–	fF
Output capacitance V_{DS} = 10 V, I_D = 4 mA, f = 1 MHz	C_{dss}	–	1	–	pF
Power gain (test circuit) V_{DS} = 10 V, I_D = 4 mA, f = 200 MHz G_G = 2 mS, G_L = 0.5 mS	G_p	–	22	–	dB
Noise figure (test circuit) V_{DS} = 10 V, I_D = 4 mA, f = 200 MHz G_G = 2 mS, G_L = 0.5 mS	F	–	1	–	

Total power dissipation $P_{tot} = f\,(T_A)$



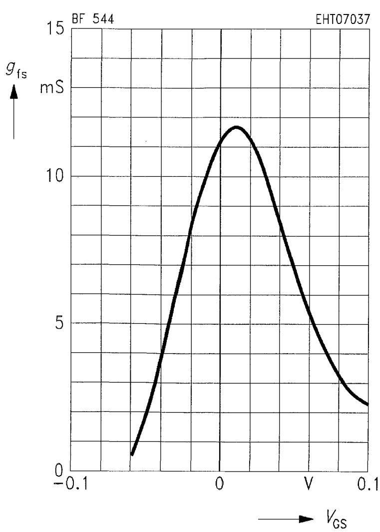
Typ. output characteristics

$I_D = f\,(V_{DS})$



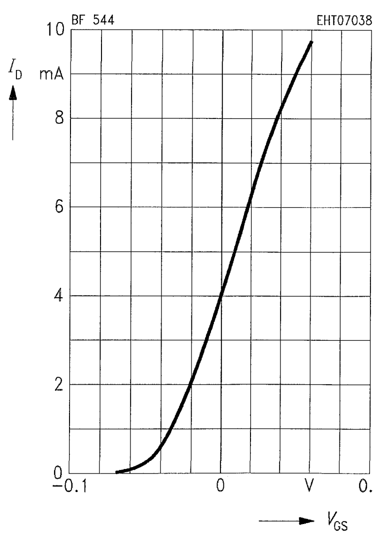
Gate transconductance $g_{fs} = f\,(V_{GS})$

V_{DS} = 10 V, I_{DSS} = 4 mA, f = 1 kHz

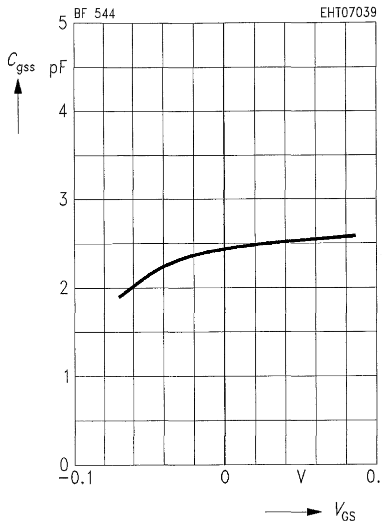


Drain current $I_D = f\,(V_{GS})$

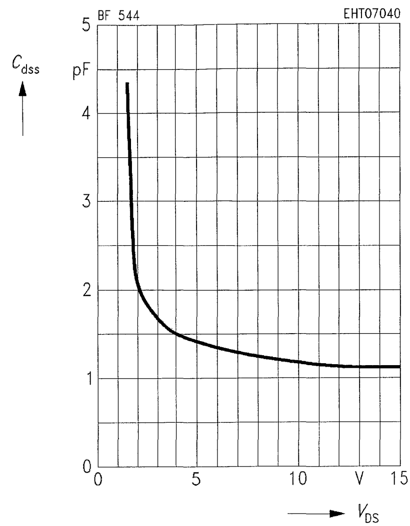
V_{DS} = 10 V



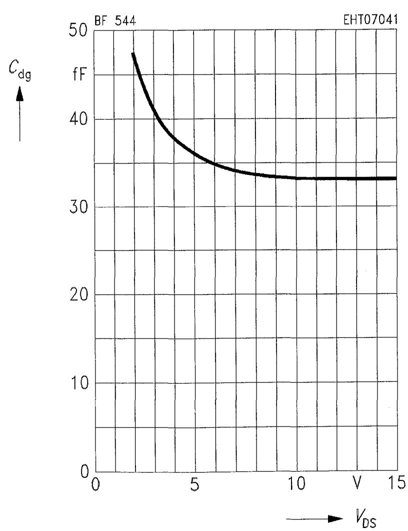
Gate input capacitance $C_{gss} = f(V_{GS})$
V_{DS} = 10 V, I_{DSS} = 4 mA, f = 1 MHz



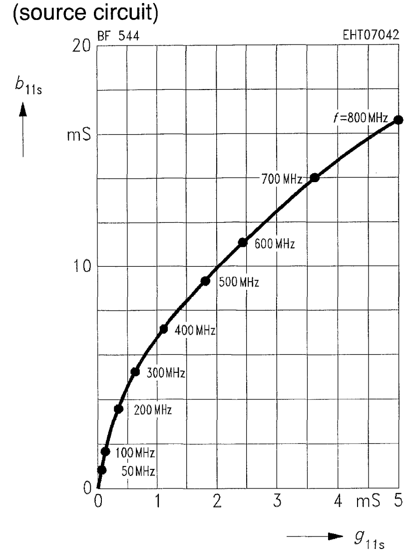
Output capacitance $C_{dss} = f(V_{DS})$
V_{GS} = 0, I_{DSS} = 4 mA, f = 1 MHz



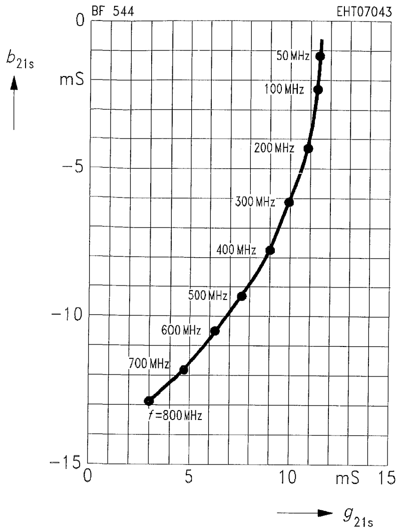
Reverse transfer capacitance $C_{dg} = f(V_{DS})$
V_{GS} = 0, I_{DSS} = 4 mA, f = 1 MHz



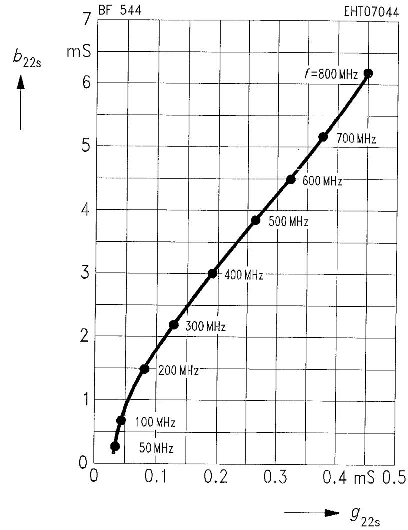
Gate 1 input admittance y_{11s}
V_{DS} = 10 V, I_{DSS} = 4 mA, V_{GS} = 0
(source circuit)



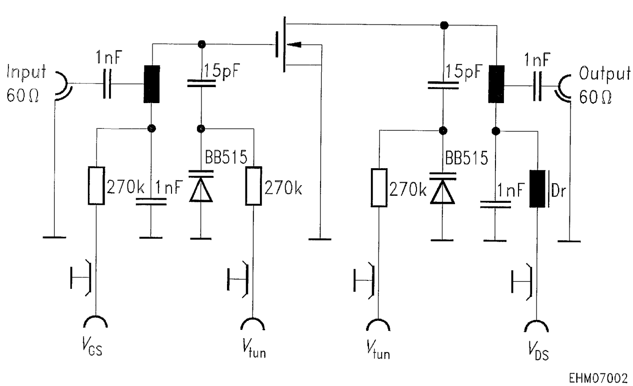
Gate 1 transconductance y_{21s}
V_{DS} = 10 V, I_{DSS} = 4 mA, V_{GS} = 0
(source circuit)



Output admittance y_{22s}
V_{DS} = 10 V, I_{DSS} = 10 mA, V_{GS} = 0
(source circuit)



Test circuit for power gain G_p **and noise figure** F
f = 200 MHz, G_G = 2 mS, G_L = 0.5 mS

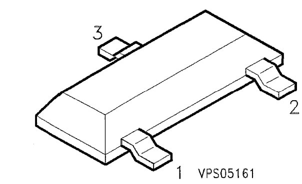


SIEMENS

PNP Silicon RF Transistor

BF 550

- For common emitter amplifier stages up to 300 MHz
- For mixer applications in AM/FM radios and VHF TV tuners
- Low feedback capacitance due to shield diffusion
- Controlled low output conductance



Type	Marking	Ordering Code (tape and reel)	Pin Configuration 1	2	3	Package[1)]
BF 550	LA	Q62702-F944	B	E	C	SOT-23

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CEO}	40	V
Collector-base voltage	V_{CBO}	40	
Emitter-base voltage	V_{EBO}	4	
Collector current	I_C	25	mA
Base current	I_B	5	
Total power dissipation, $T_A \leq 25$ ˚C	P_{tot}	280	mW
Junction temperature	T_j	150	˚C
Storage temperature range	T_{stg}	– 65 … + 150	

Thermal Resistance

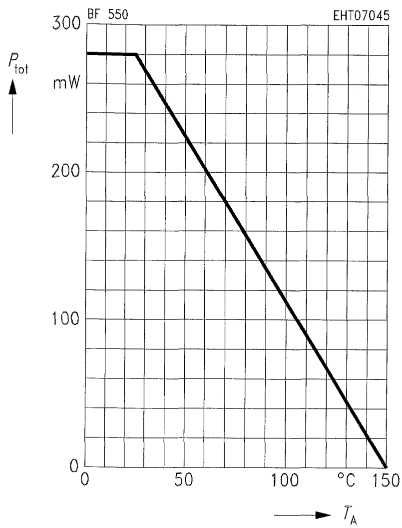
Junction - ambient[2)]	$R_{th JA}$	≤ 450	K/W

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

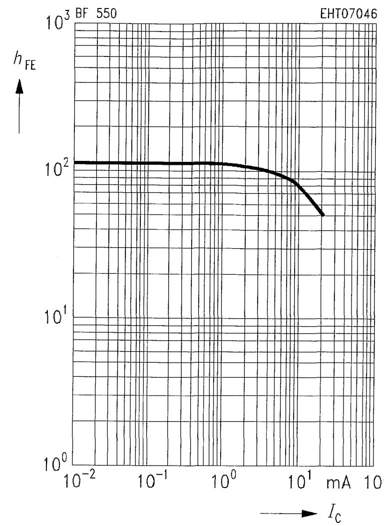
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)\,CE0}$	40	–	–	V
Collector-base breakdown voltage I_C = 10 µA, I_E = 0	$V_{(BR)\,CB0}$	40	–	–	
Emitter-base breakdown voltage I_E = 10 µA, I_C = 0	$V_{(BR)\,EB0}$	4	–	–	
Collector cutoff current V_{CB} = 30 V, I_E = 0	I_{CB0}	–	–	100	nA
DC current gain I_C = 1 mA, V_{CE} = 10 V	h_{FE}	50	–	250	–
Base-emitter voltage I_C = 1 mA, V_{CE} = 10 V	V_{BE}	–	0.72	–	V
AC Characteristics					
Transition frequency I_C = 1 mA, V_{CE} = 10 V, f = 100 MHz	f_T	–	350	–	MHz
Collector-base capacitance V_{CB} = 10 V, V_{BE} = 0 V, f = 1 MHz	C_{cb}	–	0.33	–	pF
Collector-emitter capacitance V_{CE} = 10 V, V_{BE} = 0 V, f = 1 MHz	C_{ce}	–	0.67	–	
Noise figure V_{CE} = 10 V I_C = 1 mA, f = 100 kHz, R_S = 300 Ω I_C = 2 mA, f = 100 MHz, R_S = 60 Ω	F	 – –	 2 3.4	 – –	dB
Y parameters, common emitter I_C = 1 mA, V_{CE} = 10 V f = 0.45 … 10 MHz	 g_{11e} C_{11e} $\lvert y_{21e} \rvert$ C_{22e}	 – – – –	 550 17 35 1.3	 – – – –	 µS pF mS pF
f = 500 kHz	g_{22e}	–	5	8	µS
f = 10 MHz	g_{22e}	–	5	10	µS

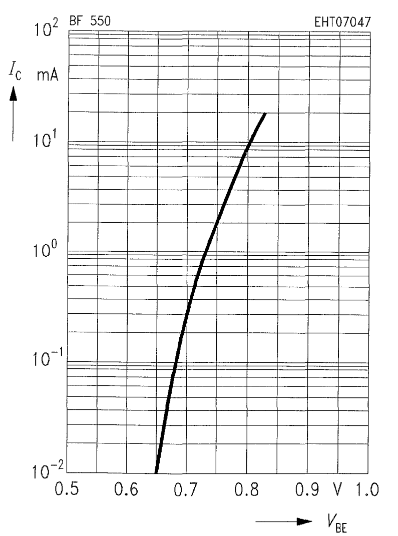
Total power dissipation $P_{tot} = f(T_A)$



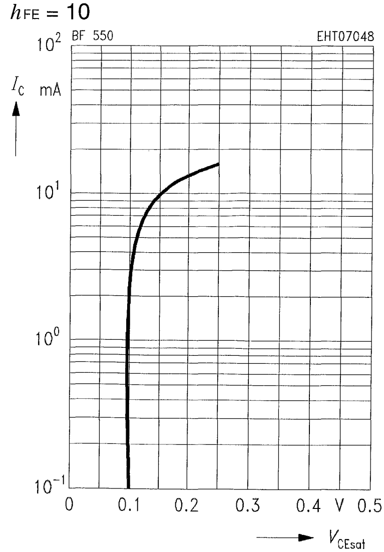
DC current gain $h_{FE} = f(I_C)$
V_{CE} = 10 V



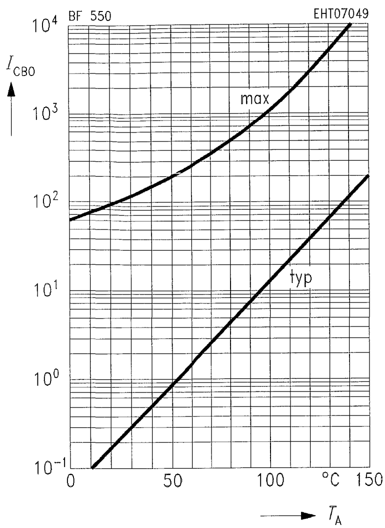
Collector current $I_C = f(V_{BE})$
V_{CE} = 10 V



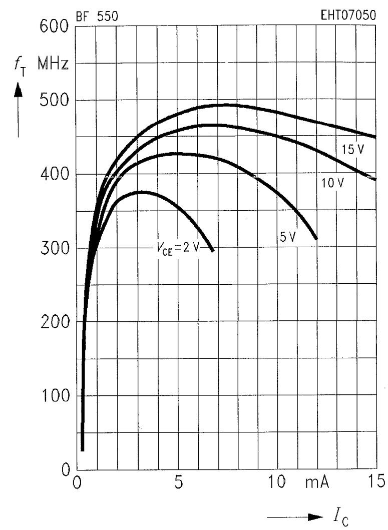
Collector-emitter saturation voltage
$V_{CEsat} = f(I_C)$
h_{FE} = 10



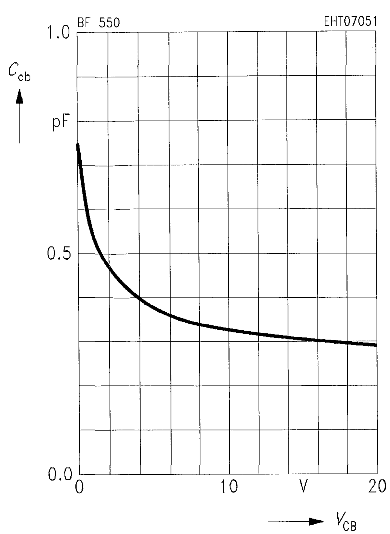
Collector cutoff current $I_{CB0} = f(T_A)$
V_{CB} = 30 V



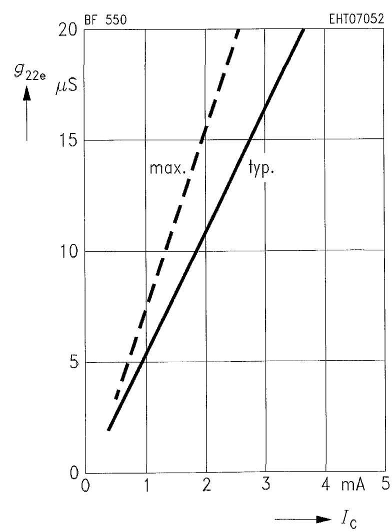
Transition frequency $f_T = f(I_C)$
f = 100 MHz



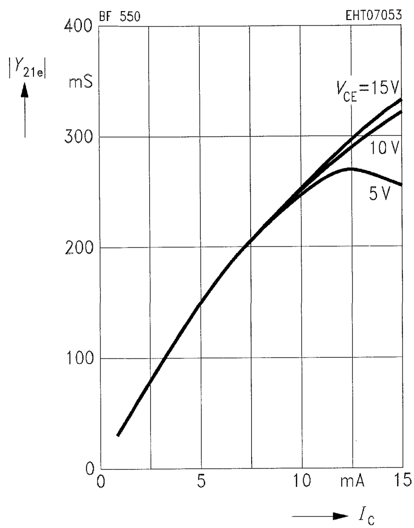
Collector-base capacitance $C_{cb} = f(V_{CB})$
f = 1 MHz



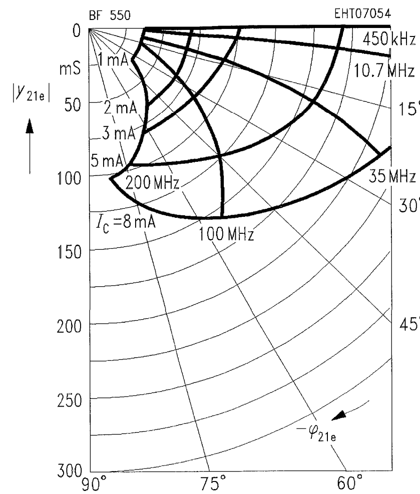
Output conductance $g_{22e} = f(I_C)$
V_{CE} = 10 V, f = 500 kHz



Forward transfer admittance $|y_{21e}| = f(I_C)$
f = 10.7 MHz



Forward transfer admittance y_{21e}
V_{CE} = 10 V

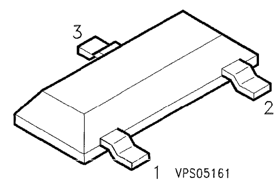


SIEMENS

NPN Silicon RF Transistor

BF 554

- For general small-signal RF applications up to 300 MHz in amplifier, mixer and oscillator circuits



Type	Marking	Ordering Code (tape and reel)	Pin Configuration 1	2	3	Package[1)]
BF 554	CC	Q62702-F1042	B	E	C	SOT-23

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CE0}	20	V
Collector-base voltage	V_{CB0}	30	
Emitter-base voltage	V_{EB0}	5	
Collector current	I_C	30	mA
Total power dissipation, $T_A \le 25$ °C	P_{tot}	280	mW
Junction temperature	T_j	150	°C
Storage temperature range	T_{stg}	– 65 … + 150	

Thermal Resistance

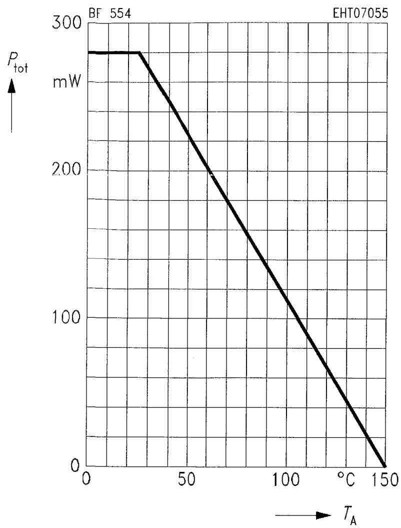
Junction - ambient[2)]	$R_{th\,JA}$	≤ 450	K/W

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

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

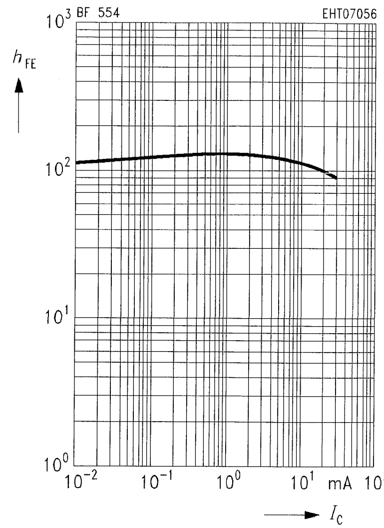
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CE0}$	20	–	–	V
Collector cutoff current V_{CB} = 20 V, I_E = 0	I_{CB0}	–	–	100	nA
DC current gain I_C = 1 mA, V_{CE} = 10 V	h_{FE}	60	–	250	–
Base-emitter voltage I_C = 1 mA, V_{CE} = 10 V	V_{BE}	–	0.7	–	V
AC Characteristics					
Transition frequency I_C = 1 mA, V_{CE} = 10 V, f = 100 MHz	f_T	–	250	–	MHz
Collector-base capacitance V_{CE} = 10 V, V_{BE} = 0 V, f = 1 MHz	C_{cb}	–	0.6	–	pF
Noise figure I_C = 1 mA, V_{CE} = 10 V f = 200 kHz, g_S = 2 mS f = 1 MHz, g_S = 1.5 mS f = 100 MHz, g_S = 10 mS	F	 – – –	 1.5 1.2 3	 – – –	dB
Output conductance I_C = 1 mA, V_{CE} = 10 V, f = 0.5...10 MHz	g_{22e}	–	4	–	µS

Total power dissipation $P_{tot} = f(T_A)$



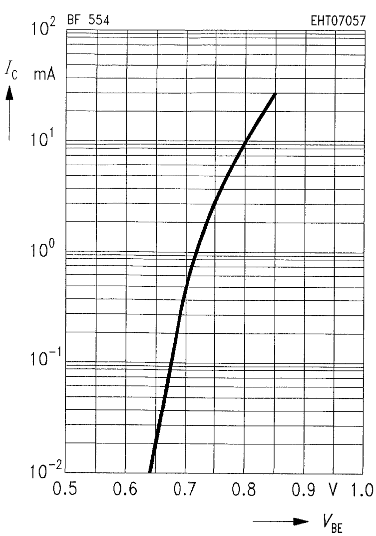
DC current gain $h_{FE} = f(I_C)$

V_{CE} = 10 V



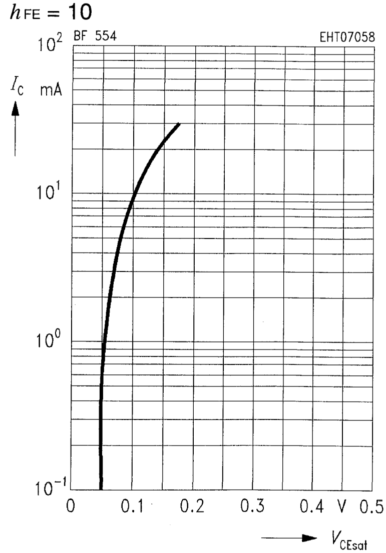
Collector current $I_C = f(V_{BE})$

V_{CE} = 10 V

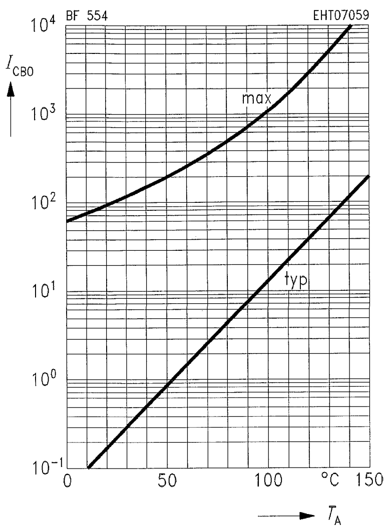


Collector-emitter saturation voltage $V_{CEsat} = f(I_C)$

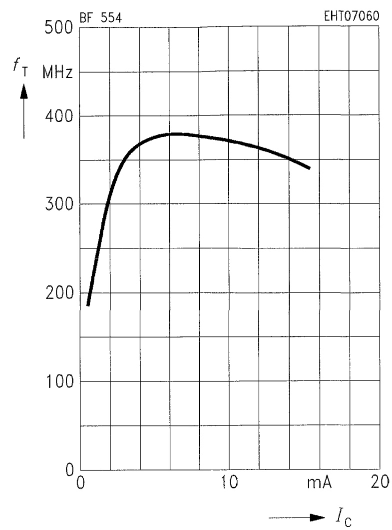
h_{FE} = 10



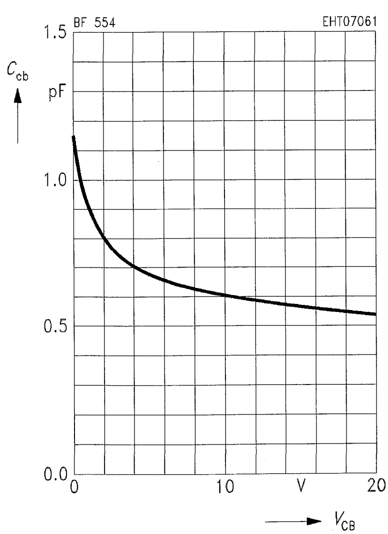
Collector cutoff current $I_{CB0} = f(T_A)$
V_{CB} = 20 V



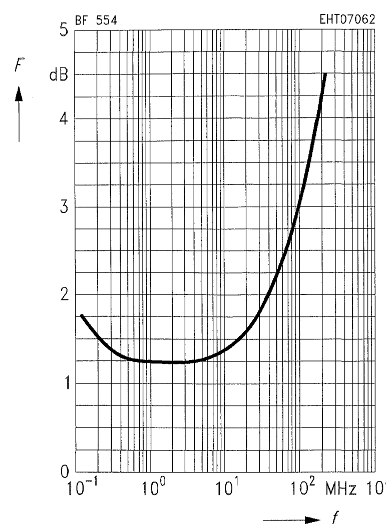
Transition frequency $f_T = f(I_C)$
V_{CE} = 10 V, f = 100 MHz



Collector-base capacitance $C_{cb} = f(V_{CB})$
f = 1 MHz



Noise figure $F = f(f)$
I_C = 1 mA, V_{CE} = 10 V, R_S = 60 Ω

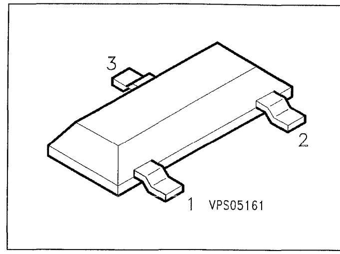


SIEMENS

PNP Silicon RF Transistor

BF 569

- For oscillators, mixers and self-oscillating mixer stages in UHF TV tuners



Type	Marking	Ordering Code (tape and reel)	Pin Configuration 1	2	3	Package[1]
BF 569	LH	Q62702-F869	B	E	C	SOT-23

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CEO}	35	V
Collector-base voltage	V_{CBO}	40	
Emitter-base voltage	V_{EBO}	3	
Collector current	I_C	30	mA
Base current	I_B	5	
Total power dissipation, $T_A \leq 25$ °C	P_{tot}	280	mW
Junction temperature	T_j	150	°C
Storage temperature range	T_{stg}	– 55 ... + 150	

Thermal Resistance

Junction - ambient[2]	$R_{th\,JA}$	≤ 450	K/W

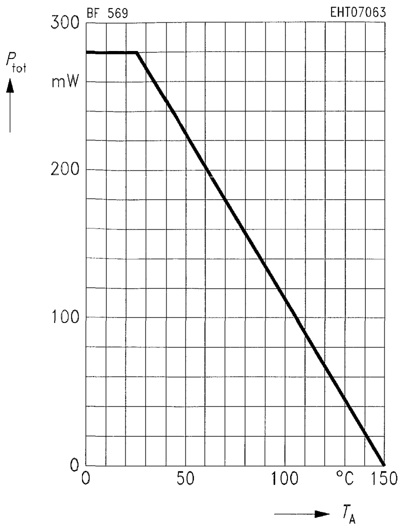
[1] For detailed information see chapter Package Outlines.
[2] Package mounted on alumina 15 mm × 16.7 mm × 0.7 mm.

Electrical Characteristics

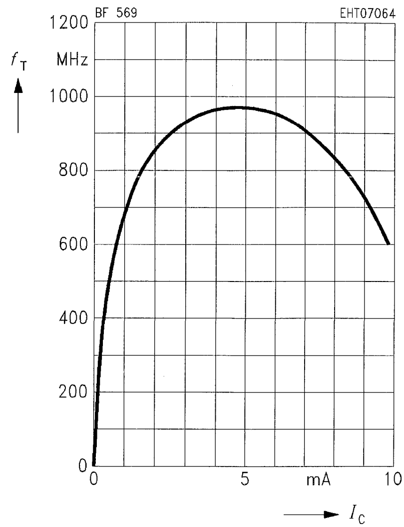
at T_A = 25 ˚C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CEO}$	35	–	–	V
Collector cutoff current V_{CB} = 20 V, I_E = 0	I_{CBO}	–	–	100	nA
DC current gain I_C = 3 mA, V_{CE} = 10 V	h_{FE}	20	50	–	–
AC Characteristics					
Transition frequency I_C = 3 mA, V_{CE} = 10 V, f = 100 MHz	f_T	–	950	–	MHz
Collector-base capacitance V_{CB} = 10 V, V_{BE} = 0 V, f = 1 MHz	C_{cb}	–	0.32	–	pF
Collector-emitter capacitance V_{CE} = 10 V, V_{BE} = 0 V, f = 1 MHz	C_{ce}	–	0.15	–	
Noise figure I_C = 3 mA, V_{CB} = 10 V, f = 800 MHz R_S = 60 Ω	F	–	4.5	–	dB
Common base power gain I_C = 3 mA, V_{CB} = 10 V, f = 800 MHz R_L = 500 Ω	G_p	–	14.8	–	

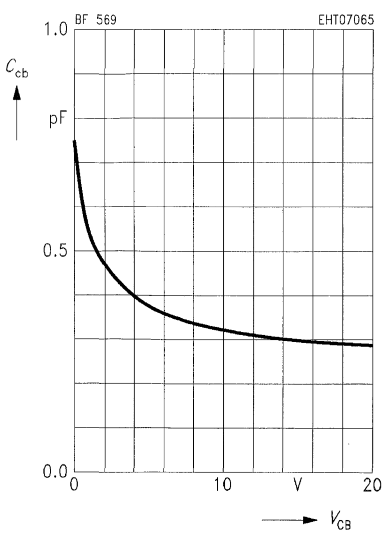
Total power dissipation $P_{tot} = f(T_A)$



Transition frequency $f_T = f(I_C)$
V_{CE} = 10 V, f = 100 MHz



Collector-base capacitance $C_{cb} = f(V_{CB})$
f = 1 MHz

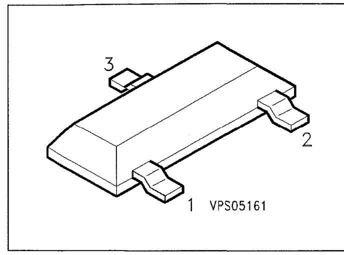


SIEMENS

PNP Silicon RF Transistor

BF 579

- For low-distortion, low-noise VHF/UHF amplifier and UHF oscillator applications in TV tuners
- Typical collector current 10 mA



Type	Marking	Ordering Code (tape and reel)	Pin Configuration 1	2	3	Package[1)]
BF 579	LJ	Q62702-F971	B	E	C	SOT-23

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CE0}	20	V
Collector-base voltage	V_{CB0}	25	
Emitter-base voltage	V_{EB0}	3	
Collector current	I_C	30	mA
Base current	I_B	5	
Total power dissipation, $T_A \leq 25$ °C	P_{tot}	280	mW
Junction temperature	T_j	150	°C
Storage temperature range	T_{stg}	– 55 ... + 150	

Thermal Resistance

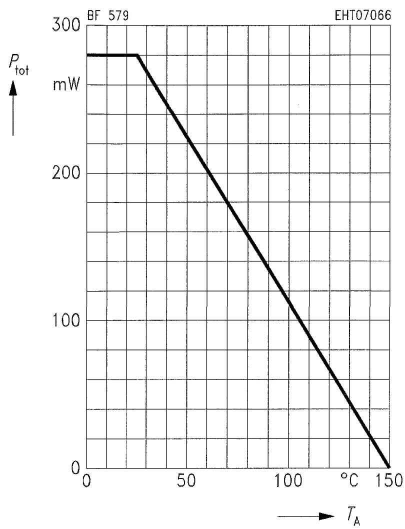
Junction - ambient[2)]	$R_{th\,JA}$	≤ 450	K/W

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

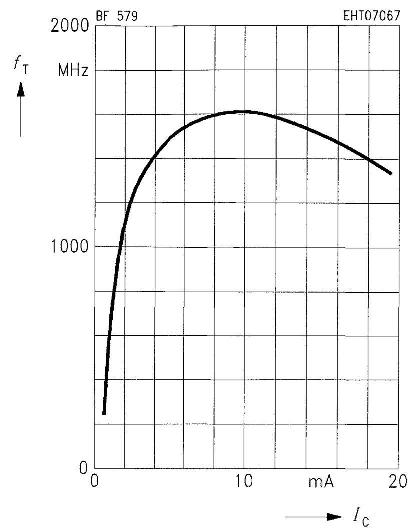
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CEO}$	20	–	–	V
Collector cutoff current V_{CB} = 20 V, I_E = 0	I_{CBO}	–	–	100	nA
DC current gain I_C = 10 mA, V_{CE} = 10 V	h_{FE}	20	–	–	–
AC Characteristics					
Transition frequency I_C = 10 mA, V_{CE} = 10 V, f = 100 MHz	f_T	–	1.6	–	GHz
Collector-base capacitance V_{CB} = 10 V, V_{BE} = 0 V, f = 1 MHz	C_{cb}	–	0.41	–	pF
Collector-emitter capacitance V_{CE} = 10 V, V_{BE} = 0 V, f = 1 MHz	C_{ce}	–	0.16	–	
Noise figure I_C = 10 mA, V_{CB} = 10 V, R_S = 60 Ω f = 800 MHz f = 200 MHz	F	 – –	 4 2.9	 – –	dB
Common base power gain I_C = 10 mA, V_{CB} = 10 V, f = 800 MHz R_L = 500 Ω	G_p	–	16	–	

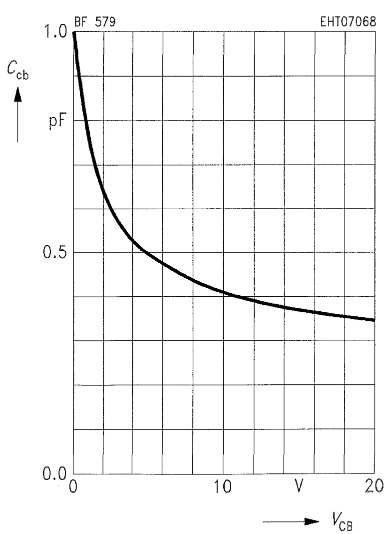
Total power dissipation $P_{tot} = f(T_A)$



Transition frequency $f_T = f(I_C)$
V_{CE} = 10 V, f = 100 MHz



Collector-base capacitance $C_{cb} = f(V_{CB})$
f = 1 MHz

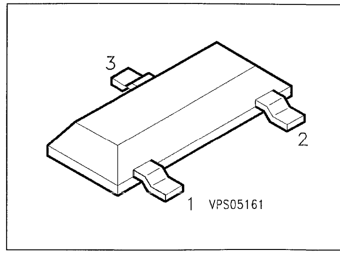


SIEMENS

NPN Silicon RF Transistor

BF 599

- Common emitter IF/RF amplifier
- Low feedback capacitance due to shield diffusion



Type	Marking	Ordering Code (tape and reel)	Pin Configuration 1	2	3	Package[1]
BF 599	NB	Q62702-F979	B	E	C	SOT-23

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CE0}	25	V
Collector-base voltage	V_{CB0}	40	
Emitter-base voltage	V_{EB0}	4	
Collector current	I_C	25	mA
Base current	I_B	5	
Total power dissipation, $T_A \leq 25$ ˚C	P_{tot}	280	mW
Junction temperature	T_j	150	˚C
Storage temperature range	T_{stg}	– 65 … + 150	

Thermal Resistance

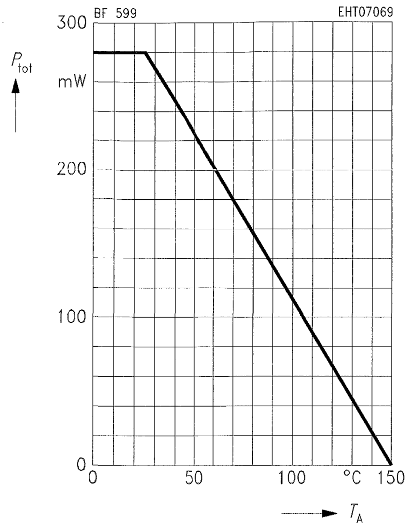
Junction - ambient[2]	$R_{th\,JA}$	≤ 450	K/W

[1] For detailed information see chapter Package Outlines.
[2] Package mounted on alumina 15 mm × 16.7 mm × 0.7 mm.

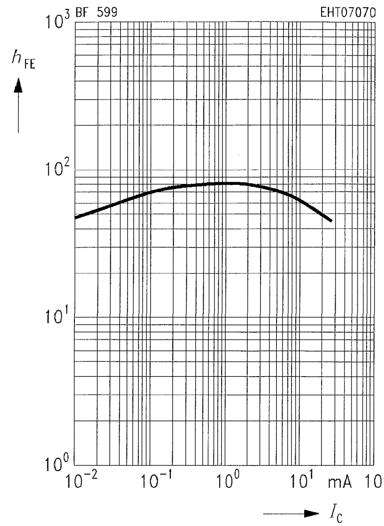
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)\,CE0}$	25	–	–	V
Collector cutoff current V_{CB} = 20 V, I_E = 0	I_{CB0}	–	–	100	nA
DC current gain I_C = 7 mA, V_{CE} = 10 V	h_{FE}	38	70	–	–
Collector-emitter saturation voltage I_C = 10 mA, I_B = 1 mA	$V_{CE\,sat}$	–	0.15	–	V
Base-emitter voltage I_C = 7 mA, V_{CE} = 10 V	V_{BE}	–	0.78	–	
AC Characteristics					
Transition frequency I_C = 5 mA, V_{CE} = 10 V, f = 100 MHz	f_T	–	550	–	MHz
Collector-base capacitance V_{CB} = 10 V, V_{BE} = 0 V, f = 1 MHz	C_{cb}	–	0.35	–	pF
Collector-emitter capacitance V_{CE} = 10 V, V_{BE} = 0 V, f = 1 MHz	C_{ce}	–	0.68	–	
Optimum power gain I_C = 7 mA, V_{CE} = 10 V, f = 35 MHz	$G_{pe\,opt}$	–	43	–	dB
Forward transfer admittance I_C = 7 mA, V_{CE} = 10 V, f = 35 MHz	$\lvert y_{21e} \rvert$	–	175	–	mS

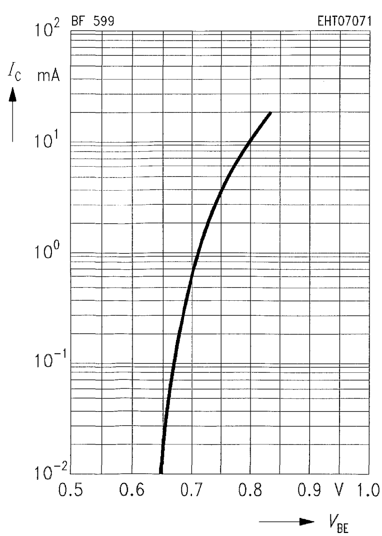
Total power dissipation $P_{tot} = f(T_A)$



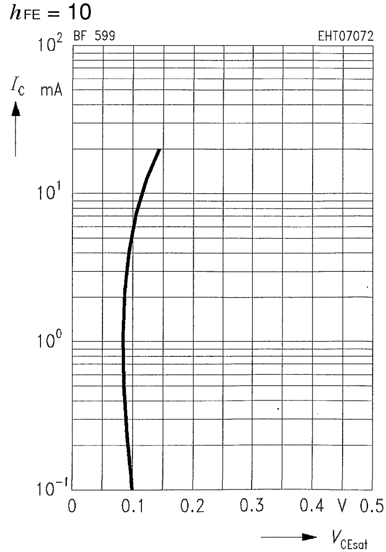
DC current gain $h_{FE} = f(I_C)$
V_{CE} = 10 V



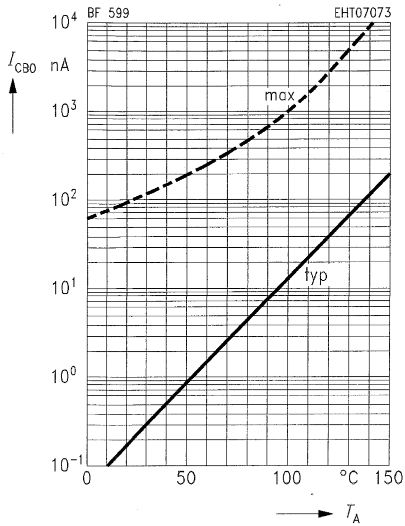
Collector current $I_C = f(V_{BE})$
V_{CE} = 10 V



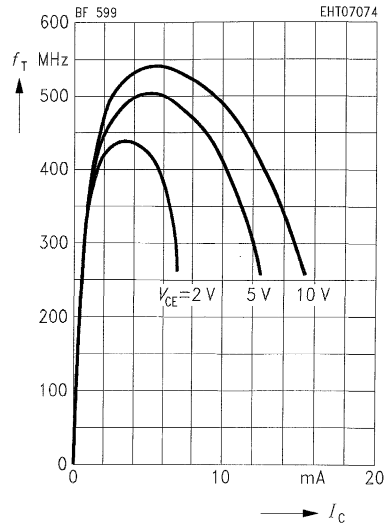
Collector-emitter saturation voltage
$V_{CEsat} = f(I_C)$
h_{FE} = 10



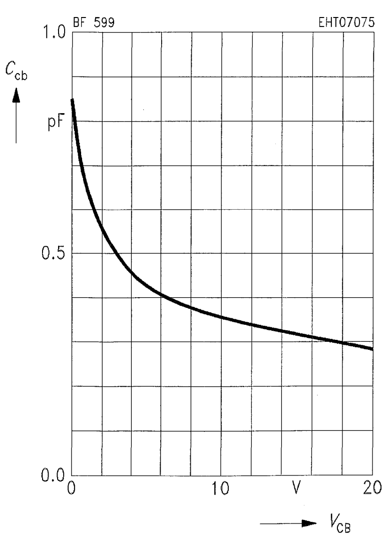
Collector cutoff current $I_{CB0} = f(T_A)$
V_{CB} = 20 V



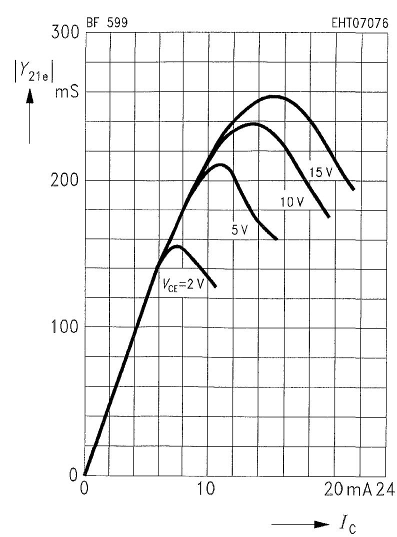
Transition frequency $f_T = f(I_C)$
f = 100 MHz



Collector-base capacitance $C_{cb} = f(V_{CB})$
f = 1 MHz



Forward transfer admittance $|y_{21e}| = f(I_C)$

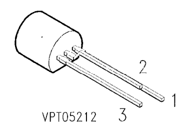


SIEMENS

PNP Silicon RF Transistor

BF 606 A

- For VHF oscillator stages



Type	Marking	Ordering Code	Pin Configuration 1	2	3	Package[1)]
BF 606 A	–	Q62702-F535	C	E	B	TO-92

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CE0}	30	V
Collector-base voltage	V_{CB0}	40	
Emitter-base voltage	V_{EB0}	4	
Collector current	I_C	25	mA
Emitter current	I_E	30	
Total power dissipation, $T_A \leq 45$ ˚C	P_{tot}	300	mW
Junction temperature	T_j	150	˚C
Storage temperature range	T_{stg}	– 55 ... + 150	

Thermal Resistance

Junction - ambient	$R_{th\,JA}$	$\leq$ 350	K/W

1) For detailed information see chapter Package Outlines.

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

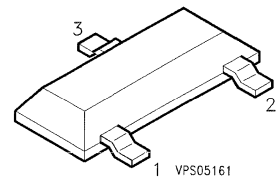
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-emitter breakdown voltage I_C = 2 mA	$V_{(BR)CEO}$	30	–	–	V
Collector-base breakdown voltage I_C = 10 µA	$V_{(BR)CBO}$	40	–	–	
Emitter-base breakdown voltage I_E = 10 µA	$V_{(BR)EBO}$	4	–	–	
Collector cutoff current V_{CB} = 20 V	I_{CBO}	–	–	60	nA
DC current gain I_C = 1 mA, V_{CE} = 10 V	h_{FE}	30	–	–	–
AC Characteristics					
Transition frequency I_C = 5 mA, V_{CE} = 10 V, f = 100 MHz	f_T	–	700	–	MHz
Collector-emitter capacitance V_{CE} = 10 V, V_{BE} = 0 V, f = 1 MHz	C_{ce}	–	0.35	–	pF
Collector-base capacitance V_{CB} = 10 V, V_{BE} = 0 V, f = 1 MHz	C_{cb}	–	–	0.85	

SIEMENS

PNP Silicon RF Transistor

BF 660

- For VHF oscillator applications



Type	Marking	Ordering Code (tape and reel)	Pin Configuration 1	2	3	Package[1]
BF 660	LE	Q62702-F982	B	E	C	SOT-23

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CE0}	30	V
Collector-base voltage	V_{CB0}	40	
Emitter-base voltage	V_{EB0}	4	
Collector current	I_C	25	mA
Emitter current	I_E	30	
Total power dissipation, $T_A \leq 25$ ˚C	P_{tot}	280	mW
Junction temperature	T_j	150	˚C
Storage temperature range	T_{stg}	– 65 … + 150	

Thermal Resistance

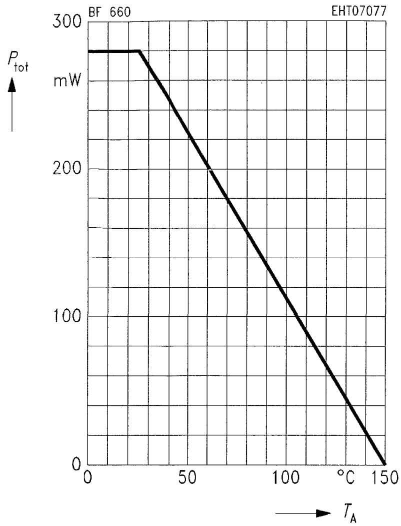
Junction - ambient[2]	$R_{th\,JA}$	≤ 450	K/W

[1] For detailed information see chapter Package Outlines.
[2] Package mounted on alumina 15 mm × 16.7 mm × 0.7 mm.

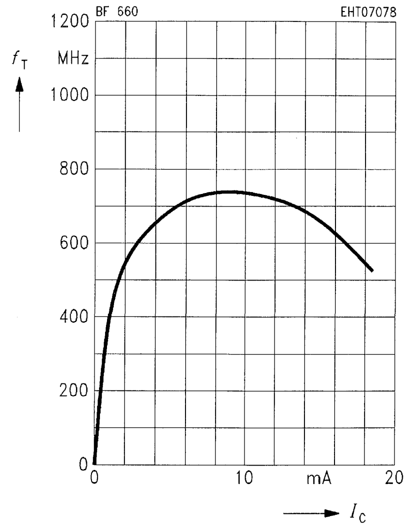
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)\,CEO}$	30	–	–	V
Collector-base breakdown voltage I_C = 10 µA, I_E = 0	$V_{(BR)\,CBO}$	40	–	–	
Emitter-base breakdown voltage I_E = 10 µA, I_C = 0	$V_{(BR)\,EBO}$	4	–	–	
Collector cutoff current V_{CB} = 20 V, I_E = 0	I_{CBO}	–	–	50	nA
DC current gain I_C = 3 mA, V_{CE} = 10 V	h_{FE}	30	–	–	–
AC Characteristics					
Transition frequency I_C = 5 mA, V_{CE} = 10 V, f = 100 MHz	f_T	–	700	–	MHz
Collector-base capacitance V_{CB} = 10 V, V_{BE} = 0 V, f = 1 MHz	C_{cb}	–	0.6	–	pF
Collector-emitter capacitance V_{CE} = 10 V, V_{BE} = 0 V, f = 1 MHz	C_{ce}	–	0.28	–	

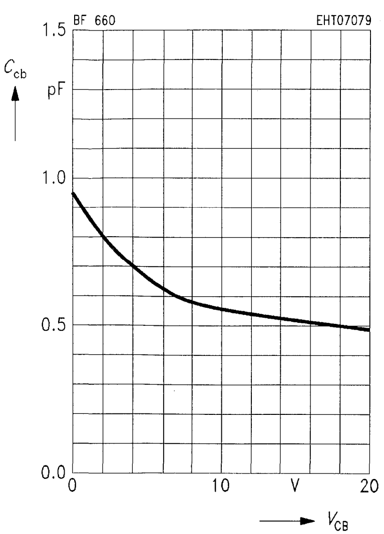
Total power dissipation $P_{tot} = f(T_A)$



Transition frequency $f_T = f(I_C)$
V_{CE} = 10 V, f = 100 MHz



Collector-base capacitance $C_{cb} = f(V_{CB})$
f = 1 MHz

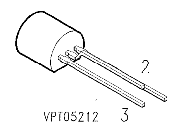


SIEMENS

NPN Silicon RF Transistor

BF 763

- For low-noise amplifiers and oscillators up to 1 GHz



Type	Marking	Ordering Code	Pin Configuration 1	2	3	Package[1)]
BF 763	–	Q62702-F766	B	E	C	TO-92

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CE0}	15	V
Collector-base voltage	V_{CB0}	25	
Emitter-base voltage	V_{EB0}	3.5	
Collector current	I_C	25	mA
Total power dissipation, $T_A \leq 25$ °C	P_{tot}	500	mW
Junction temperature	T_j	150	°C
Storage temperature range	T_{stg}	– 55 ... + 150	

Thermal Resistance

Junction - ambient	$R_{th\ JA}$	≤ 250	K/W

1) For detailed information see chapter Package Outlines.

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

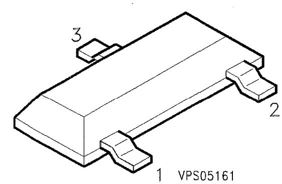
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-emitter breakdown voltage I_C = 1 mA	$V_{(BR)CEO}$	15	–	–	V
Collector-base breakdown voltage I_C = 10 µA	$V_{(BR)CBO}$	25	–	–	
Emitter-base breakdown voltage I_E = 10 µA	$V_{(BR)EBO}$	3.5	–	–	
Collector cutoff current V_{CB} = 15 V	I_{CBO}	–	–	50	nA
DC current gain I_C = 5 mA, V_{CE} = 10 V	h_{FE}	25	–	250	–
Collector-emitter saturation voltage I_C = 10 mA, I_B = 1 mA	V_{CEsat}	–	–	0.5	V
AC Characteristics					
Transition frequency I_C = 5 mA, V_{CE} = 10 V, f = 200 MHz	f_T	–	2000	–	MHz
Collector-base capacitance V_{CB} = 10 V, V_{BE} = 0 V, f = 1 MHz	C_{cb}	0.3	–	0.9	pF
Noise figure I_C = 5 mA, V_{CE} = 10 V, R_S = 60 Ω f = 200 MHz f = 800 MHz	F	 – –	 2.5 5	 – –	dB

SIEMENS

NPN Silicon RF Transistor

BF 770 A

- For IF amplifiers in TV-sat tuners and for VCR modulators



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

Type	Marking	Ordering Code (tape and reel)	Pin Configuration 1	2	3	Package1)
BF 770 A	LS	Q62702-F1124	B	E	C	SOT-23

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CE0}	12	V
Collector-base voltage	V_{CB0}	15	
Emitter-base voltage	V_{EB0}	2	
Collector current	I_C	50	mA
Total power dissipation, $T_S \leq 63$ °C3)	P_{tot}	300	mW
Junction temperature	T_j	150	°C
Storage temperature range	T_{stg}	– 65 … + 150	
Ambient temperature range	T_A	– 65 … + 150	

Thermal Resistance

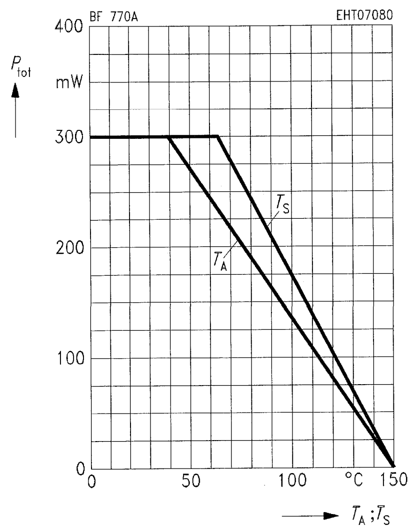
Junction - ambient 2)	$R_{th\,JA}$	≤ 370	K/W
Junction - soldering point 3)	$R_{th\,JS}$	≤ 290	

1) For detailed information 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.

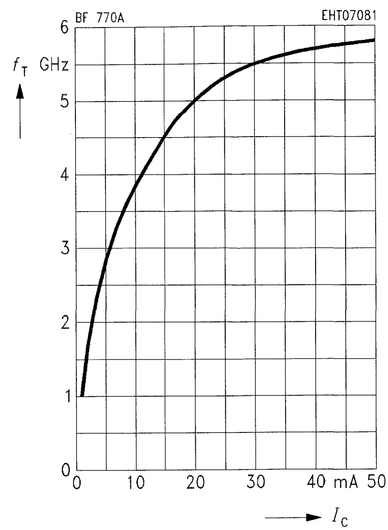
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CEO}$	12	–	–	V
Collector-base cutoff current V_{CB} = 5 V, I_E = 0	I_{CBO}	–	–	50	nA
DC current gain I_C = 30 mA, V_{CE} = 5 V	h_{FE}	40	90	–	–
Collector-emitter saturation voltage I_C = 50 mA, I_B = 5 mA	$V_{CE\,sat}$	–	0.13	0.5	V
AC Characteristics					
Transition frequency I_C = 30 mA, V_{CE} = 5 V, f = 200 MHz	f_T	–	5.5	–	GHz
Collector-base capacitance V_{CB} = 5 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{cb}	–	0.6	–	pF
Collector-emitter capacitance V_{CE} = 5 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{ce}	–	0.3	–	
Input capacitance V_{EB} = 0.5 V, I_C = i_c = 0, f = 1 MHz	C_{ibo}	–	2.1	–	
Output capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{obs}	–	0.8	–	
Noise figure I_C = 5 mA, V_{CE} = 8 V, f = 10 MHz, Z_S = 50 Ω I_C = 5 mA, V_{CE} = 8 V, f = 800 MHz, Z_S = Z_{Sopt}	F	 – –	 1.1 1.7	 – –	dB
Power gain I_C = 30 mA, V_{CE} = 8 V, f = 800 MHz, Z_S = Z_{Sopt}, Z_L = Z_{Lopt}	G_p	–	13.5	–	

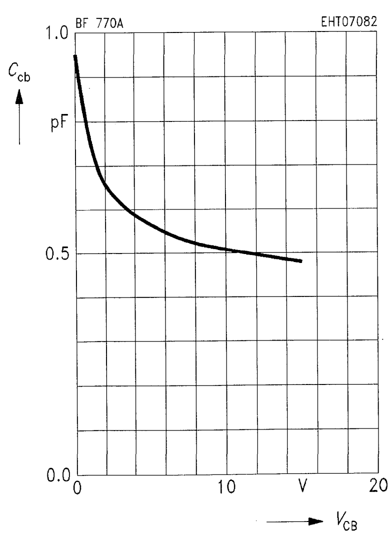
Total power dissipation $P_{tot} = f(T_A^*; T_S)$
*Package mounted on alumina



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

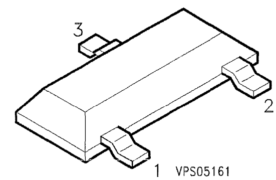


SIEMENS

NPN Silicon RF Transistor

BF 771

- For modulators and amplifiers in TV and VCR tuners



ESD: Electrostatic discharge sensitive device, observe handling precautions!

Type	Marking	Ordering Code (tape and reel)	Pin Configuration 1	2	3	Package[1]
BF 771	RB	Q62702-F1225	B	E	C	SOT-23

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CEO}	12	V
Collector-emitter voltage, $V_{BE} = 0$	V_{CES}	20	
Collector-base voltage	V_{CBO}	20	
Emitter-base voltage	V_{EBO}	2	
Collector current	I_C	80	mA
Base current	I_B	10	
Total power dissipation, $T_S \leq 50$ ˚C[2]	P_{tot}	400	mW
Junction temperature	T_j	150	˚C
Ambient temperature range	T_A	– 65 … + 150	
Storage temperature range	T_{stg}	– 65 … + 150	

Thermal Resistance

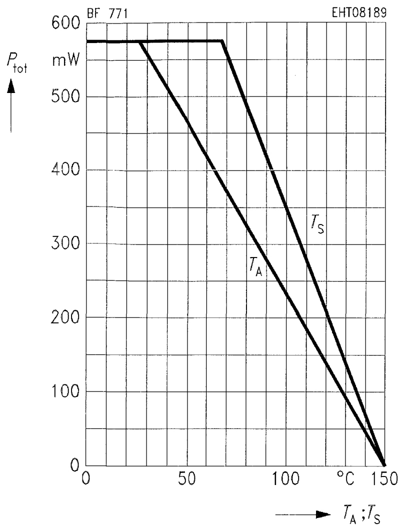
Junction - ambient[2]	$R_{th JA}$	≤ 250	K/W

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

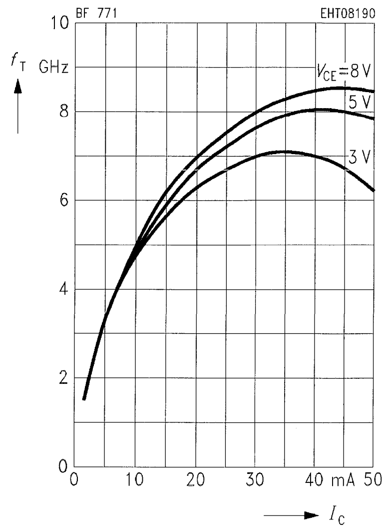
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CEO}$	12	–	–	V
Collector-emitter cutoff current V_{CE} = 20 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} = 1 V, I_C = 0	I_{EBO}	–	–	1	μA
DC current gain I_C = 5 mA, V_{CE} = 8 V I_C = 30 mA, V_{CE} = 8 V	h_{FE}	 – –	 90 100	 – –	–
Collector-emitter saturation voltage I_C = 50 mA, I_B = 5 mA	V_{CEsat}	–	–	0.4	V
AC Characteristics					
Transition frequency I_C = 5 mA, V_{CE} = 8 V, f = 200 MHz I_C = 30 mA, V_{CE} = 8 V, f = 200 MHz	f_T	 – –	 3.5 7	 – –	GHz
Collector-base capacitance V_{CB} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{cb}	–	0.66	–	pF
Collector-emitter capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{ce}	–	0.24	–	
Input capacitance V_{EB} = 0.5 V, I_C = i_c = 0, f = 1 MHz	C_{ibo}	–	2.2	–	
Output capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{obs}	–	0.9	–	
Noise figure I_C = 5 mA, V_{CE} = 8 V, f = 10 MHz, Z_S = 75 Ω I_C = 30 mA, V_{CE} = 8 V, f = 800 MHz, Z_S = Z_{Sopt}	F	 – –	 0.8 1.7	 – –	dB
Power gain I_C = 30 mA, V_{CE} = 8 V, f = 800 MHz, Z_S = 50 Ω, Z_L = Z_{Lopt}	G_{pe}	–	13.5	–	

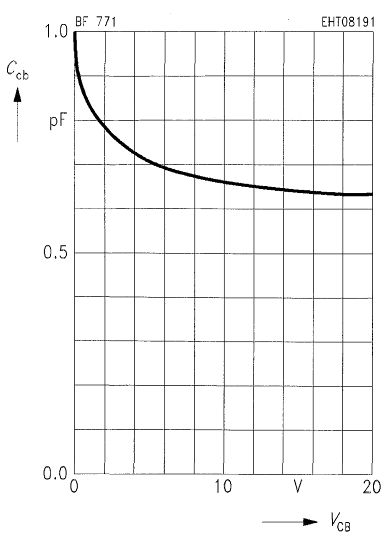
Total power dissipation $P_{tot} = f(T_A)$
Package mounted on alumina



Transition frequency $f_T = f(I_C)$
V_{CE} = 8 V, f = 200 MHz



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

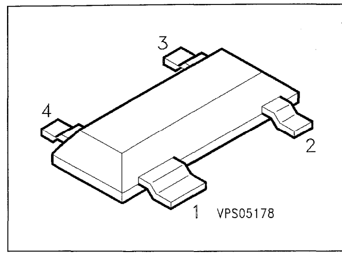


SIEMENS

NPN Silicon RF Transistor

BF 772

- For applications in TV-sat tuners



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

Type	Marking	Ordering Code (tape and reel)	Pin Configuration 1	2	3	4	Package[1)]
BF 772	RA	Q62702-F1222	C	E	B	E	SOT-143

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CE0}	12	V
Collector-emitter voltage, $V_{BE} = 0$	V_{CES}	20	
Collector-base voltage	V_{CB0}	20	
Emitter-base voltage	V_{EB0}	2	
Collector current	I_C	80	mA
Base current	I_B	10	
Total power dissipation, $T_S \leq 72$ °C[3)]	P_{tot}	580	mW
Junction temperature	T_j	150	°C
Ambient temperature range	T_A	– 65 … + 150	
Storage temperature range	T_{stg}	– 65 … + 150	

Thermal Resistance

Parameter	Symbol	Values	Unit
Junction - ambient[2)]	$R_{th\,JA}$	≤ 215	K/W
Junction - soldering point[3)]	$R_{th\,JS}$	≤ 135	

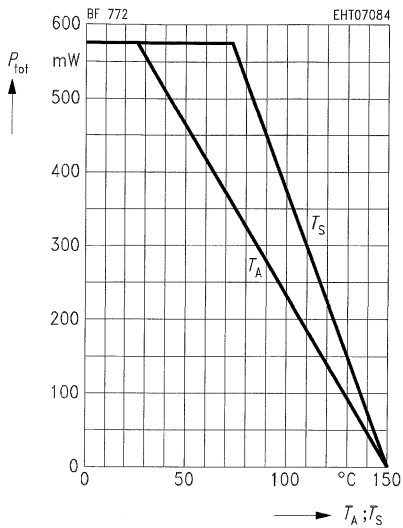
1) For detailed information see chapter Package Outlines.
2) Package mounted on alumina 15 mm × 16.7 mm × 0.7 mm.
3) T_S is measured on the collector lead at the soldering point to the pcb.

Electrical Characteristics

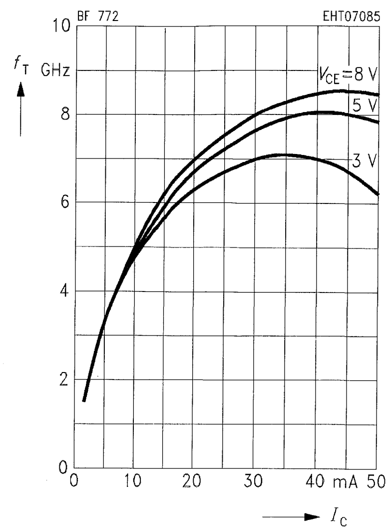
at T_A = 25 ˚C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CE0}$	12	–	–	V
Collector-emitter cutoff current V_{CE} = 20 V, V_{BE} = 0	I_{CES}	–	–	100	µA
Collector-base cutoff current V_{CB} = 10 V, I_E = 0	I_{CB0}	–	–	50	nA
Emitter-base cutoff current V_{EB} = 1 V, I_C = 0	I_{EB0}	–	–	1	µA
DC current gain I_C = 5 mA, V_{CE} = 8 V I_C = 30 mA, V_{CE} = 8 V	h_{FE}	 – 50	 90 100	 – 250	–
Collector-emitter saturation voltage I_C = 50 mA, I_B = 5 mA	V_{CEsat}	–	–	0.4	V
AC Characteristics					
Transition frequency I_C = 5 mA, V_{CE} = 8 V, f = 500 MHz I_C = 30 mA, V_{CE} = 8 V, f = 500 MHz	f_T	 – –	 3.5 8	 – –	GHz
Collector-base capacitance V_{CB} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{cb}	–	0.6	–	pF
Collector-emitter capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{ce}	–	0.33	–	
Input capacitance V_{EB} = 0.5 V, I_C = i_c = 0, f = 1 MHz	C_{ibo}	–	2.3	–	
Output capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{obs}	–	0.95	–	
Noise figure I_C = 5 mA, V_{CE} = 8 V, f = 10 MHz, Z_S = 75 Ω I_C = 30 mA, V_{CE} = 8 V, f = 800 MHz, Z_S = Z_{Sopt}	F	 – –	 0.8 1.6	 – –	dB
Power gain I_C = 30 mA, V_{CE} = 8 V, f = 800 MHz, Z_S = 50 Ω, Z_L = Z_{Lopt}	G_{pe}	–	15	–	

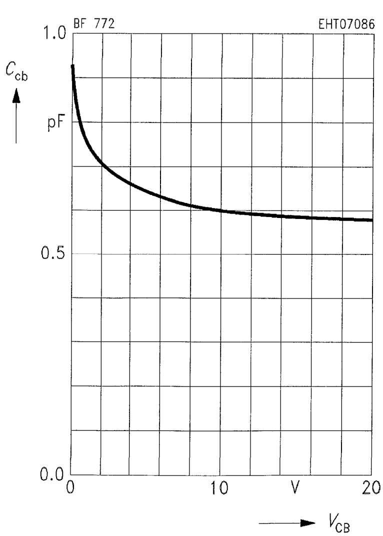
Total power dissipation $P_{tot} = f(T_A{}^*; T_S)$
*Package mounted on alumina



Transition frequency $f_T = f(I_C)$
f = 500 MHz



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

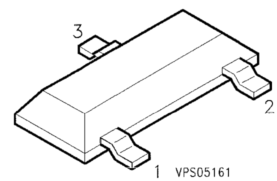


SIEMENS

NPN Silicon RF Transistor

BF 775

- Especially suitable for TV-sat and UHF tuners



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

Type	Marking	Ordering Code (tape and reel)	Pin Configuration 1	2	3	Package[1)]
BF 775	LO	Q62702-F102	B	E	C	SOT-23

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CE0}	12	V
Collector-base voltage	V_{CB0}	20	
Emitter-base voltage	V_{EB0}	2.5	
Collector current	I_C	30	mA
Base current	I_B	4	
Total power dissipation, $T_S \leq 48$ °C[3)]	P_{tot}	280	mW
Junction temperature	T_j	150	°C
Storage temperature range	T_{stg}	– 65 ... + 150	
Ambient temperature range	T_A	– 65 ... + 150	

Thermal Resistance

Junction - ambient[2)]	$R_{th JA}$	≤ 445	K/W
Junction - soldering point[3)]	$R_{th JS}$	≤ 365	

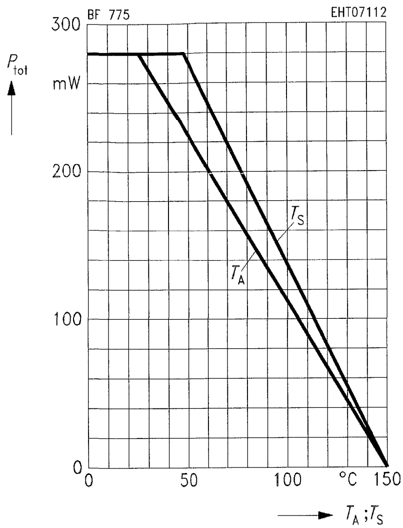
1) For detailed information see chapter Package Outlines.
2) Package mounted on alumina 15 mm × 16.7 mm × 0.7 mm.
3) T_S is measured on the collector lead at the soldering point to the pcb.

Electrical Characteristics

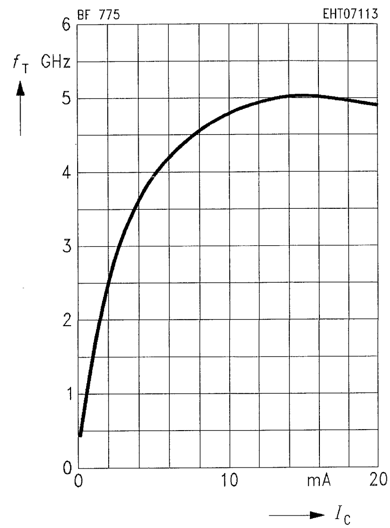
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CE0}$	12	–	–	V
Collector-base cutoff current V_{CB} = 10 V, I_E = 0	I_{CB0}	–	–	50	nA
Emitter-base cutoff current V_{EB} = 2.5 V, I_C = 0	I_{EB0}	–	–	100	µA
DC current gain, V_{CE} = 6 V I_C = 5 mA I_C = 20 mA	h_{FE}	– 40 40	– 90 100	– 250 –	–
Collector-emitter saturation voltage I_C = 20 mA, I_B = 2 mA	V_{CEsat}	–	0.16	0.5	V
AC Characteristics					
Transition frequency I_C = 5 mA, V_{CE} = 6 V, f = 200 MHz I_C = 14 mA, V_{CE} = 6 V, f = 200 MHz	f_T	 – –	 3.5 4.5	 – –	GHz
Collector-base capacitance V_{CB} = 6 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{cb}	–	0.58	–	pF
Collector-emitter capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{ce}	–	0.27	–	
Input capacitance V_{EB} = 0.5 V, I_C = i_c = 0, f = 1 MHz	C_{ibo}	–	0.9	–	
Output capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{obs}	–	0.77	–	
Noise figure I_C = 5 mA, V_{CE} = 6 V, f = 10 MHz, Z_S = 75 Ω I_C = 2 mA, V_{CE} = 6 V, f = 800 MHz, Z_S = Z_{Sopt}	F	 – –	 1.5 1.5	 – –	dB

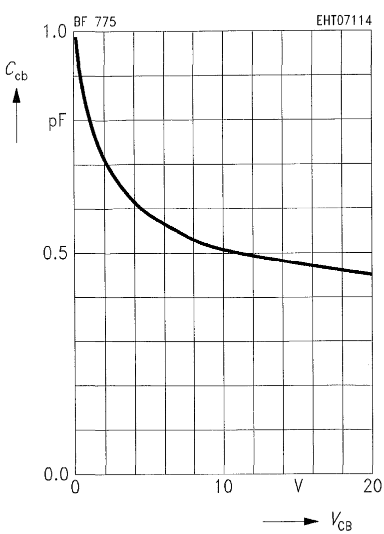
Total power dissipation $P_{tot} = f\,(T_A{}^*;\,T_S)$
*Package mounted on alumina



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



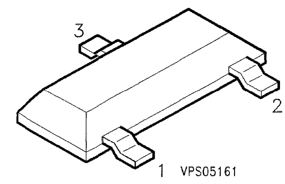
SIEMENS

NPN Silicon RF Transistor

BF 775 A

Preliminary Data

- Especially suitable for amplifiers in TV-sat tuners



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

Type	Marking	Ordering Code (tape and reel)	Pin Configuration 1	2	3	Package[1)]
BF 775 A	LG	Q62702-F1250	B	E	C	SOT-23

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CEO}	16	V
Collector-base voltage	V_{CBO}	25	
Emitter-base voltage	V_{EBO}	2	
Collector current	I_C	30	mA
Total power dissipation, $T_S \leq 59$ °C[3)]	P_{tot}	280	mW
Junction temperature	T_j	150	°C
Ambient temperature range	T_A	– 65 ... + 150	
Storage temperature range	T_{stg}	– 65 ... + 150	

Thermal Resistance

Junction - ambient[2)]	$R_{th\,JA}$	≤ 405	K/W
Junction - soldering point[3)]	$R_{th\,JS}$	≤ 325	

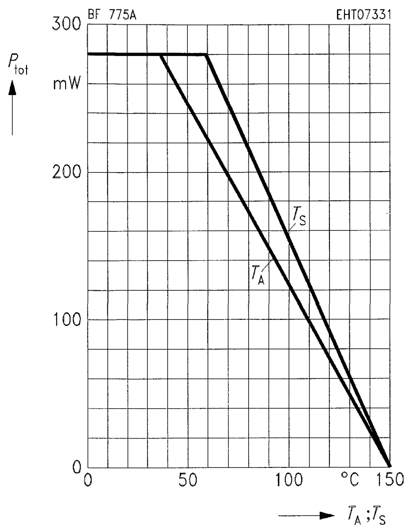
1) For detailed information see chapter Package Outlines.
2) Package mounted on alumina 15 mm × 16.7 mm × 0.7 mm.
3) T_S is measured on the collector lead at the soldering point to the pcb.

Electrical Characteristics

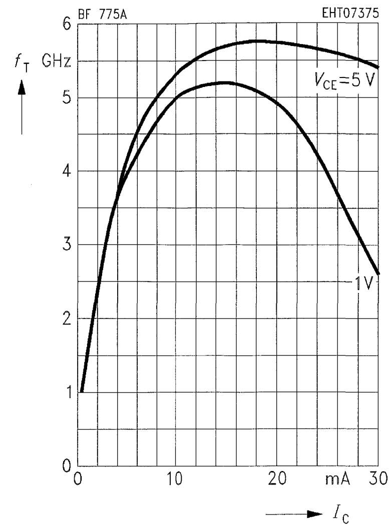
at T_A = 25 °C, unless otherwise specified.

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-base cutoff current V_{CB} = 15 V, I_E = 0	I_{CB0}	–	–	100	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}	–	0.2	0.4	V
Base-emitter voltage I_C = 10 mA, V_{CE} = 10 V	V_{BE}	–	0.78	–	
AC Characteristics					
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	 – –	 4.2 5.8	 – –	GHz
Collector-base capacitance V_{CB} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{cb}	–	0.38	–	pF
Collector-emitter capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{ce}	–	0.22	–	
Input capacitance V_{EB} = 0.5 V, I_C = i_c = 0, f = 1 MHz	C_{ibo}	–	1.27	–	
Output capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{obs}	–	0.6	–	
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	 – –	dB
Power gain I_C = 5 mA, V_{CE} = 10 V, f = 800 MHz, Z_S = 50 Ω, Z_L = Z_{Lopt}	G_{pe}	–	15	–	

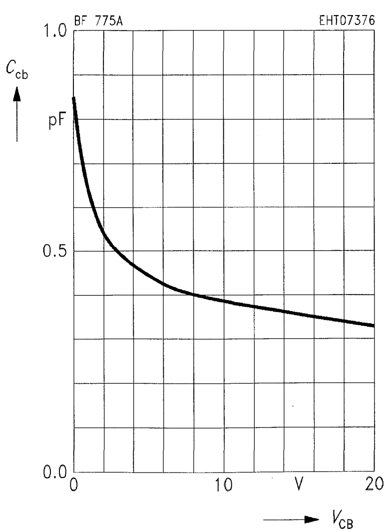
Total power dissipation $P_{tot} = f(T_A^*; T_S)$
*Package mounted on alumina



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



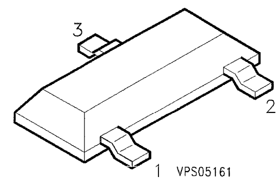
SIEMENS

NPN Silicon RF Transistor

BF 777

Preliminary Data

- For UHF/VHF frequency converters and local oscillators.
- f_T = 2.2 GHz



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

Type	Marking	Ordering Code (tape and reel)	Pin Configuration 1	2	3	Package[1)]
BF 777	LFs	Q62702-F1426	B	E	C	SOT-23

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CEO}	20	V
Collector-emitter voltage, $V_{BE} = 0$	V_{CES}	25	
Collector-base voltage	V_{CBO}	30	
Emitter-base voltage	V_{EBO}	3	
Collector current	I_C	50	mA
Peak collector current, $f \geq 10$ MHz	I_{CM}	50	
Base current	I_B	8	
Peak base current, $f \geq 10$ MHz	I_{BM}	10	
Total power dissipation, $T_S \leq 97$ °C[3)]	P_{tot}	150	mW
Junction temperature	T_j	150	°C
Ambient temperature range	T_A	– 65 … + 150	
Storage temperature range	T_{stg}	– 65 … + 150	

Thermal Resistance

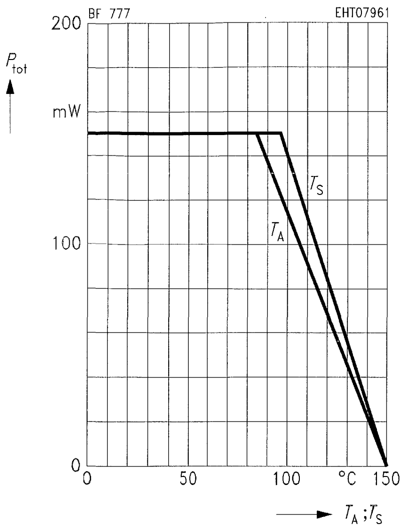
Junction - ambient[2)]	$R_{th\,JA}$	≤ 430	K/W
Junction - soldering point[3)]	$R_{th\,JS}$	≤ 350	

1) For detailed information 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.

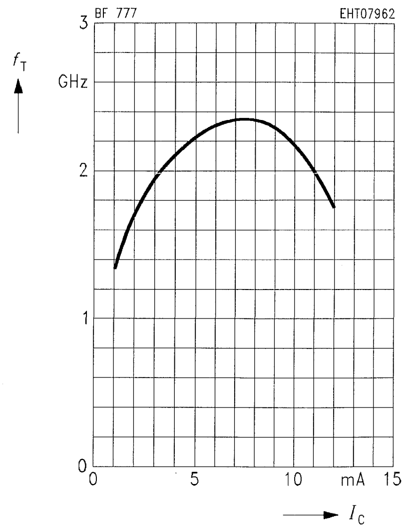
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CEO}$	20	–	–	V
Collector-emitter cutoff current V_{CE} = 15 V, V_{BE} = 0	I_{CES}	–	–	1	µA
Collector-base cutoff current V_{CB} = 30 V, I_E = 0 V_{CB} = 15 V, I_E = 0	I_{CBO}	 – –	 – –	 1.0 0.5	
Emitter-base cutoff current V_{EB} = 3 V, I_C = 0	I_{EBO}	–	–	10	
DC current gain I_C = 5 mA, V_{CE} = 10 V	h_{FE}	30	–	200	–
Collector-emitter saturation voltage I_C = 10 mA, I_B = 5 mA I_C = 10 mA, I_B = 1 mA	V_{CEsat}	 – –	 – 0.1	 0.7 0.4	V
AC Characteristics					
Transition frequency I_C = 5 mA, V_{CE} = 10 V, f = 200 MHz	f_T	1.4	2.2	–	GHz
Collector-base capacitance V_{CB} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{cb}	–	0.5	0.85	pF
Collector-emitter capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{ce}	–	0.33	–	

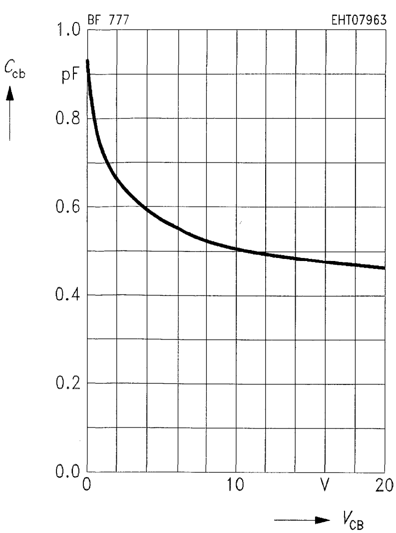
Total power dissipation $P_{tot} = f(T_A{}^*; T_S)$
*Package mounted on alumina



Transition frequency $f_T = f(I_C)$
V_{CE} = 10 V, f = 200 MHz



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

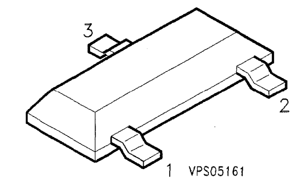


SIEMENS

NPN Silicon RF Transistor

BF 799

- For linear broadband amplifier applications up to 500 MHz
- SAW filter driver in TV tuners



Type	Marking	Ordering Code (tape and reel)	Pin Configuration 1	2	3	Package[1)]
BF 799	LK	Q62702-F935	B	E	C	SOT-23

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CEO}	20	V
Collector-emitter reverse voltage	V_{CES}	30	
Collector-base voltage	V_{CBO}	30	
Emitter-base voltage	V_{EBO}	3	
Collector current	I_C	35	mA
Peak collector current	I_{CM}	50	
Peak base current	I_{BM}	15	
Total power dissipation, $T_A \leq 25$ °C	P_{tot}	280	mW
Junction temperature	T_j	150	°C
Storage temperature range	T_{stg}	– 65 ... + 150	

Thermal Resistance

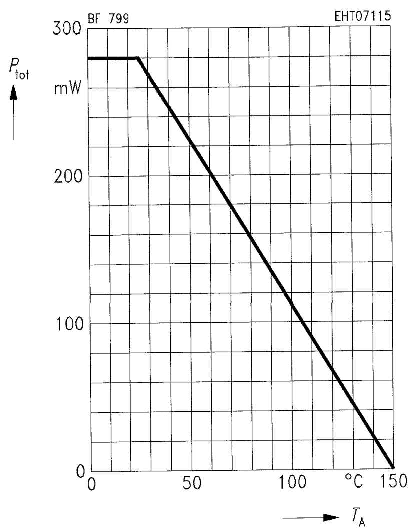
Junction - ambient[2)]	$R_{th\,JA}$	≤ 450	K/W

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

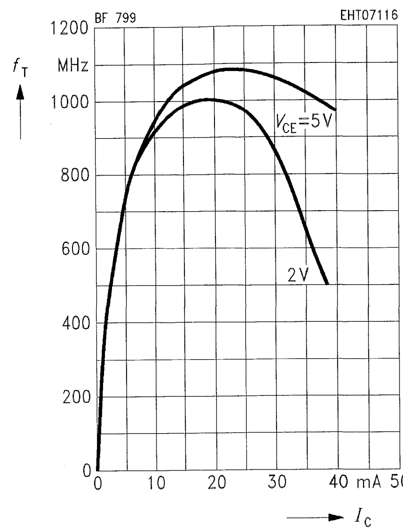
Electrical Characteristics
at T_A = 25 ˚C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)\,CEO}$	20	–	–	V
Collector-base breakdown voltage I_C = 10 µA, I_E = 0	$V_{(BR)\,CBO}$	30	–	–	
Emitter-base breakdown voltage I_E = 10 µA	$V_{(BR)\,EBO}$	3	–	–	
Collector cutoff current V_{CB} = 20 V	I_{CBO}	–	–	100	nA
DC current gain, V_{CE} = 10 V I_C = 5 mA I_C = 20 mA	h_{FE}	 35 40	 95 100	 – 250	–
Collector-emitter saturation voltage I_C = 20 mA, I_B = 2 mA	$V_{CE\,sat}$	–	0.15	0.5	V
Base-emitter saturation voltage I_C = 20 mA, I_B = 2 mA	$V_{BE\,sat}$	–	–	0.95	
AC Characteristics					
Transition frequency I_C = 5 mA, V_{CE} = 10 V, f = 100 MHz I_C = 20 mA, V_{CE} = 8 V, f = 100 MHz	f_T	 – –	 800 1100	 – –	MHz
Output capacitance V_{CB} = 10 V, f = 1 MHz, I_E = 0	C_{ob}	–	0.96	–	pF
Collector-base capacitance V_{CB} = 10 V, V_{BE} = 0 V, f = 1 MHz	C_{cb}	–	0.7	–	
Collector-emitter capacitance V_{CE} = 10 V, V_{BE} = 0 V, f = 1 MHz	C_{ce}	–	0.28	–	
Noise figure I_C = 5 mA, V_{CE} = 10 V, f = 100 MHz R_S = 50 Ω	F	–	3	–	dB
Output conductance I_C = 20 mA, V_{CE} = 10 V, f = 35 MHz	g_{22e}	–	60	–	µS

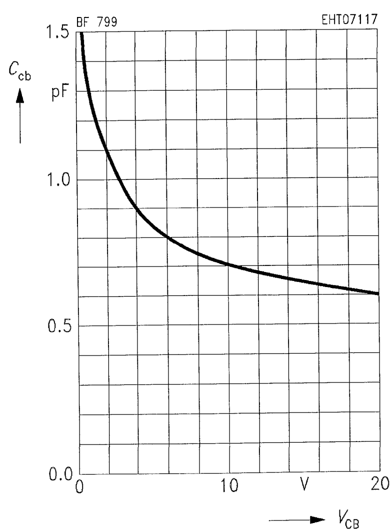
Total power dissipation $P_{tot} = f(T_A)$



Transition frequency $f_T = f(I_C)$
f = 100 MHz



Collector-base capacitance $C_{cb} = f(V_{CB})$
f = 1 MHz

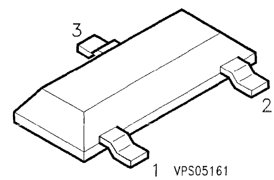


SIEMENS

NPN Silicon RF Transistors

BF 840
BF 841

- Suitable for common emitter RF, IF amplifiers
- Low collector-base capacitance due to contact shield diffusion
- Low output conductance



Type	Marking	Ordering Code	Pin Configuration 1	2	3	Package[1)]
BF 840 BF 841	NC ND	Q62702-F1240 Q62702-F1287	B	E	C	SOT-23

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CEO}	40	V
Collector-base voltage	V_{CBO}	40	
Emitter-base voltage	V_{EBO}	4	
Collector current	I_C	25	mA
Base current	I_B	2	
Total power dissipation, $T_A \leq 25$ °C[2)]	P_{tot}	280	mW
Junction temperature	T_j	150	°C
Storage temperature range	T_{stg}	– 65 … + 150	

Thermal Resistance

Junction - ambient[2)]	$R_{th\,JA}$	≤ 450	K/W

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

Electrical Characteristics

at T_A = 25 °C, unless otherwise specified.

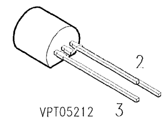
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)\,CEO}$	40	–	–	V
Emitter-base breakdown voltage I_E = 10 µA, I_B = 0	$V_{(BR)\,EBO}$	4	–	–	
Collector-base cutoff current V_{CB} = 20 V, I_E = 0	I_{CBO}	–	–	100	nA
DC current gain, I_C = 1 mA, V_{CE} = 10 V BF 840 BF 841	h_{FE}	 65 35	 – –	 220 125	–
Base-emitter voltage I_C = 1 mA, V_{CE} = 10 V	V_{BE}	–	0.7	–	V
AC Characteristics					
Transition frequency I_C = 1 mA, V_{CE} = 10 V, f = 100 MHz	f_T	–	380	–	MHz
Collector-base capacitance V_{CB} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{cb}	–	0.3	–	pF
Noise figure I_C = 1 mA, V_{CE} = 10 V, f = 100 kHz R_S = 200 Ω	F	–	1.7	–	dB
Output conductance I_C = 1 mA, V_{CE} = 10 V, f = 0.5 MHz	g_{22e}	–	4	–	µS

SIEMENS

NPN Silicon RF Transistor

BF 959

- For SAW filter driver applications in TV tuners
- For linear broadband VHF amplifier stages
- For oscillator applications



Type	Marking	Ordering Code	Pin Configuration 1	2	3	Package[1]
BF 959	–	Q62702-F640	C	E	B	TO-92

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CEO}	20	V
Collector-emitter reverse voltage	V_{CES}	30	
Collector-base voltage	V_{CBO}	30	
Emitter-base voltage	V_{EBO}	3	
Peak collector current	I_{CM}	100	mA
Peak base current	I_{BM}	30	
Total power dissipation, $T_A \leq 25$ °C $V_{CE} \leq 15$ V	P_{tot}	500	mW
Junction temperature	T_j	150	°C
Storage temperature range	T_{stg}	– 55 ... + 150	

Thermal Resistance

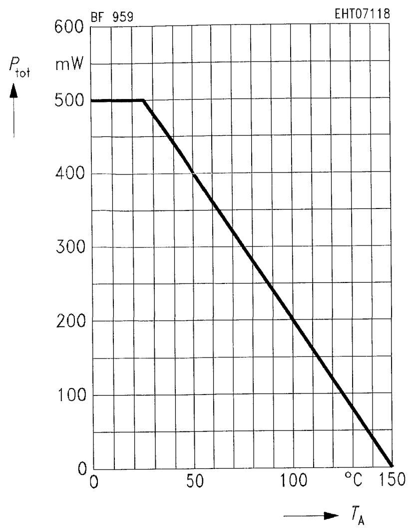
Junction - ambient	$R_{th\,JA}$	≤ 250	K/W

[1] For detailed information see chapter Package Outlines.

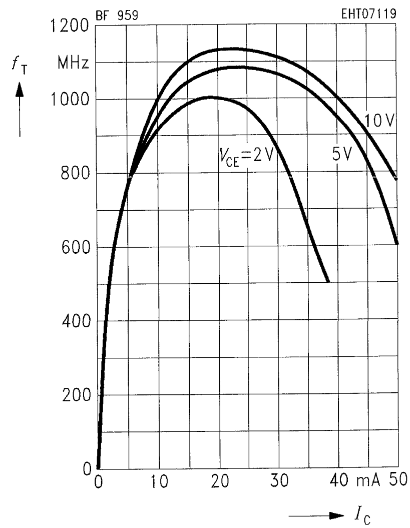
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-emitter breakdown voltage I_C = 1 mA	$V_{(BR)\,CE0}$	20	–	–	V
Collector-base breakdown voltage I_C = 10 μA	$V_{(BR)\,CB0}$	30	–	–	
Emitter-base breakdown voltage I_E = 10 μA	$V_{(BR)\,EB0}$	3	–	–	
Collector cutoff current V = 20 V	I_{CB0}	–	–	100	nA
DC current gain, V_{CE} = 10 V I_C = 5 mA I_C = 20 mA	h_{FE}	 35 40	 – 85	 – –	–
Base-emitter voltage I_C = 20 mA, V_{CE} = 10 V	V_{BE}	–	0.75	–	V
Collector-emitter saturation voltage I_C = 30 mA, I_B = 2 mA	$V_{CE\,sat}$	–	–	1	
Base-emitter saturation voltage I_C = 30 mA, I_B = 2 mA	$V_{BE\,sat}$	–	–	0.95	
AC Characteristics					
Transition frequency I_C = 20 mA, V_{CE} = 10 V, f = 100 MHz I_C = 30 mA, V_{CE} = 5 V	f_T	 700 600	 1100 –	 – –	MHz
Output capacitance V_{CB} = 10 V, I_E = 0, f = 1 MHz	C_{obo}	–	0.9	–	pF
Collector-base capacitance V_{CE} = 10 V, V_{BE} = 0, f = 1 MHz	C_{cb}	–	0.75	–	
Noise figure V_{CE} = 10 V, f = 200 MHz, R_S = 60 Ω I_C = 5 mA I_C = 20 mA	F	 – –	 3 4	 – –	dB
Output conductance I_C = 20 mA, V_{CE} = 10 V, f = 35 MHz	g_{22e}	–	0.06	–	mS

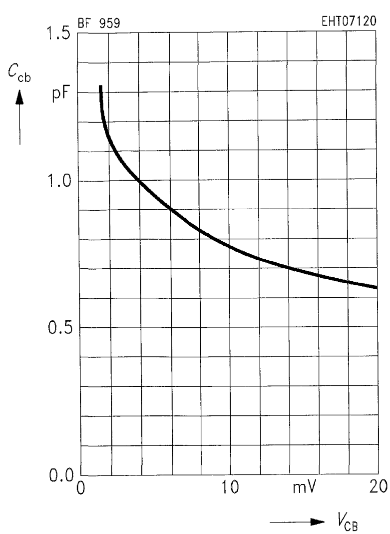
Total power dissipation $P_{tot} = f(T_A)$



Transition frequency $f_T = f(I_C)$
f = 100 MHz



Collector-base capacitance $C_{cb} = f(V_{CB})$
f = 1 MHz

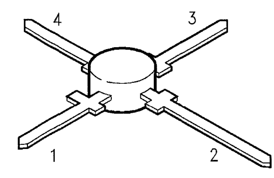


SIEMENS

Silicon N Channel MOSFET Tetrode

BF 961

- For input and mixer stages in FM and VHF TV tuners



Type	Marking	Ordering Code	Pin Configuration 1	2	3	4	Package1)
BF 961	–	Q62702-F518	S	D	G_2	G_1	X-plast

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	20	V
Drain current	I_D	30	mA
Gate 1/gate 2 peak source current	$\pm I_{G1/2SM}$	10	
Total power dissipation, $T_A \leq 60$ ˚C	P_{tot}	200	mW
Storage temperature range	T_{stg}	– 55 … + 150	˚C
Channel temperature	T_{ch}	150	

Thermal Resistance

Junction - ambient	$R_{th JA}$	$\leq$ 450	K/W

1) For detailed information see chapter Package Outlines.

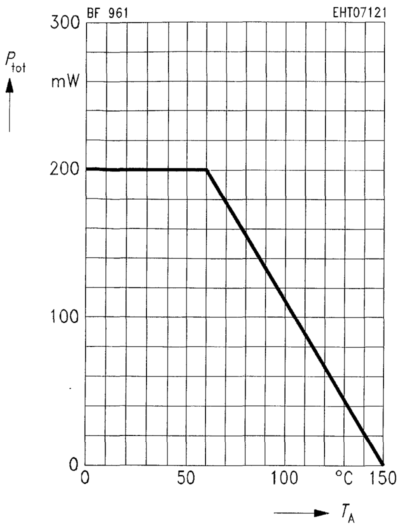
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Drain-source breakdown voltage I_D = 10 µA, – V_{G1S} = – V_{G2S} = 4 V	$V_{(BR)\,DS}$	20	–	–	V
Gate 1 source breakdown voltage ± I_{G1S} = 10 mA, V_{G2S} = V_{DS} = 0	± $V_{(BR)\,G1SS}$	8.5	–	14	
Gate 2 source breakdown voltage ± I_{G2S} = 10 mA, V_{G1S} = V_{DS} = 0	± $V_{(BR)\,G2SS}$	8.5	–	14	
Gate 1 source leakage current ± V_{G1S} = 5 V, V_{G2S} = V_{DS} = 0	± I_{G1SS}	–	–	50	nA
Gate 2 source leakage current ± V_{G2S} = 5 V, V_{G1S} = V_{DS} = 0	± I_{G2SS}	–	–	50	
Drain current V_{DS} = 15 V, V_{G1S} = 0, V_{G2S} = 4 V	I_{DSS}	4	–	20	mA
Gate 1 source pinch-off voltage V_{DS} = 15 V, V_{G2S} = 4 V, I_D = 20 µA	– $V_{G1S\,(p)}$	–	–	2.5	V
Gate 2 source pinch-off voltage V_{DS} = 15 V, V_{G1S} = 0, I_D = 20 µA	– $V_{G2S\,(p)}$	–	–	2.5	

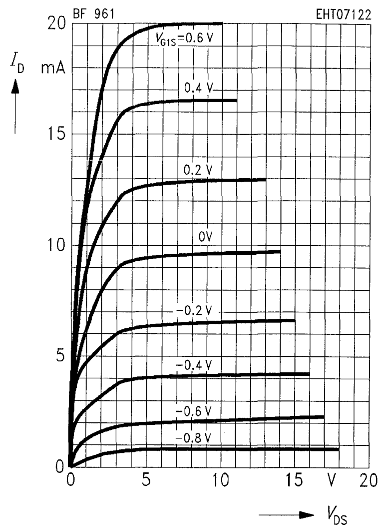
Electrical Characteristics
at T_A = 25 ˚C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
AC Characteristics					
Forward transconductance V_{DS} = 15 V, I_D = 10 mA, V_{G2S} = 4 V, f = 1 kHz	g_{fs}	12	17	–	mS
Gate 1 input capacitance V_{DS} = 15 V, I_D = 10 mA, V_{G2S} = 4 V, f = 1 MHz	C_{g1ss}	–	3.6	–	pF
Gate 2 input capacitance V_{DS} = 15 V, I_D = 10 mA, V_{G2S} = 4 V, f = 1 MHz	C_{g2ss}	–	1.6	–	
Feedback capacitance V_{DS} = 15 V, I_D = 10 mA, V_{G2S} = 4 V, f = 1 MHz	C_{dg1}	–	25	–	fF
Output capacitance V_{DS} = 15 V, I_D = 10 mA, V_{G2S} = 4 V, f = 1 MHz	C_{dss}	–	1.6	–	pF
Power gain V_{DS} = 15 V, I_D = 10 mA f = 200 MHz, G_G = 2 mS, G_L = 0.5 mS 2 Δf = 12 MHz (test circuit 1)	G_{ps}	–	23	–	dB
Noise figure V_{DS} = 15 V, I_D = 10 mA f = 200 MHz, G_G = 2 mS, G_L = 0.5 mS (test circuit 1)	F	–	1.1	–	
Gain control range V_{DS} = 15 V, V_{G2S} = 4 … – 2 V, f = 200 MHz (test circuit 1)	ΔG_{ps}	–	50	–	
Mixer gain (additive) V_{DS} = 15 V, V_{G2S} = 6 V, R_S = 220 Ω f = 200 MHz, f_{IF} = 36 MHz 2 Δf_{IF} = 5 MHz, V_{osc} = 0.5 V (test circuit 2)	G_{psc}	–	16	–	
Mixer gain (multiplicative) V_{DS} = 15 V, V_{G1S} = 1.7 V, V_{G2S} = 2.5 V R_S = 220 Ω, f = 200 MHz, f_{IF} = 36 MHz 2 Δf_{IF} = 5 MHz, V_{osc} = 2 V (test circuit 3)	G_{psc}	–	18	–	

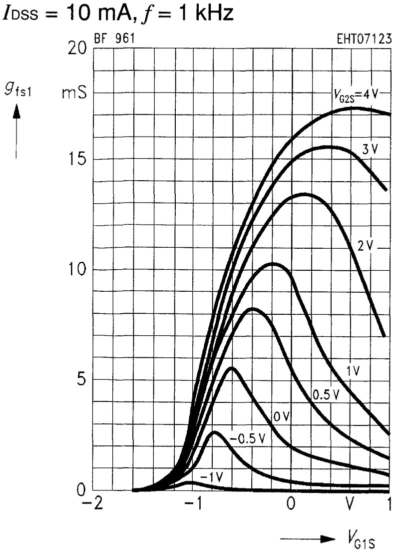
Total power dissipation $P_{tot} = f\,(T_A)$



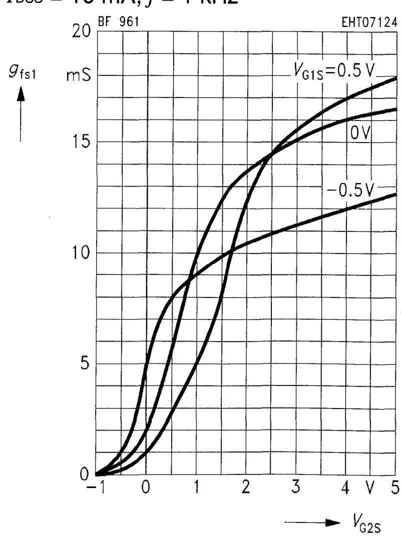
Output characteristics $I_D = f\,(V_{DS})$
$V_{G2S} = 4$ V



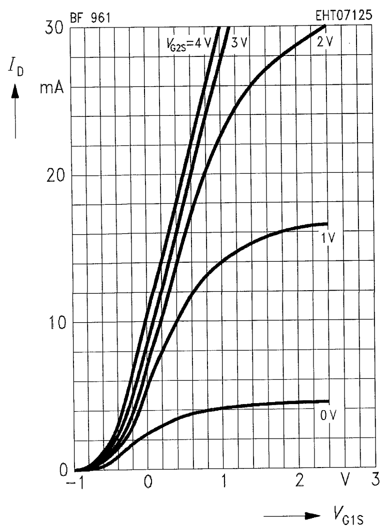
Gate 1 forward transconductance
$g_{fs1} = f\,(V_{G1S})$
$V_{DS} = 15$ V
$I_{DSS} = 10$ mA, $f = 1$ kHz



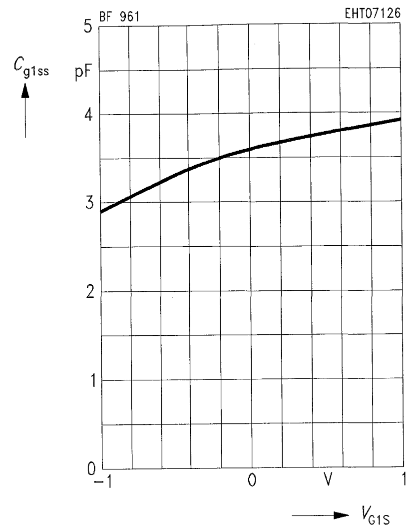
Gate 1 forward transconductance
$g_{fs1} = f\,(V_{G2S})$
$V_{DS} = 15$ V
$I_{DSS} = 10$ mA, $f = 1$ kHz



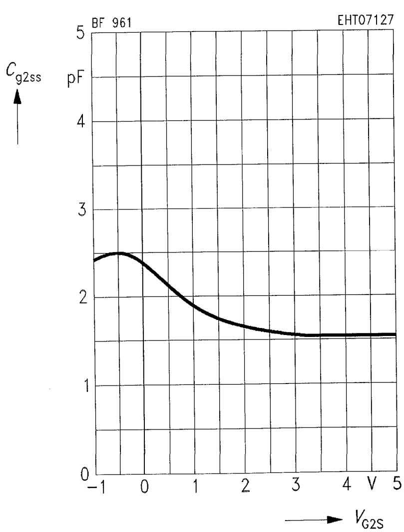
Drain current $I_D = f(V_{G1S})$
V_{DS} = 15 V



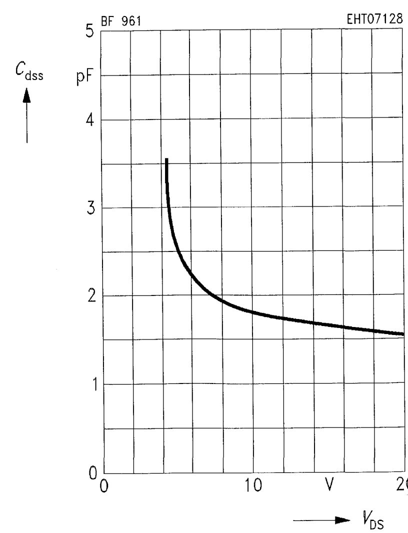
Gate 1 input capacitance $C_{g1ss} = f(V_{G1S})$
V_{G2S} = 4 V, V_{DS} = 15 V
I_{DSS} = 10 mA, f = 1 MHz



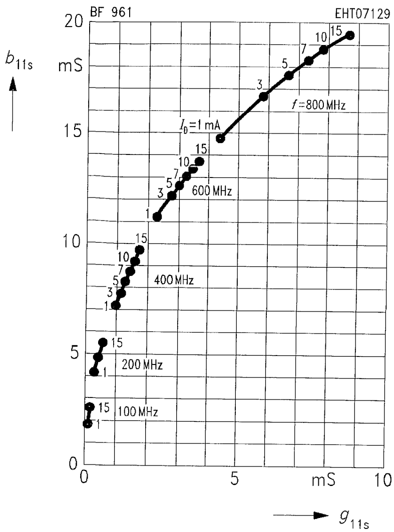
Gate 2 input capacitance $C_{g2ss} = f(V_{G2S})$
V_{G1S} = 0 V, V_{DS} = 15 V
I_{DSS} = 10 mA, f = 1 MHz



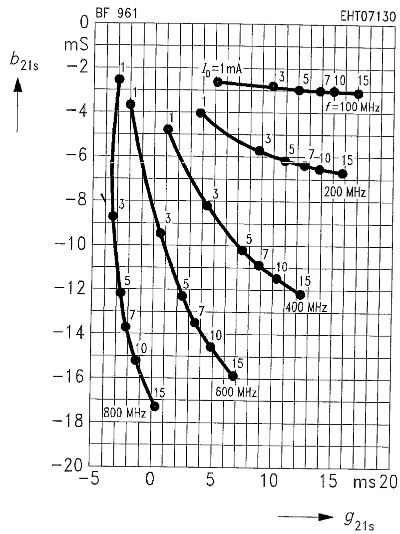
Output capacitance $C_{dss} = f(V_{DS})$
V_{G1S} = 0 V, V_{G2S} = 4 V
I_{DSS} = 10 mA, f = 1 MHz



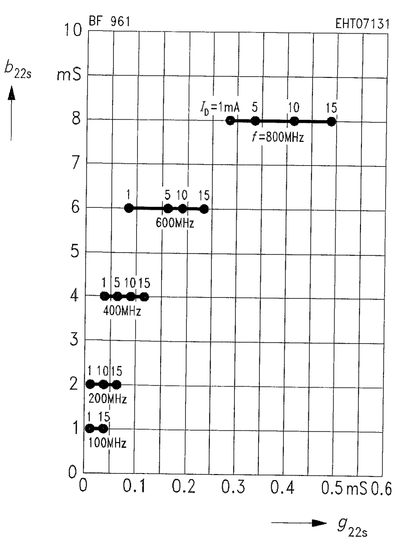
Gate 1 input admittance y_{11s}
V_{DS} = 15 V, V_{G2S} = 4 V
(common source)



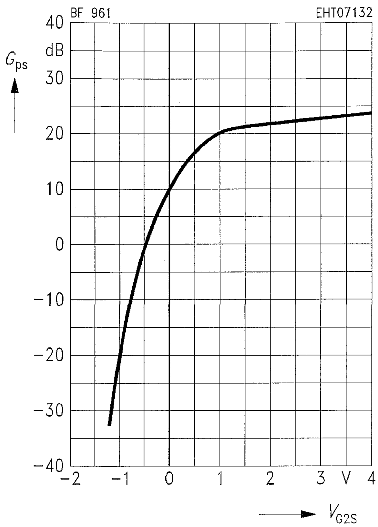
Gate 1 forward transfer admittance y_{21s}
V_{DS} = 15 V, V_{G2S} = 4 V
(common source)



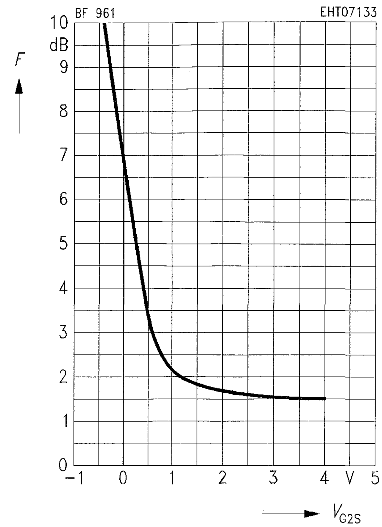
Output admittance y_{22s}
V_{DS} = 15 V, V_{G2S} = 4 V
(common source)



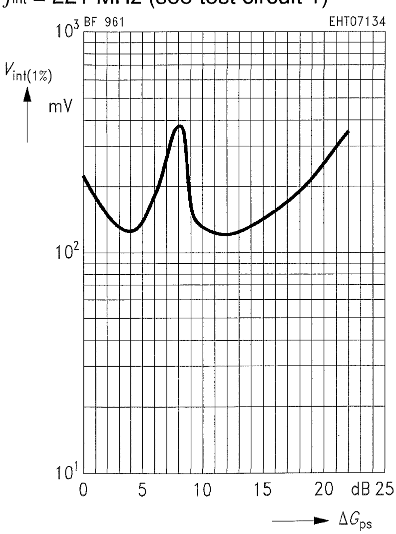
Power gain $G_{ps} = f(V_{G2S})$
V_{DS} = 15 V, V_{G1S} = 0 V, I_{DSS} = 10 mA
f = 200 MHz (see test circuit 1)



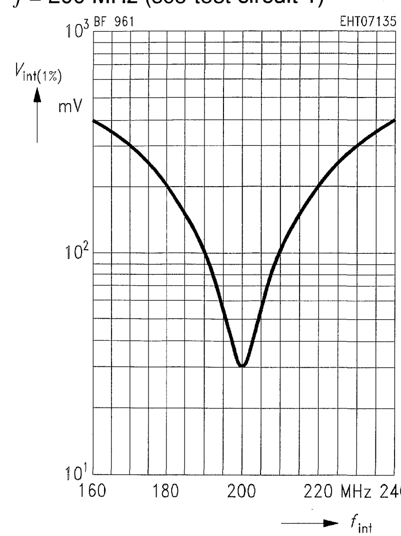
Noise figure $F = f(V_{G2S})$
V_{DS} = 15 V, V_{G1S} = 0 V, I_{DSS} = 10 mA
f = 200 MHz, (see test circuit 1)



Interference voltage for 1% cross modulation $V_{int\,(1\%)} = f(\Delta G_{ps})$[1]
V_{DS} = 15 V, V_{G1S} = 0, f = 200 MHz
f_{int} = 221 MHz (see test circuit 1)

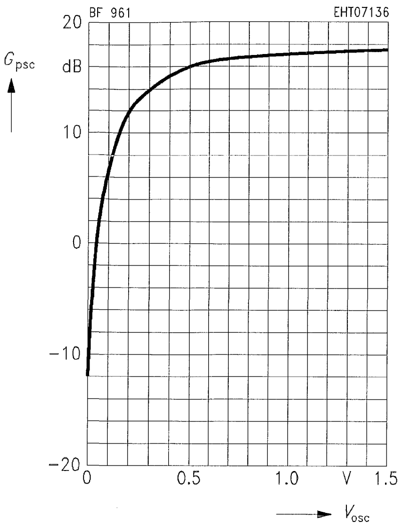


Interference voltage for 1% cross modulation $V_{int\,(1\%)} = f(f_{int})$[1]
V_{DS} = 15 V, V_{G2S} = 4 V, V_{G1S} = 0
f = 200 MHz (see test circuit 1)

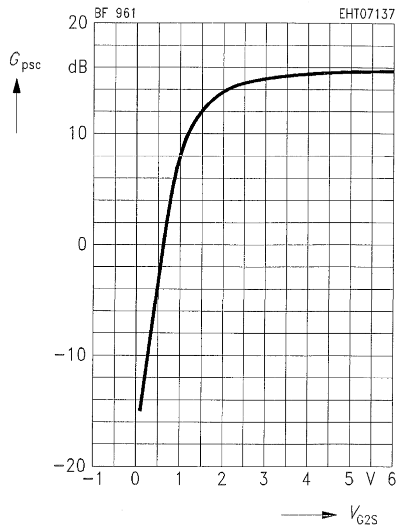


1) For footnote refer to the last page of this data sheet.

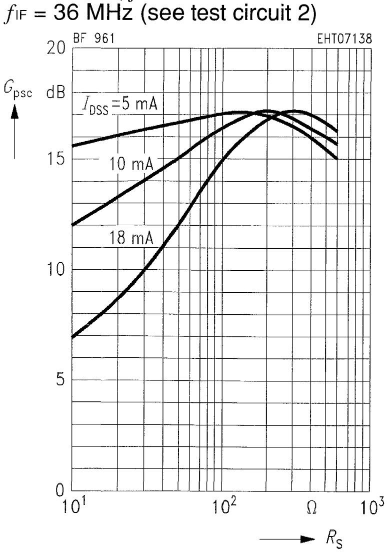
Mixer gain (additive) $G_{psc} = f(V_{osc})$
V_D = 15 V, V_{G1S} = 0, V_{G2S} = 6 V
R_S = 220 Ω, I_{DSS} = 10 mA, f = 200 MHz
f_{IF} = 36 MHz (see test circuit 2)



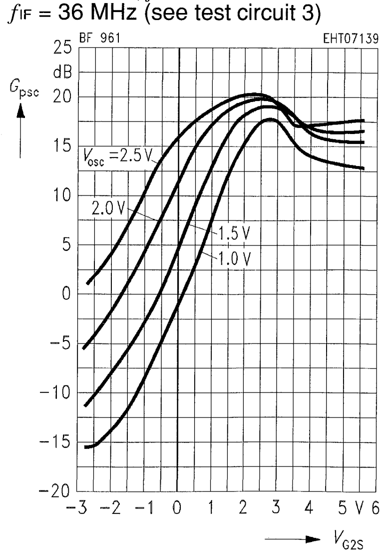
Mixer gain (additive) $G_{psc} = f(V_{G2S})$
V_D = 15 V, V_{G1S} = 0, R_S = 220 Ω
V_{osc} = 0.5 V, I_{DSS} = 10 mA, f = 200 MHz
f_{IF} = 36 MHz (see test circuit 2)



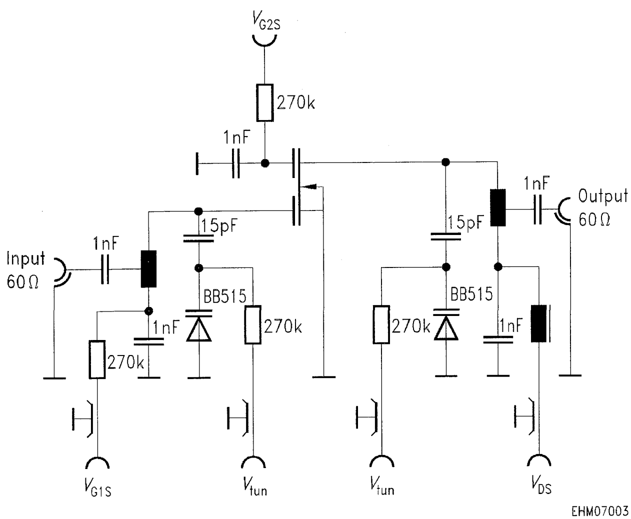
Mixer gain (additive) $G_{psc} = f(R_S)$
V_D = 15 V, V_{G1S} = 0, V_{G2S} = 6 V
V_{osc} = 0.5 V, f = 200 MHz
f_{IF} = 36 MHz (see test circuit 2)



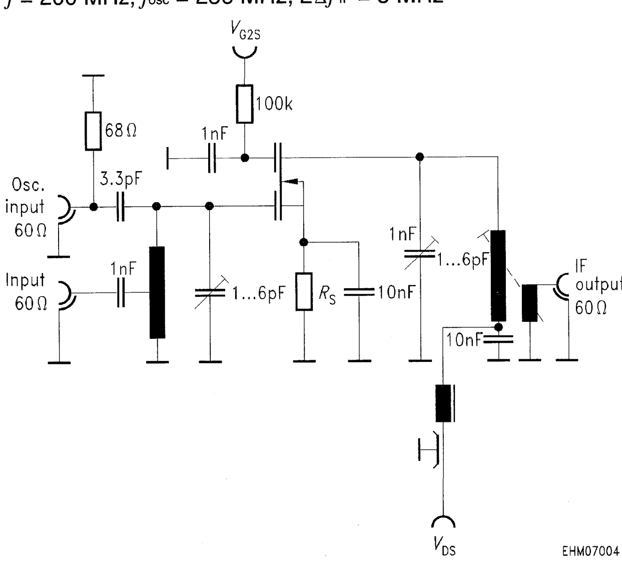
Mixer gain (multiplicative) $G_{psc} = f(V_{G2S})$
V_D = 15 V, V_{G1S} = 1.7 V, R_S = 200 Ω
I_{DSS} = 10 mA, f = 200 MHz
f_{IF} = 36 MHz (see test circuit 3)



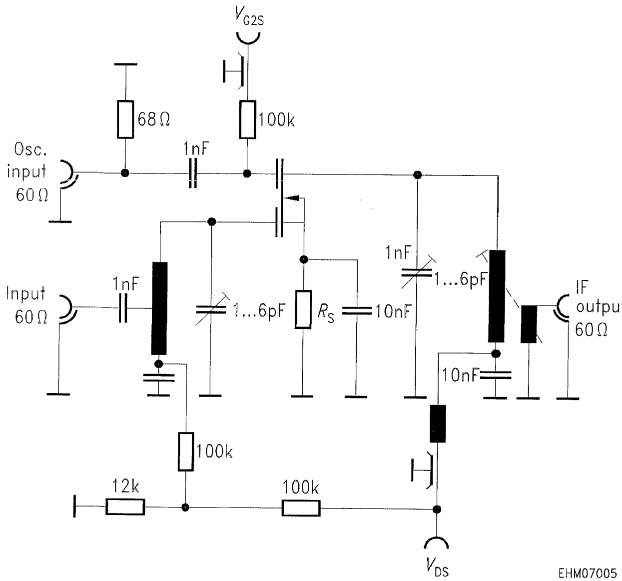
Test circuit 1 for power gain, noise figure and cross modulation
f = 200 MHz, G_G = 2 mS, G_L = 0.5 mS



Test circuit 2 for mixer gain (additive)
f = 200 MHz, f_{osc} = 236 MHz, $2\Delta f_{IF}$ = 5 MHz



Test circuit 3 for mixer gain (multiplicative)
f = 200 MHz, f_{osc} = 236 MHz, $2\Delta f_{IF}$ = 5 MHz



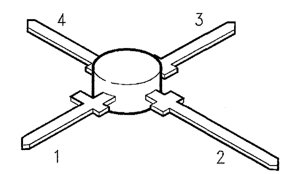
1) $V_{int\,(1\%)}$ is the rms value of half the emf (terminal voltage at matching) of a 100 % sine modulated TV carrier at an internal generator resistance of 60 Ω, causing 1 % amplitude modulation on the active carrier.

SIEMENS

Silicon N Channel MOSFET Tetrode

BF 963

- For high-gain, low-distortion VHF TV and FM mixer and input stages



Type	Marking	Ordering Code	Pin Configuration 1	2	3	4	Package[1)]
BF 963	–	Q62702-F904	S	D	G_2	G_1	X-plast

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	20	V
Drain current	I_D	50	mA
Gate 1/gate 2 peak source current	$\pm I_{G1/2SM}$	10	
Total power dissipation, $T_A \leq 60$ ˚C	P_{tot}	200	mW
Storage temperature range	T_{stg}	– 55 … + 150	˚C
Channel temperature	T_{ch}	150	

Thermal Resistance

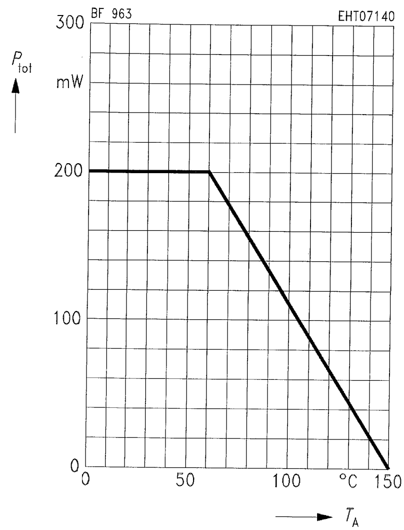
Junction - ambient	$R_{th\,JA}$	≤ 450	K/W

1) For detailed information see chapter Package Outlines.

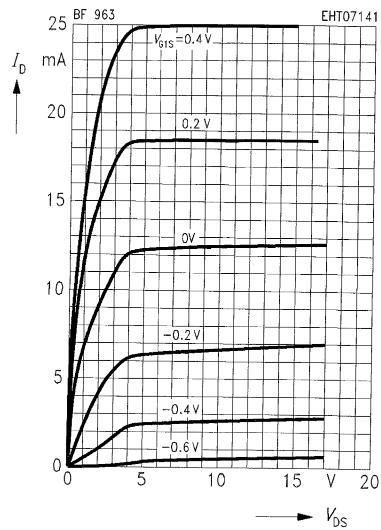
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Drain-source breakdown voltage I_D = 10 µA, – V_{G1S} = – V_{G2S} = 4 V	$V_{(BR)\,DS}$	20	–	–	V
Gate 1 source breakdown voltage ± I_{G1S} = 10 mA, V_{G2S} = V_{DS} = 0	± $V_{(BR)\,G1SS}$	8.5	–	14	
Gate 2 source breakdown voltage ± I_{G2S} = 10 mA, V_{G1S} = V_{DS} = 0	± $V_{(BR)\,G2SS}$	8.5	–	14	
Gate 1 source leakage current ± V_{G1S} = 5 V, V_{G2S} = V_{DS} = 0	± I_{G1SS}	–	–	50	nA
Gate 2 source leakage current ± V_{G2S} = 5 V, V_{G1S} = V_{DS} = 0	± I_{G2SS}	–	–	50	
Drain current V_{DS} = 15 V, V_{G1S} = 0, V_{G2S} = 4 V	I_{DSS}	6	–	40	mA
Gate 1 source pinch-off voltage V_{DS} = 15 V, V_{G2S} = 4 V, I_D = 20 µA	– $V_{G1S\,(p)}$	–	–	2.5	V
Gate 2 source pinch-off voltage V_{DS} = 15 V, V_{G1S} = 0, I_D = 20 µA	– $V_{G2S\,(p)}$	–	–	2.0	
AC Characteristics					
Forward transconductance V_{DS} = 15 V, I_D = 10 mA, V_{G2S} = 4 V, f = 1 kHz	g_{fs}	16	25	–	mS
Gate 1 input capacitance V_{DS} = 15 V, I_D = 10 mA, V_{G2S} = 4 V, f = 1 MHz	C_{g1ss}	–	6	–	pF
Gate 2 input capacitance V_{DS} = 15 V, I_D = 10 mA, V_{G2S} = 4 V, f = 1 MHz	C_{g2ss}	–	2.5	–	
Feedback capacitance V_{DS} = 15 V, I_D = 10 mA, V_{G2S} = 4 V, f = 1 MHz	C_{dg1}	–	50	–	fF
Output capacitance V_{DS} = 15 V, I_D = 10 mA, V_{G2S} = 4 V, f = 1 MHz	C_{dss}	–	2.5	–	pF
Power gain, V_{DS} = 15 V, I_D = 10 mA, f = 200 MHz, G_G = 2.5 mS, G_L = 0.8 mS 2 Δf = 12 MHz (test circuit)	G_{ps}	–	25	–	dB
Noise figure, V_{DS} = 15 V, I_D = 10 mA f = 200 MHz, G_G = 2.5 mS, G_L = 0.8 mS (test circuit)	F	–	1.5	–	

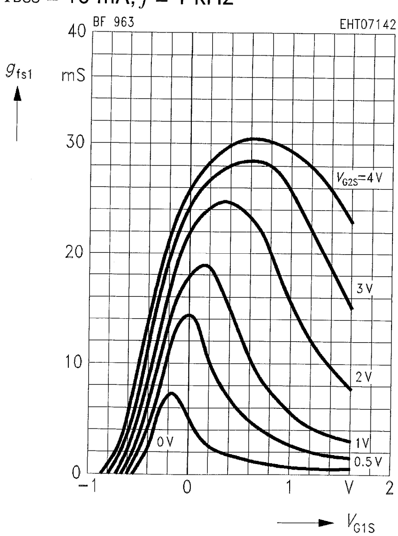
Total power dissipation $P_{tot} = f(T_A)$



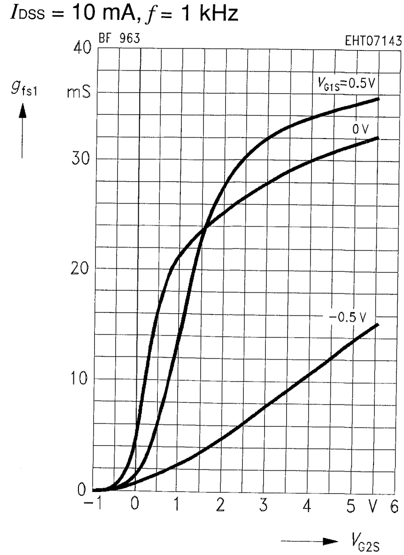
Output characteristics $I_D = f(V_{DS})$
V_{G2S} = 4 V



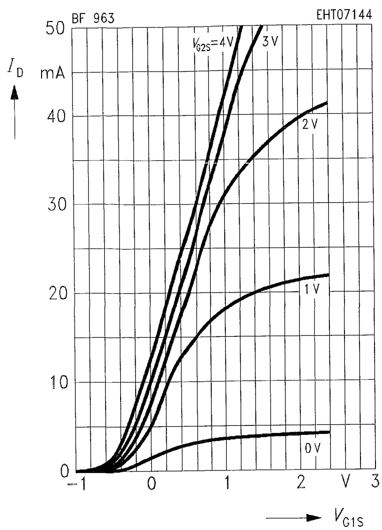
Gate 1 forward transconductance
$g_{fs1} = f(V_{G1S})$
V_{DS} = 15 V
I_{DSS} = 10 mA, f = 1 kHz



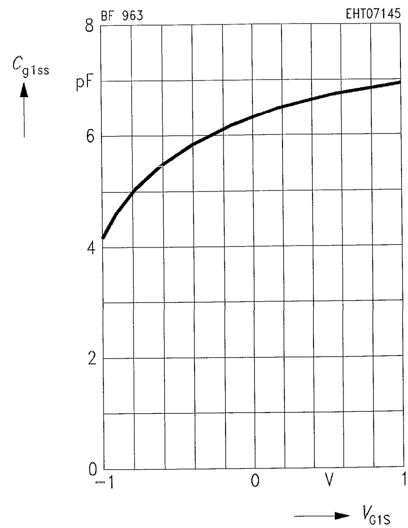
Gate 1 forward transconductance
$g_{fs1} = f(V_{G2S})$
V_{DS} = 15 V
I_{DSS} = 10 mA, f = 1 kHz



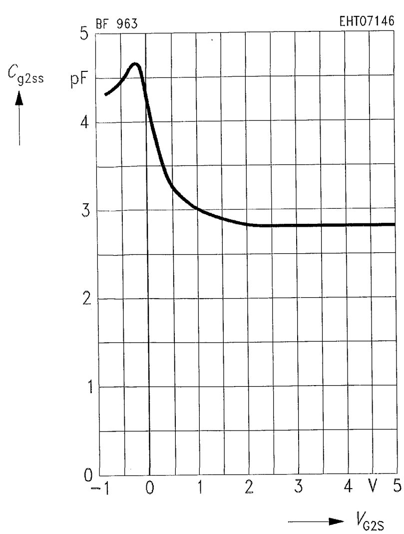
Drain current $I_D = f(V_{G1S})$
$V_{DS} = 15$ V



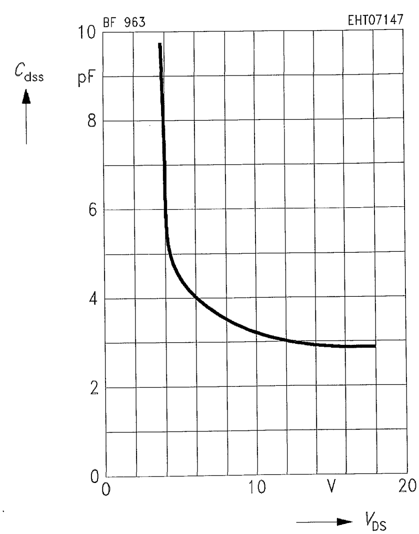
Gate 1 input capacitance $C_{g1ss} = f(V_{G1S})$
$V_{G2S} = 4$ V, $V_{DS} = 15$ V
$I_{DSS} = 10$ mA, $f = 1$ MHz



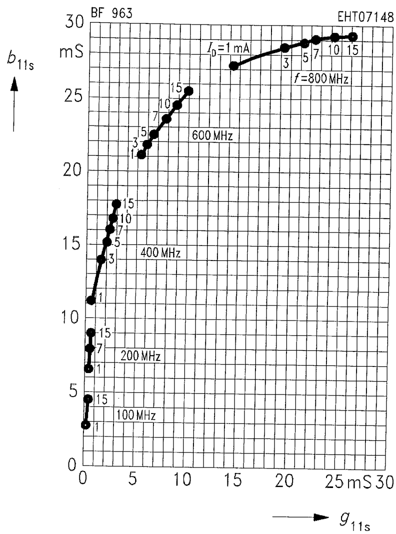
Gate 2 input capacitance $C_{g2ss} = f(V_{G2S})$
$V_{G1S} = 0$ V, $V_{DS} = 15$ V
$I_{DSS} = 10$ mA, $f = 1$ MHz



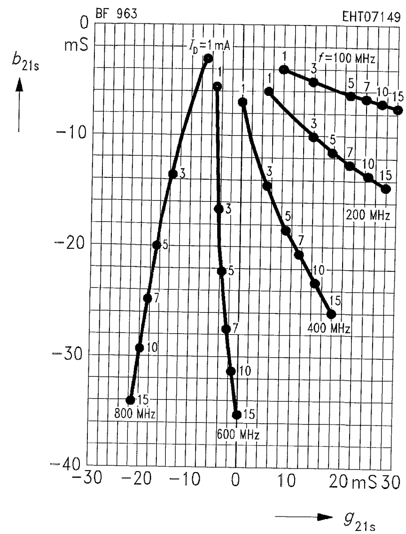
Output capacitance $C_{dss} = f(V_{DS})$
$V_{G1S} = 0$ V, $V_{G2S} = 4$ V
$I_{DSS} = 10$ mA, $f = 1$ MHz



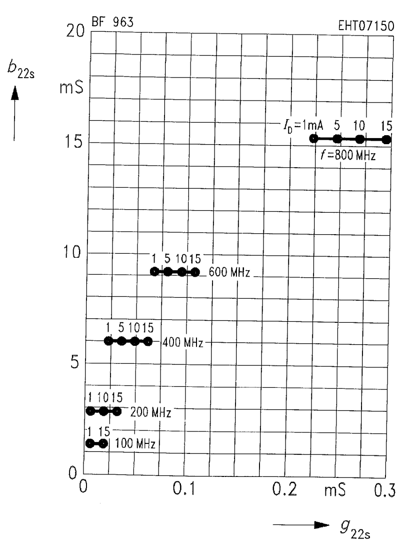
Gate 1 input admittance y_{11s}
V_{DS} = 15 V, V_{G2S} = 4 V
(common source)



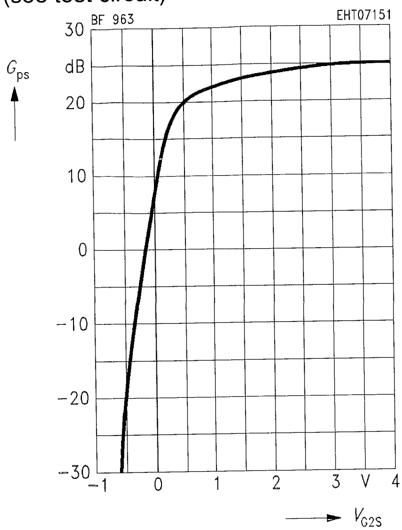
Gate 1 forward transfer admittance y_{21s}
V_{DS} = 15 V, V_{G2S} = 4 V
(common source)



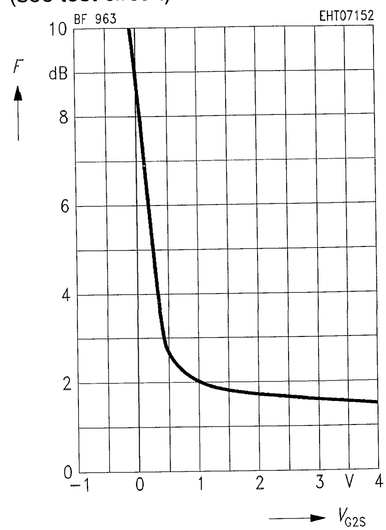
Output admittance y_{22s}
V_{DS} = 15 V, V_{G2S} = 4 V
(common source)



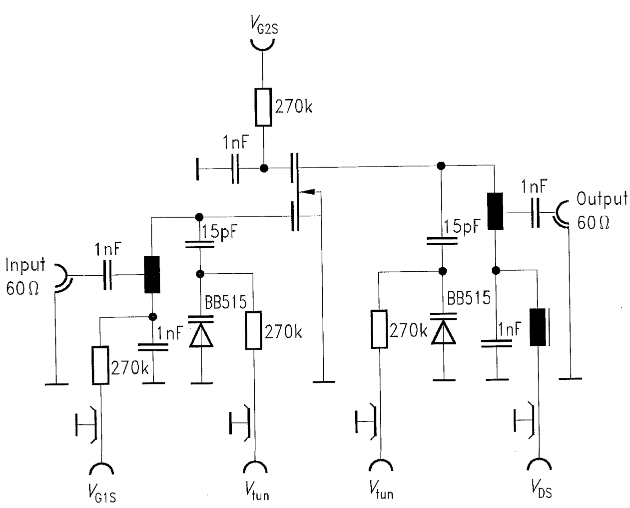
Power gain $G_{ps} = f(V_{G2S})$
V_{DS} = 15 V, V_{G1S} = 0 V, I_{DSS} = 10 mA
f = 200 MHz
(see test circuit)



Noise figure $F = f(V_{G2S})$
V_{DS} = 15 V, V_{G1S} = 0 V, I_{DSS} = 10 mA
f = 200 MHz
(see test circuit)



Test circuit for power gain and noise figure
f = 200 MHz, G_G = 2 mS, G_L = 0.5 mS

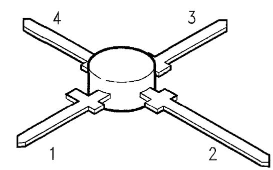


SIEMENS

Silicon N Channel MOSFET Tetrode

BF 964 S

- For VHF applications, especially for input and mixer stages with a wide tuning range, e.g. in CATV tuners



Type	Marking	Ordering Code	Pin Configuration 1	2	3	4	Package[1)]
BF 964 S	–	Q62702-F446	S	D	G_2	G_1	X-plast

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	20	V
Drain current	I_D	30	mA
Gate 1/gate 2 peak source current	$\pm I_{G1/2SM}$	10	
Total power dissipation, $T_A \leq 60$ ˚C	P_{tot}	200	mW
Storage temperature range	T_{stg}	– 55 ... + 150	˚C
Channel temperature	T_{ch}	150	

Thermal Resistance

Junction - ambient	$R_{th\,JA}$	≤ 450	K/W

1) For detailed information see chapter Package Outlines.

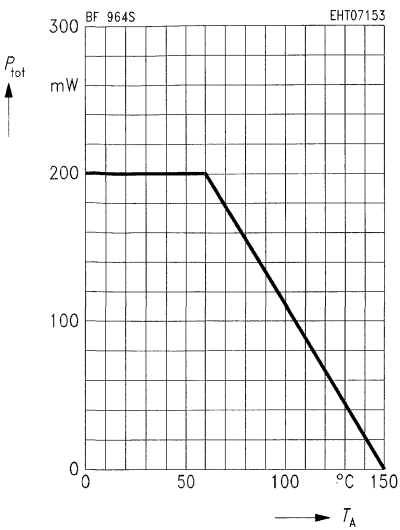
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Drain-source breakdown voltage I_D = 10 µA, $-V_{G1S} = -V_{G2S}$ = 4 V	$V_{(BR)\,DS}$	20	–	–	V
Gate 1 source breakdown voltage $\pm I_{G1S}$ = 10 mA, $V_{G2S} = V_{DS}$ = 0	$\pm V_{(BR)\,G1SS}$	8.5	–	14	
Gate 2 source breakdown voltage $\pm I_{G2S}$ = 10 mA, $V_{G1S} = V_{DS}$ = 0	$\pm V_{(BR)\,G2SS}$	8.5	–	14	
Gate 1 source leakage current $\pm V_{G1S}$ = 5 V, $V_{G2S} = V_{DS}$ = 0	$\pm I_{G1SS}$	–	–	50	nA
Gate 2 source leakage current $\pm V_{G2S}$ = 5 V, $V_{G1S} = V_{DS}$ = 0	$\pm I_{G2SS}$	–	–	50	
Drain current V_{DS} = 15 V, V_{G1S} = 0, V_{G2S} = 4 V	I_{DSS}	2	–	20	mA
Gate 1 source pinch-off voltage V_{DS} = 15 V, V_{G2S} = 4 V, I_D = 20 µA	$-V_{G1S\,(p)}$	–	–	2.5	V
Gate 2 source pinch-off voltage V_{DS} = 15 V, V_{G1S} = 0, I_D = 20 µA	$-V_{G2S\,(p)}$	–	–	2.0	

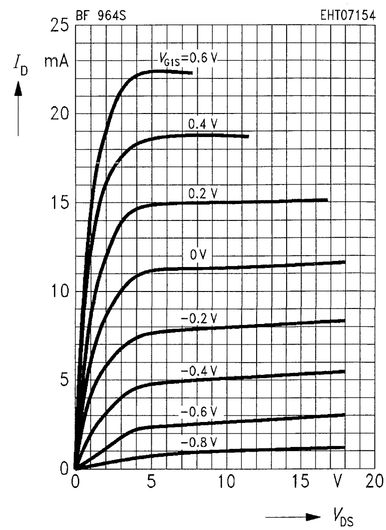
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
AC Characteristics					
Forward transconductance V_{DS} = 15 V, I_D = 10 mA, V_{G2S} = 4 V, f = 1 kHz	g_{fs}	15	18	–	mS
Gate 1 input capacitance V_{DS} = 15 V, I_D = 10 mA, V_{G2S} = 4 V, f = 1 MHz	C_{g1ss}	–	2.5	–	pF
Gate 2 input capacitance V_{DS} = 15 V, I_D = 10 mA, V_{G2S} = 4 V, f = 1 MHz	C_{g2ss}	–	1.2	–	
Feedback capacitance V_{DS} = 15 V, I_D = 10 mA, V_{G2S} = 4 V, f = 1 MHz	C_{dg1}	–	25	–	fF
Output capacitance V_{DS} = 15 V, I_D = 10 mA, V_{G2S} = 4 V, f = 1 MHz	C_{dss}	–	1	–	pF
Power gain V_{DS} = 15 V, I_D = 10 mA, f = 200 MHz, G_G = 2 mS, G_L = 0.5 mS (test circuit)	G_{ps}	–	25	–	dB
Noise figure V_{DS} = 15 V, I_D = 10 mA f = 200 MHz, G_G = 2 mS, G_L = 0.5 mS (test circuit)	F	–	1	–	
Gain control range V_{DS} = 15 V, V_{G2S} = 4 … – 2 V, f = 200 MHz (test circuit)	ΔG_{ps}	50	–	–	

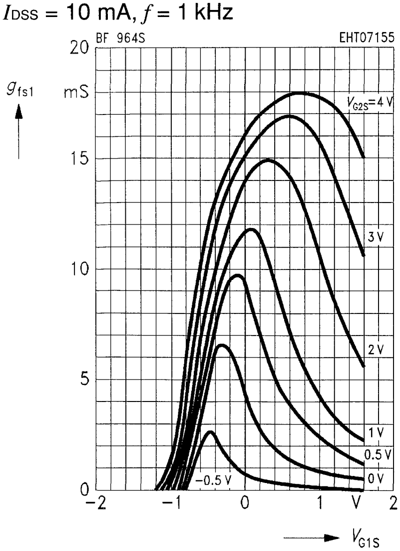
Total power dissipation $P_{tot} = f(T_A)$



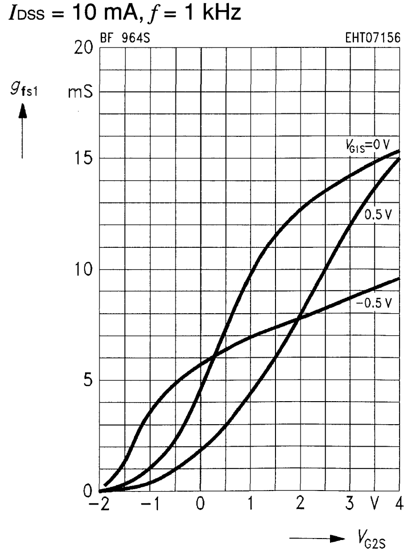
Output characteristics $I_D = f(V_{DS})$



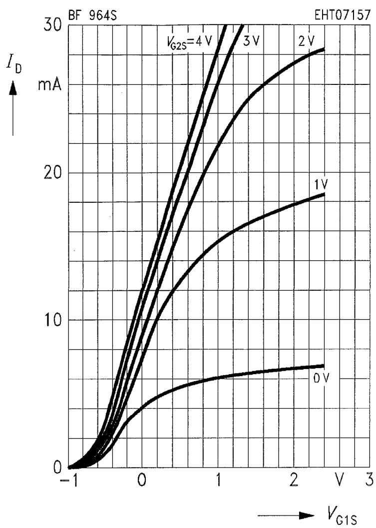
Gate 1 forward transconductance
$g_{fs1} = f(V_{G1S})$
V_{DS} = 15 V
I_{DSS} = 10 mA, f = 1 kHz



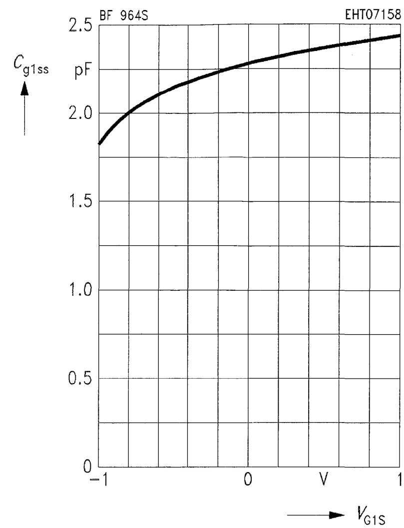
Gate 1 forward transconductance
$g_{fs1} = f(V_{G2S})$
V_{DS} = 15 V
I_{DSS} = 10 mA, f = 1 kHz



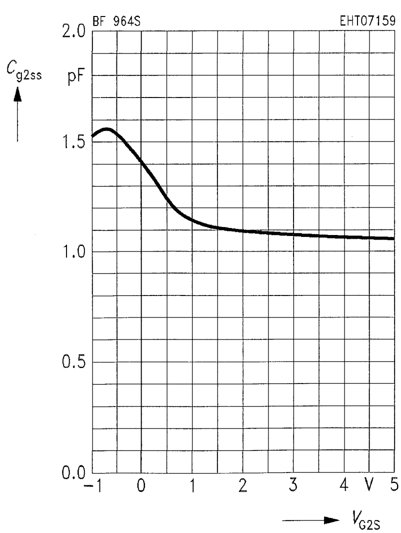
Drain current $I_D = f(V_{G1S})$
V_{DS} = 15 V



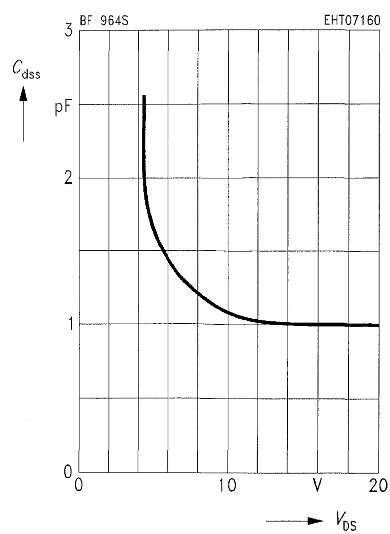
Gate 1 input capacitance $C_{g1ss} = f(V_{G1S})$
V_{G2S} = 4 V, V_{DS} = 15 V
I_{DSS} = 10 mA, f = 1 MHz



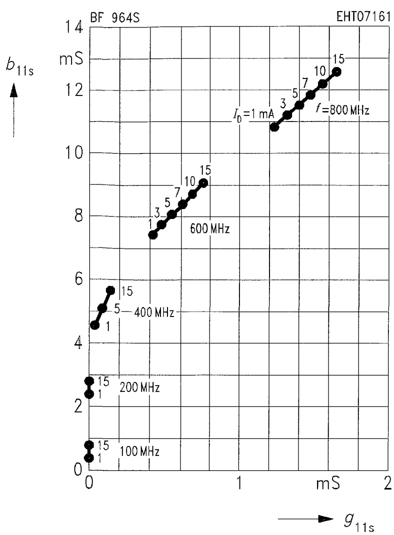
Gate 2 input capacitance $C_{g2ss} = f(V_{G2S})$
V_{G1S} = 0 V, V_{DS} = 15 V
I_{DSS} = 10 mA, f = 1 MHz



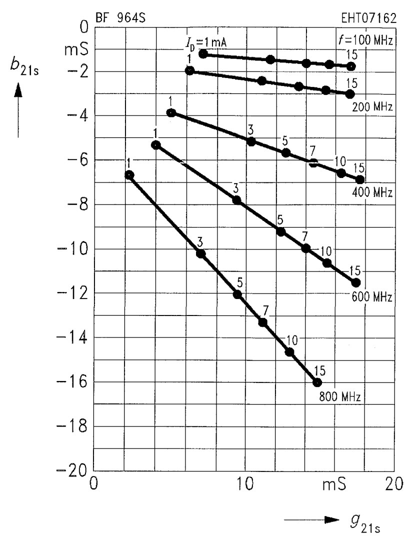
Output capacitance $C_{dss} = f(V_{DS})$
V_{G1S} = 0 V, V_{G2S} = 4 V
I_{DSS} = 10 mA, f = 1 MHz



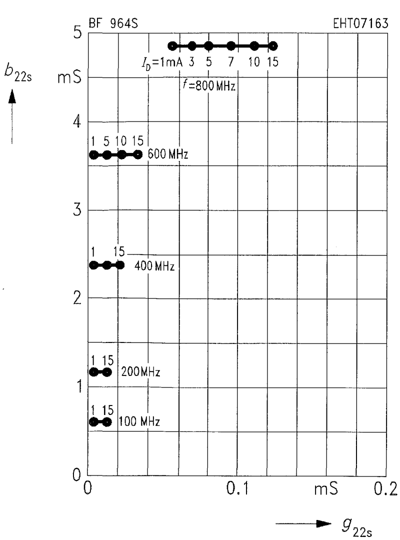
Gate 1 input admittance y_{11s}
V_{DS} = 15 V, V_{G2S} = 4 V
(common source)



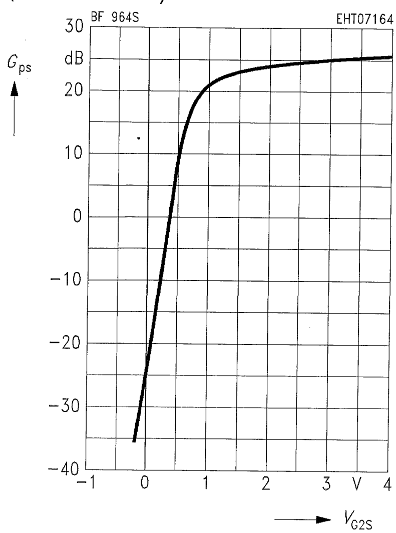
Gate 1 forward transfer admittance y_{21s}
V_{DS} = 15 V, V_{G2S} = 4 V
(common source)



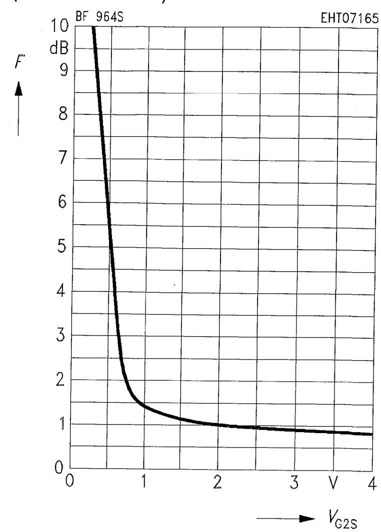
Output admittance y_{22s}
V_{DS} = 15 V, V_{G2S} = 4 V
(common source)



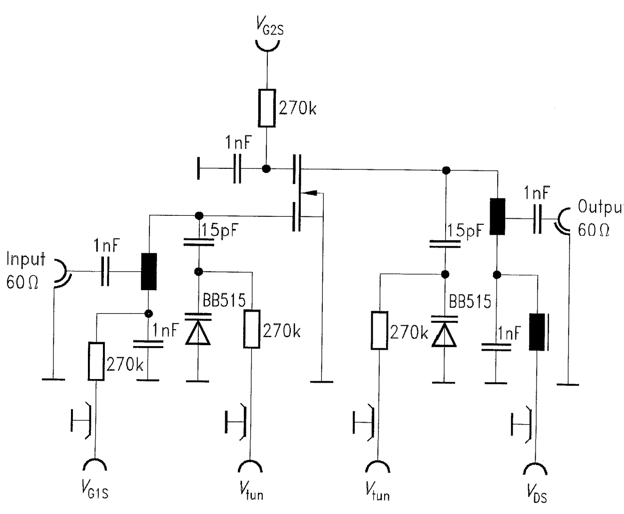
Power gain $G_{ps} = f(V_{G2S})$
V_{DS} = 15 V, V_{G1S} = 0 V, I_{DSS} = 10 mA
f = 200 MHz
(see test circuit)



Noise figure $F = f(V_{G2S})$
V_{DS} = 15 V, V_{G1S} = 0 V, I_{DSS} = 10 mA
f = 200 MHz
(see test circuit)



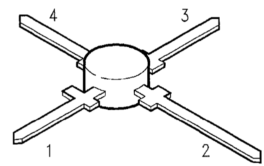
Test circuit for power gain and noise figure
f = 200 MHz, G_G = 2 mS, G_L = 0.5 mS



Silicon N Channel MOSFET Tetrode

BF 965

- Integrated suppression network against spurious VHF oscillations
- For VHF applications, especially in TV tuners with extended VHF band, e.g. CATV tuners



Type	Marking	Ordering Code	Pin Configuration 1	2	3	4	Package[1)]
BF 965	–	Q62702-F660	S	D	G_2	G_1	X-plast

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	20	V
Drain current	I_D	30	mA
Gate 1/gate 2 peak source current	$\pm I_{G1/2SM}$	10	
Total power dissipation, $T_A \leq 60$ ˚C	P_{tot}	200	mW
Storage temperature range	T_{stg}	– 55 … + 150	˚C
Channel temperature	T_{ch}	150	

Thermal Resistance

Junction - ambient	$R_{th\,JA}$	≤ 450	K/W

1) For detailed information see chapter Package Outlines.

Electrical Characteristics

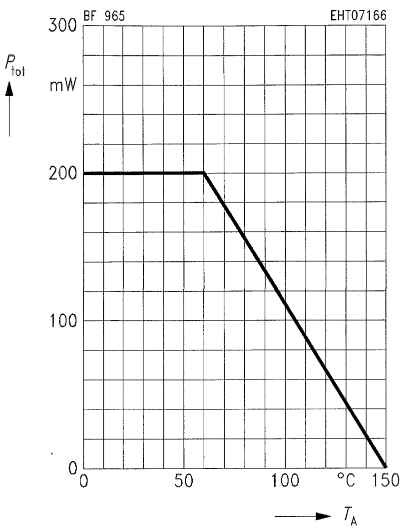
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Drain-source breakdown voltage I_D = 10 μA, $-V_{G1S} = -V_{G2S}$ = 4 V	$V_{(BR)\,DS}$	20	–	–	V
Gate 1 source breakdown voltage $\pm I_{G1S}$ = 10 mA, $V_{G2S} = V_{DS}$ = 0	$\pm V_{(BR)\,G1SS}$	8.5	–	14	
Gate 2 source breakdown voltage $\pm I_{G2S}$ = 10 mA, $V_{G1S} = V_{DS}$ = 0	$\pm V_{(BR)\,G2SS}$	8.5	–	14	
Gate 1 source leakage current $\pm V_{G1S}$ = 5 V, $V_{G2S} = V_{DS}$ = 0	$\pm I_{G1SS}$	–	–	50	nA
Gate 2 source leakage current $\pm V_{G2S}$ = 5 V, $V_{G1S} = V_{DS}$ = 0	$\pm I_{G2SS}$	–	–	50	
Drain current V_{DS} = 15 V, V_{G1S} = 0, V_{G2S} = 4 V	I_{DSS}	2	–	20	mA
Gate 1 source pinch-off voltage V_{DS} = 15 V, V_{G2S} = 4 V, I_D = 20 μA	$-V_{G1S\,(p)}$	–	–	2.5	V
Gate 2 source pinch-off voltage V_{DS} = 15 V, V_{G1S} = 0, I_D = 20 μA	$-V_{G2S\,(p)}$	–	–	2.0	

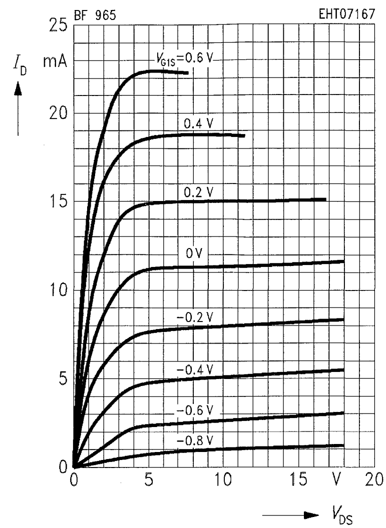
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
AC Characteristics					
Forward transconductance V_{DS} = 15 V, I_D = 10 mA, V_{G2S} = 4 V, f = 1 kHz	g_{fs}	15	18	–	mS
Gate 1 input capacitance V_{DS} = 15 V, I_D = 10 mA, V_{G2S} = 4 V, f = 1 MHz	C_{g1ss}	–	2.5	–	pF
Gate 2 input capacitance V_{DS} = 15 V, I_D = 10 mA, V_{G2S} = 4 V, f = 1 MHz	C_{g2ss}	–	1.2	–	
Feedback capacitance V_{DS} = 15 V, I_D = 10 mA, V_{G2S} = 4 V, f = 1 MHz	C_{dg1}	–	25	–	fF
Output capacitance V_{DS} = 15 V, I_D = 10 mA, V_{G2S} = 4 V, f = 1 MHz	C_{dss}	–	1	–	pF
Power gain V_{DS} = 15 V, I_D = 10 mA, f = 200 MHz, G_G = 2 mS, G_L = 0.5 mS (test circuit)	G_{ps}	–	25	–	dB
Noise figure V_{DS} = 15 V, I_D = 10 mA f = 200 MHz, G_G = 2 mS, G_L = 0.5 mS (test circuit)	F	–	1	–	
Gain control range V_{DS} = 15 V, V_{G2S} = 4 … – 2 V, f = 200 MHz (test circuit)	ΔG_{ps}	50	–	–	

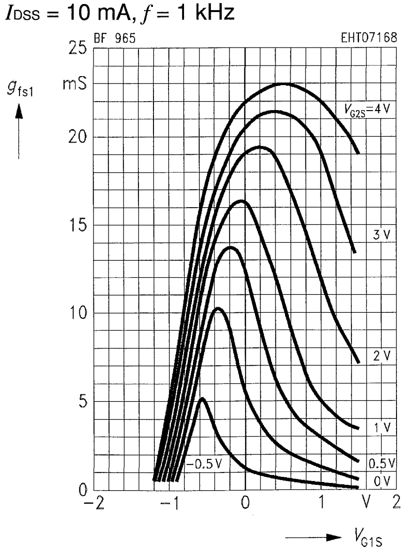
Total power dissipation $P_{tot} = f(T_A)$



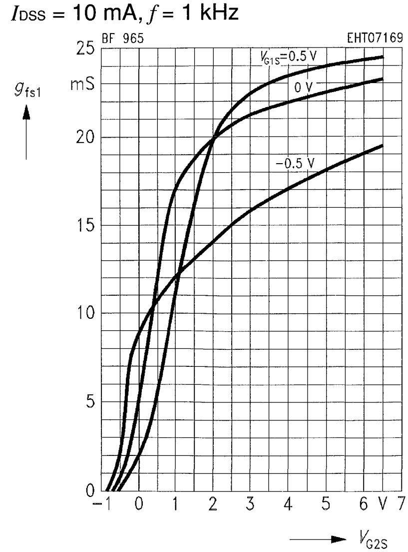
Output characteristics $I_D = f(V_{DS})$
V_{G2S} = 4 V



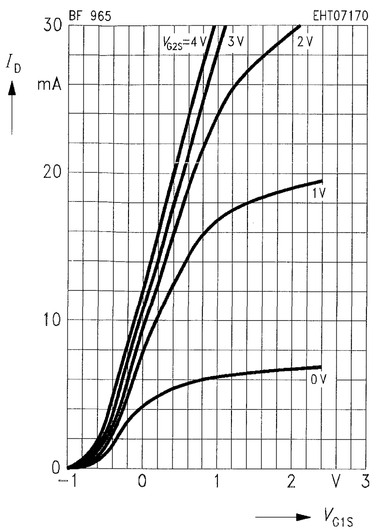
Gate 1 forward transconductance
$g_{fs1} = f(V_{G1S})$
V_{DS} = 15 V
I_{DSS} = 10 mA, f = 1 kHz



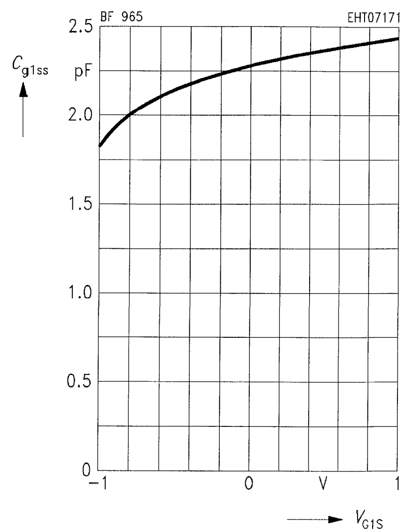
Gate 1 forward transconductance
$g_{fs1} = f(V_{G2S})$
V_{DS} = 15 V
I_{DSS} = 10 mA, f = 1 kHz



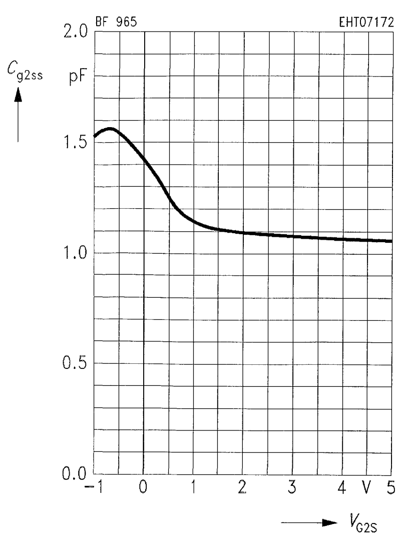
Drain current $I_D = f(V_{G1S})$
V_{DS} = 15 V



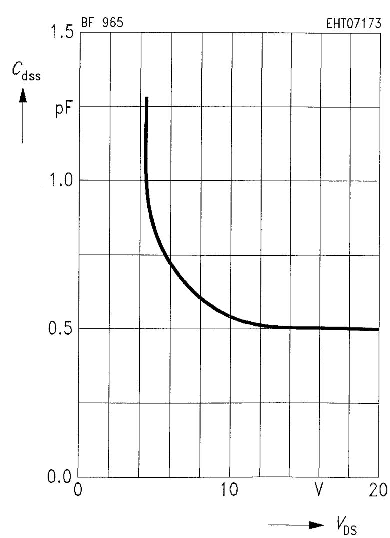
Gate 1 input capacitance $C_{g1ss} = f(V_{G1S})$
V_{G2S} = 4 V, V_{DS} = 15 V
I_{DSS} = 10 mA, f = 1 MHz



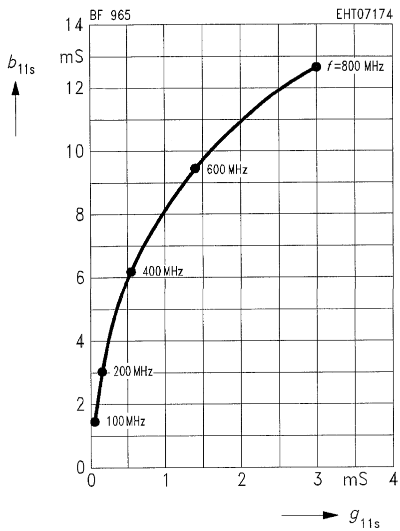
Gate 2 input capacitance $C_{g2ss} = f(V_{G2S})$
V_{G1S} = 0 V, V_{DS} = 15 V
I_{DSS} = 10 mA, f = 1 MHz



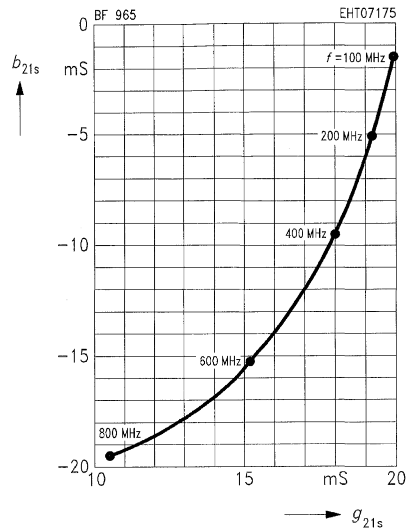
Output capacitance $C_{dss} = f(V_{DS})$
V_{G1S} = 0 V, V_{G2S} = 4 V
I_{DSS} = 10 mA, f = 1 MHz



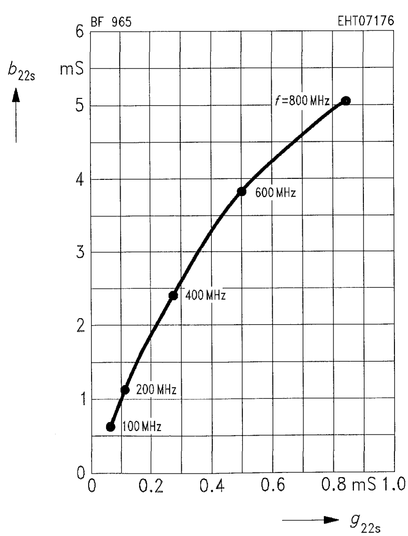
Gate 1 input admittance y_{11s}
V_{DS} = 15 V, V_{G2S} = 4 V, V_{G1S} = 0 V
I_{DSS} = 10 mA (common source)



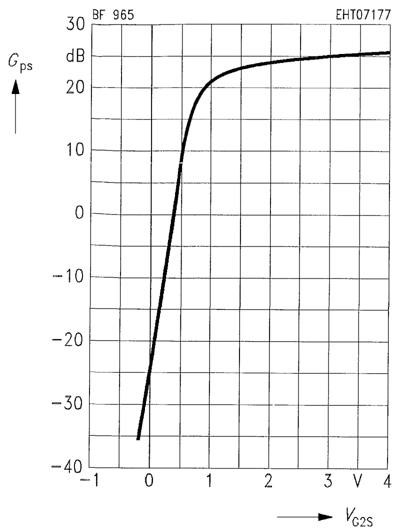
Gate 1 forward transfer admittance y_{21s}
V_{DS} = 15 V, V_{G2S} = 4 V, V_{G1S} = 0 V
I_{DSS} = 10 mA (common source)



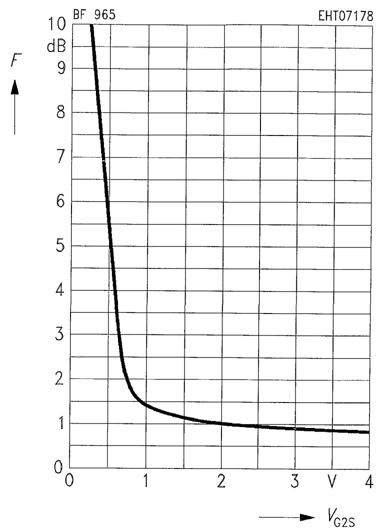
Output admittance y_{22s}
V_{DS} = 15 V, V_{G2S} = 4 V, V_{G1S} = 0 V
I_{DSS} = 10 mA (common source)



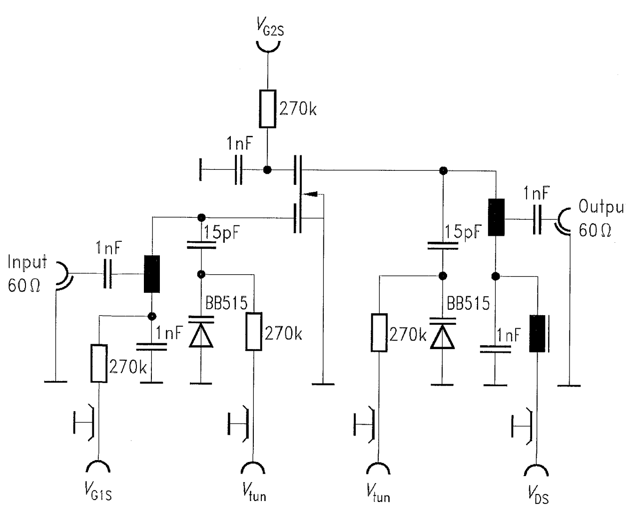
Power gain $G_{ps} = f(V_{G2S})$
V_{DS} = 15 V, V_{G1S} = 0 V, I_{DSS} = 10 mA
f = 200 MHz (see test circuit)



Noise figure $F = f(V_{G2S})$
V_{DS} = 15 V, V_{G1S} = 0 V, I_{DSS} = 10 mA
f = 200 MHz (see test circuit)



Test circuit for power gain and noise figure
f = 200 MHz, G_G = 2 mS, G_L = 0.5 mS

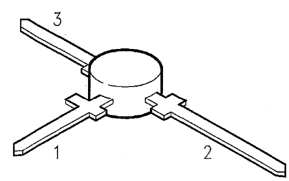


SIEMENS

PNP Silicon RF Transistor

BF 970

- For UHF mixer and oscillator stages



VPT05180

Type	Marking	Ordering Code	Pin Configuration			Package[1]
			1	2	3	
BF 970	–	Q62702-F650	B	C	E	T-plast

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CE0}	35	V
Collector-base voltage	V_{CB0}	40	
Emitter-base voltage	V_{EB0}	3	
Collector current	I_C	30	mA
Base current	I_B	5	
Total power dissipation, $T_A \le 50$ ˚C	P_{tot}	160	mW
Junction temperature	T_j	150	˚C
Storage temperature range	T_{stg}	– 50 … + 150	

Thermal Resistance

Junction - ambient	$R_{th\,JA}$	≤ 600	K/W

[1] For detailed information see chapter Package Outlines.

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

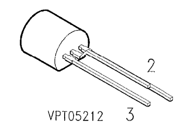
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector cutoff current V_{CB} = 20 V	I_{CB0}	–	–	100	nA
DC current gain I_C = 3 mA, V_{CE} = 10 V	h_{FE}	25	50	–	–
AC Characteristics					
Transition frequency I_C = 3 mA, V_{CE} = 10 V, f = 100 MHz	f_T	–	950	–	MHz
Output capacitance V_{CB} = 10 V, I_E = 0, f = 1 MHz	C_{obo}	–	0.45	–	pF
Collector-emitter capacitance V_{CB} = 1 V, V_{BE} = 0, f = 1 MHz	C_{ce}	–	0.1	–	
Noise figure I_C = 3 mA, V_{CB} = 10 V, f = 800 MHz R_S = 60 Ω	F	–	4.5	–	dB
Common base power gain I_C = 3 mA, V_{CB} = 10 V, f = 800 MHz R_L = 500 Ω	G_{pb}	–	14.8	–	
Collector current for G_{pbmax} V_{CC} = 12 V, R_{CC} = 1 kΩ, f = 800 MHz R_L = 500 Ω	I_{CGmax}	–	4.5	–	mA

SIEMENS

Silicon N Channel MOSFET Triode

BF 987

- For high-frequency stages up to 300 MHz, preferably in FM applications
- High overload capability



Type	Marking	Ordering Code	Pin Configuration 1	2	3	Package[1)]
BF 987	–	Q62702-F35	D	S	G	TO-92

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	20	V
Drain current	I_D	30	mA
Gate-source peak current	$\pm I_{GSM}$	10	
Total power dissipation, $T_A \leq 45$ ˚C	P_{tot}	300	mW
Storage temperature range	T_{stg}	– 55 … + 150	˚C
Channel temperature	T_{ch}	150	

Thermal Resistance

Junction - ambient	$R_{th\,JA}$	≤ 350	K/W

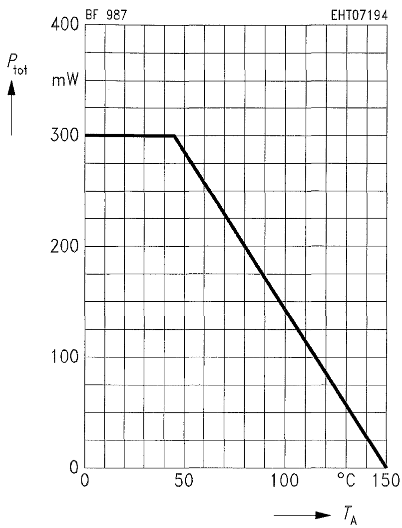
1) For detailed information see chapter Package Outlines.

Electrical Characteristics

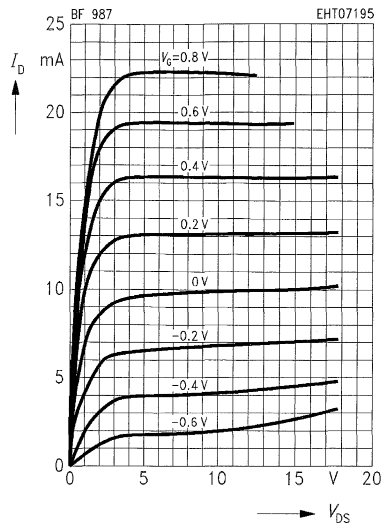
at $T_A = 25\ ^\circ C$, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Drain-source breakdown voltage $I_D = 10\ \mu A$, $-V_{GS} = 4$ V	$V_{(BR)\ DS}$	20	–	–	V
Gate-source breakdown voltage $\pm I_{GS} = 10$ mA, $V_{DS} = 0$	$\pm V_{(BR)\ GSS}$	6.5	–	12	
Gate-source leakage current $\pm V_{GS} = 5$ V, $V_{DS} = 0$	$\pm I_{GSS}$	–	–	50	nA
Drain current $V_{DS} = 10$ V, $V_{GS} = 0$	I_{DSS}	5	–	18	mA
Gate-source pinch-off voltage $V_{DS} = 10$ V, $I_D = 20\ \mu A$	$-V_{GS\ (p)}$	–	–	2.5	V
AC Characteristics					
Forward transconductance $V_{DS} = 10$ V, $I_D = 10$ mA, $f = 1$ kHz	g_{fs}	14	16	–	mS
Gate input capacitance $V_{DS} = 10$ V, $I_D = 10$ mA, $f = 1$ MHz	C_{gss}	–	2.7	–	pF
Reverse transfer capacitance $V_{DS} = 10$ V, $I_D = 10$ mA, $f = 1$ MHz	C_{dg}	–	35	–	fF
Output capacitance $V_{DS} = 10$ V, $I_D = 10$ mA, $f = 1$ MHz	C_{dss}	–	1	–	pF
Power gain (test circuit) $V_{DS} = 10$ V, $I_D = 10$ mA, $f = 200$ MHz, $G_G = 2$ mS, $G_L = 0.5$ mS	G_p	–	25	–	dB
Noise figure (test circuit) $V_{DS} = 10$ V, $I_D = 10$ mA, $f = 200$ MHz, $G_G = 2$ mS, $G_L = 0.5$ mS	F	–	1	–	

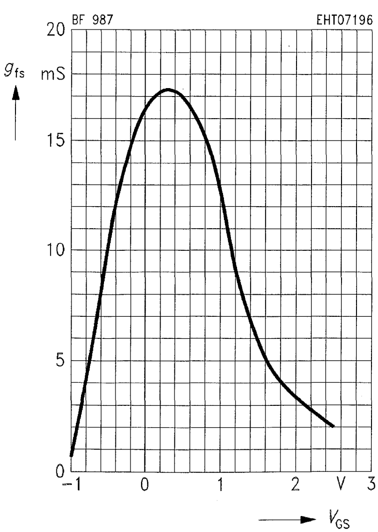
Total power dissipation $P_{tot} = f(T_A)$



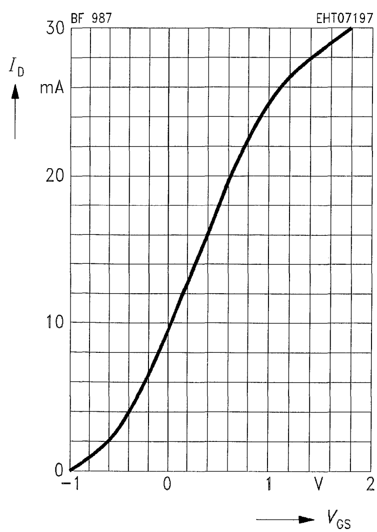
Output characteristics $I_D = f(V_{DS})$



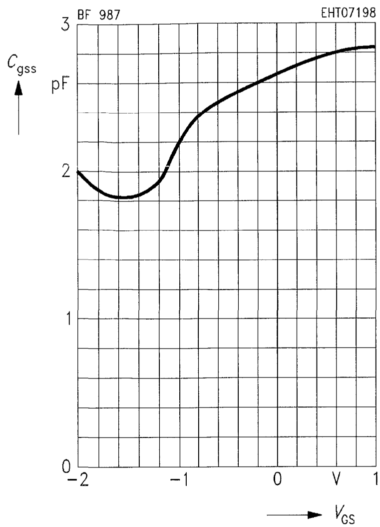
Gate transconductance $g_{fs} = f(V_{GS})$
V_{DS} = 10 V, I_{DSS} = 10 mA, f = 1 kHz



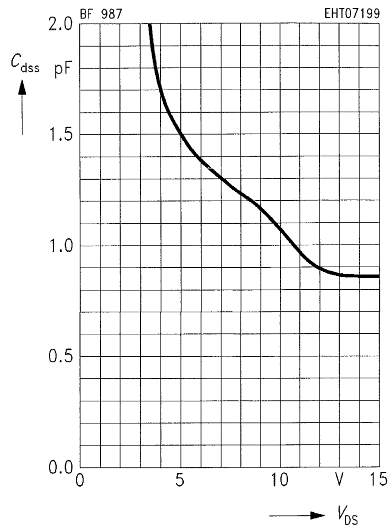
Drain current $I_D = f(V_{GS})$
V_{DS} = 10 V



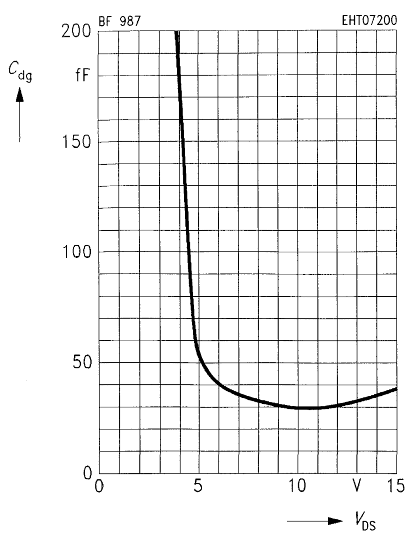
Gate input capacitance $C_{gss} = f(V_{GS})$
V_{DS} = 10 V, I_{DSS} = 10 mA, f = 1 MHz



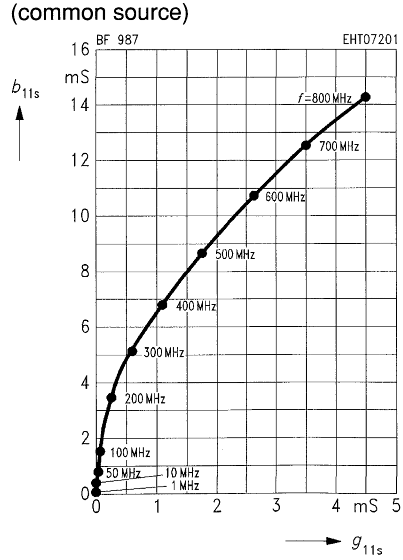
Output capacitance $C_{dss} = f(V_{DS})$
V_{GS} = 0, I_{DSS} = 10 mA, f = 1 MHz



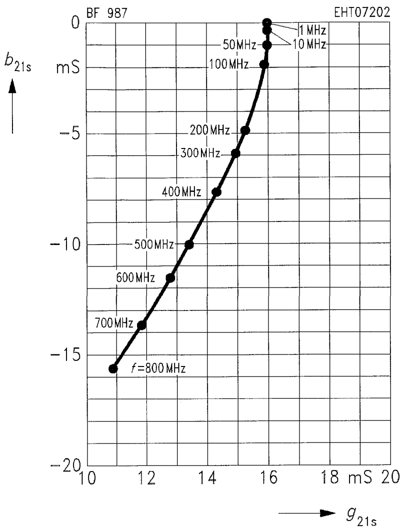
Reverse transfer capacitance $C_{dg} = f(V_{DS})$
I_{DSS} = 10 mA, f = 1 MHz, V_{GS} = 0



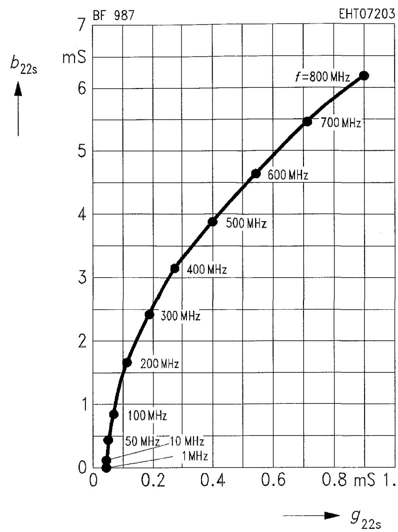
Gate input admittance y_{11s}
V_{DS} = 10 V, I_{DSS} = 10 mA, V_G = 0
(common source)



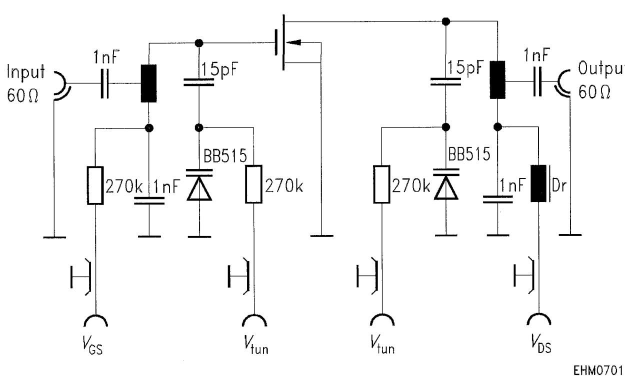
Gate forward transfer admittance y_{21s}
V_{DS} = 10 V, V_G = 0, I_{DSS} = 10 mA
(common source)



Output admittance y_{22s}
V_{DS} = 10 V, I_{DSS} = 10 mA, V_G = 0
(common source)



Test circuit for power gain and noise figure
f = 200 MHz

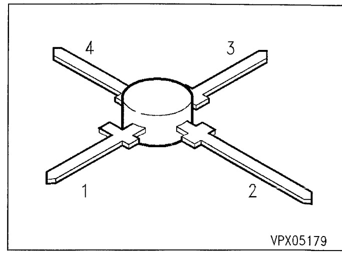


SIEMENS

Silicon N Channel MOSFET Tetrode

BF 988

- Short-channel transistor with high S/C quality factor
- For low-noise, gain-controlled input stages up to 1 GHz



Type	Marking	Ordering Code	Pin Configuration				Package[1)]
			1	2	3	4	
BF 988	–	Q62702-F36	S	D	G_2	G_1	X-plast

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	12	V
Drain current	I_D	30	mA
Gate 1/Gate 2 source peak current	$\pm I_{G1/2SM}$	10	
Total power dissipation, $T_A \leq 60$ °C	P_{tot}	200	mW
Storage temperature range	T_{stg}	– 55 … + 150	°C
Channel temperature	T_{ch}	150	

Thermal Resistance

Junction - ambient	$R_{th\,JA}$	≤ 450	K/W

1) For detailed information see chapter Package Outlines.

Electrical Characteristics

at T_A = 25 °C, unless otherwise specified.

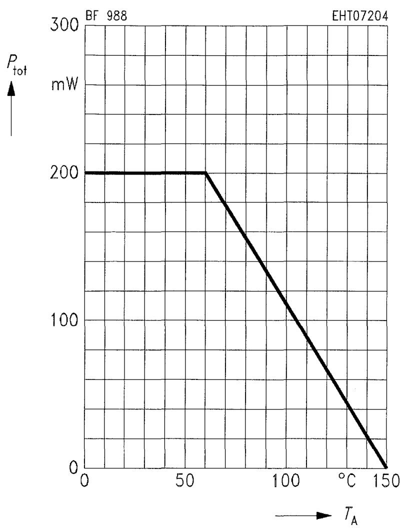
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Drain-source breakdown voltage I_D = 10 µA, $-V_{G1S} = -V_{G2S}$ = 4 V	$V_{(BR)\,DS}$	12	–	–	V
Gate 1-source breakdown voltage $\pm I_{G1S}$ = 10 mA, $V_{G2S} = V_{DS}$ = 0	$\pm V_{(BR)\,G1SS}$	8	–	12	
Gate 2-source breakdown voltage $\pm I_{G2S}$ = 10 mA, $V_{G1S} = V_{DS}$ = 0	$\pm V_{(BR)\,G2SS}$	8	–	12	
Gate 1-source leakage current $\pm V_{G1S}$ = 5 V, $V_{G2S} = V_{DS}$ = 0	$\pm I_{G1SS}$	–	–	50	nA
Gate 2-source leakage current $\pm V_{G2S}$ = 5 V, $V_{G1S} = V_{DS}$ = 0	$\pm I_{G2SS}$	–	–	50	
Drain current V_{DS} = 8 V, V_{G1S} = 0, V_{G2S} = 4 V	I_{DSS}	2	–	18	mA
Gate 1-source pinch-off voltage V_{DS} = 8 V, V_{G2S} = 4 V, I_D = 20 µA	$-V_{G1S\,(p)}$	–	–	2.5	V
Gate 2-source pinch-off voltage V_{DS} = 8 V, V_{G1S} = 0, I_D = 20 µA	$-V_{G2S\,(p)}$	–	–	2	

71%

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

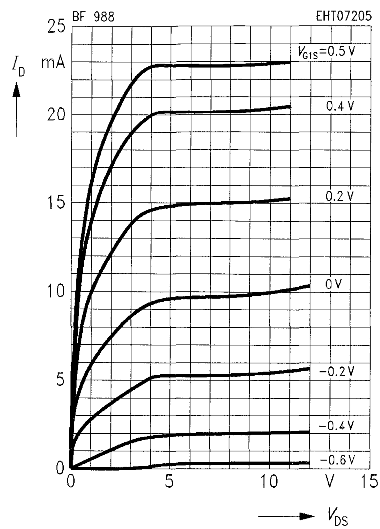
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
AC Characteristics					
Forward transconductance V_{DS} = 8 V, I_D = 10 mA, V_{G2S} = 4 V, f = 1 kHz	g_{fs}	–	24	–	mS
Gate 1 input capacitance V_{DS} = 8 V, I_D = 10 mA, V_{G2S} = 4 V, f = 1 MHz	C_{g1ss}	–	2.1	–	pF
Gate 2 input capacitance V_{DS} = 8 V, I_D = 10 mA, V_{G2S} = 4 V, f = 1 MHz	C_{g2ss}	–	1.2	–	
Reverse transfer capacitance V_{DS} = 8 V, I_D = 10 mA, V_{G2S} = 4 V, f = 1 MHz	C_{dg1}	–	25	–	fF
Output capacitance V_{DS} = 8 V, I_D = 10 mA, V_{G2S} = 4 V, f = 1 MHz	C_{dss}	–	1.05	–	pF
Power gain (test circuit 1) V_{DS} = 8 V, I_D = 10 mA , f = 200 MHz, G_G = 2 mS, G_L = 0.5 mS, V_{G2S} = 4 V	G_{ps}	–	28	–	dB
Power gain (test circuit 2) V_{DS} = 8 V, I_D = 10 mA , f = 800 MHz, G_G = 3.3 mS, G_L = 1 mS, V_{G2S} = 4 V	G_{ps}	–	20	–	
Noise figure (test circuit 1) V_{DS} = 8 V, I_D = 10 mA , f = 200 MHz, G_G = 2 mS, G_L = 0.5 mS, V_{G2S} = 4 V	F	–	0.6	–	
Noise figure (test circuit 2) V_{DS} = 8 V, I_D = 10 mA , f = 800 MHz, G_G = 3.3 mS, G_L = 1 mS, V_{G2S} = 4 V	F	–	1	–	
Gain control range (test circuit 2) V_{DS} = 8 V, V_{G2S} = 4 … – 2 V, f = 800 MHz	ΔG_{ps}	40	–	–	

Total power dissipation $P_{tot} = f(T_A)$



Output characteristics $I_D = f(V_{DS})$

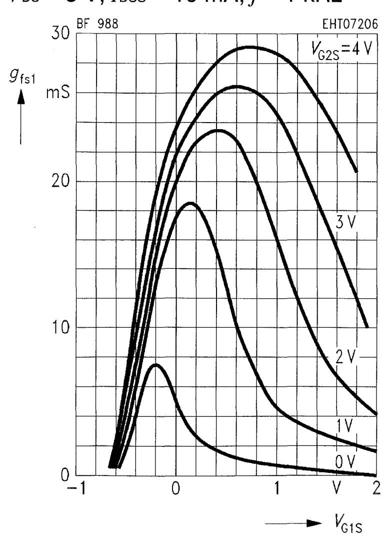
V_{G2S} = 4 V



Gate 1 forward transconductance

$g_{fs1} = f(V_{G1S})$

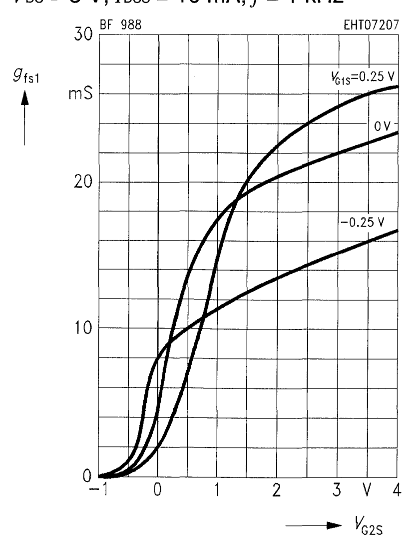
V_{DS} = 8 V, I_{DSS} = 10 mA, f = 1 kHz



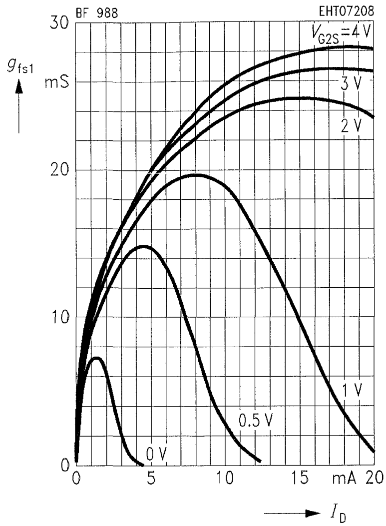
Gate 1 forward transconductance

$g_{fs1} = f(V_{G2S})$

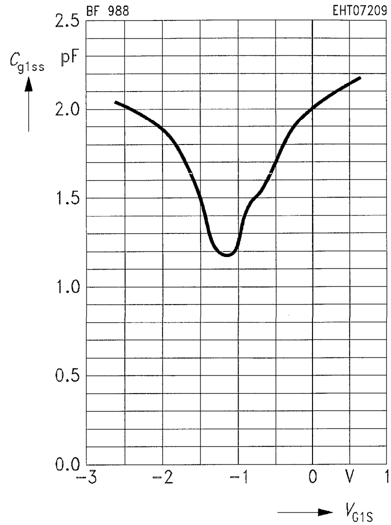
V_{DS} = 8 V, I_{DSS} = 10 mA, f = 1 kHz



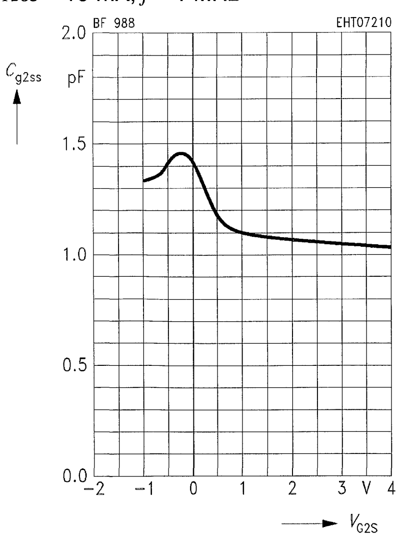
Gate 1 forward transconductance
$g_{fs1} = f(I_D)$
V_{DS} = 8 V, I_{DSS} = 10 mA, f = 1 kHz



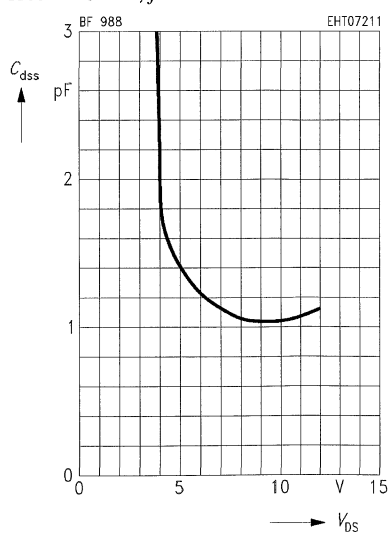
Gate 1 input capacitance $C_{g1ss} = f(V_{G1S})$
V_{G2S} = 4 V, V_{DS} = 8 V, I_{DSS} = 10 mA
f = 1 MHz



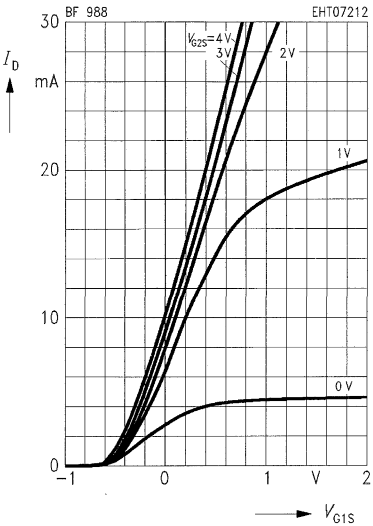
Gate 2 input capacitance $C_{g2ss} = f(V_{G2S})$
V_{G1S} = 0 V, V_{DS} = 8 V
I_{DSS} = 10 mA, f = 1 MHz



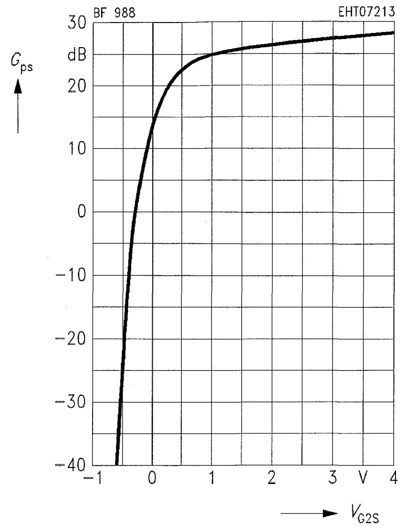
Output capacitance $C_{dss} = f(V_{DS})$
V_{G1S} = 0 V, V_{G2S} = 4 V
I_{DSS} = 10 mA, f = 1 MHz



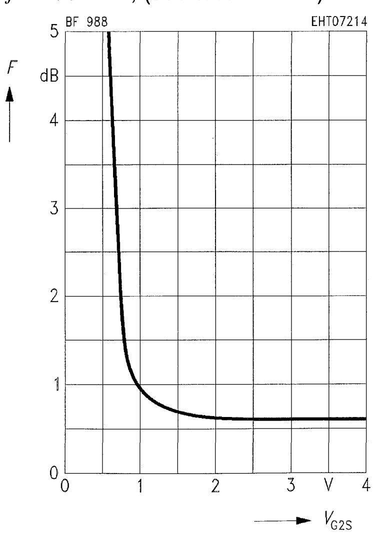
Drain current $I_D = f(V_{G1S})$
V_{DS} = 8 V



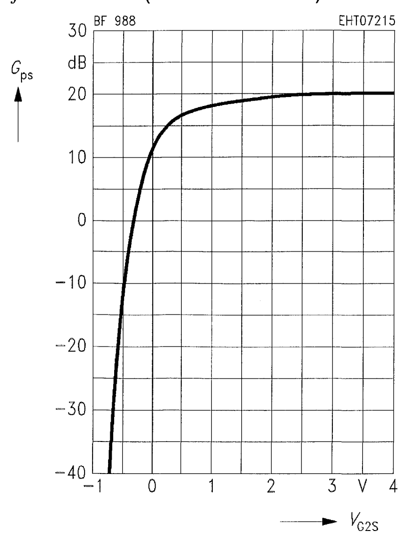
Power gain $G_{ps} = f(V_{G2S})$
V_{DS} = 8 V, V_{G1S} = 0, I_{DSS} = 10 mA
f = 200 MHz (see test circuit 1)



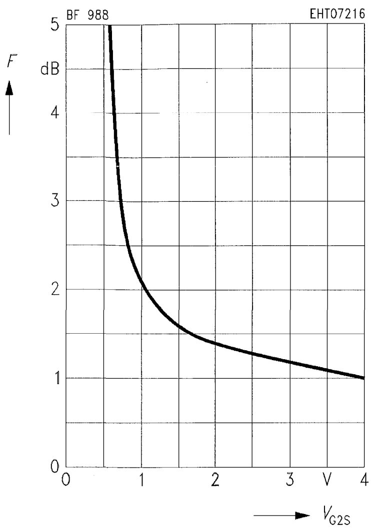
Noise figure $F = f(V_{G2S})$
V_{DS} = 8 V, V_{G1S} = 0, I_{DSS} = 10 mA,
f = 200 MHz, (see test circuit 1)



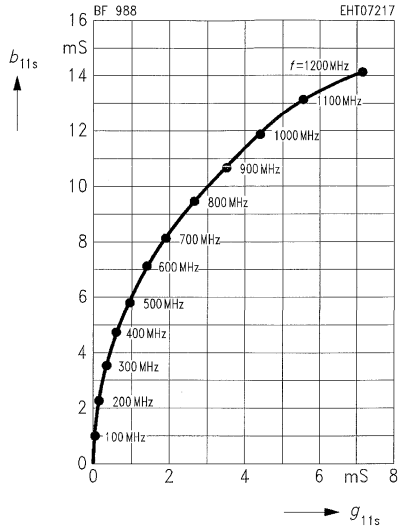
Power gain $G_{ps} = f(V_{G2S})$
V_{DS} = 8 V, V_{G1S} = 0, I_{DSS} = 10 mA
f = 800 MHz (see test circuit 2)



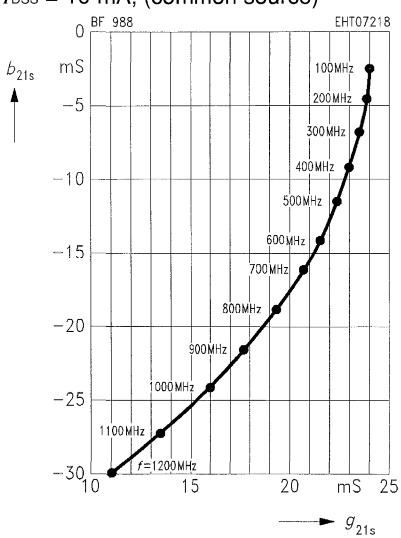
Noise figure $F = f(V_{G2S})$
V_{DS} = 8 V, V_{G1S} = 0, I_{DSS} = 10 mA,
f = 800 MHz, (see test circuit 2)



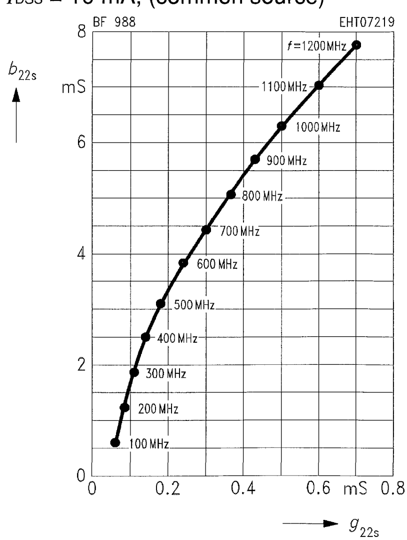
Gate 1 input admittance y_{11s}
V_{DS} = 8 V, V_{G2S} = 4 V, V_{G1S} = 4 V,
I_{DSS} = 10 mA, (common source)



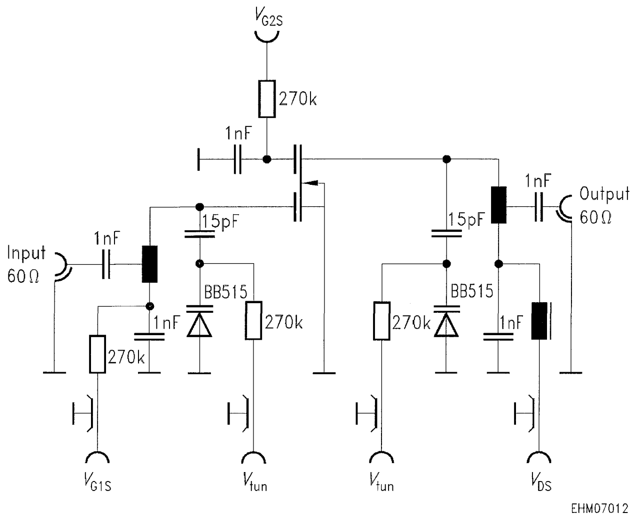
Gate 1 forward transfer admittance y_{21s}
V_{DS} = 8 V, V_{G2S} = 4 V, V_{G1S} = 0
I_{DSS} = 10 mA, (common source)



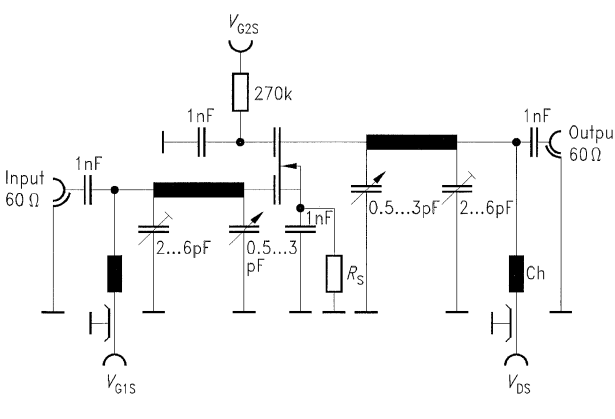
Output admittance y_{22s}
V_{DS} = 8 V, V_{G2S} = 4 V, V_{G1S} = 0
I_{DSS} = 10 mA, (common source)



Test circuit 1 for power gain and noise figure
f = 200 MHz, G_G = 2 mS, G_L = 0.5 mS



Test circuit 2 for power gain and noise figure
f = 800 MHz, G_G = 3.3 mS, G_L = 1 mS

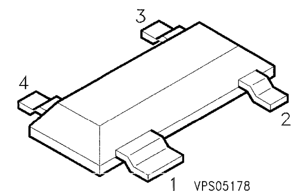


SIEMENS

Silicon N Channel MOSFET Tetrode

BF 993

- For high-gain, low-distortion VHF TV and FM mixer and input stages



Type	Marking	Ordering Code (tape and reel)	Pin Configuration 1	2	3	4	Package[1]
BF 993	ME	Q62702-F1018	S	D	G_2	G_1	SOT-143

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	20	V
Drain current	I_D	50	mA
Gate 1/gate 2 peak source current	$\pm I_{G1/2SM}$	10	
Total power dissipation, $T_A \leq 60$ ˚C	P_{tot}	200	mW
Storage temperature range	T_{stg}	– 55 … + 150	˚C
Channel temperature	T_{ch}	150	

Thermal Resistance

Junction - ambient[2]	$R_{th\,JA}$	≤ 450	K/W

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

Electrical Characteristics

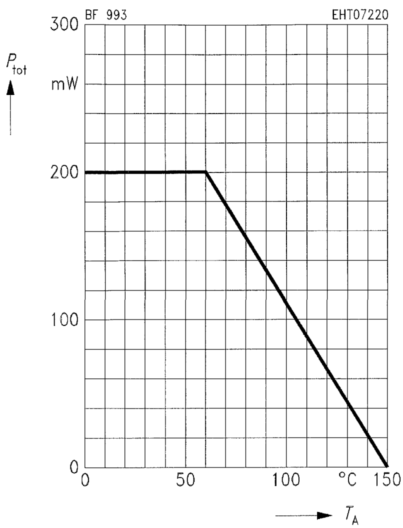
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Drain-source breakdown voltage I_D = 10 µA, – V_{G1S} = – V_{G2S} = 4 V	$V_{(BR)\,DS}$	20	–	–	V
Gate 1 source breakdown voltage ± I_{G1S} = 10 mA, V_{G2S} = V_{DS} = 0	± $V_{(BR)\,G1SS}$	8.5	–	14	
Gate 2 source breakdown voltage ± I_{G2S} = 10 mA, V_{G1S} = V_{DS} = 0	± $V_{(BR)\,G2SS}$	8.5	–	14	
Gate 1 source leakage current ± V_{G1S} = 5 V, V_{G2S} = V_{DS} = 0	± I_{G1SS}	–	–	50	nA
Gate 2 source leakage current ± V_{G2S} = 5 V, V_{G1S} = V_{DS} = 0	± I_{G2SS}	–	–	50	
Drain current V_{DS} = 15 V, V_{G1S} = 0, V_{G2S} = 4 V	I_{DSS}	6	–	40	mA
Gate 1 source pinch-off voltage V_{DS} = 15 V, V_{G2S} = 4 V, I_D = 20 µA	– $V_{G1S\,(p)}$	–	–	2.5	V
Gate 2 source pinch-off voltage V_{DS} = 15 V, V_{G1S} = 0, I_D = 20 µA	– $V_{G2S\,(p)}$	–	–	2.0	

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

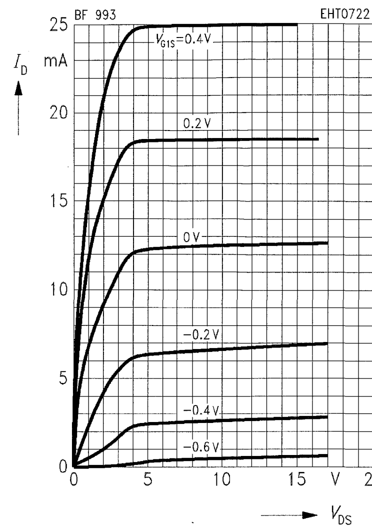
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
AC Characteristics					
Forward transconductance V_{DS} = 15 V, I_D = 10 mA, V_{G2S} = 4 V, f = 1 kHz	g_{fs}	16	25	–	mS
Gate 1 input capacitance V_{DS} = 15 V, I_D = 10 mA, V_{G2S} = 4 V, f = 1 MHz	C_{g1ss}	–	6	–	pF
Gate 2 input capacitance V_{DS} = 15 V, I_D = 10 mA, V_{G2S} = 4 V, f = 1 MHz	C_{g2ss}	–	2.5	–	
Feedback capacitance V_{DS} = 15 V, I_D = 10 mA, V_{G2S} = 4 V, f = 1 MHz	C_{dg1}	–	50	–	fF
Output capacitance V_{DS} = 15 V, I_D = 10 mA, V_{G2S} = 4 V, f = 1 MHz	C_{dss}	–	2.5	–	pF
Power gain V_{DS} = 15 V, I_D = 10 mA f = 200 MHz, G_G = 2 mS, G_L = 0.5 mS $2\Delta f$ = 12 MHz (test circuit)	G_{ps}	–	25	–	dB
Noise figure V_{DS} = 15 V, I_D = 10 mA f = 200 MHz, G_G = 2 mS, G_L = 0.5 mS (test circuit)	F	–	1.5	–	

Total power dissipation $P_{tot} = f(T_A)$



Output characteristics $I_D = f(V_{DS})$

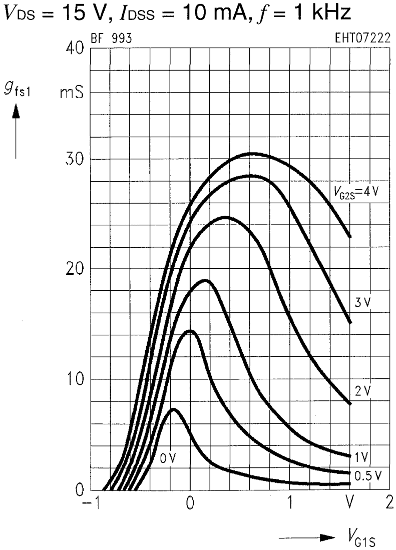
$V_{G2S} = 4$ V



Gate 1 forward transconductance

$g_{fs1} = f(V_{G1S})$

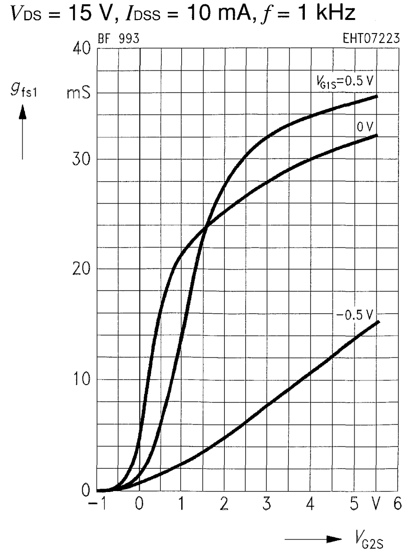
$V_{DS} = 15$ V, $I_{DSS} = 10$ mA, $f = 1$ kHz



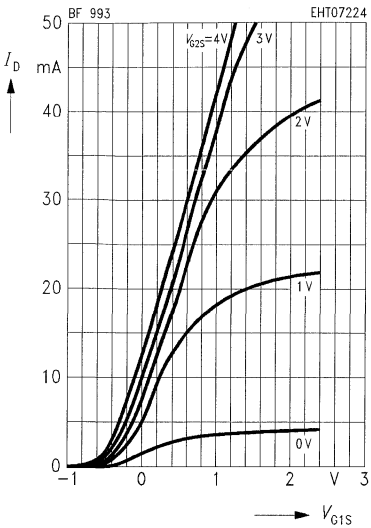
Gate 1 forward transconductance

$g_{fs1} = f(V_{G2S})$

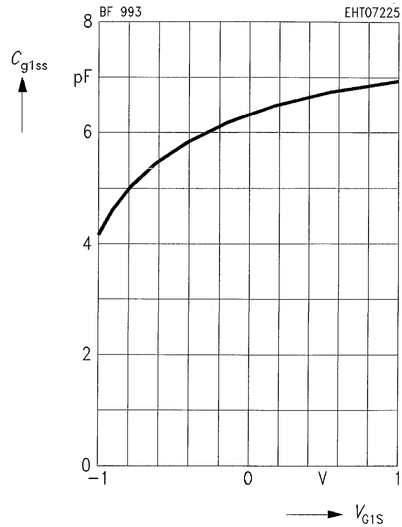
$V_{DS} = 15$ V, $I_{DSS} = 10$ mA, $f = 1$ kHz



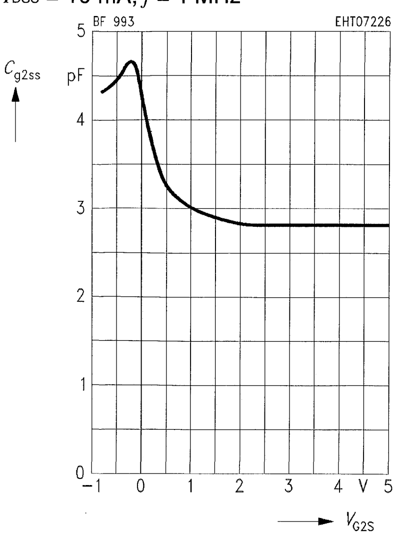
Drain current $I_D = f(V_{G1S})$
V_{DS} = 15 V



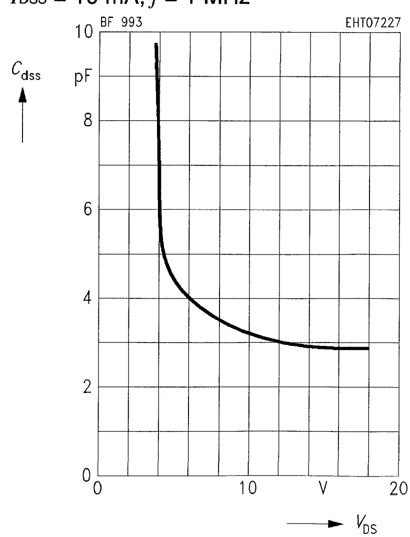
Gate 1 input capacitance $C_{g1ss} = f(V_{G1S})$
V_{G2S} = 4 V, V_{DS} = 15 V
I_{DSS} = 10 mA, f = 1 MHz



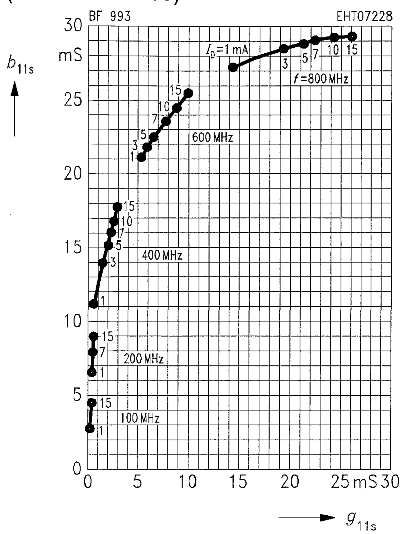
Gate 2 input capacitance $C_{g2ss} = f(V_{G2S})$
V_{G1S} = 0 V, V_{DS} = 15 V
I_{DSS} = 10 mA, f = 1 MHz



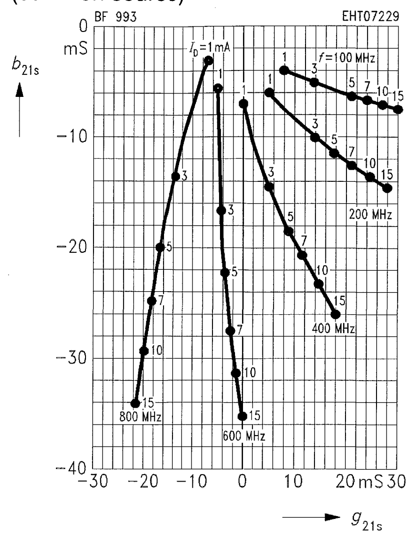
Output capacitance $C_{dss} = f(V_{DS})$
V_{G1S} = 0 V, V_{G2S} = 4 V
I_{DSS} = 10 mA, f = 1 MHz



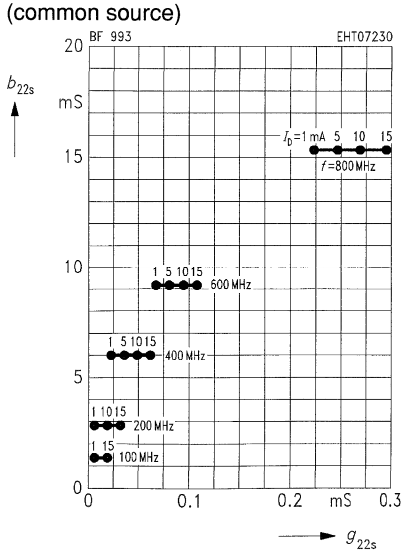
Gate 1 input admittance y_{11s}
V_{DS} = 15 V, V_{G2S} = 4 V
(common source)



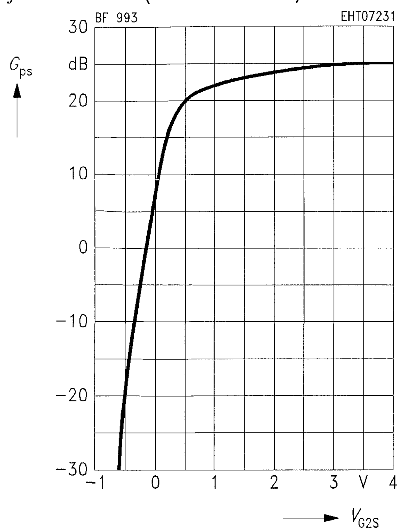
Gate 1 forward transfer admittance y_{21s}
V_{DS} = 15 V, V_{G2S} = 4 V
(common source)



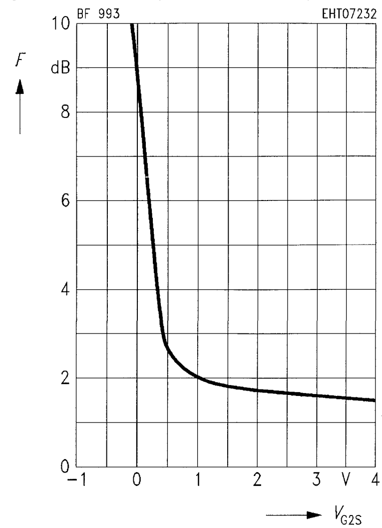
Output admittance y_{22s}
V_{DS} = 15 V, V_{G2S} = 4 V
(common source)



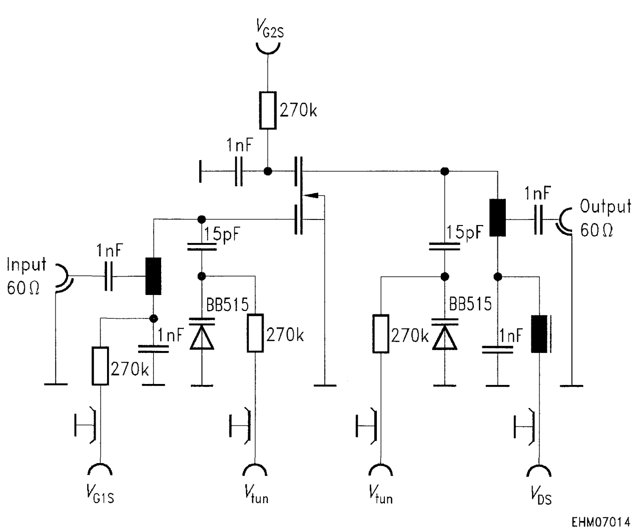
Power gain $G_{ps} = f(V_{G2S})$
V_{DS} = 15 V, V_{G1S} = 0 V, I_{DSS} = 10 mA
f = 200 MHz (see test circuit)



Noise figure $F = f(V_{G2S})$
V_{DS} = 15 V, V_{G1S} = 0 V, I_{DSS} = 10 mA
f = 200 MHz, (see test circuit)



Test circuit for power gain and noise figure
f = 200 MHz, G_G = 2 mS, G_L = 0.5 mS

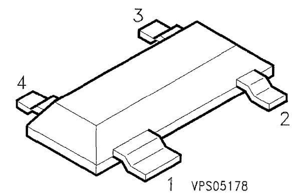


SIEMENS

Silicon N Channel MOSFET Tetrode

BF 994 S

- For VHF applications, especially for input and mixer stages with a wide tuning range, e.g. in CATV tuners



Type	Marking	Ordering Code (tape and reel)	Pin Configuration 1	2	3	4	Package[1]
BF 994 S	MG	Q62702-F1020	S	D	G_2	G_1	SOT-143

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	20	V
Drain current	I_D	30	mA
Gate 1/gate 2 peak source current	$\pm I_{G1/2SM}$	10	
Total power dissipation, $T_A \leq 60$ ˚C	P_{tot}	200	mW
Storage temperature range	T_{stg}	– 55 … + 150	˚C
Channel temperature	T_{ch}	150	

Thermal Resistance

Junction - ambient[2]	$R_{th\,JA}$	$\leq$ 450	K/W

[1] For detailed information see chapter Package Outlines.
[2] Package mounted on alumina 15 mm × 16.7 mm × 0.7 mm.

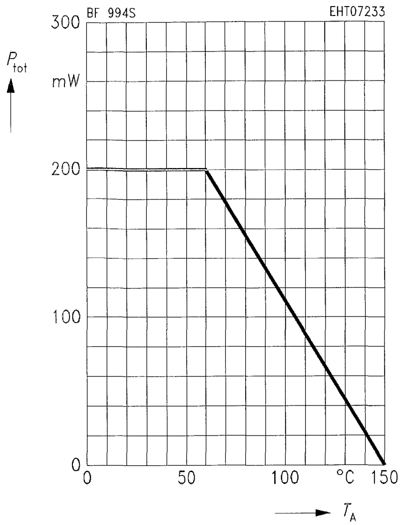
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Drain-source breakdown voltage I_D = 10 µA, $-V_{G1S} = -V_{G2S}$ = 4 V	$V_{(BR)DS}$	20	–	–	V
Gate 1 source breakdown voltage $\pm I_{G1S}$ = 10 mA, $V_{G2S} = V_{DS}$ = 0	$\pm V_{(BR)G1SS}$	8.5	–	14	
Gate 2 source breakdown voltage $\pm I_{G2S}$ = 10 mA, $V_{G1S} = V_{DS}$ = 0	$\pm V_{(BR)G2SS}$	8.5	–	14	
Gate 1 source leakage current $\pm V_{G1S}$ = 5 V, $V_{G2S} = V_{DS}$ = 0	$\pm I_{G1SS}$	–	–	50	nA
Gate 2 source leakage current $\pm V_{G2S}$ = 5 V, $V_{G1S} = V_{DS}$ = 0	$\pm I_{G2SS}$	–	–	50	
Drain current V_{DS} = 15 V, V_{G1S} = 0, V_{G2S} = 4 V	I_{DSS}	2	–	20	mA
Gate 1 source pinch-off voltage V_{DS} = 15 V, V_{G2S} = 4 V, I_D = 20 µA	$-V_{G1S(p)}$	–	–	2.5	V
Gate 2 source pinch-off voltage V_{DS} = 15 V, V_{G1S} = 0, I_D = 20 µA	$-V_{G2S(p)}$	–	–	2.0	

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

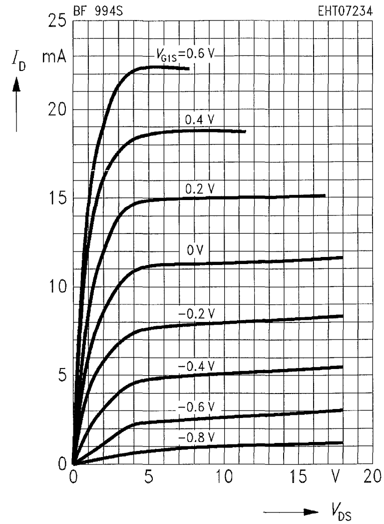
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
AC Characteristics					
Forward transconductance V_{DS} = 15 V, I_D = 10 mA, V_{G2S} = 4 V, f = 1 kHz	g_{fs}	15	18	–	mS
Gate 1 input capacitance V_{DS} = 15 V, I_D = 10 mA, V_{G2S} = 4 V, f = 1 MHz	C_{g1ss}	–	2.5	–	pF
Gate 2 input capacitance V_{DS} = 15 V, I_D = 10 mA, V_{G2S} = 4 V, f = 1 MHz	C_{g2ss}	–	1.2	–	
Feedback capacitance V_{DS} = 15 V, I_D = 10 mA, V_{G2S} = 4 V, f = 1 MHz	C_{dg1}	–	25	–	fF
Output capacitance V_{DS} = 15 V, I_D = 10 mA, V_{G2S} = 4 V, f = 1 MHz	C_{dss}	–	1	–	pF
Power gain V_{DS} = 15 V, I_D = 10 mA f = 200 MHz, G_G = 2 mS, G_L = 0.5 mS (test circuit)	G_{ps}	–	25	–	dB
Noise figure V_{DS} = 15 V, I_D = 10 mA f = 200 MHz, G_G = 2 mS, G_L = 0.5 mS (test circuit)	F	–	1	–	
Gain control range V_{DS} = 15 V, V_{G2S} = 4 … – 2 V, f = 200 MHz (test circuit)	ΔG_{ps}	50	–	–	

Total power dissipation $P_{tot} = f(T_A)$



Output characteristics $I_D = f(V_{DS})$

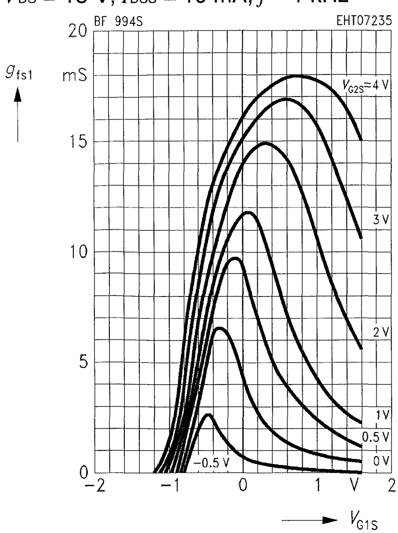
V_{G2S} = 4 V



Gate 1 forward transconductance

$g_{fs1} = f(V_{G1S})$

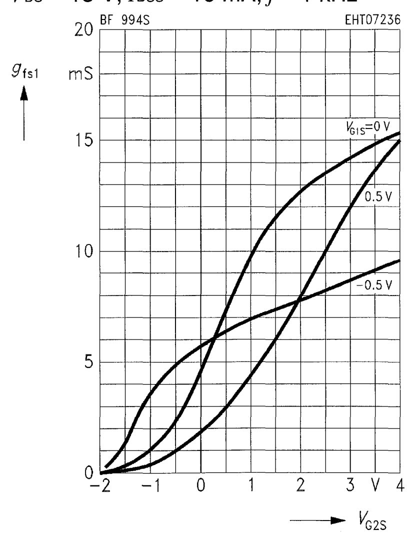
V_{DS} = 15 V, I_{DSS} = 10 mA, f = 1 kHz



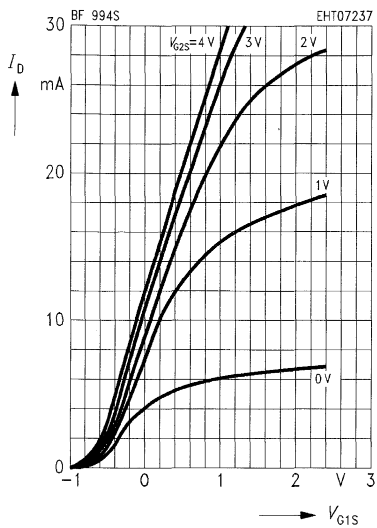
Gate 1 forward transconductance

$g_{fs1} = f(V_{G2S})$

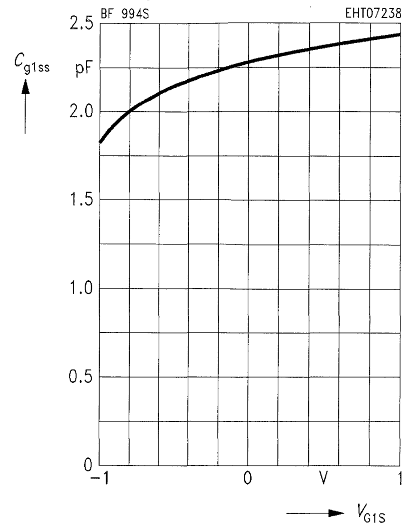
V_{DS} = 15 V, I_{DSS} = 10 mA, f = 1 kHz



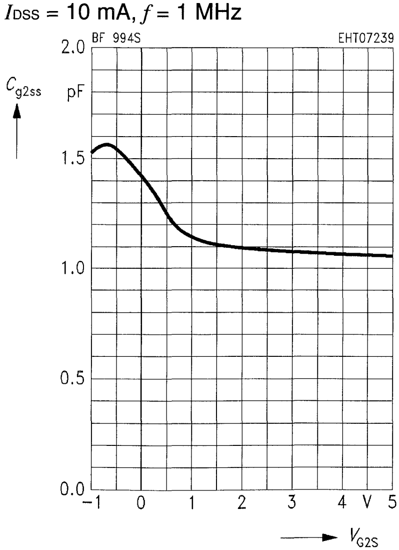
Drain current $I_D = f(V_{G1S})$
V_{DS} = 15 V



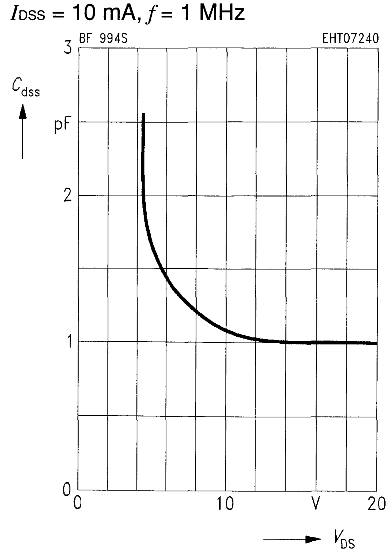
Gate 1 input capacitance $C_{g1ss} = f(V_{G1S})$
V_{G2S} = 4 V, V_{DS} = 15 V
I_{DSS} = 10 mA, f = 1 MHz



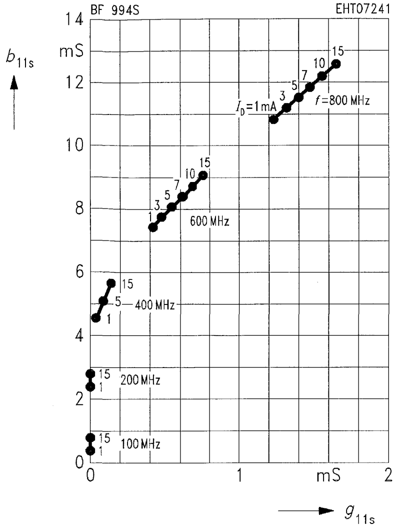
Gate 2 input capacitance $C_{g2ss} = f(V_{G2S})$
V_{G1S} = 0 V, V_{DS} = 15 V
I_{DSS} = 10 mA, f = 1 MHz



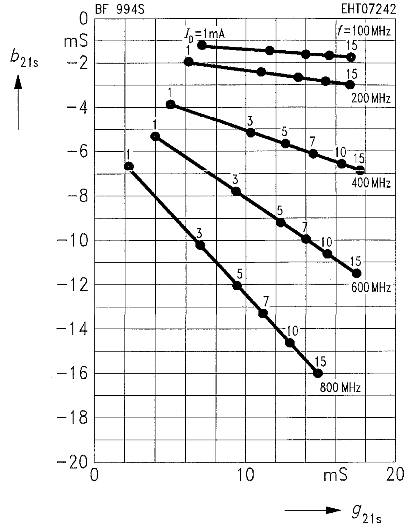
Output capacitance $C_{dss} = f(V_{DS})$
V_{G1S} = 0 V, V_{G2S} = 4 V
I_{DSS} = 10 mA, f = 1 MHz



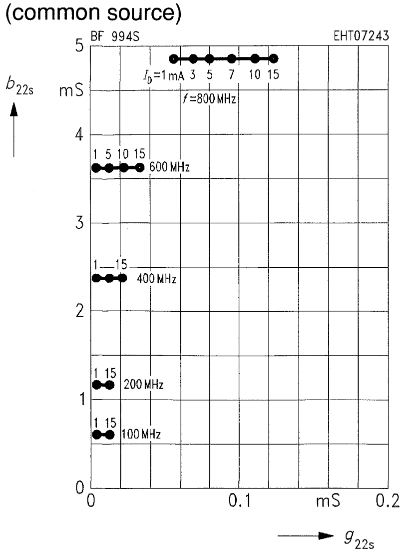
Gate 1 input admittance y_{11s}
V_{DS} = 15 V, V_{G2S} = 4 V
(common source)



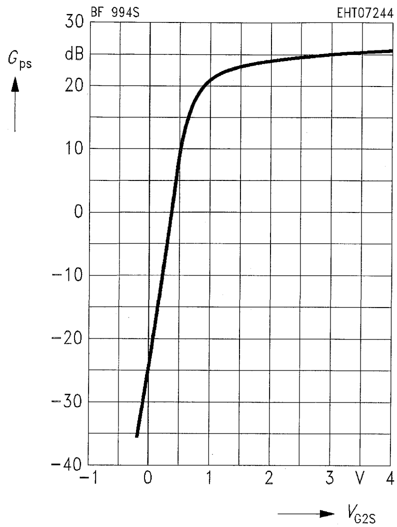
Gate 1 forward transfer admittance y_{21s}
V_{DS} = 15 V, V_{G2S} = 4 V
(common source)



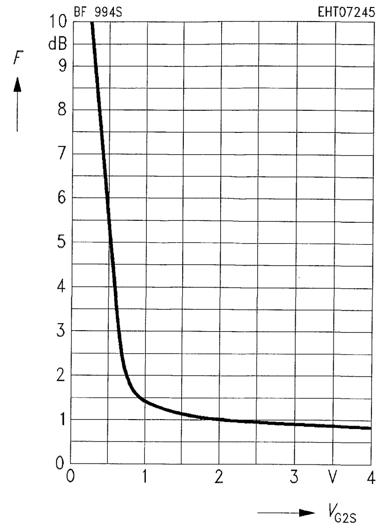
Output admittance y_{22s}
V_{DS} = 15 V, V_{G2S} = 4 V
(common source)



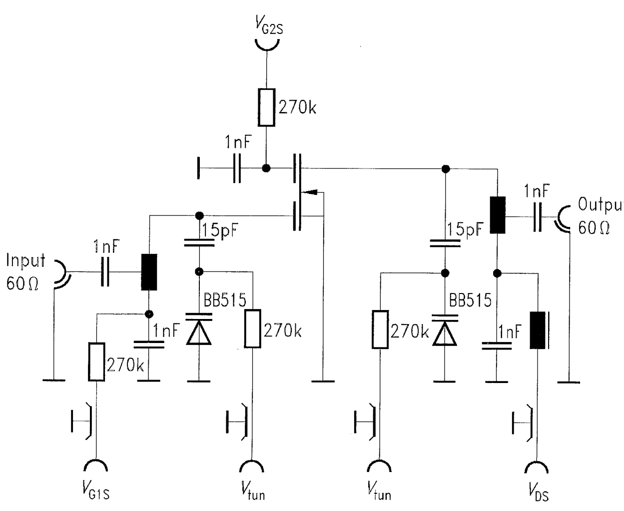
Power gain $G_{ps} = f(V_{G2S})$
V_{DS} = 15 V, V_{G1S} = 0 V, I_{DSS} = 10 mA
f = 200 MHz (see test circuit)



Noise figure $F = f(V_{G2S})$
V_{DS} = 15 V, V_{G1S} = 0 V, I_{DSS} = 10 mA
f = 200 MHz (see test circuit)



Test circuit for power gain and noise figure
f = 200 MHz, G_G = 2 mS, G_L = 0.5 mS

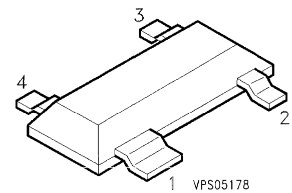


SIEMENS

Silicon N Channel MOSFET Tetrode

BF 995

- For input and mixer stages in FM and VHF TV tuners



Type	Marking	Ordering Code (tape and reel)	Pin Configuration 1	2	3	4	Package[1)]
BF 995	MB	Q62702-F936	S	D	G_2	G_1	SOT-143

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	20	V
Drain current	I_D	30	mA
Gate 1/gate 2 peak source current	$\pm I_{G1/2SM}$	10	
Total power dissipation, $T_A \leq 60$ °C	P_{tot}	200	mW
Storage temperature range	T_{stg}	– 55 ... + 150	°C
Channel temperature	T_{ch}	150	

Thermal Resistance

Junction - ambient[2)]	$R_{th JA}$	≤ 450	K/W

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

Electrical Characteristics

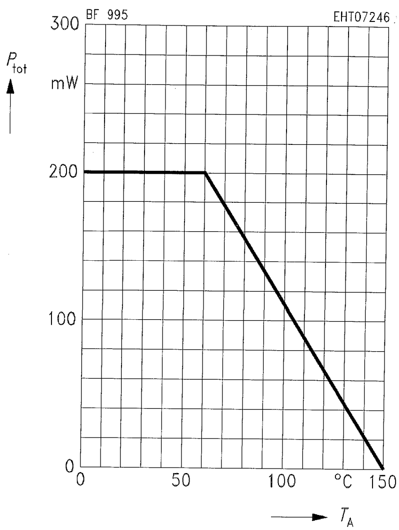
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Drain-source breakdown voltage I_D = 10 μA, – V_{G1S} = – V_{G2S} = 4 V	$V_{(BR)\,DS}$	20	–	–	V
Gate 1 source breakdown voltage ± I_{G1S} = 10 mA, V_{G2S} = V_{DS} = 0	± $V_{(BR)\,G1SS}$	8.5	–	14	
Gate 2 source breakdown voltage ± I_{G2S} = 10 mA, V_{G1S} = V_{DS} = 0	± $V_{(BR)\,G2SS}$	8.5	–	14	
Gate 1 source leakage current ± V_{G1S} = 5 V, V_{G2S} = V_{DS} = 0	± I_{G1SS}	–	–	50	nA
Gate 2 source leakage current ± V_{G2S} = 5 V, V_{G1S} = V_{DS} = 0	± I_{G2SS}	–	–	50	
Drain current V_{DS} = 15 V, V_{G1S} = 0, V_{G2S} = 4 V	I_{DSS}	4	–	20	mA
Gate 1 source pinch-off voltage V_{DS} = 15 V, V_{G2S} = 4 V, I_D = 20 μA	– $V_{G1S\,(p)}$	–	–	2.5	V
Gate 2 source pinch-off voltage V_{DS} = 15 V, V_{G1S} = 0, I_D = 20 μA	– $V_{G2S\,(p)}$	–	–	2.0	

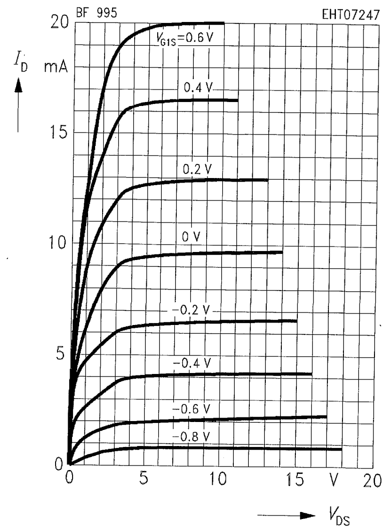
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
AC Characteristics					
Forward transconductance V_{DS} = 15 V, I_D = 10 mA, V_{G2S} = 4 V, f = 1 kHz	g_{fs}	12	17	–	mS
Gate 1 input capacitance V_{DS} = 15 V, I_D = 10 mA, V_{G2S} = 4 V, f = 1 MHz	C_{g1ss}	–	3.6	–	pF
Gate 2 input capacitance V_{DS} = 15 V, I_D = 10 mA, V_{G2S} = 4 V, f = 1 MHz	C_{g2ss}	–	1.6	–	
Feedback capacitance V_{DS} = 15 V, I_D = 10 mA, V_{G2S} = 4 V, f = 1 MHz	C_{dg1}	–	25	–	fF
Output capacitance V_{DS} = 15 V, I_D = 10 mA, V_{G2S} = 4 V, f = 1 MHz	C_{dss}	–	1.6	–	pF
Power gain V_{DS} = 15 V, I_D = 10 mA f = 200 MHz, G_G = 2 mS, G_L = 0.5 mS $2\Delta f$ = 12 MHz (see test circuit 1)	G_{ps}	–	23	–	dB
Noise figure V_{DS} = 15 V, I_D = 10 mA f = 200 MHz, G_G = 2 mS, G_L = 0.5 mS (see test circuit 1)	F	–	1.1	–	
Gain control range V_{DS} = 15 V, V_{G2S} = 4 ... – 2 V, f = 200 MHz (see test circuit 1)	ΔG_{ps}	–	50	–	
Mixer gain (additive) V_{DS} = 15 V, V_{G2S} = 6 V, R_S = 220 Ω f = 200 MHz, f_{IF} = 36 MHz $2\Delta f_{IF}$ = 5 MHz, V_{osc} = 0.5 V (see test circuit 2)	G_{psc}	–	16	–	
Mixer gain (multiplicative) V_{DS} = 15 V, V_{G1S} = 1.7 V, V_{G2S} = 2.5 V R_S = 220 Ω, f = 200 MHz, f_{IF} = 36 MHz $2\Delta f_{IF}$ = 5 MHz, V_{osc} = 2 V (see test circuit 3)	G_{psc}	–	18	–	

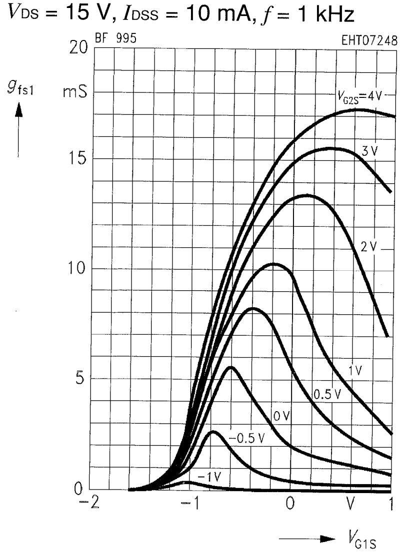
Total power dissipation $P_{tot} = f(T_A)$



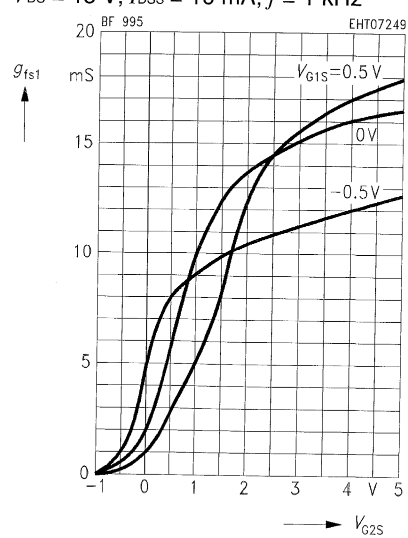
Output characteristics $I_D = f(V_{DS})$
V_{G2S} = 4 V



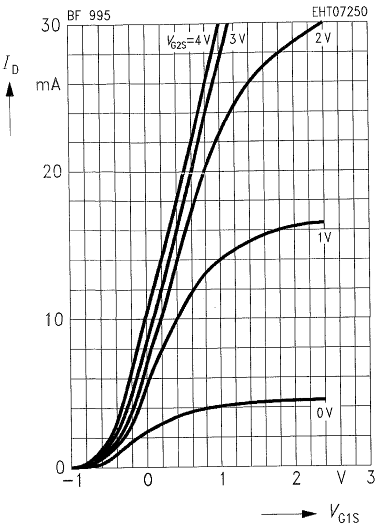
Gate 1 forward transconductance
$g_{fs1} = f(V_{G1S})$
V_{DS} = 15 V, I_{DSS} = 10 mA, f = 1 kHz



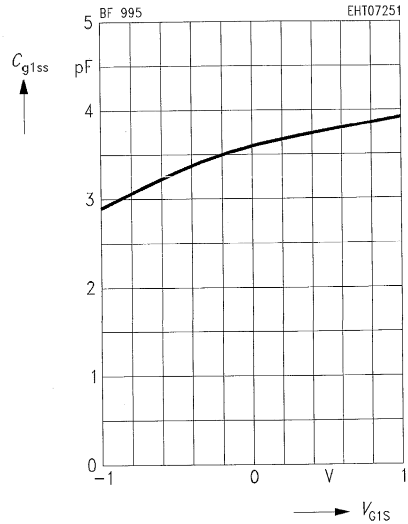
Gate 1 forward transconductance
$g_{fs1} = f(V_{G2S})$
V_{DS} = 15 V, I_{DSS} = 10 mA, f = 1 kHz



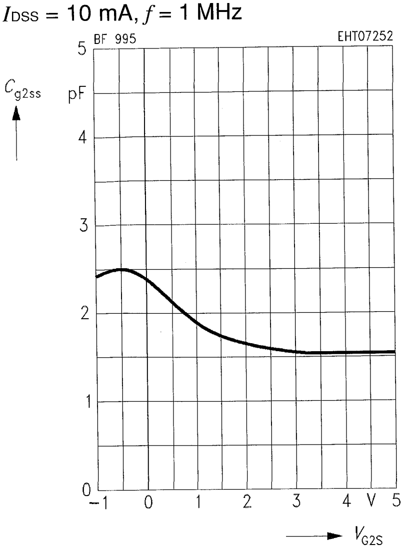
Drain current $I_D = f(V_{G1S})$
V_{DS} = 15 V



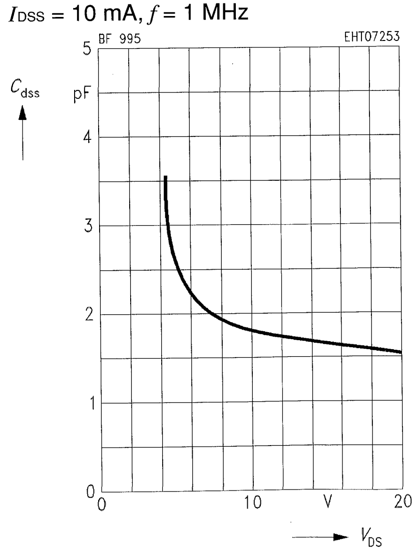
Gate 1 input capacitance $C_{g1ss} = f(V_{G1S})$
V_{G2S} = 4 V, V_{DS} = 15 V
I_{DSS} = 10 mA, f = 1 MHz



Gate 2 input capacitance $C_{g2ss} = f(V_{G2S})$
V_{G1S} = 0 V, V_{DS} = 15 V
I_{DSS} = 10 mA, f = 1 MHz



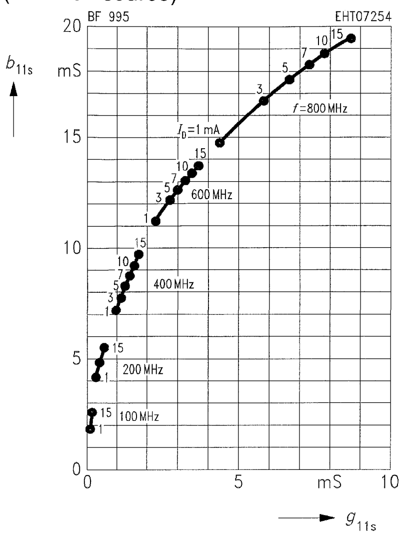
Output capacitance $C_{dss} = f(V_{DS})$
V_{G1S} = 0 V, V_{G2S} = 4 V
I_{DSS} = 10 mA, f = 1 MHz



Gate 1 input admittance *y*₁₁ₛ

V_{DS} = 15 V, V_{G2S} = 4 V

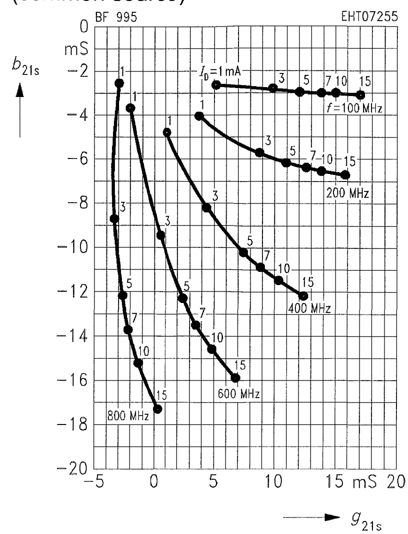
(common source)



Gate 1 forward transfer admittance *y*₂₁ₛ

V_{DS} = 15 V, V_{G2S} = 4 V

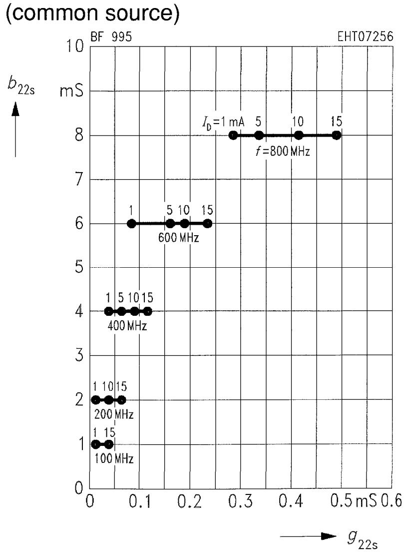
(common source)



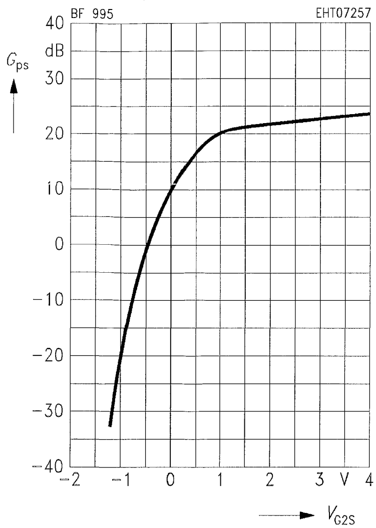
Output admittance *y*₂₂ₛ

V_{DS} = 15 V, V_{G2S} = 4 V

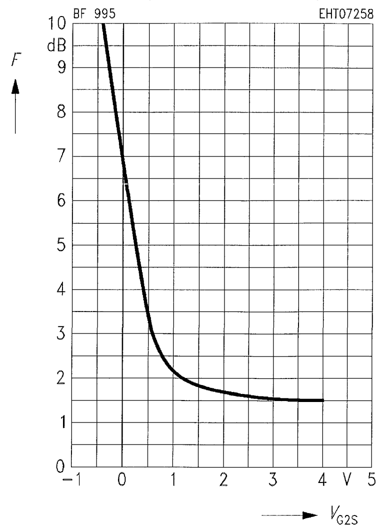
(common source)



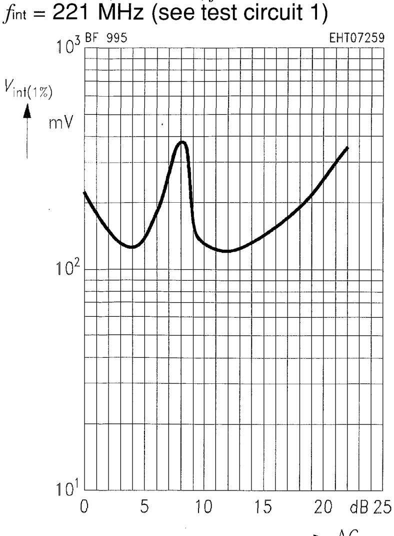
Power gain $G_{ps} = f(V_{G2S})$
V_{DS} = 15 V, V_{G1S} = 0 V, I_{DSS} = 10 mA
f = 200 MHz (see test circuit 1)



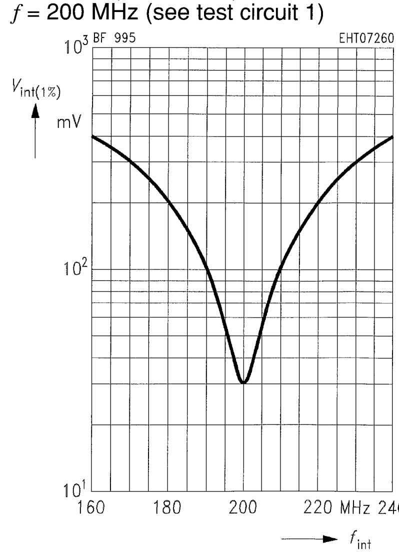
Noise figure $F = f(V_{G2S})$
V_{DS} = 15 V, V_{G1S} = 0 V, I_{DSS} = 10 mA
f = 200 MHz (see test circuit 1)



Interference voltage for 1% cross modulation $V_{int\,(1\%)} = f(\Delta G_{ps})$[1]
V_{DS} = 15 V, V_{G1S} = 0, f = 200 MHz
f_{int} = 221 MHz (see test circuit 1)

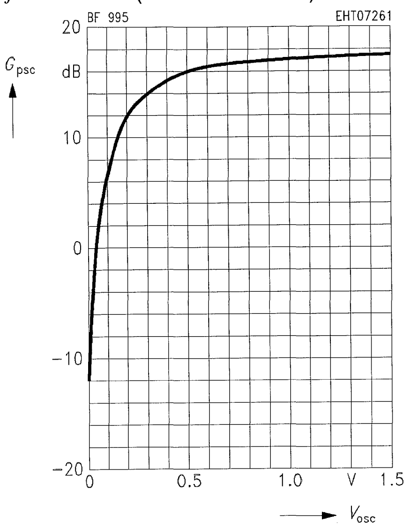


Interference voltage for 1% cross modulation $V_{int\,(1\%)} = f(f_{int})$[1]
V_{DS} = 15 V, V_{G2S} = 4 V, V_{G1S} = 0
f = 200 MHz (see test circuit 1)

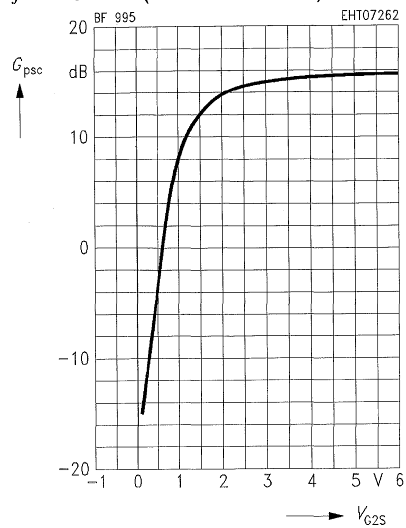


1) For footnote refer to the last page of this data sheet.

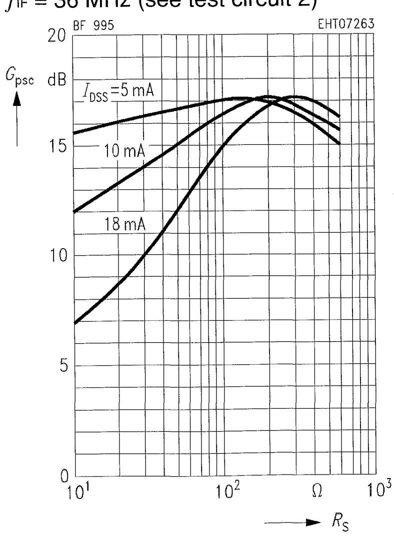
Mixer gain (additive) $G_{psc} = f(V_{osc})$
V_D = 15 V, V_{G1S} = 0, V_{G2S} = 6 V
R_S = 220 Ω, I_{DSS} = 10 mA, f = 200 MHz
f_{IF} = 36 MHz (see test circuit 2)



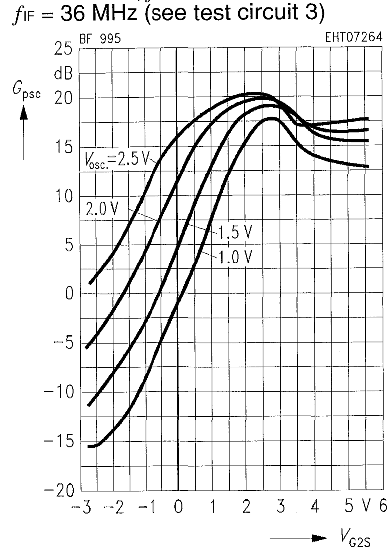
Mixer gain (additive) $G_{psc} = f(V_{G2S})$
V_D = 15 V, V_{G1S} = 0, R_S = 220 Ω
V_{osc} = 0.5 V, I_{DSS} = 10 mA, f = 200 MHz
f_{IF} = 36 MHz (see test circuit 2)



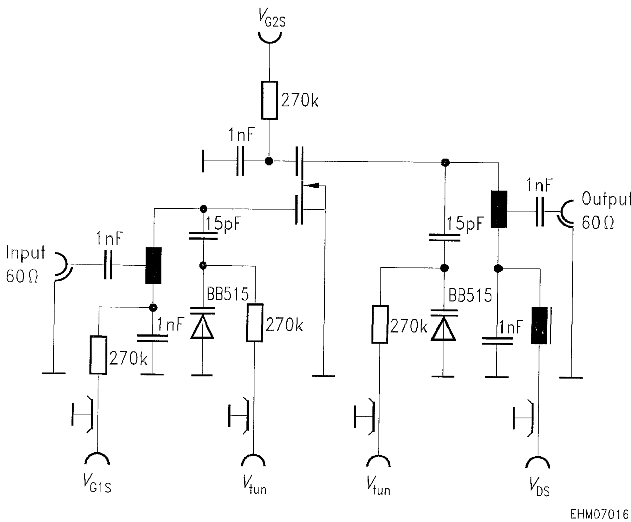
Mixer gain (additive) $G_{psc} = f(R_S)$
V_D = 15 V, V_{G1S} = 0, V_{G2S} = 6 V
V_{osc} = 0.5 V, f = 200 MHz
f_{IF} = 36 MHz (see test circuit 2)



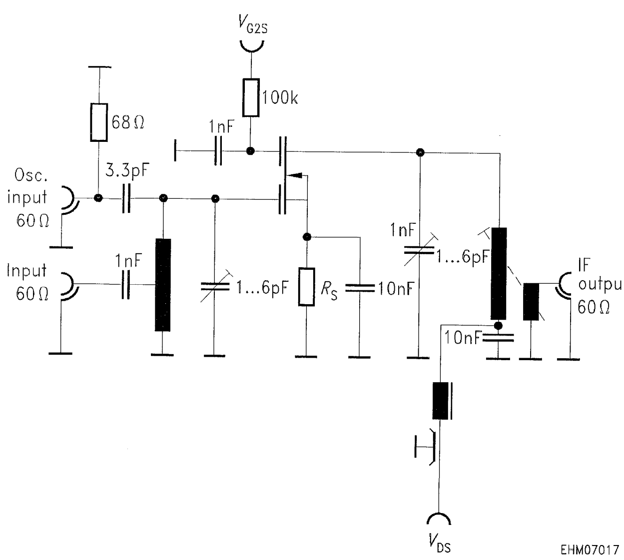
Mixer gain (multiplicative) $G_{psc} = f(V_{G2S})$
V_D = 15 V, V_{G1S} = 1.7 V, R_S = 200 Ω
I_{DSS} = 10 mA, f = 200 MHz
f_{IF} = 36 MHz (see test circuit 3)



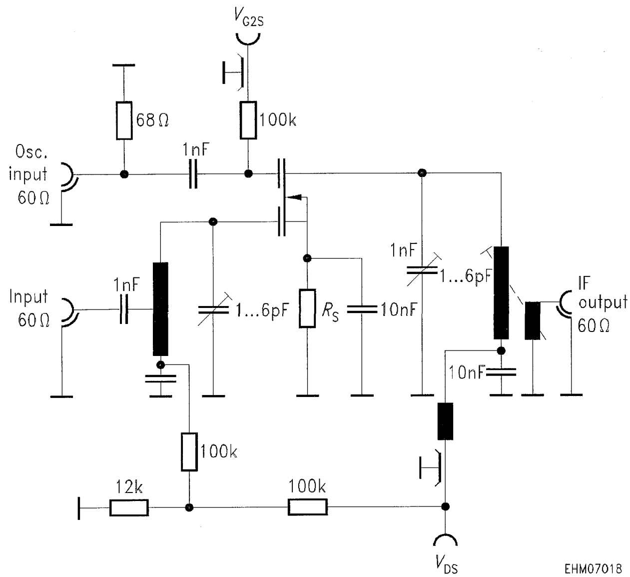
Test circuit 1 for power gain, noise figure and cross modulation
f = 200 MHz, G_G = 2 mS, G_L = 0.5 mS



Test circuit 2 for mixer gain (additive)
f = 200 MHz, f_{osc} = 236 MHz, $2\Delta f_{IF}$ = 5 MHz



Test circuit 3 for mixer gain (multiplicative)
f = 200 MHz, f_{osc} = 236 MHz, 2Δf_{IF} = 5 MHz

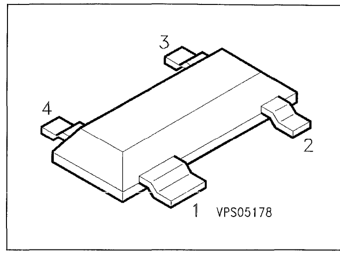


1) $V_{int\,(1\%)}$ is the rms value of half the emf (terminal voltage at matching) of a 100 % sine modulated TV carrier at an internal generator resistance of 60 Ω, causing 1 % amplitude modulation on the active carrier.

Silicon N Channel MOSFET Tetrode

BF 996 S

- For input stages in UHF TV tuners
- High transconductance
- Low noise figure



Type	Marking	Ordering Code (tape and reel)	Pin Configuration 1	2	3	4	Package[1]
BF 996 S	MH	Q62702-F1021	S	D	G_2	G_1	SOT-143

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	20	V
Drain current	I_D	30	mA
Gate 1/gate 2 peak source current	$\pm I_{G1/2SM}$	10	
Total power dissipation, $T_A \leq 60$ ˚C	P_{tot}	200	mW
Storage temperature range	T_{stg}	– 55 … + 150	˚C
Channel temperature	T_{ch}	150	

Thermal Resistance

Junction - ambient[2]	$R_{th\,JA}$	≤ 450	K/W

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

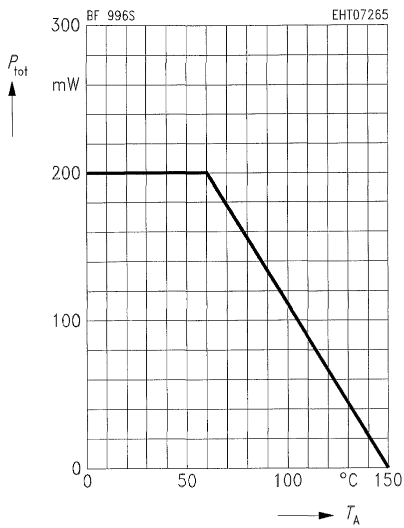
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Drain-source breakdown voltage I_D = 10 μA, – V_{G1S} = – V_{G2S} = 4 V	$V_{(BR)\,DS}$	20	–	–	V
Gate 1 source breakdown voltage ± I_{G1S} = 10 mA, V_{G2S} = V_{DS} = 0	± $V_{(BR)\,G1SS}$	8.5	–	14	
Gate 2 source breakdown voltage ± I_{G2S} = 10 mA, V_{G1S} = V_{DS} = 0	± $V_{(BR)\,G2SS}$	8.5	–	14	
Gate 1 source leakage current ± V_{G1S} = 5 V, V_{G2S} = V_{DS} = 0	± I_{G1SS}	–	–	50	nA
Gate 2 source leakage current ± V_{G2S} = 5 V, V_{G1S} = V_{DS} = 0	± I_{G2SS}	–	–	50	
Drain current V_{DS} = 15 V, V_{G1S} = 0, V_{G2S} = 4 V	I_{DSS}	2	–	20	mA
Gate 1 source pinch-off voltage V_{DS} = 15 V, V_{G2S} = 4 V, I_D = 20 μA	– $V_{G1S\,(p)}$	–	–	2.5	V
Gate 2 source pinch-off voltage V_{DS} = 15 V, V_{G1S} = 0, I_D = 20 μA	– $V_{G2S\,(p)}$	–	–	2.0	

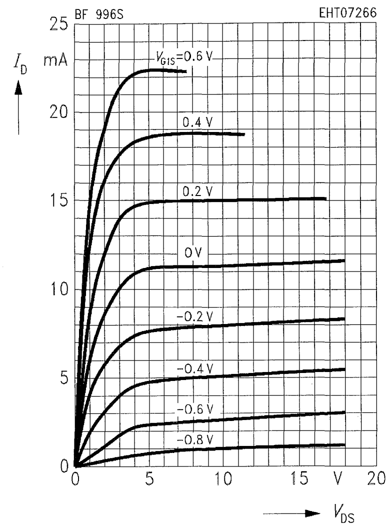
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
AC Characteristics					
Forward transconductance V_{DS} = 15 V, I_D = 10 mA, V_{G2S} = 4 V, f = 1 kHz	g_{fs}	15	18	–	mS
Gate 1 input capacitance V_{DS} = 15 V, I_D = 10 mA, V_{G2S} = 4 V, f = 1 MHz	C_{g1ss}	–	2.3	–	pF
Gate 2 input capacitance V_{DS} = 15 V, I_D = 10 mA, V_{G2S} = 4 V, f = 1 MHz	C_{g2ss}	–	1.1	–	
Feedback capacitance V_{DS} = 15 V, I_D = 10 mA, V_{G2S} = 4 V, f = 1 MHz	C_{dg1}	–	25	–	fF
Output capacitance V_{DS} = 15 V, I_D = 10 mA, V_{G2S} = 4 V, f = 1 MHz	C_{dss}	–	0.8	–	pF
Power gain V_{DS} = 15 V, I_D = 10 mA f = 200 MHz, G_G = 2 mS, G_L = 0.5 mS (test circuit 1)	G_{ps}	–	25	–	dB
Power gain V_{DS} = 15 V, I_D = 10 mA f = 800 MHz, G_G = 2.5 mS, G_L = 0.8 mS (test circuit 2)	G_{ps}	–	18	–	
Noise figure V_{DS} = 15 V, I_D = 10 mA f = 200 MHz, G_G = 2 mS, G_L = 0.5 mS (test circuit 1)	F	–	1	–	
Noise figure V_{DS} = 15 V, I_D = 10 mA f = 800 MHz, G_G = 2.5 mS, G_L = 0.8 mS (test circuit 2)	F	–	1.8	–	
Gain control range V_{DS} = 15 V, V_{G2S} = 4 … – 2 V, f = 800 MHz (test circuit 2)	ΔG_{ps}	40	–	–	

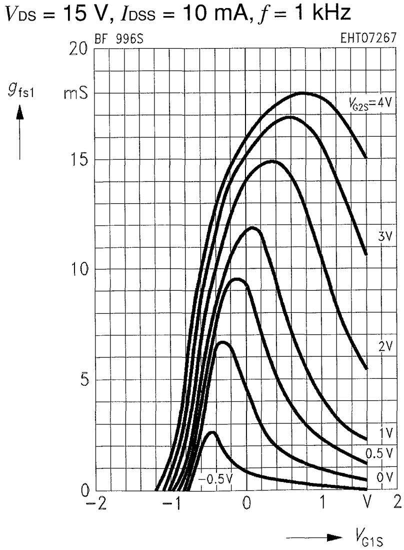
Total power dissipation $P_{tot} = f(T_A)$



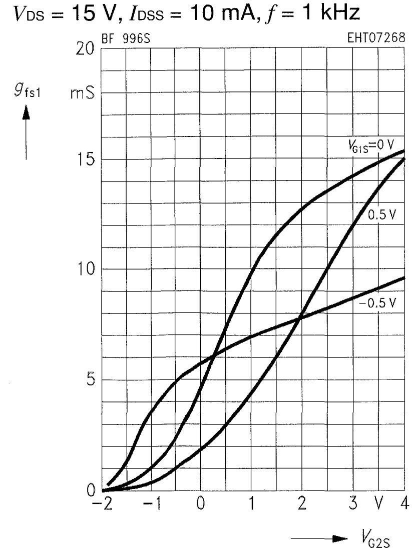
Output characteristics $I_D = f(V_{DS})$
V_{G2S} = 4 V



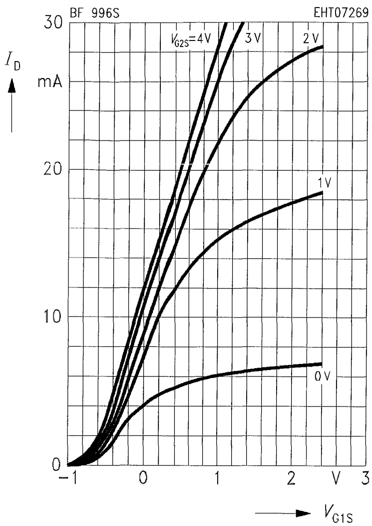
Gate 1 forward transconductance
$g_{fs1} = f(V_{G1S})$
V_{DS} = 15 V, I_{DSS} = 10 mA, f = 1 kHz



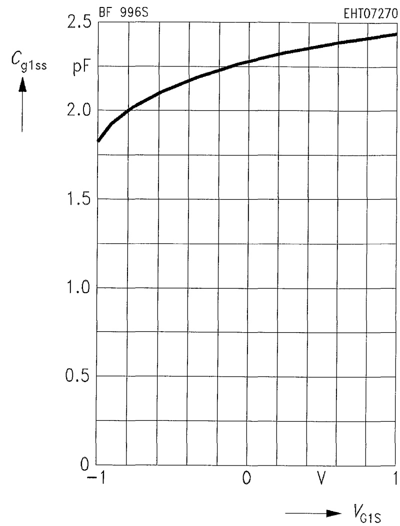
Gate 1 forward transconductance
$g_{fs1} = f(V_{G2S})$
V_{DS} = 15 V, I_{DSS} = 10 mA, f = 1 kHz



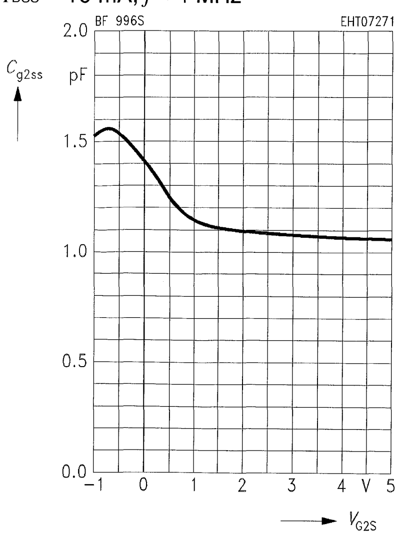
Drain current $I_D = f(V_{G1S})$
V_{DS} = 15 V



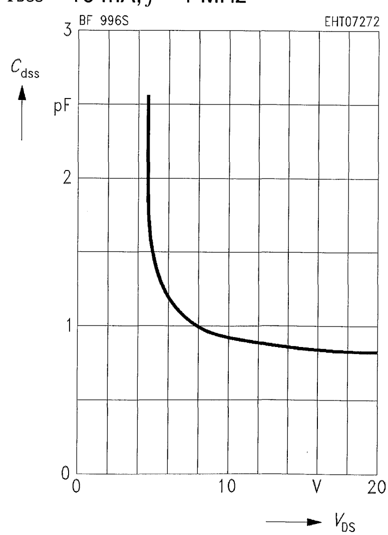
Gate 1 input capacitance $C_{g1ss} = f(V_{G1S})$
V_{G2S} = 4 V, V_{DS} = 15 V
I_{DSS} = 10 mA, f = 1 MHz



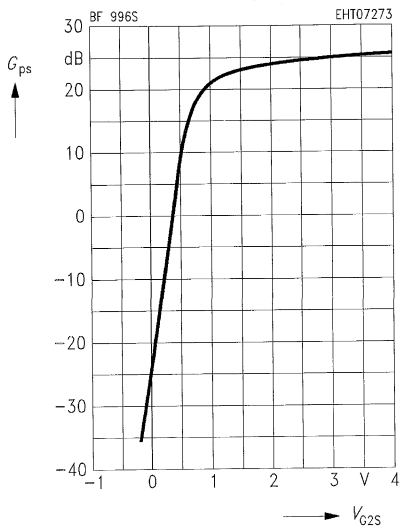
Gate 2 input capacitance $C_{g2ss} = f(V_{G2S})$
V_{G1S} = 0 V, V_{DS} = 15 V
I_{DSS} = 10 mA, f = 1 MHz



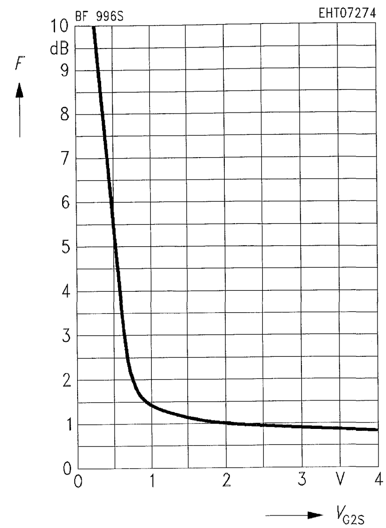
Output capacitance $C_{dss} = f(V_{DS})$
V_{G1S} = 0 V, V_{G2S} = 4 V
I_{DSS} = 10 mA, f = 1 MHz



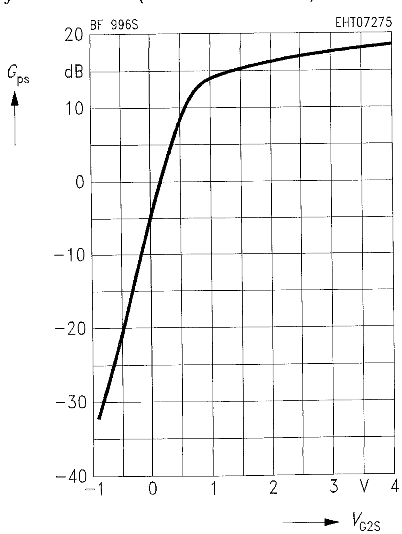
Power gain $G_{ps} = f\,(V_{G2S})$
V_{DS} = 15 V, V_{G1S} = 0 V, I_{DSS} = 10 mA
f = 200 MHz (see test circuit 1)



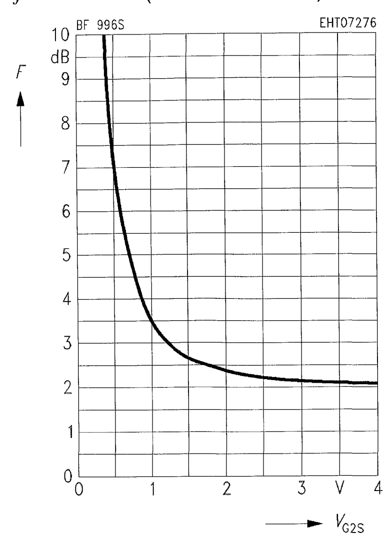
Noise figure $F = f\,(V_{G2S})$
V_{DS} = 15 V, V_{G1S} = 0 V, I_{DSS} = 10 mA
f = 200 MHz (see test circuit 1)



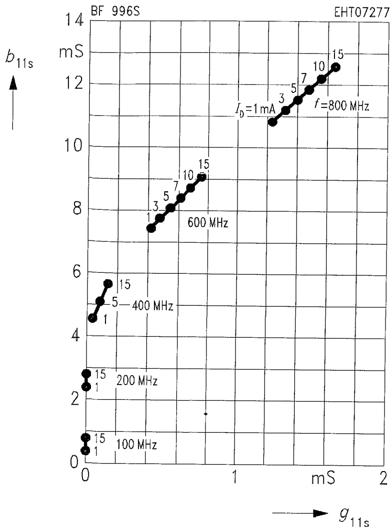
Power gain $G_{ps} = f\,(V_{G2S})$
V_{DS} = 15 V, V_{G1S} = 0 V, I_{DSS} = 10 mA
f = 800 MHz (see test circuit 2)



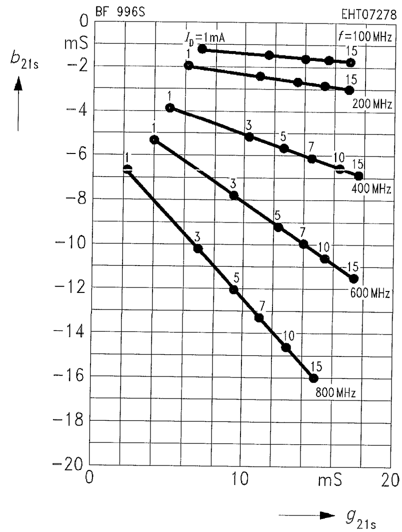
Noise figure $F = f\,(V_{G2S})$
V_{DS} = 15 V, V_{G1S} = 0 V, I_{DSS} = 10 mA
f = 800 MHz (see test circuit 2)



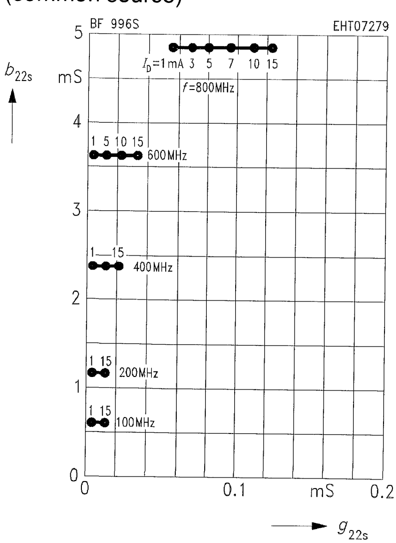
Gate 1 input admittance y_{11s}
V_{DS} = 15 V, V_{G2S} = 4 V
(common source)



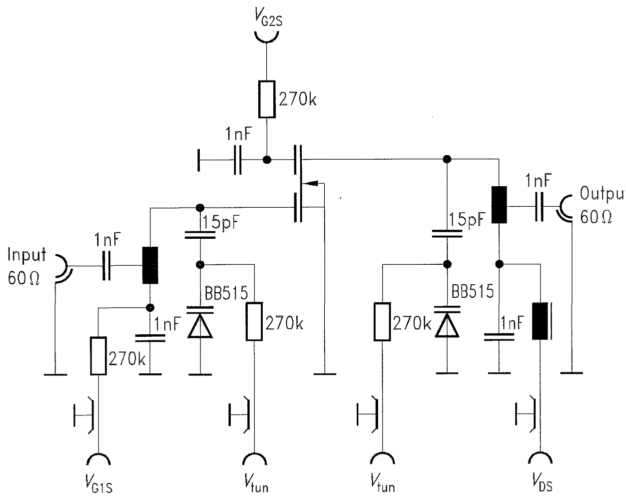
Gate 1 forward transfer admittance y_{21s}
V_{DS} = 15 V, V_{G2S} = 4 V
(common source)



Output admittance y_{22s}
V_{DS} = 15 V, V_{G2S} = 4 V
(common source)

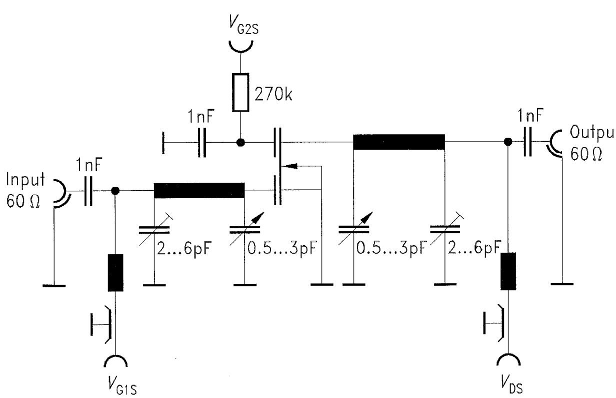


Test circuit 1 for power gain and noise figure
f = 200 MHz, G_G = 2 mS, G_L = 0.5 mS



EHM07019

Test circuit 2 for power gain, noise figure and cross modulation
f = 800 MHz, G_G = 2.5 mS, G_L = 0.8 mS



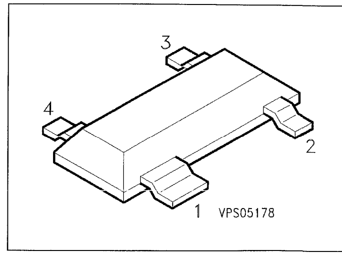
EHM07020

SIEMENS

Silicon N Channel MOSFET Tetrode

BF 997

- Integrated suppression network against spurious VHF oscillations
- For VHF applications, especially in TV tuners with extended VHF band, e. g. in CATV tuners



Type	Marking	Ordering Code (tape and reel)	Pin Configuration 1	2	3	4	Package[1]
BF 997	MK	Q62702-F1055	S	D	G_2	G_1	SOT-143

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	20	V
Drain current	I_D	30	mA
Gate 1/gate 2 peak source current	$\pm I_{G1/2SM}$	10	
Total power dissipation, $T_A \leq 60$ ˚C	P_{tot}	200	mW
Storage temperature range	T_{stg}	– 55 ... + 150	˚C
Channel temperature	T_{ch}	150	

Thermal Resistance

Junction - ambient[2]	$R_{th\,JA}$	$\leq$ 450	K/W

[1] For detailed information see chapter Package Outlines.
[2] Package mounted on alumina 15 mm × 16.7 mm × 0.7 mm.

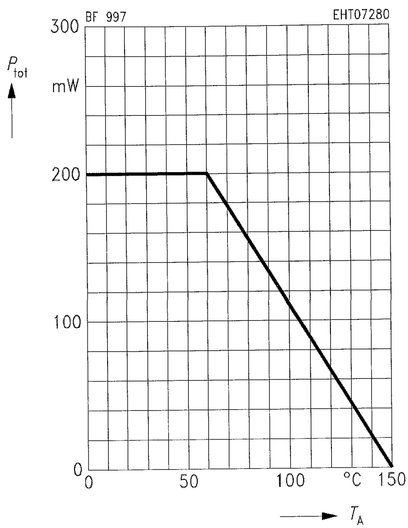
Electrical Characteristics
at T_A = 25 ˚C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Drain-source breakdown voltage I_D = 10 µA, – V_{G1S} = – V_{G2S} = 4 V	$V_{(BR)\,DS}$	20	–	–	V
Gate 1 source breakdown voltage ± I_{G1S} = 10 mA, V_{G2S} = V_{DS} = 0	± $V_{(BR)\,G1SS}$	8.5	–	14	
Gate 2 source breakdown voltage ± I_{G2S} = 10 mA, V_{G1S} = V_{DS} = 0	± $V_{(BR)\,G2SS}$	8.5	–	14	
Gate 1 source leakage current ± V_{G1S} = 5 V, V_{G2S} = V_{DS} = 0	± I_{G1SS}	–	–	50	nA
Gate 2 source leakage current ± V_{G2S} = 5 V, V_{G1S} = V_{DS} = 0	± I_{G2SS}	–	–	50	
Drain current V_{DS} = 15 V, V_{G1S} = 0, V_{G2S} = 4 V	I_{DSS}	2	–	20	mA
Gate 1 source pinch-off voltage V_{DS} = 15 V, V_{G2S} = 4 V, I_D = 20 µA	– $V_{G1S\,(p)}$	–	–	2.5	V
Gate 2 source pinch-off voltage V_{DS} = 15 V, V_{G1S} = 0, I_D = 20 µA	– $V_{G2S\,(p)}$	–	–	2.0	

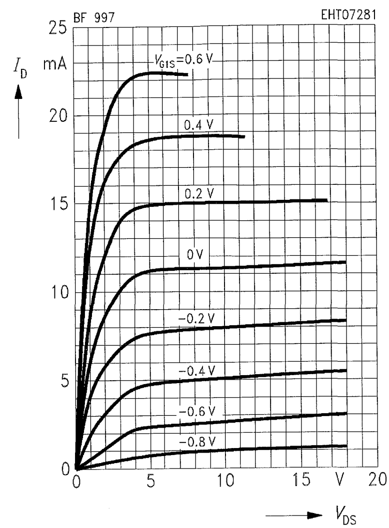
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
AC Characteristics					
Forward transconductance V_{DS} = 15 V, I_D = 10 mA, V_{G2S} = 4 V, f = 1 kHz	g_{fs}	15	18	–	mS
Gate 1 input capacitance V_{DS} = 15 V, I_D = 10 mA, V_{G2S} = 4 V, f = 1 MHz	C_{g1ss}	–	2.5	–	pF
Gate 2 input capacitance V_{DS} = 15 V, I_D = 10 mA, V_{G2S} = 4 V, f = 1 MHz	C_{g2ss}	–	1.2	–	
Feedback capacitance V_{DS} = 15 V, I_D = 10 mA, V_{G2S} = 4 V, f = 1 MHz	C_{dg1}	–	25	–	fF
Output capacitance V_{DS} = 15 V, I_D = 10 mA, V_{G2S} = 4 V, f = 1 MHz	C_{dss}	–	1	–	pF
Power gain V_{DS} = 15 V, I_D = 10 mA f = 200 MHz, G_G = 2 mS, G_L = 0.5 mS (test circuit)	G_{ps}	–	25	–	dB
Noise figure V_{DS} = 15 V, I_D = 10 mA f = 200 MHz, G_G = 2 mS, G_L = 0.5 mS (test circuit)	F	–	1	–	
Gain control range V_{DS} = 15 V, V_{G2S} = 4 … – 2 V, f = 200 MHz (test circuit)	ΔG_{ps}	50	–	–	

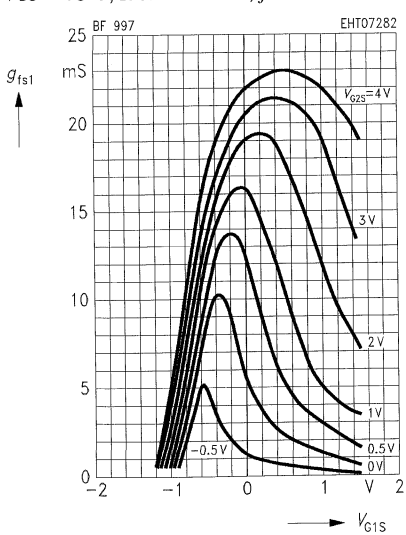
Total power dissipation $P_{tot} = f(T_A)$



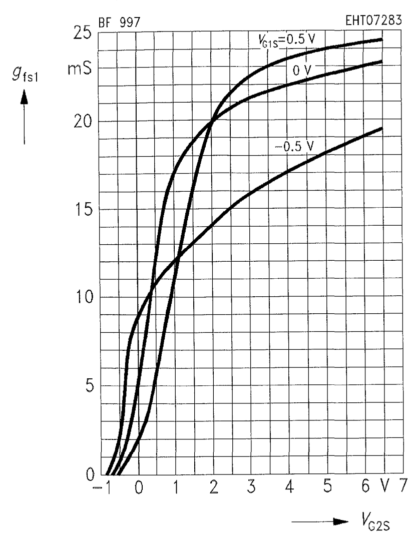
Output characteristics $I_D = f(V_{DS})$
V_{G2S} = 4 V



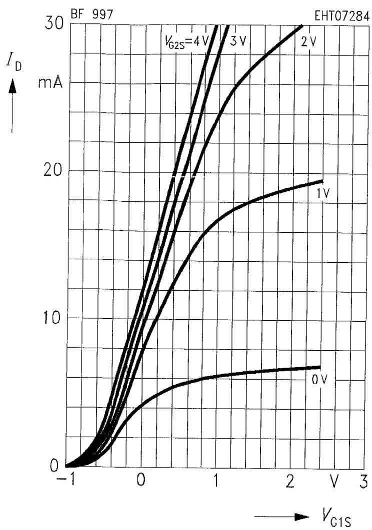
Gate 1 forward transconductance
$g_{fs1} = f(V_{G1S})$
V_{DS} = 15 V, I_{DSS} = 10 mA, f = 1 kHz



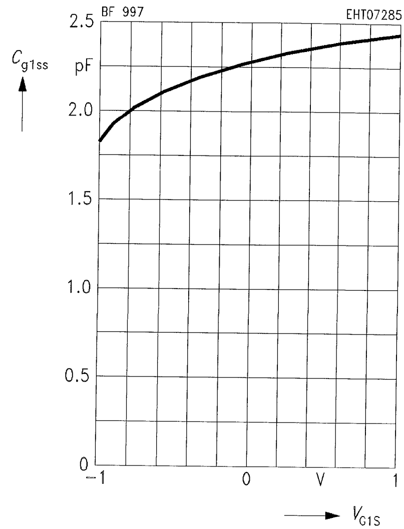
Gate 1 forward transconductance
$g_{fs1} = f(V_{G2S})$
V_{DS} = 15 V, I_{DSS} = 10 mA, f = 1 kHz



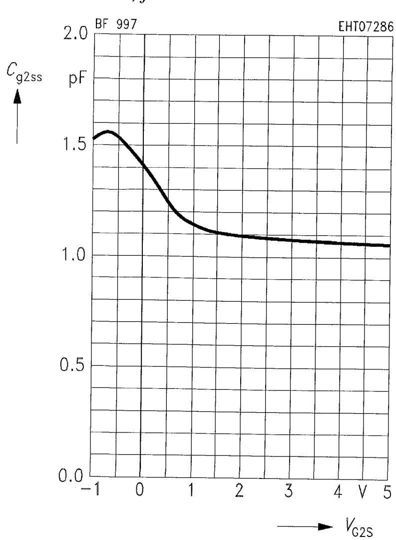
Drain current $I_D = f\,(V_{G1S})$
V_{DS} = 15 V



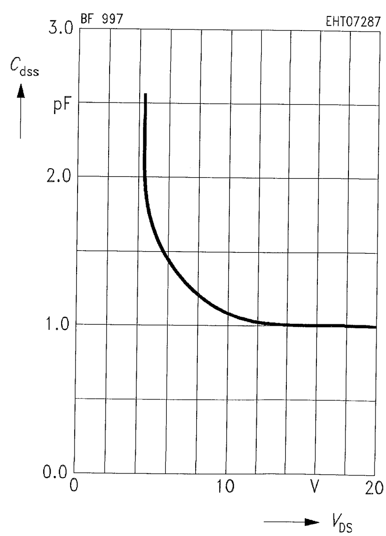
Gate 1 input capacitance $C_{g1ss} = f\,(V_{G1S})$
V_{G2S} = 4 V, V_{DS} = 15 V
I_{DSS} = 10 mA, f = 1 MHz



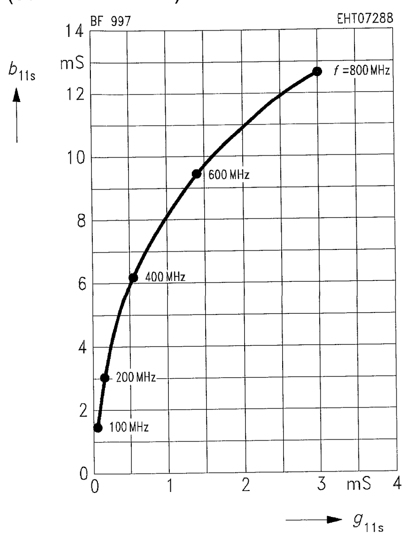
Gate 2 input capacitance $C_{g2ss} = f\,(V_{G2S})$
V_{G1S} = 0 V, V_{DS} = 15 V
I_{DSS} = 10 mA, f = 1 MHz



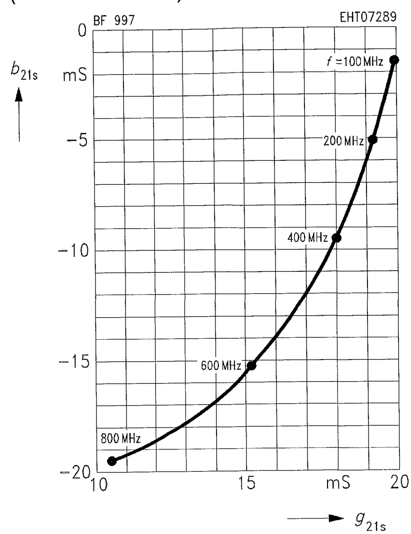
Output capacitance $C_{dss} = f\,(V_{DS})$
V_{G1S} = 0 V, V_{G2S} = 4 V
I_{DSS} = 10 mA, f = 1 MHz



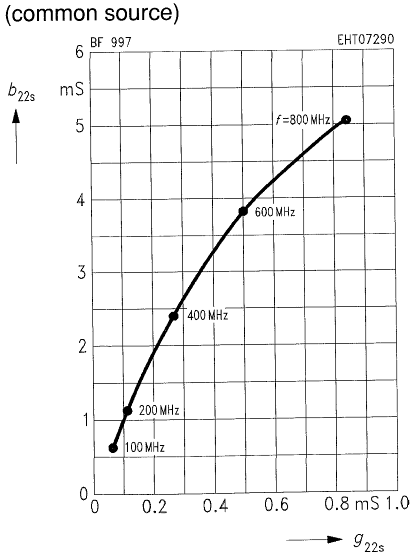
Gate 1 input admittance y_{11s}
V_{DS} = 15 V, V_{G2S} = 4 V
(common source)



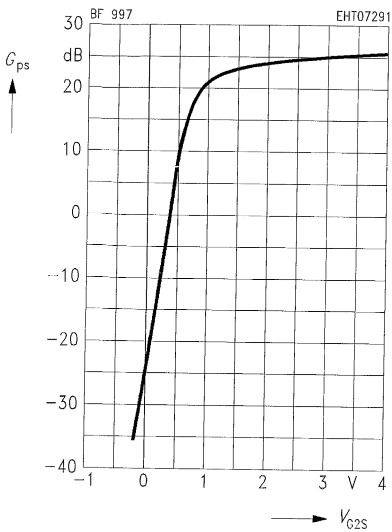
Gate 1 forward transfer admittance y_{21s}
V_{DS} = 15 V, V_{G2S} = 4 V
(common source)



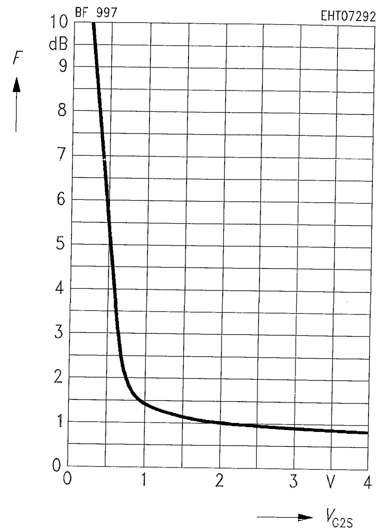
Output admittance y_{22s}
V_{DS} = 15 V, V_{G2S} = 4 V
(common source)



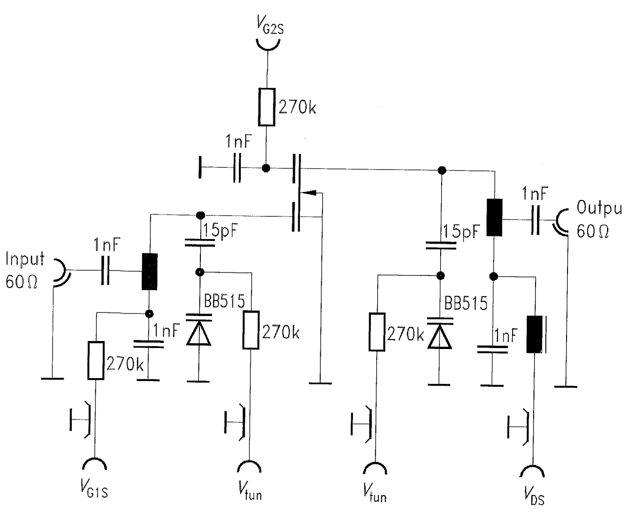
Power gain $G_{ps} = f(V_{G2S})$
V_{DS} = 15 V, V_{G1S} = 0 V, I_{DSS} = 10 mA
f = 200 MHz (see test circuit)



Noise figure $F = f(V_{G2S})$
V_{DS} = 15 V, V_{G1S} = 0 V, I_{DSS} = 10 mA
f = 200 MHz, (see test circuit)



Test circuit for power gain and noise figure
f = 200 MHz, G_G = 2 mS, G_L = 0.5 mS

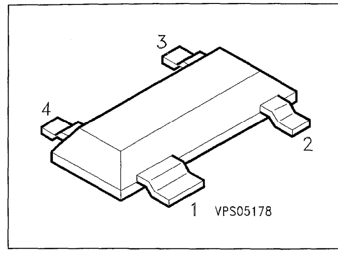


SIEMENS

Silicon N Channel MOSFET Tetrode

BF 998

- Short-channel transistor with high S/C quality factor
- For low-noise, gain-controlled input stages up to 1 GHz



Type	Marking	Ordering Code (tape and reel)	Pin Configuration 1	2	3	4	Package[1)]
BF 998	MO	Q62702-F1129	S	D	G_2	G_1	SOT-143

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	12	V
Drain current	I_D	30	mA
Gate 1/gate 2 peak source current	$\pm I_{G1/2SM}$	10	
Total power dissipation, $T_A \leq 60$ ˚C	P_{tot}	200	mW
Storage temperature range	T_{stg}	– 55 … + 150	˚C
Channel temperature	T_{ch}	150	

Thermal Resistance

Junction - ambient[2)]	$R_{th\,JA}$	≤ 450	K/W

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

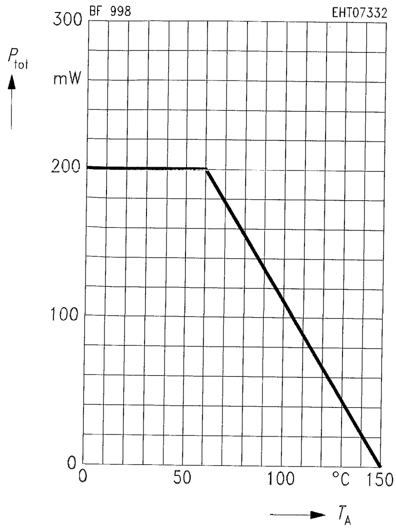
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Drain-source breakdown voltage I_D = 10 µA, – V_{G1S} = – V_{G2S} = 4 V	$V_{(BR)\,DS}$	12	–	–	V
Gate 1-source breakdown voltage ± I_{G1S} = 10 mA, V_{G2S} = V_{DS} = 0	± $V_{(BR)\,G1SS}$	8	–	12	
Gate 2-source breakdown voltage ± I_{G2S} = 10 mA, V_{G1S} = V_{DS} = 0	± $V_{(BR)\,G2SS}$	8	–	12	
Gate 1-source leakage current ± V_{G1S} = 5 V, V_{G2S} = V_{DS} = 0	± I_{G1SS}	–	–	50	nA
Gate 2-source leakage current ± V_{G2S} = 5 V, V_{G1S} = V_{DS} = 0	± I_{G2SS}	–	–	50	
Drain current V_{DS} = 8 V, V_{G1S} = 0, V_{G2S} = 4 V	I_{DSS}	2	–	18	mA
Gate 1-source pinch-off voltage V_{DS} = 8 V, V_{G2S} = 4 V, I_D = 20 µA	– $V_{G1S(p)}$	–	–	2.5	V
Gate 2-source pinch-off voltage V_{DS} = 8 V, V_{G1S} = 0, I_D = 20 µA	– $V_{G2S(p)}$	–	–	2	

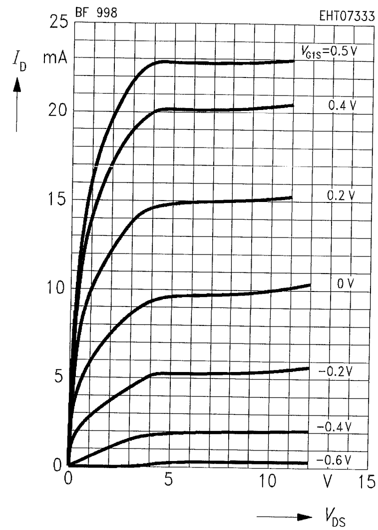
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
AC Characteristics					
Forward transconductance V_{DS} = 8 V, I_D = 10 mA, V_{G2S} = 4 V f = 1 kHz	g_{fs}	–	24	–	mS
Gate 1 input capacitance V_{DS} = 8 V, I_D = 10 mA, V_{G2S} = 4 V f = 1 MHz	C_{g1ss}	–	2.1	2.5	pF
Gate 2 input capacitance V_{DS} = 8 V, I_D = 10 mA, V_{G2S} = 4 V f = 1 MHz	C_{g2ss}	–	1.2	–	
Reverse transfer capacitance V_{DS} = 8 V, I_D = 10 mA, V_{G2S} = 4 V f = 1 MHz	C_{dg1}	–	25	–	fF
Output capacitance V_{DS} = 8 V, I_D = 10 mA, V_{G2S} = 4 V f = 1 MHz	C_{dss}	–	1.05	–	pF
Power gain (test circuit 1) V_{DS} = 8 V, I_D = 10 mA, f = 200 MHz, G_G = 2 mS, G_L = 0.5 mS, V_{G2S} = 4 V	G_{ps}	–	28	–	dB
Power gain (test circuit 2) V_{DS} = 8 V, I_D = 10 mA, f = 800 MHz, G_G = 3.3 mS, G_L = 1 mS, V_{G2S} = 4 V	G_{ps}	–	20	–	
Noise figure (test circuit 1) V_{DS} = 8 V, I_D = 10 mA, f = 200 MHz, G_G = 2 mS, G_L = 0.5 mS, V_{G2S} = 4 V	F	–	0.6	–	dB
Noise figure (test circuit 2) V_{DS} = 8 V, I_D = 10 mA, f = 800 MHz, G_G = 3.3 mS, G_L = 1 mS, V_{G2S} = 4 V	F	–	1	–	
Control range (test circuit 2) V_{DS} = 8 V, V_{G2S} = 4 … – 2 V f = 800 MHz	ΔG_{ps}	40	–	–	

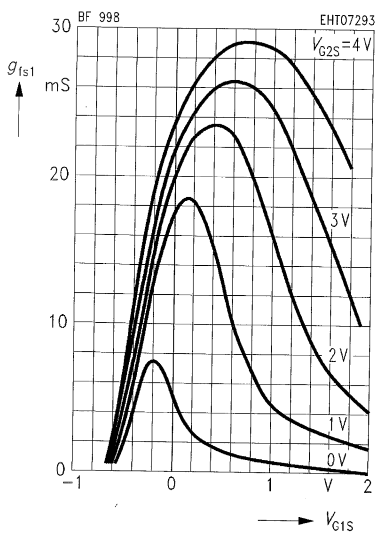
Total power dissipation $P_{tot} = f(T_A)$



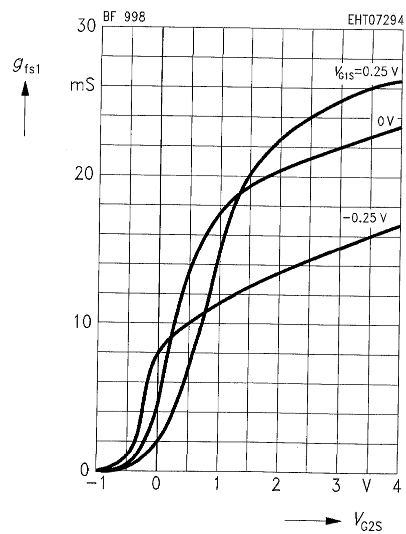
Output characteristics $I_D = f(V_{DS})$
V_{G2S} = 4 V



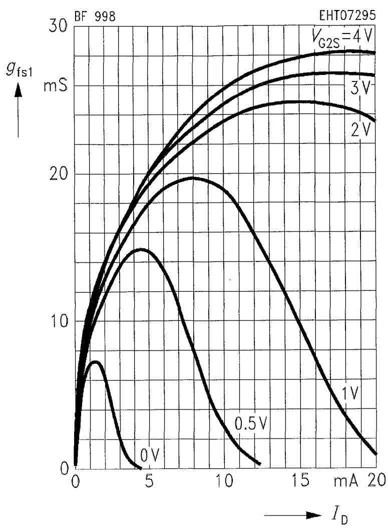
Gate 1 forward transconductance
$g_{fs1} = f(V_{G1S})$
V_{DS} = 8 V, I_{DSS} = 10 mA, f = 1 kHz



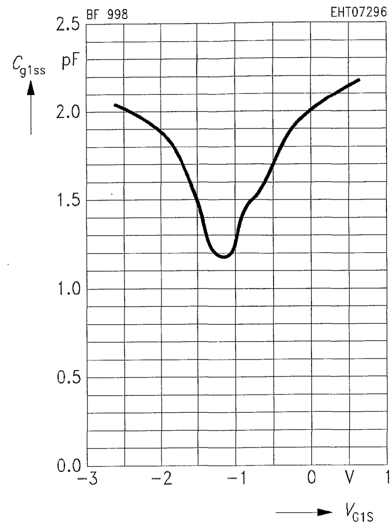
Gate 1 forward transconductance
$g_{fs1} = f(V_{G2S})$
V_{DS} = 8 V, I_{DSS} = 10 mA, f = 1 kHz



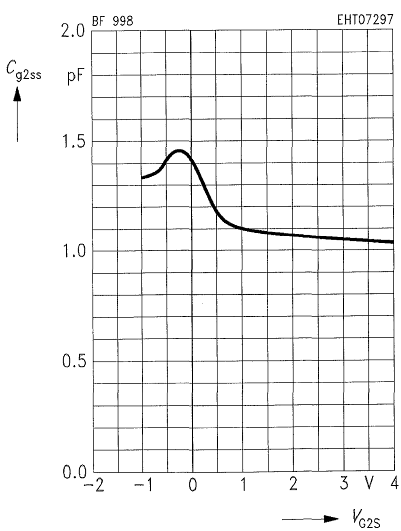
Gate 1 forward transconductance
$g_{fs1} = f(I_D)$
V_{DS} = 8 V, I_{DSS} = 10 mA, f = 1 kHz



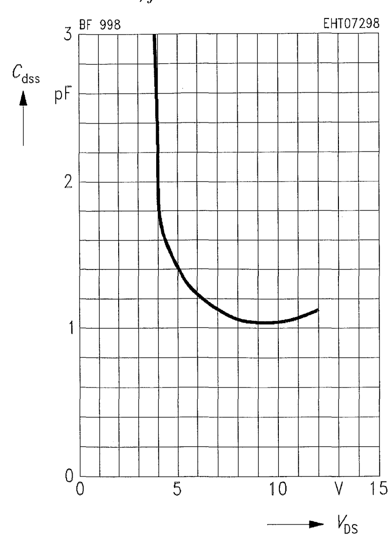
Gate 1 input capacitance $C_{g1ss} = f(V_{G1S})$
V_{G2S} = 4 V, V_{DS} = 8 V, I_{DSS} = 10 mA,
f = 1 MHz



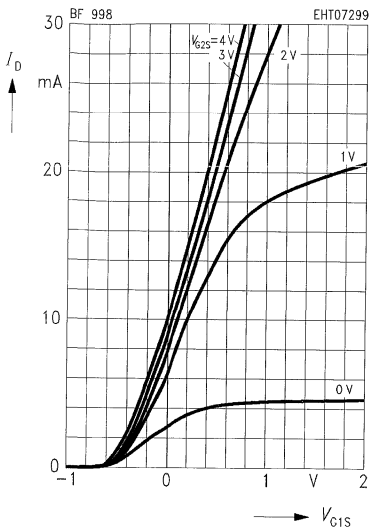
Gate 2 input capacitance $C_{g2ss} = f(V_{G2S})$
V_{G1S} = 0 V, V_{DS} = 8 V
I_{DSS} = 10 mA, f = 1 MHz



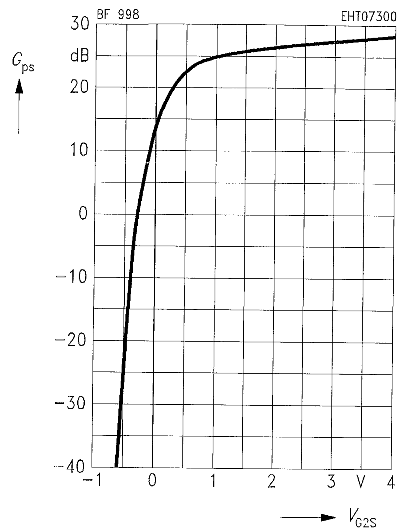
Output capacitance $C_{dss} = f(V_{DS})$
V_{G1S} = 0 V, V_{G2S} = 4 V
I_{DSS} = 10 mA, f = 1 MHz



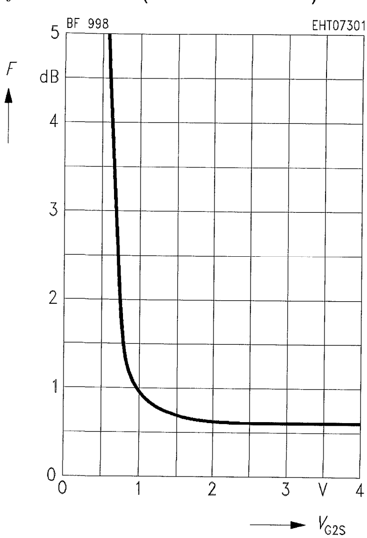
Drain current $I_D = f(V_{G1S})$
V_{DS} = 8 V



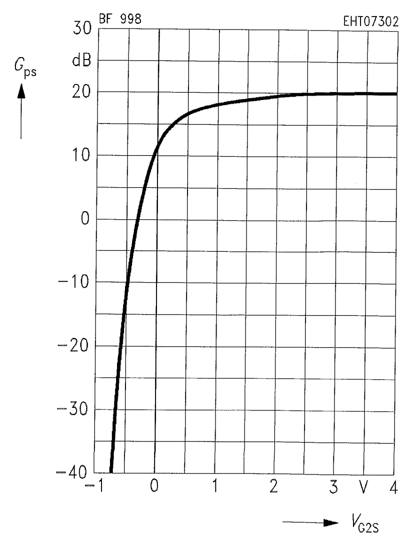
Power gain $G_{ps} = f(V_{G2S})$
V_{DS} = 8 V, V_{G1S} = 0, I_{DSS} = 10 mA,
f = 200 MHz (see test circuit 1)



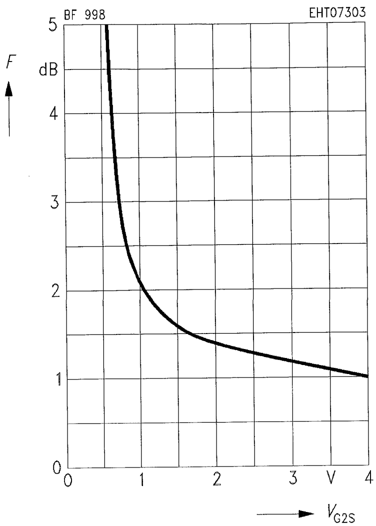
Noise figure $F = f(V_{G2S})$
V_{DS} = 8 V, V_{G1S} = 0, I_{DSS} = 10 mA,
f = 200 MHz (see test circuit 1)



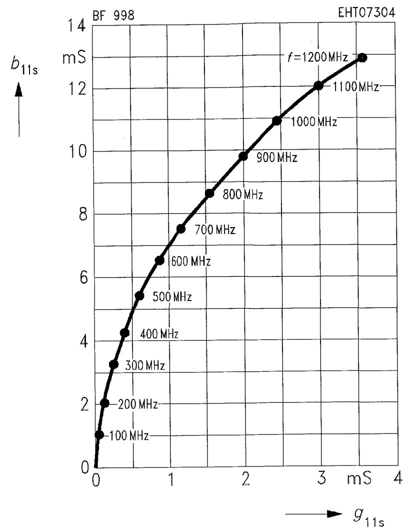
Power gain $G_{ps} = f(V_{G2S})$
V_{DS} = 8 V, V_{G1S} = 0, I_{DSS} = 10 mA,
f = 800 MHz (see test circuit 2)



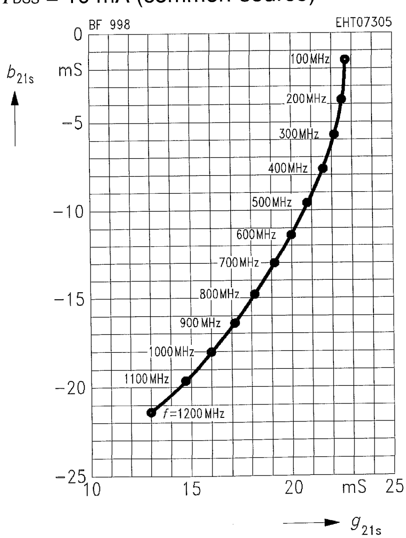
Noise figure $F = f(V_{G2S})$
V_{DS} = 8 V, V_{G1S} = 0, I_{DSS} = 10 mA,
f = 800 MHz (see test circuit 2)



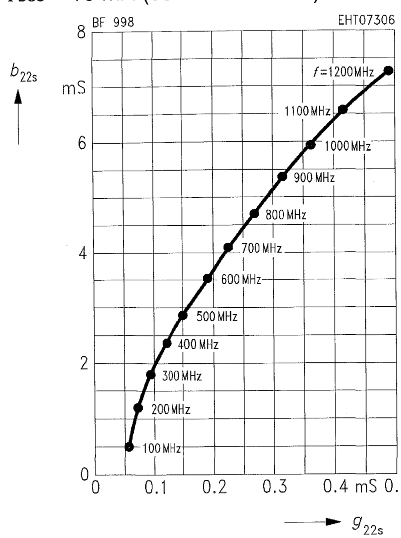
Gate 1 input admittance y_{11s}
V_{DS} = 8 V, V_{G2S} = 4 V, V_{G1S} = 0,
I_{DSS} = 10 mA (common-source)



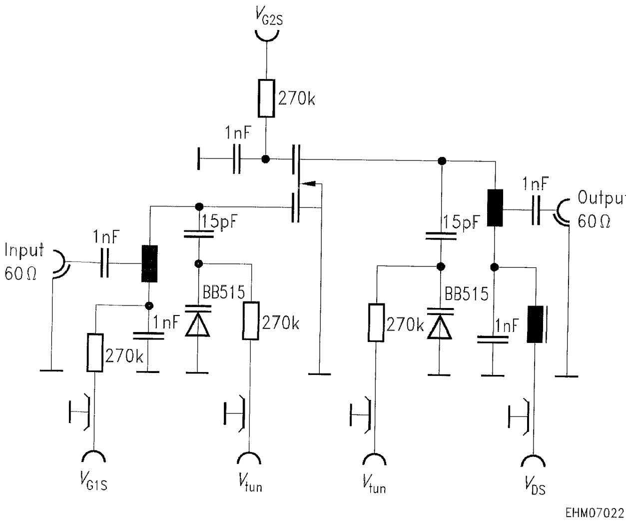
Gate 1 forward transfer admittance y_{21s}
V_{DS} = 8 V, V_{G2S} = 4 V, V_{G1S} = 0
I_{DSS} = 10 mA (common-source)



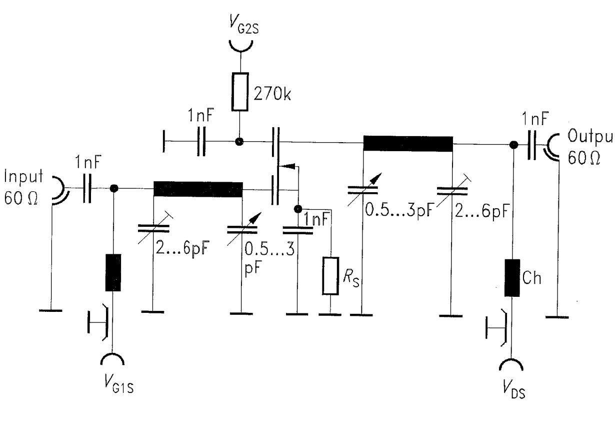
Output admittance y_{22s}
V_{DS} = 8 V, V_{G2S} = 4 V, V_{G1S} = 0
I_{DSS} = 10 mA (common-source)



Test circuit 1 for power gain and noise figure
f = 200 MHz, G_G = 2 mS, G_L = 0.5 mS



Test circuit 2 for power gain and noise figure
f = 800 MHz, G_G = 3.3 mS, G_L = 1 mS

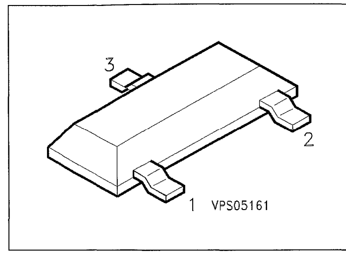


SIEMENS

Silicon N Channel MOSFET Triode

BF 999

- For high-frequency stages up to 300 MHz, preferably in FM applications



Type	Marking	Ordering Code (tape and reel)	Pin Configuration 1	2	3	Package[1)]
BF 999	LB	Q62702-F1132	G	D	S	SOT-23

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	20	V
Drain current	I_D	30	mA
Gate-source peak current	$\pm I_{GSM}$	10	
Total power dissipation, $T_A \leq 60$ ˚C	P_{tot}	200	mW
Storage temperature range	T_{stg}	– 55 ... + 150	˚C
Channel temperature	T_{ch}	150	

Thermal Resistance

Junction - ambient[2)]	$R_{th\,JA}$	$\leq$ 450	K/W

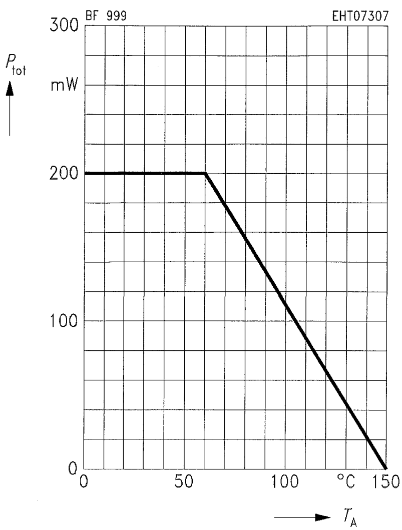
1) For detailed information see chapter Package Outlines.
2) Package mounted on alumina 15 mm × 16.7 mm × 0.7 mm.

Electrical Characteristics

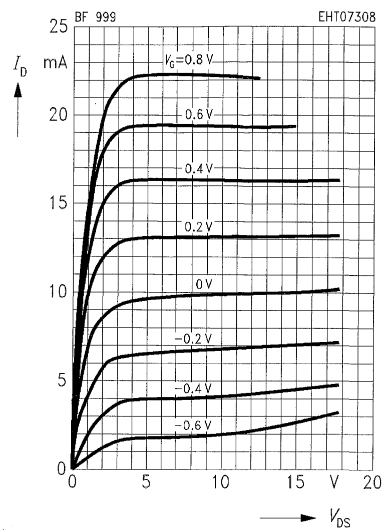
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Drain-source breakdown voltage I_D = 10 µA, – V_{GS} = 4 V	$V_{(BR)\,DS}$	20	–	–	V
Gate-source breakdown voltage ± I_{GS} = 10 mA, V_{DS} = 0	± $V_{(BR)\,GSS}$	6.5	–	12	
Gate-source leakage current ± V_{GS} = 5 V, V_{DS} = 0	± I_{GSS}	–	–	50	nA
Drain current V_{DS} = 10 V, V_{GS} = 0	I_{DSS}	5	–	18	mA
Gate-source pinch-off voltage V_{DS} = 10 V, I_D = 20 µA	– $V_{GS\,(p)}$	–	–	2.5	V
AC Characteristics					
Forward transconductance V_{DS} = 10 V, I_D = 10 mA, f = 1 kHz	g_{fs}	14	16	–	mS
Gate 1 input capacitance V_{DS} = 10 V, I_D = 10 mA, f = 1 MHz	C_{gss}	–	2.5	–	pF
Reverse transfer capacitance V_{DS} = 10 V, I_D = 10 mA, f = 1 MHz	C_{dg}	–	25	–	fF
Output capacitance V_{DS} = 10 V, I_D = 10 mA, f = 1 MHz	C_{dss}	–	1	–	pF
Power gain (test circuit) V_{DS} = 10 V, I_D = 10 mA, f = 200 MHz, G_G = 2 mS, G_L = 0.5 mS	G_p	–	25	–	dB
Noise figure (test circuit) V_{DS} = 10 V, I_D = 10 mA, f = 200 MHz, G_G = 2 mS, G_L = 0.5 mS	F	–	1	–	

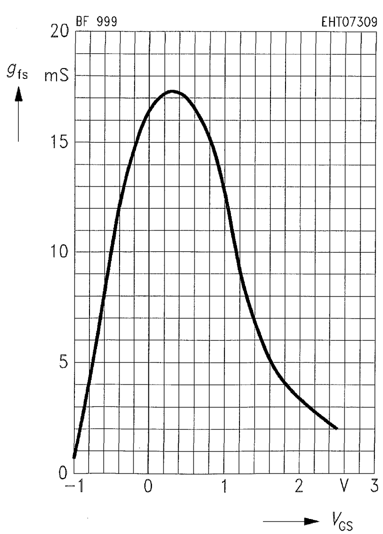
Total power dissipation $P_{tot} = f(T_A)$



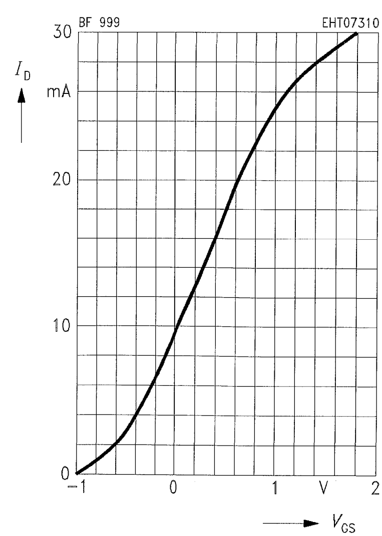
Output characteristics $I_D = f(V_{DS})$



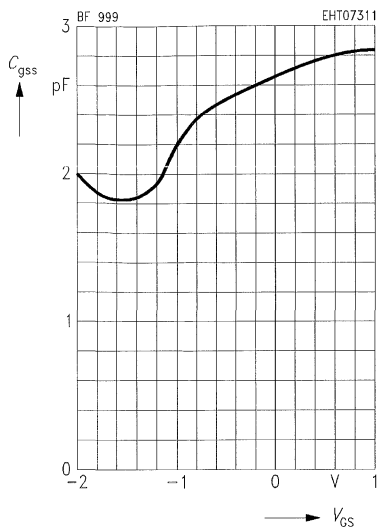
Gate transconductance $g_{fs} = f(V_{GS})$
V_{DS} = 10 V, I_{DSS} = 10 mA, f = 1 kHz



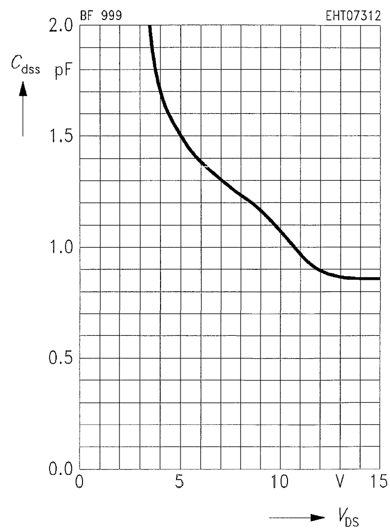
Drain current $I_D = f(V_{GS})$
V_{DS} = 10 V



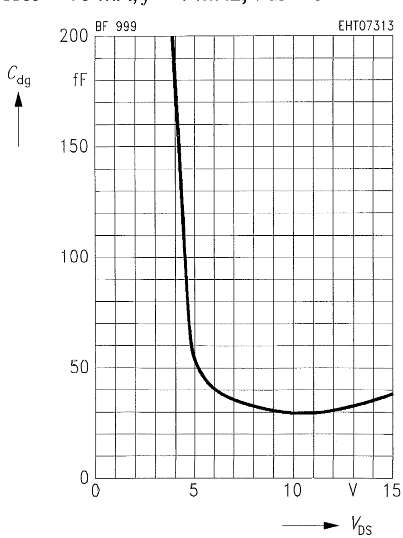
Gate input capacitance $C_{gss} = f(V_{GS})$
V_{DS} = 10 V, I_{DSS} = 10 mA, f = 1 MHz



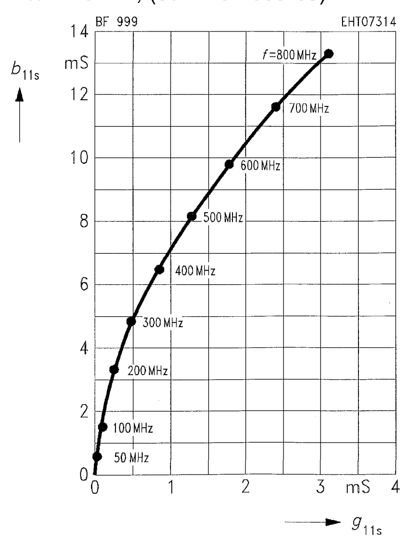
Output capacitance $C_{dss} = f(V_{DS})$
V_{GS} = 0, I_{DSS} = 10 mA, f = 1 MHz



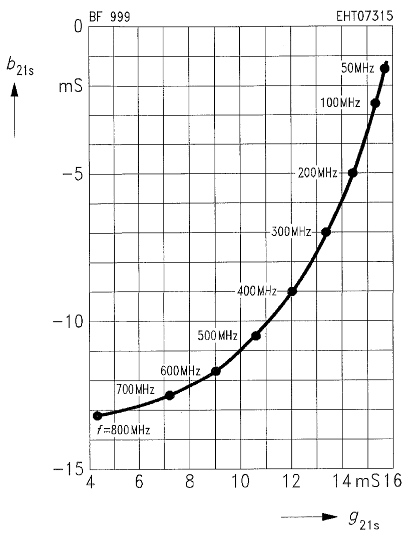
Reverse transfer capacitance
$C_{dg} = f(V_{DS})$
I_{DSS} = 10 mA, f = 1 MHz, V_{GS} = 0



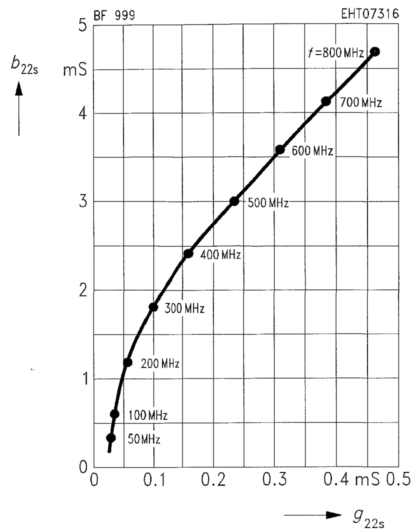
Gate 1 input admittance y_{11s}
V_{DS} = 10 V, V_{GS} = 0,
I_{DSS} = 10 mA, (common-source)



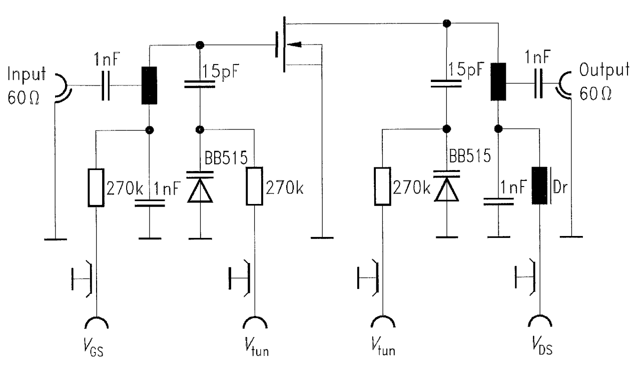
Gate 1 forward transfer admittance y_{21s}
V_{DS} = 10 V, V_{GS} = 0,
I_{DSS} = 10 mA, (common-source)



Output admittance y_{22s}
V_{DS} = 10 V, V_{GS} = 0,
I_{DSS} = 10 mA, (common-source)



Test circuit for power gain and noise figure
f = 200 MHz



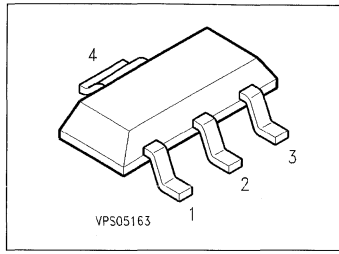
SIEMENS

NPN Silicon RF Transistor

BFG 19S

Preliminary Data

- For low-noise, low-distortion broadband output amplifier stages in antenna and telecommunications systems up to 1.5 GHz at collector currents from 10 mA to 70 mA.
- f_T = 5 GHz
- Complementary type: BFG 194 (PNP)



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

Type	Marking	Ordering Code (tape and reel)	Pin Configuration 1	2	3	4	Package[1]
BFG 19S	BFG 19S	Q62702-F1359	E	B	E	C	SOT-223

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CE0}	15	V
Collector-base voltage	V_{CB0}	20	
Emitter-base voltage	V_{EB0}	3	
Collector current	I_C	100	mA
Peak collector current, $f \geq$ 10 MHz	I_{CM}	150	
Base current	I_B	12	
Peak base current, $f \geq$ 10 MHz	I_{BM}	15	
Total power dissipation, $T_S \leq$ 75 ˚C[3]	P_{tot}	1	W
Junction temperature	T_j	150	˚C
Ambient temperature range	T_A	– 65 ... + 150	
Storage temperature range	T_{stg}	– 65 ... + 150	

Thermal Resistance

Parameter	Symbol	Values	Unit
Junction - ambient[2]	$R_{th\,JA}$	≤ 155	K/W
Junction - soldering point[3]	$R_{th\,JS}$	≤ 75	

1) For detailed information 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.

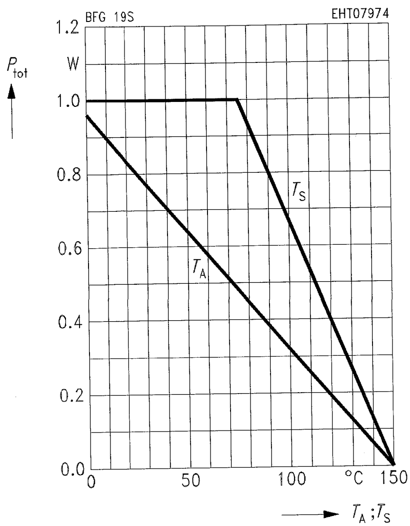
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CE0}$	15	–	–	V
Collector-base cutoff current V_{CB} = 10 V, I_E = 0	I_{CB0}	–	–	100	nA
Emitter-base cutoff current V_{EB} = 2 V, I_C = 0	I_{EB0}	–	–	10	µA
DC current gain I_C = 50 mA, V_{CE} = 10 V I_C = 70 mA, V_{CE} = 10 V	h_{FE}	 30 –	 90 95	 250 –	–
Collector-emitter saturation voltage I_C = 75 mA, I_B = 7.5 mA	V_{CEsat}	–	0.2	0.5	V

Electrical Characteristics
at $T_A = 25\ ^\circ C$, unless otherwise specified.

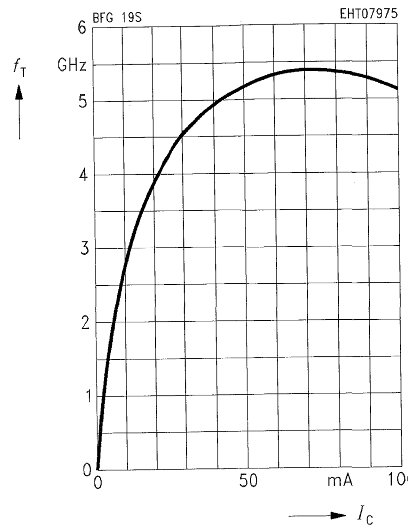
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
AC Characteristics					
Transition frequency $I_C = 50$ mA, $V_{CE} = 10$ V, $f = 200$ MHz $I_C = 70$ mA, $V_{CE} = 10$ V, $f = 200$ MHz	f_T	 – –	 5.2 5.3	 – –	GHz
Collector-base capacitance $V_{CB} = 10$ V, $V_{BE} = v_{be} = 0, f = 1$ MHz	C_{cb}	–	0.85	–	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}	–	4.5	–	
Output capacitance $V_{CE} = 10$ V, $V_{BE} = v_{be} = 0, f = 1$ MHz	C_{obs}	–	1.25	–	
Noise figure $I_C = 5$ mA, $V_{CE} = 10$ V, $f = 10$ MHz, $Z_S = 50\ \Omega$ $I_C = 50$ mA, $V_{CE} = 10$ V, $f = 800$ MHz, $Z_S = Z_{Sopt}$	F	 – –	 0.9 2.5	 – –	dB
Power gain $I_C = 50$ mA, $V_{CE} = 10$ V, $f = 500$ MHz, $Z_0 = 50\ \Omega$ $I_C = 70$ mA, $V_{CE} = 10$ V, $f = 900$ MHz, $Z_0 = 50\ \Omega$	G_{ma} [1]	 – –	 18 13	 – –	
Transducer gain $I_C = 70$ mA, $V_{CE} = 10$ V, $f = 500$ MHz, $Z_0 = 50\ \Omega$	$\vert S_{21e}\vert^2$	–	15.5	–	
Linear output voltage two-tone intermodulation test $I_C = 70$ mA, $V_{CE} = 10$ V, $d_{IM} = 60$ dB, $f_1 = 806$ MHz, $f_2 = 810$ MHz, $Z_S = Z_L = 50\ \Omega$	$V_{01} = V_{02}$	–	475	–	mV
Third order intercept point $I_C = 70$ mA, $V_{CE} = 10$ V, $f = 800$ MHz	IP_3	–	36.5	–	dBm

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

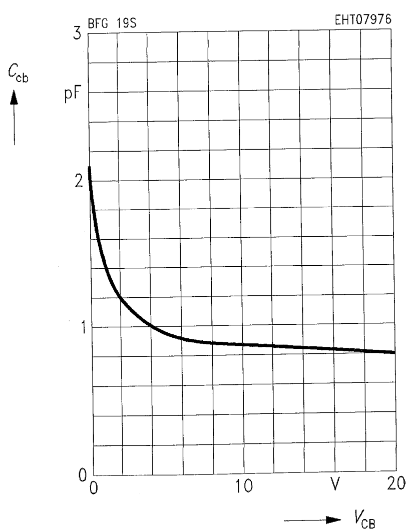
Total power dissipation $P_{tot} = f\,(T_A{}^*;\,T_S)$
*Package mounted on alumina



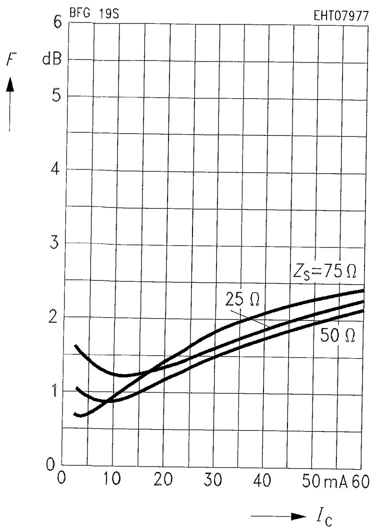
Transition frequency $f_T = f\,(I_C)$
$V_{CE} = 10$ V, $f = 500$ MHz



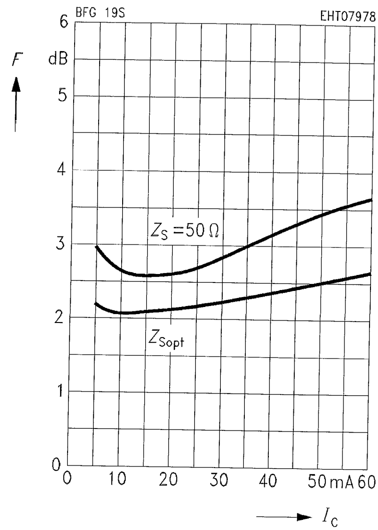
Collector-base capacitance $C_{cb} = f\,(V_{CB})$
$V_{BE} = v_{be} = 0$, $f = 1$ MHz



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



Noise figure $F = f\,(I_C)$
V_{CE} = 10 V, f = 900 MHz, Z_{Lopt} (G)



Common Emitter S Parameters

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_C = 50 mA, V_{CE} = 2.5 V, Z_0 = 50 Ω								
0.10	0.556	– 157.2	23.20	102.2	0.023	59.1	0.302	– 104.1
0.20	0.573	– 173.2	11.98	90.2	0.038	65.6	0.209	– 133.1
0.30	0.582	179.0	8.04	83.2	0.054	67.6	0.189	– 149.3
0.40	0.587	173.4	6.04	77.9	0.070	67.7	0.184	– 159.9
0.50	0.595	168.5	4.85	73.0	0.086	66.6	0.187	– 168.1
0.60	0.601	164.4	4.06	68.6	0.101	65.2	0.188	– 173.9
0.70	0.605	160.6	3.49	64.4	0.117	63.5	0.196	– 179.2
0.80	0.609	156.3	3.08	60.1	0.132	61.5	0.200	176.9
0.90	0.613	152.9	2.75	56.0	0.147	59.4	0.209	173.2
0.95	0.614	151.0	2.60	54.2	0.154	58.3	0.213	171.4
1.00	0.617	149.2	2.48	52.1	0.162	57.1	0.215	169.6
1.20	0.625	142.5	2.09	44.4	0.190	52.5	0.234	163.0
1.40	0.637	136.0	1.81	37.1	0.216	47.8	0.253	156.8
1.60	0.650	130.5	1.60	30.0	0.240	42.9	0.275	151.1
1.70	0.661	127.9	1.51	26.9	0.250	40.6	0.292	148.4
1.75	0.665	126.4	1.47	25.1	0.256	39.5	0.299	146.8
1.80	0.675	124.7	1.43	23.6	0.261	38.5	0.304	144.7
2.00	0.688	119.5	1.30	17.9	0.283	34.4	0.324	139.3
2.50	0.707	107.6	1.10	4.6	0.333	24.7	0.377	128.8
3.00	0.716	95.4	0.97	– 7.7	0.388	14.8	0.421	117.7
I_C = 30 mA, V_{CE} = 5 V, Z_0 = 50 Ω								
0.10	0.510	– 134.7	25.69	109.6	0.024	55.4	0.395	– 62.5
0.20	0.513	– 160.9	13.72	94.5	0.035	60.2	0.222	– 71.7
0.30	0.520	– 172.6	9.28	86.4	0.047	63.5	0.160	– 76.1
0.40	0.524	180.0	6.99	80.5	0.060	64.9	0.128	– 79.7
0.50	0.531	173.8	5.61	75.4	0.073	64.9	0.108	– 85.5
0.60	0.538	169.1	4.70	70.8	0.086	64.3	0.097	– 89.8
0.70	0.543	164.7	4.05	66.5	0.099	63.3	0.090	– 98.2
0.80	0.548	160.1	3.56	62.2	0.112	62.0	0.086	– 103.8
0.90	0.554	156.5	3.18	58.1	0.125	60.5	0.085	– 113.3
0.95	0.555	154.4	3.02	56.2	0.131	59.6	0.085	– 117.2
1.00	0.558	152.6	2.88	54.1	0.137	58.8	0.085	– 120.3
1.20	0.568	145.6	2.42	46.3	0.162	55.0	0.092	– 137.6
1.40	0.582	138.9	2.09	39.0	0.186	51.1	0.104	– 152.9
1.60	0.598	133.4	1.84	31.7	0.207	47.0	0.123	– 166.3
1.70	0.611	130.8	1.73	28.5	0.217	45.1	0.138	– 173.8
1.75	0.615	129.3	1.69	26.7	0.223	44.1	0.144	– 177.1
1.80	0.627	127.6	1.64	25.1	0.228	43.3	0.146	179.2
2.00	0.643	122.3	1.49	19.0	0.249	39.5	0.167	170.5
2.50	0.672	110.3	1.24	4.9	0.300	30.4	0.235	154.7
3.00	0.689	97.8	1.08	– 8.3	0.354	21.3	0.294	140.6

Common Emitter S Parameters (continued)

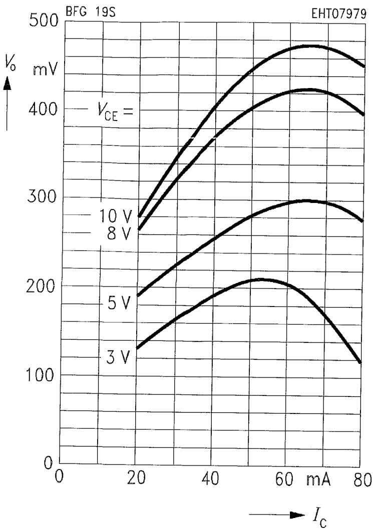
f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**
I_C = 50 mA, V_{CE} = 5 V, Z_0 = 50 Ω								
0.10	0.489	– 148.1	27.21	105.1	0.020	60.8	0.316	– 70.8
0.20	0.502	– 168.1	14.21	92.1	0.033	66.6	0.173	– 81.9
0.30	0.511	– 177.3	9.57	84.9	0.047	68.7	0.124	– 89.4
0.40	0.516	176.3	7.20	79.5	0.061	68.9	0.099	– 96.5
0.50	0.523	171.0	5.78	74.7	0.075	68.2	0.086	– 106.1
0.60	0.531	166.8	4.83	70.3	0.088	67.0	0.078	– 113.1
0.70	0.536	162.9	4.16	66.1	0.102	65.4	0.076	– 124.0
0.80	0.540	158.5	3.66	62.0	0.116	63.7	0.075	– 130.6
0.90	0.547	155.0	3.27	58.0	0.129	61.8	0.080	– 140.0
0.95	0.549	153.2	3.09	56.1	0.135	60.8	0.082	– 143.7
1.00	0.551	151.3	2.95	54.1	0.142	59.8	0.083	– 146.7
1.20	0.562	144.6	2.48	46.5	0.167	55.6	0.096	– 161.1
1.40	0.576	138.2	2.14	39.2	0.191	51.3	0.113	– 172.7
1.60	0.591	132.9	1.89	32.1	0.213	46.8	0.135	177.4
1.70	0.606	130.3	1.78	29.0	0.223	44.8	0.152	172.1
1.75	0.610	128.9	1.73	27.4	0.229	43.8	0.158	169.4
1.80	0.621	127.2	1.68	25.8	0.234	42.9	0.162	166.1
2.00	0.638	121.7	1.53	19.8	0.255	38.9	0.183	159.0
2.50	0.666	109.9	1.27	5.8	0.305	29.5	0.247	146.2
3.00	0.684	97.6	1.11	– 7.3	0.358	20.2	0.301	133.7
I_C = 70 mA, V_{CE} = 5 V, Z_0 = 50 Ω								
0.10	0.487	– 155.2	27.57	102.9	0.019	64.2	0.276	– 75.2
0.20	0.503	– 171.9	14.27	90.9	0.033	69.8	0.151	– 88.0
0.30	0.512	– 179.8	9.59	84.2	0.047	71.0	0.109	– 97.3
0.40	0.519	174.7	7.21	78.9	0.061	70.8	0.090	– 106.5
0.50	0.526	169.7	5.78	74.2	0.075	69.6	0.080	– 117.6
0.60	0.533	165.7	4.84	69.9	0.089	68.2	0.075	– 125.7
0.70	0.538	161.9	4.16	65.8	0.103	66.4	0.076	– 136.3
0.80	0.544	157.8	3.66	61.7	0.117	64.5	0.076	– 142.6
0.90	0.548	154.4	3.27	57.7	0.131	62.4	0.082	– 150.6
0.95	0.550	152.5	3.10	55.8	0.137	61.4	0.084	– 154.1
1.00	0.554	150.6	2.95	53.8	0.144	60.2	0.086	– 157.0
1.20	0.564	143.9	2.48	46.2	0.170	55.8	0.103	– 169.1
1.40	0.577	137.3	2.14	38.9	0.194	51.2	0.121	– 179.2
1.60	0.591	131.8	1.88	32.0	0.215	46.7	0.144	171.3
1.70	0.601	129.3	1.77	28.9	0.225	44.7	0.159	166.9
1.75	0.606	128.2	1.72	27.4	0.231	43.8	0.166	164.2
1.80	0.618	126.7	1.67	25.9	0.236	43.0	0.170	161.4
2.00	0.641	121.6	1.53	19.9	0.258	38.9	0.192	155.4
2.50	0.672	110.0	1.27	6.1	0.308	29.3	0.256	142.5
3.00	0.690	97.5	1.11	– 7.0	0.362	19.7	0.310	130.8

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} = 10 V, Z_0 = 50 Ω								
0.10	0.462	– 138.3	29.05	107.0	0.020	60.0	0.356	– 56.5
0.20	0.463	– 162.6	15.29	93.2	0.031	65.6	0.210	– 58.2
0.30	0.469	– 173.4	10.32	85.8	0.044	68.0	0.160	– 57.3
0.40	0.474	179.4	7.77	80.3	0.057	68.6	0.135	– 57.4
0.50	0.482	173.7	6.24	75.5	0.069	68.1	0.118	– 59.3
0.60	0.489	169.2	5.21	71.1	0.082	67.1	0.108	– 61.2
0.70	0.495	165.2	4.49	66.9	0.095	65.7	0.098	– 65.9
0.80	0.500	160.6	3.95	62.7	0.107	64.1	0.094	– 69.4
0.90	0.506	157.0	3.53	58.7	0.120	62.4	0.088	– 76.8
0.95	0.509	155.1	3.34	56.8	0.126	61.5	0.086	– 79.8
1.00	0.511	153.1	3.19	54.8	0.132	60.4	0.084	– 82.6
1.20	0.522	146.2	2.68	47.2	0.156	56.5	0.080	– 100.5
1.40	0.538	139.4	2.31	39.8	0.178	52.3	0.081	– 120.4
1.60	0.554	133.9	2.02	32.8	0.198	48.2	0.088	– 141.4
1.70	0.564	131.4	1.90	29.6	0.207	46.5	0.097	– 152.7
1.75	0.571	130.2	1.85	28.1	0.212	45.7	0.099	– 158.1
1.80	0.583	128.6	1.80	26.6	0.218	45.0	0.100	– 162.6
2.00	0.608	123.5	1.64	20.4	0.240	41.1	0.118	– 174.1
2.50	0.646	111.8	1.36	6.0	0.288	32.0	0.182	163.7
3.00	0.670	99.1	1.18	– 7.6	0.341	22.8	0.241	148.5
I_C = 70 mA, V_{CE} = 10 V, Z_0 = 50 Ω								
0.10	0.456	– 144.4	29.16	104.6	0.019	62.3	0.315	– 57.5
0.20	0.461	– 165.9	15.19	91.9	0.031	68.1	0.187	– 57.7
0.30	0.468	– 175.6	10.23	84.9	0.044	69.8	0.144	– 56.5
0.40	0.474	178.0	7.70	79.6	0.057	70.0	0.122	– 56.8
0.50	0.482	172.6	6.18	74.8	0.070	69.0	0.107	– 59.0
0.60	0.489	168.5	5.16	70.5	0.083	67.8	0.098	– 61.2
0.70	0.496	164.4	4.45	66.4	0.096	66.3	0.089	– 66.5
0.80	0.500	160.1	3.91	62.3	0.108	64.6	0.085	– 70.4
0.90	0.507	156.6	3.49	58.3	0.121	62.7	0.081	– 78.6
0.95	0.510	154.8	3.31	56.5	0.127	61.7	0.079	– 81.8
1.00	0.514	152.8	3.15	54.4	0.133	60.7	0.077	– 84.9
1.20	0.525	145.8	2.65	46.8	0.157	56.6	0.074	– 104.2
1.40	0.541	139.2	2.28	39.5	0.179	52.4	0.077	– 125.0
1.60	0.557	133.7	2.00	32.5	0.200	48.2	0.087	– 146.0
1.70	0.568	131.2	1.88	29.2	0.209	46.5	0.097	– 156.8
1.75	0.574	129.9	1.83	27.8	0.214	45.6	0.100	– 162.2
1.80	0.588	128.4	1.78	26.3	0.219	44.9	0.101	– 166.6
2.00	0.612	123.2	1.63	20.1	0.241	41.0	0.121	– 177.5
2.50	0.649	111.6	1.34	5.9	0.290	31.9	0.186	161.6
3.00	0.672	98.8	1.17	– 7.7	0.342	22.6	0.245	146.8

Common Emitter Large Signal Parameters

Linear output voltage $V_o = f\ (I_C)$
d_{IM} = 60 dB, f_1 = 806 MHz,
f_2 = 810 MHz, $Z_S = Z_L$ = 50 Ω



Note:

The transistor is driven by 2 adjacent signals f_1, f_2 with equal output power levels P_o for each carrier.
The distance d_{IM} between P_o and the third order intermodulation products P_{IM} ($2f_1 - f_2$ or $2f_2 - f_1$) is:

$d_{IM} = P_o - P_{IM}$
where $P_o = 10 \log (V_o^2/(50\ \Omega \cdot 1\ \text{mW}))$ (dBm)
and V_o = linear output voltage of each carrier.

The 3rd order intercept point IP_3 will be found by extrapolation to the point where P_{IM} would be identical to P_o:

IP_3 (output) $= P_o + d_{IM}/2$.

Linear output voltages for other d_{IM} (e.g. 50 dB) can be calculated thereby.

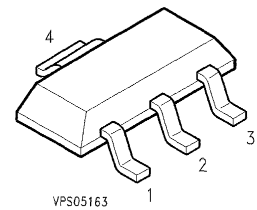
SIEMENS

NPN Silicon RF Transistor

BFG 135 A

Preliminary Data

- For low-distortion broadband output amplifier stages in antenna and telecommunications systems up to 2 GHz at collector currents from 70 mA to 130 mA.
- Power amplifiers for DECT and PCN systems.
- Integrated emitter ballast resistor.
- f_T = 6 GHz



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)]
BFG 135 A	FG 135	Q62702-F1322	E	B	E	C	SOT-223

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CEO}	15	V
Collector-emitter voltage, V_{BE} = 0	V_{CES}	25	
Collector-base voltage	V_{CBO}	25	
Emitter-base voltage	V_{EBO}	2	
Collector current	I_C	150	mA
Peak collector current, $f \geq$ 10 MHz	I_{CM}	200	
Base current	I_B	20	
Peak base current, $f \geq$ 10 MHz	I_{BM}	50	
Total power dissipation, $T_S \leq$ 100 °C[2)]	P_{tot}	1	W
Junction temperature	T_j	150	°C
Ambient temperature range	T_A	– 65 ... + 150	
Storage temperature range	T_{stg}	– 65 ... + 150	

Thermal Resistance

Junction - soldering point[2)]	$R_{th\,JS}$	≤ 50	K/W

1) For detailed information see chapter Package Outlines.
2) 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	$V_{(BR)CE0}$	15	–	–	V
Collector-emitter cutoff current V_{CE} = 20 V, V_{BE} = 0	I_{CES}	–	–	100	µA
Collector-base cutoff current V_{CB} = 10 V, I_E = 0	I_{CB0}	–	–	50	nA
Emitter-base cutoff current V_{EB} = 1 V, I_C = 0	I_{EB0}	–	–	1	µA
DC current gain I_C = 100 mA, V_{CE} = 10 V	h_{FE}	80	125	250	–
Collector-emitter saturation voltage I_C = 75 mA, I_B = 7.5 mA	$V_{CE\,sat}$	–	–	0.4	V

Electrical Characteristics

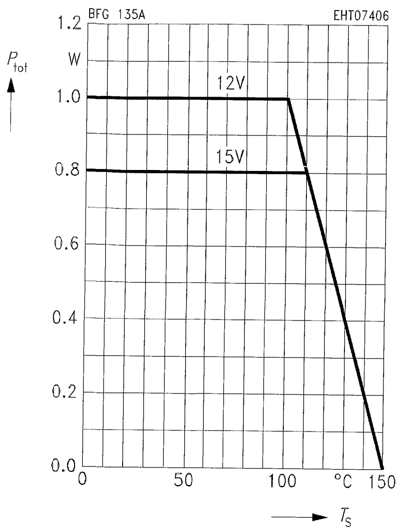
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
AC Characteristics					
Transition frequency	f_T				GHz
I_C = 80 mA, V_{CE} = 8 V, f = 500 MHz		–	5.9	–	
I_C = 120 mA, V_{CE} = 8 V, f = 500 MHz		–	6	–	
Collector-base capacitance V_{CB} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{cb}	–	1.2	–	pF
Collector-emitter capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{ce}	–	0.8	–	
Input capacitance V_{EB} = 0.5 V, I_C = i_c = 0, f = 1 MHz	C_{ibo}	–	8	–	
Output capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{obs}	–	2	–	
Noise figure	F				dB
I_C = 50 mA, V_{CE} = 10 V, f = 10 MHz, Z_S = 50 Ω		–	1.8	–	
I_C = 50 mA, V_{CE} = 10 V, f = 900 MHz, Z_S = 50 Ω, Z_L = Z_{Lopt}		–	3	–	
Power gain	G_{ma} 1)				
I_C = 100 mA, V_{CE} = 8 V, f = 900 MHz, Z_0 = 50 Ω		–	15	–	
I_C = 100 mA, V_{CE} = 8 V, f = 1.5 GHz, Z_0 = 50 Ω		–	10.5	–	
Transducer gain I_C = 100 mA, V_{CE} = 10 V, f = 900 MHz, Z_0 = 50 Ω	$\|S_{21e}\|^2$	–	10.5	–	
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

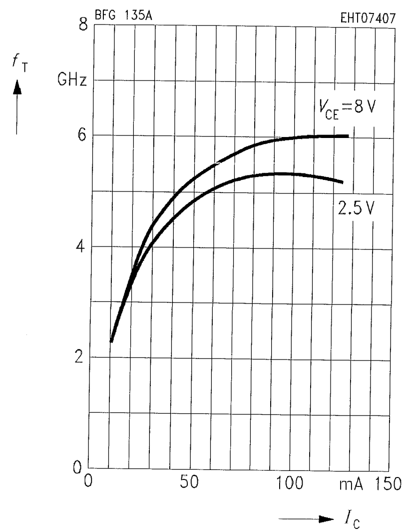
*) Note for P_{totmax}/P_{totDC} on next page:
Safe operating area: For the dynamic permissible P_{totmax} a linear power derating is necessary above $V_{CE0}/2$ to V_{CE0max}.

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

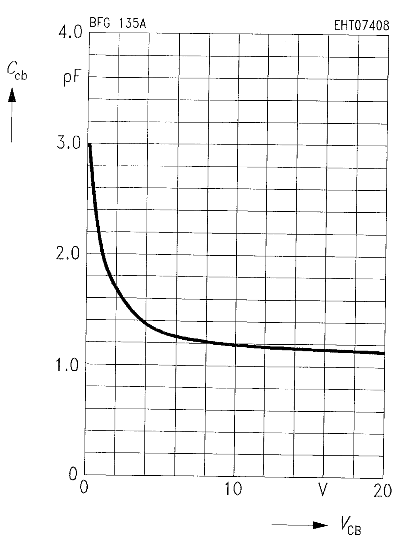
Total power dissipation $P_{tot} = f(T_S)$



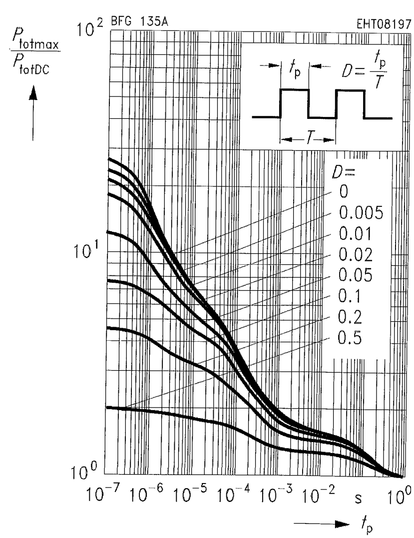
Transition frequency $f_T = f(I_C)$
f = 500 MHz



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



Permissible pulse load $P_{totmax}/P_{totDC} = f(t_p)$
*) For note refer to previous page.



Common Emitter S Parameters

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_C = 30 mA, V_{CE} = 2.5 V, Z_0 = 50 Ω								
0.10	0.719	– 130.8	18.79	114.7	0.044	38.0	0.550	– 98.1
0.20	0.750	– 158.2	10.36	97.0	0.052	32.5	0.409	– 127.4
0.30	0.756	– 169.9	7.03	87.9	0.057	34.0	0.371	– 145.0
0.40	0.763	– 177.4	5.31	81.2	0.063	36.7	0.358	– 155.9
0.50	0.768	176.8	4.26	75.6	0.069	39.1	0.355	– 163.7
0.60	0.774	172.2	3.56	70.5	0.076	41.0	0.355	– 169.4
0.70	0.772	168.5	3.05	66.0	0.083	42.3	0.360	– 174.2
0.80	0.777	164.7	2.68	61.5	0.090	43.3	0.365	– 178.2
0.90	0.776	161.3	2.39	57.3	0.098	43.6	0.370	178.3
0.95	0.780	159.6	2.26	55.3	0.102	43.7	0.373	176.6
1.00	0.786	157.8	2.16	53.2	0.106	43.6	0.378	175.2
1.20	0.788	151.4	1.81	45.4	0.122	42.9	0.390	169.4
1.40	0.796	146.0	1.55	37.8	0.138	41.2	0.408	163.8
1.60	0.802	140.6	1.37	30.6	0.154	38.8	0.429	159.1
1.70	0.806	138.2	1.28	26.9	0.161	37.0	0.445	157.0
1.75	0.816	136.7	1.24	25.3	0.162	36.5	0.455	155.3
1.80	0.818	135.3	1.21	23.8	0.166	36.4	0.459	153.6
2.00	0.821	130.5	1.08	18.0	0.181	34.2	0.478	148.6
2.50	0.846	120.6	0.88	5.5	0.217	28.2	0.537	137.8
3.00	0.847	109.1	0.78	– 6.4	0.263	20.7	0.579	126.5
I_C = 50 mA, V_{CE} = 2.5 V, Z_0 = 50 Ω								
0.10	0.712	– 137.5	20.06	112.5	0.040	36.0	0.546	– 102.8
0.20	0.747	– 162.0	10.89	95.9	0.047	35.3	0.435	– 136.7
0.30	0.755	– 172.5	7.35	87.4	0.053	38.1	0.408	– 153.0
0.40	0.762	– 179.4	5.56	81.1	0.060	41.3	0.401	– 162.9
0.50	0.766	175.2	4.45	75.8	0.067	43.8	0.400	– 170.0
0.60	0.773	170.9	3.72	70.9	0.075	45.3	0.401	– 175.4
0.70	0.769	167.4	3.19	66.6	0.084	46.1	0.406	180.0
0.80	0.775	163.6	2.79	62.3	0.092	46.6	0.410	176.1
0.90	0.774	160.3	2.49	58.3	0.100	46.6	0.415	172.7
0.95	0.778	158.7	2.36	56.4	0.105	46.4	0.417	171.0
1.00	0.782	157.0	2.25	54.4	0.109	46.1	0.422	169.6
1.20	0.786	150.7	1.88	46.8	0.126	44.6	0.431	163.7
1.40	0.792	145.3	1.62	39.5	0.143	42.3	0.447	158.1
1.60	0.798	139.9	1.43	32.5	0.160	39.4	0.464	153.4
1.70	0.802	137.6	1.34	28.9	0.167	37.1	0.477	151.4
1.75	0.812	136.2	1.29	27.3	0.168	36.6	0.487	149.9
1.80	0.813	134.7	1.26	25.8	0.171	36.4	0.490	148.2
2.00	0.817	129.9	1.13	20.2	0.186	33.9	0.505	143.2
2.50	0.840	120.3	0.93	7.9	0.222	27.4	0.553	132.8
3.00	0.842	109.0	0.83	– 4.1	0.266	19.7	0.585	122.1

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 = 70 mA, V_{CE} = 2.5 V, Z_0 = 50 Ω								
0.10	0.711	– 141.0	20.51	111.3	0.037	38.0	0.543	– 107.6
0.20	0.746	– 163.9	11.06	95.3	0.044	36.8	0.447	– 140.8
0.30	0.755	– 178.8	7.45	87.1	0.051	40.3	0.425	– 156.2
0.40	0.763	179.6	5.62	80.9	0.059	43.5	0.420	– 165.7
0.50	0.766	174.4	4.50	75.8	0.066	46.0	0.420	– 172.5
0.60	0.772	170.2	3.76	71.1	0.075	47.2	0.421	– 177.7
0.70	0.771	166.7	3.22	66.8	0.084	48.0	0.426	177.8
0.80	0.775	163.2	2.83	62.6	0.092	48.1	0.430	173.9
0.90	0.774	160.0	2.52	58.6	0.101	47.9	0.435	170.6
0.95	0.778	158.3	2.39	56.8	0.106	47.7	0.437	169.0
1.00	0.782	156.6	2.28	54.8	0.110	47.3	0.441	167.6
1.20	0.787	150.3	1.91	47.4	0.128	45.4	0.450	161.7
1.40	0.793	145.0	1.64	40.2	0.145	42.8	0.464	156.0
1.60	0.797	139.6	1.45	33.2	0.162	39.7	0.480	151.3
1.70	0.801	137.3	1.36	29.7	0.169	37.3	0.498	149.3
1.75	0.812	135.8	1.31	28.0	0.170	36.7	0.502	147.8
1.80	0.811	134.5	1.28	26.7	0.173	36.5	0.505	146.1
2.00	0.815	129.8	1.15	21.2	0.188	33.9	0.519	141.2
2.50	0.838	120.1	0.94	8.9	0.224	27.1	0.563	130.9
3.00	0.838	108.9	0.84	– 3.1	0.267	19.3	0.590	120.2
I_C = 90 mA, V_{CE} = 2.5 V, Z_0 = 50 Ω								
0.10	0.712	– 143.4	20.59	110.5	0.036	37.8	0.538	– 110.6
0.20	0.749	– 165.3	11.04	94.8	0.043	37.6	0.451	– 143.1
0.30	0.757	– 174.7	7.44	86.8	0.050	41.5	0.433	– 158.1
0.40	0.764	179.0	5.61	80.7	0.058	44.8	0.428	– 167.2
0.50	0.767	173.8	4.49	75.6	0.066	47.1	0.429	– 173.8
0.60	0.775	169.7	3.75	71.0	0.075	48.4	0.431	– 178.9
0.70	0.772	166.3	3.21	66.8	0.084	49.0	0.436	176.7
0.80	0.777	162.8	2.82	62.5	0.093	49.1	0.440	172.9
0.90	0.777	159.6	2.51	58.7	0.102	48.7	0.444	169.6
0.95	0.779	158.0	2.38	56.8	0.106	48.5	0.446	168.0
1.00	0.786	156.1	2.27	54.9	0.111	48.0	0.451	166.6
1.20	0.787	150.1	1.90	47.5	0.129	45.9	0.459	160.7
1.40	0.794	144.7	1.64	40.3	0.146	43.2	0.473	155.1
1.60	0.798	139.5	1.44	33.4	0.163	39.9	0.488	150.4
1.70	0.802	137.1	1.35	29.9	0.170	37.6	0.500	148.4
1.75	0.811	135.8	1.31	28.3	0.171	37.0	0.510	146.9
1.80	0.814	134.3	1.27	26.9	0.175	36.6	0.513	145.3
2.00	0.816	129.5	1.15	21.4	0.190	34.0	0.526	140.3
2.50	0.838	120.0	0.94	9.3	0.225	27.2	0.569	130.1
3.00	0.839	108.6	0.84	– 2.6	0.268	19.2	0.594	119.5

Common Emitter S Parameters (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_C = 30 mA, V_{CE} = 5 V, Z_0 = 50 Ω								
0.10	0.693	– 120.9	21.39	119.0	0.039	42.3	0.565	– 75.3
0.20	0.719	– 152.2	12.16	99.9	0.046	35.3	0.369	– 106.1
0.30	0.727	– 165.6	8.31	90.1	0.051	36.2	0.301	– 124.3
0.40	0.734	– 174.0	6.29	83.1	0.057	38.6	0.274	– 136.7
0.50	0.738	179.6	5.05	77.2	0.062	41.0	0.263	– 145.9
0.60	0.745	174.6	4.22	72.0	0.069	43.0	0.259	– 152.9
0.70	0.744	170.7	3.62	67.4	0.075	44.4	0.261	– 158.7
0.80	0.748	166.8	3.18	62.9	0.082	45.5	0.264	– 163.4
0.90	0.749	163.3	2.83	58.6	0.089	46.2	0.270	– 167.2
0.95	0.754	161.6	2.68	56.6	0.093	46.4	0.273	– 169.0
1.00	0.758	159.7	2.55	54.5	0.097	46.4	0.278	– 170.7
1.20	0.763	153.2	2.13	46.5	0.112	46.1	0.292	– 176.9
1.40	0.773	147.6	1.83	38.8	0.127	44.8	0.312	177.1
1.60	0.778	142.1	1.61	31.5	0.143	42.7	0.337	172.0
1.70	0.785	139.7	1.51	27.7	0.149	41.1	0.356	169.6
1.75	0.794	138.3	1.46	26.0	0.151	40.9	0.367	167.5
1.80	0.796	136.9	1.42	24.5	0.155	40.7	0.371	165.5
2.00	0.804	132.0	1.27	18.3	0.171	38.6	0.394	160.0
2.50	0.832	122.0	1.02	5.1	0.208	32.7	0.466	148.1
3.00	0.840	110.5	0.88	– 7.5	0.255	25.4	0.521	136.1
I_C = 50 mA, V_{CE} = 5 V, Z_0 = 50 Ω								
0.10	0.679	– 127.7	23.16	116.6	0.035	41.9	0.544	– 84.9
0.20	0.711	– 156.3	12.92	98.5	0.043	37.8	0.377	– 118.2
0.30	0.720	– 168.5	8.79	89.4	0.049	40.1	0.326	– 136.7
0.40	0.728	– 176.1	6.65	82.8	0.055	43.0	0.308	– 148.7
0.50	0.732	177.8	5.33	77.3	0.062	45.3	0.301	– 157.4
0.60	0.739	173.3	4.45	72.3	0.069	47.1	0.299	– 163.8
0.70	0.737	169.5	3.81	67.9	0.077	48.0	0.303	– 169.2
0.80	0.742	165.6	3.35	63.5	0.084	48.6	0.307	– 173.6
0.90	0.743	162.3	2.98	59.5	0.092	48.8	0.312	– 177.3
0.95	0.746	160.6	2.82	57.6	0.096	48.8	0.314	– 179.1
1.00	0.752	158.9	2.69	55.6	0.100	48.5	0.319	179.4
1.20	0.756	152.4	2.25	47.9	0.117	47.3	0.330	173.4
1.40	0.764	147.0	1.93	40.4	0.133	45.3	0.347	167.7
1.60	0.772	141.6	1.69	33.4	0.149	42.7	0.368	162.9
1.70	0.776	139.3	1.59	29.7	0.155	40.7	0.384	160.9
1.75	0.787	138.0	1.54	28.0	0.157	40.3	0.395	159.0
1.80	0.790	136.5	1.49	26.6	0.161	40.0	0.398	157.2
2.00	0.796	131.6	1.34	20.6	0.176	37.7	0.417	152.0
2.50	0.824	121.8	1.08	7.7	0.212	31.3	0.477	141.2
3.00	0.831	110.4	0.95	– 4.9	0.257	23.8	0.520	130.3

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 = 70 mA, V_{CE} = 5 V, Z_0 = 50 Ω								
0.10	0.676	– 131.3	23.90	115.3	0.034	41.8	0.534	– 90.1
0.20	0.710	– 158.3	13.20	97.8	0.041	38.9	0.383	– 124.0
0.30	0.719	– 169.9	8.96	89.0	0.047	41.9	0.341	– 142.1
0.40	0.725	– 177.3	6.77	82.5	0.054	45.0	0.326	– 153.6
0.50	0.730	177.0	5.43	77.2	0.062	47.3	0.322	– 161.8
0.60	0.737	172.5	4.53	72.4	0.069	48.9	0.321	– 168.0
0.70	0.735	168.8	3.88	68.1	0.077	49.6	0.325	– 173.2
0.80	0.740	165.1	3.41	63.8	0.086	50.0	0.329	– 177.4
0.90	0.741	161.7	3.03	59.8	0.094	49.9	0.334	178.9
0.95	0.744	160.1	2.87	57.9	0.098	49.8	0.336	177.2
1.00	0.750	158.3	2.74	55.9	0.102	49.4	0.340	175.7
1.20	0.753	152.1	2.29	48.4	0.119	47.8	0.351	169.7
1.40	0.763	146.5	1.97	41.1	0.135	45.5	0.367	164.0
1.60	0.768	141.2	1.73	34.1	0.151	42.6	0.386	159.4
1.70	0.772	139.0	1.62	30.5	0.158	40.6	0.401	157.4
1.75	0.783	137.7	1.56	28.9	0.160	40.1	0.412	155.7
1.80	0.786	136.2	1.52	27.5	0.163	39.8	0.415	153.9
2.00	0.792	131.3	1.36	21.6	0.179	37.3	0.432	148.8
2.50	0.820	121.6	1.11	8.7	0.214	30.7	0.487	138.3
3.00	0.825	110.2	0.97	– 3.8	0.258	23.1	0.524	127.6
I_C = 90 mA, V_{CE} = 5 V, Z_0 = 50 Ω								
0.10	0.676	– 133.5	24.20	114.4	0.033	41.7	0.526	– 93.4
0.20	0.710	– 159.6	13.28	97.3	0.040	39.7	0.386	– 127.4
0.30	0.718	– 170.8	9.00	88.6	0.047	43.0	0.348	– 145.1
0.40	0.726	– 177.9	6.79	82.3	0.054	46.1	0.336	– 156.3
0.50	0.731	176.5	5.45	77.1	0.061	48.3	0.333	– 164.2
0.60	0.738	172.1	4.55	72.3	0.069	49.8	0.332	– 170.2
0.70	0.734	168.4	3.90	68.1	0.078	50.4	0.337	– 175.2
0.80	0.741	164.7	3.42	63.8	0.086	50.7	0.341	– 179.4
0.90	0.742	161.4	3.04	59.9	0.095	50.5	0.346	177.1
0.95	0.745	159.8	2.88	58.0	0.099	50.3	0.348	175.3
1.00	0.749	157.9	2.75	56.0	0.103	49.9	0.352	173.9
1.20	0.754	151.9	2.29	48.6	0.120	48.2	0.363	167.9
1.40	0.763	146.3	1.97	41.3	0.137	45.7	0.378	162.2
1.60	0.767	141.1	1.73	34.4	0.153	42.6	0.397	157.7
1.70	0.773	138.9	1.62	30.8	0.160	40.5	0.411	155.7
1.75	0.783	137.6	1.57	29.2	0.161	40.1	0.421	154.0
1.80	0.788	136.0	1.53	27.8	0.165	39.7	0.425	152.2
2.00	0.792	131.3	1.37	22.0	0.180	37.1	0.441	147.2
2.50	0.820	121.4	1.11	9.3	0.215	30.4	0.494	136.8
3.00	0.823	110.1	0.98	– 3.4	0.259	22.8	0.528	126.3

Common Emitter S Parameters (continued)

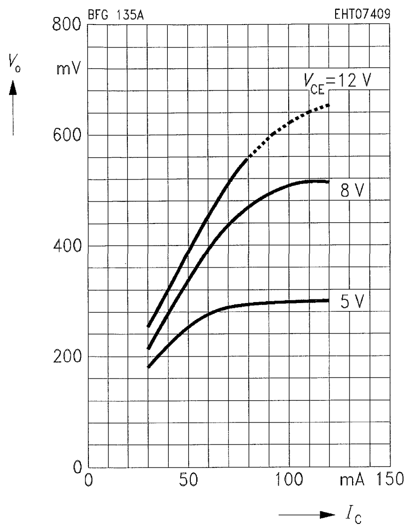
f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**
I_C = 120 mA, V_{CE} = 5 V, Z_0 = 50 Ω								
0.10	0.681	– 136.4	23.95	113.0	0.032	40.9	0.510	– 97.6
0.20	0.714	– 161.3	13.04	96.4	0.039	39.9	0.384	– 131.3
0.30	0.723	– 172.0	8.81	87.9	0.046	43.7	0.352	– 148.2
0.40	0.730	– 178.9	6.65	81.7	0.054	47.0	0.342	– 158.8
0.50	0.734	175.5	5.33	76.5	0.061	49.2	0.340	– 166.1
0.60	0.742	171.2	4.45	71.3	0.070	50.6	0.340	– 171.7
0.70	0.738	167.5	3.81	67.6	0.078	51.1	0.345	– 176.3
0.80	0.745	163.9	3.34	63.4	0.087	51.2	0.349	179.7
0.90	0.743	160.5	2.97	59.5	0.096	50.9	0.353	176.4
0.95	0.749	158.8	2.82	57.6	0.100	50.7	0.355	174.8
1.00	0.752	157.2	2.69	55.6	0.104	50.2	0.360	173.2
1.20	0.758	150.9	2.24	48.1	0.122	48.2	0.370	167.5
1.40	0.765	145.5	1.93	40.9	0.139	45.6	0.384	162.1
1.60	0.772	140.1	1.69	34.0	0.155	42.5	0.401	157.8
1.70	0.776	137.8	1.59	30.4	0.162	40.3	0.415	155.6
1.75	0.787	136.4	1.54	28.8	0.163	39.8	0.425	154.0
1.80	0.788	135.0	1.50	27.3	0.167	39.5	0.427	152.2
2.00	0.794	130.2	1.34	21.5	0.182	36.7	0.444	147.1
2.50	0.822	120.4	1.09	8.8	0.218	29.9	0.492	137.1
3.00	0.824	109.1	0.97	– 3.8	0.262	22.2	0.524	126.3
I_C = 30 mA, V_{CE} = 12 V, Z_0 = 50 Ω								
0.10	0.696	– 113.9	22.54	121.0	0.038	43.5	0.580	– 69.0
0.20	0.709	– 147.6	13.02	101.3	0.046	35.8	0.368	– 97.5
0.30	0.711	– 162.5	8.93	91.2	0.051	36.2	0.288	– 114.7
0.40	0.718	– 171.5	6.78	84.0	0.056	38.4	0.254	– 127.1
0.50	0.722	– 178.4	5.45	78.1	0.061	40.7	0.238	– 136.7
0.60	0.729	176.4	4.55	72.9	0.067	42.8	0.230	– 144.0
0.70	0.727	172.3	3.90	68.2	0.073	44.4	0.230	– 150.3
0.80	0.733	168.2	3.43	63.7	0.079	45.5	0.233	– 155.4
0.90	0.733	164.5	3.05	59.4	0.086	46.2	0.238	– 159.7
0.95	0.737	162.7	2.89	57.4	0.090	46.5	0.240	– 161.6
1.00	0.741	160.9	2.75	55.4	0.093	46.6	0.245	– 163.4
1.20	0.747	154.3	2.30	47.3	0.108	46.5	0.259	– 170.1
1.40	0.757	148.7	1.98	39.6	0.123	45.5	0.279	– 176.5
1.60	0.763	143.2	1.73	32.3	0.138	43.6	0.305	178.0
1.70	0.770	140.9	1.62	28.6	0.145	42.1	0.325	175.4
1.75	0.781	139.5	1.57	26.9	0.147	42.0	0.335	173.0
1.80	0.785	137.8	1.53	25.4	0.151	41.8	0.339	170.9
2.00	0.791	132.8	1.36	19.0	0.166	39.7	0.362	165.2
2.50	0.824	122.8	1.09	5.5	0.204	34.1	0.439	152.5
3.00	0.832	111.2	0.95	– 7.3	0.251	26.9	0.497	140.3

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} = 12 V, Z_0 = 50 Ω								
0.10	0.683	– 120.0	24.59	118.4	0.035	42.9	0.551	– 78.5
0.20	0.698	– 151.6	13.89	99.7	0.042	37.8	0.365	– 110.4
0.30	0.703	– 165.3	9.48	90.3	0.048	39.6	0.303	– 129.0
0.40	0.708	– 173.7	7.18	83.5	0.054	42.3	0.279	– 141.6
0.50	0.713	180.0	5.76	78.0	0.060	44.7	0.269	– 150.9
0.60	0.720	175.0	4.81	73.0	0.068	46.4	0.265	– 157.9
0.70	0.717	171.0	4.12	68.6	0.075	47.6	0.267	– 163.7
0.80	0.723	167.1	3.62	64.2	0.082	48.4	0.271	– 168.4
0.90	0.724	163.6	3.22	60.2	0.090	48.5	0.275	– 172.3
0.95	0.728	161.8	3.05	58.2	0.094	48.6	0.277	– 174.2
1.00	0.733	160.0	2.91	56.3	0.098	48.4	0.282	– 175.8
1.20	0.738	153.6	2.43	40.6	0.113	47.4	0.294	177.9
1.40	0.748	148.1	2.09	41.1	0.129	45.6	0.311	172.0
1.60	0.754	142.7	1.83	34.0	0.144	43.2	0.333	167.2
1.70	0.760	140.4	1.71	30.4	0.151	41.4	0.350	165.1
1.75	0.771	138.9	1.66	28.8	0.153	41.0	0.360	163.1
1.80	0.775	137.5	1.61	27.3	0.156	40.8	0.364	161.1
2.00	0.780	132.6	1.44	21.2	0.172	38.5	0.383	155.8
2.50	0.813	122.6	1.17	8.0	0.208	32.4	0.447	144.7
3.00	0.819	111.2	1.01	– 4.9	0.252	25.1	0.493	133.9
I_C = 80 mA, V_{CE} = 12 V, Z_0 = 50 Ω								
0.10	0.679	– 124.3	25.68	116.4	0.033	42.4	0.529	– 85.3
0.20	0.695	– 154.2	14.29	98.6	0.041	39.1	0.365	– 118.6
0.30	0.700	– 167.0	9.71	89.6	0.047	41.8	0.316	– 137.1
0.40	0.705	– 175.0	7.34	83.1	0.053	44.8	0.298	– 149.2
0.50	0.710	178.9	5.89	77.8	0.061	47.1	0.291	– 157.9
0.60	0.717	174.1	4.92	72.9	0.068	48.6	0.289	– 164.5
0.70	0.714	170.3	4.21	68.7	0.076	49.4	0.293	– 170.0
0.80	0.720	166.4	3.69	64.4	0.084	49.9	0.296	– 174.5
0.90	0.719	162.9	3.29	60.4	0.092	49.8	0.301	– 178.2
0.95	0.724	161.2	3.12	58.5	0.096	49.7	0.303	180.0
1.00	0.729	159.4	2.97	56.6	0.100	49.5	0.308	178.5
1.20	0.735	153.1	2.48	49.1	0.116	47.9	0.318	172.4
1.40	0.744	147.5	2.13	41.8	0.132	45.8	0.334	166.6
1.60	0.750	142.2	1.87	34.8	0.148	43.0	0.354	161.9
1.70	0.754	140.0	1.75	31.2	0.155	41.0	0.370	160.0
1.75	0.766	138.6	1.69	29.6	0.156	40.7	0.380	158.2
1.80	0.768	137.2	1.65	28.2	0.160	40.4	0.384	156.3
2.00	0.776	132.2	1.48	22.2	0.175	37.9	0.401	151.1
2.50	0.806	122.3	1.20	9.2	0.210	31.4	0.458	140.6
3.00	0.814	110.9	1.05	– 3.6	0.254	24.1	0.496	130.2

Common Emitter Large Signal Parameters

Linear output voltage $V_o = f\ (I_C)$
$d_{IM} = 60$ dB, $f_1 = 806$ MHz,
$f_2 = 810$ MHz, $Z_S = Z_L = 50\ \Omega$



Note:

The transistor is driven by 2 adjacent signals f_1, f_2 with equal output power levels P_o for each carrier.
The distance d_{IM} between P_o and the third order intermodulation products P_{IM} ($2f_1 - f_2$ or $2f_2 - f_1$) is:

$d_{IM} = P_o - P_{IM}$
where $P_o = 10 \log (V_o^2/(50\ \Omega \cdot 1\ \text{mW}))$ (dBm)
and V_o = linear output voltage of each carrier.

The 3rd order intercept point IP_3 will be found by extrapolation to the point where P_{IM} would be identical to P_o:

IP_3 (output) $= P_o + d_{IM}/2$.

Linear output voltages for other d_{IM} (e.g. 50 dB) can be calculated thereby.

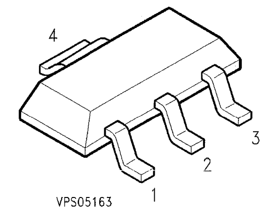
SIEMENS

NPN Silicon RF Transistor

BFG 193

Preliminary Data

- For low-noise, high-gain amplifiers up to 2 GHz at collector currents up to 50 mA.
- For linear broadband amplifiers
- f_T = 8 GHz
  F = 1.2 dB at 800 MHz



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

Type	Marking	Ordering Code (tape and reel)	Pin Configuration 1	2	3	4	Package[1]
BFG 193	BFG 193	Q62702-F1291	E	B	E	C	SOT-223

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CEO}	12	V
Collector-emitter voltage, V_{BE} = 0	V_{CES}	20	
Collector-base voltage	V_{CBO}	20	
Emitter-base voltage	V_{EBO}	2	
Collector current	I_C	80	mA
Peak collector current, $f \geq$ 10 MHz	I_{CM}	80	
Base current	I_B	10	
Peak base current, $f \geq$ 10 MHz	I_{BM}	10	
Total power dissipation, $T_S \leq$ 87 ˚C[3]	P_{tot}	600	mW
Junction temperature	T_j	150	˚C
Ambient temperature range	T_A	– 65 … + 150	
Storage temperature range	T_{stg}	– 65 … + 150	

Thermal Resistance

Junction - ambient[2]	$R_{th\,JA}$	≤ 185	K/W
Junction - soldering point[3]	$R_{th\,JS}$	≤ 105	

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

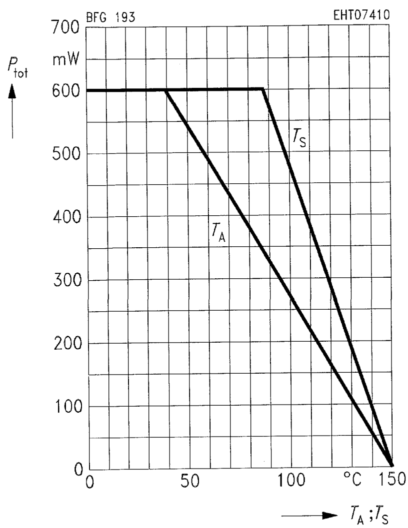
Electrical Characteristics
at T_A = 25 ˚C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CE0}$	12	–	–	V
Collector-emitter cutoff current V_{CE} = 20 V, V_{BE} = 0	I_{CES}	–	–	100	µA
Collector-base cutoff current V_{CB} = 10 V, I_E = 0	I_{CB0}	–	–	50	nA
Emitter-base cutoff current V_{EB} = 1 V, I_C = 0	I_{EB0}	–	–	1	µA
DC current gain I_C = 5 mA, V_{CE} = 8 V I_C = 30 mA, V_{CE} = 8 V	h_{FE}	 – 50	 90 100	 – 250	–
Collector-emitter saturation voltage I_C = 50 mA, I_B = 5 mA	$V_{CE\,sat}$	–	0.1	0.4	V

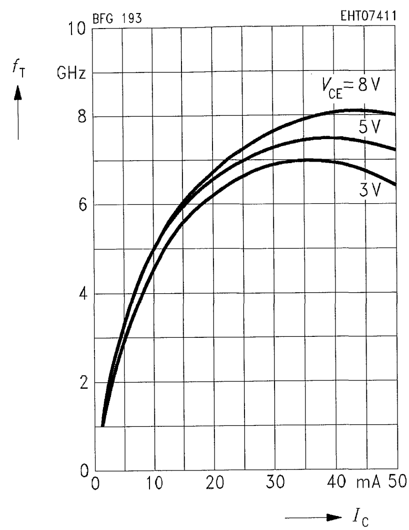
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
AC Characteristics					
Transition frequency	f_T				GHz
I_C = 20 mA, V_{CE} = 8 V, f = 500 MHz		–	6.7	–	
I_C = 50 mA, V_{CE} = 8 V, f = 500 MHz		–	8	–	
Collector-base capacitance V_{CB} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{cb}	–	0.62	–	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}	–	2.4	–	
Output capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{obs}	–	1.05	–	
Noise figure	F				dB
I_C = 5 mA, V_{CE} = 8 V, f = 10 MHz, Z_S = 75 Ω		–	0.8	–	
I_C = 7 mA, V_{CE} = 8 V, f = 800 MHz, Z_S = Z_{Sopt}		–	1.2	–	
I_C = 30 mA, V_{CE} = 8 V, f = 1 GHz, Z_S = Z_{Sopt}		–	1.8	–	
Power gain I_C = 40 mA, V_{CE} = 8 V, f = 800 MHz, Z_S = Z_{Sopt}, Z_L = Z_{Lopt}	G_{pe}	–	16	–	
Transducer gain I_C = 40 mA, V_{CE} = 8 V, f = 1 GHz, Z_0 = 50 Ω	$\|S_{21e}\|^2$	–	13	–	
Linear output voltage two-tone intermodulation test I_C = 50 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}	–	360	–	mV
Third order intercept point I_C = 50 mA, V_{CE} = 8 V, f = 800 MHz	IP_3	–	34	–	dBm

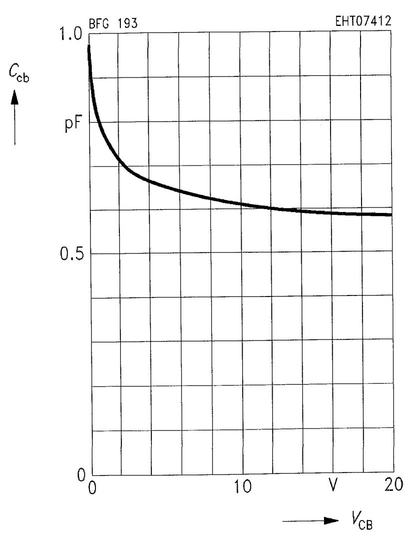
Total power dissipation $P_{tot} = f(T_A^*; T_S)$
*Package mounted on alumina



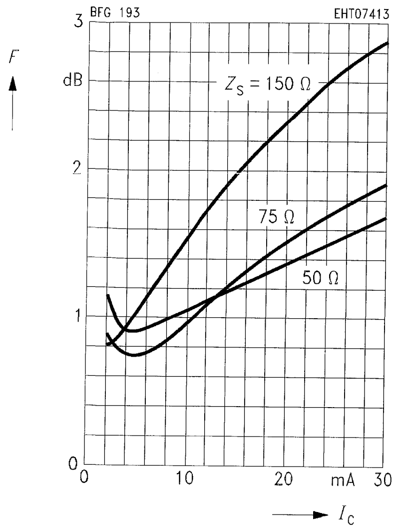
Transition frequency $f_T = f(I_C)$
f = 500 MHz



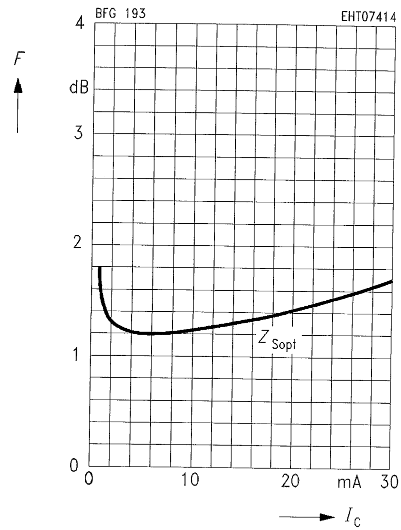
Collector-base capacitance $C_{cb} = f(V_{CB})$
$V_{BE} = v_{be} = 0$, f = 1 MHz



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



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



Common Emitter S Parameters

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_C = 10 mA, V_{CE} = 2.5 V, Z_0 = 50 Ω								
0.10	0.621	– 67.4	21.62	137.2	0.031	62.4	0.772	– 33.9
0.20	0.521	– 108.0	14.61	114.5	0.045	52.8	0.541	– 48.7
0.30	0.480	– 132.5	10.62	101.6	0.054	51.1	0.411	– 54.9
0.40	0.461	– 148.7	8.22	92.9	0.063	51.7	0.337	– 57.7
0.50	0.457	– 160.8	6.69	86.1	0.072	52.5	0.289	– 60.1
0.60	0.457	– 169.7	5.64	80.4	0.081	53.3	0.258	– 61.8
0.70	0.459	– 177.2	4.88	75.4	0.090	53.6	0.234	– 64.6
0.80	0.459	175.9	4.30	70.7	0.100	53.7	0.218	– 66.7
0.90	0.464	170.3	3.85	66.3	0.109	53.4	0.205	– 70.7
0.95	0.465	167.5	3.65	64.2	0.114	53.1	0.199	– 72.3
1.00	0.469	164.9	3.48	62.0	0.119	52.8	0.193	– 73.9
1.20	0.476	155.7	2.93	54.1	0.139	51.1	0.175	– 83.3
1.40	0.490	147.5	2.53	46.5	0.159	48.8	0.162	– 94.6
1.60	0.507	140.8	2.23	39.3	0.178	46.1	0.154	– 108.9
1.70	0.520	137.7	2.10	36.1	0.187	44.9	0.152	– 118.4
1.75	0.525	135.9	2.05	34.5	0.192	44.2	0.150	– 122.6
1.80	0.538	133.9	1.99	32.8	0.197	43.5	0.147	– 126.4
2.00	0.557	127.8	1.81	26.6	0.217	40.5	0.150	– 140.8
2.50	0.590	114.7	1.49	12.3	0.266	32.6	0.196	– 173.6
3.00	0.615	101.5	1.30	– 1.3	0.319	24.3	0.248	163.5
I_C = 30 mA, V_{CE} = 2.5 V, Z_0 = 50 Ω								
0.10	0.404	– 110.2	30.74	120.9	0.022	62.8	0.548	– 50.8
0.20	0.397	– 145.5	17.66	102.2	0.033	63.7	0.329	– 63.0
0.30	0.401	– 161.7	12.17	92.8	0.045	65.4	0.238	– 67.7
0.40	0.405	– 172.0	9.24	86.3	0.057	66.3	0.190	– 70.8
0.50	0.411	– 179.6	7.44	81.0	0.069	66.1	0.159	– 74.5
0.60	0.418	174.5	6.24	76.4	0.081	65.5	0.139	– 77.5
0.70	0.424	169.6	5.37	72.2	0.094	64.4	0.124	– 83.0
0.80	0.428	164.2	4.72	68.2	0.106	63.1	0.115	– 86.9
0.90	0.434	160.1	4.22	64.3	0.118	61.5	0.108	– 94.4
0.95	0.436	157.9	4.00	62.5	0.124	60.7	0.104	– 97.6
1.00	0.440	155.9	3.81	60.5	0.130	59.8	0.101	– 100.5
1.20	0.450	148.5	3.20	53.3	0.154	56.2	0.096	– 117.9
1.40	0.465	141.5	2.76	46.4	0.176	52.2	0.098	– 136.0
1.60	0.481	136.0	2.43	39.7	0.198	48.1	0.109	– 154.2
1.70	0.494	133.4	2.29	36.7	0.208	46.3	0.121	– 164.2
1.75	0.502	131.8	2.22	35.1	0.214	45.2	0.125	– 169.0
1.80	0.512	130.1	2.16	33.6	0.218	44.3	0.127	– 173.7
2.00	0.535	124.5	1.96	27.8	0.239	40.4	0.143	174.0
2.50	0.566	112.4	1.63	14.1	0.288	30.9	0.205	153.9
3.00	0.588	99.9	1.43	0.8	0.340	21.4	0.255	138.4

Common Emitter S Parameters (continued)

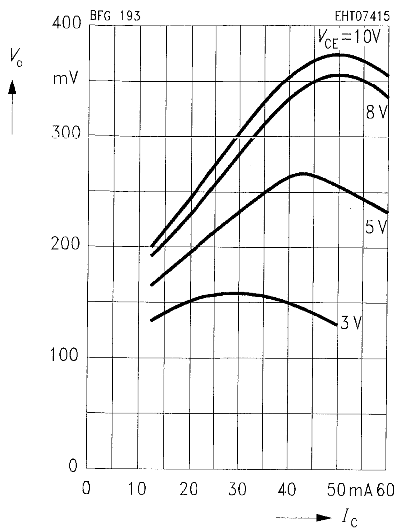
f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_C = 20 mA, V_{CE} = 5 V, Z_0 = 50 Ω								
0.10	0.477	– 86.5	29.09	127.7	0.024	62.3	0.648	– 42.8
0.20	0.410	– 126.7	17.74	107.0	0.036	59.5	0.413	– 55.6
0.30	0.394	– 147.8	12.43	96.3	0.046	60.7	0.306	– 60.1
0.40	0.390	– 161.2	9.49	89.1	0.057	62.0	0.248	– 62.2
0.50	0.393	– 171.0	7.67	83.4	0.068	62.3	0.210	– 64.6
0.60	0.398	– 178.2	6.44	78.5	0.079	62.3	0.187	– 66.2
0.70	0.401	175.6	5.55	74.1	0.090	61.7	0.167	– 69.8
0.80	0.405	169.7	4.89	69.9	0.102	60.9	0.155	– 72.2
0.90	0.410	164.6	4.37	65.9	0.113	59.7	0.144	– 77.4
0.95	0.413	162.3	4.14	64.0	0.119	59.1	0.140	– 79.5
1.00	0.416	160.1	3.94	62.0	0.124	58.3	0.135	– 81.4
1.20	0.425	151.9	3.32	54.7	0.147	55.2	0.121	– 94.0
1.40	0.441	144.2	2.86	47.7	0.168	51.7	0.113	– 109.0
1.60	0.457	138.3	2.52	41.0	0.189	48.0	0.112	– 127.4
1.70	0.471	135.8	2.37	38.0	0.199	46.4	0.116	– 139.7
1.75	0.478	134.1	2.31	36.4	0.204	45.4	0.116	– 144.7
1.80	0.491	132.3	2.25	34.8	0.209	44.6	0.115	– 149.8
2.00	0.512	126.4	2.04	28.9	0.229	40.9	0.124	– 165.3
2.50	0.547	113.7	1.69	15.1	0.278	31.9	0.179	167.2
3.00	0.570	101.0	1.47	1.7	0.328	22.7	0.228	148.6
I_C = 30 mA, V_{CE} = 5 V, Z_0 = 50 Ω								
0.10	0.407	– 101.2	32.05	122.5	0.021	63.4	0.570	– 48.1
0.20	0.375	– 138.9	18.64	103.4	0.033	63.7	0.349	– 59.6
0.30	0.372	– 156.9	12.89	93.8	0.044	65.4	0.255	– 63.6
0.40	0.374	– 168.2	9.79	87.3	0.056	66.3	0.205	– 65.9
0.50	0.380	– 176.7	7.89	81.9	0.068	66.1	0.173	– 68.7
0.60	0.385	177.0	6.61	77.3	0.080	65.5	0.153	– 70.8
0.70	0.392	171.5	5.70	73.2	0.092	64.5	0.136	– 75.2
0.80	0.395	166.1	5.02	69.1	0.104	63.2	0.126	– 78.4
0.90	0.402	161.7	4.48	65.3	0.116	61.7	0.117	– 85.0
0.95	0.405	159.4	4.24	63.5	0.122	60.9	0.113	– 87.7
1.00	0.408	157.3	4.04	61.6	0.128	60.0	0.109	– 90.0
1.20	0.417	149.7	3.40	54.5	0.151	56.4	0.100	– 105.6
1.40	0.433	142.5	2.93	47.7	0.173	52.5	0.097	– 123.4
1.60	0.449	136.9	2.58	41.0	0.195	48.5	0.103	– 143.3
1.70	0.463	134.3	2.42	38.0	0.204	46.6	0.112	– 155.3
1.75	0.470	133.0	2.36	36.5	0.210	45.6	0.114	– 160.2
1.80	0.484	131.2	2.29	35.0	0.215	44.7	0.115	– 165.5
2.00	0.504	125.3	2.08	29.2	0.236	40.8	0.129	– 179.6
2.50	0.540	113.1	1.73	15.6	0.284	31.4	0.188	157.7
3.00	0.563	100.6	1.51	2.3	0.334	21.9	0.237	141.2

Common Emitter S Parameters (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**
I_C = 30 mA, V_{CE} = 8 V, Z_0 = 50 Ω								
0.10	0.424	–94.8	32.61	123.4	0.022	63.3	0.579	–47.0
0.20	0.370	–133.6	19.11	104.1	0.033	63.2	0.357	–58.6
0.30	0.359	–152.8	13.24	94.3	0.045	64.9	0.262	–62.6
0.40	0.359	–165.1	10.07	87.8	0.056	65.7	0.211	–64.7
0.50	0.363	–174.3	8.12	82.4	0.068	65.6	0.178	–67.4
0.60	0.369	179.2	6.81	77.8	0.080	65.1	0.157	–69.3
0.70	0.374	173.3	5.86	73.7	0.092	64.1	0.140	–73.5
0.80	0.377	167.6	5.16	69.6	0.104	62.9	0.129	–76.5
0.90	0.383	163.0	4.61	65.8	0.116	61.4	0.120	–82.7
0.95	0.386	160.7	4.37	64.0	0.121	60.6	0.116	–85.2
1.00	0.389	158.5	4.16	62.1	0.127	59.7	0.112	–87.5
1.20	0.399	150.8	3.50	55.0	0.150	56.2	0.101	–102.6
1.40	0.415	143.3	3.02	48.2	0.173	52.3	0.096	–120.2
1.60	0.431	137.7	2.65	41.7	0.193	48.3	0.101	–140.4
1.70	0.445	135.1	2.50	38.7	0.203	46.5	0.109	–152.9
1.75	0.454	133.7	2.43	37.2	0.209	45.5	0.111	–158.1
1.80	0.465	131.9	2.36	35.6	0.214	44.6	0.111	–163.5
2.00	0.488	126.0	2.14	30.0	0.234	40.7	0.124	–178.0
2.50	0.522	113.6	1.77	16.3	0.282	31.3	0.182	158.4
3.00	0.547	101.0	1.55	3.1	0.332	21.9	0.229	141.6
I_C = 50 mA, V_{CE} = 8 V, Z_0 = 50 Ω								
0.10	0.367	–110.7	34.91	118.3	0.019	65.3	0.496	–51.7
0.20	0.346	–145.6	19.63	100.7	0.031	67.3	0.295	–61.7
0.30	0.348	–161.7	13.46	92.0	0.043	68.8	0.216	–65.1
0.40	0.351	–171.9	10.19	86.0	0.056	69.1	0.173	–67.3
0.50	0.358	–179.6	8.20	81.0	0.068	68.5	0.146	–70.5
0.60	0.365	174.8	6.87	76.7	0.081	67.5	0.128	–73.0
0.70	0.371	169.6	5.91	72.7	0.093	66.2	0.114	–78.3
0.80	0.375	164.4	5.21	68.8	0.105	64.7	0.105	–82.0
0.90	0.381	160.3	4.65	65.1	0.118	62.8	0.098	–89.8
0.95	0.385	158.2	4.40	63.4	0.124	61.9	0.095	–93.1
1.00	0.388	156.1	4.19	61.5	0.130	61.0	0.092	–95.8
1.20	0.398	148.7	3.52	54.6	0.154	57.0	0.086	–114.2
1.40	0.414	141.8	3.04	47.9	0.176	52.9	0.087	–133.9
1.60	0.432	136.3	2.67	41.4	0.198	48.6	0.098	–154.0
1.70	0.444	133.9	2.51	38.5	0.207	46.8	0.110	–165.2
1.75	0.453	132.5	2.44	36.9	0.213	45.7	0.113	–170.0
1.80	0.465	130.8	2.37	35.5	0.218	44.8	0.115	–175.3
2.00	0.488	125.0	2.16	29.8	0.239	40.7	0.132	171.9
2.50	0.525	112.9	1.78	16.4	0.287	31.0	0.192	151.9
3.00	0.547	100.4	1.56	3.2	0.337	21.4	0.239	136.6

Common Emitter Large Signal Parameters

Linear output voltage $V_o = f(I_C)$
d_{IM} = 60 dB, f_1 = 806 MHz,
f_2 = 810 MHz, $Z_S = Z_L$ = 50 Ω



Note:

The transistor is driven by 2 adjacent signals f_1, f_2 with equal <u>output</u> power levels P_o for each carrier.
The distance d_{IM} between P_o and the third order intermodulation products P_{IM} ($2f_1 - f_2$ or $2f_2 - f_1$) is:

$d_{IM} = P_o - P_{IM}$
where $P_o = 10 \log (V_o^2 / (50\ \Omega \cdot 1\ \text{mW}))$ (dBm)
and V_o = linear <u>output</u> voltage of each carrier.

The 3rd order intercept point IP_3 will be found by extrapolation to the point where P_{IM} would be identical to P_o:

IP_3 (output) $= P_o + d_{IM}/2$.

Linear output voltages for other d_{IM} (e.g. 50 dB) can be calculated thereby.

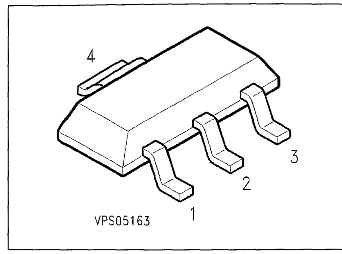
SIEMENS

PNP Silicon RF Transistor

BFG 194

Preliminary Data

- For low-distortion broadband amplifiers in antenna and telecommunications systems up to 1.5 GHz at collector currents from 20 mA to 80 mA.
- f_T = 4.5 GHz
- Complementary type: BFG 19S (NPN).



ESD: **E**lectro**st**atic **d**ischarge sensitive device, observe handling precautions!

Type	Marking	Ordering Code (tape and reel)	Pin Configuration 1	2	3	4	Package1)
BFG 194	BFG 194	Q62702-F1321	E	B	E	C	SOT-223

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CE0}	15	V
Collector-base voltage	V_{CB0}	20	
Emitter-base voltage	V_{EB0}	3	
Collector current	I_C	100	mA
Peak collector current, $f \geq 10$ MHz	I_{CM}	120	
Base current	I_B	10	
Peak base current, $f \geq 10$ MHz	I_{BM}	12	
Total power dissipation, $T_S \leq 75$ ˚C3)	P_{tot}	1	W
Junction temperature	T_j	150	˚C
Ambient temperature range	T_A	– 65 … + 150	
Storage temperature range	T_{stg}	– 65 … + 150	

Thermal Resistance

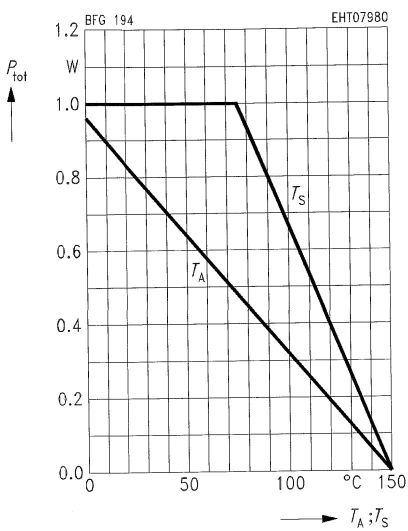
Parameter	Symbol	Values	Unit
Junction - ambient2)	$R_{th\,JA}$	≤ 155	K/W
Junction - soldering point3)	$R_{th\,JS}$	≤ 75	

1) For detailed information 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.

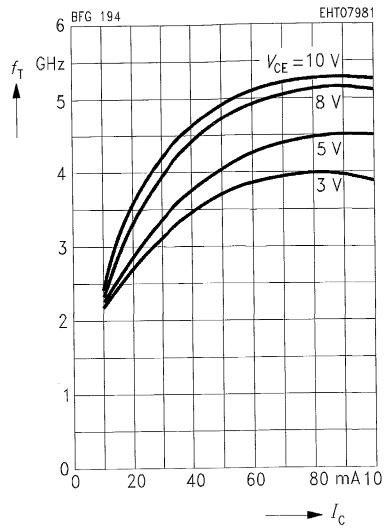
Electrical Characteristics
at T_A = 25 ˚C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CEO}$	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}	–	–	1	µA
DC current gain I_C = 50 mA, V_{CE} = 10 V I_C = 70 mA, V_{CE} = 10 V	h_{FE}	 20 20	 50 50	 150 –	–
Collector-emitter saturation voltage I_C = 75 mA, I_B = 7.5 mA	V_{CEsat}	–	–	0.5	V
AC Characteristics					
Transition frequency I_C = 70 mA, V_{CE} = 10 V, f = 500 MHz	f_T	–	5.0	–	GHz
Collector-base capacitance V_{CB} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{cb}	–	1.45	–	pF

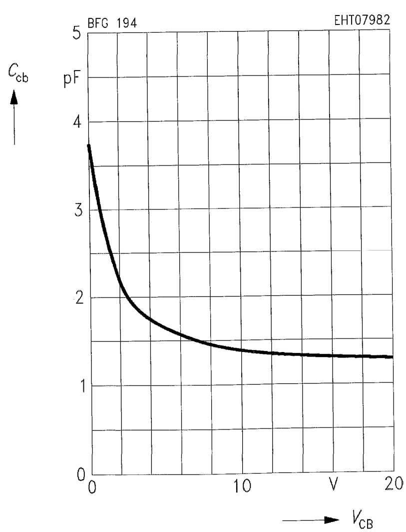
Total power dissipation $P_{tot} = f(T_A^*; T_S)$
*Package mounted on alumina



Transition frequency $f_T = f(I_C)$
f = 500 MHz



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

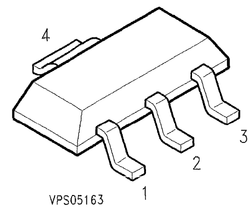


SIEMENS

NPN Silicon RF Transistor — BFG 196

Preliminary Data

- For low-noise, low-distortion broadband output amplifier stages in antenna and telecommunications systems up to 1.5 GHz at collector currents from 20 mA to 80 mA.
- f_T = 7.5 GHz
  F = 1.35 dB at 900 MHz



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

Type	Marking	Ordering Code (tape and reel)	Pin Configuration 1	2	3	4	Package[1]
BFG 196	BFG 196	Q62702-F1292	E	B	E	C	SOT-223

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CEO}	12	V
Collector-emitter voltage, V_{BE} = 0	V_{CES}	20	
Collector-base voltage	V_{CBO}	20	
Emitter-base voltage	V_{EBO}	2	
Collector current	I_C	100	mA
Peak collector current, $f \geq$ 10 MHz	I_{CM}	150	
Base current	I_B	12	
Peak base current, $f \geq$ 10 MHz	I_{BM}	15	
Total power dissipation, $T_S \leq$ 90 °C[3]	P_{tot}	800	mW
Junction temperature	T_j	150	°C
Ambient temperature range	T_A	– 65 ... + 150	
Storage temperature range	T_{stg}	– 65 ... + 150	

Thermal Resistance

Junction - ambient[2]	$R_{th\,JA}$	≤ 155	K/W
Junction - soldering point[3]	$R_{th\,JS}$	≤ 75	

1) For detailed information 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.

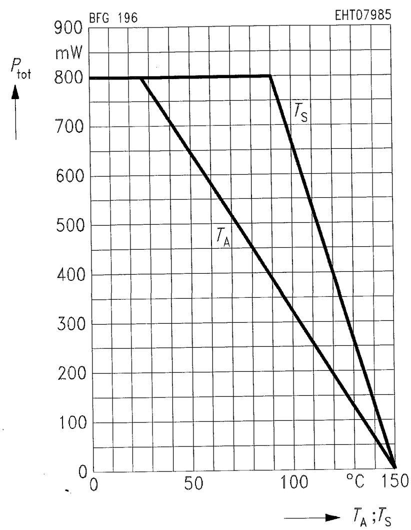
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CEO}$	12	–	–	V
Collector-emitter cutoff current V_{CE} = 20 V, V_{BE} = 0	I_{CES}	–	–	100	µA
Collector-base cutoff current V_{CB} = 10 V, I_E = 0	I_{CBO}	–	–	50	nA
Emitter-base cutoff current V_{EB} = 1 V, I_C = 0	I_{EBO}	–	–	1	µA
DC current gain I_C = 50 mA, V_{CE} = 5 V	h_{FE}	50	90	250	–
Collector-emitter saturation voltage I_C = 75 mA, I_B = 7.5 mA	V_{CEsat}	–	0.1	0.5	V

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

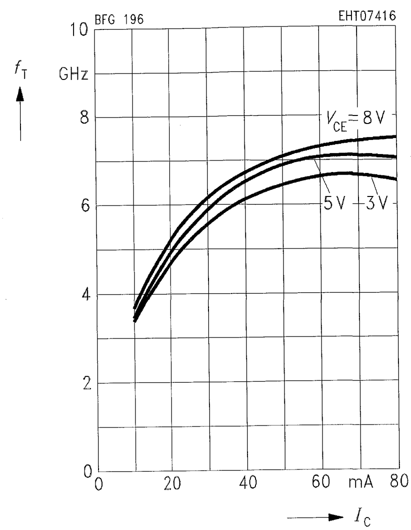
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
AC Characteristics					
Transition frequency	f_T				GHz
I_C = 50 mA, V_{CE} = 5 V, f = 500 MHz		–	6.9	–	
I_C = 70 mA, V_{CE} = 5 V, f = 500 MHz		–	7.2	–	
Collector-base capacitance V_{CB} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{cb}	–	0.95	–	pF
Collector-emitter capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{ce}	–	0.45	–	
Input capacitance V_{EB} = 0.5 V, I_C = i_c = 0, f = 1 MHz	C_{ibo}	–	4.4	–	
Output capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{obs}	–	1.4	–	
Noise figure	F				dB
I_C = 10 mA, V_{CE} = 8 V, f = 10 MHz, Z_S = 50 Ω		–	0.95	–	
I_C = 10 mA, V_{CE} = 8 V, f = 900 MHz, Z_S = Z_{Sopt}		–	1.35	–	
I_C = 50 mA, V_{CE} = 8 V, f = 1 GHz, Z_S = Z_{Sopt}		–	1.9	–	
Power gain	G_{ma} 1)				
I_C = 70 mA, V_{CE} = 8 V, f = 900 MHz, Z_0 = 50 Ω		–	14.0	–	
I_C = 70 mA, V_{CE} = 8 V, f = 1.75 GHz, Z_0 = 50 Ω		–	8.5	–	
Transducer gain I_C = 70 mA, V_{CE} = 8 V, f = 900 MHz, Z_0 = 50 Ω	$\lvert S_{21e} \rvert^2$	–	11.5	–	
Linear output voltage two-tone intermodulation test I_C = 70 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}	–	550	–	mV
Third order intercept point I_C = 70 mA, V_{CE} = 10 V, f = 800 MHz	IP_3	–	37.5	–	dBm

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

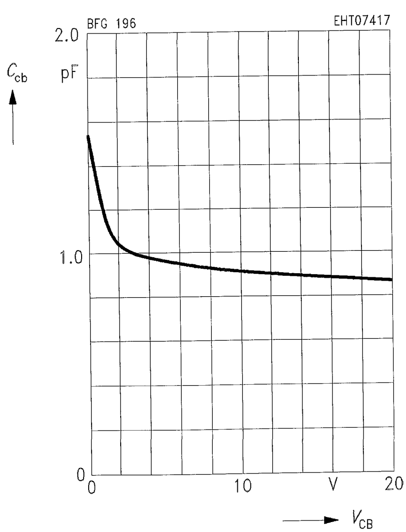
Total power dissipation $P_{tot} = f(T_A^*; T_S)$
* Package mounted on alumina



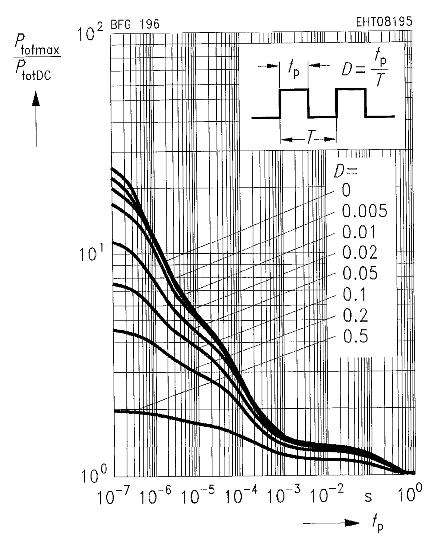
Transition frequency $f_T = f(I_C)$
f = 500 MHz



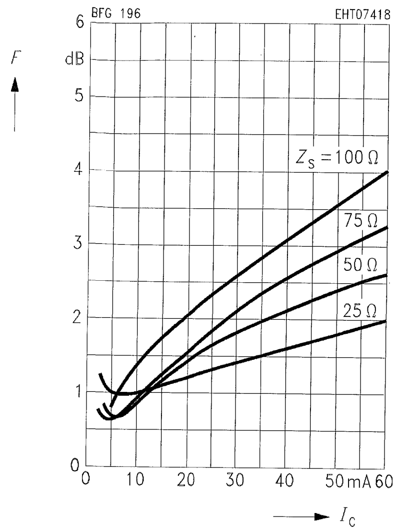
Collector-base capacitance $C_{cb} = f(V_{CB})$
$V_{BE} = v_{be} = 0$, f = 1 MHz



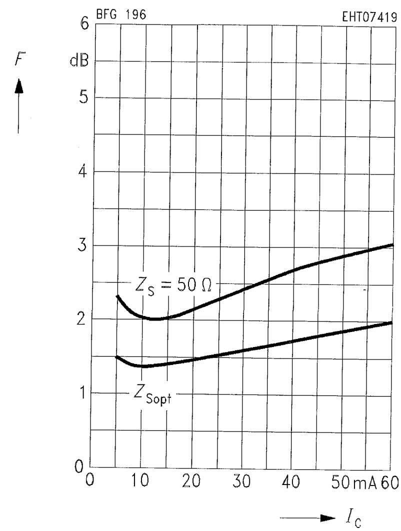
Permissible pulse load $P_{totmax}/P_{totDC} = f(t_p)$
* For note refer to next page.



Noise figure $F = f\ (I_C)$
V_{CE} = 5 V, f = 10 MHz



Noise figure $F = f\ (I_C)$
V_{CE} = 8 V, f = 900 MHz, Z_{Lopt} (G)



* Note for P_{totmax}/P_{totDC} on previous page:
Safe operating area: For the dynamic permissible P_{totmax} a linear power derating is necessary above $V_{CE0}/2$ to V_{CE0max}.

Common Emitter S Parameters

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_C = 20 mA, V_{CE} = 2.5 V, Z_0 = 50 Ω								
0.10	0.541	– 123.6	24.30	119.9	0.029	52.7	0.549	– 63.9
0.20	0.577	– 153.7	13.86	101.1	0.039	51.3	0.325	– 87.3
0.30	0.591	– 167.0	9.51	91.4	0.048	54.2	0.236	– 101.6
0.40	0.597	– 175.2	7.20	84.8	0.058	56.5	0.193	– 112.8
0.50	0.604	178.3	5.79	79.3	0.069	57.7	0.170	– 123.5
0.60	0.609	173.6	4.85	74.5	0.079	58.3	0.157	– 131.6
0.70	0.614	169.2	4.18	70.2	0.090	58.3	0.154	– 140.2
0.80	0.617	164.7	3.68	65.9	0.101	57.8	0.150	– 146.5
0.90	0.621	161.1	3.28	61.9	0.112	57.0	0.154	– 152.9
0.95	0.622	159.4	3.11	60.0	0.118	56.6	0.155	– 155.6
1.00	0.624	157.6	2.96	58.0	0.123	55.9	0.156	– 158.5
1.20	0.630	151.0	2.49	50.5	0.145	53.3	0.169	– 169.0
1.40	0.640	144.8	2.15	43.3	0.166	50.2	0.184	– 177.9
1.60	0.652	139.5	1.89	36.4	0.187	46.6	0.205	174.0
1.70	0.659	137.1	1.78	33.2	0.195	44.3	0.223	170.5
1.75	0.665	135.9	1.72	31.8	0.200	44.2	0.230	167.3
1.80	0.676	133.9	1.68	30.1	0.205	43.6	0.233	164.4
2.00	0.688	128.9	1.52	24.4	0.225	40.1	0.254	157.9
2.50	0.708	117.8	1.27	11.2	0.274	31.9	0.320	144.9
3.00	0.718	105.9	1.11	– 1.4	0.327	23.2	0.372	131.5
I_C = 50 mA, V_{CE} = 2.5 V, Z_0 = 50 Ω								
0.10	0.525	– 152.8	27.73	111.3	0.021	60.3	0.424	– 85.1
0.20	0.568	– 169.8	14.91	96.0	0.032	64.6	0.265	– 114.6
0.30	0.582	– 177.8	10.09	88.1	0.045	67.0	0.217	– 132.7
0.40	0.589	176.6	7.60	82.4	0.057	67.7	0.200	– 145.5
0.50	0.597	171.9	6.10	77.6	0.070	67.1	0.195	– 155.7
0.60	0.602	168.2	5.10	73.3	0.083	66.2	0.192	– 162.9
0.70	0.607	164.7	4.39	69.4	0.095	65.0	0.197	– 169.5
0.80	0.610	160.8	3.86	65.4	0.108	63.4	0.198	– 174.6
0.90	0.614	157.6	3.44	61.6	0.120	61.6	0.206	– 178.9
0.95	0.615	156.1	3.26	59.9	0.127	60.7	0.208	178.9
1.00	0.617	154.4	3.10	58.0	0.133	59.7	0.210	176.7
1.20	0.624	148.5	2.61	50.9	0.157	55.8	0.227	169.1
1.40	0.632	142.6	2.25	44.0	0.180	51.6	0.244	162.4
1.60	0.644	137.6	1.98	37.4	0.201	47.2	0.264	156.1
1.70	0.650	135.4	1.86	34.2	0.210	44.9	0.281	153.9
1.75	0.657	134.1	1.80	32.8	0.215	44.1	0.290	151.5
1.80	0.667	132.5	1.76	31.4	0.220	43.4	0.294	148.9
2.00	0.680	127.5	1.59	25.9	0.240	39.3	0.312	143.3
2.50	0.696	116.6	1.33	13.1	0.288	30.2	0.366	132.2
3.00	0.706	105.0	1.18	0.7	0.340	20.9	0.408	120.3

Common Emitter S Parameters (continued)

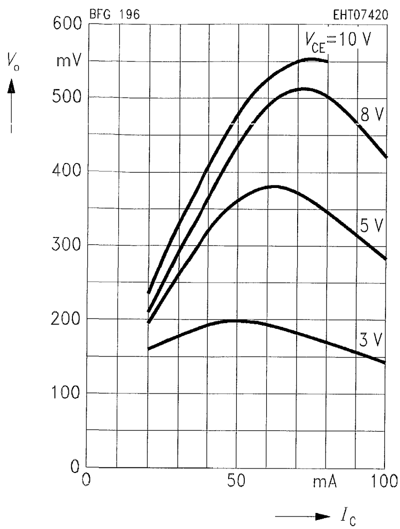
f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_C = 30 mA, V_{CE} = 5 V, Z_0 = 50 Ω								
0.10	0.507	– 132.8	27.72	116.9	0.024	55.9	0.500	– 68.8
0.20	0.544	– 158.9	15.45	99.4	0.034	57.5	0.292	– 93.0
0.30	0.559	– 170.5	10.54	90.5	0.045	60.5	0.215	– 108.3
0.40	0.566	– 177.9	7.96	84.3	0.056	62.4	0.178	– 120.4
0.50	0.572	176.3	6.40	79.2	0.067	62.8	0.162	– 131.6
0.60	0.579	172.0	5.35	74.7	0.079	62.8	0.151	– 140.1
0.70	0.584	167.9	4.60	70.6	0.090	62.1	0.151	– 148.6
0.80	0.587	163.6	4.05	66.6	0.102	61.1	0.148	– 154.9
0.90	0.591	160.2	3.61	62.7	0.113	59.8	0.154	– 161.0
0.95	0.592	158.5	3.42	61.0	0.119	59.2	0.155	– 163.4
1.00	0.596	156.7	3.26	59.0	0.125	58.4	0.155	– 166.4
1.20	0.602	150.5	2.74	51.8	0.147	55.1	0.169	– 176.3
1.40	0.612	144.4	2.36	44.9	0.169	51.5	0.185	175.3
1.60	0.624	139.4	2.08	38.2	0.190	47.5	0.205	168.0
1.70	0.630	137.1	1.94	35.1	0.198	45.5	0.226	165.2
1.75	0.637	135.8	1.89	33.7	0.203	45.0	0.232	162.1
1.80	0.649	134.1	1.84	32.1	0.208	44.2	0.235	158.7
2.00	0.661	128.9	1.67	26.5	0.228	40.4	0.254	152.5
2.50	0.683	117.9	1.38	13.7	0.276	31.9	0.315	140.5
3.00	0.695	106.1	1.22	1.0	0.327	22.8	0.361	127.9
I_C = 50 mA, V_{CE} = 5 V, Z_0 = 50 Ω								
0.10	0.497	– 147.2	29.70	112.5	0.020	60.3	0.433	– 79.5
0.20	0.538	– 166.9	16.08	96.8	0.032	64.1	0.259	– 106.6
0.30	0.552	– 175.7	10.89	68.8	0.044	66.6	0.203	– 124.1
0.40	0.559	178.2	8.21	83.1	0.056	67.4	0.180	– 137.2
0.50	0.567	173.2	6.59	78.4	0.068	67.1	0.172	– 148.2
0.60	0.573	169.4	5.51	74.1	0.081	66.2	0.167	– 156.2
0.70	0.577	165.7	4.74	70.2	0.093	65.0	0.171	– 163.4
0.80	0.580	161.7	4.17	66.3	0.105	63.4	0.170	– 169.1
0.90	0.584	158.6	3.72	62.6	0.117	61.9	0.179	– 173.9
0.95	0.587	156.9	3.52	60.9	0.123	61.0	0.180	– 176.1
1.00	0.589	155.2	3.35	59.0	0.129	60.0	0.181	– 178.7
1.20	0.596	149.3	2.81	52.0	0.153	56.1	0.197	173.0
1.40	0.605	143.4	2.43	45.2	0.175	52.1	0.214	165.8
1.60	0.617	138.5	2.13	38.7	0.197	47.7	0.234	159.4
1.70	0.623	136.2	2.00	35.6	0.205	45.5	0.254	157.3
1.75	0.632	135.1	1.94	34.3	0.210	44.9	0.262	154.5
1.80	0.642	133.2	1.89	32.8	0.215	44.1	0.265	151.4
2.00	0.656	128.2	1.71	27.2	0.235	40.0	0.284	145.6
2.50	0.676	117.5	1.42	14.7	0.282	31.1	0.339	134.6
3.00	0.688	105.7	1.26	2.0	0.334	21.8	0.380	122.5

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 = 70 mA, V_{CE} = 5 V, Z_0 = 50 Ω								
0.10	0.502	– 154.4	30.27	110.2	0.019	63.1	0.397	– 85.6
0.20	0.541	– 170.6	16.16	95.5	0.031	67.6	0.245	– 114.3
0.30	0.555	– 178.3	10.92	87.9	0.044	69.4	0.200	– 132.1
0.40	0.561	176.3	8.22	82.5	0.056	69.6	0.183	– 144.9
0.50	0.568	171.8	6.60	77.9	0.069	68.8	0.179	– 155.2
0.60	0.575	168.1	5.51	73.7	0.082	67.6	0.176	– 162.6
0.70	0.579	164.6	4.74	69.9	0.094	66.2	0.182	– 169.2
0.80	0.582	160.8	4.17	66.0	0.107	64.4	0.182	– 174.5
0.90	0.586	157.8	3.72	62.4	0.119	62.6	0.191	– 178.7
0.95	0.588	156.3	3.52	60.7	0.125	61.7	0.193	179.3
1.00	0.590	154.4	3.35	58.8	0.131	60.6	0.195	176.8
1.20	0.598	148.6	2.81	51.9	0.155	56.6	0.211	169.1
1.40	0.607	142.9	2.42	45.2	0.178	52.3	0.228	162.3
1.60	0.618	138.1	2.13	38.6	0.200	47.8	0.248	156.3
1.70	0.624	135.8	2.00	35.5	0.208	45.5	0.268	154.4
1.75	0.633	134.7	1.94	34.3	0.213	44.8	0.276	151.8
1.80	0.645	132.9	1.90	32.8	0.218	44.0	0.280	148.7
2.00	0.656	127.8	1.71	27.3	0.238	39.9	0.298	143.2
2.50	0.676	117.2	1.43	14.7	0.285	30.8	0.351	132.3
3.00	0.688	105.5	1.26	2.2	0.336	21.4	0.390	120.4
I_C = 70 mA, V_{CE} = 8 V, Z_0 = 50 Ω								
0.10	0.492	– 148.9	31.33	110.4	0.020	61.4	0.396	– 84.0
0.20	0.526	– 167.8	16.75	95.7	0.031	66.0	0.241	– 111.9
0.30	0.539	– 176.4	11.33	88.1	0.044	68.1	0.194	– 129.6
0.40	0.546	177.8	8.52	82.7	0.056	68.7	0.175	– 142.6
0.50	0.553	172.9	6.84	78.1	0.069	68.0	0.170	– 153.2
0.60	0.559	169.1	5.71	74.0	0.081	67.0	0.167	– 160.8
0.70	0.564	165.5	4.91	70.2	0.094	65.7	0.172	– 167.7
0.80	0.567	161.5	4.32	66.3	0.106	64.0	0.173	– 173.1
0.90	0.570	158.3	3.85	62.7	0.118	62.3	0.181	– 177.5
0.95	0.572	156.8	3.65	61.1	0.124	61.3	0.183	– 179.6
1.00	0.575	155.1	3.47	59.2	0.130	60.3	0.185	178.0
1.20	0.582	149.1	2.91	52.3	0.154	56.3	0.201	170.0
1.40	0.591	143.4	2.51	45.7	0.176	52.1	0.218	163.0
1.60	0.604	138.5	2.21	39.2	0.198	47.7	0.238	156.9
1.70	0.610	136.3	2.07	36.1	0.206	45.4	0.258	155.1
1.75	0.618	135.2	2.01	34.9	0.211	44.8	0.265	152.4
1.80	0.630	133.4	1.96	33.3	0.216	44.0	0.269	149.3
2.00	0.643	128.2	1.77	27.9	0.236	39.8	0.287	143.7
2.50	0.665	117.5	1.47	15.4	0.283	30.9	0.341	132.8
3.00	0.676	105.7	1.30	2.8	0.333	21.5	0.379	120.9

Common Emitter Large Signal Parameters

Linear output voltage $V_o = f\ (I_C)$
d_{IM} = 60 dB, f_1 = 806 MHz,
f_2 = 810 MHz, $Z_S = Z_L$ = 50 Ω



Note:

The transistor is driven by 2 adjacent signals f_1, f_2 with equal output power levels P_o for each carrier.
The distance d_{IM} between P_o and the third order intermodulation products P_{IM} ($2f_1 - f_2$ or $2f_2 - f_1$) is:

$d_{IM} = P_o - P_{IM}$
where P_o = 10 log (V_o^2/(50 Ω · 1 mW)) (dBm)
and V_o = linear output voltage of each carrier.

The 3rd order intercept point IP_3 will be found by extrapolation to the point where P_{IM} would be identical to P_o:

IP_3 (output) = $P_o + d_{IM}/2$.

Linear output voltages for other d_{IM} (e.g. 50 dB) can be calculated thereby.

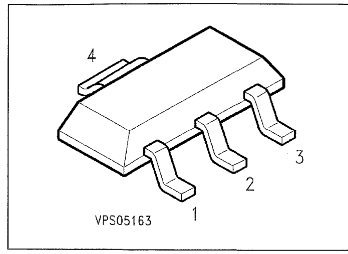
SIEMENS

NPN Silicon RF Transistor

BFG 235

Preliminary Data

- For low-distortion broadband output amplifier stages in antenna and telecommunications systems up to 2 GHz at collector currents from 120 mA to 250 mA.
- Power amplifiers for DECT and PCN systems
- Integrated emitter ballasting resistor
- f_T = 6 GHz



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]
BFG 235	BFG 235	Q62702-F1432	E	B	E	C	SOT-223

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CEO}	12	V
Collector-emitter voltage, $V_{BE} = 0$	V_{CES}	20	
Collector-base voltage	V_{CBO}	20	
Emitter-base voltage	V_{EBO}	2	
Collector current	I_C	300	mA
Peak collector current, $f \geq 10$ MHz	I_{CM}	400	
Base current	I_B	40	
Peak base current, $f \geq 10$ MHz	I_{BM}	100	
Total power dissipation, $T_S \leq 80$ °C[2]	P_{tot}	2000	mW
Junction temperature	T_j	– 65 ... + 150	°C
Ambient temperature range	T_A	– 65 ... + 150	
Storage temperature range	T_{stg}	– 65 ... + 150	

Thermal Resistance

Junction - soldering point[2]	$R_{th JS}$	≤ 35	K/W

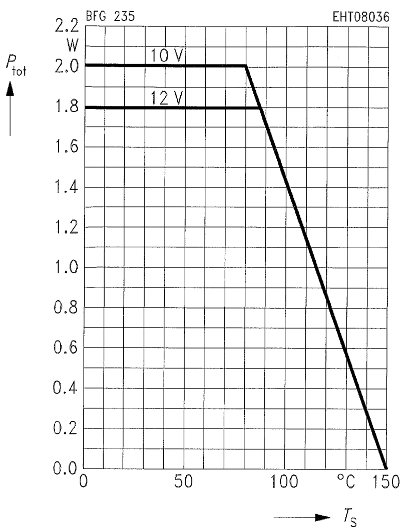
1) For detailed information see chapter Package Outlines.

2) 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.

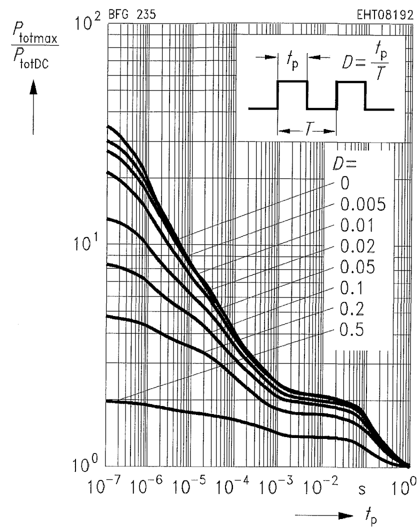
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CEO}$	12	–	–	V
Collector-emitter cutoff current V_{CE} = 20 V, V_{BE} = 0	I_{CES}	–	–	200	µA
Collector-base cutoff current V_{CB} = 10 V, I_E = 0	I_{CB0}	–	–	100	nA
Emitter-base cutoff current V_{EB} = 1 V, I_C = 0	I_{EB0}	–	–	2	µA
DC current gain I_C = 200 mA, V_{CE} = 10 V	h_{FE}	50	125	250	–
Collector-emitter saturation voltage I_C = 150 mA, I_B = 15 mA	V_{CEsat}	–	–	0.4	V
AC Characteristics					
Transition frequency I_C = 160 mA, V_{CE} = 8 V, f = 200 MHz I_C = 240 mA, V_{CE} = 8 V, f = 200 MHz	f_T	 – –	 5.9 6	 – –	GHz

Total power dissipation $P_{tot} = f(T_S)$



Permissible pulse load

$P_{totmax}/P_{totDC} = f(t_p)$*)



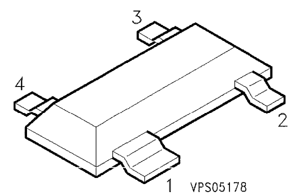
*) Safe operating area: For the dynamic permissible P_{totmax} a linear power derating is necessary above $V_{CE0}/2$ to V_{CE0max}.

SIEMENS

NPN Silicon RF Transistor

BFP 81

- For low-noise amplifiers up to 2 GHz at collector currents from 0.5 mA to 25 mA.



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

Type	Marking	Ordering Code (tape and reel)	Pin Configuration 1	2	3	4	Package[1]
BFP 81	FA	Q62702-F1122	C	E	B	E	SOT-143

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CEO}	16	V
Collector-base voltage	V_{CBO}	25	
Emitter-base voltage	V_{EBO}	2	
Collector current	I_C	30	mA
Base current	I_B	4	
Total power dissipation, $T_S \leq 73$ ˚C[3]	P_{tot}	280	mW
Junction temperature	T_j	150	˚C
Ambient temperature range	T_A	– 65 … + 150	
Storage temperature range	T_{stg}	– 65 … + 150	

Thermal Resistance

Junction - ambient[2]	$R_{th\,JA}$	≤ 355	K/W
Junction - soldering point[3]	$R_{th\,JS}$	≤ 275	

1) For detailed information 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.

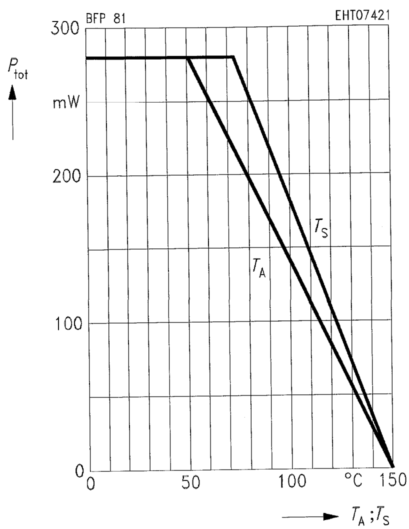
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

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-base cutoff current V_{CB} = 15 V, I_E = 0	I_{CB0}	–	–	100	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}	–	0.2	0.4	V

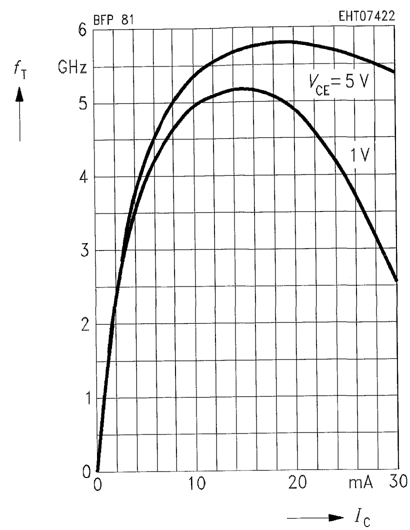
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

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		–	4.2	–	
I_C = 15 mA, V_{CE} = 10 V, f = 200 MHz		–	5.8	–	
Collector-base capacitance V_{CB} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{cb}	–	0.34	–	pF
Collector-emitter capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{ce}	–	0.32	–	
Input capacitance V_{EB} = 0.5 V, I_C = i_c = 0, f = 1 MHz	C_{ibo}	–	1.2	–	
Output capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{obs}	–	0.65	–	
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 = Z_{Sopt}		–	1.25	–	
I_C = 5 mA, V_{CE} = 10 V, f = 2 GHz, Z_S = Z_{Sopt}		–	2.25	–	
Power gain	G_{pe}				
I_C = 5 mA, V_{CE} = 10 V, f = 800 MHz, Z_S = 50 Ω, Z_L = Z_{Lopt}		–	15.5	–	
I_C = 10 mA, V_{CE} = 10 V, f = 800 MHz, Z_S = 50 Ω, Z_L = Z_{Lopt}		–	16.5	–	
Transducer gain I_C = 20 mA, V_{CE} = 10 V, f = 1 GHz, Z_0 = 50 Ω	$\|S_{21e}\|^2$	–	15	–	
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

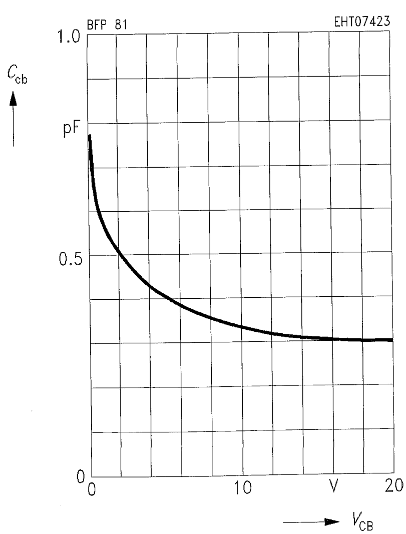
Total power dissipation $P_{tot} = f(T_A^*; T_S)$
*Package mounted on alumina



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



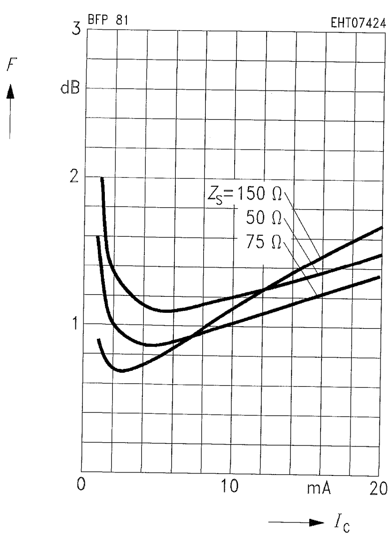
Collector-base capacitance $C_{cb} = f(V_{CB})$
$V_{BE} = v_{be} = 0$, f = 1 MHz



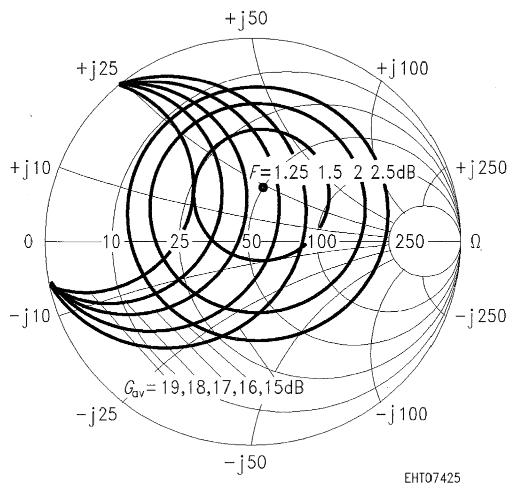
Common Emitter Noise Parameters

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 = 5 mA, V_{CE} = 10 V, Z_0 = 50 Ω								
0.01	0.8	–	(Z_S = 120 Ω)		–	–	1.1	–
0.8	1.25	16	0.26	77	9.6	0.151	1.4	15.5
2.0	2.25	10	0.32	178	8.6	0.334	2.7	8.5
I_C = 10 mA, V_{CE} = 10 V, Z_0 = 50 Ω								
0.01	1.05	–	(Z_S = 75 Ω)		–	–	1.2	–
0.8	1.4	17	0.21	93	8.3	0.155	1.5	16.5
2.0	2.5	11	0.33	– 167	10.8	0.413	2.9	9.5

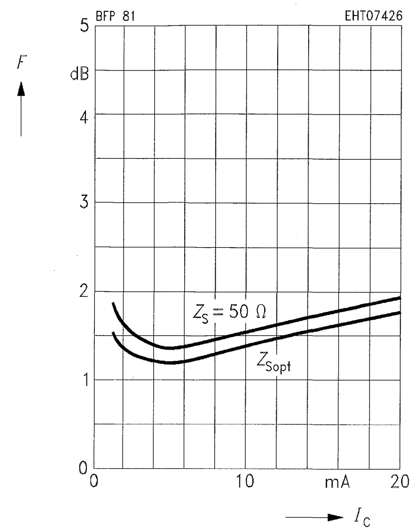
Noise figure $F = f(I_C)$
V_{CE} = 10 V, f = 10 MHz



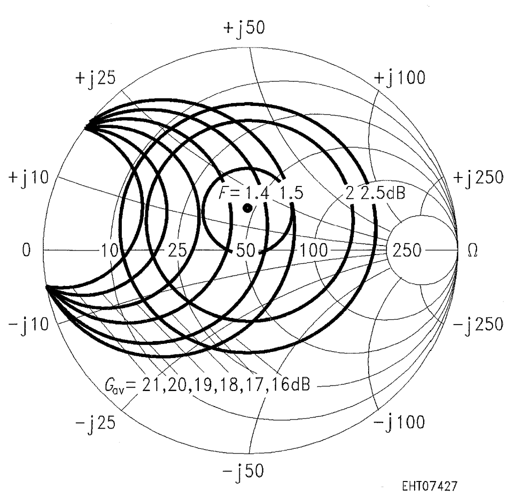
Circles of constant noise figure $F = f(Z_S)$ and available power gain $G_{av} = f(Z_S)$
I_C = 5 mA, V_{CE} = 10 V, f = 800 MHz



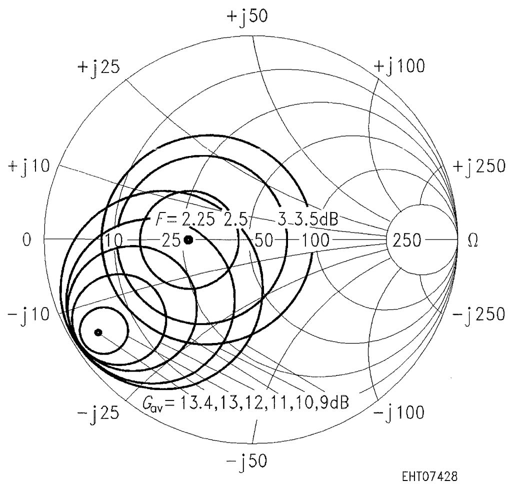
Noise figure $F = f(I_C)$
V_{CE} = 10 V, f = 800 MHz, Z_{Lopt} (G)



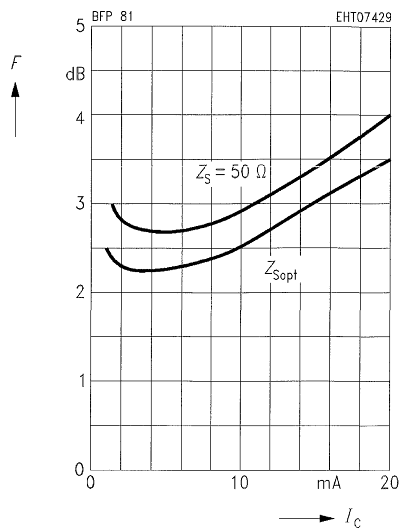
Circles of constant noise figure $F = f(Z_S)$ and available power gain $G_{av} = f(Z_S)$
I_C = 10 mA, V_{CE} = 10 V, f = 800 MHz



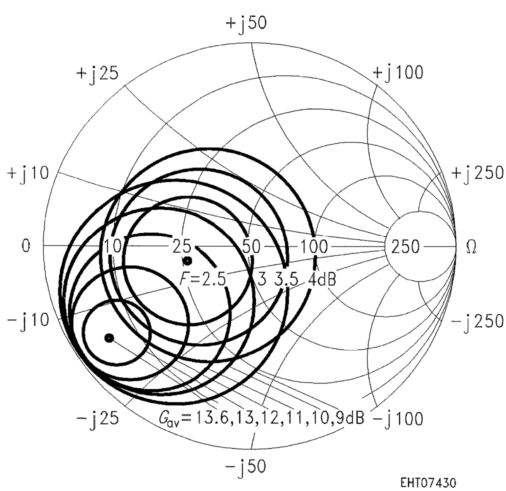
Circles of constant noise figure $F = f(Z_S)$ and available power gain $G_{av} = f(Z_S)$
I_C = 5 mA, V_{CE} = 10 V, f = 2 GHz



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

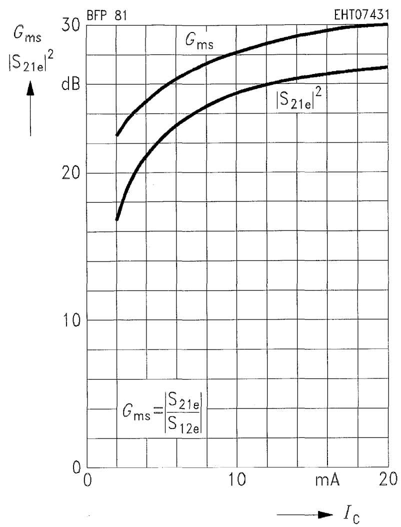


Circles of constant noise figure $F = f(Z_S)$ and available power gain $G_{av} = f(Z_S)$
I_C = 10 mA, V_{CE} = 10 V, f = 2 GHz

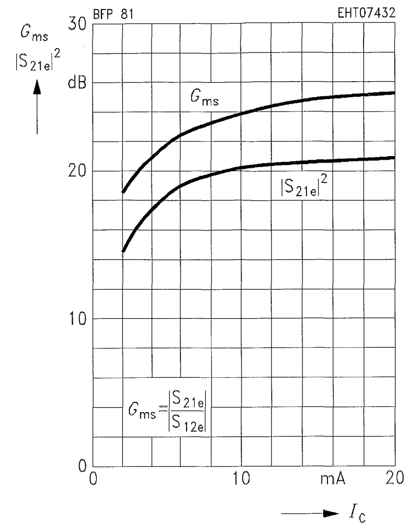


Common Emitter Power Gain

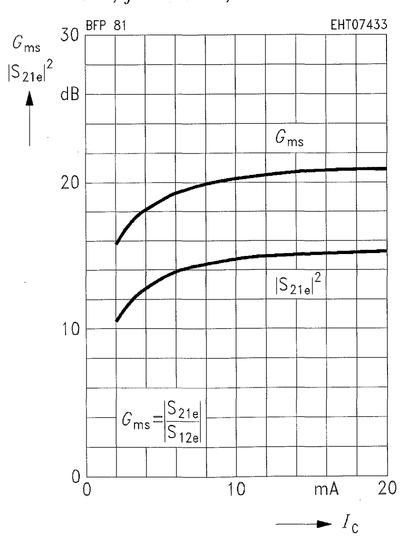
Power gain G_{ms}, $|S_{21e}|^2 = f(I_C)$
V_{CE} = 10 V, f = 200 MHz, Z_0 = 50 Ω



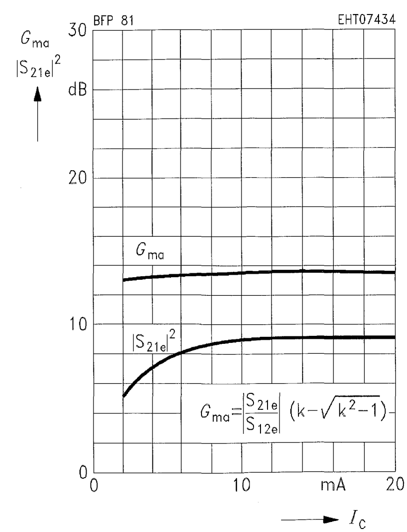
Power gain G_{ms}, $|S_{21e}|^2 = f(I_C)$
V_{CE} = 10 V, f = 500 MHz, Z_0 = 50 Ω



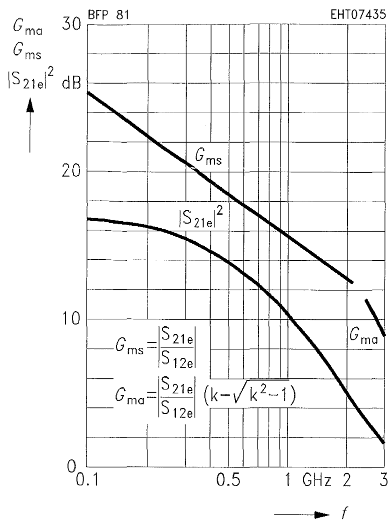
Power gain G_{ms}, $|S_{21e}|^2 = f(I_C)$
V_{CE} = 10 V, f = 1 GHz, Z_0 = 50 Ω



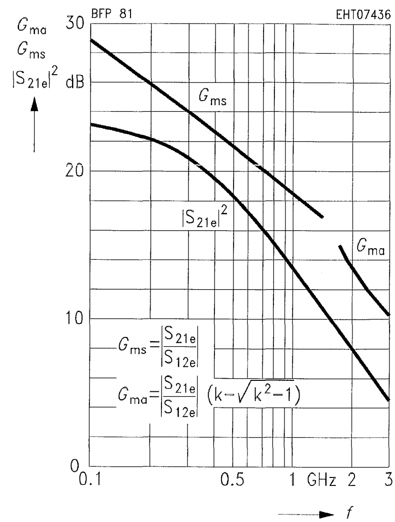
Power gain G_{ma}, $|S_{21e}|^2 = f(I_C)$
V_{CE} = 10 V, f = 2 GHz, Z_0 = 50 Ω



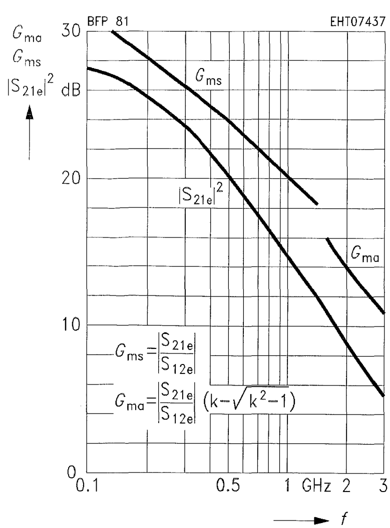
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
I_C = 2 mA, V_{CE} = 10 V, Z_0 = 50 Ω



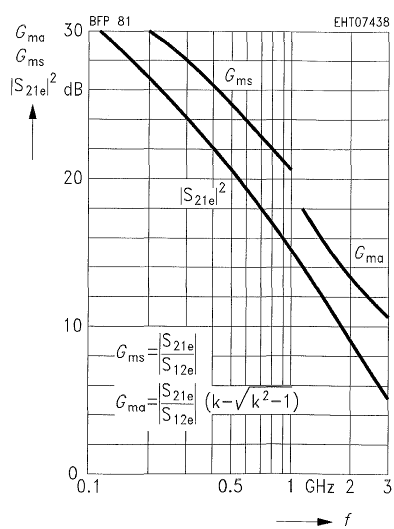
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
I_C = 5 mA, V_{CE} = 10 V, Z_0 = 50 Ω



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 = 20 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 = 1 mA, V_{CE} = 1 V, Z_0 = 50 Ω								
0.10	0.959	– 18.9	3.63	166.5	0.040	78.6	0.985	– 7.9
0.15	0.948	– 28.1	3.57	159.9	0.058	72.9	0.971	– 11.7
0.20	0.934	– 37.1	3.49	153.6	0.076	67.6	0.953	– 15.3
0.25	0.916	– 45.8	3.39	147.3	0.092	62.6	0.931	– 18.6
0.30	0.896	– 54.0	3.26	141.4	0.106	57.8	0.907	– 21.7
0.40	0.868	– 69.1	3.01	131.2	0.130	49.0	0.861	– 27.3
0.50	0.832	– 83.2	2.78	121.7	0.148	41.4	0.814	– 32.0
0.60	0.802	– 95.6	2.54	113.2	0.161	35.0	0.773	– 35.8
0.70	0.773	– 107.0	2.34	105.4	0.171	29.4	0.736	– 39.2
0.80	0.758	– 116.5	2.15	98.6	0.180	24.6	0.709	– 41.9
0.90	0.754	– 126.0	2.00	92.3	0.186	19.5	0.681	– 44.9
1.00	0.741	– 135.0	1.86	86.2	0.188	15.2	0.655	– 47.3
1.20	0.721	– 150.2	1.61	75.4	0.189	8.5	0.618	– 51.9
1.40	0.706	– 162.6	1.42	66.3	0.188	2.7	0.595	– 56.7
1.50	0.701	– 168.3	1.34	62.0	0.186	0.2	0.587	– 59.0
1.60	0.699	– 173.8	1.27	57.7	0.184	– 1.9	0.582	– 61.3
1.80	0.707	176.0	1.16	49.6	0.178	– 6.1	0.572	– 65.6
2.00	0.711	167.0	1.05	42.1	0.170	– 9.9	0.563	– 69.9
I_C = 2 mA, V_{CE} = 1 V, Z_0 = 50 Ω								
0.10	0.921	– 25.8	6.99	162.9	0.038	75.5	0.968	– 12.0
0.15	0.904	– 38.1	6.76	154.8	0.055	68.6	0.938	– 17.4
0.20	0.880	– 49.6	6.44	147.2	0.070	62.3	0.901	– 22.4
0.25	0.854	– 60.4	6.11	140.1	0.083	56.5	0.861	– 26.8
0.30	0.827	– 70.0	5.71	133.8	0.094	51.5	0.820	– 30.5
0.40	0.798	– 87.7	5.09	123.5	0.111	42.5	0.747	– 37.1
0.50	0.761	– 102.9	4.50	114.1	0.122	35.6	0.681	– 41.8
0.60	0.733	– 115.5	3.99	106.4	0.129	30.2	0.630	– 45.5
0.70	0.712	– 126.4	3.58	99.5	0.134	26.0	0.589	– 48.3
0.80	0.699	– 135.2	3.21	93.6	0.139	22.4	0.559	– 50.6
0.90	0.697	– 143.1	2.95	88.5	0.142	18.7	0.532	– 53.3
1.00	0.694	– 151.3	2.70	83.2	0.142	15.7	0.507	– 55.5
1.20	0.681	– 164.8	2.30	74.1	0.142	11.5	0.474	– 59.3
1.40	0.682	– 175.6	2.00	66.4	0.142	8.0	0.455	– 63.4
1.50	0.681	179.9	1.89	62.9	0.140	6.6	0.447	– 65.4
1.60	0.679	174.9	1.78	59.1	0.139	5.7	0.444	– 67.3
1.80	0.685	166.5	1.60	52.0	0.137	3.9	0.438	– 71.0
2.00	0.691	158.7	1.45	45.5	0.133	2.3	0.432	– 75.0

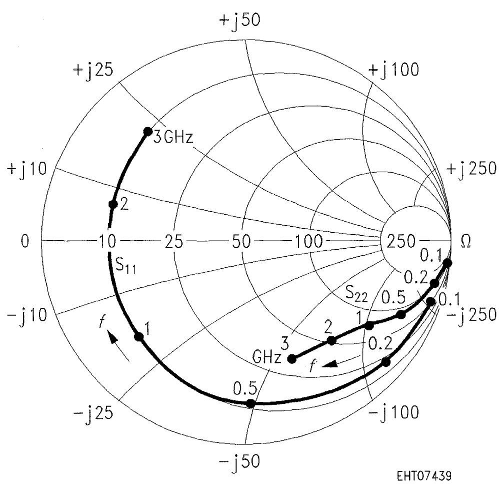
Common Emitter S Parameters (continued)

f	*S*11		*S*21		*S*12		*S*22	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_C = 2 mA, V_{CE} = 3 V, Z_0 = 50 Ω								
0.10	0.930	– 22.1	7.00	165.2	0.027	77.8	0.979	– 8.6
0.15	0.914	– 32.8	6.83	158.0	0.039	71.7	0.959	– 12.5
0.20	0.896	– 43.0	6.59	151.2	0.050	66.1	0.933	– 16.2
0.25	0.873	– 52.6	6.32	144.7	0.060	60.9	0.905	– 19.5
0.30	0.848	– 61.4	5.98	138.8	0.068	56.3	0.876	– 22.4
0.40	0.821	– 78.0	5.44	129.0	0.083	47.9	0.819	– 27.5
0.50	0.781	– 92.8	4.91	119.8	0.092	41.0	0.765	– 31.3
0.60	0.752	– 105.5	4.41	112.0	0.099	35.7	0.721	– 34.3
0.70	0.725	– 116.7	4.00	105.1	0.104	31.3	0.685	– 36.6
0.80	0.709	– 125.7	3.61	99.2	0.108	27.8	0.659	– 38.5
0.90	0.705	– 134.0	3.34	94.0	0.111	24.0	0.633	– 40.6
1.00	0.698	– 142.8	3.08	88.6	0.112	20.9	0.610	– 42.5
1.20	0.679	– 157.3	2.64	79.4	0.113	16.7	0.578	– 45.5
1.40	0.677	– 169.1	2.31	71.5	0.113	13.4	0.559	– 49.0
1.50	0.675	– 174.1	2.17	68.1	0.112	11.9	0.551	– 50.6
1.60	0.673	– 179.3	2.06	64.3	0.111	11.2	0.547	– 52.2
1.80	0.675	171.7	1.84	57.2	0.109	9.8	0.540	– 55.5
2.00	0.680	163.2	1.67	50.7	0.106	8.6	0.532	– 58.9
2.50	0.717	146.0	1.33	36.3	0.100	10.1	0.523	– 70.2
3.00	0.728	130.5	1.10	22.6	0.097	14.3	0.533	– 80.1
I_C = 5 mA, V_{CE} = 3 V, Z_0 = 50 Ω								
0.10	0.844	– 35.5	15.15	157.5	0.025	71.7	0.938	– 15.4
0.15	0.814	– 51.6	14.18	147.7	0.035	64.0	0.885	– 21.6
0.20	0.780	– 66.0	13.04	139.0	0.043	57.5	0.825	– 26.8
0.25	0.747	– 78.6	11.92	131.4	0.049	52.2	0.767	– 30.8
0.30	0.717	– 88.9	10.78	125.3	0.054	48.3	0.717	– 33.8
0.40	0.706	– 107.8	9.23	115.8	0.061	40.3	0.633	– 39.3
0.50	0.670	– 123.0	7.86	107.3	0.065	36.1	0.565	– 41.8
0.60	0.650	– 134.7	6.79	100.6	0.068	33.5	0.519	– 43.5
0.70	0.635	– 144.3	5.97	95.0	0.071	32.1	0.487	– 44.7
0.80	0.626	– 151.6	5.28	90.4	0.074	31.0	0.466	– 45.9
0.90	0.637	– 158.1	4.81	86.3	0.076	28.7	0.444	– 47.8
1.00	0.638	– 165.5	4.38	81.9	0.076	27.9	0.424	– 48.8
1.20	0.631	– 177.2	3.68	74.5	0.079	28.0	0.400	– 50.9
1.40	0.639	173.6	3.18	68.2	0.082	27.3	0.386	– 54.0
1.50	0.639	169.7	2.99	65.2	0.083	27.8	0.381	– 55.3
1.60	0.639	165.3	2.82	62.0	0.084	28.3	0.379	– 56.8
1.80	0.644	157.9	2.51	55.9	0.087	28.9	0.376	– 59.7
2.00	0.651	151.1	2.26	50.3	0.090	29.5	0.371	– 63.0
2.50	0.692	137.3	1.80	37.9	0.098	31.5	0.365	– 74.6
3.00	0.704	123.8	1.49	25.5	0.109	32.5	0.377	– 84.3

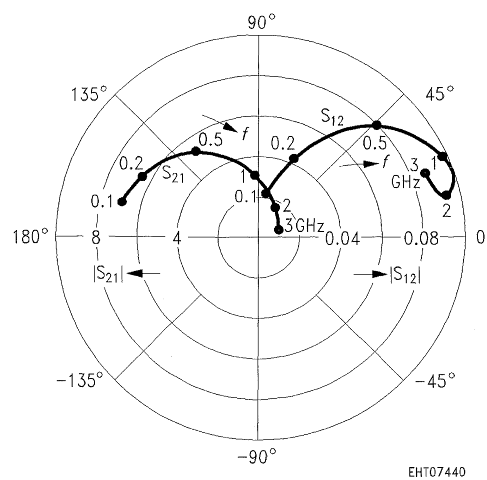
Common Emitter S Parameters (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_C = 2 mA, V_{CE} = 6 V, Z_0 = 50 Ω								
0.10	0.935	– 20.7	6.91	166.0	0.022	78.6	0.983	– 7.2
0.15	0.922	– 30.7	6.77	159.3	0.032	72.7	0.967	– 10.6
0.20	0.903	– 40.3	6.56	152.7	0.042	67.7	0.945	– 13.7
0.25	0.881	– 49.5	6.33	146.5	0.050	62.8	0.922	– 16.6
0.30	0.857	– 57.9	6.02	140.7	0.058	58.3	0.897	– 19.0
0.40	0.830	– 74.0	5.53	131.1	0.070	50.1	0.849	– 23.5
0.50	0.790	– 88.5	5.01	122.1	0.079	43.4	0.802	– 26.8
0.60	0.759	– 101.1	4.53	114.3	0.085	38.1	0.763	– 29.4
0.70	0.731	– 112.2	4.13	107.4	0.090	33.8	0.731	– 31.6
0.80	0.712	– 121.6	3.74	101.4	0.094	30.2	0.707	– 33.3
0.90	0.706	– 129.9	3.47	96.2	0.097	26.6	0.684	– 35.3
1.00	0.700	– 138.8	3.21	90.8	0.098	23.4	0.662	– 36.9
1.20	0.679	– 153.7	2.76	81.4	0.099	19.2	0.632	– 39.8
1.40	0.673	– 166.0	2.41	73.6	0.099	16.0	0.614	– 43.0
1.50	0.670	– 171.0	2.27	70.0	0.098	14.6	0.607	– 44.5
1.60	0.668	– 176.4	2.15	66.2	0.097	14.0	0.603	– 46.0
1.80	0.670	174.2	1.93	59.1	0.096	12.9	0.596	– 49.0
2.00	0.674	165.4	1.75	52.7	0.093	12.0	0.589	– 52.2
2.50	0.709	147.6	1.40	38.2	0.088	14.3	0.577	– 62.6
3.00	0.719	131.6	1.16	24.4	0.086	19.9	0.585	– 72.0

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



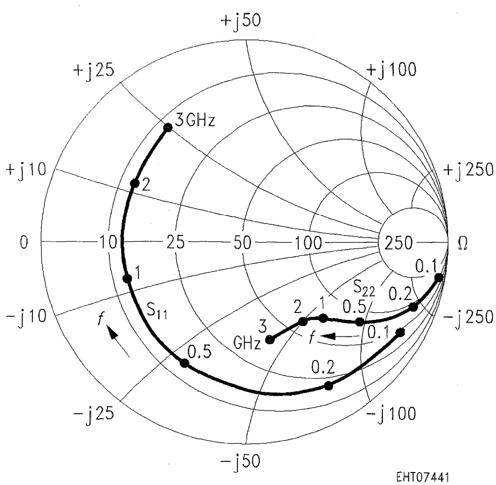
S_{12}, S_{21} = f (f)
I_C = 2 mA, V_{CE} = 6 V, Z_0 = 50 Ω



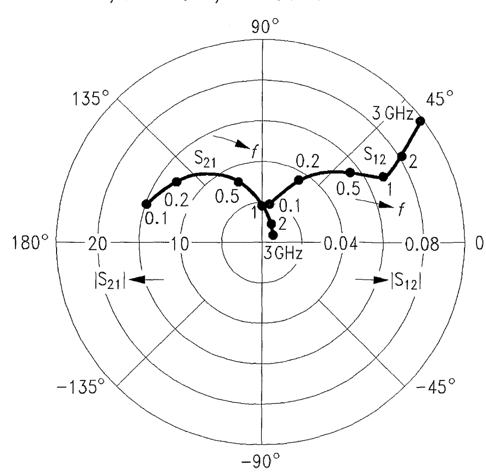
Common Emitter S Parameters (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**
I_C = 5 mA, V_{CE} = 6 V, Z_0 = 50 Ω								
0.10	0.859	– 32.4	14.96	159.0	0.021	73.3	0.951	– 12.6
0.15	0.829	– 47.4	14.12	149.7	0.029	65.9	0.907	– 17.9
0.20	0.794	– 60.8	13.11	141.3	0.036	59.8	0.855	– 22.3
0.25	0.762	– 72.9	12.08	133.9	0.042	54.5	0.806	– 25.7
0.30	0.728	– 82.9	11.00	127.7	0.047	50.6	0.761	– 28.1
0.40	0.713	– 101.8	9.53	118.2	0.054	42.8	0.685	– 32.8
0.50	0.672	– 117.2	8.18	109.5	0.057	38.4	0.624	– 34.8
0.60	0.647	– 129.2	7.11	102.7	0.060	35.7	0.581	– 36.3
0.70	0.628	– 139.1	6.26	96.9	0.063	34.3	0.551	– 37.3
0.80	0.618	– 146.6	5.55	92.3	0.066	32.9	0.532	– 38.3
0.90	0.626	– 153.7	5.07	88.1	0.068	30.6	0.511	– 39.9
1.00	0.626	– 161.3	4.62	83.6	0.068	29.8	0.492	– 40.7
1.20	0.618	– 173.6	3.89	76.0	0.070	30.0	0.469	– 42.6
1.40	0.626	176.6	3.38	69.6	0.073	29.4	0.456	– 45.4
1.50	0.623	172.6	3.17	66.6	0.073	29.8	0.451	– 46.5
1.60	0.626	168.1	2.99	63.4	0.074	30.5	0.448	– 47.9
1.80	0.629	160.3	2.66	57.3	0.078	31.4	0.445	– 50.6
2.00	0.636	153.3	2.40	51.8	0.080	32.2	0.441	– 53.6
2.50	0.676	139.0	1.91	39.1	0.088	35.0	0.431	– 63.9
3.00	0.689	125.1	1.58	26.5	0.099	36.5	0.440	– 73.1

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



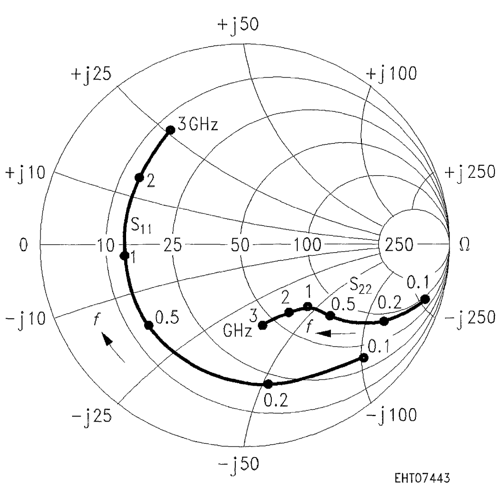
S_{12}, S_{21} = f (f)
I_C = 5 mA, V_{CE} = 6 V, Z_0 = 50 Ω



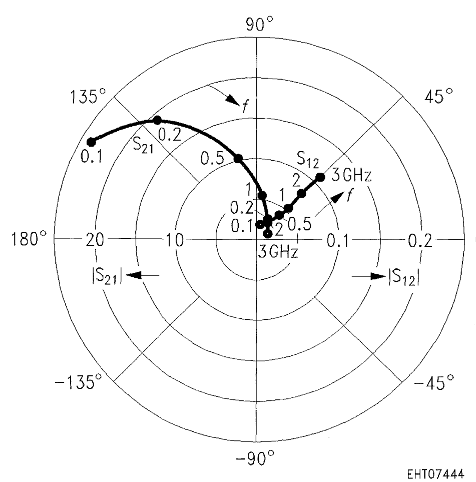
Common Emitter S Parameters (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_C = 10 mA, V_{CE} = 6 V, Z_0 = 50 Ω								
0.10	0.764	– 47.7	24.13	150.6	0.019	67.6	0.893	– 18.9
0.15	0.724	– 67.5	21.53	139.2	0.025	59.2	0.812	– 25.3
0.20	0.685	– 84.0	18.95	129.9	0.030	53.4	0.736	– 29.8
0.25	0.653	– 97.2	16.67	122.5	0.033	49.6	0.670	– 32.5
0.30	0.626	– 107.2	14.62	116.8	0.036	47.1	0.622	– 34.1
0.40	0.638	– 125.6	12.14	108.4	0.040	40.6	0.542	– 38.0
0.50	0.607	– 139.8	10.06	100.8	0.042	39.7	0.486	– 38.1
0.60	0.594	– 150.0	8.55	95.1	0.045	40.0	0.455	– 38.3
0.70	0.584	– 157.9	7.42	90.3	0.048	40.7	0.434	– 38.4
0.80	0.578	– 163.4	6.52	86.6	0.051	40.7	0.423	– 39.2
0.90	0.595	– 168.9	5.92	83.0	0.053	39.1	0.406	– 40.7
1.00	0.600	– 175.4	5.36	79.1	0.054	40.0	0.391	– 41.2
1.20	0.598	174.5	4.48	72.7	0.059	42.2	0.376	– 42.8
1.40	0.610	166.6	3.88	67.1	0.064	41.9	0.366	– 45.6
1.50	0.610	163.2	3.63	64.3	0.066	42.8	0.364	– 46.6
1.60	0.611	159.1	3.42	61.4	0.069	43.7	0.363	– 48.0
1.80	0.615	152.5	3.03	55.8	0.074	44.3	0.363	– 50.9
2.00	0.623	146.5	2.73	50.7	0.079	44.4	0.360	– 54.0
2.50	0.668	134.2	2.17	39.2	0.093	44.8	0.352	– 64.9
3.00	0.680	121.5	1.80	27.3	0.107	43.6	0.362	– 74.3

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



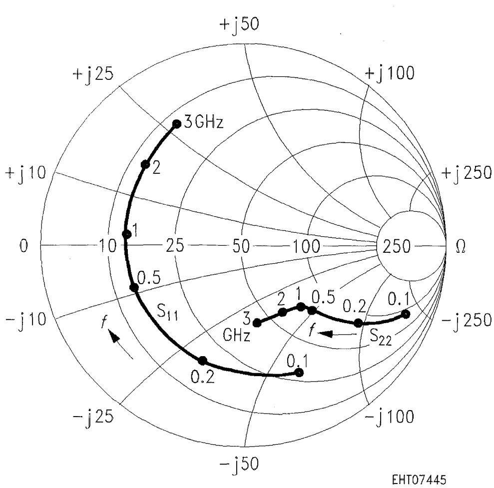
$S_{12}, S_{21} = f(f)$
I_C = 10 mA, V_{CE} = 6 V, Z_0 = 50 Ω



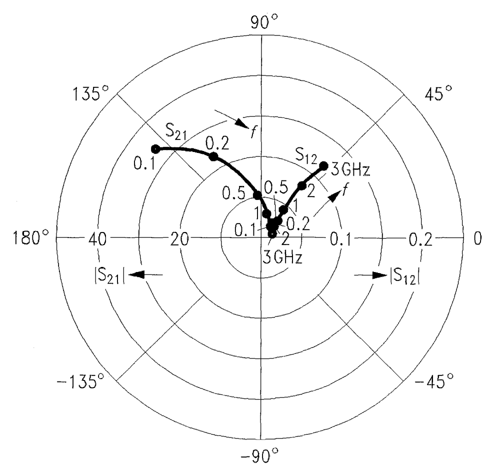
Common Emitter S Parameters (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_C = 20 mA, V_{CE} = 6 V, Z_0 = 50 Ω								
0.10	0.660	– 69.0	33.24	140.5	0.016	61.4	0.803	– 25.2
0.15	0.626	– 92.6	27.53	127.9	0.020	53.9	0.690	– 31.0
0.20	0.599	– 109.8	22.90	118.9	0.023	49.7	0.604	– 34.0
0.25	0.582	– 122.2	19.35	112.3	0.025	48.1	0.543	– 35.0
0.30	0.565	– 130.5	16.52	107.7	0.028	47.8	0.505	– 35.2
0.40	0.606	– 146.0	13.34	100.5	0.030	43.4	0.436	– 37.6
0.50	0.586	– 157.5	10.84	94.1	0.033	46.0	0.398	– 35.9
0.60	0.578	– 165.4	9.10	89.4	0.036	48.0	0.379	– 35.3
0.70	0.571	– 171.4	7.84	85.4	0.039	49.9	0.369	– 35.2
0.80	0.568	– 175.4	6.86	82.3	0.043	49.9	0.365	– 36.2
0.90	0.588	– 179.5	6.20	79.2	0.046	48.5	0.351	– 37.8
1.00	0.595	175.1	5.59	75.6	0.047	50.4	0.341	– 38.1
1.20	0.597	166.7	4.66	69.8	0.054	52.4	0.333	– 39.9
1.40	0.612	160.0	4.03	64.8	0.060	51.7	0.326	– 43.0
1.50	0.612	156.9	3.77	62.1	0.063	52.4	0.325	– 44.2
1.60	0.612	153.4	3.55	59.3	0.066	53.0	0.326	– 45.7
1.80	0.617	147.4	3.14	54.0	0.073	52.8	0.328	– 48.9
2.00	0.624	142.0	2.83	49.2	0.080	52.2	0.327	– 52.3
2.50	0.670	131.1	2.25	38.1	0.096	50.6	0.320	– 63.9
3.00	0.683	119.0	1.86	26.4	0.112	47.9	0.331	– 73.7

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



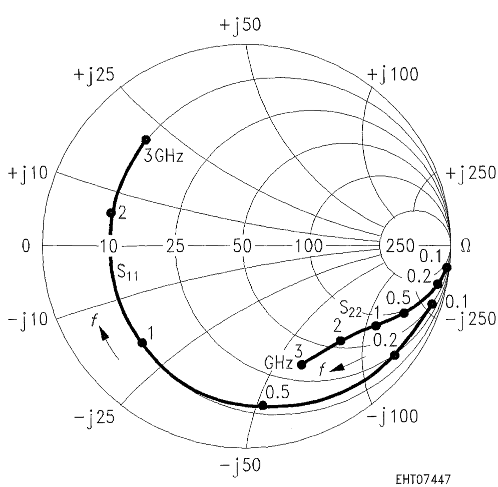
S_{12}, S_{21} = f (f)
I_C = 20 mA, V_{CE} = 6 V, Z_0 = 50 Ω



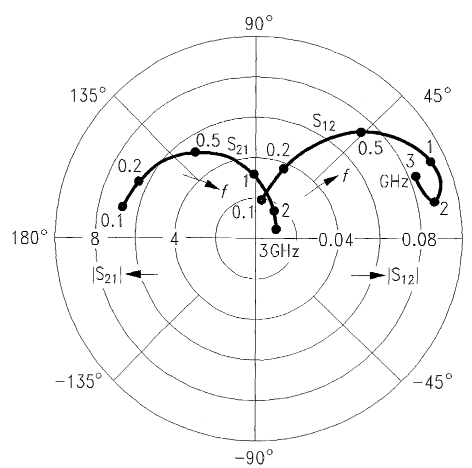
Common Emitter S Parameters (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**
I_C = 2 mA, V_{CE} = 10 V, Z_0 = 50 Ω								
0.10	0.940	– 19.8	6.80	166.5	0.020	79.0	0.985	– 6.6
0.15	0.927	– 29.5	6.66	159.9	0.029	73.5	0.971	– 9.7
0.20	0.910	– 38.7	6.47	153.6	0.038	68.4	0.952	– 12.5
0.25	0.889	– 47.5	6.27	147.5	0.046	63.7	0.930	– 15.2
0.30	0.864	– 55.8	5.97	141.8	0.053	59.4	0.908	– 17.4
0.40	0.838	– 71.5	5.51	132.4	0.065	51.4	0.864	– 21.6
0.50	0.797	– 85.8	5.01	123.3	0.073	44.7	0.820	– 24.8
0.60	0.764	– 98.2	4.55	115.6	0.080	39.4	0.785	– 27.3
0.70	0.735	– 109.3	4.16	108.6	0.084	35.0	0.754	– 29.3
0.80	0.714	– 118.6	3.77	102.7	0.088	31.5	0.731	– 31.0
0.90	0.710	– 127.2	3.51	97.5	0.091	27.9	0.709	– 32.8
1.00	0.699	– 136.3	3.25	92.0	0.092	24.8	0.689	– 34.3
1.20	0.676	– 151.3	2.80	82.6	0.093	20.6	0.659	– 37.1
1.40	0.671	– 163.8	2.46	74.7	0.094	17.3	0.642	– 40.2
1.50	0.666	– 168.9	2.31	71.1	0.092	16.0	0.634	– 41.7
1.60	0.663	– 174.5	2.19	67.3	0.091	15.4	0.630	– 43.1
1.80	0.664	175.9	1.97	60.1	0.090	14.2	0.624	– 45.9
2.00	0.668	166.8	1.79	53.7	0.088	13.4	0.616	– 49.0
2.50	0.701	148.8	1.43	39.0	0.083	16.1	0.604	– 58.9
3.00	0.715	132.6	1.18	25.3	0.082	21.8	0.611	– 67.9

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



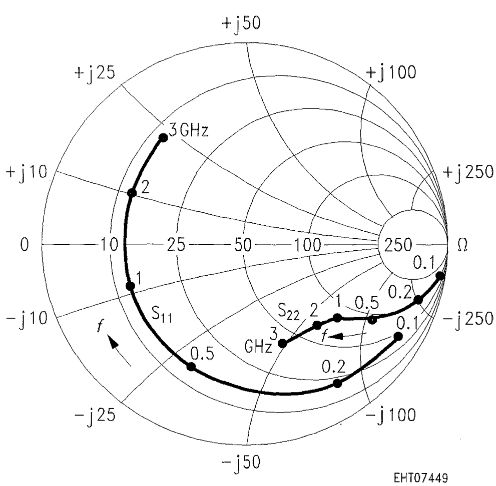
$S_{12}, S_{21} = f(f)$
I_C = 2 mA, V_{CE} = 10 V, Z_0 = 50 Ω



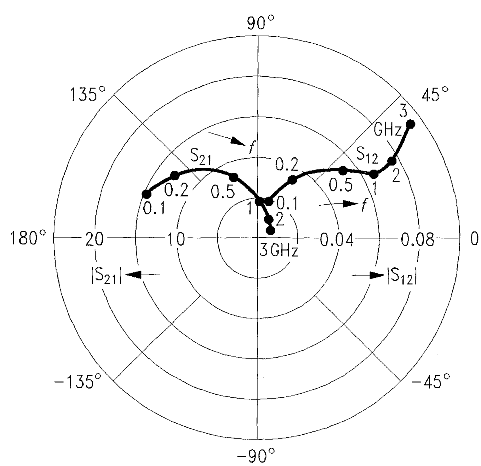
Common Emitter S Parameters (continued)

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								
0.10	0.873	– 30.5	14.61	159.9	0.019	74.1	0.956	– 11.4
0.15	0.844	– 44.7	13.87	150.9	0.027	67.1	0.917	– 16.1
0.20	0.809	– 57.6	12.94	142.7	0.034	61.0	0.871	– 20.2
0.25	0.775	– 69.2	11.99	135.4	0.039	56.0	0.825	– 23.3
0.30	0.742	– 79.1	10.97	129.3	0.044	52.0	0.785	– 25.6
0.40	0.720	– 97.6	9.57	119.8	0.051	44.3	0.714	– 30.0
0.50	0.675	– 113.0	8.27	111.0	0.055	39.7	0.654	– 32.0
0.60	0.647	– 125.3	7.20	104.1	0.058	36.8	0.613	– 33.3
0.70	0.626	– 135.3	6.36	98.3	0.060	35.2	0.584	– 34.3
0.80	0.613	– 143.2	5.65	93.5	0.063	33.9	0.565	– 35.3
0.90	0.621	– 150.4	5.17	89.3	0.065	31.6	0.545	– 36.7
1.00	0.619	– 158.4	4.72	84.6	0.065	30.7	0.526	– 37.5
1.20	0.608	– 171.1	3.98	77.0	0.067	30.6	0.504	– 39.4
1.40	0.615	179.0	3.45	70.5	0.070	30.0	0.490	– 42.0
1.50	0.613	174.7	3.24	67.5	0.071	30.3	0.485	– 43.1
1.60	0.613	170.0	3.06	64.2	0.071	31.2	0.483	– 44.4
1.80	0.617	162.1	2.72	58.1	0.074	32.0	0.480	– 47.0
2.00	0.623	154.9	2.46	52.5	0.077	32.7	0.474	– 49.8
2.50	0.665	140.1	1.96	39.8	0.084	35.9	0.463	– 59.5
3.00	0.679	126.1	1.62	27.1	0.094	37.6	0.472	– 68.2

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



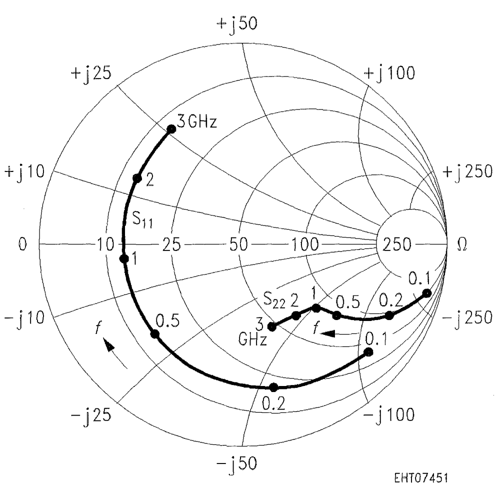
S_{12}, S_{21} = $f(f)$
I_C = 5 mA, V_{CE} = 10 V, Z_0 = 50 Ω



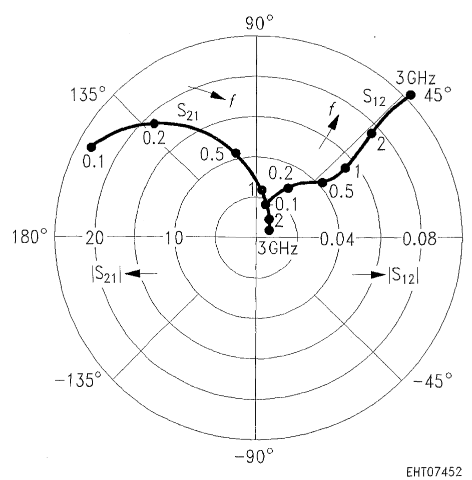
Common Emitter S Parameters (continued)

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								
0.10	0.794	– 43.8	23.34	152.3	0.018	69.0	0.907	– 16.8
0.15	0.750	– 62.4	21.08	141.1	0.024	60.8	0.835	– 22.6
0.20	0.707	– 78.1	18.73	132.0	0.029	55.0	0.764	– 26.8
0.25	0.670	– 91.2	16.61	124.5	0.032	50.9	0.703	– 29.4
0.30	0.637	– 101.2	14.65	118.7	0.035	48.3	0.657	– 31.0
0.40	0.640	– 120.1	12.26	110.1	0.039	41.9	0.579	– 34.5
0.50	0.606	– 134.5	10.22	102.3	0.042	40.5	0.526	– 34.8
0.60	0.586	– 145.2	8.70	96.4	0.044	40.2	0.493	– 34.9
0.70	0.574	– 153.6	7.56	91.5	0.046	40.8	0.472	– 35.0
0.80	0.567	– 159.5	6.66	87.7	0.050	40.8	0.461	– 35.8
0.90	0.584	– 165.2	6.05	84.1	0.052	39.3	0.445	– 37.2
1.00	0.585	– 172.2	5.48	80.1	0.053	40.0	0.430	– 37.7
1.20	0.583	177.3	4.58	73.5	0.057	41.9	0.415	– 39.1
1.40	0.594	168.9	3.97	67.8	0.062	41.8	0.405	– 41.7
1.50	0.594	165.3	3.72	65.0	0.064	42.6	0.402	– 42.7
1.60	0.594	161.1	3.50	62.1	0.066	43.6	0.401	– 44.0
1.80	0.598	154.4	3.11	56.4	0.072	44.3	0.401	– 46.7
2.00	0.607	148.0	2.80	51.3	0.076	44.5	0.397	– 49.7
2.50	0.652	135.2	2.23	39.7	0.089	45.0	0.387	– 59.7
3.00	0.665	122.4	1.85	27.7	0.103	44.2	0.396	– 68.7

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



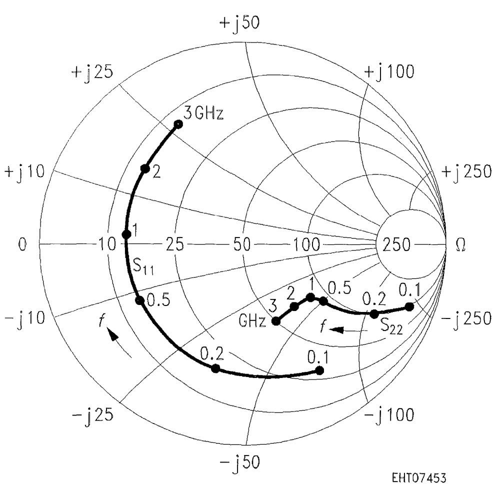
S_{12}, S_{21} = f (f)
I_C = 10 mA, V_{CE} = 10 V, Z_0 = 50 Ω



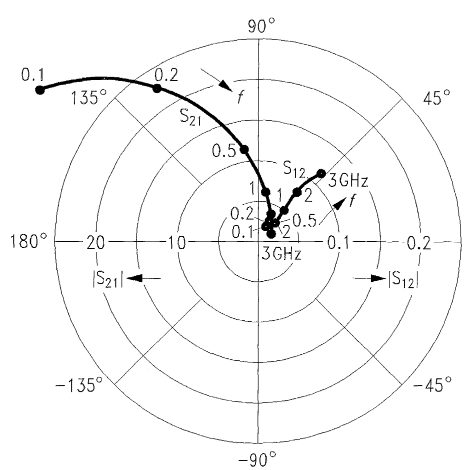
Common Emitter S Parameters (continued)

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								
0.10	0.707	– 61.6	31.92	142.9	0.016	63.1	0.830	– 22.1
0.15	0.658	– 84.0	26.93	130.5	0.020	55.1	0.728	– 27.6
0.20	0.619	– 101.2	22.66	121.3	0.023	50.7	0.646	– 30.4
0.25	0.592	– 113.9	19.30	114.4	0.025	48.6	0.587	– 31.6
0.30	0.570	– 122.7	16.56	109.6	0.028	47.9	0.549	– 31.8
0.40	0.597	– 139.7	13.46	102.1	0.030	43.4	0.480	– 34.0
0.50	0.572	– 152.0	10.96	95.4	0.033	45.3	0.442	– 32.5
0.60	0.562	– 160.7	9.22	90.5	0.036	47.1	0.423	– 32.0
0.70	0.553	– 167.1	7.95	86.5	0.039	48.9	0.413	– 31.9
0.80	0.549	– 171.5	6.97	83.2	0.043	49.0	0.408	– 32.9
0.90	0.570	– 176.2	6.31	80.0	0.045	47.7	0.394	– 34.3
1.00	0.575	178.1	5.70	76.3	0.047	49.3	0.384	– 34.6
1.20	0.575	169.2	4.75	70.4	0.053	51.4	0.376	– 36.2
1.40	0.591	162.1	4.11	65.2	0.059	50.9	0.369	– 39.2
1.50	0.590	158.8	3.84	62.6	0.061	51.6	0.368	– 40.3
1.60	0.591	155.2	3.61	59.7	0.065	52.2	0.368	– 41.7
1.80	0.596	149.1	3.21	54.4	0.071	52.0	0.370	– 44.7
2.00	0.604	143.7	2.88	49.5	0.077	51.5	0.368	– 47.8
2.50	0.649	132.2	2.29	38.3	0.092	50.4	0.358	– 58.5
3.00	0.665	120.1	1.89	26.5	0.107	47.8	0.369	– 67.8

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

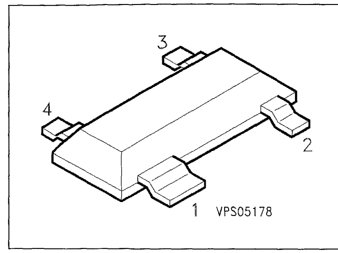


SIEMENS

NPN Silicon RF Transistor

BFP 93 A

- For broadband amplifiers and oscillators up to 2 GHz at collector currents from 5 mA to 30 mA.



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	
BFP 93 A	FE	Q62702-F1144	C	E	B	E	SOT-143

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CEO}	12	V
Collector-base voltage	V_{CBO}	15	
Emitter-base voltage	V_{EBO}	2	
Collector current	I_C	50	mA
Base current	I_B	6	
Total power dissipation, $T_S \leq 78$ ˚C[3]	P_{tot}	300	mW
Junction temperature	T_j	150	˚C
Ambient temperature range	T_A	– 65 ... + 150	
Storage temperature range	T_{stg}	– 65 ... + 150	

Thermal Resistance

Junction - ambient[2]	$R_{th\,JA}$	≤ 320	K/W
Junction - soldering point[3]	$R_{th\,JS}$	≤ 240	

1) For detailed information 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.

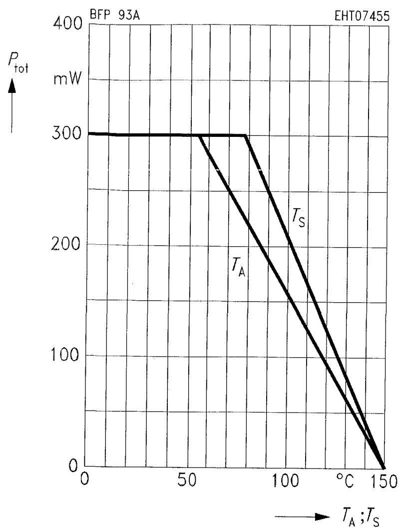
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CEO}$	12	–	–	V
Collector-base cutoff current V_{CB} = 5 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 = 30 mA, V_{CE} = 5 V	h_{FE}	40	90	250	–
Collector-emitter saturation voltage I_C = 50 mA, I_B = 5 mA	V_{CEsat}	–	0.13	0.4	V

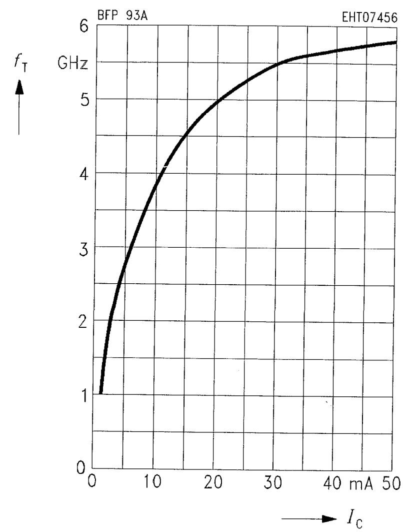
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
AC Characteristics					
Transition frequency I_C = 30 mA, V_{CE} = 5 V, f = 200 MHz	f_T	–	5.5	–	GHz
Collector-base capacitance V_{CB} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{cb}	–	0.47	–	pF
Collector-emitter capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{ce}	–	0.34	–	
Input capacitance V_{EB} = 0.5 V, I_C = i_c = 0, f = 1 MHz	C_{ibo}	–	2.2	–	
Output capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{obs}	–	0.8	–	
Noise figure I_C = 5 mA, V_{CE} = 8 V, f = 10 MHz, Z_S = 50 Ω I_C = 5 mA, V_{CE} = 8 V, f = 800 MHz, Z_S = Z_{Sopt} I_C = 30 mA, V_{CE} = 8 V, f = 800 MHz, Z_S = Z_{Sopt}	F	 – – –	 1.1 1.7 2.6	 – – –	dB
Power gain I_C = 30 mA, V_{CE} = 8 V, f = 800 MHz, Z_S = Z_{Sopt}, Z_L = Z_{Lopt}	G_{pe}	–	16.5	–	
Transducer gain I_C = 30 mA, V_{CE} = 8 V, f = 1 GHz, Z_0 = 50 Ω	$\|S_{21e}\|^2$	–	13.4	–	
Linear output voltage two-tone intermodulation test I_C = 30 mA, V_{CE} = 8 V, d_{IM} = 60 dB f_1 = 806 MHz, f_2 = 810 MHz, Z_S = Z_L = 50 Ω	$V_{o1} = V_{o2}$	–	280	–	mV
Third order intercept point I_C = 30 mA, V_{CE} = 8 V, f = 800 MHz	IP_3	–	32	–	dBm

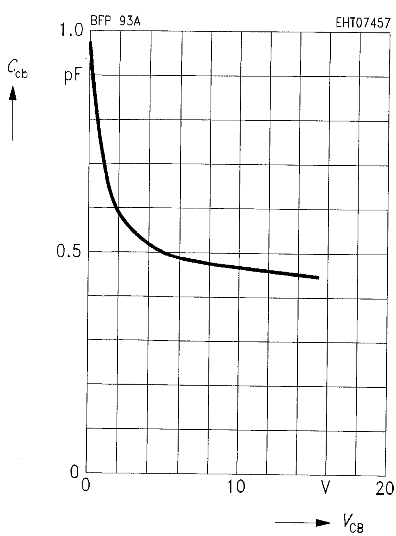
Total power dissipation $P_{tot} = f(T_A{}^*; T_S)$
*Package mounted on alumina



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



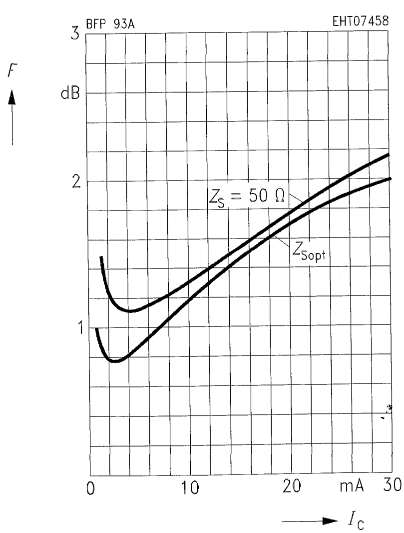
Collector-base capacitance $C_{cb} = f(V_{CB})$
$V_{BE} = v_{be} = 0$, f = 1 MHz



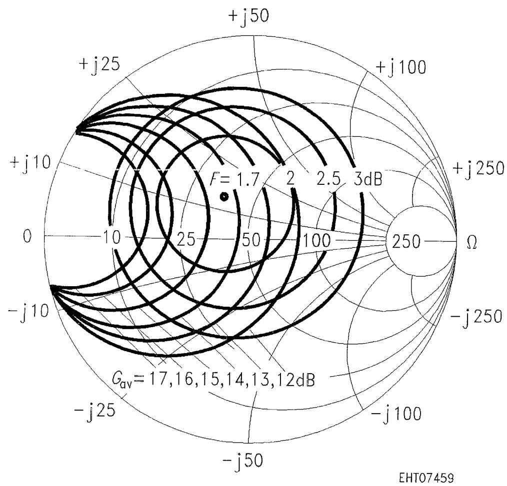
Common Emitter Noise Parameters

f	F_{min}	G_p (F_{min})	Γ_{opt}		R_N	N	$F_{50\,\Omega}$	G_p ($F_{50\,\Omega}$)
GHz	dB	dB	MAG	ANG	Ω	–	dB	dB
I_C = 5 mA, V_{CE} = 8 V, Z_0 = 50 Ω								
0.01	0.8	–	(Z_S = 150 Ω)		–	–	1.1	–
0.8	1.7	13.5	0.26	124	8.3	0.199	1.8	13
I_C = 30 mA, V_{CE} = 8 V, Z_0 = 50 Ω								
0.01	2.0	–	(Z_S = 100 Ω)		–	–	2.15	–
0.8	2.6	15.5	0.2	156	10.9	0.31	2.85	15

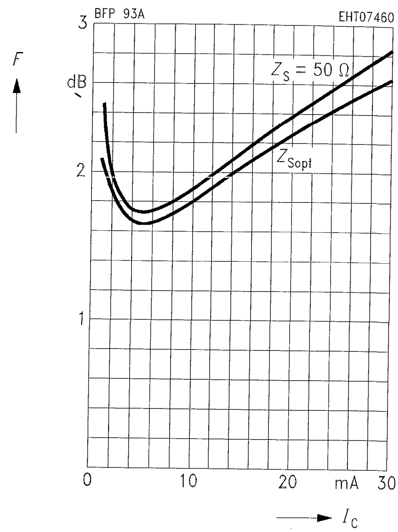
Noise figure $F = f\,(I_C)$
V_{CE} = 8 V, f = 10 MHz



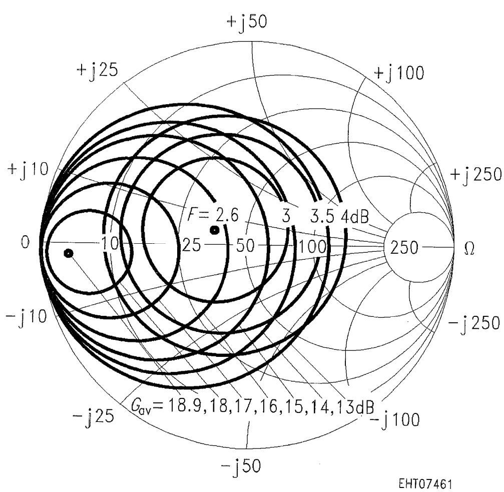
Circles of constant noise figure $F = f(Z_S)$ and available power gain $G_{av} = f(Z_S)$
I_C = 5 mA, V_{CE} = 8 V, f = 800 MHz



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

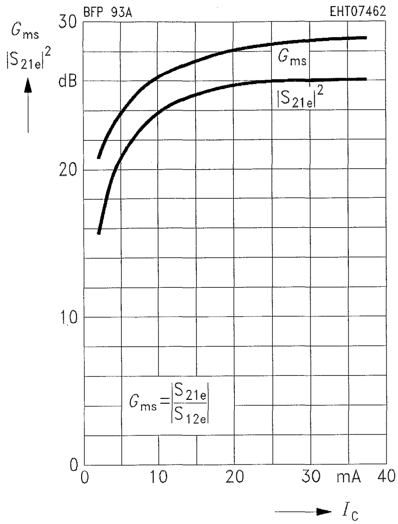


Circles of constant noise figure $F = f(Z_S)$ and available power gain $G_{av} = f(Z_S)$
I_C = 30 mA, V_{CE} = 8 V, f = 800 MHz

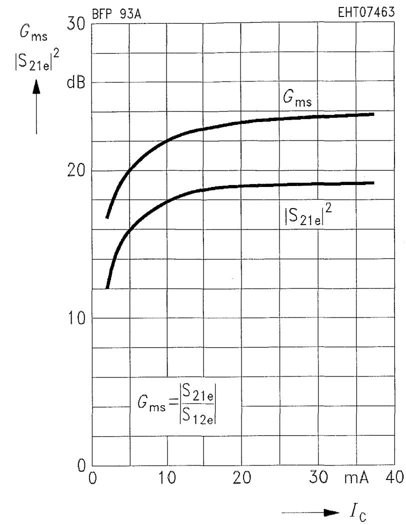


Common Emitter Power Gain

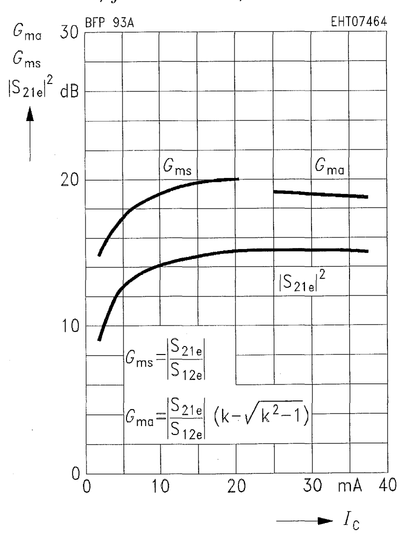
Power gain G_{ms}, $|S_{21e}|^2 = f(I_C)$
V_{CE} = 8 V, f = 200 MHz, Z_0 = 50 Ω



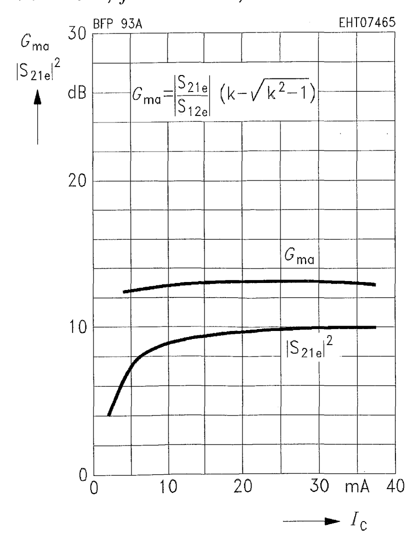
Power gain G_{ms}, $|S_{21e}|^2 = f(I_C)$
V_{CE} = 8 V, f = 500 MHz, Z_0 = 50 Ω



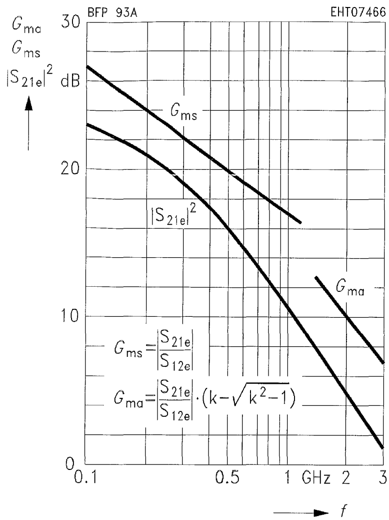
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(I_C)$
V_{CE} = 8 V, f = 800 MHz, Z_0 = 50 Ω



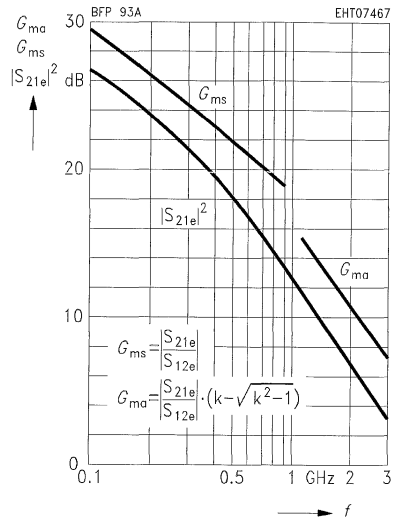
Power gain G_{ma}, $|S_{21e}|^2 = f(I_C)$
V_{CE} = 8 V, f = 1.5 GHz, Z_0 = 50 Ω



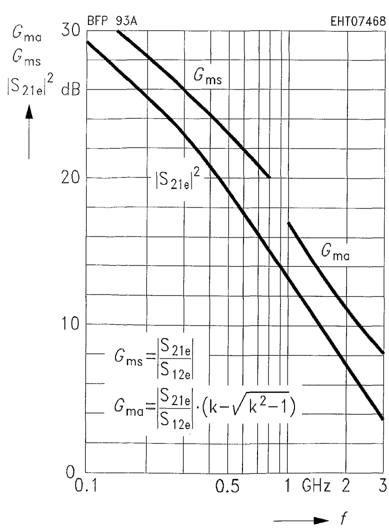
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
I_C = 5 mA, V_{CE} = 8 V, Z_0 = 50 Ω



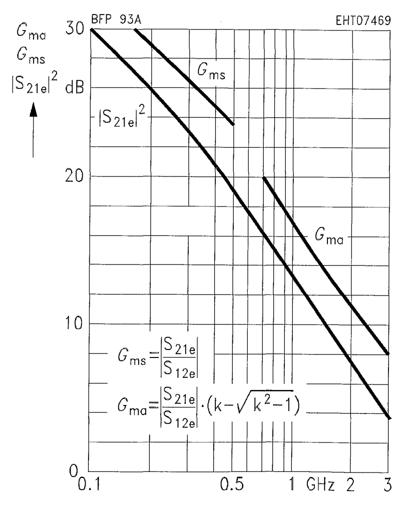
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
I_C = 10 mA, V_{CE} = 8 V, Z_0 = 50 Ω



Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
I_C = 20 mA, V_{CE} = 8 V, Z_0 = 50 Ω



Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
I_C = 30 mA, V_{CE} = 8 V, Z_0 = 50 Ω



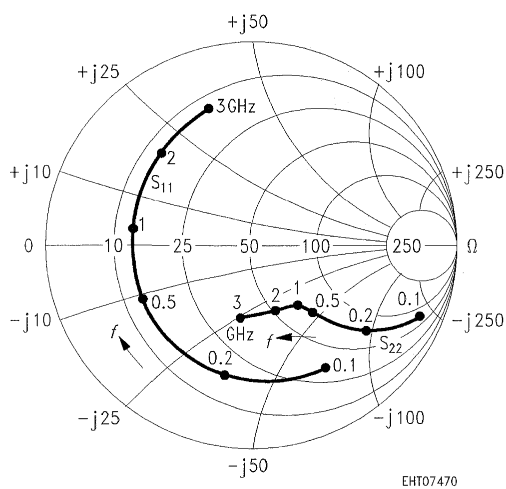
Common Emitter S Parameters

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_C = 10 mA, V_{CE} = 3 V, Z_0 = 50 Ω								
0.10	0.669	– 66.5	21.87	142.0	0.027	61.1	0.820	– 28.4
0.15	0.638	– 89.6	18.34	129.5	0.034	52.6	0.705	– 36.3
0.20	0.619	– 106.6	15.41	120.3	0.039	47.7	0.612	– 41.2
0.25	0.606	– 118.7	13.08	113.8	0.043	44.6	0.546	– 44.3
0.30	0.613	– 127.6	11.38	109.3	0.047	41.5	0.502	– 47.1
0.40	0.636	– 145.7	9.21	100.5	0.050	36.3	0.412	– 51.8
0.50	0.619	– 157.9	7.51	93.5	0.051	37.3	0.359	– 52.1
0.60	0.609	– 166.3	6.31	88.1	0.054	39.0	0.330	– 52.2
0.70	0.602	– 172.9	5.43	83.6	0.059	40.8	0.314	– 52.5
0.80	0.604	– 177.0	4.78	80.1	0.065	40.3	0.308	– 54.1
0.90	0.627	177.4	4.31	76.4	0.066	38.2	0.292	– 57.0
1.00	0.631	171.4	3.89	72.4	0.067	40.3	0.278	– 57.7
1.20	0.632	162.5	3.24	65.9	0.075	43.1	0.268	– 60.6
1.40	0.641	155.3	2.80	60.2	0.082	42.7	0.262	– 65.8
1.50	0.641	151.4	2.62	57.3	0.085	43.8	0.261	– 67.4
1.60	0.647	148.3	2.47	54.2	0.089	44.2	0.264	– 69.6
1.80	0.653	141.4	2.20	48.4	0.097	44.2	0.267	– 73.9
2.00	0.664	136.0	1.97	42.9	0.105	43.9	0.267	– 78.7
2.50	0.708	123.4	1.57	31.1	0.124	42.9	0.275	– 95.3
3.00	0.721	111.6	1.29	18.7	0.144	40.4	0.301	– 107.7
I_C = 30 mA, V_{CE} = 3 V, Z_0 = 50 Ω								
0.10	0.527	– 104.9	32.22	127.4	0.019	55.0	0.636	– 43.7
0.15	0.536	– 126.7	24.42	115.7	0.023	50.7	0.498	– 51.3
0.20	0.543	– 139.7	19.32	108.3	0.027	50.1	0.412	– 55.1
0.25	0.548	– 147.4	15.85	103.6	0.030	49.5	0.362	– 57.4
0.30	0.570	– 152.2	13.55	100.5	0.034	47.2	0.333	– 60.9
0.40	0.616	– 165.9	10.71	93.4	0.035	46.0	0.255	– 67.8
0.50	0.603	– 174.8	8.60	87.8	0.039	51.1	0.214	– 66.9
0.60	0.596	179.3	7.16	83.5	0.044	54.4	0.196	– 66.2
0.70	0.590	175.0	6.14	79.9	0.051	55.8	0.189	– 66.1
0.80	0.592	172.6	5.38	77.1	0.058	53.6	0.190	– 68.6
0.90	0.620	168.4	4.85	73.8	0.059	52.0	0.178	– 74.0
1.00	0.625	163.1	4.37	70.3	0.062	54.6	0.165	– 74.7
1.20	0.626	155.9	3.62	64.6	0.074	55.7	0.161	– 77.8
1.40	0.637	149.7	3.13	59.5	0.083	53.7	0.160	– 84.9
1.50	0.637	146.3	2.93	56.7	0.088	54.2	0.160	– 86.3
1.60	0.645	143.4	2.75	54.0	0.093	53.9	0.164	– 88.3
1.80	0.647	137.3	2.45	48.5	0.103	52.4	0.170	– 92.6
2.00	0.658	132.7	2.19	43.4	0.112	50.6	0.174	– 98.0
2.50	0.706	121.1	1.75	32.3	0.134	47.0	0.193	– 116.0
3.00	0.717	109.8	1.44	20.5	0.155	42.5	0.222	– 126.6

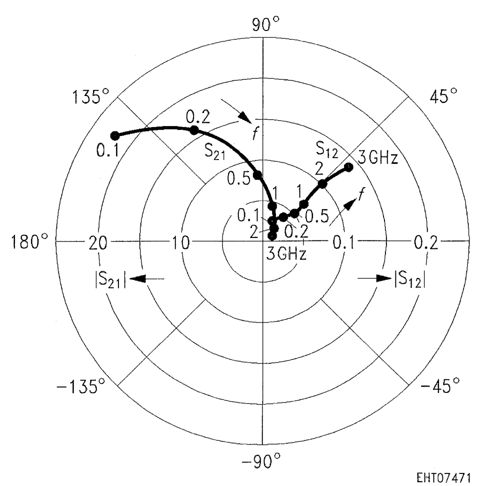
Common Emitter S Parameters (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_C = 10 mA, V_{CE} = 5 V, Z_0 = 50 Ω								
0.10	0.686	– 62.1	21.91	143.6	0.025	62.5	0.838	– 25.8
0.15	0.649	– 84.6	18.59	131.2	0.032	54.0	0.730	– 33.1
0.20	0.624	– 101.6	15.74	121.9	0.037	49.1	0.641	– 37.6
0.25	0.606	– 113.9	13.44	115.3	0.041	45.7	0.577	– 40.4
0.30	0.611	– 123.2	11.73	110.7	0.045	42.6	0.533	– 43.0
0.40	0.628	– 142.1	9.54	101.8	0.048	37.3	0.443	– 47.1
0.50	0.608	– 154.7	7.80	94.6	0.050	37.9	0.390	– 47.2
0.60	0.597	– 163.6	6.56	89.2	0.053	39.5	0.362	– 47.1
0.70	0.588	– 170.5	5.65	84.6	0.057	41.1	0.346	– 47.2
0.80	0.591	– 174.8	4.97	81.0	0.063	40.7	0.339	– 48.7
0.90	0.614	179.4	4.50	77.3	0.064	38.7	0.322	– 51.3
1.00	0.617	173.0	4.06	73.3	0.065	40.6	0.308	– 51.7
1.20	0.618	163.9	3.38	66.8	0.072	43.4	0.298	– 54.3
1.40	0.627	156.4	2.92	61.0	0.079	43.1	0.291	– 59.0
1.50	0.628	152.4	2.73	58.1	0.082	44.3	0.290	– 60.6
1.60	0.635	149.4	2.57	55.1	0.086	44.7	0.292	– 62.6
1.80	0.638	142.4	2.29	49.3	0.094	44.9	0.294	– 66.8
2.00	0.650	136.8	2.06	43.7	0.100	44.6	0.294	– 71.2
2.50	0.698	124.2	1.63	31.8	0.120	43.8	0.295	– 86.9
3.00	0.710	112.0	1.35	19.4	0.139	41.6	0.317	– 99.3

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



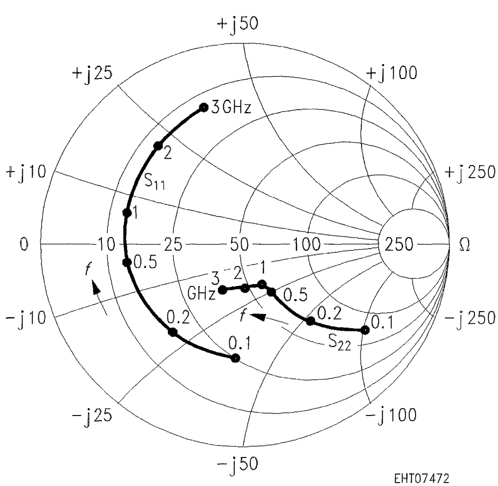
$S_{12}, S_{21} = f(f)$
I_C = 10 mA, V_{CE} = 5 V, Z_0 = 50 Ω



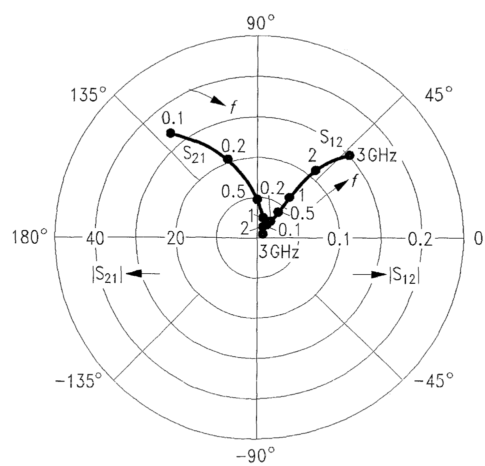
Common Emitter S Parameters (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**
I_C = 30 mA, V_{CE} = 5 V, Z_0 = 50 Ω								
0.10	0.544	– 95.7	32.88	129.4	0.019	56.3	0.667	– 39.4
0.15	0.536	– 118.5	25.24	117.5	0.023	51.3	0.532	– 46.3
0.20	0.533	– 132.7	20.09	109.9	0.026	50.3	0.445	– 49.4
0.25	0.534	– 141.3	16.54	105.0	0.030	49.7	0.394	– 51.3
0.30	0.554	– 147.0	14.17	101.8	0.033	47.3	0.363	– 54.1
0.40	0.596	– 162.1	11.25	94.5	0.035	45.8	0.283	– 59.1
0.50	0.581	– 171.7	9.04	88.7	0.038	50.4	0.242	– 57.3
0.60	0.573	– 178.1	7.53	84.3	0.043	53.7	0.225	– 56.1
0.70	0.566	177.2	6.45	80.7	0.050	55.2	0.218	– 55.7
0.80	0.570	174.8	5.66	77.8	0.057	53.3	0.218	– 58.2
0.90	0.598	170.2	5.11	74.5	0.058	51.7	0.203	– 62.4
1.00	0.603	164.8	4.61	71.0	0.061	54.1	0.191	– 62.4
1.20	0.603	157.3	3.82	65.2	0.072	55.4	0.186	– 64.9
1.40	0.615	151.0	3.30	60.2	0.081	53.5	0.182	– 71.1
1.50	0.616	147.4	3.08	57.4	0.085	54.1	0.182	– 72.4
1.60	0.622	144.6	2.90	54.7	0.090	53.8	0.185	– 74.6
1.80	0.625	138.5	2.58	49.3	0.100	52.3	0.190	– 79.0
2.00	0.640	133.5	2.31	44.1	0.109	50.8	0.191	– 84.1
2.50	0.687	121.8	1.84	32.9	0.130	47.3	0.200	– 102.2
3.00	0.700	110.4	1.52	21.1	0.150	43.0	0.225	– 113.9

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



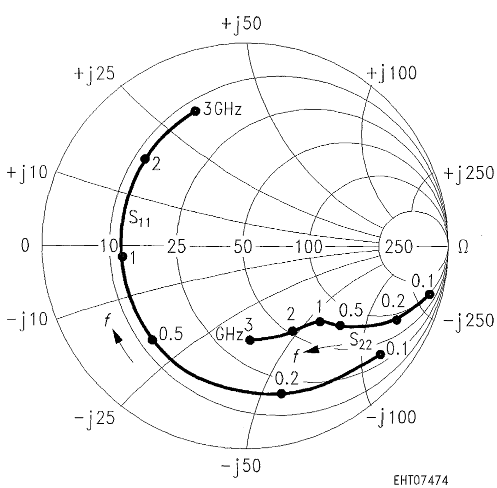
$S_{12}, S_{21} = f(f)$
I_C = 30 mA, V_{CE} = 5 V, Z_0 = 50 Ω



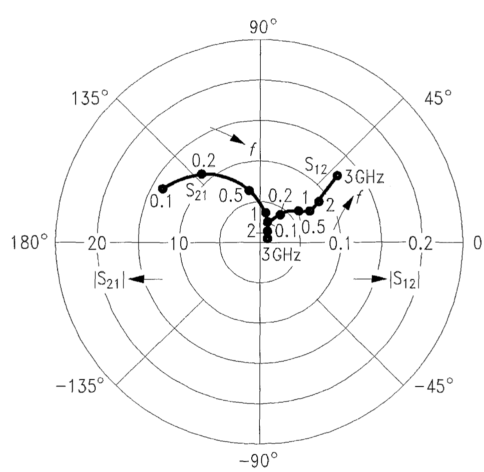
Common Emitter S Parameters (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_C = 5 mA, V_{CE} = 8 V, Z_0 = 50 Ω								
0.10	0.811	– 43.1	13.94	152.9	0.027	68.3	0.922	– 16.4
0.15	0.771	– 61.5	12.68	141.8	0.037	59.7	0.856	– 22.3
0.20	0.735	– 77.3	11.34	132.5	0.045	53.4	0.789	– 26.7
0.25	0.703	– 90.2	10.09	125.2	0.051	48.5	0.733	– 29.8
0.30	0.691	– 100.7	9.03	119.6	0.056	44.2	0.689	– 32.3
0.40	0.679	– 121.1	7.58	109.4	0.061	36.6	0.605	– 36.2
0.50	0.649	– 135.9	6.35	101.0	0.063	33.5	0.550	– 37.4
0.60	0.631	– 147.1	5.41	94.5	0.066	32.2	0.515	– 38.3
0.70	0.618	– 156.0	4.71	89.0	0.068	32.1	0.494	– 39.2
0.80	0.617	– 162.2	4.17	84.6	0.072	31.4	0.483	– 40.4
0.90	0.633	– 169.4	3.78	80.3	0.073	28.8	0.465	– 42.5
1.00	0.633	– 176.7	3.43	75.8	0.073	29.4	0.451	– 43.4
1.20	0.631	172.4	2.86	68.3	0.076	31.4	0.438	– 46.3
1.40	0.636	163.5	2.48	61.9	0.080	31.6	0.428	– 50.5
1.50	0.637	159.0	2.32	58.6	0.081	32.9	0.426	– 52.2
1.60	0.644	155.4	2.19	55.4	0.083	33.9	0.427	– 54.3
1.80	0.647	147.7	1.95	49.1	0.088	35.3	0.428	– 58.3
2.00	0.658	141.2	1.75	43.2	0.092	36.5	0.426	– 62.5
2.50	0.704	127.1	1.39	30.3	0.106	39.5	0.423	– 76.8
3.00	0.720	114.2	1.14	17.6	0.123	40.2	0.442	– 89.3

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



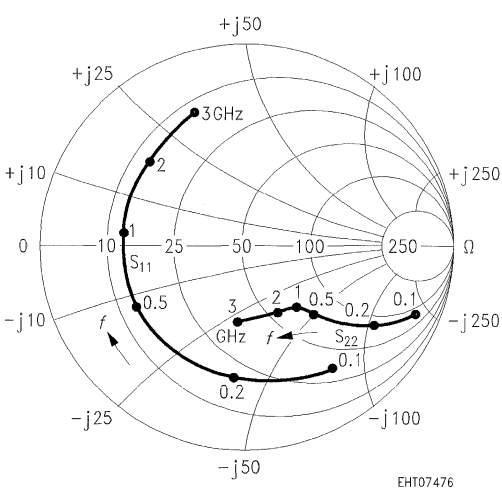
S_{12}, $S_{21} = f(f)$
I_C = 5 mA, V_{CE} = 8 V, Z_0 = 50 Ω



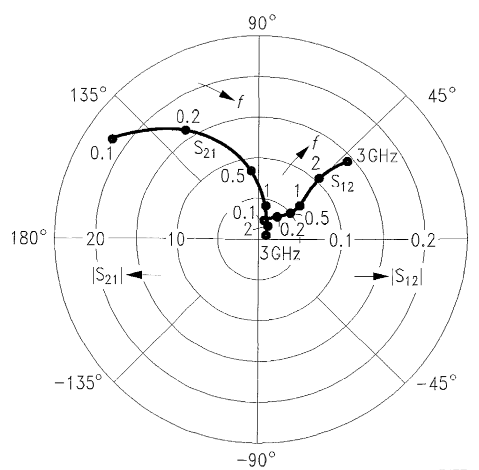
Common Emitter S Parameters (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_C = 10 mA, V_{CE} = 8 V, Z_0 = 50 Ω								
0.10	0.709	– 58.1	21.68	145.0	0.024	63.4	0.853	– 23.8
0.15	0.668	– 80.0	18.62	132.6	0.031	54.8	0.750	– 30.9
0.20	0.635	– 97.3	15.93	123.3	0.036	49.6	0.662	– 35.3
0.25	0.605	– 110.8	13.65	116.0	0.040	46.4	0.593	– 37.8
0.30	0.584	– 120.3	11.81	110.6	0.043	44.7	0.546	– 39.0
0.40	0.612	– 137.3	9.62	102.9	0.047	38.7	0.471	– 43.1
0.50	0.588	– 150.5	7.90	95.5	0.050	39.4	0.418	– 43.1
0.60	0.574	– 159.8	6.66	90.0	0.053	40.6	0.390	– 43.0
0.70	0.566	– 167.3	5.74	85.4	0.057	42.0	0.374	– 43.3
0.80	0.566	– 171.8	5.06	81.8	0.062	41.7	0.368	– 44.8
0.90	0.593	– 177.7	4.58	78.0	0.063	39.9	0.349	– 46.8
1.00	0.591	175.9	4.13	73.9	0.065	41.7	0.336	– 47.3
1.20	0.594	166.9	3.44	67.5	0.072	44.0	0.324	– 49.6
1.40	0.601	159.3	2.98	61.7	0.079	43.9	0.315	– 54.0
1.50	0.602	155.3	2.79	58.8	0.082	44.7	0.314	– 55.7
1.60	0.605	151.8	2.62	55.7	0.086	45.3	0.315	– 57.7
1.80	0.614	145.1	2.33	49.9	0.094	45.5	0.316	– 61.7
2.00	0.626	139.4	2.09	44.5	0.100	45.3	0.314	– 66.1
2.50	0.675	126.7	1.67	32.2	0.120	44.6	0.310	– 81.5
3.00	0.690	114.1	1.38	20.3	0.139	42.3	0.327	– 94.0

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



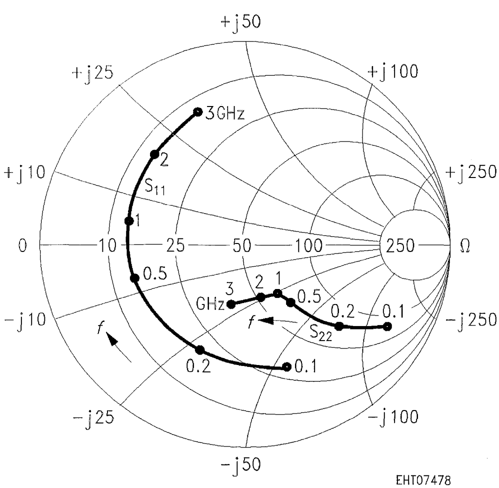
S_{12}, S_{21} = f (f)
I_C = 10 mA, V_{CE} = 8 V, Z_0 = 50 Ω



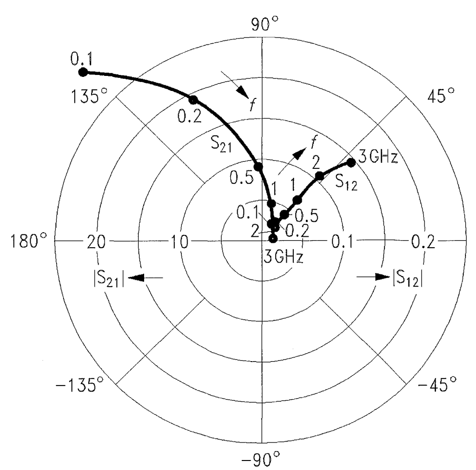
Common Emitter S Parameters (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_C = 20 mA, V_{CE} = 8 V, Z_0 = 50 Ω								
0.10	0.617	– 76.1	29.26	136.3	0.021	59.2	0.755	– 32.3
0.15	0.582	– 99.6	23.50	123.8	0.026	52.2	0.627	– 39.6
0.20	0.560	– 115.8	19.20	115.3	0.030	49.3	0.536	– 43.3
0.25	0.550	– 126.6	16.03	109.6	0.034	47.9	0.478	– 45.4
0.30	0.562	– 134.2	13.84	105.9	0.037	45.2	0.440	– 47.9
0.40	0.591	– 151.9	11.11	97.8	0.039	41.9	0.353	– 52.1
0.50	0.571	– 163.2	8.99	91.4	0.042	45.4	0.307	– 50.8
0.60	0.562	– 170.8	7.51	86.6	0.046	48.1	0.286	– 49.9
0.70	0.553	– 176.6	6.44	82.6	0.051	50.0	0.275	– 49.7
0.80	0.557	– 179.8	5.66	79.5	0.058	48.8	0.272	– 51.5
0.90	0.583	175.0	5.12	76.0	0.059	47.0	0.255	– 54.6
1.00	0.588	169.0	4.61	72.3	0.062	49.4	0.243	– 54.6
1.20	0.587	160.6	3.83	66.3	0.071	51.3	0.235	– 56.8
1.40	0.601	153.8	3.31	61.1	0.080	49.9	0.229	– 61.9
1.50	0.600	150.0	3.09	58.2	0.083	50.8	0.228	– 63.2
1.60	0.605	147.0	2.91	55.4	0.088	50.7	0.230	– 65.2
1.80	0.610	140.5	2.59	49.9	0.097	49.7	0.233	– 69.3
2.00	0.623	135.3	2.32	44.6	0.105	48.5	0.232	– 74.0
2.50	0.674	123.1	1.85	33.3	0.126	46.0	0.234	– 90.4
3.00	0.688	111.5	1.53	21.3	0.145	42.3	0.255	– 102.7

S_{11}, S_{22} = *f* (*f*)
I_C = 20 mA, V_{CE} = 8 V, Z_0 = 50 Ω



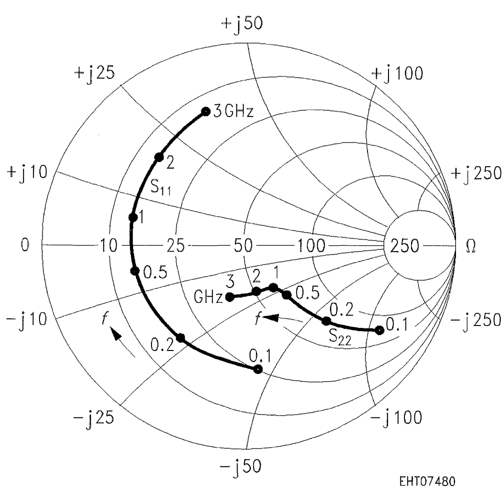
S_{12}, S_{21} = *f* (*f*)
I_C = 20 mA, V_{CE} = 8 V, Z_0 = 50 Ω



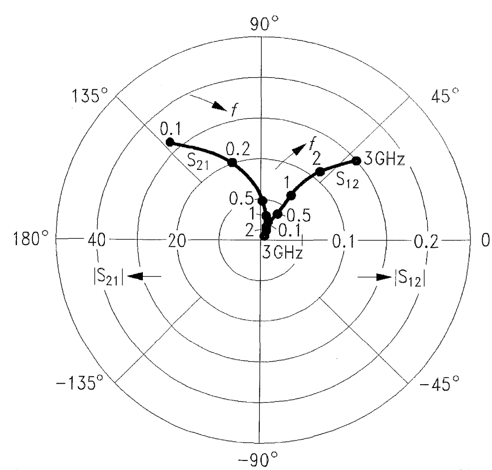
Common Emitter S Parameters (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_C = 30 mA, V_{CE} = 8 V, Z_0 = 50 Ω								
0.10	0.578	– 86.6	32.52	131.3	0.019	56.9	0.693	– 36.4
0.15	0.548	– 110.0	25.24	119.2	0.024	51.6	0.561	– 43.0
0.20	0.533	– 125.2	20.22	111.3	0.027	50.1	0.473	– 45.9
0.25	0.528	– 134.6	16.71	106.2	0.031	49.3	0.422	– 47.5
0.30	0.545	– 141.3	14.35	103.0	0.034	47.0	0.389	– 50.1
0.40	0.579	– 157.7	11.43	95.4	0.035	45.1	0.307	– 54.0
0.50	0.561	– 168.2	9.19	89.4	0.039	49.5	0.267	– 52.0
0.60	0.552	– 174.9	7.66	84.9	0.044	52.5	0.250	– 50.7
0.70	0.543	– 180.0	6.56	81.2	0.050	53.9	0.243	– 50.3
0.80	0.548	177.4	5.76	78.4	0.057	52.2	0.242	– 52.6
0.90	0.576	172.4	5.21	75.0	0.058	50.5	0.226	– 56.0
1.00	0.580	166.7	4.69	71.4	0.061	53.1	0.214	– 55.8
1.20	0.580	158.9	3.89	65.6	0.072	54.3	0.208	– 58.1
1.40	0.592	152.3	3.36	60.4	0.081	52.6	0.203	– 63.7
1.50	0.595	148.6	3.14	57.7	0.085	53.0	0.202	– 65.0
1.60	0.601	145.8	2.96	54.9	0.090	52.7	0.205	– 67.0
1.80	0.605	139.6	2.63	49.5	0.099	51.3	0.209	– 71.4
2.00	0.619	134.5	2.36	44.3	0.108	49.9	0.209	– 76.2
2.50	0.669	122.7	1.88	33.1	0.128	46.6	0.212	– 93.5
3.00	0.684	111.0	1.55	21.1	0.148	42.4	0.235	– 105.7

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



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



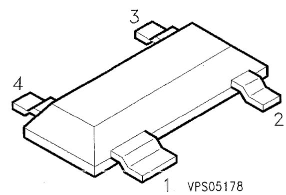
SIEMENS

NPN Silicon RF Transistor

BFP 180

Preliminary Data

- For low-power amplifiers in mobile communication systems (pager) at collector currents from 0.2 mA to 2.5 mA.
- f_T = 6 GHz
  F = 2.1 dB at 900 MHz



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)]
BFP 180	RDs	Q62702-F1297	C	E	B	E	SOT-143

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CEO}	8	V
Collector-emitter voltage, $V_{BE} = 0$	V_{CES}	10	
Collector-base voltage	V_{CBO}	10	
Emitter-base voltage	V_{EBO}	2	
Collector current	I_C	4	mA
Peak collector current, $f \geq 10$ MHz	I_{CM}	5	
Base current	I_B	0.5	
Peak base current, $f \geq 10$ MHz	I_{BM}	0.75	
Total power dissipation, $T_S \leq 127$ ˚C[3)]	P_{tot}	30	mW
Junction temperature	T_j	150	˚C
Ambient temperature range	T_A	– 65 … + 150	
Storage temperature range	T_{stg}	– 65 … + 150	

Thermal Resistance

Parameter	Symbol	Values	Unit
Junction - ambient[2)]	$R_{th\,JA}$	≤ 855	K/W
Junction - soldering point[3)]	$R_{th\,JS}$	≤ 775	

1) For detailed information 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	$V_{(BR)CE0}$	8	–	–	V
Collector-emitter cutoff current V_{CE} = 10 V, V_{BE} = 0	I_{CES}	–	–	100	µA
Collector-base cutoff current V_{CB} = 8 V, I_E = 0	I_{CB0}	–	–	100	nA
Emitter-base cutoff current V_{EB} = 1 V, I_C = 0	I_{EB0}	–	–	2	µA
DC current gain I_C = 0.25 mA, V_{CE} = 1 V I_C = 1 mA, V_{CE} = 1 V	h_{FE}	 30 30	 90 100	 200 –	–
Collector-emitter saturation voltage I_C = 3 mA, I_B = 0.3 mA	V_{CEsat}	–	0.1	0.4	V

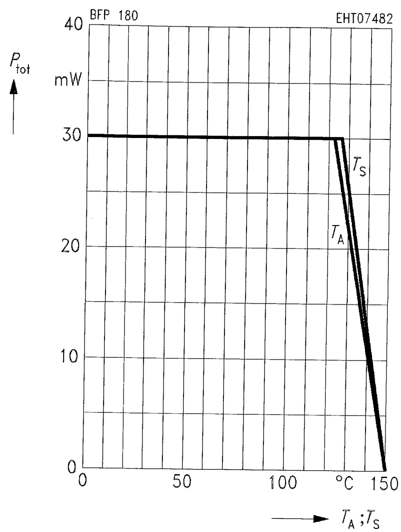
Electrical Characteristics

at T_A = 25 °C, unless otherwise specified.

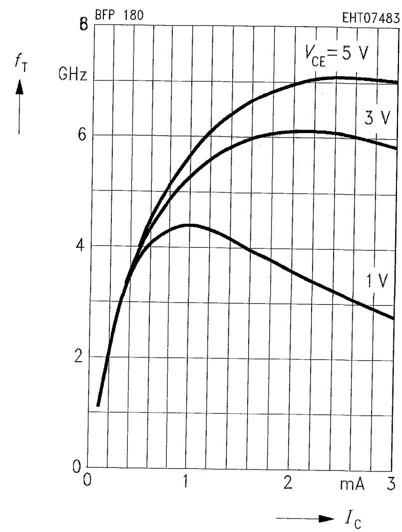
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
AC Characteristics					
Transition frequency I_C = 1 mA, V_{CE} = 1 V, f = 500 MHz I_C = 2 mA, V_{CE} = 3 V, f = 500 MHz	f_T	 – –	 4.4 6.2	 – –	GHz
Collector-base capacitance V_{CB} = 1 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{cb}	–	0.17	–	pF
Collector-emitter capacitance V_{CE} = 1 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{ce}	–	0.22	–	
Input capacitance V_{EB} = 0.5 V, I_C = i_c = 0, f = 1 MHz	C_{ibo}	–	0.25	–	
Output capacitance V_{CE} = 1 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{obs}	–	0.4	–	
Noise figure I_C = 1 mA, V_{CE} = 1 V, f = 900 MHz, Z_S = Z_{Sopt}	F	 –	 2.1	 –	dB
Power gain I_C = 1 mA, V_{CE} = 1 V, f = 900 MHz, Z_0 = 50 Ω I_C = 2 mA, V_{CE} = 3 V, f = 900 MHz, Z_0 = 50 Ω	G_{ms} [1]	 – –	 14 16.5	 – –	
Transducer gain I_C = 2 mA, V_{CE} = 3 V, f = 450 MHz, Z_0 = 50 Ω	$\lvert S_{21e} \rvert^2$	–	13	–	

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

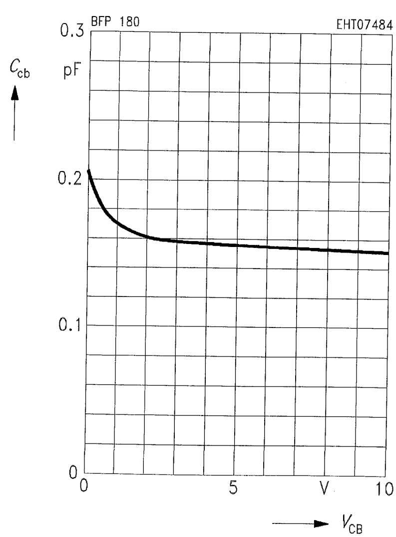
Total power dissipation $P_{tot} = f(T_A^*; T_S)$
*Package mounted on alumina



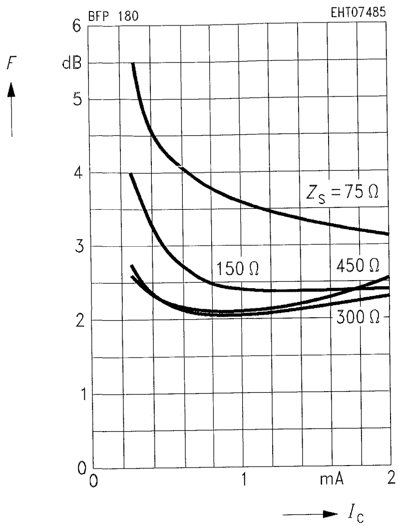
Transition frequency $f_T = f(I_C)$
f = 500 MHz



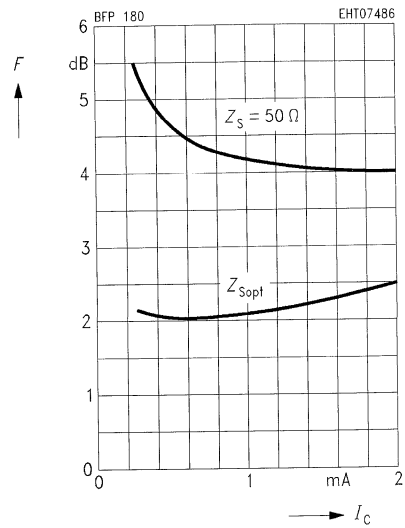
Collector-base capacitance $C_{cb} = f(V_{CB})$
$V_{BE} = v_{be} = 0$, f = 1 MHz



Noise figure $F = f(I_C)$
V_{CE} = 1 V, f = 10 MHz



Noise figure $F = f(I_C)$
V_{CE} = 1 V, f = 900 MHz, Z_{Lopt} (G)



Common Emitter S Parameters

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**
I_C = 0.5 mA, V_{CE} = 1 V, Z_0 = 50 Ω								
0.10	0.970	– 3.4	1.64	175.7	0.011	87.7	0.997	– 2.2
0.20	0.969	– 6.7	1.65	171.3	0.022	85.0	0.996	– 4.3
0.30	0.962	– 10.0	1.65	167.0	0.034	82.3	0.993	– 6.4
0.40	0.955	– 13.3	1.65	162.4	0.045	79.9	0.989	– 8.5
0.50	0.945	– 16.6	1.64	157.8	0.055	77.4	0.983	– 10.6
0.60	0.935	– 19.9	1.63	153.8	0.066	74.9	0.979	– 12.6
0.70	0.922	– 23.1	1.62	149.3	0.077	72.5	0.972	– 14.7
0.80	0.916	– 26.3	1.61	144.9	0.087	70.1	0.964	– 16.7
0.90	0.892	– 29.5	1.60	140.6	0.097	67.6	0.957	– 18.7
0.95	0.883	– 31.0	1.60	138.6	0.101	66.5	0.952	– 19.7
1.00	0.874	– 32.6	1.58	136.6	0.106	65.4	0.949	– 20.7
1.20	0.835	– 38.6	1.55	128.2	0.124	60.8	0.931	– 24.5
1.40	0.793	– 44.6	1.52	120.3	0.140	56.5	0.911	– 28.1
1.60	0.756	– 50.3	1.44	113.0	0.155	52.2	0.895	– 31.5
1.70	0.733	– 53.3	1.46	109.1	0.162	50.2	0.882	– 33.3
1.75	0.720	– 54.5	1.45	107.0	0.166	49.4	0.878	– 34.1
1.80	0.711	– 55.9	1.43	105.3	0.169	48.5	0.873	– 34.9
2.00	0.668	– 61.1	1.39	98.4	0.181	44.9	0.854	– 38.1
2.50	0.567	– 73.7	1.31	82.5	0.207	36.6	0.809	– 45.5
3.00	0.471	– 86.3	1.28	67.5	0.227	29.5	0.756	– 52.7
I_C = 0.75 mA, V_{CE} = 1 V, Z_0 = 50 Ω								
0.10	0.957	– 4.1	2.35	175.0	0.011	87.3	0.995	– 2.4
0.20	0.953	– 8.1	2.34	169.9	0.022	84.3	0.993	– 4.8
0.30	0.943	– 12.1	2.31	165.0	0.033	81.3	0.988	– 7.1
0.40	0.931	– 16.1	2.30	159.8	0.044	78.6	0.982	– 9.4
0.50	0.916	– 20.1	2.28	154.7	0.055	75.8	0.975	– 11.7
0.60	0.899	– 23.9	2.26	149.9	0.065	73.0	0.966	– 13.9
0.70	0.880	– 27.6	2.23	145.0	0.075	70.3	0.956	– 16.1
0.80	0.863	– 31.4	2.19	140.2	0.085	67.8	0.945	– 18.2
0.90	0.834	– 34.9	2.16	135.5	0.093	65.2	0.935	– 20.3
0.95	0.822	– 36.7	2.14	133.3	0.098	64.1	0.929	– 21.2
1.00	0.810	– 38.4	2.12	131.2	0.102	62.9	0.923	– 22.2
1.20	0.757	– 45.1	2.03	122.3	0.117	58.3	0.899	– 26.0
1.40	0.703	– 51.3	1.96	114.1	0.131	54.2	0.874	– 29.6
1.60	0.654	– 57.3	1.83	106.4	0.144	50.3	0.854	– 32.7
1.70	0.628	– 60.3	1.82	102.6	0.150	48.4	0.839	– 34.4
1.75	0.612	– 61.6	1.80	100.6	0.153	47.8	0.835	– 35.1
1.80	0.604	– 63.0	1.78	98.9	0.155	46.9	0.829	– 35.8
2.00	0.554	– 68.2	1.70	92.1	0.165	43.9	0.810	– 38.7
2.50	0.443	– 80.2	1.53	76.6	0.187	37.0	0.764	– 45.5
3.00	0.351	– 92.7	1.44	62.6	0.206	31.2	0.717	– 52.2

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 = 1 mA, V_{CE} = 1 V, Z_0 = 50 Ω								
0.10	0.942	– 4.8	2.95	174.2	0.011	87.0	0.994	– 2.6
0.20	0.937	– 9.6	2.93	168.4	0.022	83.5	0.990	– 5.2
0.30	0.923	– 14.2	2.91	162.7	0.033	80.3	0.983	– 7.8
0.40	0.906	– 18.8	2.88	156.8	0.044	77.0	0.974	– 10.3
0.50	0.884	– 23.3	2.83	151.1	0.054	74.1	0.964	– 12.7
0.60	0.861	– 27.6	2.77	145.9	0.064	71.1	0.952	– 15.0
0.70	0.835	– 31.8	2.71	140.5	0.073	68.4	0.938	– 17.1
0.80	0.811	– 35.9	2.64	135.2	0.082	65.7	0.925	– 19.3
0.90	0.776	– 39.7	2.57	130.2	0.090	63.2	0.911	– 21.3
0.95	0.761	– 41.7	2.55	127.9	0.094	62.0	0.904	– 22.3
1.00	0.745	– 43.5	2.51	125.6	0.098	60.9	0.897	– 23.2
1.20	0.682	– 50.3	2.36	116.4	0.111	56.6	0.868	– 26.8
1.40	0.621	– 56.8	2.23	108.1	0.123	52.9	0.841	– 30.1
1.60	0.567	– 62.7	2.07	100.2	0.134	49.4	0.820	– 32.9
1.70	0.538	– 65.6	2.03	96.7	0.139	47.8	0.806	– 34.5
1.75	0.522	– 66.9	1.99	94.7	0.142	47.3	0.802	– 35.1
1.80	0.510	– 68.2	1.97	93.1	0.144	46.6	0.796	– 35.8
2.00	0.461	– 73.3	1.86	86.5	0.154	44.0	0.777	– 38.4
2.50	0.355	– 84.8	1.63	71.5	0.174	38.2	0.737	– 44.7
3.00	0.268	– 96.7	1.49	58.5	0.192	33.4	0.698	– 51.1
I_C = 0.5 mA, V_{CE} = 2.5 V, Z_0 = 50 Ω								
0.10	0.973	– 3.1	1.65	176.0	0.010	88.1	0.997	– 2.0
0.20	0.969	– 6.2	1.65	171.9	0.020	85.4	0.996	– 3.9
0.30	0.967	– 9.3	1.65	167.9	0.030	83.0	0.994	– 5.9
0.40	0.959	– 12.3	1.65	163.7	0.039	80.6	0.991	– 7.9
0.50	0.950	– 15.4	1.64	159.4	0.049	78.3	0.987	– 9.8
0.60	0.942	– 18.5	1.64	155.6	0.058	76.0	0.982	– 11.7
0.70	0.929	– 21.5	1.63	151.4	0.068	73.8	0.977	– 13.6
0.80	0.927	– 24.6	1.62	147.3	0.077	71.4	0.972	– 15.5
0.90	0.903	– 27.4	1.61	143.2	0.085	69.2	0.965	– 17.4
0.95	0.895	– 29.0	1.61	141.3	0.090	68.1	0.961	– 18.3
1.00	0.888	– 30.4	1.60	139.4	0.094	67.1	0.958	– 19.2
1.20	0.853	– 36.2	1.57	131.5	0.110	62.7	0.943	– 22.8
1.40	0.815	– 41.7	1.55	124.0	0.125	58.7	0.926	– 26.4
1.60	0.781	– 47.4	1.47	117.1	0.139	54.6	0.913	– 29.6
1.70	0.758	– 50.1	1.49	113.1	0.146	52.5	0.901	– 31.3
1.75	0.749	– 51.4	1.48	111.1	0.149	51.8	0.897	– 32.1
1.80	0.740	– 52.7	1.47	109.5	0.152	50.9	0.893	– 32.9
2.00	0.699	– 57.7	1.43	102.8	0.164	47.5	0.876	– 35.9
2.50	0.601	– 69.9	1.35	87.2	0.189	39.3	0.835	– 43.2
3.00	0.509	– 82.2	1.33	72.0	0.208	32.2	0.785	– 50.3

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 = 1 mA, V_{CE} = 2.5 V, Z_0 = 50 Ω								
0.10	0.947	– 4.2	2.98	174.8	0.010	87.6	0.995	– 2.4
0.20	0.942	– 8.4	2.96	169.7	0.019	84.3	0.993	– 4.7
0.30	0.932	– 12.5	2.94	164.6	0.029	81.4	0.987	– 7.1
0.40	0.918	– 16.5	2.92	159.4	0.038	78.5	0.981	– 9.4
0.50	0.902	– 20.5	2.89	154.2	0.047	75.7	0.972	– 11.6
0.60	0.883	– 24.3	2.85	149.5	0.056	73.2	0.963	– 13.8
0.70	0.862	– 28.2	2.80	144.5	0.065	70.7	0.952	– 15.8
0.80	0.843	– 31.9	2.74	139.7	0.073	68.1	0.941	– 17.9
0.90	0.813	– 35.4	2.69	135.1	0.080	65.8	0.929	– 19.9
0.95	0.800	– 37.2	2.67	132.9	0.084	64.7	0.923	– 20.8
1.00	0.785	– 38.9	2.62	130.8	0.087	63.6	0.917	– 21.8
1.20	0.731	– 45.3	2.51	122.1	0.101	59.4	0.892	– 25.3
1.40	0.675	– 51.5	2.39	114.0	0.112	55.7	0.867	– 28.7
1.60	0.624	– 57.1	2.22	106.6	0.123	52.2	0.847	– 31.6
1.70	0.597	– 59.8	2.20	103.0	0.128	50.5	0.833	– 33.1
1.75	0.581	– 61.2	2.17	101.0	0.131	50.0	0.828	– 33.8
1.80	0.571	– 62.6	2.14	99.5	0.133	49.2	0.823	– 34.5
2.00	0.523	– 67.2	2.03	92.9	0.142	46.6	0.804	– 37.1
2.50	0.417	– 78.4	1.80	78.2	0.161	40.6	0.762	– 43.5
3.00	0.327	– 89.4	1.67	64.9	0.179	35.7	0.720	– 49.7
I_C = 1 mA, V_{CE} = 5 V, Z_0 = 50 Ω								
0.10	0.951	– 3.9	2.97	175.1	0.009	87.6	0.996	– 2.4
0.20	0.945	– 7.9	2.97	170.2	0.019	84.6	0.993	– 4.6
0.30	0.938	– 11.7	2.95	165.3	0.028	81.9	0.989	– 6.9
0.40	0.925	– 15.6	2.94	160.3	0.037	79.2	0.983	– 9.2
0.50	0.911	– 19.4	2.91	155.3	0.046	76.5	0.974	– 11.4
0.60	0.893	– 23.1	2.86	150.8	0.054	73.9	0.966	– 13.5
0.70	0.873	– 26.6	2.82	146.0	0.063	71.5	0.956	– 15.6
0.80	0.857	– 30.2	2.77	141.4	0.071	69.0	0.946	– 17.6
0.90	0.827	– 33.6	2.72	136.8	0.078	66.7	0.934	– 19.6
0.95	0.816	– 35.3	2.70	134.7	0.082	65.7	0.928	– 20.5
1.00	0.803	– 37.0	2.67	132.6	0.085	64.6	0.922	– 21.5
1.20	0.752	– 43.2	2.56	124.1	0.098	60.5	0.898	– 25.0
1.40	0.699	– 49.1	2.45	116.3	0.110	56.7	0.874	– 28.4
1.60	0.649	– 54.7	2.28	109.0	0.121	53.2	0.855	– 31.4
1.70	0.622	– 57.4	2.26	105.4	0.126	51.5	0.841	– 32.9
1.75	0.608	– 58.6	2.23	103.4	0.129	50.9	0.836	– 33.7
1.80	0.597	– 59.8	2.21	101.8	0.131	50.1	0.832	– 34.4
2.00	0.550	– 64.7	2.10	95.3	0.140	47.4	0.811	– 37.1
2.50	0.444	– 75.4	1.87	80.6	0.160	41.2	0.769	– 43.5
3.00	0.353	– 86.2	1.74	67.1	0.177	36.0	0.724	– 49.7

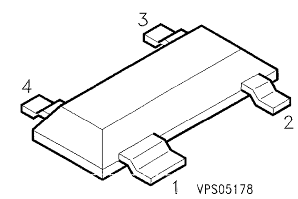
SIEMENS

NPN Silicon RF Transistor

BFP 181

Preliminary Data

- For low-noise, high-gain broadband amplifiers at collector currents from 0.5 mA to 12 mA.
- f_T = 8 GHz
  F = 1.4 dB at 900 MHz



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]
BFP 181	RFs	Q62702-F1317	C	E	B	E	SOT-143

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CEO}	12	V
Collector-emitter voltage, V_{BE} = 0	V_{CES}	20	
Collector-base voltage	V_{CBO}	20	
Emitter-base voltage	V_{EBO}	2	
Collector current	I_C	20	mA
Peak collector current, $f \geq 10$ MHz	I_{CM}	35	
Base current	I_B	2	
Peak base current, $f \geq 10$ MHz	I_{BM}	3	
Total power dissipation, $T_S \leq 92$ ˚C[3]	P_{tot}	175	mW
Junction temperature	T_j	150	˚C
Ambient temperature range	T_A	– 65 … + 150	
Storage temperature range	T_{stg}	– 65 … + 150	

Thermal Resistance

Junction - ambient[2]	$R_{th\,JA}$	≤ 410	K/W
Junction - soldering point[3]	$R_{th\,JS}$	≤ 330	

1) For detailed information 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	$V_{(BR)CEO}$	12	–	–	V
Collector-emitter cutoff current V_{CE} = 20 V, V_{BE} = 0	I_{CES}	–	–	100	µA
Collector-base cutoff current V_{CB} = 10 V, I_E = 0	I_{CBO}	–	–	100	nA
Emitter-base cutoff current V_{EB} = 1 V, I_C = 0	I_{EBO}	–	–	1	µA
DC current gain I_C = 5 mA, V_{CE} = 6 V I_C = 10 mA, V_{CE} = 6 V	h_{FE}	 50 –	 100 100	 250 –	–
Collector-emitter saturation voltage I_C = 15 mA, I_B = 1.5 mA	V_{CEsat}	–	0.1	0.4	V

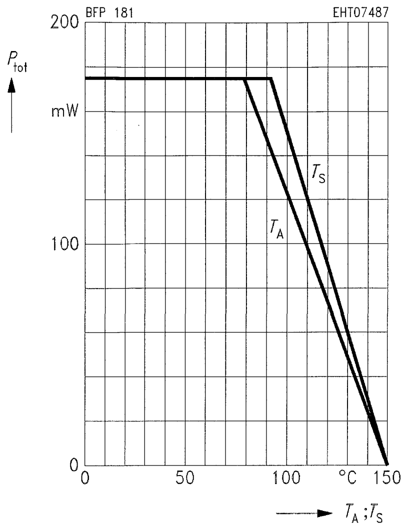
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
AC Characteristics					
Transition frequency	f_T				GHz
I_C = 6 mA, V_{CE} = 3 V, f = 500 MHz		–	6.7	–	
I_C = 10 mA, V_{CE} = 8 V, f = 500 MHz		–	8	–	
Collector-base capacitance V_{CB} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{cb}	–	0.21	–	pF
Collector-emitter capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{ce}	–	0.22	–	
Input capacitance V_{EB} = 0.5 V, I_C = i_c = 0, f = 1 MHz	C_{ibo}	–	0.5	–	
Output capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{obs}	–	0.45	–	
Noise figure	F				dB
I_C = 3 mA, V_{CE} = 5 V, f = 10 MHz, Z_S = 75 Ω		–	1.1	–	
I_C = 3 mA, V_{CE} = 5 V, f = 900 MHz, Z_S = Z_{Sopt}		–	1.5	–	
I_C = 3 mA, V_{CE} = 5 V, f = 1.75 GHz, Z_S = Z_{Sopt}		–	1.8	–	
Power gain					
I_C = 8 mA, V_{CE} = 8 V, f = 900 MHz, Z_0 = 50 Ω	G_{ms}[1]	–	20	–	
I_C = 8 mA, V_{CE} = 8 V, f = 1.75 GHz, Z_0 = 50 Ω	G_{ma}[2]	–	16	–	
Transducer gain I_C = 8 mA, V_{CE} = 8 V, f = 900 MHz, Z_0 = 50 Ω	$\lvert S_{21e} \rvert^2$	–	16	–	

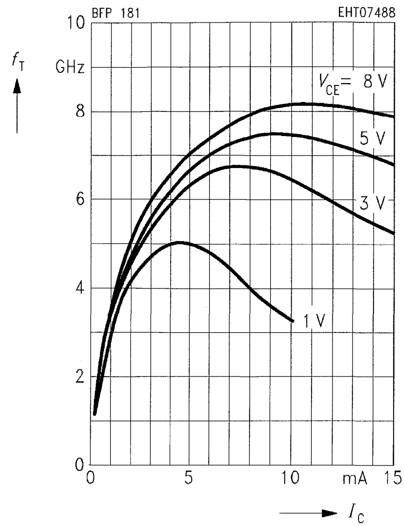
1) $G_{ms} = \left| \dfrac{S_{21e}}{S_{12e}} \right|$

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

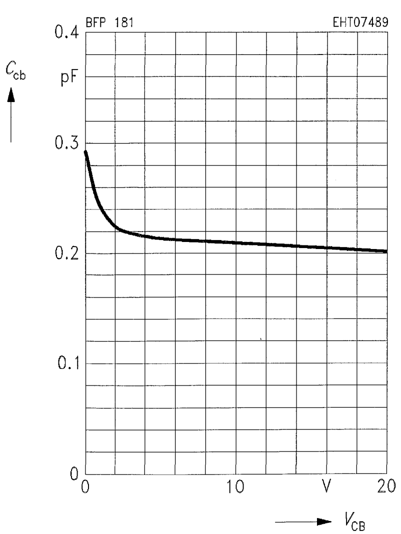
Total power dissipation $P_{tot} = f(T_A^*; T_S)$
*Package mounted on alumina



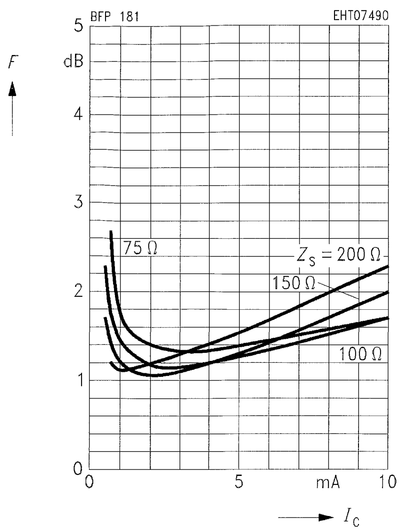
Transition frequency $f_T = f(I_C)$
f = 500 MHz



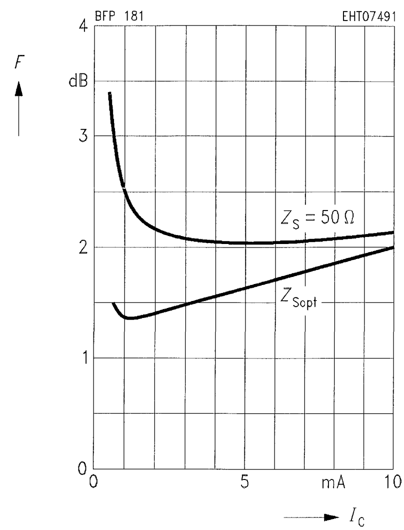
Collector-base capacitance $C_{cb} = f(V_{CB})$
$V_{BE} = v_{be} = 0, f = 1$ MHz



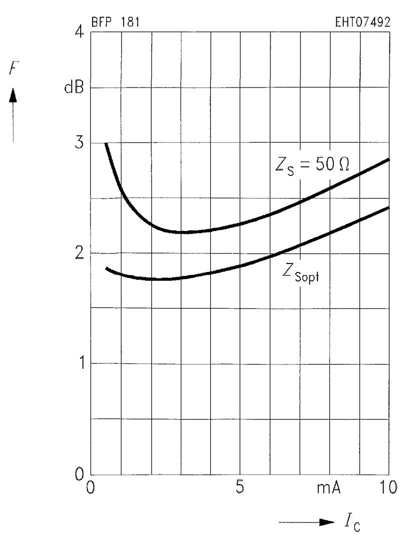
Noise figure $F = f\,(I_C)$
V_{CE} = 5 V, f = 10 MHz



Noise figure $F = f\,(I_C)$
V_{CE} = 5 V, f = 900 MHz, Z_{Lopt} (G)



Noise figure $F = f\,(I_C)$
V_{CE} = 5 V, f = 1.75 GHz, Z_{Lopt} (G)



Common Emitter S Parameters

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_C = 2 mA, V_{CE} = 3 V, Z_0 = 50 Ω								
0.10	0.921	– 10.8	6.63	171.4	0.013	84.1	0.991	– 4.6
0.20	0.904	– 21.4	6.52	163.0	0.026	77.5	0.977	– 9.1
0.30	0.878	– 31.6	6.33	154.9	0.037	71.5	0.957	– 13.3
0.40	0.844	– 41.6	6.10	147.0	0.048	66.0	0.931	– 17.2
0.50	0.808	– 51.1	5.82	139.6	0.057	61.0	0.902	– 20.7
0.60	0.770	– 60.0	5.54	133.0	0.065	56.4	0.872	– 23.8
0.70	0.732	– 68.6	5.24	126.6	0.072	52.3	0.842	– 26.6
0.80	0.693	– 76.8	4.95	120.6	0.078	48.7	0.814	– 29.1
0.90	0.661	– 84.6	4.67	115.2	0.083	45.4	0.787	– 31.3
0.95	0.645	– 88.5	4.56	112.6	0.085	43.9	0.775	– 32.3
1.00	0.629	– 92.1	4.42	110.2	0.087	42.6	0.764	– 33.3
1.20	0.573	– 106.1	3.96	100.9	0.093	37.8	0.722	– 36.8
1.40	0.534	– 119.4	3.57	92.7	0.098	33.9	0.688	– 39.9
1.60	0.501	– 131.2	3.20	85.1	0.102	30.9	0.663	– 42.5
1.70	0.487	– 137.5	3.08	81.9	0.103	29.6	0.650	– 44.1
1.75	0.480	– 140.2	3.01	80.1	0.104	29.2	0.645	– 44.8
1.80	0.477	– 142.9	2.94	78.5	0.104	28.7	0.641	– 45.4
2.00	0.462	– 153.4	2.70	72.4	0.107	26.8	0.624	– 48.0
2.50	0.439	– 176.9	2.23	58.2	0.112	23.5	0.594	– 54.7
3.00	0.446	163.1	1.93	45.7	0.116	21.8	0.567	– 62.0
I_C = 5 mA, V_{CE} = 3 V, Z_0 = 50 Ω								
0.10	0.829	– 18.5	13.65	166.3	0.012	80.4	0.975	– 7.5
0.20	0.788	– 35.9	12.89	153.5	0.023	71.4	0.934	– 14.2
0.30	0.734	– 51.9	11.86	142.3	0.032	63.8	0.879	– 19.7
0.40	0.676	– 66.3	10.76	132.4	0.040	58.0	0.823	– 23.9
0.50	0.624	– 79.1	9.69	124.0	0.045	53.4	0.771	– 27.1
0.60	0.580	– 90.5	8.77	117.1	0.049	50.0	0.726	– 29.3
0.70	0.543	– 100.9	7.94	110.8	0.053	47.4	0.689	– 31.2
0.80	0.510	– 110.5	7.21	105.4	0.056	45.5	0.658	– 32.6
0.90	0.487	– 119.0	6.60	100.5	0.059	44.0	0.632	– 33.9
0.95	0.477	– 123.3	6.34	98.3	0.060	43.5	0.621	– 34.4
1.00	0.466	– 127.2	6.08	96.2	0.061	43.1	0.611	– 35.0
1.20	0.439	– 141.5	5.22	88.5	0.066	41.7	0.579	– 37.0
1.40	0.424	– 154.1	4.57	81.7	0.070	40.8	0.557	– 39.1
1.60	0.415	– 164.8	4.04	75.6	0.074	40.4	0.541	– 41.2
1.70	0.414	– 170.3	3.83	72.9	0.076	40.2	0.533	– 42.4
1.75	0.410	– 172.9	3.73	71.4	0.077	40.3	0.531	– 43.0
1.80	0.413	– 174.8	3.63	70.0	0.078	40.2	0.528	– 43.5
2.00	0.413	176.4	3.30	64.9	0.083	39.9	0.519	– 45.9
2.50	0.419	158.1	2.67	52.9	0.094	38.8	0.502	– 52.5
3.00	0.441	143.1	2.25	42.0	0.105	37.6	0.489	– 59.9

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 = 2 mA, V_{CE} = 5 V, Z_0 = 50 Ω								
0.10	0.925	– 10.3	6.56	171.7	0.013	84.3	0.991	– 4.4
0.20	0.909	– 20.4	6.46	163.5	0.025	77.9	0.979	– 8.8
0.30	0.884	– 30.3	6.28	155.6	0.036	72.2	0.959	– 12.9
0.40	0.851	– 39.8	6.08	147.9	0.047	66.8	0.935	– 16.8
0.50	0.816	– 49.0	5.82	140.7	0.056	61.9	0.908	– 20.2
0.60	0.779	– 57.6	5.55	134.2	0.064	57.4	0.879	– 23.3
0.70	0.742	– 65.9	5.26	127.8	0.071	53.4	0.851	– 26.1
0.80	0.703	– 73.9	4.98	121.9	0.077	49.8	0.823	– 28.7
0.90	0.669	– 81.5	4.72	116.5	0.082	46.4	0.796	– 30.9
0.95	0.654	– 85.3	4.60	113.9	0.084	44.9	0.785	– 32.0
1.00	0.636	– 88.8	4.47	111.5	0.086	43.6	0.773	– 32.9
1.20	0.580	– 102.6	4.01	102.2	0.093	38.7	0.731	– 36.5
1.40	0.538	– 115.7	3.63	94.0	0.098	34.8	0.697	– 39.7
1.60	0.502	– 127.4	3.26	86.5	0.102	31.7	0.672	– 42.4
1.70	0.486	– 133.7	3.14	83.2	0.103	30.4	0.658	– 44.0
1.75	0.478	– 136.5	3.07	81.4	0.104	29.8	0.653	– 44.6
1.80	0.475	– 139.3	3.00	79.8	0.105	29.3	0.649	– 45.3
2.00	0.458	– 150.0	2.76	73.6	0.107	27.3	0.631	– 47.9
2.50	0.432	– 173.6	2.29	59.4	0.112	23.7	0.599	– 54.5
3.00	0.435	165.6	1.98	46.9	0.116	21.8	0.572	– 61.8
I_C = 10 mA, V_{CE} = 5 V, Z_0 = 50 Ω								
0.10	0.733	– 26.2	20.72	161.4	0.011	77.6	0.952	– 10.1
0.20	0.670	– 49.7	18.57	145.3	0.020	67.2	0.877	– 18.1
0.30	0.604	– 69.8	16.12	132.5	0.027	59.8	0.797	– 23.5
0.40	0.545	– 86.6	13.90	122.3	0.032	55.3	0.727	– 26.8
0.50	0.501	– 100.9	12.04	114.3	0.035	52.4	0.672	– 28.8
0.60	0.470	– 112.7	10.57	107.9	0.039	50.8	0.630	– 30.0
0.70	0.445	– 123.2	9.35	102.4	0.041	49.8	0.599	– 31.0
0.80	0.426	– 132.7	8.35	97.6	0.044	49.5	0.574	– 31.7
0.90	0.413	– 140.7	7.55	93.4	0.047	49.2	0.555	– 32.4
0.95	0.409	– 144.6	7.21	91.5	0.048	49.1	0.547	– 32.7
1.00	0.404	– 148.3	6.88	89.8	0.049	49.3	0.540	– 33.1
1.20	0.393	– 161.0	5.83	83.0	0.054	49.4	0.519	– 34.7
1.40	0.394	– 171.7	5.06	77.2	0.060	49.5	0.504	– 36.6
1.60	0.393	179.2	4.45	71.8	0.065	49.4	0.493	– 38.7
1.70	0.395	174.8	4.21	69.4	0.068	49.2	0.488	– 39.9
1.75	0.394	172.5	4.09	68.0	0.069	49.4	0.487	– 40.5
1.80	0.397	170.9	3.98	66.8	0.070	49.2	0.485	– 41.1
2.00	0.403	163.7	3.60	62.2	0.076	49.0	0.479	– 43.6
2.50	0.417	148.4	2.90	51.1	0.090	47.1	0.468	– 50.4
3.00	0.441	135.8	2.43	41.0	0.104	44.9	0.458	– 58.1

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} = 5 V, Z_0 = 50 Ω								
0.10	0.648	– 34.5	24.42	157.1	0.011	74.7	0.927	– 11.8
0.20	0.581	– 63.7	20.76	138.8	0.018	63.8	0.828	– 19.9
0.30	0.523	– 86.7	17.18	125.5	0.024	57.2	0.737	– 24.2
0.40	0.477	– 104.6	14.32	115.6	0.028	54.2	0.670	– 26.3
0.50	0.449	– 119.2	12.13	108.1	0.031	52.7	0.622	– 27.3
0.60	0.432	– 130.5	10.48	102.3	0.033	52.3	0.588	– 27.9
0.70	0.420	– 140.2	9.18	97.3	0.036	52.3	0.565	– 28.3
0.80	0.410	– 148.8	8.14	93.0	0.039	52.5	0.547	– 28.8
0.90	0.405	– 155.8	7.31	89.2	0.041	52.9	0.533	– 29.5
0.95	0.405	– 159.1	6.97	87.5	0.043	53.1	0.528	– 29.8
1.00	0.402	– 162.3	6.64	85.9	0.044	53.4	0.523	– 30.2
1.20	0.403	– 173.0	5.60	79.7	0.050	53.8	0.508	– 31.9
1.40	0.406	177.8	4.84	74.2	0.055	54.0	0.498	– 34.1
1.60	0.411	170.2	4.25	69.1	0.061	54.1	0.490	– 36.5
1.70	0.415	166.3	4.01	66.8	0.064	53.8	0.487	– 37.7
1.75	0.415	164.6	3.90	65.5	0.066	53.9	0.486	– 38.4
1.80	0.417	163.1	3.79	64.4	0.067	53.8	0.485	– 39.0
2.00	0.427	156.8	3.43	59.9	0.073	53.3	0.481	– 41.8
2.50	0.441	143.3	2.76	49.2	0.087	51.0	0.472	– 49.2
3.00	0.466	132.0	2.30	39.3	0.102	48.4	0.465	– 57.2
I_C = 15 mA, V_{CE} = 8 V, Z_0 = 50 Ω								
0.10	0.704	– 29.6	24.22	159.1	0.011	75.7	0.935	– 11.2
0.20	0.630	– 55.3	21.12	141.7	0.019	65.5	0.846	– 19.6
0.30	0.559	– 76.4	17.83	128.6	0.025	59.0	0.757	– 24.5
0.40	0.499	– 93.8	15.08	118.4	0.029	55.5	0.685	– 27.2
0.50	0.459	– 107.8	12.87	110.8	0.032	53.5	0.634	– 28.6
0.60	0.431	– 119.8	11.20	104.8	0.035	52.6	0.596	– 29.4
0.70	0.410	– 129.9	9.84	99.6	0.038	52.3	0.568	– 30.1
0.80	0.394	– 138.6	8.75	95.3	0.041	52.4	0.547	– 30.5
0.90	0.385	– 146.5	7.89	91.2	0.044	52.4	0.531	– 31.2
0.95	0.382	– 150.3	7.52	89.4	0.045	52.6	0.524	– 31.4
1.00	0.378	– 153.7	7.17	87.8	0.047	52.7	0.519	– 31.8
1.20	0.372	– 165.9	6.05	81.6	0.052	53.0	0.501	– 33.4
1.40	0.373	– 175.9	5.24	76.0	0.058	52.9	0.488	– 35.4
1.60	0.375	175.5	4.61	70.9	0.064	52.8	0.479	– 37.6
1.70	0.378	171.5	4.35	68.5	0.067	52.6	0.475	– 38.8
1.75	0.379	169.1	4.23	67.2	0.068	52.5	0.474	– 39.5
1.80	0.381	167.8	4.12	66.0	0.070	52.4	0.473	– 40.1
2.00	0.388	160.9	3.72	61.6	0.075	51.8	0.468	– 42.6
2.50	0.402	146.4	3.00	50.9	0.090	49.4	0.457	– 49.7
3.00	0.428	134.4	2.50	41.0	0.104	46.5	0.448	– 57.4

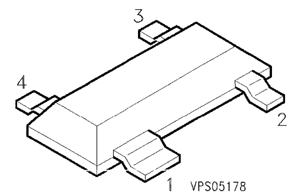
SIEMENS

NPN Silicon RF Transistor

BFP 182

Preliminary Data

- For low-noise, high-gain broadband amplifiers at collector currents from 1 mA to 20 mA.
- f_T = 8 GHz
  F = 1.2 dB at 900 MHz



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)]
BFP 182	RGs	Q62702-F1318	C	E	B	E	SOT-143

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CEO}	12	V
Collector-emitter voltage, V_{BE} = 0	V_{CES}	20	
Collector-base voltage	V_{CBO}	20	
Emitter-base voltage	V_{EBO}	2	
Collector current	I_C	35	mA
Peak collector current, $f \geq$ 10 MHz	I_{CM}	50	
Base current	I_B	4	
Peak base current, $f \geq$ 10 MHz	I_{BM}	5	
Total power dissipation, $T_S \leq$ 94 ˚C[3)]	P_{tot}	250	mW
Junction temperature	T_j	150	˚C
Ambient temperature range	T_A	– 65 … + 150	
Storage temperature range	T_{stg}	– 65 … + 150	

Thermal Resistance

Junction - ambient[2)]	$R_{th\,JA}$	$\leq$ 305	K/W
Junction - soldering point[3)]	$R_{th\,JS}$	$\leq$ 225	

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

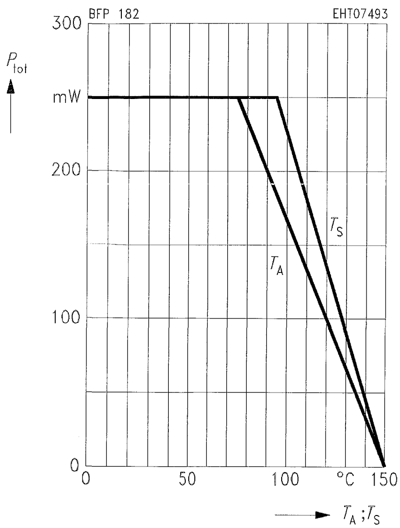
Electrical Characteristics
at $T_A = 25$ ˚C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-emitter breakdown voltage $I_C = 1$ mA, $I_B = 0$	$V_{(BR)CE0}$	12	–	–	V
Collector-emitter cutoff current $V_{CE} = 20$ V, $V_{BE} = 0$	I_{CES}	–	–	100	µA
Collector-base cutoff current $V_{CB} = 10$ V, $I_E = 0$	I_{CB0}	–	–	100	nA
Emitter-base cutoff current $V_{EB} = 1$ V, $I_C = 0$	I_{EB0}	–	–	1	µA
DC current gain $I_C =$ 5 mA, $V_{CE} = 6$ V $I_C = 20$ mA, $V_{CE} = 8$ V	h_{FE}	 50 –	 90 100	 250 –	–
Collector-emitter saturation voltage $I_C = 15$ mA, $I_B = 1.5$ mA	V_{CEsat}	–	0.1	0.4	V
AC Characteristics					
Transition frequency $I_C = 15$ mA, $V_{CE} = 6$ V, $f = 500$ MHz $I_C = 20$ mA, $V_{CE} = 8$ V, $f = 500$ MHz	f_T	 – –	 8 8.3	 – –	GHz
Collector-base capacitance $V_{CB} = 10$ V, $V_{BE} = v_{be} = 0$, $f = 1$ MHz	C_{cb}	–	0.26	–	pF
Noise figure $I_C = 6$ mA, $V_{CE} = 5$ V, $f = 10$ MHz, $Z_S = 75\ \Omega$ $I_C = 6$ mA, $V_{CE} = 5$ V, $f = 900$ MHz, $Z_S = Z_{Sopt}$ $I_C = 6$ mA, $V_{CE} = 5$ V, $f = 1.75$ GHz, $Z_S = Z_{Sopt}$	F	 – – –	 1.1 1.3 1.75	 – – –	dB
Power gain $I_C = 15$ mA, $V_{CE} = 6$ V, $f = 900$ MHz, $Z_0 = 50\ \Omega$ $I_C = 15$ mA, $V_{CE} = 6$ V, $f = 1.75$ GHz, $Z_0 = 50\ \Omega$	 G_{ms} 1) G_{ma} 2)	 – –	 22.5 16	 – –	
Transducer gain $I_C = 15$ mA, $V_{CE} = 6$ V, $f = 900$ MHz, $Z_0 = 50\ \Omega$	$\vert S_{21e} \vert^2$	–	17.5	–	

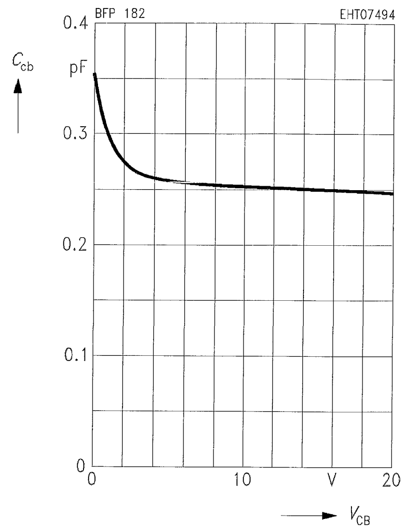
1) $G_{ms} = \left| \dfrac{S_{21e}}{S_{12e}} \right|$

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

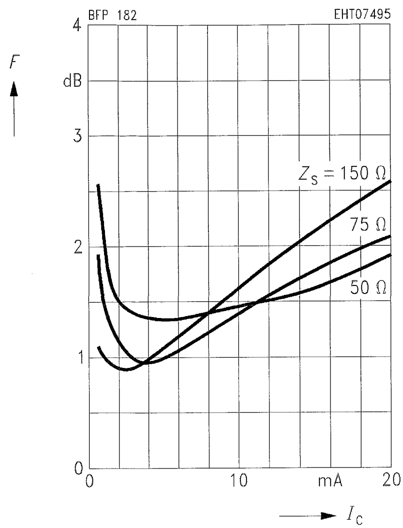
Total power dissipation $P_{tot} = f(T_A^*; T_S)$
*Package mounted on alumina



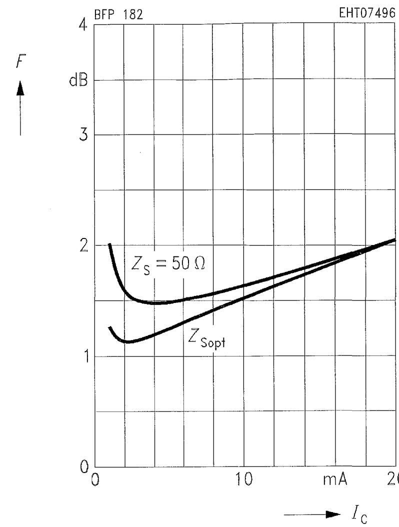
Collector-base capacitance $C_{cb} = f(V_{CB})$
$V_{BE} = v_{be} = 0$, f = 1 MHz



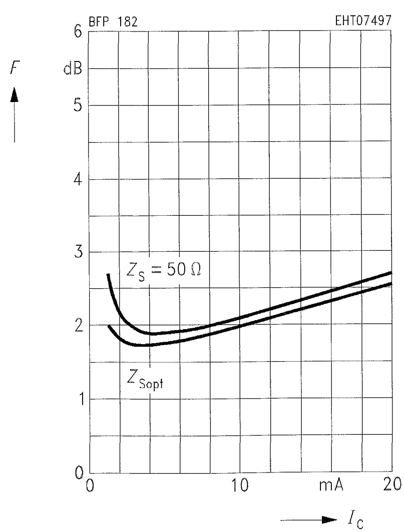
Noise figure $F = f\ (I_C)$
V_{CE} = 5 V, f = 10 MHz



Noise figure $F = f\ (I_C)$
V_{CE} = 5 V, f = 900 MHz, $Z_{Lopt}\ (G)$



Noise figure $F = f\ (I_C)$
V_{CE} = 5 V, f = 1.75 GHz, $Z_{Lopt}\ (G)$



Common Emitter S Parameters

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_C = 5 mA, V_{CE} = 2.5 V, Z_0 = 50 Ω								
0.10	0.819	– 23.9	14.55	164.7	0.016	77.8	0.970	– 9.9
0.20	0.778	– 46.3	13.56	150.1	0.029	66.6	0.911	– 18.4
0.30	0.735	– 66.0	12.27	138.1	0.039	57.5	0.838	– 25.1
0.40	0.691	– 83.5	10.92	127.7	0.046	50.2	0.766	– 30.1
0.50	0.655	– 98.7	9.71	118.9	0.052	45.2	0.703	– 33.5
0.60	0.625	– 111.0	8.66	111.9	0.055	41.5	0.651	– 36.0
0.70	0.608	– 122.4	7.76	105.6	0.059	38.4	0.609	– 37.9
0.80	0.590	– 131.3	7.00	100.5	0.061	36.4	0.575	– 39.3
0.90	0.581	– 140.0	6.35	95.7	0.063	34.4	0.548	– 40.4
0.95	0.581	– 144.0	6.07	93.4	0.063	34.1	0.537	– 41.0
1.00	0.574	– 147.5	5.83	91.4	0.064	33.4	0.526	– 41.5
1.20	0.560	– 161.1	4.95	83.8	0.067	31.9	0.493	– 43.3
1.40	0.560	– 170.6	4.31	77.5	0.069	31.5	0.470	– 45.3
1.60	0.557	179.7	3.79	71.4	0.072	31.1	0.455	– 47.3
1.70	0.558	175.5	3.58	68.7	0.073	31.5	0.448	– 48.4
1.75	0.569	173.1	3.50	67.3	0.074	31.3	0.445	– 49.0
1.80	0.568	171.2	3.40	65.8	0.074	31.4	0.444	– 49.5
2.00	0.567	163.5	3.08	60.5	0.077	31.8	0.437	– 52.0
2.50	0.584	148.2	2.48	48.4	0.085	32.5	0.430	– 58.9
3.00	0.608	135.1	2.06	37.2	0.093	33.5	0.433	– 67.0
I_C = 10 mA, V_{CE} = 2.5 V, Z_0 = 50 Ω								
0.10	0.683	– 37.6	23.40	157.8	0.014	73.2	0.931	– 14.7
0.20	0.640	– 69.7	20.13	139.3	0.024	60.2	0.818	– 25.5
0.30	0.606	– 94.1	16.82	125.9	0.031	51.5	0.708	– 31.9
0.40	0.577	– 112.8	14.02	115.8	0.035	46.6	0.622	– 35.5
0.50	0.564	– 127.7	11.92	107.9	0.038	44.1	0.560	– 37.4
0.60	0.550	– 138.5	10.31	101.9	0.041	42.8	0.515	– 38.5
0.70	0.550	– 148.3	9.04	96.6	0.043	41.5	0.481	– 39.1
0.80	0.543	– 155.6	8.02	92.4	0.045	41.9	0.456	– 39.7
0.90	0.546	– 162.3	7.20	88.4	0.047	41.6	0.437	– 40.2
0.95	0.547	– 165.6	6.85	86.5	0.047	42.2	0.429	– 40.5
1.00	0.547	– 168.4	6.54	84.7	0.049	42.2	0.422	– 40.8
1.20	0.547	– 178.9	5.49	78.4	0.053	42.8	0.401	– 42.1
1.40	0.548	174.1	4.75	73.0	0.057	43.7	0.387	– 43.9
1.60	0.551	166.2	4.15	67.5	0.061	44.2	0.377	– 46.0
1.70	0.554	162.7	3.91	65.2	0.064	44.7	0.373	– 47.1
1.75	0.567	160.9	3.82	63.9	0.065	44.7	0.372	– 47.7
1.80	0.564	159.1	3.72	62.5	0.066	44.6	0.371	– 48.2
2.00	0.567	152.8	3.35	57.7	0.071	45.0	0.368	– 50.9
2.50	0.586	140.0	2.69	46.6	0.083	44.9	0.367	– 58.5
3.00	0.612	129.0	2.23	36.3	0.096	43.8	0.372	– 67.1

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} = 2.5 V, Z_0 = 50 Ω								
0.10	0.587	– 50.9	28.58	152.5	0.013	69.8	0.890	– 18.0
0.20	0.566	– 88.9	22.90	132.0	0.021	56.3	0.741	– 29.0
0.30	0.555	– 114.1	18.16	118.7	0.026	49.5	0.622	– 34.0
0.40	0.547	– 131.3	14.65	109.4	0.029	46.6	0.543	– 36.0
0.50	0.547	– 144.3	12.20	102.3	0.032	45.7	0.490	– 36.7
0.60	0.541	– 153.2	10.42	96.8	0.034	45.9	0.454	– 37.0
0.70	0.550	– 161.2	9.07	92.2	0.036	45.9	0.429	– 37.2
0.80	0.545	– 167.3	8.00	88.4	0.038	46.8	0.411	– 37.4
0.90	0.550	– 172.7	7.15	84.8	0.041	47.5	0.397	– 37.7
0.95	0.554	– 175.9	6.80	83.0	0.042	48.2	0.391	– 38.0
1.00	0.555	– 178.0	6.48	81.4	0.043	48.6	0.386	– 38.3
1.20	0.557	173.1	5.42	75.6	0.048	49.7	0.371	– 39.7
1.40	0.562	167.0	4.68	70.5	0.053	50.7	0.361	– 41.7
1.60	0.566	160.2	4.08	65.4	0.058	50.8	0.355	– 44.0
1.70	0.569	157.1	3.84	63.0	0.061	51.2	0.352	– 45.3
1.75	0.582	155.6	3.75	61.9	0.063	50.9	0.352	– 46.0
1.80	0.578	154.2	3.65	60.5	0.064	51.0	0.351	– 46.6
2.00	0.581	148.2	3.29	55.8	0.069	51.1	0.349	– 49.5
2.50	0.601	136.5	2.63	45.1	0.083	50.1	0.351	– 57.6
3.00	0.623	126.1	2.19	35.0	0.097	47.8	0.358	– 66.8
I_C = 20 mA, V_{CE} = 2.5 V, Z_0 = 50 Ω								
0.10	0.524	– 65.4	30.79	147.5	0.013	66.1	0.842	– 20.4
0.20	0.536	– 106.6	23.07	126.0	0.019	53.2	0.672	– 30.4
0.30	0.545	– 129.9	17.58	113.2	0.023	48.6	0.560	– 33.6
0.40	0.552	– 145.1	13.90	104.7	0.026	46.8	0.492	– 34.2
0.50	0.558	– 155.9	11.43	98.2	0.028	47.7	0.450	– 34.1
0.60	0.558	– 163.5	9.69	93.3	0.030	48.7	0.423	– 34.0
0.70	0.566	– 170.0	8.40	89.0	0.033	49.2	0.405	– 34.0
0.80	0.564	– 175.0	7.38	85.5	0.035	51.0	0.392	– 34.2
0.90	0.569	– 179.7	6.59	82.2	0.038	51.5	0.382	– 34.7
0.95	0.574	177.9	6.26	80.4	0.039	52.2	0.378	– 35.0
1.00	0.575	175.8	5.96	78.9	0.040	52.6	0.375	– 35.4
1.20	0.578	167.9	4.97	73.4	0.046	53.6	0.364	– 37.2
1.40	0.583	163.0	4.29	68.5	0.051	54.5	0.357	– 39.6
1.60	0.589	156.5	3.74	63.4	0.056	54.5	0.353	– 42.3
1.70	0.591	154.2	3.52	61.1	0.059	55.1	0.351	– 43.7
1.75	0.605	152.6	3.44	60.0	0.061	54.8	0.350	– 44.5
1.80	0.600	151.0	3.34	58.6	0.062	54.7	0.350	– 45.1
2.00	0.602	145.5	3.01	54.0	0.068	54.7	0.349	– 48.4
2.50	0.622	134.5	2.41	43.4	0.083	53.1	0.353	– 57.2
3.00	0.644	124.2	2.00	33.2	0.098	50.7	0.361	– 66.8

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} = 5 V, Z_0 = 50 Ω								
0.10	0.832	– 22.2	14.46	165.4	0.015	77.8	0.972	– 9.3
0.20	0.794	– 43.4	13.57	151.6	0.028	67.6	0.919	– 17.5
0.30	0.750	– 62.1	12.39	139.9	0.038	59.2	0.851	– 24.2
0.40	0.703	– 78.9	11.11	129.6	0.045	51.9	0.783	– 29.1
0.50	0.662	– 93.8	9.94	120.8	0.051	46.8	0.721	– 32.7
0.60	0.630	– 106.1	8.92	113.7	0.055	42.8	0.669	– 35.4
0.70	0.608	– 117.5	8.03	107.3	0.058	39.6	0.627	– 37.4
0.80	0.588	– 126.6	7.26	102.2	0.061	37.2	0.592	– 38.9
0.90	0.576	– 135.6	6.60	97.4	0.062	35.3	0.564	– 40.1
0.95	0.574	– 139.7	6.32	95.1	0.063	34.9	0.551	– 40.7
1.00	0.568	– 143.4	6.06	93.0	0.064	34.2	0.540	– 41.2
1.20	0.552	– 157.3	5.16	85.3	0.067	32.5	0.505	– 43.2
1.40	0.546	– 167.1	4.50	79.0	0.070	31.8	0.481	– 45.1
1.60	0.544	– 177.4	3.97	72.8	0.072	31.2	0.464	– 47.1
1.70	0.544	178.5	3.74	70.1	0.073	31.7	0.457	– 48.1
1.75	0.555	175.9	3.66	68.7	0.074	31.7	0.454	– 48.7
1.80	0.551	173.9	3.57	67.1	0.075	31.6	0.452	– 49.2
2.00	0.553	165.9	3.23	61.9	0.077	31.8	0.444	– 51.6
2.50	0.567	150.0	2.60	49.8	0.084	32.5	0.435	– 58.2
3.00	0.592	136.6	2.17	38.7	0.093	33.3	0.438	– 66.0
I_C = 10 mA, V_{CE} = 5 V, Z_0 = 50 Ω								
0.10	0.714	– 33.7	23.38	159.3	0.014	75.1	0.940	– 13.8
0.20	0.662	– 63.2	20.46	141.6	0.024	61.9	0.837	– 24.3
0.30	0.621	– 86.7	17.38	128.4	0.030	53.2	0.732	– 31.1
0.40	0.586	– 105.4	14.66	118.2	0.035	48.0	0.646	– 35.1
0.50	0.562	– 120.6	12.55	110.1	0.038	45.1	0.581	– 37.4
0.60	0.544	– 132.1	10.91	103.9	0.041	43.4	0.534	– 38.8
0.70	0.539	– 142.4	9.60	98.5	0.043	42.2	0.497	– 39.6
0.80	0.529	– 150.1	8.54	94.2	0.046	42.2	0.470	– 40.3
0.90	0.528	– 157.5	7.67	90.2	0.047	41.6	0.449	– 40.8
0.95	0.530	– 160.8	7.31	88.2	0.048	42.3	0.440	– 41.2
1.00	0.528	– 163.8	6.98	86.4	0.050	42.2	0.432	– 41.5
1.20	0.526	– 175.1	5.87	79.9	0.054	42.5	0.408	– 42.8
1.40	0.527	177.2	5.08	74.6	0.058	43.4	0.392	– 44.4
1.60	0.528	169.0	4.45	69.1	0.062	43.5	0.381	– 46.4
1.70	0.531	165.3	4.19	66.7	0.064	44.4	0.376	– 47.4
1.75	0.545	163.5	4.09	65.4	0.065	44.2	0.375	– 48.0
1.80	0.542	161.9	3.98	64.1	0.067	44.2	0.374	– 48.5
2.00	0.543	155.2	3.59	59.3	0.071	44.6	0.369	– 51.0
2.50	0.559	141.7	2.88	48.3	0.084	44.1	0.366	– 58.1
3.00	0.587	130.2	2.40	38.0	0.096	43.1	0.370	– 66.4

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} = 5 V, Z_0 = 50 Ω								
0.10	0.632	– 43.4	29.06	154.9	0.013	71.0	0.909	– 16.7
0.20	0.588	– 78.4	24.03	135.3	0.021	59.0	0.773	– 28.0
0.30	0.560	– 103.4	19.47	121.9	0.026	51.6	0.655	– 33.9
0.40	0.539	– 121.7	15.94	112.3	0.030	47.9	0.571	– 36.7
0.50	0.531	– 135.7	13.36	104.9	0.032	46.9	0.512	– 37.9
0.60	0.520	– 145.7	11.48	99.3	0.035	46.6	0.471	– 38.5
0.70	0.523	– 154.6	10.02	94.5	0.037	46.3	0.442	– 38.8
0.80	0.519	– 161.3	8.85	90.5	0.040	47.0	0.420	– 39.1
0.90	0.522	– 167.5	7.93	86.9	0.042	47.2	0.403	– 39.5
0.95	0.523	– 170.4	7.54	85.1	0.043	47.9	0.397	– 39.7
1.00	0.522	– 173.2	7.19	83.4	0.044	47.9	0.390	– 40.0
1.20	0.527	176.8	6.02	77.5	0.049	49.0	0.372	– 41.2
1.40	0.528	170.7	5.20	72.5	0.054	49.6	0.360	– 42.9
1.60	0.532	163.1	4.54	67.3	0.059	49.9	0.352	– 45.0
1.70	0.535	160.0	4.28	65.0	0.062	50.3	0.349	– 46.0
1.75	0.547	158.1	4.18	63.8	0.063	50.1	0.347	– 46.7
1.80	0.544	156.5	4.06	62.5	0.065	50.0	0.347	– 47.2
2.00	0.549	150.5	3.66	57.9	0.070	50.0	0.344	– 49.9
2.50	0.567	138.3	2.93	47.3	0.084	48.9	0.344	– 57.5
3.00	0.591	127.7	2.44	37.2	0.097	46.7	0.349	– 66.2
I_C = 20 mA, V_{CE} = 5 V, Z_0 = 50 Ω								
0.10	0.574	– 52.1	32.55	151.4	0.012	69.0	0.880	– 18.8
0.20	0.547	– 90.8	25.70	130.8	0.019	57.0	0.724	– 29.8
0.30	0.531	– 115.4	20.18	117.7	0.024	51.1	0.604	– 34.6
0.40	0.523	– 132.7	16.21	108.6	0.027	48.6	0.526	– 36.4
0.50	0.522	– 145.7	13.45	101.7	0.029	48.4	0.474	– 36.9
0.60	0.516	– 154.4	11.47	96.5	0.031	49.2	0.440	– 37.0
0.70	0.523	– 162.3	9.97	92.0	0.034	49.4	0.415	– 37.0
0.80	0.519	– 168.0	8.79	88.3	0.037	50.8	0.397	– 37.2
0.90	0.525	– 173.6	7.86	84.9	0.039	50.6	0.384	– 37.5
0.95	0.531	– 176.2	7.47	83.1	0.041	51.8	0.379	– 37.8
1.00	0.527	– 178.7	7.11	81.6	0.042	51.6	0.374	– 38.0
1.20	0.534	172.4	5.95	75.9	0.047	52.5	0.360	– 39.3
1.40	0.535	166.8	5.13	71.1	0.052	53.2	0.349	– 41.2
1.60	0.540	159.9	4.48	66.1	0.058	53.4	0.343	– 43.5
1.70	0.544	156.8	4.21	63.8	0.061	53.8	0.341	– 44.6
1.75	0.558	155.2	4.12	62.6	0.062	53.5	0.340	– 45.3
1.80	0.553	153.9	4.00	61.3	0.064	53.4	0.340	– 45.9
2.00	0.559	147.9	3.61	56.9	0.069	53.2	0.338	– 48.8
2.50	0.574	136.3	2.89	46.3	0.083	51.6	0.339	– 56.7
3.00	0.599	125.8	2.40	36.5	0.098	49.0	0.344	– 65.8

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} = 8 V, Z_0 = 50 Ω								
0.10	0.848	– 21.0	14.27	166.0	0.015	78.8	0.973	– 9.0
0.20	0.807	– 41.0	13.46	152.6	0.027	68.8	0.924	– 17.0
0.30	0.764	– 59.0	12.37	141.2	0.038	60.0	0.860	– 23.6
0.40	0.713	– 75.4	11.17	130.9	0.045	52.9	0.793	– 28.6
0.50	0.672	– 90.0	10.05	122.2	0.051	47.8	0.732	– 32.4
0.60	0.636	– 102.3	9.05	115.1	0.055	43.7	0.681	– 35.2
0.70	0.612	– 113.6	8.17	108.6	0.059	40.1	0.637	– 37.3
0.80	0.588	– 122.9	7.40	103.5	0.061	38.1	0.602	– 38.9
0.90	0.575	– 131.7	6.75	98.6	0.064	36.0	0.573	– 40.2
0.95	0.572	– 136.0	6.46	96.3	0.064	35.5	0.560	– 40.8
1.00	0.563	– 139.7	6.21	94.1	0.065	34.7	0.548	– 41.4
1.20	0.544	– 154.0	5.30	86.3	0.068	32.8	0.512	– 43.4
1.40	0.539	– 164.4	4.63	80.0	0.071	31.9	0.485	– 45.3
1.60	0.533	– 174.8	4.07	73.8	0.073	31.1	0.467	– 47.3
1.70	0.533	– 179.2	3.85	71.0	0.074	31.5	0.460	– 48.3
1.75	0.544	178.3	3.76	69.6	0.075	31.4	0.456	– 48.9
1.80	0.540	176.0	3.67	68.1	0.076	31.4	0.455	– 49.4
2.00	0.539	168.0	3.32	62.8	0.078	31.5	0.446	– 51.7
2.50	0.556	151.7	2.68	50.7	0.086	32.0	0.436	– 58.2
3.00	0.580	137.9	2.24	39.6	0.094	32.3	0.437	– 65.8
I_C = 10 mA, V_{CE} = 8 V, Z_0 = 50 Ω								
0.10	0.745	– 31.1	23.03	160.3	0.014	74.9	0.942	– 13.2
0.20	0.690	– 59.0	20.40	143.1	0.024	62.6	0.847	– 23.6
0.30	0.642	– 81.2	17.53	130.1	0.031	54.7	0.746	– 30.6
0.40	0.595	– 99.9	14.91	119.8	0.036	49.2	0.661	– 35.0
0.50	0.565	– 115.0	12.82	111.7	0.039	45.8	0.595	– 37.5
0.60	0.543	– 126.7	11.20	105.4	0.042	43.9	0.545	– 39.2
0.70	0.534	– 137.4	9.88	99.8	0.045	42.3	0.507	– 40.2
0.80	0.522	– 145.4	8.80	95.5	0.047	42.3	0.478	– 40.9
0.90	0.520	– 153.1	7.92	91.3	0.049	41.7	0.455	– 41.6
0.95	0.519	– 156.9	7.55	89.4	0.050	42.0	0.445	– 41.9
1.00	0.513	– 160.2	7.21	87.5	0.051	42.0	0.437	– 42.3
1.20	0.511	– 172.0	6.07	81.0	0.055	42.1	0.411	– 43.5
1.40	0.511	– 179.8	5.26	75.5	0.059	42.6	0.393	– 45.1
1.60	0.513	171.1	4.61	70.0	0.063	42.9	0.381	– 47.0
1.70	0.514	167.8	4.34	67.7	0.065	43.3	0.376	– 48.0
1.75	0.525	165.8	4.24	66.4	0.067	43.1	0.374	– 48.5
1.80	0.523	163.8	4.13	65.0	0.068	43.3	0.373	– 49.0
2.00	0.528	156.8	3.73	60.2	0.073	43.6	0.367	– 51.4
2.50	0.546	143.2	2.99	49.2	0.085	43.2	0.363	– 58.3
3.00	0.568	131.1	2.49	38.8	0.097	41.8	0.367	– 66.5

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} = 8 V, Z_0 = 50 Ω								
0.10	0.680	– 39.0	28.67	156.3	0.013	72.1	0.915	– 16.0
0.20	0.622	– 71.5	24.14	137.2	0.022	60.1	0.789	– 27.3
0.30	0.579	– 95.9	19.83	123.9	0.027	52.4	0.673	– 33.6
0.40	0.546	– 114.5	16.36	114.1	0.031	48.5	0.587	– 36.9
0.50	0.527	– 128.9	13.80	106.6	0.034	47.2	0.525	– 38.5
0.60	0.514	– 139.7	11.88	100.8	0.036	46.4	0.482	– 39.4
0.70	0.511	– 149.2	10.40	95.8	0.039	45.8	0.449	– 39.9
0.80	0.502	– 156.5	9.20	91.8	0.041	46.5	0.426	– 40.3
0.90	0.504	– 163.0	8.25	88.1	0.043	46.2	0.408	– 40.6
0.95	0.507	– 166.5	7.85	86.2	0.045	47.0	0.400	– 40.9
1.00	0.503	– 169.0	7.49	84.6	0.046	47.1	0.393	– 41.1
1.20	0.506	– 179.8	6.28	78.6	0.051	47.9	0.373	– 42.2
1.40	0.505	173.5	5.43	73.5	0.056	48.6	0.359	– 43.8
1.60	0.510	165.6	4.74	68.3	0.061	48.4	0.350	– 45.8
1.70	0.513	162.1	4.47	66.0	0.063	49.0	0.346	– 46.8
1.75	0.526	160.3	4.37	64.8	0.065	48.8	0.345	– 47.4
1.80	0.523	158.6	4.24	63.5	0.066	48.7	0.344	– 48.0
2.00	0.525	152.2	3.83	58.9	0.071	48.9	0.340	– 50.5
2.50	0.545	139.8	3.07	48.3	0.085	47.4	0.338	– 57.8
3.00	0.571	128.7	2.55	38.2	0.099	45.4	0.342	– 66.3
I_C = 20 mA, V_{CE} = 8 V, Z_0 = 50 Ω								
0.10	0.632	– 45.7	32.27	153.2	0.012	70.6	0.890	– 17.9
0.20	0.579	– 81.5	26.06	133.1	0.020	58.3	0.744	– 29.2
0.30	0.547	– 106.3	20.79	119.8	0.025	51.5	0.625	– 34.7
0.40	0.525	– 124.3	16.84	110.5	0.028	49.1	0.542	– 37.0
0.50	0.513	– 138.0	14.05	103.4	0.031	48.0	0.486	– 37.9
0.60	0.503	– 147.9	12.01	98.0	0.033	48.4	0.448	– 38.3
0.70	0.507	– 156.6	10.46	93.4	0.036	48.1	0.421	– 38.4
0.80	0.499	– 162.9	9.24	89.6	0.038	49.6	0.401	– 38.6
0.90	0.502	– 168.9	8.27	86.1	0.041	49.7	0.386	– 38.9
0.95	0.506	– 172.1	7.86	84.4	0.042	50.5	0.380	– 39.1
1.00	0.505	– 174.5	7.49	82.8	0.043	50.7	0.374	– 39.3
1.20	0.507	175.6	6.27	77.0	0.049	51.1	0.358	– 40.6
1.40	0.508	169.8	5.41	72.2	0.054	52.1	0.346	– 42.3
1.60	0.514	162.1	4.72	67.1	0.060	51.9	0.339	– 44.4
1.70	0.516	159.2	4.44	64.9	0.062	52.1	0.336	– 45.4
1.75	0.529	157.2	4.34	63.7	0.064	51.8	0.335	– 46.1
1.80	0.526	156.0	4.22	62.4	0.065	51.9	0.335	– 46.7
2.00	0.531	150.1	3.81	57.9	0.071	51.6	0.332	– 49.4
2.50	0.547	137.9	3.05	47.5	0.085	49.8	0.331	– 57.1
3.00	0.575	127.2	2.54	37.6	0.099	47.3	0.336	– 65.8

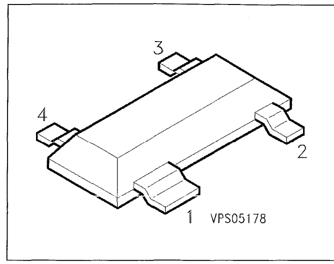
SIEMENS

NPN Silicon RF Transistor

BFP 183

Preliminary Data

- For low-noise, high-gain broadband amplifiers at collector currents from 2 mA to 28 mA.
- f_T = 8 GHz
  F = 1.2 dB at 900 MHz



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)]
BFP 183	RHs	Q62702-F1319	C	E	B	E	SOT-143

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CEO}	12	V
Collector-emitter voltage, V_{BE} = 0	V_{CES}	20	
Collector-base voltage	V_{CBO}	20	
Emitter-base voltage	V_{EBO}	2	
Collector current	I_C	65	mA
Peak collector current, $f \geq$ 10 MHz	I_{CM}	100	
Base current	I_B	5	
Peak base current, $f \geq$ 10 MHz	I_{BM}	8	
Total power dissipation, $T_S \leq$ 62 ˚C[3)]	P_{tot}	450	mW
Junction temperature	T_j	150	˚C
Ambient temperature range	T_A	– 65 ... + 150	
Storage temperature range	T_{stg}	– 65 ... + 150	

Thermal Resistance

Junction - ambient[2)]	$R_{th JA}$	≤ 275	K/W
Junction - soldering point[3)]	$R_{th JS}$	≤ 195	

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

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

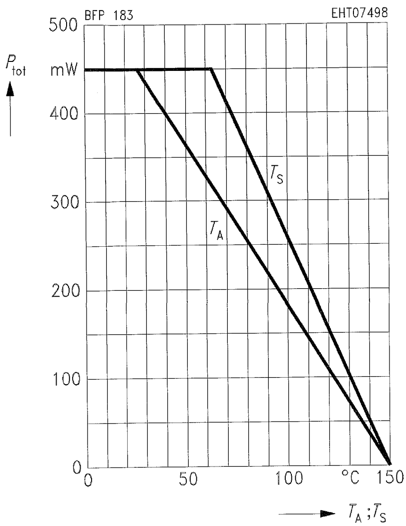
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CE0}$	12	–	–	V
Collector-emitter cutoff current V_{CE} = 20 V, V_{BE} = 0	I_{CES}	–	–	100	µA
Collector-base cutoff current V_{CB} = 10 V, I_E = 0	I_{CB0}	–	–	100	nA
Emitter-base cutoff current V_{EB} = 1 V, I_C = 0	I_{EB0}	–	–	1	µA
DC current gain I_C = 5 mA, V_{CE} = 6 V I_C = 20 mA, V_{CE} = 8 V	h_{FE}	 50 50	 90 110	 250 –	–
Collector-emitter saturation voltage I_C = 30 mA, I_B = 3 mA	V_{CEsat}	–	0.1	0.4	V

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

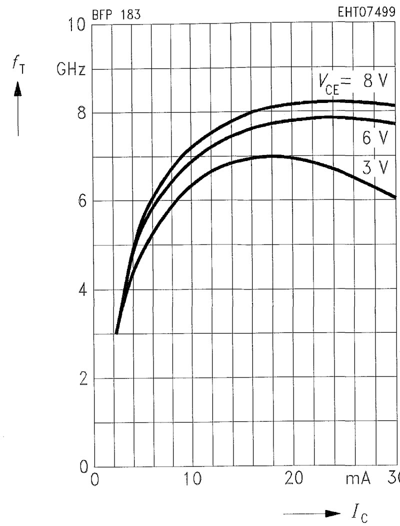
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
AC Characteristics					
Transition frequency I_C = 15 mA, V_{CE} = 8 V, f = 500 MHz I_C = 30 mA, V_{CE} = 8 V, f = 500 MHz	f_T	 – –	 7.8 8	 – –	GHz
Collector-base capacitance V_{CB} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{cb}	–	0.32	–	pF
Collector-emitter capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{ce}	–	0.25	–	
Input capacitance V_{EB} = 0.5 V, I_C = i_c = 0, f = 1 MHz	C_{ibo}	–	1.1	–	
Output capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{obs}	–	0.6	–	
Noise figure I_C = 5 mA, V_{CE} = 6 V, f = 10 MHz, Z_S = 75 Ω I_C = 5 mA, V_{CE} = 6 V, f = 900 MHz, Z_S = Z_{Sopt} I_C = 5 mA, V_{CE} = 6 V, f = 1.75 GHz, Z_S = Z_{Sopt}	F	 – – –	 0.9 1.2 1.75	 – – –	dB
Power gain I_C = 30 mA, V_{CE} = 8 V, f = 900 MHz, Z_0 = 50 Ω I_C = 30 mA, V_{CE} = 8 V, f = 1.75 GHz, Z_0 = 50 Ω	G_{ma} 1)	 – –	 20 13.5	 – –	
Transducer gain I_C = 30 mA, V_{CE} = 8 V, f = 2 GHz, Z_0 = 50 Ω	$\|S_{21e}\|^2$	–	10	–	
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}	–	170	–	mV
Third order intercept point I_C = 25 mA, V_{CE} = 8 V, f = 800 MHz	IP_3	–	27.5	–	dBm

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

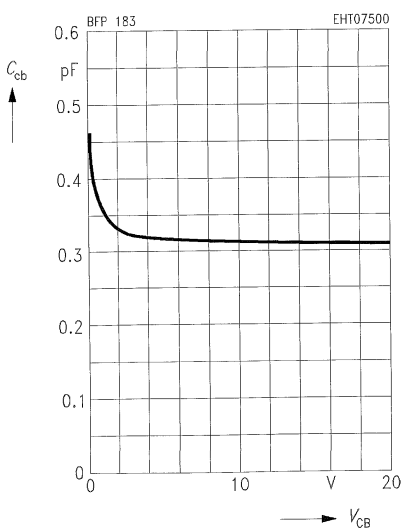
Total power dissipation $P_{tot} = f(T_A^*; T_S)$
* Package mounted on alumina



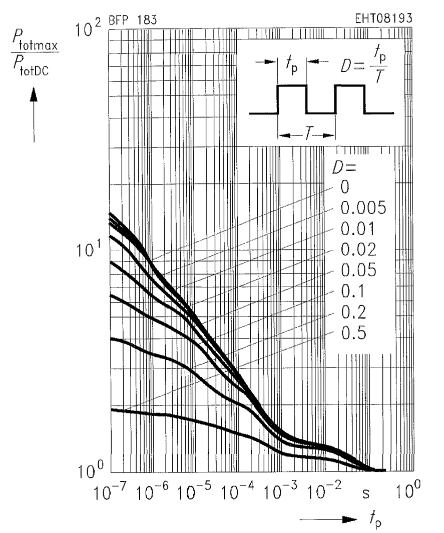
Transition frequency $f_T = f(I_C)$
f = 500 MHz



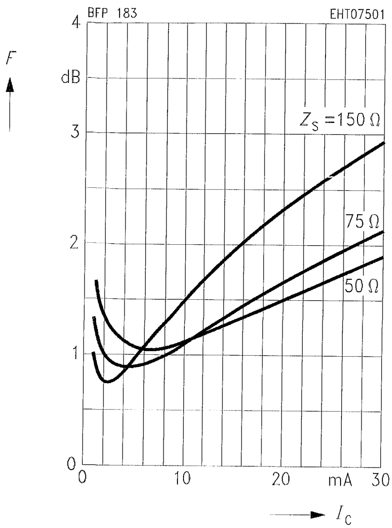
Collector-base capacitance $C_{cb} = f(V_{CB})$
$V_{BE} = v_{be} = 0, f$ = 1 MHz



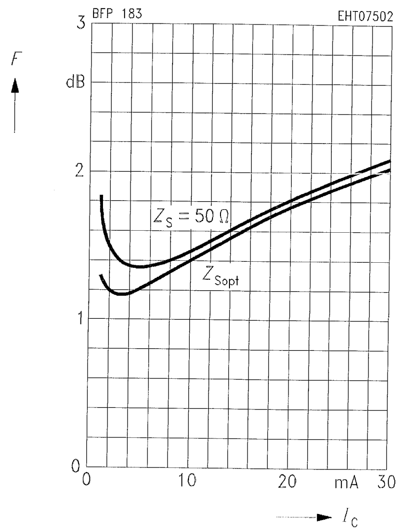
Permissible pulse load $P_{totmax}/P_{totDC} = f(t_p)$
* For note refer to next page.



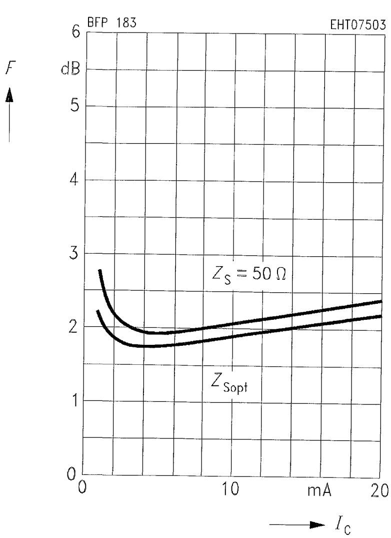
Noise figure $F = f(I_C)$
V_{CE} = 6 V, f = 10 MHz



Noise figure $F = f(I_C)$
V_{CE} = 6 V, f = 900 MHz, Z_{Lopt} (G)



Noise figure $F = f(I_C)$
V_{CE} = 6 V, f = 1.75 GHz, Z_{Lopt} (G)



* Note for P_{totmax}/P_{totDC} on previous page:
Safe operating area: For the dynamic permissible P_{totmax} a linear power derating is necessary above $V_{CE0}/2$ to V_{CE0max}.

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} = 3 V, Z_0 = 50 Ω								
0.10	0.919	– 17.7	6.89	168.0	0.021	80.2	0.985	– 6.8
0.20	0.894	– 34.6	6.62	156.5	0.041	71.1	0.955	– 13.0
0.30	0.858	– 50.3	6.22	145.9	0.058	62.6	0.912	– 18.5
0.40	0.820	– 64.8	5.78	136.3	0.071	55.4	0.864	– 23.0
0.50	0.782	– 77.9	5.30	127.6	0.082	49.3	0.816	– 26.7
0.60	0.747	– 89.7	4.88	120.1	0.089	44.1	0.773	– 29.8
0.70	0.719	– 100.2	4.50	113.5	0.096	39.7	0.735	– 32.2
0.80	0.693	– 110.0	4.14	107.5	0.100	36.1	0.702	– 34.3
0.90	0.674	– 118.6	3.82	102.0	0.103	33.1	0.674	– 36.0
0.95	0.664	– 122.6	3.67	99.5	0.105	31.8	0.662	– 36.8
1.00	0.656	– 126.5	3.53	97.1	0.105	30.5	0.650	– 37.6
1.20	0.630	– 140.3	3.06	88.4	0.108	26.5	0.614	– 40.3
1.40	0.619	– 152.3	2.70	80.8	0.109	23.9	0.588	– 42.8
1.60	0.606	– 161.9	2.40	74.0	0.110	22.3	0.570	– 45.3
1.70	0.604	– 167.1	2.28	70.9	0.110	21.8	0.563	– 46.5
1.75	0.603	– 169.1	2.22	69.3	0.110	21.6	0.560	– 47.2
1.80	0.605	– 171.2	2.17	67.8	0.109	21.5	0.557	– 47.8
2.00	0.605	– 179.7	1.98	61.9	0.109	21.2	0.547	– 50.5
2.50	0.606	163.1	1.62	49.0	0.108	23.4	0.533	– 57.4
3.00	0.617	148.9	1.36	37.3	0.110	27.6	0.528	– 64.8
I_C = 5 mA, V_{CE} = 3 V, Z_0 = 50 Ω								
0.10	0.822	– 28.3	14.90	161.4	0.020	75.7	0.957	– 12.1
0.20	0.768	– 53.7	13.38	145.3	0.036	63.9	0.873	– 22.0
0.30	0.710	– 74.9	11.65	132.3	0.047	55.0	0.779	– 28.9
0.40	0.663	– 92.4	10.08	122.1	0.055	48.8	0.698	– 33.5
0.50	0.625	– 106.9	8.72	113.8	0.060	44.8	0.631	– 36.5
0.60	0.599	– 119.1	7.66	107.1	0.064	42.1	0.581	– 38.5
0.70	0.580	– 129.2	6.80	101.5	0.067	40.2	0.540	– 39.8
0.80	0.564	– 138.0	6.08	96.5	0.070	39.2	0.509	– 40.9
0.90	0.557	– 145.6	5.50	92.1	0.072	38.6	0.485	– 41.8
0.95	0.551	– 148.9	5.24	90.1	0.073	38.4	0.476	– 42.3
1.00	0.547	– 152.1	5.01	88.3	0.074	38.2	0.466	– 42.6
1.20	0.537	– 163.7	4.24	81.3	0.079	38.3	0.438	– 44.2
1.40	0.538	– 173.2	3.68	75.3	0.083	38.9	0.419	– 46.1
1.60	0.532	179.2	3.25	69.8	0.088	39.7	0.407	– 48.1
1.70	0.533	175.1	3.07	67.2	0.090	40.0	0.402	– 49.2
1.75	0.535	173.3	2.99	65.8	0.092	40.3	0.401	– 49.8
1.80	0.537	171.8	2.91	64.6	0.093	40.6	0.399	– 50.3
2.00	0.542	165.1	2.63	59.7	0.098	41.2	0.392	– 52.8
2.50	0.549	151.3	2.14	48.6	0.112	42.7	0.382	– 59.4
3.00	0.562	139.5	1.79	38.3	0.128	43.1	0.379	– 66.6

Common Emitter S Parameters (continued)

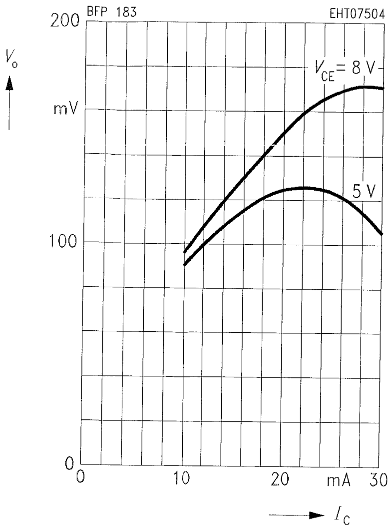
f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_C = 2 mA, V_{CE} = 6 V, Z_0 = 50 Ω								
0.10	0.925	– 17.0	6.86	168.3	0.020	80.4	0.986	– 6.4
0.20	0.901	– 33.2	6.61	157.2	0.039	71.8	0.958	– 12.4
0.30	0.865	– 48.4	6.24	146.9	0.055	63.6	0.918	– 17.7
0.40	0.828	– 62.5	5.83	137.5	0.068	56.5	0.873	– 22.1
0.50	0.789	– 75.4	5.36	128.9	0.079	50.4	0.827	– 25.7
0.60	0.754	– 87.1	4.96	121.4	0.086	45.2	0.786	– 28.7
0.70	0.724	– 97.5	4.57	114.9	0.093	40.9	0.748	– 31.2
0.80	0.696	– 107.2	4.22	108.9	0.097	37.2	0.715	– 33.3
0.90	0.676	– 115.9	3.90	103.4	0.101	34.2	0.687	– 35.0
0.95	0.666	– 119.8	3.75	100.9	0.102	32.8	0.676	– 35.8
1.00	0.656	– 123.7	3.62	98.5	0.103	31.5	0.664	– 36.5
1.20	0.629	– 137.7	3.14	89.7	0.106	27.4	0.627	– 39.3
1.40	0.616	– 149.9	2.77	82.0	0.107	24.8	0.601	– 41.8
1.60	0.602	– 159.8	2.47	75.3	0.108	23.0	0.582	– 44.2
1.70	0.600	– 165.0	2.35	72.1	0.108	22.4	0.575	– 45.4
1.75	0.598	– 167.2	2.29	70.5	0.108	22.3	0.572	– 46.1
1.80	0.599	– 169.3	2.24	69.0	0.107	22.2	0.569	– 46.6
2.00	0.599	– 177.9	2.03	63.2	0.107	21.8	0.559	– 49.2
2.50	0.599	164.5	1.67	50.2	0.106	23.8	0.544	– 55.9
3.00	0.608	149.9	1.40	38.6	0.108	27.9	0.538	– 63.0
I_C = 10 mA, V_{CE} = 6 V, Z_0 = 50 Ω								
0.10	0.720	– 39.2	24.08	155.0	0.017	71.9	0.913	– 17.3
0.20	0.648	– 71.1	19.93	135.9	0.029	59.8	0.776	– 29.1
0.30	0.589	– 95.0	16.16	122.5	0.036	52.8	0.654	– 35.6
0.40	0.551	– 112.7	13.32	113.0	0.041	49.4	0.566	– 39.0
0.50	0.525	– 126.6	11.16	105.8	0.045	48.1	0.503	– 40.6
0.60	0.511	– 137.5	9.59	100.0	0.048	47.6	0.459	– 41.4
0.70	0.501	– 146.2	8.38	95.3	0.052	47.8	0.426	– 41.9
0.80	0.493	– 153.8	7.42	91.2	0.055	48.4	0.402	– 42.3
0.90	0.491	– 160.0	6.66	87.6	0.058	49.0	0.384	– 42.7
0.95	0.488	– 163.0	6.33	85.9	0.060	49.2	0.377	– 43.0
1.00	0.487	– 165.8	6.03	84.4	0.062	49.5	0.370	– 43.2
1.20	0.484	– 175.5	5.07	78.5	0.069	50.4	0.350	– 44.4
1.40	0.489	176.6	4.38	73.2	0.076	51.4	0.336	– 46.1
1.60	0.486	170.2	3.85	68.4	0.083	51.8	0.327	– 48.1
1.70	0.490	166.5	3.64	66.1	0.087	51.9	0.324	– 49.1
1.75	0.492	165.3	3.53	65.0	0.089	52.0	0.323	– 49.8
1.80	0.493	163.9	3.44	63.9	0.091	52.1	0.321	– 50.2
2.00	0.498	158.0	3.11	59.4	0.099	51.9	0.317	– 52.7
2.50	0.508	146.0	2.52	49.3	0.119	50.8	0.309	– 59.4
3.00	0.521	135.4	2.11	39.7	0.139	48.8	0.305	– 66.7

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} = 6 V, Z_0 = 50 Ω								
0.10	0.583	– 57.0	33.74	146.6	0.015	67.6	0.840	– 23.7
0.20	0.527	– 95.6	25.03	125.6	0.023	57.2	0.650	– 35.8
0.30	0.496	– 119.8	18.93	113.1	0.028	53.8	0.522	– 40.3
0.40	0.482	– 135.6	15.00	104.9	0.033	53.6	0.445	– 41.7
0.50	0.474	– 147.1	12.31	98.9	0.036	54.6	0.396	– 41.8
0.60	0.472	– 155.7	10.43	94.2	0.040	55.6	0.363	– 41.6
0.70	0.470	– 162.6	9.04	90.2	0.044	56.7	0.340	– 41.5
0.80	0.468	– 168.5	7.95	86.8	0.048	57.7	0.323	– 41.4
0.90	0.470	– 173.5	7.10	83.6	0.053	58.4	0.311	– 41.7
0.95	0.469	– 175.8	6.74	82.2	0.055	58.7	0.307	– 41.9
1.00	0.470	– 177.9	6.42	80.9	0.057	59.0	0.302	– 42.0
1.20	0.472	174.2	5.38	75.7	0.066	59.6	0.288	– 43.4
1.40	0.479	167.9	4.63	70.9	0.075	59.7	0.280	– 45.3
1.60	0.477	162.6	4.07	66.5	0.084	59.5	0.274	– 47.6
1.70	0.481	159.3	3.84	64.4	0.088	59.1	0.271	– 48.7
1.75	0.484	158.2	3.72	63.4	0.090	59.0	0.271	– 49.6
1.80	0.486	157.0	3.63	62.3	0.093	58.9	0.270	– 50.1
2.00	0.491	152.0	3.28	58.2	0.102	58.0	0.267	– 52.9
2.50	0.501	141.5	2.65	48.6	0.124	55.1	0.261	– 60.2
3.00	0.514	131.9	2.22	39.5	0.146	51.9	0.259	– 68.1
I_C = 30 mA, V_{CE} = 8 V, Z_0 = 50 Ω								
0.10	0.543	– 65.3	38.00	142.7	0.014	65.8	0.796	– 26.3
0.20	0.496	– 105.3	26.82	121.5	0.021	57.1	0.592	– 37.5
0.30	0.472	– 128.5	19.81	109.7	0.026	55.6	0.472	– 40.7
0.40	0.463	– 142.9	15.51	102.1	0.030	56.3	0.403	– 41.0
0.50	0.459	– 153.2	12.64	96.6	0.034	58.0	0.361	– 40.5
0.60	0.459	– 161.1	10.68	92.2	0.038	59.2	0.334	– 40.0
0.70	0.459	– 167.4	9.23	88.6	0.043	60.3	0.315	– 39.7
0.80	0.458	– 172.7	8.11	85.3	0.047	61.3	0.302	– 39.6
0.90	0.461	– 177.1	7.24	82.4	0.052	61.9	0.291	– 39.8
0.95	0.461	– 179.3	6.86	81.0	0.054	62.0	0.288	– 40.1
1.00	0.462	178.7	6.54	79.7	0.056	62.3	0.284	– 40.3
1.20	0.463	171.6	5.47	74.8	0.065	62.3	0.273	– 41.7
1.40	0.471	165.7	4.71	70.2	0.075	62.2	0.266	– 43.8
1.60	0.471	160.5	4.13	65.9	0.084	61.7	0.261	– 46.3
1.70	0.474	157.5	3.90	63.9	0.089	61.2	0.259	– 47.5
1.75	0.477	156.7	3.78	62.8	0.091	61.0	0.259	– 48.3
1.80	0.478	155.4	3.69	61.8	0.093	60.8	0.258	– 48.9
2.00	0.485	150.5	3.33	57.8	0.103	59.6	0.255	– 51.9
2.50	0.495	140.3	2.69	48.4	0.126	56.3	0.251	– 59.4
3.00	0.509	131.1	2.25	39.3	0.148	52.6	0.249	– 67.5

Common Emitter Large Signal Parameters

Linear output voltage $V_o = f\ (I_C)$
d_{IM} = 60 dB, f_1 = 806 MHz,
f_2 = 810 MHz, $Z_S = Z_L$ = 50 Ω



Note:

The transistor is driven by 2 adjacent signals f_1, f_2 with equal output power levels P_o for each carrier.

The distance d_{IM} between P_o and the third order intermodulation products P_{IM} ($2f_1 - f_2$ or $2f_2 - f_1$) is:

$d_{IM} = P_o - P_{IM}$
where P_o = 10 log (V_o^2/(50 Ω • 1 mW)) (dBm)
and V_o = linear output voltage of each carrier.

The 3rd order intercept point IP_3 will be found by extrapolation to the point where P_{IM} would be identical to P_o:

IP_3 (output) = $P_o + d_{IM}/2$.

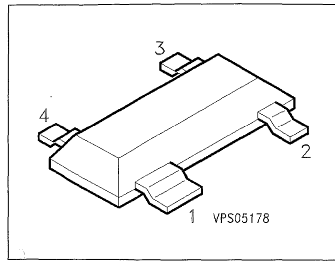
Linear output voltages for other d_{IM} (e.g. 50 dB) can be calculated thereby.

SIEMENS

NPN Silicon RF Transistor

BFP 193

- For low-noise, high-gain amplifiers up to 2 GHz.
- For linear broadband amplifiers.
- Power amplifier for DECT and PCN systems
- f_T = 8 GHz
  F = 1.2 dB at 800 MHz



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]
BFP 193	RCs	Q62702-F1282	C	E	B	E	SOT-143

Maximum Ratings

Parameter	**Symbol**	**Values**	**Unit**
Collector-emitter voltage	V_{CEO}	12	V
Collector-emitter voltage, $V_{BE} = 0$	V_{CES}	20	
Collector-base voltage	V_{CBO}	20	
Emitter-base voltage	V_{EBO}	2	
Collector current	I_C	80	mA
Peak collector current, $f \geq 10$ MHz	I_{CM}	80	
Base current	I_B	10	
Peak base current, $f \geq 10$ MHz	I_{BM}	10	
Total power dissipation, $T_S \leq 72$ ˚C[3]	P_{tot}	580	mW
Junction temperature	T_j	150	˚C
Ambient temperature range	T_A	– 65 ... + 150	
Storage temperature range	T_{stg}	– 65 ... + 150	

Thermal Resistance

Junction - ambient[2]	$R_{th\,JA}$	$\leq$ 215	K/W
Junction - soldering point[3]	$R_{th\,JS}$	$\leq$ 135	

1) For detailed information 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.

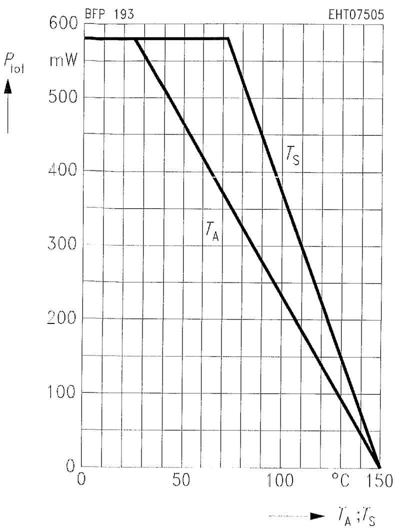
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CEO}$	12	–	–	V
Collector-emitter cutoff current V_{CE} = 20 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} = 1 V, I_C = 0	I_{EBO}	–	–	1	µA
DC current gain I_C = 5 mA, V_{CE} = 8 V I_C = 30 mA, V_{CE} = 8 V	h_{FE}	 – 50	 90 100	 – 250	–
Collector-emitter saturation voltage I_C = 50 mA, I_B = 5 mA	V_{CEsat}	–	–	0.4	V

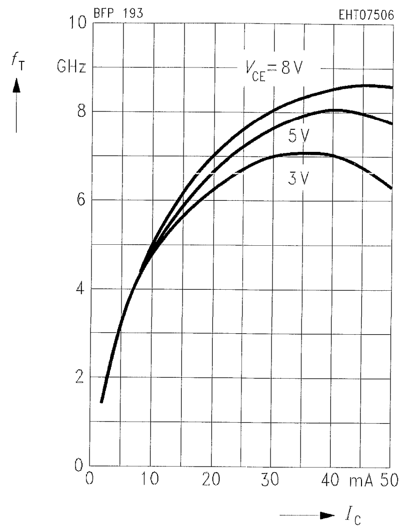
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
AC Characteristics					
Transition frequency I_C = 5 mA, V_{CE} = 8 V, f = 500 MHz I_C = 30 mA, V_{CE} = 8 V, f = 500 MHz	f_T	 – –	 3.5 8	 – –	GHz
Collector-base capacitance V_{CB} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{cb}	–	0.6	–	pF
Collector-emitter capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{ce}	–	0.33	–	
Input capacitance V_{EB} = 0.5 V, I_C = i_c = 0, f = 1 MHz	C_{ibo}	–	2.3	–	
Output capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{obs}	–	0.95	–	
Noise figure I_C = 5 mA, V_{CE} = 8 V, f = 10 MHz, Z_S = 75 Ω I_C = 30 mA, V_{CE} = 8 V, f = 800 MHz, Z_S = Z_{Sopt} I_C = 30 mA, V_{CE} = 8 V, f = 1 GHz, Z_S = 50 Ω	F	 – – –	 0.8 1.6 1.9	 – – –	dB
Power gain I_C = 30 mA, V_{CE} = 8 V, f = 800 MHz, Z_S = 50 Ω, Z_L = Z_{Lopt}	G_{pe}	–	15	–	
Transducer gain I_C = 30 mA, V_{CE} = 8 V, f = 1GHz, Z_0 = 50 Ω	$\|S_{21e}\|^2$	–	13.5	–	
Linear output voltage two-tone intermodulation test I_C = 50 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}	–	315	–	mV
Third order intercept point I_C = 50 mA, V_{CE} = 8 V, f = 800 MHz	IP_3	–	33	–	dBm

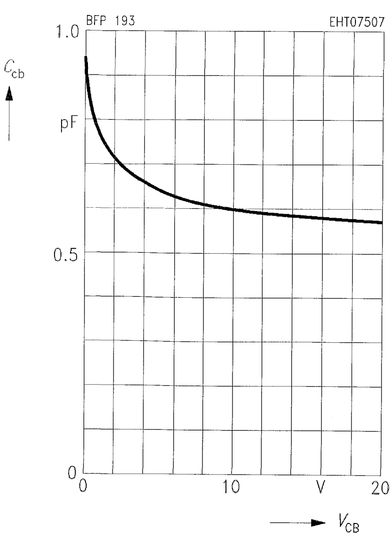
Total power dissipation $P_{tot} = f(T_A^*; T_S)$
* Package mounted on alumina



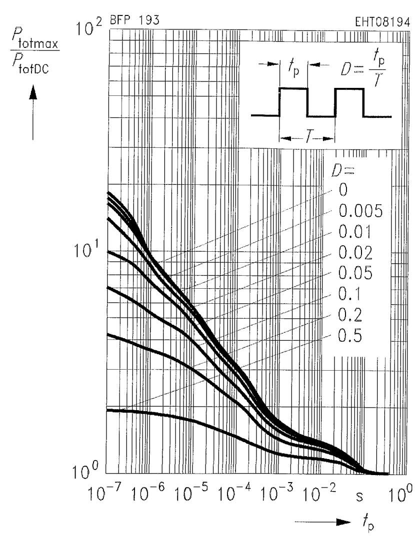
Transition frequency $f_T = f(I_C)$
f = 500 MHz



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



Permissible pulse load $P_{totmax}/P_{totDC} = f(t_p)$
* For note refer to following page.

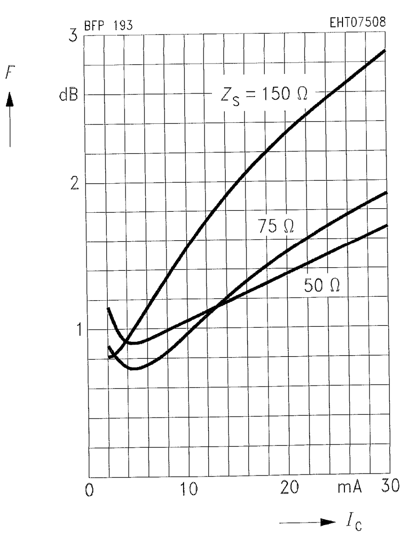


Common Emitter Noise Parameters

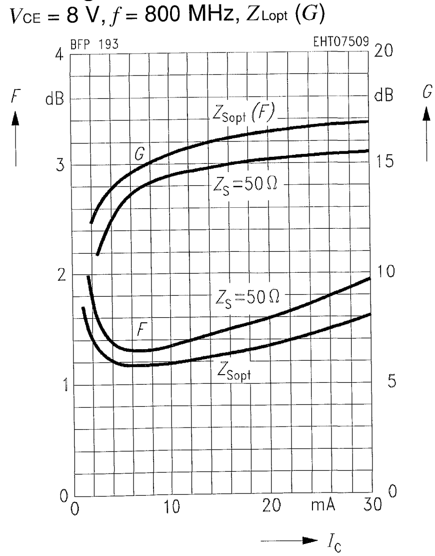
f	F_{min}	$G_p(F_{min})$	Γ_{opt}		R_N	N	$F_{50\,\Omega}$	$G_p(F_{50\Omega})$
GHz	dB	dB	MAG	ANG	Ω	–	dB	dB
I_C = 10 mA, V_{CE} = 8 V, Z_0 = 50 Ω								
0.01	1	–	(Z_S = 75 Ω)		–	–	1.05	–
0.8	1.2	15.4	–	–	–	–	1.35	14.4
2.0	2.3	9	–	–	–	–	2.8	7
I_C = 30 mA, V_{CE} = 8 V, Z_0 = 50 Ω								
0.01	1.65	–	(Z_S = 50 Ω)		–	–	1.65	–
0.8	1.6	16.7	–	–	–	–	1.95	15.4
2.0	2.6	9.5	–	–	–	–	3.3	7.5

Note for P_{totmax}/P_{totDC} on previous page:
Safe operating area: For the dynamic permissible P_{totmax} a linear power derating is necessary above $V_{CE0}/2$ to V_{CE0max}.

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

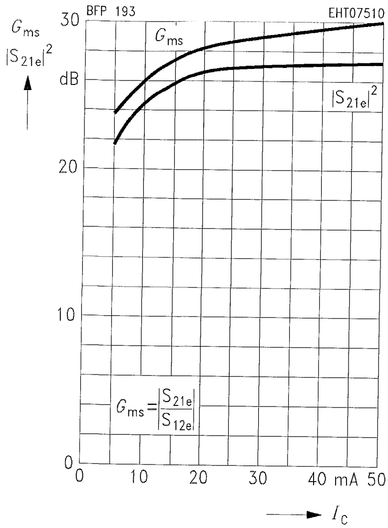


Noise figure $F = f(I_C)$
Power gain $G = f(I_C)$
V_{CE} = 8 V, f = 800 MHz, Z_{Lopt} (G)

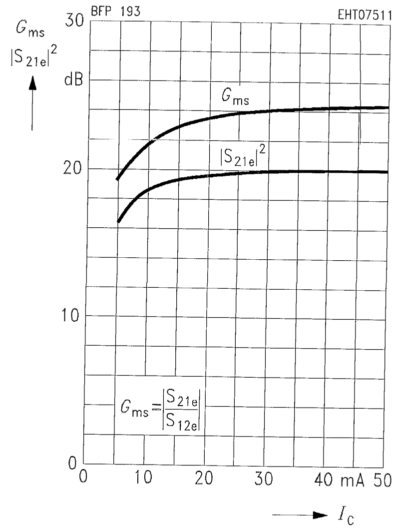


Common Emitter Power Gain

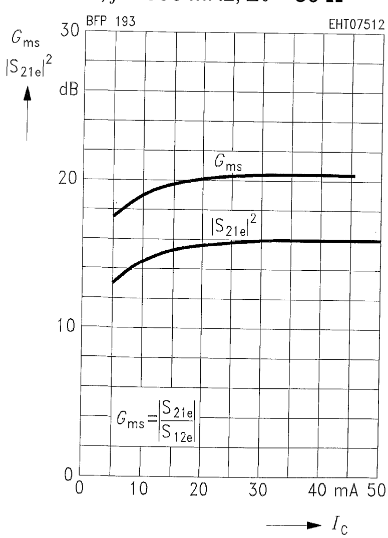
Power gain G_{ms}, $|S_{21e}|^2 = f(I_C)$
V_{CE} = 8 V, f = 200 MHz, Z_0 = 50 Ω



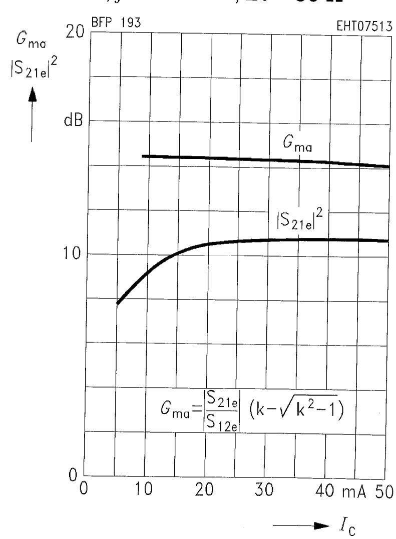
Power gain G_{ms}, $|S_{21e}|^2 = f(I_C)$
V_{CE} = 8 V, f = 500 MHz, Z_0 = 50 Ω



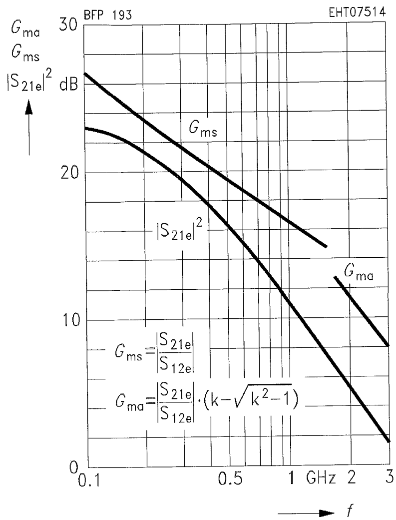
Power gain G_{ms}, $|S_{21e}|^2 = f(I_C)$
V_{CE} = 8 V, f = 800 MHz, Z_0 = 50 Ω



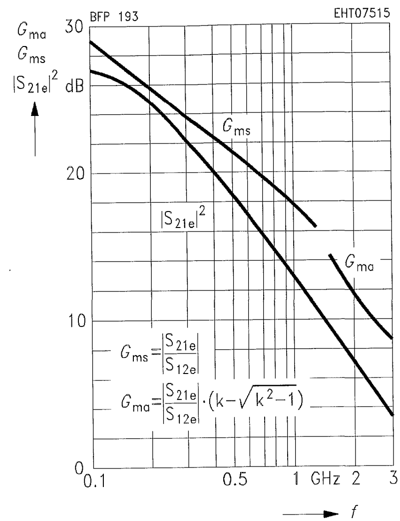
Power gain G_{ma}, $|S_{21e}|^2 = f(I_C)$
V_{CE} = 8 V, f = 1.5 GHz, Z_0 = 50 Ω



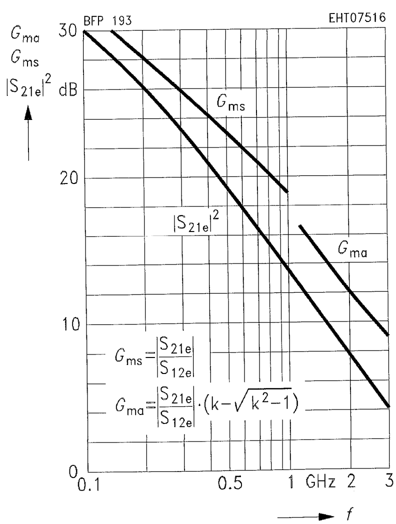
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
I_C = 5 mA, V_{CE} = 8 V, Z_0 = 50 Ω



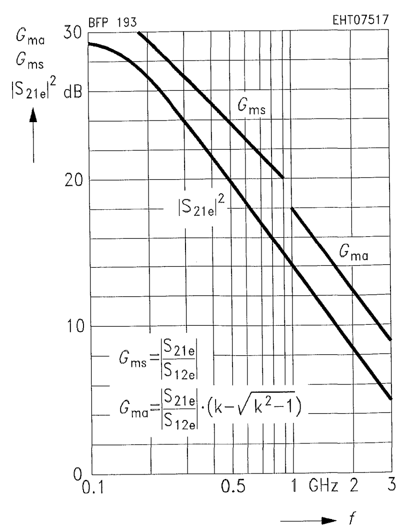
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
I_C = 10 mA, V_{CE} = 8 V, Z_0 = 50 Ω



Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
I_C = 20 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



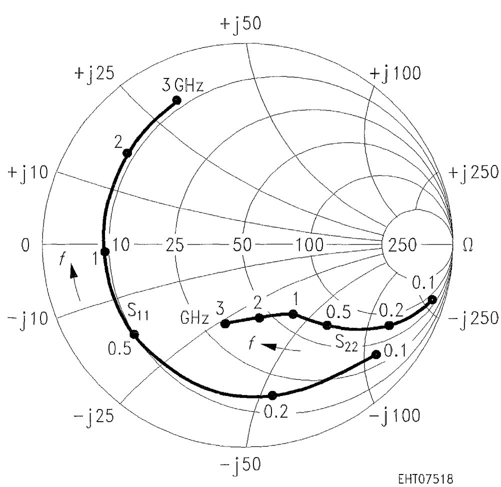
Common Emitter S Parameters

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_C = 10 mA, V_{CE} = 3 V, Z_0 = 50 Ω								
0.10	0.673	– 68.6	22.95	143.4	0.029	60.3	0.820	– 32.7
0.15	0.665	– 92.3	19.44	130.9	0.037	51.4	0.701	– 43.2
0.20	0.660	– 109.9	16.49	121.6	0.042	45.5	0.602	– 50.6
0.25	0.650	– 123.2	14.07	114.5	0.046	41.9	0.524	– 55.9
0.30	0.645	– 132.9	12.18	109.1	0.049	39.8	0.465	– 59.5
0.40	0.666	– 146.1	9.65	101.8	0.054	35.3	0.392	– 66.5
0.50	0.669	– 158.2	7.98	94.9	0.055	34.2	0.329	– 71.0
0.60	0.663	– 166.6	6.74	89.6	0.058	35.3	0.291	– 73.1
0.70	0.658	– 173.4	5.81	85.1	0.061	36.6	0.268	– 75.0
0.80	0.657	– 178.1	5.11	81.2	0.066	36.9	0.257	– 76.8
0.90	0.676	177.6	4.59	77.9	0.069	34.9	0.246	– 81.2
1.00	0.684	172.2	4.15	74.1	0.069	35.8	0.229	– 83.8
1.20	0.687	163.7	3.45	68.0	0.075	38.6	0.213	– 87.6
1.40	0.692	156.8	2.98	62.7	0.081	38.6	0.210	– 93.7
1.50	0.692	153.2	2.79	59.8	0.084	39.5	0.210	– 95.6
1.60	0.696	149.9	2.62	56.8	0.087	40.2	0.212	– 97.8
1.80	0.703	143.4	2.34	51.1	0.095	40.6	0.216	– 101.4
2.00	0.714	138.0	2.09	45.9	0.101	40.5	0.219	– 106.2
2.50	0.758	126.1	1.66	34.4	0.118	40.5	0.240	– 122.1
3.00	0.763	113.6	1.38	23.1	0.136	38.6	0.269	– 131.3
I_C = 30 mA, V_{CE} = 3 V, Z_0 = 50 Ω								
0.10	0.545	– 113.4	35.23	128.3	0.020	53.9	0.631	– 54.0
0.15	0.585	– 133.8	26.85	116.3	0.023	48.8	0.488	– 66.8
0.20	0.605	– 146.4	21.33	108.7	0.026	47.8	0.396	– 75.5
0.25	0.611	– 154.9	17.49	103.3	0.029	48.1	0.336	– 81.9
0.30	0.613	– 160.5	14.77	99.5	0.032	49.0	0.294	– 86.3
0.40	0.648	– 167.4	11.44	94.5	0.037	46.4	0.259	– 96.9
0.50	0.658	– 176.1	9.32	89.0	0.039	50.2	0.215	– 105.7
0.60	0.653	178.1	7.79	84.8	0.044	53.4	0.191	– 109.5
0.70	0.649	173.6	6.67	81.2	0.050	54.9	0.179	– 112.5
0.80	0.647	170.4	5.85	78.1	0.057	54.2	0.178	– 114.4
0.90	0.668	167.6	5.24	75.5	0.060	51.6	0.181	– 120.8
1.00	0.676	163.1	4.73	72.2	0.063	53.5	0.172	– 126.1
1.20	0.680	156.3	3.93	67.0	0.073	54.9	0.165	– 131.4
1.40	0.687	150.5	3.39	62.4	0.082	53.2	0.172	– 137.3
1.50	0.686	147.1	3.18	59.7	0.087	53.3	0.173	– 138.6
1.60	0.691	144.3	2.98	57.1	0.092	53.3	0.176	– 139.8
1.80	0.697	138.6	2.66	51.9	0.102	51.8	0.181	– 142.0
2.00	0.707	133.8	2.37	47.1	0.111	50.2	0.189	– 145.9
2.50	0.748	123.0	1.89	36.8	0.132	46.5	0.222	– 157.1
3.00	0.754	111.2	1.57	25.9	0.153	41.9	0.246	– 162.1

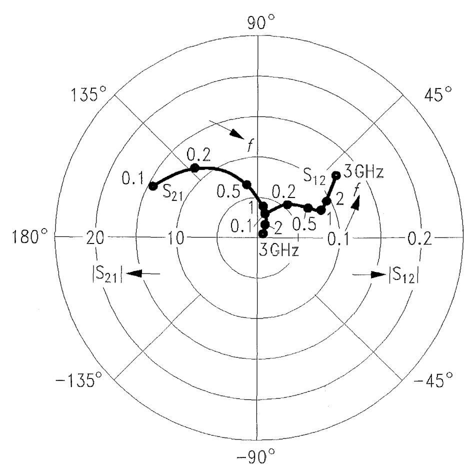
Common Emitter S Parameters (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_C = 5 mA, V_{CE} = 5 V, Z_0 = 50 Ω								
0.10	0.796	– 46.6	14.63	153.0	0.033	67.0	0.911	– 20.5
0.15	0.772	– 66.3	13.32	141.9	0.044	58.1	0.837	– 28.4
0.20	0.751	– 82.9	11.95	132.5	0.053	51.0	0.759	– 34.6
0.25	0.727	– 96.7	10.64	124.8	0.060	45.5	0.692	– 39.2
0.30	0.708	– 107.6	9.46	118.7	0.065	41.5	0.636	– 42.4
0.40	0.717	– 125.9	7.86	109.3	0.071	33.7	0.547	– 48.5
0.50	0.699	– 140.1	6.58	101.3	0.074	30.2	0.483	– 51.4
0.60	0.690	– 150.6	5.61	94.9	0.076	28.1	0.440	– 53.4
0.70	0.682	– 159.2	4.89	89.5	0.078	27.2	0.411	– 55.0
0.80	0.681	– 165.1	4.32	85.2	0.082	26.3	0.394	– 56.8
0.90	0.695	– 171.5	3.91	81.0	0.082	23.8	0.375	– 59.3
1.00	0.700	– 178.1	3.54	76.7	0.082	23.7	0.359	– 60.7
1.20	0.699	171.6	2.96	69.5	0.084	24.8	0.342	– 64.2
1.40	0.707	163.5	2.56	63.4	0.086	24.3	0.333	– 68.8
1.50	0.707	159.4	2.39	60.4	0.086	25.7	0.332	– 70.7
1.60	0.713	155.8	2.26	57.2	0.087	26.6	0.332	– 72.7
1.80	0.715	148.4	2.01	51.1	0.090	28.0	0.335	– 76.9
2.00	0.726	142.1	1.80	45.2	0.093	29.3	0.336	– 81.1
2.50	0.764	128.7	1.43	33.2	0.103	33.9	0.349	– 95.9
3.00	0.776	116.2	1.17	21.0	0.117	36.5	0.376	– 106.7

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



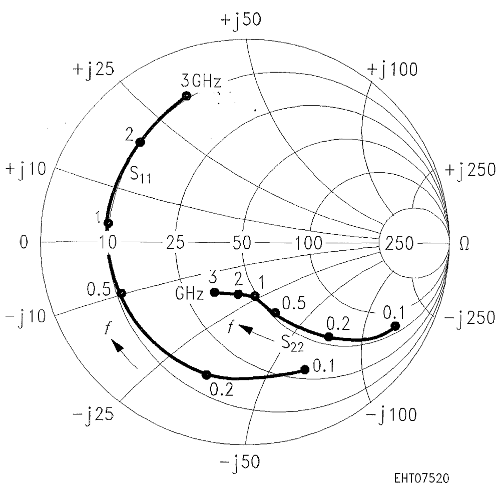
$S_{12}, S_{21} = f(f)$
I_C = 5 mA, V_{CE} = 5 V, Z_0 = 50 Ω



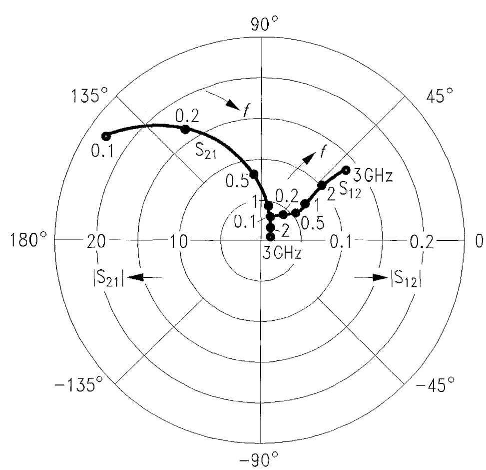
Common Emitter S Parameters (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_C = 10 mA, V_{CE} = 5 V, Z_0 = 50 Ω								
0.10	0.690	– 65.1	22.92	144.7	0.028	61.6	0.833	– 30.9
0.15	0.675	– 88.5	19.63	132.3	0.037	52.4	0.719	– 41.1
0.20	0.664	– 106.2	16.74	122.8	0.042	46.6	0.619	– 48.4
0.25	0.651	– 119.4	14.33	115.7	0.046	43.0	0.544	– 53.4
0.30	0.639	– 128.8	12.39	110.5	0.049	40.8	0.488	– 56.7
0.40	0.674	– 144.6	9.99	102.6	0.053	35.1	0.403	– 64.5
0.50	0.661	– 156.5	8.19	95.7	0.055	35.0	0.343	– 67.5
0.60	0.656	– 165.1	6.90	90.4	0.058	35.9	0.307	– 69.6
0.70	0.650	– 171.7	5.96	86.0	0.062	36.9	0.284	– 71.2
0.80	0.649	– 176.1	5.24	82.4	0.067	36.7	0.274	– 73.4
0.90	0.670	178.8	4.73	78.9	0.068	35.1	0.258	– 77.3
1.00	0.675	173.2	4.27	75.0	0.069	36.5	0.242	– 79.0
1.20	0.677	164.3	3.55	68.8	0.075	38.8	0.231	– 82.9
1.40	0.688	157.3	3.07	63.5	0.081	38.5	0.225	– 88.4
1.50	0.688	153.6	2.87	60.7	0.084	39.9	0.224	– 90.1
1.60	0.695	150.5	2.71	57.8	0.087	40.4	0.226	– 92.1
1.80	0.696	143.6	2.41	52.3	0.094	40.9	0.231	– 95.8
2.00	0.705	138.1	2.16	46.9	0.100	40.8	0.233	– 100.2
2.50	0.747	125.8	1.71	35.9	0.117	41.0	0.253	– 114.9
3.00	0.755	114.1	1.41	24.3	0.134	39.5	0.280	– 123.8

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



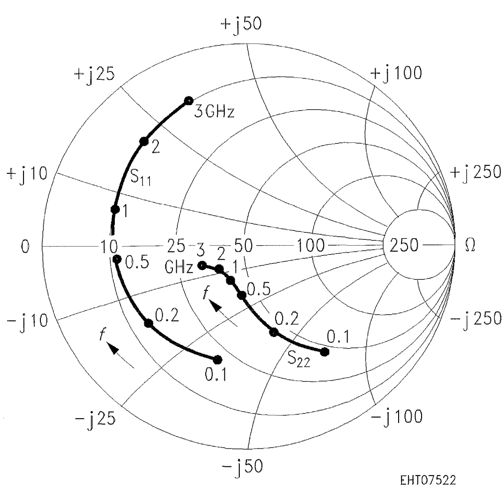
$S_{12}, S_{21} = f(f)$
I_C = 10 mA, V_{CE} = 5 V, Z_0 = 50 Ω



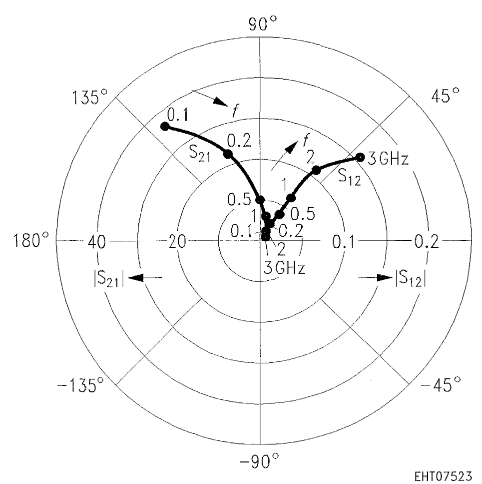
Common Emitter S Parameters (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**
I_C = 30 mA, V_{CE} = 5 V, Z_0 = 50 Ω								
0.10	0.556	– 106.4	36.18	129.6	0.020	54.6	0.648	– 51.6
0.15	0.581	– 128.5	27.79	117.6	0.024	49.1	0.506	– 64.3
0.20	0.595	– 142.1	22.15	109.7	0.027	47.9	0.411	– 72.7
0.25	0.597	– 151.0	18.19	104.3	0.029	48.3	0.349	– 78.3
0.30	0.595	– 156.4	15.32	100.6	0.033	48.9	0.312	– 81.9
0.40	0.651	– 166.5	12.09	94.8	0.035	46.2	0.260	– 95.6
0.50	0.640	– 174.8	9.73	89.5	0.039	50.7	0.217	– 100.6
0.60	0.636	179.5	8.11	85.5	0.045	53.4	0.195	– 104.4
0.70	0.633	174.9	6.97	82.0	0.051	54.7	0.184	– 106.9
0.80	0.630	172.4	6.10	79.2	0.057	53.3	0.185	– 109.5
0.90	0.655	168.6	5.50	76.3	0.059	51.9	0.182	– 116.4
1.00	0.662	163.9	4.95	73.0	0.063	53.9	0.172	– 120.0
1.20	0.664	156.8	4.11	67.7	0.074	54.8	0.169	– 124.6
1.40	0.676	150.9	3.54	63.3	0.082	53.1	0.174	– 130.9
1.50	0.676	147.6	3.32	60.8	0.087	53.6	0.174	– 132.0
1.60	0.682	144.7	3.12	58.1	0.092	53.3	0.177	– 133.4
1.80	0.683	138.8	2.78	53.1	0.102	51.8	0.184	– 135.5
2.00	0.693	133.8	2.49	48.1	0.111	50.1	0.189	– 139.3
2.50	0.733	122.8	1.97	38.2	0.132	46.8	0.221	– 150.2
3.00	0.744	111.6	1.63	27.4	0.152	42.5	0.244	– 155.3

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



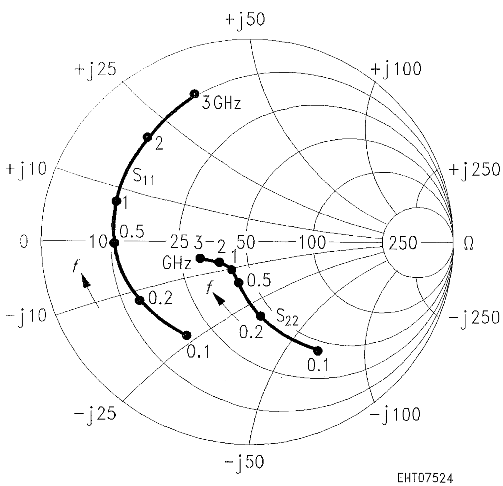
S_{12}, S_{21} = f (f)
I_C = 30 mA, V_{CE} = 5 V, Z_0 = 50 Ω



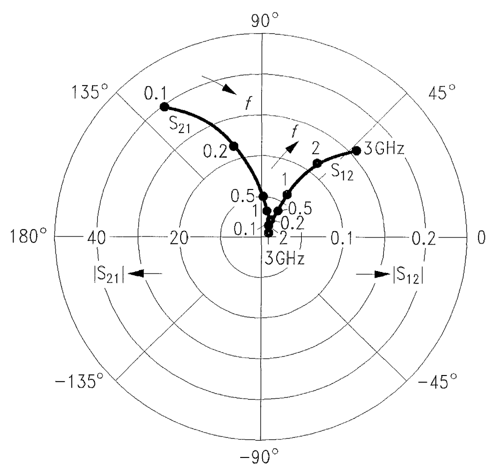
Common Emitter S Parameters (continued)

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								
0.10	0.544	– 124.1	39.07	123.8	0.017	53.8	0.560	– 59.8
0.15	0.580	– 142.5	28.97	112.6	0.020	50.5	0.425	– 72.7
0.20	0.599	– 153.3	22.68	105.5	0.023	51.3	0.341	– 81.3
0.25	0.602	– 160.4	18.45	100.8	0.026	52.9	0.290	– 87.0
0.30	0.598	– 164.3	15.46	97.7	0.029	53.7	0.262	– 90.5
0.40	0.657	– 172.5	12.13	92.5	0.032	51.8	0.225	– 106.1
0.50	0.647	– 179.8	9.73	87.6	0.036	56.9	0.190	– 111.6
0.60	0.643	175.4	8.10	83.9	0.043	59.3	0.174	– 115.5
0.70	0.638	171.4	6.95	80.6	0.049	60.1	0.166	– 117.8
0.80	0.635	169.3	6.08	78.0	0.056	57.7	0.171	– 119.8
0.90	0.661	165.9	5.47	75.2	0.058	56.6	0.172	– 126.8
1.00	0.666	161.6	4.93	72.1	0.062	58.5	0.164	– 130.6
1.20	0.670	154.8	4.08	66.9	0.074	58.3	0.165	– 134.6
1.40	0.682	149.3	3.53	62.6	0.083	56.5	0.172	– 139.9
1.50	0.681	146.0	3.30	60.1	0.088	56.6	0.173	– 141.1
1.60	0.686	143.3	3.11	57.6	0.093	56.2	0.176	– 142.2
1.80	0.688	137.5	2.77	52.6	0.104	54.3	0.184	– 143.7
2.00	0.698	132.6	2.47	47.7	0.113	52.3	0.190	– 147.1
2.50	0.737	121.9	1.96	38.1	0.135	48.2	0.224	– 156.6
3.00	0.746	111.0	1.63	27.2	0.155	43.5	0.246	– 160.9

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



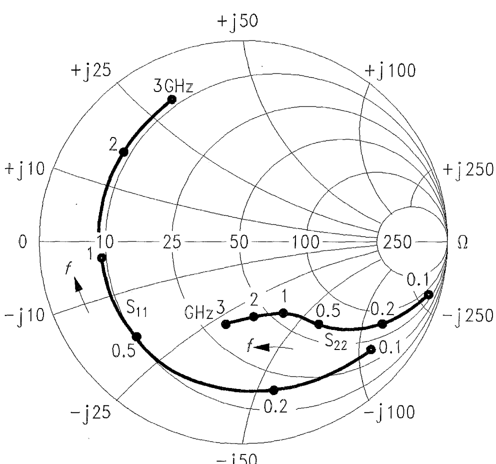
S_{12}, S_{21} = f (f)
I_C = 50 mA, V_{CE} = 5 V, Z_0 = 50 Ω



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} = 8 V, Z_0 = 50 Ω								
0.10	0.808	– 44.9	14.57	153.6	0.032	67.7	0.914	– 19.8
0.15	0.782	– 64.1	13.32	142.7	0.044	58.9	0.843	– 27.5
0.20	0.758	– 80.6	12.01	133.4	0.053	51.7	0.768	– 33.6
0.25	0.733	– 94.1	10.74	125.8	0.059	46.2	0.703	– 38.2
0.30	0.712	– 105.1	9.56	119.5	0.064	42.2	0.647	– 41.5
0.40	0.718	– 123.7	7.96	110.2	0.071	34.4	0.558	– 47.6
0.50	0.698	– 138.0	6.68	102.1	0.074	30.7	0.493	– 50.5
0.60	0.687	– 148.9	5.71	95.7	0.076	28.6	0.449	– 52.6
0.70	0.678	– 157.6	4.98	90.3	0.078	27.4	0.420	– 54.1
0.80	0.676	– 163.7	4.41	85.8	0.082	26.5	0.403	– 55.8
0.90	0.691	– 170.2	3.99	81.7	0.083	24.0	0.383	– 58.3
1.00	0.694	– 176.8	3.62	77.3	0.082	23.8	0.366	– 59.7
1.20	0.694	172.7	3.02	70.0	0.084	24.7	0.348	– 63.1
1.40	0.702	164.3	2.61	64.0	0.086	24.4	0.338	– 67.6
1.50	0.700	160.3	2.44	60.9	0.086	25.6	0.337	– 69.4
1.60	0.709	156.6	2.30	57.7	0.087	26.4	0.337	– 71.4
1.80	0.708	149.0	2.06	51.7	0.090	27.8	0.340	– 75.5
2.00	0.721	142.8	1.84	45.8	0.092	29.0	0.339	– 79.7
2.50	0.759	129.4	1.46	33.7	0.102	33.5	0.351	– 94.2
3.00	0.772	116.6	1.19	21.6	0.116	36.1	0.376	– 105.0

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



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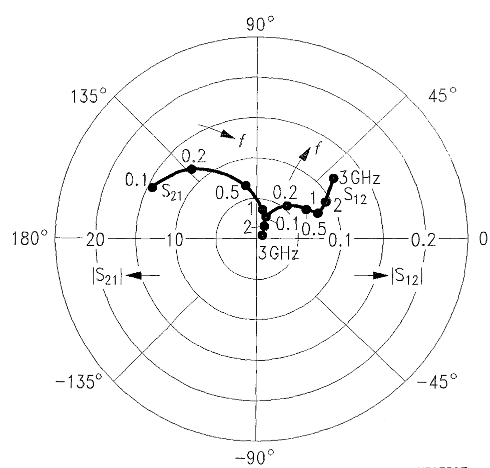
$S_{12}, S_{21} = f(f)$
I_C = 5 mA, V_{CE} = 8 V, Z_0 = 50 Ω



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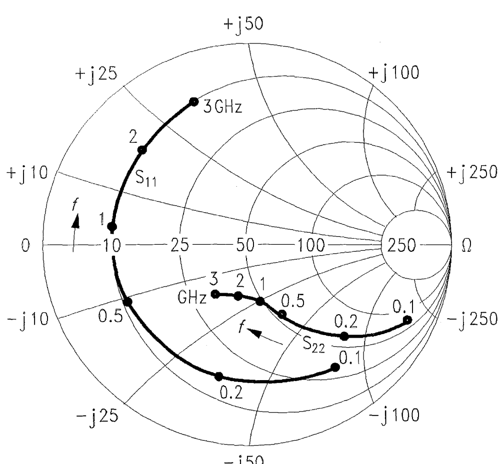
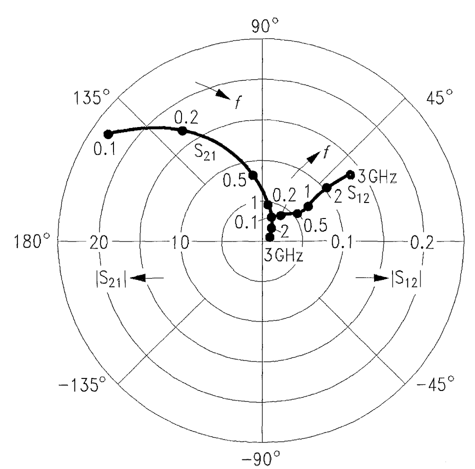
Common Emitter S Parameters (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**
I_C = 10 mA, V_{CE} = 8 V, Z_0 = 50 Ω								
0.10	0.707	– 62.3	23.03	145.5	0.028	62.2	0.838	– 30.0
0.15	0.686	– 85.3	19.82	133.2	0.036	53.2	0.729	– 40.1
0.20	0.669	– 103.0	16.98	123.8	0.042	47.3	0.631	– 47.4
0.25	0.653	– 116.4	14.59	116.6	0.046	43.5	0.554	– 52.4
0.30	0.639	– 126.0	12.63	111.3	0.049	41.3	0.498	– 55.7
0.40	0.670	– 142.3	10.22	103.3	0.054	35.5	0.412	– 63.6
0.50	0.656	– 154.4	8.39	96.3	0.056	35.3	0.351	– 66.6
0.60	0.648	– 163.3	7.08	91.0	0.058	35.9	0.313	– 68.7
0.70	0.643	– 170.3	6.12	86.5	0.062	36.9	0.290	– 70.3
0.80	0.642	– 174.7	5.38	83.0	0.067	36.7	0.279	– 72.5
0.90	0.662	180.0	4.85	79.4	0.068	34.8	0.262	– 76.4
1.00	0.669	174.3	4.39	75.6	0.069	36.3	0.246	– 78.0
1.20	0.669	165.2	3.65	69.3	0.076	38.6	0.233	– 81.8
1.40	0.679	158.2	3.15	64.0	0.081	38.1	0.226	– 87.2
1.50	0.679	154.3	2.95	61.2	0.084	39.6	0.225	– 88.9
1.60	0.685	151.1	2.78	58.4	0.087	40.0	0.226	– 90.8
1.80	0.687	144.3	2.47	52.9	0.094	40.5	0.231	– 94.6
2.00	0.698	138.7	2.22	47.4	0.100	40.4	0.232	– 98.8
2.50	0.739	126.2	1.76	36.5	0.117	40.6	0.250	– 113.6
3.00	0.748	114.3	1.45	24.9	0.134	39.2	0.276	– 122.5

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



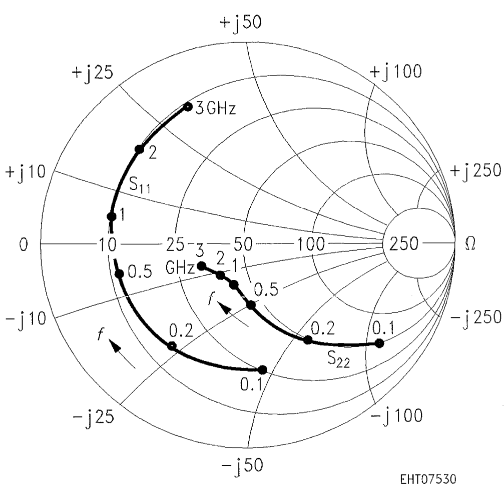
$S_{12}, S_{21} = f(f)$
I_C = 10 mA, V_{CE} = 8 V, Z_0 = 50 Ω



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} = 8 V, Z_0 = 50 Ω								
0.10	0.607	– 85.2	32.08	136.1	0.023	57.0	0.731	– 42.7
0.15	0.607	– 109.4	25.79	123.6	0.029	49.5	0.592	– 54.6
0.20	0.609	– 125.7	21.10	114.9	0.032	46.1	0.492	– 62.7
0.25	0.604	– 137.3	17.60	108.7	0.035	44.7	0.419	– 68.5
0.30	0.600	– 145.4	15.00	104.2	0.038	44.4	0.367	– 72.3
0.40	0.630	– 155.3	11.73	98.4	0.043	41.3	0.315	– 81.2
0.50	0.637	– 166.5	9.64	92.2	0.044	42.9	0.256	– 88.1
0.60	0.630	– 173.8	8.08	87.6	0.048	45.6	0.225	– 91.0
0.70	0.624	– 179.5	6.94	83.6	0.053	47.5	0.207	– 93.4
0.80	0.622	176.6	6.09	80.3	0.059	47.6	0.201	– 95.5
0.90	0.645	173.3	5.46	77.6	0.062	45.1	0.197	– 101.7
1.00	0.654	168.0	4.94	74.0	0.064	46.7	0.182	– 106.2
1.20	0.657	160.2	4.10	68.5	0.074	49.0	0.169	– 111.1
1.40	0.663	153.9	3.54	63.7	0.081	47.8	0.170	– 117.9
1.50	0.664	150.4	3.31	61.1	0.085	48.3	0.170	– 119.5
1.60	0.666	147.3	3.11	58.4	0.090	48.6	0.173	– 121.4
1.80	0.675	141.2	2.77	53.1	0.099	47.8	0.176	– 124.2
2.00	0.684	136.1	2.48	48.2	0.107	46.6	0.181	– 128.9
2.50	0.731	124.7	1.97	37.7	0.127	44.1	0.207	– 143.0
3.00	0.735	112.7	1.64	26.7	0.146	40.4	0.232	– 149.6

S_{11}, $S_{22} = f(f)$
I_C = 20 mA, V_{CE} = 8 V, Z_0 = 50 Ω



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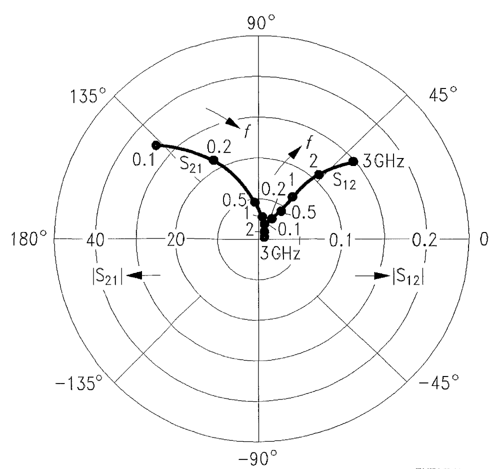
S_{12}, $S_{21} = f(f)$
I_C = 20 mA, V_{CE} = 8 V, Z_0 = 50 Ω



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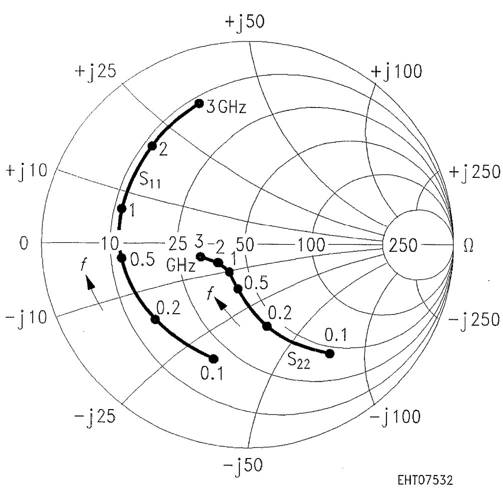
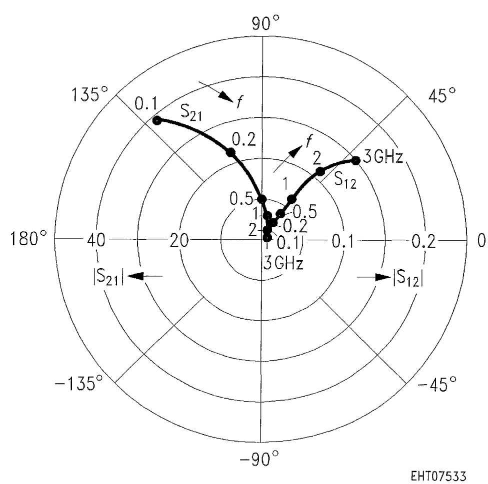
Common Emitter S Parameters (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_C = 40 mA, V_{CE} = 8 V, Z_0 = 50 Ω								
0.10	0.558	– 108.0	38.69	127.7	0.019	53.5	0.614	– 54.7
0.15	0.578	– 129.8	29.36	115.9	0.023	49.3	0.473	– 67.6
0.20	0.590	– 143.1	23.28	108.3	0.025	48.9	0.383	– 76.2
0.25	0.589	– 152.1	19.06	103.1	0.028	49.3	0.324	– 82.5
0.30	0.589	– 158.1	16.07	99.4	0.031	50.1	0.284	– 86.9
0.40	0.624	– 165.3	12.46	94.6	0.036	47.6	0.254	– 97.8
0.50	0.633	– 174.6	10.16	89.1	0.039	51.4	0.208	– 107.0
0.60	0.625	179.3	8.49	85.0	0.044	54.6	0.184	– 110.8
0.70	0.620	174.6	7.26	81.5	0.050	56.1	0.173	– 113.6
0.80	0.616	171.6	6.36	78.6	0.057	55.2	0.173	– 115.4
0.90	0.642	168.7	5.71	76.1	0.060	52.4	0.176	– 122.4
1.00	0.650	163.9	5.16	72.8	0.063	54.3	0.167	– 128.0
1.20	0.654	156.9	4.27	67.7	0.074	55.5	0.159	– 133.3
1.40	0.661	151.1	3.70	63.2	0.083	53.6	0.166	– 139.5
1.50	0.661	147.7	3.46	60.6	0.088	53.7	0.166	– 140.8
1.60	0.665	144.7	3.25	58.0	0.093	53.5	0.169	– 142.0
1.80	0.671	139.1	2.89	52.9	0.103	51.8	0.174	– 144.1
2.00	0.681	134.3	2.58	48.2	0.112	50.2	0.180	– 148.0
2.50	0.725	123.3	2.05	38.1	0.133	46.2	0.212	– 159.4
3.00	0.732	111.4	1.71	27.4	0.154	41.4	0.234	– 164.2

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

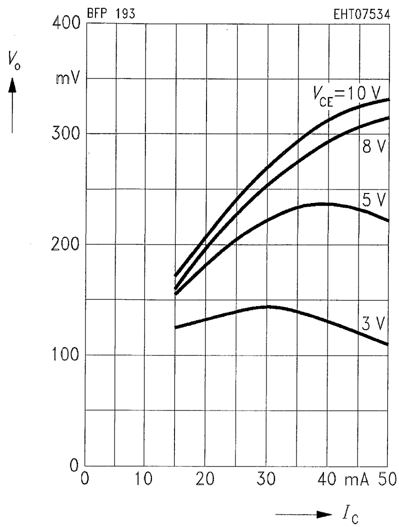


S_{12}, S_{21} = f (f)
I_C = 40 mA, V_{CE} = 8 V, Z_0 = 50 Ω



Common Emitter Large Signal Parameters

Linear output voltage $V_o = f(I_C)$
d_{IM} = 60 dB, f_1 = 806 MHz,
f_2 = 810 MHz, $Z_S = Z_L$ = 50 Ω



Note:

The transistor is driven by 2 adjacent signals f_1, f_2 with equal <u>output</u> power levels P_o for each carrier.

The distance d_{IM} between P_o and the third order intermodulation products P_{IM} ($2f_1 - f_2$ or $2f_2 - f_1$) is:

$d_{IM} = P_o - P_{IM}$
where $P_o = 10 \log (V_o^2/(50\ \Omega \cdot 1\ \text{mW}))$ (dBm)
and V_o = linear <u>output</u> voltage of each carrier.

The 3rd order intercept point IP_3 will be found by extrapolation to the point where P_{IM} would be identical to P_o:

IP_3 (output) $= P_o + d_{IM}/2$.

Linear output voltages for other d_{IM} (e.g. 50 dB) can be calculated thereby.

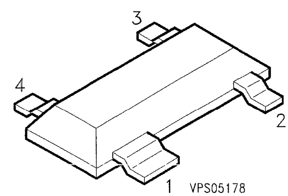
SIEMENS

PNP Silicon RF Transistor

BFP 194

Preliminary Data

- For low-distortion broadband amplifiers in antenna and telecommunications systems up to 1.5 GHz at collector currents from 20 mA to 80 mA.
- f_T = 4.5 GHz



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]
BFP 194	RKs	Q62702-F1347	C	E	B	E	SOT-143

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CEO}	15	V
Collector-base voltage	V_{CBO}	20	
Emitter-base voltage	V_{EBO}	3	
Collector current	I_C	100	mA
Peak collector current, $f \geq 10$ MHz	I_{CM}	120	
Base current	I_B	10	
Peak base current, $f \geq 10$ MHz	I_{BM}	12	
Total power dissipation, $T_S \leq 77$ °C[3]	P_{tot}	700	mW
Junction temperature	T_j	150	°C
Ambient temperature range	T_A	– 65 … + 150	
Storage temperature range	T_{stg}	– 65 … + 150	

Thermal Resistance

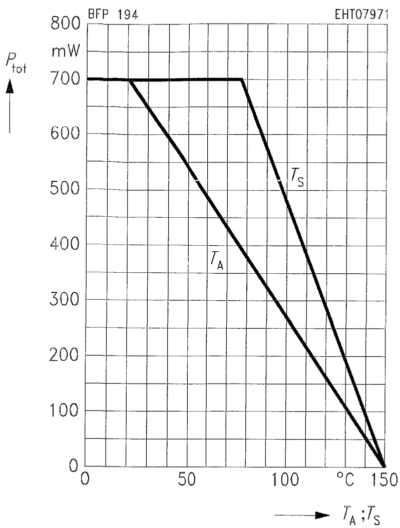
Junction - ambient[2]	$R_{th\,JA}$	≤ 185	K/W
Junction - soldering point[3]	$R_{th\,JS}$	≤ 105	

1) For detailed information 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.

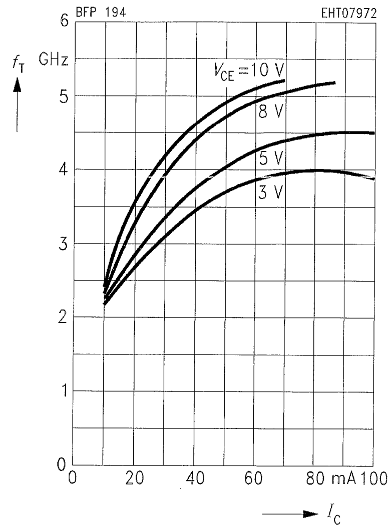
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CEO}$	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}	–	–	1	µA
DC current gain I_C = 50 mA, V_{CE} = 10 V I_C = 70 mA, V_{CE} = 10 V	h_{FE}	 20 20	 50 50	 150 –	–
Collector-emitter saturation voltage I_C = 75 mA, I_B = 7.5 mA	V_{CEsat}	–	–	0.5	V
AC Characteristics					
Transition frequency I_C = 70 mA, V_{CE} = 10 V, f = 500 MHz	f_T	–	5.0	–	GHz
Collector-base capacitance V_{CB} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{cb}	–	1.45	–	pF

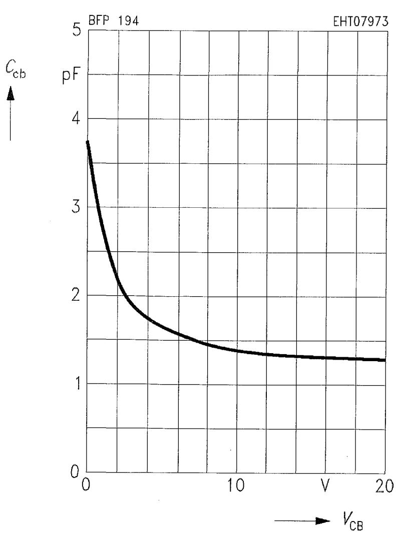
Total power dissipation $P_{tot} = f\,(T_A{}^*;\, T_S)$
*Package mounted on alumina



Transition frequency $f_T = f\,(I_C)$
f = 500 MHz



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



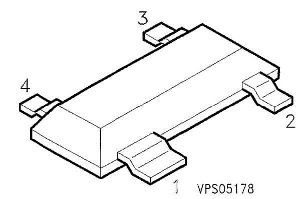
SIEMENS

NPN Silicon RF Transistor

BFP 196

Preliminary Data

- For low-noise, low-distortion broadband amplifiers in antenna and telecommunications systems up to 1.5 GHz at collector currents from 20 mA to 80 mA.
- Power amplifier for DECT and PCN systems
- f_T = 7.5 GHz
  F = 1.35 dB at 900 MHz



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]
BFP 196	RIs	Q62702-F1320	C	E	B	E	SOT-143

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CEO}	12	V
Collector-emitter voltage, V_{BE} = 0	V_{CES}	20	
Collector-base voltage	V_{CBO}	20	
Emitter-base voltage	V_{EBO}	2	
Collector current	I_C	100	mA
Peak collector current, $f \geq$ 10 MHz	I_{CM}	150	
Base current	I_B	12	
Peak base current, $f \geq$ 10 MHz	I_{BM}	15	
Total power dissipation, $T_S \leq$ 77 ˚C[3]	P_{tot}	700	mW
Junction temperature	T_j	150	˚C
Ambient temperature range	T_A	– 65 … + 150	
Storage temperature range	T_{stg}	– 65 … + 150	

Thermal Resistance

Junction - ambient[2]	$R_{th JA}$	≤ 185	K/W
Junction - soldering point[3]	$R_{th JS}$	≤ 105	

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

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

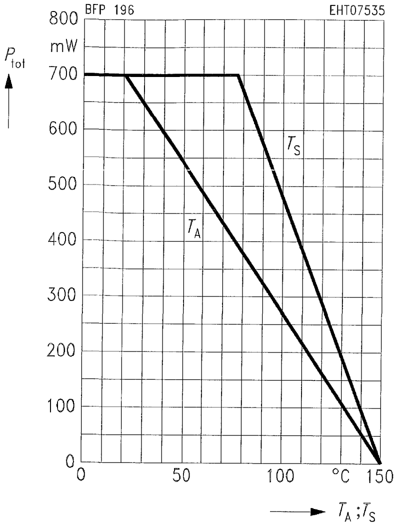
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CE0}$	12	–	–	V
Collector-emitter cutoff current V_{CE} = 20 V, V_{BE} = 0	I_{CES}	–	–	100	µA
Collector-base cutoff current V_{CB} = 10 V, I_E = 0	I_{CB0}	–	–	50	nA
Emitter-base cutoff current V_{EB} = 1 V, I_C = 0	I_{EB0}	–	–	1	µA
DC current gain I_C = 50 mA, V_{CE} = 5 V	h_{FE}	50	90	250	–
Collector-emitter saturation voltage I_C = 75 mA, I_B = 7.5 mA	V_{CEsat}	–	0.1	0.5	V

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

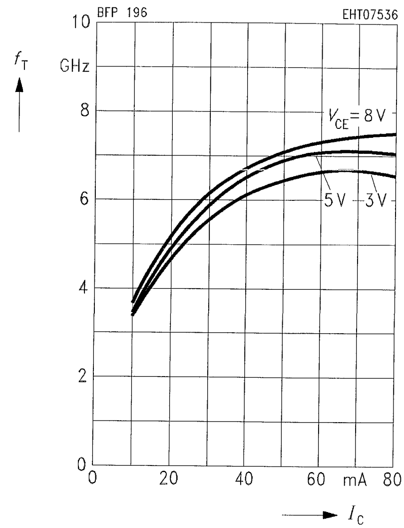
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
AC Characteristics					
Transition frequency	f_T				GHz
I_C = 50 mA, V_{CE} = 5 V, f = 500 MHz		–	6.9	–	
I_C = 70 mA, V_{CE} = 5 V, f = 500 MHz		–	7.2	–	
Collector-base capacitance V_{CB} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{cb}	–	0.95	–	pF
Collector-emitter capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{ce}	–	0.32	–	
Input capacitance V_{EB} = 0.5 V, I_C = i_c = 0, f = 1 MHz	C_{ibo}	–	4.3	–	
Output capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{obs}	–	1.4	–	
Noise figure	F				dB
I_C = 10 mA, V_{CE} = 8 V, f = 10 MHz, Z_S = 50 Ω		–	0.95	–	
I_C = 10 mA, V_{CE} = 8 V, f = 900 MHz, Z_S = Z_{Sopt}		–	1.35	–	
I_C = 50 mA, V_{CE} = 8 V, f = 1 GHz, Z_S = Z_{Sopt}		–	1.9	–	
Power gain	G_{ma} 1)				
I_C = 70 mA, V_{CE} = 5 V, f = 900 MHz, Z_0 = 50 Ω		–	16	–	
I_C = 70 mA, V_{CE} = 5 V, f = 1.75 GHz, Z_0 = 50 Ω		–	10.5	–	
Transducer gain I_C = 70 mA, V_{CE} = 8 V, f = 500 MHz, Z_0 = 50 Ω	$\vert S_{21e}\vert^2$	–	17.5	–	
Linear output voltage two-tone intermodulation test I_C = 70 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}	–	400	–	mV
Third order intercept point I_C = 70 mA, V_{CE} = 8 V, f = 800 MHz	IP_3	–	35	–	dBm

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

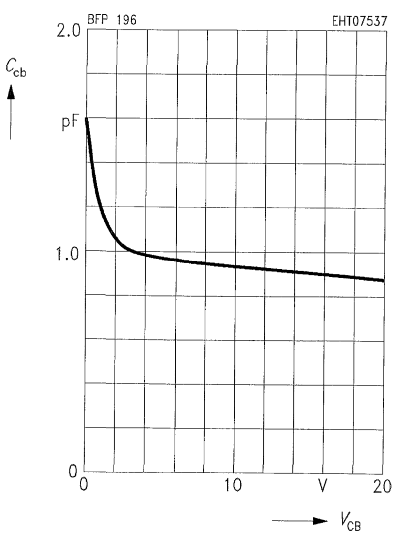
Total power dissipation $P_{tot} = f\,(T_A^*;\ T_S)$
*Package mounted on alumina



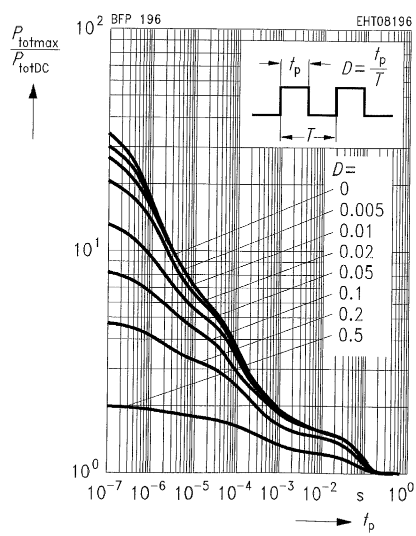
Transition frequency $f_T = f\,(I_C)$
f = 500 MHz



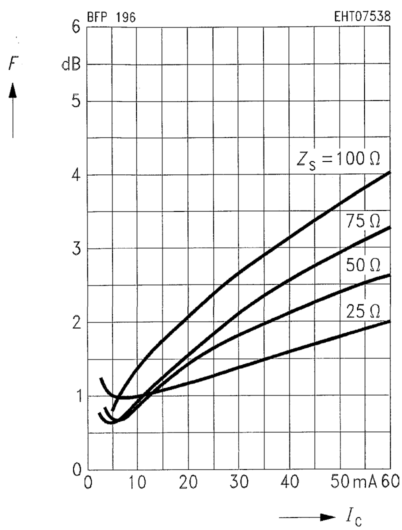
Collector-base capacitance $C_{cb} = f\,(V_{CB})$
$V_{BE} = v_{be} = 0$, f = 1 MHz



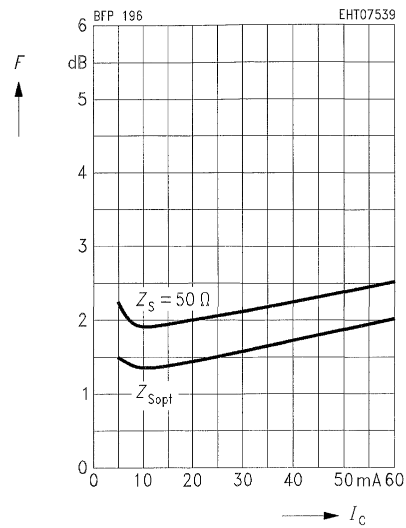
Permissible pulse load $P_{totmax}/P_{totDC} = f\,(t_p)$
* For note refer to next page.



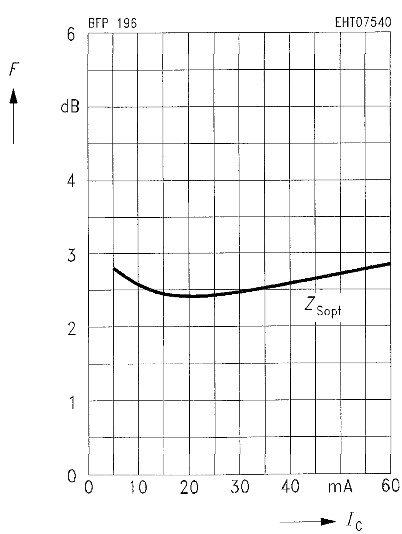
Noise figure $F = f\ (I_C)$
V_{CE} = 5 V, f = 10 MHz



Noise figure $F = f\ (I_C)$
V_{CE} = 8 V, f = 900 MHz, Z_{Lopt} (G)



Noise figure $F = f\ (I_C)$
V_{CE} = 8 V, f = 1.75 GHz, Z_{Sopt} (G)



* Note for P_{totmax}/P_{totDC} on previous page:
Safe operating area: For the dynamic permissible P_{totmax} a linear power derating is necessary above $V_{CE0}/2$ to V_{CE0max}.

Common Emitter S Parameters

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_C = 20 mA, V_{CE} = 3 V, Z_0 = 50 Ω								
0.10	0.640	– 122.6	26.21	122.3	0.028	47.1	0.574	– 66.0
0.20	0.688	– 152.3	15.09	104.0	0.035	41.9	0.359	– 91.6
0.30	0.701	– 164.7	10.39	95.4	0.040	44.1	0.276	– 106.1
0.40	0.706	– 172.2	7.88	89.7	0.045	47.4	0.238	– 116.0
0.50	0.711	– 178.0	6.35	85.1	0.051	50.5	0.219	– 123.1
0.60	0.714	177.6	5.31	81.3	0.057	52.8	0.209	– 128.4
0.70	0.715	173.9	4.57	77.8	0.063	54.4	0.205	– 132.5
0.80	0.717	170.3	4.00	74.7	0.070	55.8	0.203	– 135.7
0.90	0.723	167.5	3.57	71.7	0.076	56.7	0.203	– 138.3
1.00	0.721	164.5	3.21	68.8	0.083	57.4	0.205	– 140.5
1.20	0.721	158.9	2.69	63.3	0.096	57.9	0.212	– 143.8
1.40	0.729	154.1	2.32	58.2	0.110	57.8	0.222	– 146.4
1.60	0.731	149.1	2.04	53.2	0.124	57.2	0.233	– 148.6
1.80	0.738	144.2	1.83	48.5	0.138	56.3	0.245	– 150.5
2.00	0.739	140.7	1.65	44.2	0.152	55.1	0.257	– 152.5
2.50	0.749	130.1	1.34	33.4	0.186	51.3	0.289	– 157.3
3.00	0.766	120.0	1.14	24.1	0.219	46.9	0.321	– 162.6
I_C = 50 mA, V_{CE} = 3 V, Z_0 = 50 Ω								
0.10	0.639	– 150.0	30.84	113.1	0.019	50.1	0.459	– 90.8
0.20	0.686	– 167.7	16.63	98.6	0.025	54.4	0.319	– 121.0
0.30	0.697	– 175.2	11.27	91.9	0.032	59.5	0.279	– 136.2
0.40	0.701	179.8	8.50	87.3	0.040	62.7	0.265	– 145.3
0.50	0.706	175.6	6.83	83.4	0.048	64.6	0.259	– 151.1
0.60	0.710	172.3	5.70	80.1	0.056	65.7	0.257	– 155.3
0.70	0.710	169.4	4.90	77.1	0.064	65.9	0.257	– 158.1
0.80	0.713	166.2	4.29	74.3	0.072	66.1	0.259	– 160.4
0.90	0.718	163.8	3.82	71.7	0.080	65.8	0.261	– 162.3
1.00	0.714	161.2	3.44	69.0	0.088	65.4	0.263	– 163.9
1.20	0.714	156.2	2.88	64.0	0.104	64.1	0.270	– 166.2
1.40	0.723	151.7	2.48	59.3	0.120	62.6	0.278	– 168.0
1.60	0.723	146.9	2.18	54.6	0.135	60.9	0.285	– 169.8
1.80	0.729	142.1	1.96	50.0	0.151	58.9	0.294	– 171.1
2.00	0.730	138.9	1.77	46.1	0.166	56.8	0.302	– 172.6
2.50	0.739	128.4	1.45	35.8	0.201	51.2	0.323	– 176.1
3.00	0.753	118.9	1.23	26.7	0.235	45.7	0.345	– 179.8

Common Emitter S Parameters (continued)

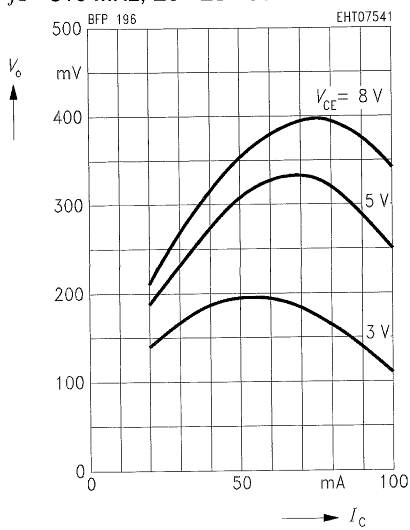
f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_C = 30 mA, V_{CE} = 5 V, Z_0 = 50 Ω								
0.10	0.625	– 132.1	29.76	118.8	0.023	47.8	0.525	– 74.4
0.20	0.673	– 157.9	16.65	102.0	0.030	46.7	0.334	– 102.2
0.30	0.685	– 168.6	11.39	94.1	0.036	50.5	0.267	– 117.9
0.40	0.690	– 175.2	8.61	88.9	0.042	54.4	0.239	– 128.1
0.50	0.695	179.7	6.93	84.8	0.049	57.1	0.226	– 135.2
0.60	0.699	175.6	5.79	81.1	0.056	59.0	0.218	– 140.4
0.70	0.699	172.3	4.98	78.0	0.063	60.1	0.217	– 144.1
0.80	0.701	168.8	4.36	75.0	0.070	61.0	0.216	– 147.0
0.90	0.707	166.1	3.89	72.2	0.077	61.3	0.217	– 149.4
1.00	0.705	163.3	3.50	69.3	0.085	61.5	0.219	– 151.5
1.20	0.705	157.9	2.92	64.2	0.099	61.0	0.225	– 154.3
1.40	0.714	153.3	2.52	59.4	0.114	60.2	0.234	– 156.5
1.60	0.714	148.4	2.22	54.5	0.128	59.1	0.243	– 158.5
1.80	0.721	143.4	1.99	50.0	0.143	57.6	0.253	– 160.1
2.00	0.722	140.2	1.80	45.8	0.157	55.9	0.263	– 161.7
2.50	0.732	129.5	1.46	35.3	0.192	51.3	0.288	– 165.8
3.00	0.749	119.7	1.24	26.1	0.224	46.3	0.315	– 170.3
I_C = 50 mA, V_{CE} = 5 V, Z_0 = 50 Ω								
0.10	0.627	– 145.6	32.24	113.9	0.019	49.8	0.463	– 88.0
0.20	0.672	– 165.4	17.45	99.1	0.026	53.3	0.315	– 117.8
0.30	0.683	– 173.7	11.84	92.2	0.033	58.3	0.271	– 133.3
0.40	0.687	– 179.1	8.93	87.6	0.040	61.8	0.254	– 142.7
0.50	0.693	176.6	7.18	83.8	0.048	64.0	0.248	– 148.7
0.60	0.695	173.2	5.99	80.5	0.056	65.0	0.245	– 153.1
0.70	0.697	170.0	5.15	77.5	0.064	65.4	0.245	– 156.1
0.80	0.699	166.9	4.50	74.7	0.071	65.6	0.246	– 158.6
0.90	0.704	164.3	4.02	72.1	0.079	65.4	0.247	– 160.6
1.00	0.702	161.7	3.62	69.4	0.088	65.0	0.250	– 162.3
1.20	0.701	156.5	3.02	64.4	0.103	63.9	0.256	– 164.6
1.40	0.709	152.0	2.61	59.8	0.119	62.3	0.264	– 166.6
1.60	0.710	147.4	2.29	55.1	0.134	60.6	0.272	– 168.3
1.80	0.718	142.5	2.05	50.7	0.149	58.7	0.280	– 169.7
2.00	0.718	139.3	1.86	46.7	0.164	56.7	0.288	– 171.2
2.50	0.726	128.8	1.52	36.5	0.199	51.2	0.309	– 174.8
3.00	0.743	119.0	1.29	27.3	0.232	45.7	0.330	– 178.9

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 = 70 mA, V_{CE} = 5 V, Z_0 = 50 Ω								
0.10	0.636	– 152.2	32.91	111.3	0.017	51.8	0.430	– 95.6
0.20	0.676	– 168.8	17.55	97.6	0.024	57.2	0.307	– 125.6
0.30	0.687	– 176.0	11.87	91.3	0.031	62.4	0.274	– 140.2
0.40	0.689	179.2	8.94	86.9	0.039	65.2	0.263	– 148.8
0.50	0.695	175.1	7.18	83.2	0.048	66.7	0.258	– 154.1
0.60	0.698	171.8	5.99	80.0	0.056	67.4	0.257	– 158.0
0.70	0.698	168.9	5.15	77.1	0.064	67.6	0.258	– 160.6
0.80	0.699	165.9	4.50	74.4	0.072	67.5	0.259	– 162.8
0.90	0.705	163.4	4.02	71.8	0.081	67.1	0.261	– 164.5
1.00	0.703	161.0	3.62	69.2	0.089	66.5	0.264	– 166.2
1.20	0.705	155.9	3.02	64.3	0.105	65.0	0.270	– 168.3
1.40	0.710	151.5	2.61	59.8	0.121	63.2	0.278	– 170.0
1.60	0.711	146.7	2.29	55.1	0.136	61.3	0.285	– 171.7
1.80	0.719	142.0	2.06	50.8	0.152	59.2	0.293	– 173.1
2.00	0.720	138.8	1.86	46.7	0.167	57.0	0.300	– 174.5
2.50	0.727	128.4	1.52	36.5	0.202	51.3	0.320	– 178.0
3.00	0.740	118.8	1.29	27.5	0.236	45.5	0.339	– 177.9
I_C = 70 mA, V_{CE} = 8 V, Z_0 = 50 Ω								
0.10	0.631	– 146.3	33.94	111.8	0.018	49.9	0.429	– 93.3
0.20	0.666	– 165.8	18.15	97.9	0.025	54.9	0.301	– 123.2
0.30	0.674	– 174.0	12.28	91.5	0.032	60.1	0.265	– 138.2
0.40	0.677	– 179.3	9.26	87.1	0.040	63.3	0.252	– 147.0
0.50	0.682	176.4	7.43	83.4	0.048	65.1	0.248	– 152.5
0.60	0.684	172.9	6.20	80.3	0.056	66.1	0.246	– 156.6
0.70	0.684	169.8	5.33	77.3	0.064	66.3	0.246	– 159.3
0.80	0.687	166.8	4.66	74.6	0.072	66.4	0.248	– 161.6
0.90	0.693	164.2	4.16	72.1	0.080	66.1	0.250	– 163.4
1.00	0.690	161.7	3.74	69.4	0.088	65.6	0.252	– 165.0
1.20	0.690	156.4	3.13	64.6	0.104	64.2	0.258	– 167.3
1.40	0.699	151.9	2.70	60.1	0.120	62.5	0.266	– 169.1
1.60	0.699	147.2	2.37	55.4	0.135	60.7	0.273	– 170.8
1.80	0.705	142.3	2.13	51.0	0.150	58.7	0.280	– 172.1
2.00	0.707	139.3	1.92	47.1	0.165	56.5	0.288	– 173.6
2.50	0.716	128.7	1.57	36.9	0.201	50.9	0.306	– 177.0
3.00	0.732	119.1	1.33	27.9	0.233	45.3	0.326	– 179.0

Common Emitter Large Signal Parameters

Linear output voltage $V_o = f\ (I_C)$
d_{IM} = 60 dB, f_1 = 806 MHz,
f_2 = 810 MHz, $Z_S = Z_L$ = 50 Ω



Note:

The transistor is driven by 2 adjacent signals f_1, f_2 with equal output power levels P_o for each carrier.
The distance d_{IM} between P_o and the third order intermodulation products P_{IM} ($2f_1 - f_2$ or $2f_2 - f_1$) is:

$d_{IM} = P_o - P_{IM}$
where $P_o = 10 \log (V_o^2 / (50\ \Omega \cdot 1\ \text{mW}))$ (dBm)
and V_o = linear output voltage of each carrier.

The 3rd order intercept point IP_3 will be found by extrapolation to the point where P_{IM} would be identical to P_o:

IP_3 (output) = $P_o + d_{IM}/2$.

Linear output voltages for other d_{IM} (e.g. 50 dB) can be calculated thereby.

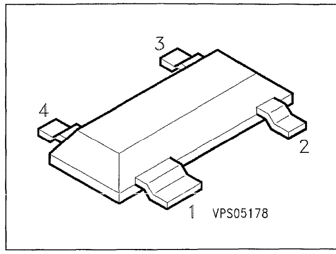
SIEMENS

NPN Silicon RF Transistor

BFP 280

Preliminary Data

- For low-noise, low-power amplifiers in mobile communication systems (pager, cordless telephone) at collector currents from 0.2 mA to 8 mA.
- f_T = 7 GHz
  F = 1.6 dB at 900 MHz



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)]
BFP 280	REs	Q62702-F1300	C	E	B	E	SOT-143

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CEO}	8	V
Collector-emitter voltage, V_{BE} = 0	V_{CES}	10	
Collector-base voltage	V_{CBO}	10	
Emitter-base voltage	V_{EBO}	2	
Collector current	I_C	10	mA
Peak collector current, $f \geq$ 10 MHz	I_{CM}	15	
Base current	I_B	1.2	
Peak base current, $f \geq$ 10 MHz	I_{BM}	1.5	
Total power dissipation, $T_S \leq$ 116 °C[3)]	P_{tot}	80	mW
Junction temperature	T_j	150	°C
Ambient temperature range	T_A	– 65 ... + 150	
Storage temperature range	T_{stg}	– 65 ... + 150	

Thermal Resistance

Junction - ambient[2)]	$R_{th JA}$	≤ 500	K/W
Junction - soldering point[3)]	$R_{th JS}$	≤ 420	

1) For detailed information 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.

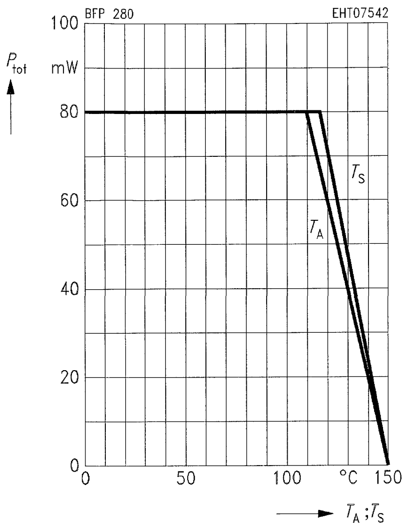
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CEO}$	8	–	–	V
Collector-emitter cutoff current V_{CE} = 10 V, V_{BE} = 0	I_{CES}	–	–	100	µA
Collector-base cutoff current V_{CB} = 8 V, I_E = 0	I_{CBO}	–	–	100	nA
Emitter-base cutoff current V_{EB} = 1 V, I_C = 0	I_{EBO}	–	–	2	µA
DC current gain I_C = 0.25 mA, V_{CE} = 1 V I_C = 3 mA, V_{CE} = 1 V	h_{FE}	 30 30	 90 100	 200 –	–
Collector-emitter saturation voltage I_C = 5 mA, I_B = 0.5 mA	V_{CEsat}	–	0.1	0.4	V

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

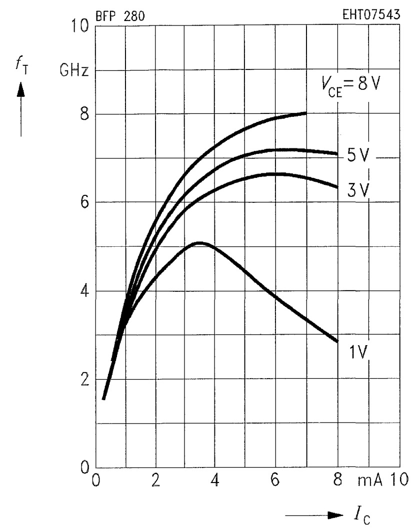
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
AC Characteristics					
Transition frequency I_C = 3 mA, V_{CE} = 1 V, f = 500 MHz I_C = 6 mA, V_{CE} = 5 V, f = 500 MHz	f_T	 – –	 5 7	 – –	GHz
Collector-base capacitance V_{CB} = 1 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{cb}	–	0.21	–	pF
Collector-emitter capacitance V_{CE} = 1 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{ce}	–	0.23	–	
Input capacitance V_{EB} = 0.5 V, I_C = i_c = 0, f = 1 MHz	C_{ibo}	–	0.4	–	
Output capacitance V_{CE} = 1 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{obs}	–	0.45	–	
Noise figure I_C = 3 mA, V_{CE} = 1 V, f = 10 MHz, Z_S = 75 Ω I_C = 3 mA, V_{CE} = 1 V, f = 900 MHz, Z_S = Z_{Sopt} I_C = 3 mA, V_{CE} = 1 V, f = 1.75 GHz, Z_S = Z_{Sopt}	F	 – – –	 1.8 1.6 2.4	 – – –	dB
Power gain I_C = 3 mA, V_{CE} = 1 V, f = 900 MHz, Z_0 = 50 Ω I_C = 6 mA, V_{CE} = 5 V, f = 900 MHz, Z_0 = 50 Ω	G_{ms} 1)	 – –	 17 20	 – –	
Transducer gain I_C = 6 mA, V_{CE} = 5 V, f = 1 GHz, Z_0 = 50 Ω	$\lvert S_{21e} \rvert^2$	–	16	–	

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

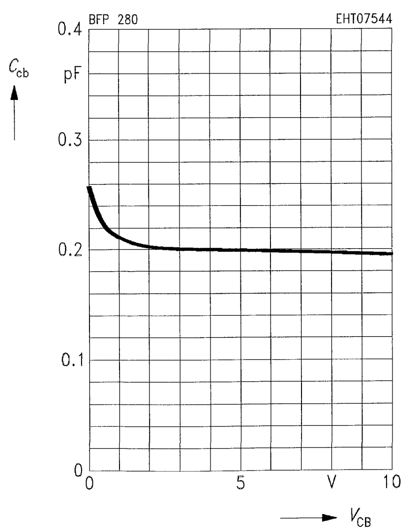
Total power dissipation $P_{tot} = f(T_A^*; T_S)$
*Package mounted on alumina



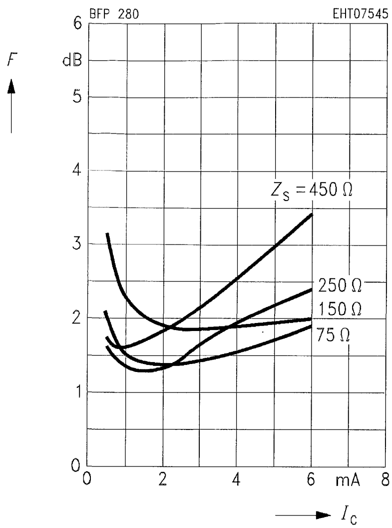
Transition frequency $f_T = f(I_C)$
f = 500 MHz



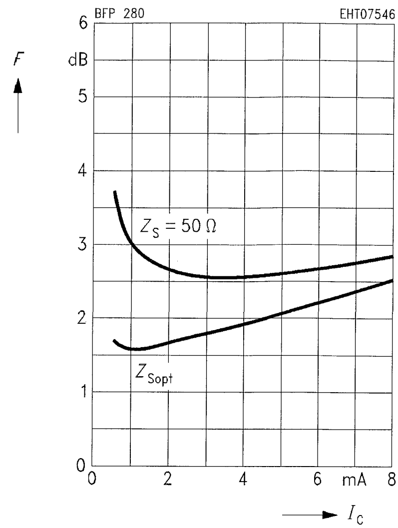
Collector-base capacitance $C_{cb} = f(V_{CB})$
$V_{BE} = v_{be} = 0$, f = 1 MHz



Noise figure $F = f\,(I_C)$
V_{CE} = 3 V, f = 10 MHz



Noise figure $F = f\,(I_C)$
V_{CE} = 3 V, f = 900 MHz, Z_{Lopt} (G)



Common Emitter S Parameters

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_C = 0.5 mA, V_{CE} = 1 V, Z_0 = 50 Ω								
0.10	0.972	– 5.1	1.77	174.9	0.015	86.7	0.997	– 2.6
0.20	0.968	– 10.2	1.77	169.8	0.030	83.0	0.994	– 5.2
0.30	0.962	– 15.2	1.77	164.7	0.045	79.5	0.991	– 7.8
0.40	0.949	– 20.2	1.76	159.5	0.059	76.0	0.984	– 10.3
0.50	0.937	– 25.2	1.75	154.2	0.073	72.4	0.977	– 12.9
0.60	0.924	– 30.2	1.74	149.4	0.086	68.9	0.968	– 15.3
0.70	0.906	– 35.1	1.72	144.3	0.100	65.6	0.958	– 17.8
0.80	0.892	– 40.1	1.70	139.3	0.112	62.3	0.947	– 20.1
0.90	0.867	– 44.9	1.67	134.4	0.123	59.0	0.936	– 22.4
0.95	0.859	– 47.4	1.67	132.1	0.129	57.4	0.929	– 23.5
1.00	0.846	– 49.8	1.65	129.8	0.134	55.9	0.923	– 24.7
1.20	0.799	– 59.2	1.60	120.4	0.154	49.8	0.897	– 28.9
1.40	0.753	– 68.6	1.55	111.6	0.170	44.2	0.871	– 33.1
1.60	0.713	– 77.7	1.45	103.3	0.184	38.6	0.849	– 36.6
1.70	0.685	– 82.6	1.46	99.3	0.190	36.1	0.833	– 38.6
1.75	0.672	– 84.8	1.45	97.0	0.193	35.0	0.826	– 39.5
1.80	0.663	– 87.1	1.43	95.2	0.195	33.9	0.821	– 40.3
2.00	0.623	– 96.1	1.38	87.8	0.204	29.3	0.797	– 43.6
2.50	0.531	– 118.5	1.26	70.5	0.218	19.3	0.746	– 51.0
3.00	0.464	– 142.1	1.20	54.9	0.222	11.3	0.691	– 58.4
I_C = 0.75 mA, V_{CE} = 1 V, Z_0 = 50 Ω								
0.10	0.961	– 5.9	2.58	174.3	0.015	86.2	0.995	– 3.0
0.20	0.954	– 11.9	2.57	168.7	0.030	82.1	0.992	– 5.9
0.30	0.945	– 17.7	2.56	163.1	0.044	78.2	0.985	– 8.9
0.40	0.928	– 23.6	2.54	157.3	0.058	74.2	0.976	– 11.8
0.50	0.911	– 29.4	2.50	151.6	0.072	70.4	0.964	– 14.5
0.60	0.891	– 35.0	2.46	146.4	0.084	66.7	0.952	– 17.2
0.70	0.868	– 40.7	2.42	140.9	0.097	63.1	0.937	– 19.9
0.80	0.846	– 46.2	2.37	135.7	0.108	59.6	0.922	– 22.4
0.90	0.815	– 51.6	2.32	130.5	0.118	56.2	0.906	– 24.8
0.95	0.804	– 54.4	2.30	128.1	0.123	54.7	0.897	– 26.0
1.00	0.787	– 57.0	2.27	125.8	0.128	53.2	0.888	– 27.1
1.20	0.731	– 67.3	2.15	116.2	0.144	47.2	0.855	– 31.4
1.40	0.679	– 77.6	2.05	107.4	0.157	41.8	0.822	– 35.4
1.60	0.631	– 87.3	1.90	99.1	0.168	36.8	0.796	– 38.7
1.70	0.601	– 92.6	1.88	95.3	0.172	34.5	0.778	– 40.6
1.75	0.588	– 94.7	1.85	93.1	0.175	33.6	0.772	– 41.5
1.80	0.576	– 97.2	1.83	91.4	0.176	32.6	0.765	– 42.2
2.00	0.536	– 106.8	1.73	84.2	0.183	28.7	0.740	– 45.2
2.50	0.450	– 130.5	1.53	67.7	0.193	20.5	0.688	– 52.1
3.00	0.397	– 155.2	1.42	53.1	0.197	14.6	0.637	– 58.9

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 = 1 mA, V_{CE} = 1 V, Z_0 = 50 Ω								
0.10	0.950	– 6.8	3.34	173.7	0.015	85.8	0.994	– 3.4
0.20	0.941	– 13.6	3.31	167.5	0.030	81.3	0.988	– 6.6
0.30	0.929	– 20.1	3.28	161.4	0.044	76.9	0.979	– 9.9
0.40	0.907	– 26.8	3.23	155.1	0.058	72.7	0.966	– 13.0
0.50	0.884	– 33.2	3.17	149.0	0.071	68.7	0.951	– 16.1
0.60	0.859	– 39.5	3.10	143.4	0.083	64.8	0.934	– 18.9
0.70	0.829	– 45.7	3.02	137.6	0.094	61.1	0.916	– 21.7
0.80	0.800	– 51.7	2.93	132.2	0.104	57.5	0.896	– 24.3
0.90	0.767	– 57.6	2.85	126.8	0.113	54.1	0.875	– 26.7
0.95	0.752	– 60.6	2.81	124.3	0.117	52.6	0.865	– 27.9
1.00	0.736	– 63.3	2.76	121.9	0.121	51.0	0.855	– 29.0
1.20	0.671	– 74.3	2.58	112.3	0.135	45.4	0.816	– 33.2
1.40	0.615	– 85.3	2.42	103.6	0.146	40.4	0.779	– 36.9
1.60	0.563	– 95.3	2.22	95.4	0.155	36.0	0.752	– 40.0
1.70	0.536	– 101.0	2.18	91.7	0.159	34.0	0.733	– 41.7
1.75	0.522	– 103.3	2.14	89.7	0.160	33.2	0.727	– 42.5
1.80	0.512	– 105.9	2.11	87.9	0.162	32.4	0.721	– 43.2
2.00	0.472	– 115.8	1.98	81.0	0.167	29.1	0.696	– 45.9
2.50	0.395	– 140.6	1.72	65.3	0.177	22.5	0.646	– 52.4
3.00	0.355	– 166.0	1.55	51.4	0.182	18.0	0.599	– 58.9
I_C = 2 mA, V_{CE} = 2.5 V, Z_0 = 50 Ω								
0.10	0.915	– 8.7	6.02	172.1	0.012	84.9	0.990	– 4.0
0.20	0.898	– 17.3	5.93	164.4	0.024	79.8	0.979	– 7.9
0.30	0.874	– 25.5	5.78	157.0	0.036	74.8	0.962	– 11.6
0.40	0.839	– 33.6	5.61	149.6	0.046	70.3	0.940	– 15.1
0.50	0.802	– 41.2	5.39	142.7	0.056	66.1	0.914	– 18.2
0.60	0.763	– 48.6	5.17	136.4	0.064	62.2	0.887	– 21.0
0.70	0.721	– 55.6	4.93	130.2	0.072	58.8	0.860	– 23.5
0.80	0.679	– 62.3	4.69	124.6	0.078	55.8	0.834	– 25.8
0.90	0.639	– 68.6	4.46	119.3	0.084	53.1	0.809	– 27.8
0.95	0.621	– 71.9	4.36	116.8	0.087	51.9	0.797	– 28.8
1.00	0.600	– 74.9	4.24	114.4	0.089	50.8	0.785	– 29.6
1.20	0.529	– 86.5	3.84	105.3	0.098	46.9	0.743	– 32.8
1.40	0.472	– 97.8	3.49	97.3	0.105	43.7	0.708	– 35.5
1.60	0.420	– 108.1	3.15	90.0	0.111	41.4	0.682	– 37.7
1.70	0.396	– 114.1	3.04	86.8	0.114	40.3	0.668	– 39.0
1.75	0.385	– 116.6	2.98	84.9	0.115	40.0	0.662	– 39.6
1.80	0.376	– 119.0	2.92	83.4	0.116	39.6	0.658	– 40.1
2.00	0.345	– 129.6	2.69	77.4	0.121	38.1	0.639	– 42.2
2.50	0.287	– 155.5	2.26	63.7	0.133	35.2	0.603	– 47.4
3.00	0.269	178.9	1.98	51.8	0.145	33.3	0.570	– 53.2

Common Emitter S Parameters (continued)

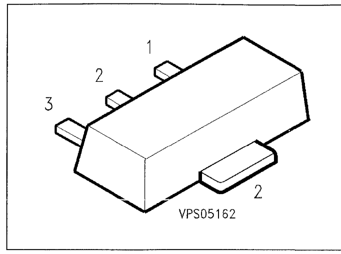
f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_C = 3 mA, V_{CE} = 5 V, Z_0 = 50 Ω								
0.10	0.889	– 10.1	8.23	170.8	0.012	84.2	0.987	– 4.7
0.20	0.865	– 20.0	8.05	161.9	0.023	78.7	0.970	– 9.1
0.30	0.832	– 29.3	7.77	153.5	0.033	73.4	0.945	– 13.3
0.40	0.787	– 38.3	7.42	145.4	0.042	68.8	0.914	– 16.9
0.50	0.739	– 46.7	7.03	138.0	0.050	64.7	0.881	– 20.2
0.60	0.692	– 54.4	6.63	131.5	0.057	61.0	0.847	– 22.9
0.70	0.643	– 61.8	6.22	125.1	0.064	58.1	0.815	– 25.3
0.80	0.596	– 68.7	5.84	119.4	0.069	55.5	0.785	– 27.3
0.90	0.554	– 75.2	5.48	114.2	0.074	53.3	0.758	– 29.0
0.95	0.534	– 78.6	5.32	111.8	0.076	52.4	0.745	– 29.8
1.00	0.514	– 81.5	5.16	109.6	0.078	51.6	0.734	– 30.6
1.20	0.444	– 93.1	4.58	100.9	0.085	48.9	0.693	– 33.1
1.40	0.391	– 104.7	4.11	93.4	0.092	46.7	0.659	– 35.4
1.60	0.343	– 115.4	3.69	86.7	0.098	45.3	0.636	– 37.2
1.70	0.324	– 121.5	3.53	83.7	0.101	44.6	0.624	– 38.3
1.75	0.313	– 124.0	3.45	82.0	0.103	44.5	0.619	– 38.8
1.80	0.305	– 126.6	3.37	80.6	0.104	44.3	0.615	– 39.3
2.00	0.278	– 137.7	3.10	75.1	0.110	43.3	0.599	– 41.1
2.50	0.235	– 164.7	2.57	62.5	0.124	41.1	0.568	– 46.0
3.00	0.229	169.6	2.22	51.3	0.139	39.3	0.542	– 51.6
I_C = 8 mA, V_{CE} = 5 V, Z_0 = 50 Ω								
0.10	0.751	– 17.5	15.07	165.0	0.011	81.2	0.965	– 7.3
0.20	0.697	– 33.9	14.03	151.4	0.020	73.5	0.919	– 13.5
0.30	0.630	– 48.2	12.70	139.8	0.028	67.6	0.861	– 18.2
0.40	0.560	– 61.0	11.36	129.8	0.034	63.4	0.804	– 21.5
0.50	0.497	– 72.1	10.10	121.7	0.040	60.5	0.755	– 23.7
0.60	0.445	– 81.9	9.05	115.0	0.044	58.8	0.715	– 25.2
0.70	0.401	– 91.1	8.13	109.1	0.048	57.5	0.682	– 26.4
0.80	0.360	– 99.4	7.35	104.0	0.052	56.8	0.656	– 27.2
0.90	0.330	– 107.7	6.70	99.5	0.056	56.3	0.634	– 28.0
0.95	0.318	– 111.6	6.43	97.4	0.057	56.2	0.625	– 28.3
1.00	0.305	– 115.5	6.16	95.5	0.059	56.1	0.618	– 28.6
1.20	0.266	– 130.2	5.28	88.5	0.066	55.7	0.590	– 30.0
1.40	0.242	– 144.5	4.61	82.3	0.073	55.4	0.572	– 31.5
1.60	0.225	– 157.2	4.09	76.7	0.081	55.2	0.560	– 33.0
1.70	0.222	– 164.1	3.87	74.2	0.085	54.8	0.554	– 33.9
1.75	0.219	– 167.7	3.76	72.8	0.086	54.7	0.552	– 34.4
1.80	0.219	– 170.1	3.67	71.6	0.088	54.7	0.550	– 34.8
2.00	0.217	178.6	3.34	66.9	0.096	54.1	0.542	– 36.7
2.50	0.221	155.2	2.72	56.0	0.115	51.9	0.526	– 41.9
3.00	0.244	137.3	2.30	46.2	0.134	49.3	0.512	– 47.9

SIEMENS

NPN Silicon RF Transistor

BFQ 19S

- For low-noise, low-distortion broadband amplifiers in antenna and telecommunications systems up to 1.5 GHz at collector currents from 10 mA to 70 mA.
- CECC-type available: CECC 50002/259.



Type	Marking	Ordering Code (tape and reel)	Pin Configuration 1	2	3	Package[1]
BFQ 19S	FG	Q62702-F1088	B	C	E	SOT-89

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CEO}	15	V
Collector-base voltage	V_{CBO}	20	
Emitter-base voltage	V_{EBO}	3	
Collector current	I_C	75	mA
Peak collector current, $f \geq 1$ MHz	I_{CM}	150	
Base current	I_B	10	
Total power dissipation, $T_S \leq 85$ ˚C[3]	P_{tot}	1	W
Junction temperature	T_j	150	˚C
Ambient temperature range	T_A	– 65 … + 150	
Storage temperature range	T_{stg}	– 65 … + 150	

Thermal Resistance

Junction - ambient[2]	$R_{th\,JA}$	≤ 145	K/W
Junction - soldering point	$R_{th\,JS}$	≤ 65	

1) For detailed information 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.

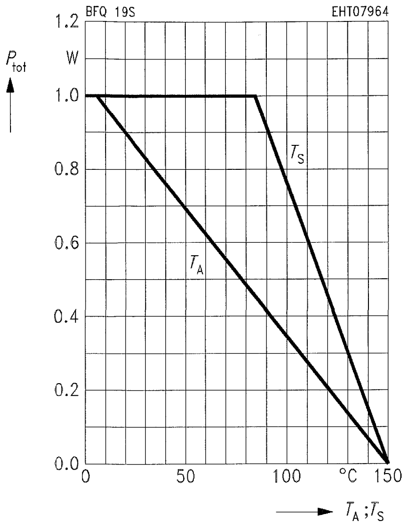
Electrical Characteristics
at $T_A = 25\ ^\circ C$, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC characteristics					
Collector-emitter breakdown voltage $I_C = 1$ mA, $I_B = 0$	$V_{(BR)CE0}$	15	–	–	V
Collector-base cutoff current $V_{CB} = 10$ V, $I_E = 0$	I_{CB0}	–	–	100	nA
Emitter-base cutoff current $V_{EB} = 2$ V, $I_C = 0$	I_{EB0}	–	–	10	µA
DC current gain $I_C = 50$ mA, $V_{CE} = 10$ V	h_{FE}	25	75	250	–
Collector-emitter saturation voltage $I_C = 75$ mA, $I_B = 7.5$ mA	V_{CEsat}	–	0.2	0.5	V

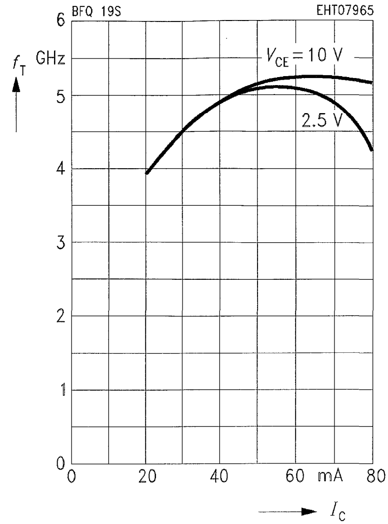
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
AC characteristics					
Transition frequency	f_T				GHz
I_C = 50 mA, V_{CE} = 10 V, f = 200 MHz		–	5	–	
I_C = 70 mA, V_{CE} = 10 V, f = 200 MHz		–	5.1	–	
Collector-base capacitance V_{CB} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{cb}	–	1	–	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}	–	4.5	–	
Output capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{obs}	–	1.45	–	
Noise figure	F				dB
I_C = 5 mA, V_{CE} = 10 V, f = 10 MHz, Z_S = 50 Ω		–	0.9	–	
I_C = 50 mA, V_{CE} = 10 V, f = 800 MHz, Z_S = Z_{Sopt}		–	2.8	–	
Power gain I_C = 70 mA, V_{CE} = 10 V, f = 800 MHz, Z_S = 50 Ω, Z_L = Z_{Lopt}	G_{pe}	–	11.8	–	
Linear output voltage two-tone intermodulation test I_C = 70 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}	–	520	–	mV
Third order intercept point I_C = 70 mA, V_{CE} = 10 V, f = 800 MHz	IP_3	–	37.5	–	dBm

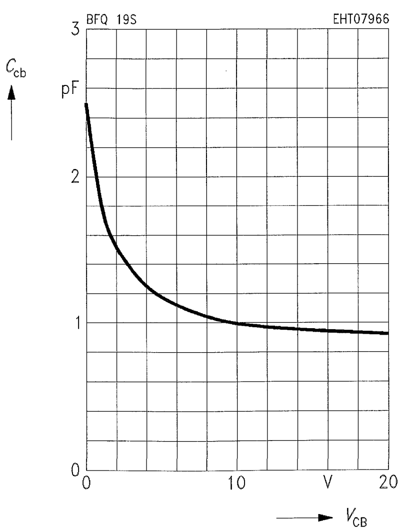
Total power dissipation $P_{tot} = f(T_A^*; T_S)$
*Package mounted on alumina



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



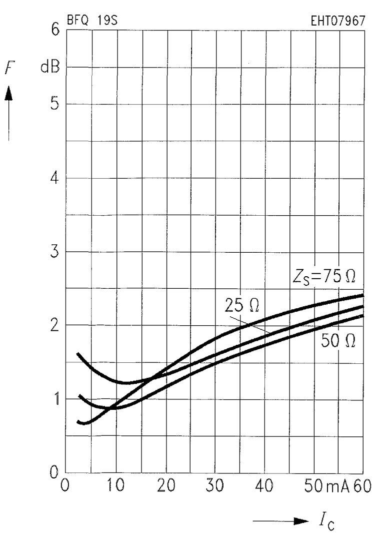
Collector-base capacitance $C_{cb} = f(V_{CB})$
$V_{BE} = v_{be} = 0$, f = 1 MHz



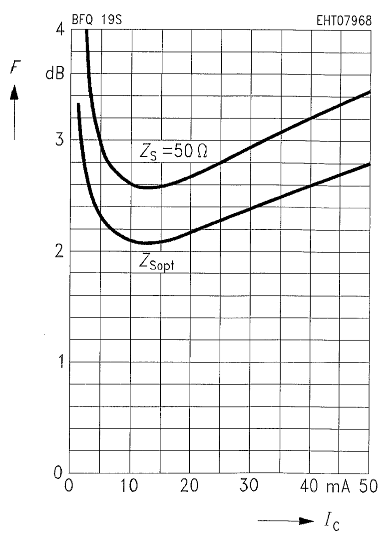
Common Emitter Noise Parameters

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 = 5 mA, V_{CE} = 10 V, Z_0 = 50 Ω								
0.01	0.9	–	(Z_S = 50 Ω)		–	–	0.9	–
I_C = 50 mA, V_{CE} = 10 V, Z_0 = 50 Ω								
0.01	2.2	–	–	–	–	–	2.2	–
0.8	2.8	–	–	–	–	–	3.5	–

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



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



Common Emitter S Parameters

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_C = 50 mA, V_{CE} = 2.5 V, Z_0 = 50 Ω								
0.10	0.431	– 157.0	20.33	104.3	0.029	67.1	0.323	– 91.1
0.20	0.452	– 175.2	10.63	92.1	0.051	71.6	0.210	– 113.7
0.30	0.457	175.6	7.16	85.4	0.073	72.3	0.182	– 125.5
0.40	0.460	168.4	5.42	80.3	0.095	71.7	0.174	– 132.3
0.50	0.470	161.6	4.39	75.9	0.117	70.4	0.174	– 136.0
0.60	0.470	156.7	3.68	71.8	0.138	68.8	0.177	– 138.8
0.70	0.473	151.8	3.18	67.8	0.159	67.1	0.183	– 140.4
0.80	0.479	146.9	2.81	64.0	0.179	65.1	0.190	– 142.0
0.90	0.487	142.7	2.52	60.5	0.199	63.4	0.195	– 143.7
0.95	0.493	140.5	2.39	58.7	0.209	62.4	0.198	– 144.6
1.00	0.492	137.9	2.29	57.1	0.218	61.5	0.200	– 145.3
1.20	0.501	129.9	1.94	50.7	0.255	57.8	0.209	– 148.6
1.40	0.514	121.1	1.72	44.7	0.291	54.2	0.218	– 151.5
1.50	0.525	116.8	1.64	41.7	0.308	52.2	0.222	– 152.2
1.60	0.522	112.8	1.55	38.5	0.325	50.2	0.227	– 152.8
1.70	0.523	109.4	1.48	35.7	0.340	48.3	0.233	– 153.9
1.75	0.532	108.3	1.45	34.5	0.348	47.3	0.234	– 154.1
1.80	0.529	106.7	1.41	33.1	0.355	46.3	0.237	– 154.8
2.00	0.548	101.9	1.31	28.2	0.383	42.8	0.248	– 157.9
I_C = 30 mA, V_{CE} = 5 V, Z_0 = 50 Ω								
0.10	0.389	– 134.2	21.89	110.5	0.028	64.0	0.414	– 60.8
0.20	0.393	– 162.9	11.78	95.7	0.046	68.0	0.249	– 69.2
0.30	0.395	– 176.0	8.00	88.1	0.065	69.8	0.195	– 72.8
0.40	0.396	174.6	6.06	82.6	0.084	70.1	0.173	– 75.8
0.50	0.406	166.7	4.90	77.8	0.102	69.6	0.165	– 78.7
0.60	0.408	161.1	4.11	73.5	0.121	68.6	0.163	– 82.0
0.70	0.412	155.5	3.55	69.5	0.139	67.6	0.165	– 85.4
0.80	0.420	150.2	3.13	65.6	0.156	66.2	0.170	– 88.9
0.90	0.430	145.7	2.80	62.1	0.174	64.9	0.173	– 91.9
0.95	0.436	143.5	2.66	60.2	0.182	64.1	0.175	– 93.7
1.00	0.435	141.0	2.54	58.6	0.190	63.4	0.177	– 95.0
1.20	0.448	132.3	2.15	52.2	0.224	60.3	0.184	– 100.8
1.40	0.461	123.6	1.90	46.0	0.257	57.2	0.193	– 105.9
1.50	0.479	118.8	1.80	42.8	0.273	55.5	0.199	– 107.6
1.60	0.474	114.7	1.69	39.8	0.288	53.7	0.206	– 109.5
1.70	0.478	111.3	1.61	36.8	0.303	52.2	0.213	– 111.6
1.75	0.487	110.3	1.58	35.7	0.310	51.4	0.216	– 112.2
1.80	0.485	108.2	1.54	34.2	0.317	50.5	0.219	– 113.5
2.00	0.508	104.0	1.41	29.2	0.345	47.4	0.232	– 118.8

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								
0.10	0.368	– 147.3	23.07	106.7	0.026	68.1	0.347	– 67.0
0.20	0.381	– 170.1	12.17	93.7	0.045	72.5	0.206	– 75.9
0.30	0.387	179.4	8.23	86.9	0.065	73.2	0.163	– 80.5
0.40	0.388	171.1	6.23	81.7	0.085	72.6	0.147	– 84.5
0.50	0.399	163.8	5.03	77.2	0.104	71.8	0.143	– 8.9
0.60	0.401	158.6	4.22	73.2	0.123	70.2	0.143	– 91.4
0.70	0.404	153.3	3.65	69.3	0.142	68.9	0.147	– 94.6
0.80	0.412	148.4	3.21	65.6	0.160	67.1	0.153	– 98.1
0.90	0.420	144.1	2.87	62.2	0.178	65.6	0.157	– 101.1
0.95	0.429	141.7	2.73	60.4	0.187	64.7	0.160	– 102.8
1.00	0.428	139.3	2.60	58.8	0.196	63.8	0.162	– 104.0
1.20	0.440	131.1	2.21	52.5	0.230	60.4	0.171	– 109.5
1.40	0.453	122.4	1.95	46.5	0.263	57.1	0.179	– 114.2
1.50	0.468	117.8	1.84	43.4	0.279	55.3	0.185	– 115.7
1.60	0.463	113.5	1.74	40.2	0.295	53.4	0.193	– 117.3
1.70	0.470	110.1	1.65	37.4	0.310	51.7	0.200	– 119.1
1.75	0.480	109.3	1.62	36.2	0.317	50.9	0.202	– 119.6
1.80	0.479	107.6	1.57	34.8	0.324	50.0	0.206	– 120.9
2.00	0.501	103.2	1.45	29.9	0.352	46.7	0.218	– 125.7
I_C = 70 mA, V_{CE} = 5 V, Z_0 = 50 Ω								
0.10	0.365	– 154.5	23.34	104.8	0.025	70.9	0.312	– 69.7
0.20	0.380	– 173.7	12.21	92.6	0.045	74.4	0.186	– 78.5
0.30	0.388	176.6	8.24	86.2	0.065	74.7	0.149	– 83.7
0.40	0.391	169.0	6.23	81.2	0.085	73.9	0.136	– 87.8
0.50	0.402	162.2	5.03	76.8	0.105	72.7	0.134	– 91.3
0.60	0.404	157.3	4.22	72.9	0.124	71.0	0.136	– 94.9
0.70	0.406	152.3	3.65	69.1	0.143	69.4	0.141	– 98.0
0.80	0.415	147.5	3.21	65.4	0.162	67.7	0.148	– 101.5
0.90	0.424	143.4	2.87	62.0	0.180	66.0	0.152	– 104.4
0.95	0.432	140.8	2.73	60.2	0.189	65.0	0.156	– 106.1
1.00	0.431	138.6	2.60	58.6	0.198	64.2	0.158	– 107.3
1.20	0.444	130.1	2.20	52.4	0.232	60.6	0.167	– 112.7
1.40	0.458	122.0	1.95	46.4	0.266	57.2	0.176	– 117.2
1.50	0.470	117.2	1.84	43.4	0.282	55.4	0.182	– 118.6
1.60	0.465	113.4	1.74	40.2	0.297	53.4	0.189	– 120.1
1.70	0.471	109.8	1.65	37.4	0.312	51.8	0.196	– 121.9
1.75	0.482	108.7	1.62	36.2	0.319	50.9	0.198	– 122.3
1.80	0.479	107.4	1.58	34.8	0.327	49.9	0.203	– 123.5
2.00	0.500	103.0	1.45	29.8	0.354	46.6	0.215	– 128.3

Common Emitter S Parameters (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**
I_C = 30 mA, V_{CE} = 8 V, Z_0 = 50 Ω								
0.10	0.376	– 126.9	22.81	111.7	0.027	63.9	0.441	– 53.4
0.20	0.366	– 158.3	12.36	96.5	0.044	67.6	0.275	– 57.8
0.30	0.367	– 172.9	8.41	88.8	0.061	69.8	0.221	– 58.6
0.40	0.367	176.8	6.37	83.2	0.079	70.3	0.199	– 59.9
0.50	0.378	168.6	5.15	78.4	0.096	70.0	0.190	– 62.0
0.60	0.380	162.6	4.32	74.2	0.114	69.1	0.187	– 64.9
0.70	0.382	157.2	3.73	70.2	0.131	68.2	0.188	– 68.0
0.80	0.392	151.6	3.29	66.3	0.148	67.0	0.191	– 71.6
0.90	0.401	146.6	2.94	62.8	0.164	65.8	0.193	– 74.7
0.95	0.409	144.2	2.79	60.9	0.173	64.9	0.194	– 76.5
1.00	0.408	141.8	2.67	59.3	0.181	64.3	0.196	– 77.9
1.20	0.423	132.9	2.26	52.9	0.213	61.4	0.200	– 83.9
1.40	0.437	124.0	1.98	46.7	0.244	58.5	0.207	– 89.4
1.50	0.451	119.3	1.87	43.5	0.259	56.9	0.213	– 91.6
1.60	0.449	115.2	1.77	40.4	0.274	55.2	0.220	– 93.9
1.70	0.456	112.1	1.68	37.6	0.289	53.8	0.227	– 96.4
1.75	0.465	110.7	1.64	36.4	0.295	52.9	0.230	– 97.3
1.80	0.466	108.9	1.60	34.9	0.302	52.2	0.233	– 98.6
2.00	0.488	104.6	1.47	29.8	0.330	49.2	0.244	– 104.5
I_C = 50 mA, V_{CE} = 8 V, Z_0 = 50 Ω								
0.10	0.349	– 139.4	24.12	107.7	0.025	67.2	0.369	– 58.3
0.20	0.352	– 165.8	12.78	94.3	0.043	71.7	0.227	– 61.9
0.30	0.355	– 177.8	8.65	87.4	0.062	73.0	0.184	– 63.2
0.40	0.357	173.3	6.55	82.2	0.081	72.7	0.166	– 65.0
0.50	0.369	165.2	5.29	77.8	0.099	71.9	0.161	– 67.6
0.60	0.368	159.9	4.43	73.7	0.117	70.4	0.160	– 70.7
0.70	0.374	154.8	3.83	69.9	0.135	69.3	0.163	– 74.3
0.80	0.381	149.4	3.37	66.1	0.152	67.7	0.167	– 78.2
0.90	0.391	145.3	3.01	62.8	0.169	66.2	0.170	– 81.5
0.95	0.398	142.7	2.86	61.0	0.178	65.4	0.171	– 83.3
1.00	0.401	140.2	2.73	59.3	0.186	64.6	0.173	– 84.8
1.20	0.414	131.6	2.31	53.1	0.219	61.4	0.179	– 90.8
1.40	0.427	122.8	2.03	47.0	0.251	58.2	0.187	– 96.1
1.50	0.441	118.3	1.92	44.0	0.266	56.5	0.193	– 98.2
1.60	0.440	114.1	1.81	40.9	0.281	54.7	0.200	– 100.3
1.70	0.446	110.9	1.72	38.0	0.296	53.2	0.206	– 102.7
1.75	0.455	110.0	1.68	36.9	0.303	52.3	0.209	– 103.3
1.80	0.456	108.3	1.64	35.4	0.310	51.5	0.212	– 104.9
2.00	0.480	103.7	1.51	30.4	0.337	48.3	0.224	– 110.5

Common Emitter S Parameters (continued)

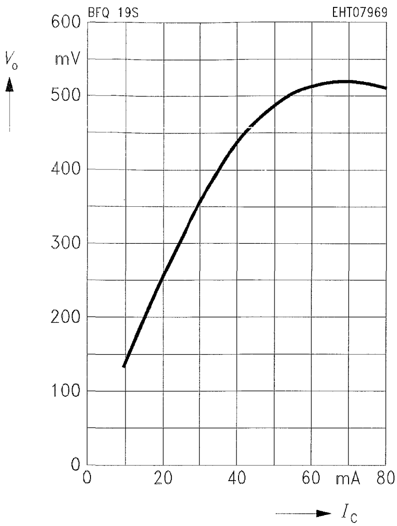
f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**
I_C = 70 mA, V_{CE} = 8 V, Z_0 = 50 Ω								
0.10	0.347	– 145.6	24.30	105.6	0.024	64.4	0.332	– 59.8
0.20	0.352	– 169.1	12.75	93.1	0.043	73.5	0.205	– 62.4
0.30	0.356	179.9	8.61	86.6	0.062	74.1	0.168	– 63.7
0.40	0.359	171.3	6.51	81.6	0.081	73.6	0.154	– 65.9
0.50	0.369	163.7	5.26	77.2	0.100	72.6	0.151	– 68.6
0.60	0.371	158.7	4.40	73.2	0.118	71.1	0.151	– 72.1
0.70	0.374	153.9	3.80	69.5	0.136	69.7	0.154	– 75.7
0.80	0.384	148.6	3.35	65.8	0.154	68.0	0.159	– 79.8
0.90	0.392	144.2	3.00	62.4	0.171	66.5	0.163	– 83.2
0.95	0.401	141.9	2.85	60.6	0.180	65.5	0.165	– 85.1
1.00	0.401	139.4	2.72	59.0	0.188	64.8	0.167	– 86.5
1.20	0.415	131.1	2.30	52.8	0.221	61.4	0.174	– 92.6
1.40	0.429	122.4	2.02	46.8	0.253	58.2	0.181	– 98.0
1.50	0.445	118.1	1.91	43.7	0.269	56.4	0.187	– 100.1
1.60	0.442	114.0	1.80	40.6	0.283	54.6	0.194	– 102.2
1.70	0.450	110.4	1.71	37.7	0.298	53.0	0.201	– 104.6
1.75	0.456	109.9	1.68	36.7	0.305	52.2	0.204	– 105.1
1.80	0.455	107.7	1.63	35.1	0.312	51.3	0.208	– 106.6
2.00	0.479	103.4	1.50	30.1	0.339	48.1	0.219	– 112.2
I_C = 50 mA, V_{CE} = 10 V, Z_0 = 50 Ω								
0.10	0.348	– 135.2	24.34	108.1	0.025	67.2	0.378	– 55.9
0.20	0.344	– 163.3	12.92	94.5	0.043	71.4	0.236	– 58.3
0.30	0.346	– 176.4	8.75	87.6	0.061	72.6	0.193	– 58.8
0.40	0.347	174.6	6.62	82.4	0.079	72.5	0.175	– 60.1
0.50	0.359	166.2	5.35	77.9	0.098	71.7	0.170	– 62.5
0.60	0.360	160.9	4.48	73.8	0.115	70.4	0.168	– 65.6
0.70	0.363	155.2	3.87	70.0	0.133	69.2	0.171	– 68.9
0.80	0.371	150.2	3.41	66.3	0.150	67.8	0.174	– 72.8
0.90	0.383	145.6	3.05	62.9	0.167	66.3	0.176	– 76.1
0.95	0.390	142.9	2.89	61.1	0.175	65.4	0.178	– 78.0
1.00	0.388	140.7	2.76	59.5	0.183	64.6	0.180	– 79.4
1.20	0.405	132.3	2.34	53.2	0.215	61.5	0.185	– 85.5
1.40	0.420	123.4	2.05	47.1	0.247	58.4	0.192	– 90.9
1.50	0.433	118.6	1.94	44.0	0.263	56.7	0.198	– 93.0
1.60	0.432	114.6	1.83	40.9	0.277	54.9	0.204	– 95.4
1.70	0.440	110.8	1.74	38.1	0.291	53.4	0.211	– 97.9
1.75	0.447	110.0	1.70	36.9	0.298	52.6	0.214	– 98.5
1.80	0.448	108.5	1.65	35.5	0.305	51.8	0.217	– 100.1
2.00	0.473	104.0	1.52	30.4	0.332	48.8	0.228	– 105.9

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 = 70 mA, V_{CE} = 10 V, Z_0 = 50 Ω								
0.10	0.345	– 141.2	24.39	105.9	0.024	68.6	0.342	– 56.6
0.20	0.345	– 166.6	12.82	93.3	0.043	72.6	0.216	– 57.7
0.30	0.348	– 178.5	8.66	86.7	0.061	73.6	0.179	– 58.1
0.40	0.350	172.7	6.55	81.7	0.080	73.2	0.165	– 59.7
0.50	0.360	164.9	5.29	77.3	0.098	72.3	0.161	– 62.2
0.60	0.362	159.8	4.43	73.3	0.116	70.8	0.160	– 65.6
0.70	0.366	154.8	3.83	69.6	0.134	69.6	0.164	– 69.2
0.80	0.374	149.3	3.37	65.8	0.151	67.9	0.168	– 73.2
0.90	0.384	145.3	3.01	62.4	0.168	66.5	0.171	– 76.6
0.95	0.393	142.6	2.86	60.6	0.176	65.6	0.172	– 78.5
1.00	0.391	140.0	2.73	59.0	0.185	64.8	0.174	– 80.1
1.20	0.407	131.8	2.31	52.8	0.217	61.6	0.180	– 86.3
1.40	0.422	123.0	2.03	46.6	0.249	58.4	0.187	– 91.8
1.50	0.438	118.5	1.92	43.7	0.264	56.6	0.193	– 94.0
1.60	0.434	114.2	1.81	40.5	0.278	54.9	0.200	– 96.3
1.70	0.442	110.7	1.72	37.7	0.293	53.3	0.207	– 98.7
1.75	0.450	109.9	1.68	36.6	0.300	52.5	0.210	– 99.4
1.80	0.449	108.2	1.64	35.1	0.307	51.7	0.213	– 101.0
2.00	0.475	104.1	1.51	30.0	0.334	48.5	0.224	– 106.8

Common Emitter Large Signal Parameters

Linear output voltage $V_o = f\ (I_C)$
V_{CE} = 10 V, d_{IM} = 60 dB, f_1 = 806 MHz,
f_2 = 810 MHz, $Z_S = Z_L$ = 50 Ω



Note:

The transistor is driven by 2 adjacent signals f_1, f_2 with equal output power levels P_o for each carrier.

The distance d_{IM} between P_o and the third order intermodulation products P_{IM} ($2f_1 - f_2$ or $2f_2 - f_1$) is:

$d_{IM} = P_o - P_{IM}$
where P_o = 10 log (V_o^2 / (50 Ω • 1 mW)) (dBm)
and V_o = linear output voltage of each carrier.

The 3rd order intercept point IP_3 will be found by extrapolation to the point where P_{IM} would be identical to P_o:

IP_3 (output) = $P_o + d_{IM}/2$.

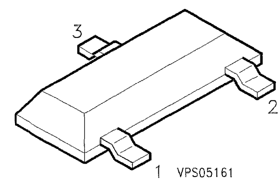
Linear output voltages for other d_{IM} (e.g. 50 dB) can be calculated thereby.

SIEMENS

NPN Silicon RF Transistor

BFQ 29P

- For low-noise IF and broadband amplifiers up to 1 GHz at collector currents from 1 mA to 20 mA.
- CECC-type available: CECC 50002/258.



ESD: **E**lectro**st**atic **d**ischarge sensitive device, observe handling precautions!

Type	Marking	Ordering Code (tape and reel)	Pin Configuration 1	2	3	Package[1)]
BFQ 29P	KC	Q62702-F659	B	E	C	SOT-23

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CEO}	15	V
Collector-base voltage	V_{CBO}	20	
Emitter-base voltage	V_{EBO}	3	
Collector current	I_C	30	mA
Base current	I_B	4	
Total power dissipation, $T_S \leq 65$ °C[3)]	P_{tot}	280	mW
Junction temperature	T_j	150	°C
Ambient temperature range	T_A	– 65 … + 150	
Storage temperature range	T_{stg}	– 65 … + 150	

Thermal Resistance

Junction - ambient[2)]	$R_{th\,JA}$	≤ 385	K/W
Junction - soldering point[3)]	$R_{th\,JS}$	≤ 305	

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.

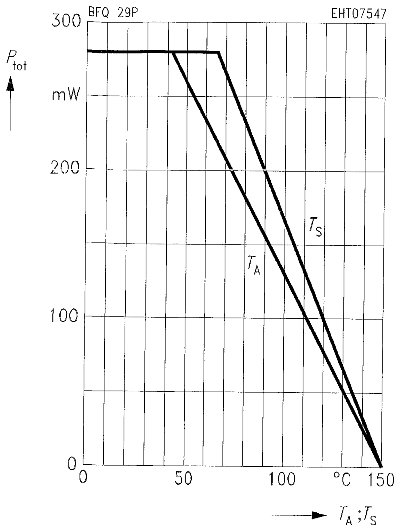
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CE0}$	15	–	–	V
Collector-base cutoff current V_{CB} = 10 V, I_E = 0 V_{CB} = 20 V, I_E = 0	I_{CB0}	 – –	 – –	 0.05 10	µA
Emitter-base cutoff current V_{EB} = 3 V, I_C = 0	I_{EB0}	–	–	100	µA
DC current gain I_C = 3 mA, V_{CE} = 6 V I_C = 10 mA, V_{CE} = 6 V	h_{FE}	 50 50	 – 140	 250 –	–
Collector-emitter saturation voltage I_C = 20 mA, I_B = 1 mA	V_{CEsat}	–	0.1	0.4	V

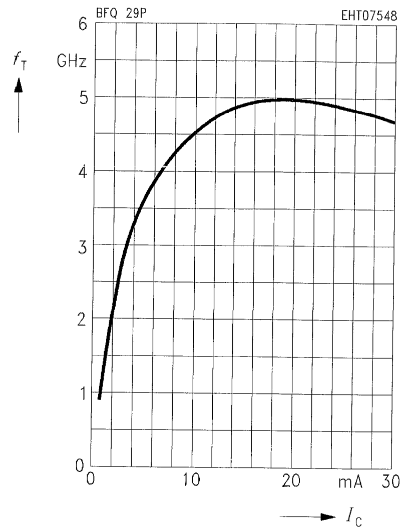
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
AC Characteristics					
Transition frequency I_C = 3 mA, V_{CE} = 6 V, f = 200 MHz I_C = 20 mA, V_{CE} = 6 V, f = 200 MHz	f_T	 – 3.6	 2.7 5	 – –	GHz
Collector-base capacitance V_{CB} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{cb}	–	0.5	0.65	pF
Collector-emitter capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{ce}	–	0.28	–	
Input capacitance V_{EB} = 0.5 V, I_C = i_c = 0, f = 1 MHz	C_{ibo}	–	1.35	–	
Output capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{obs}	–	0.8	–	
Noise figure I_C = 3 mA, V_{CE} = 6 V, f = 10 MHz, Z_S = 75 Ω I_C = 4 mA, V_{CE} = 6 V, f = 800 MHz, Z_S = 50 Ω	F	 – –	 0.9 1.5	 1.2 –	dB
Power gain I_C = 20 mA, V_{CE} = 6 V, f = 800 MHz, Z_0 = 50 Ω, Z_L = Z_{Lopt}	G_{pe}	–	14	–	
Transducer gain I_C = 20 mA, V_{CE} = 6 V, f = 1 GHz, Z_0 = 50 Ω	$\lvert S_{21e} \rvert^2$	–	11	–	
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}	–	180	–	mV
Third order intercept point I_C = 20 mA, V_{CE} = 6 V, f = 800 MHz	IP_3	–	28	–	dBm

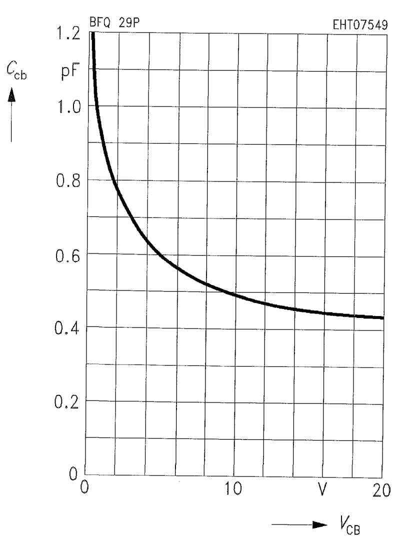
Total power dissipation $P_{tot} = f(T_A\text{*}; T_S)$
*Package mounted on alumina



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

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

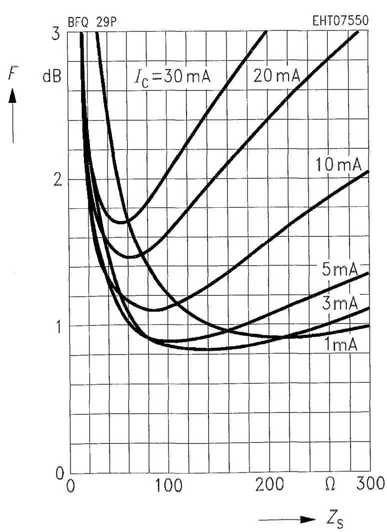
I_C = 3 mA, V_{CE} = 6 V, Z_0 = 50 Ω

0.01	0.85	–	(Z_S = 130 Ω)		–	–	1.2	–

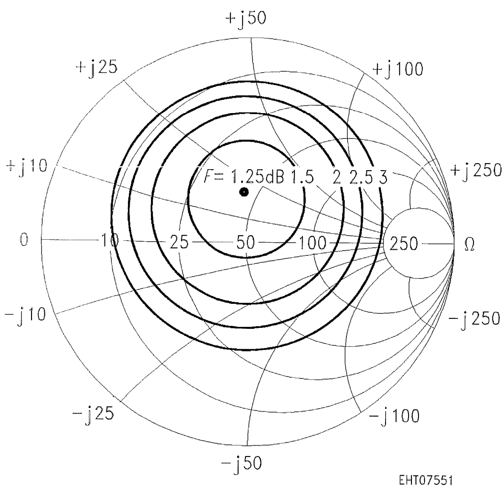
I_C = 5 mA, V_{CE} = 6 V, Z_0 = 50 Ω

0.01	0.85	–	(Z_S = 100 Ω)		–	–	1.1	–
0.8	1.25	13	0.25	93.5	11.1	0.20	1.45	14

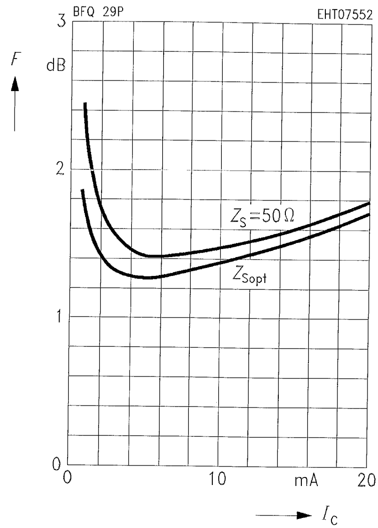
Noise figure $F = f (Z_S)$
V_{CE} = 6 V, f = 10 MHz



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



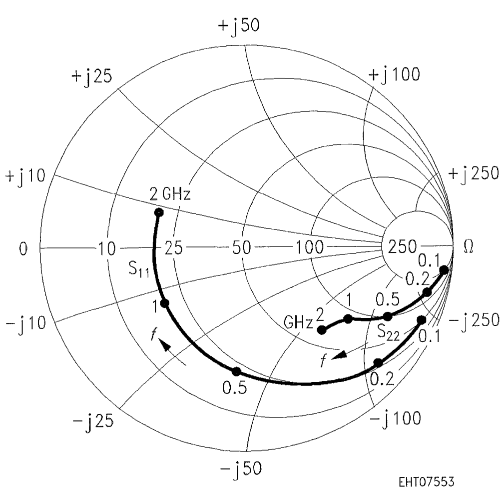
Noise figure $F = f\,(I_C)$
V_{CE} = 6 V, f = 800 MHz, $Z_{Lopt}\,(G)$



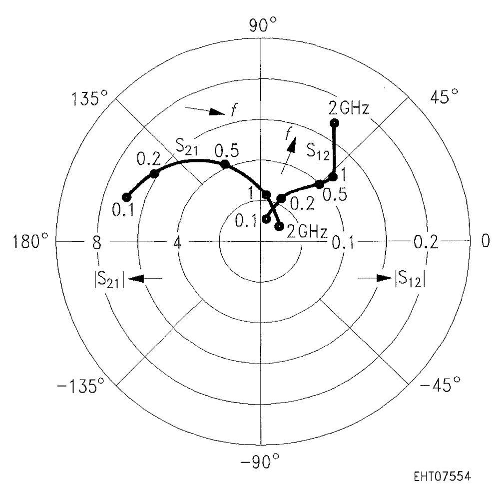
Common Emitter S Parameters

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**
I_C = 2 mA, V_{CE} = 6 V, Z_0 = 50 Ω								
0.1	0.93	– 20	6.76	158	0.03	76	0.97	– 7
0.2	0.86	– 45	6.42	144	0.06	65	0.89	– 17
0.3	0.79	– 62	5.16	133	0.08	57	0.85	– 23
0.5	0.66	– 93	4.19	113	0.11	47	0.73	– 29
0.8	0.50	– 129	2.99	92	0.11	41	0.62	– 33
1.0	0.47	– 147	2.48	82	0.12	41	0.59	– 35
1.2	0.45	– 161	2.11	74	0.13	42	0.57	– 37
1.5	0.43	179	1.78	63	0.14	47	0.55	– 40
1.8	0.45	159	1.51	54	0.16	52	0.54	– 46
2.0	0.46	149	1.42	48	0.17	56	0.52	– 48

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



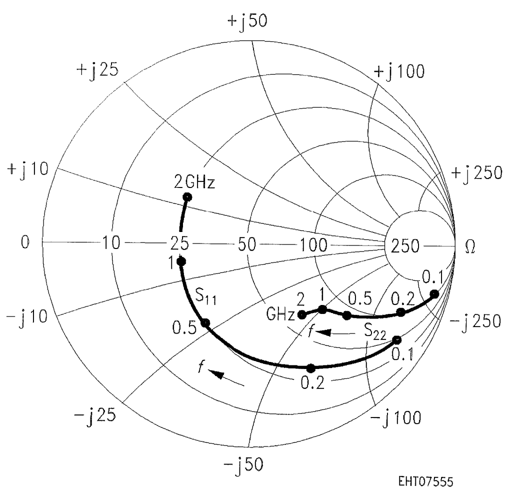
S_{12}, S_{21} = f (f)
I_C = 2 mA, V_{CE} = 6 V, Z_0 = 50 Ω



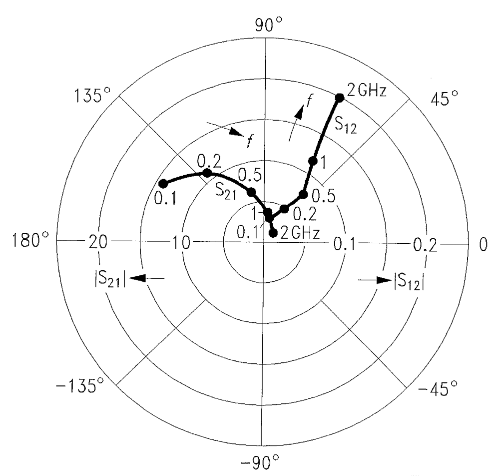
Common Emitter S Parameters (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_C = 5 mA, V_{CE} = 6 V, Z_0 = 50 Ω								
0.1	0.80	– 31	13.96	147	0.03	72	0.89	– 13
0.2	0.69	– 66	11.55	129	0.05	60	0.76	– 28
0.3	0.57	– 84	8.56	119	0.06	55	0.68	– 31
0.5	0.46	– 118	6.06	102	0.08	53	0.54	– 34
0.8	0.35	– 152	4.00	85	0.10	55	0.46	– 33
1.0	0.34	– 167	3.25	77	0.12	57	0.45	– 35
1.2	0.34	– 180	2.74	71	0.13	58	0.43	– 36
1.5	0.34	164	2.28	61	0.16	59	0.42	– 39
1.8	0.36	148	1.94	54	0.19	60	0.41	– 44
2.0	0.37	139	1.80	49	0.20	60	0.39	– 44

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



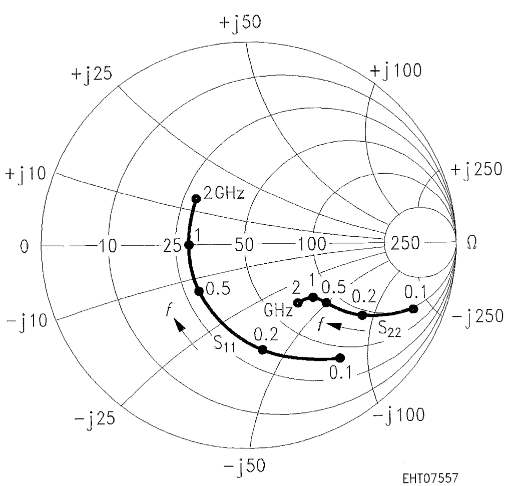
$S_{12}, S_{21} = f(f)$
I_C = 5 mA, V_{CE} = 6 V, Z_0 = 50 Ω



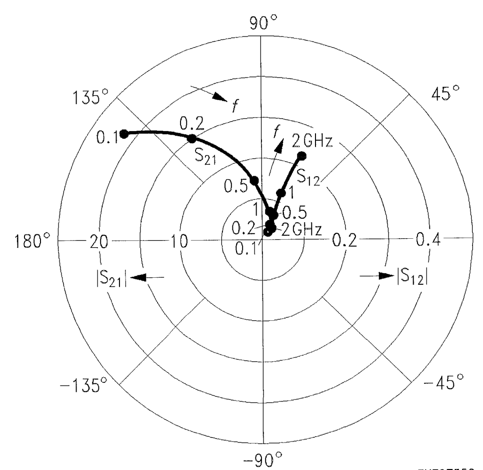
Common Emitter S Parameters (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_C = 10 mA, V_{CE} = 6 V, Z_0 = 50 Ω								
0.1	0.65	– 46	20.65	135	0.03	69	0.79	– 18
0.2	0.53	– 87	14.88	117	0.04	58	0.61	– 32
0.3	0.42	– 104	10.41	108	0.05	59	0.54	– 33
0.5	0.35	– 137	6.92	94	0.07	61	0.43	– 33
0.8	0.29	– 169	4.47	80	0.10	63	0.39	– 30
1.0	0.30	179	3.59	74	0.12	65	0.38	– 32
1.2	0.30	169	3.04	69	0.14	64	0.36	– 34
1.5	0.30	155	2.50	60	0.17	63	0.36	– 36
1.8	0.33	141	2.11	53	0.20	62	0.35	– 41
2.0	0.35	133	1.97	49	0.22	62	0.33	– 42

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



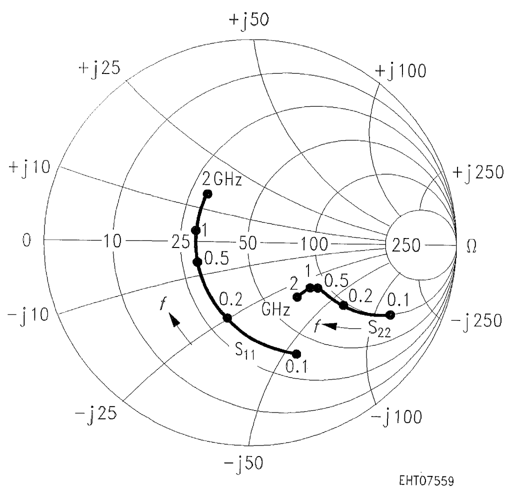
S_{12}, S_{21} = f (f)
I_C = 10 mA, V_{CE} = 6 V, Z_0 = 50 Ω



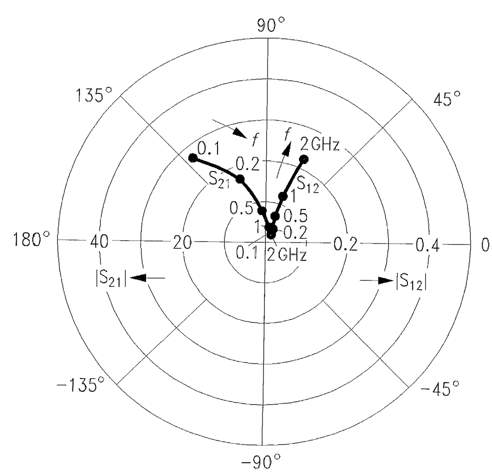
Common Emitter S Parameters (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_C = 20 mA, V_{CE} = 6 V, Z_0 = 50 Ω								
0.1	0.47	– 64	25.26	126	0.02	67	0.69	– 21
0.2	0.40	– 108	16.60	109	0.03	62	0.50	– 32
0.3	0.33	– 125	11.22	102	0.04	65	0.46	– 30
0.5	0.31	– 154	7.16	89	0.06	68	0.39	– 28
0.8	0.28	178	4.57	77	0.09	68	0.36	– 26
1.0	0.29	169	3.65	72	0.12	69	0.36	– 28
1.2	0.30	161	3.09	67	0.14	68	0.35	– 30
1.5	0.30	148	2.54	59	0.17	66	0.34	– 33
1.8	0.33	135	2.15	52	0.21	64	0.34	– 39
2.0	0.35	128	2.00	48	0.22	63	0.32	– 39

$S_{11}, S_{22} = f(f)$
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

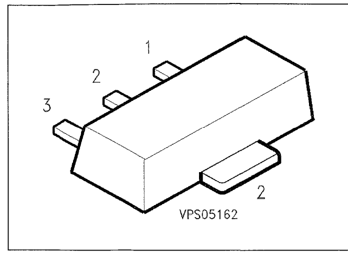


SIEMENS

NPN Silicon RF Transistor

BFQ 64

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



Type	Marking	Ordering Code (tape and reel)	Pin Configuration 1	2	3	Package[1)]
BFQ 64	FC	Q62702-F1061	B	C	E	SOT-89

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CE0}	20	V
Collector-base voltage	V_{CB0}	30	
Emitter-base voltage	V_{EB0}	3	
Collector current	I_C	200	mA
Peak collector current, $f \geq 1$ MHz	I_{CM}	250	
Base current	I_B	25	
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	
Storage temperature range	T_{stg}	– 65 … + 150	

Thermal Resistance

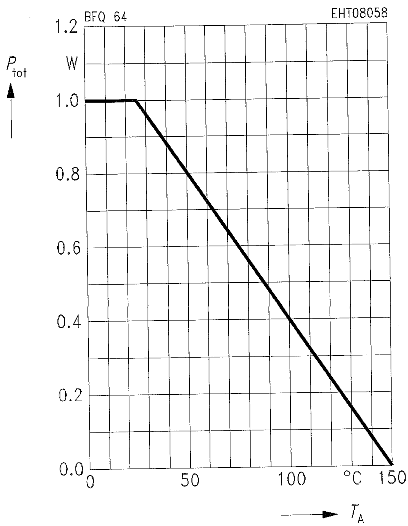
Junction - ambient [2)]	$R_{th\,JA}$	≤ 125	K/W

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

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

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
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_{CB0}	–	–	200	nA
Emitter-base cutoff current V_{EB} = 2 V, I_C = 0	I_{EB0}	–	–	10	µA
DC current gain I_C = 120 mA, V_{CE} = 5 V	h_{FE}	25	–	–	–
AC Characteristics					
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	–	
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

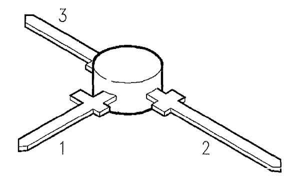


SIEMENS

NPN Silicon RF Transistor

BFQ 69

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



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

Type	Marking	Ordering Code	Pin Configuration 1	2	3	Package[1]
BFQ 69	BFQ 69	Q62702-F780	E	C	B	T-plast

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CEO}	15	V
Collector-base voltage	V_{CBO}	25	
Emitter-base voltage	V_{EBO}	2	
Collector current	I_C	30	mA
Base current	I_B	4	
Total power dissipation, $T_S \leq 102$ ˚C[3]	P_{tot}	300	mW
Junction temperature	T_j	150	˚C
Ambient temperature range	T_A	– 65 … + 150	
Storage temperature range	T_{stg}	– 65 … + 150	

Thermal Resistance

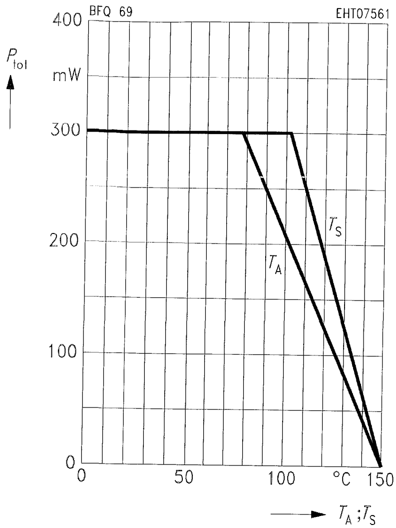
Junction - ambient[2]	$R_{th\,JA}$	≤ 240	K/W
Junction - soldering point[3]	$R_{th\,JS}$	≤ 160	

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.

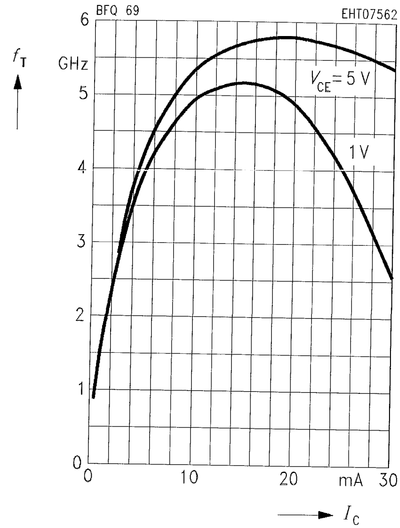
Electrical Characteristics
at T_A = 25 ˚C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CE0}$	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_{CB0}	–	–	50	nA
Emitter-base cutoff current V_{EB} = 2 V, I_C = 0	I_{EB0}	–	–	100	µA
DC current gain I_C = 15 mA, V_{CE} = 10 V	h_{FE}	50	120	250	–
AC Characteristics					
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	–	
Output capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{obs}	–	0.65	–	
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	–	
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

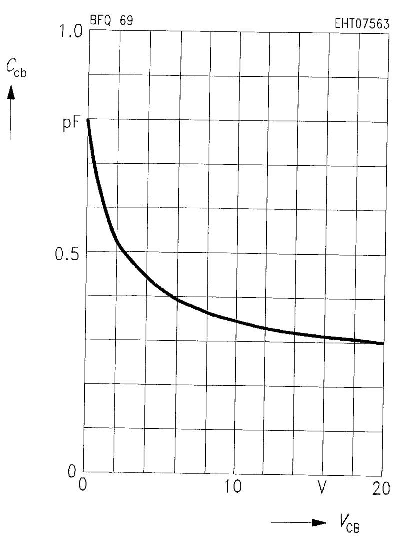
Total power dissipation $P_{tot} = f(T_A^*; T_S)$
*Package mounted on alumina



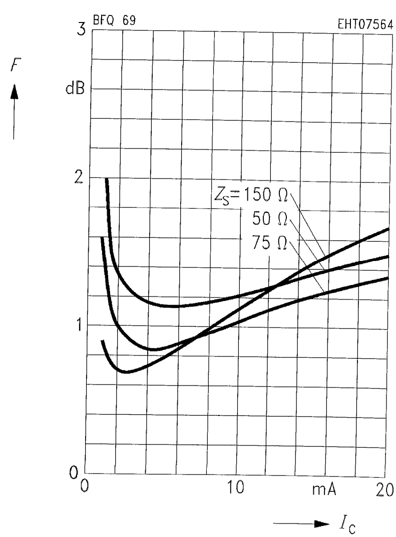
Transition frequency $f_T = f(I_C)$
f = 200 MHz



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



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

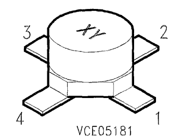


SIEMENS

NPN Silicon RF Transistor

BFQ 70

- For low-noise IF and broadband amplifiers in antenna and telecommunications systems at collector currents from 2 mA to 20 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 70	70	Q62702-F774	B	E	C	E	Cerex-X

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CEO}	15	V
Collector-emitter voltage, $V_{BE} = 0$	V_{CES}	20	
Collector-base voltage	V_{CBO}	20	
Emitter-base voltage	V_{EBO}	2.5	
Collector current	I_C	35	mA
Base current	I_B	4	
Total power dissipation, $T_S \leq 121$ °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]	$R_{th\,JA}$	≤ 260	K/W
Junction - soldering point[3]	$R_{th\,JS}$	≤ 180	

1) For detailed dimensions see chapter Package Outlines.
2) Package mounted on alumina 16 mm × 25 mm × 0.7 mm.
3) T_S is measured on the collector lead at the soldering point to the pcb.

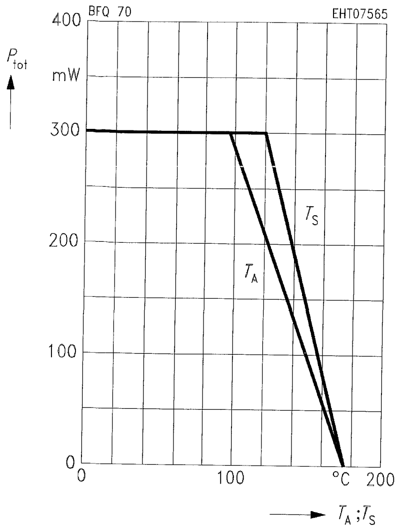
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CE0}$	15	–	–	V
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 = 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	–	

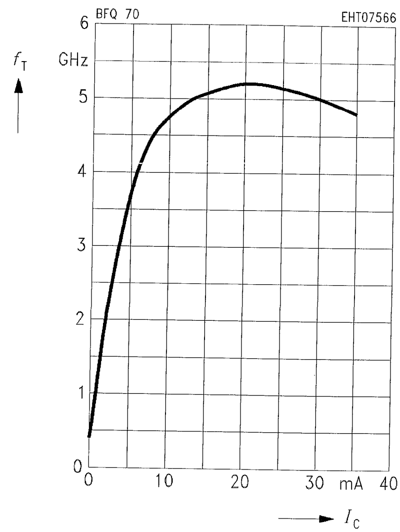
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
AC Characteristics					
Transition frequency I_C = 3 mA, V_{CE} = 6 V, f = 200 MHz I_C = 20 mA, V_{CE} = 6 V, f = 200 MHz	f_T	 – 3.6	 2.7 5	 – –	GHz
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	–	
Input capacitance V_{EB} = 0.5 V, I_C = i_c = 0, f = 1 MHz	C_{ibo}	–	2.2	–	
Output capacitance V_{CE} = 6 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{obs}	–	0.87	1.3	
Noise figure I_C = 3 mA, V_{CE} = 6 V, f = 10 MHz, Z_S = 75 Ω I_C = 4 mA, V_{CE} = 6 V, f = 800 MHz, Z_S = 50 Ω	F	 – –	 0.9 1.5	 1.2 –	dB
Power gain I_C = 20 mA, V_{CE} = 6 V, f = 800 MHz, $Z_S = Z_{Sopt}$, $Z_L = Z_{Lopt}$	G_{pe}	–	18	–	
Transducer gain I_C = 10 mA, V_{CE} = 6 V, f = 1 GHz, Z_0 = 50 Ω	$\|S_{21e}\|^2$	–	13	–	
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

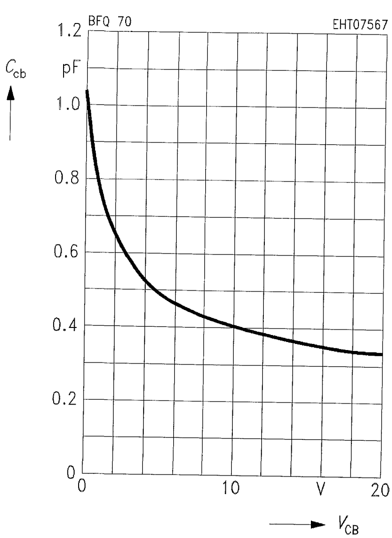
Total power dissipation $P_{tot} = f(T_A^*; T_S)$
*Package mounted on alumina



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



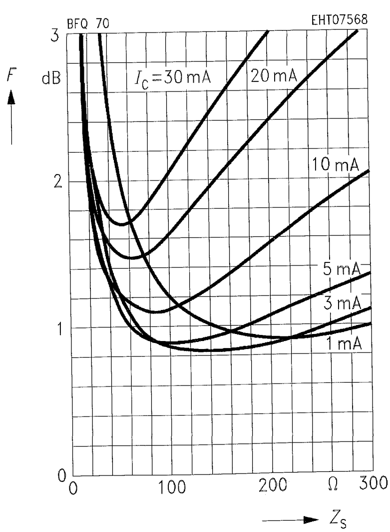
Collector-base capacitance $C_{cb} = f(V_{CB})$
$V_{BE} = v_{be} = 0$, f = 1 MHz



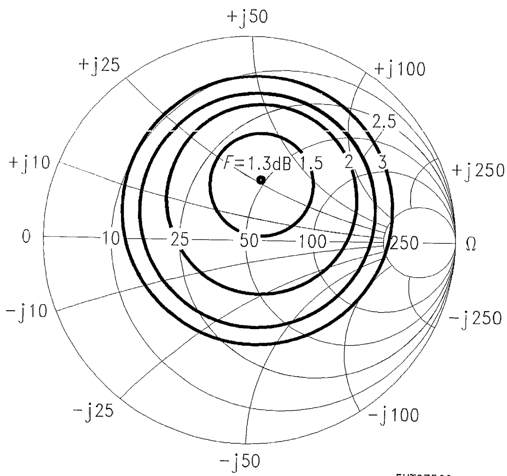
Common Emitter Noise Parameters

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} = 6 V, Z_0 = 50 Ω								
0.01	0.8	–	(Z_S = 150 Ω)		–	–	1.2	–
I_C = 5 mA, V_{CE} = 6 V, Z_0 = 50 Ω								
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

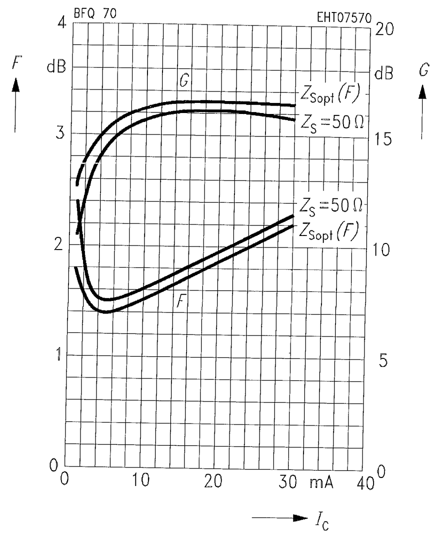
Noise figure $F = f$ (Z_S)
V_{CE} = 6 V, f = 10 MHz



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

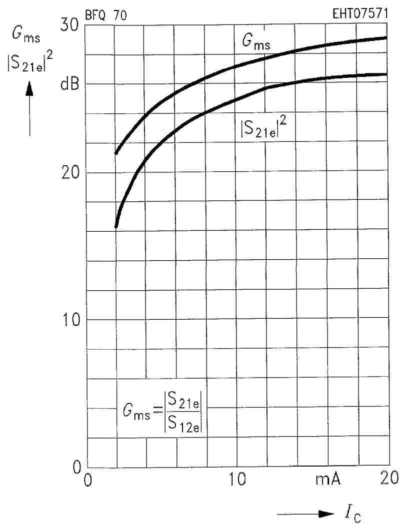


Noise figure $F = f(I_C)$
Power gain $G = f(I_C)$
V_{CE} = 6 V, f = 800 MHz, Z_{Lopt} (G)

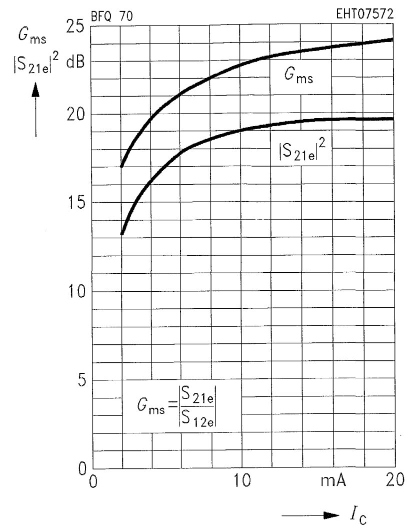


Common Emitter Power Gain

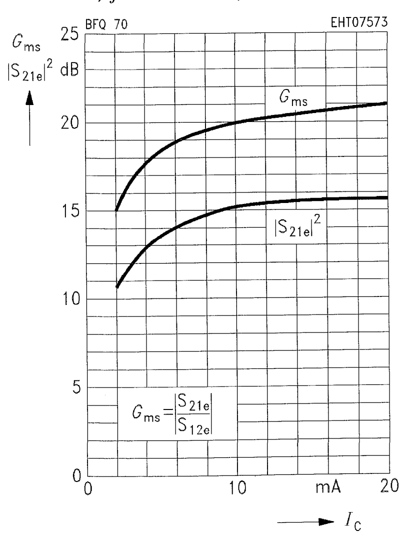
Power gain G_{ms}, $|S_{21e}|^2 = f(I_C)$
V_{CE} = 6 V, f = 200 MHz, Z_0 = 50 Ω



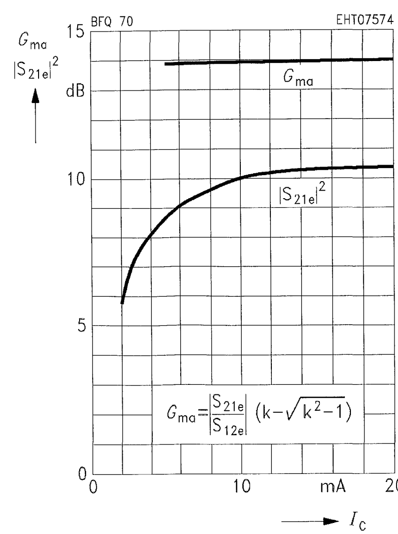
Power gain G_{ms}, $|S_{21e}|^2 = f(I_C)$
V_{CE} = 6 V, f = 500 MHz, Z_0 = 50 Ω



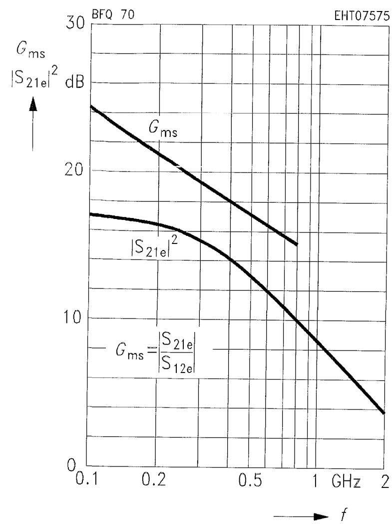
Power gain G_{ms}, $|S_{21e}|^2 = f(I_C)$
V_{CE} = 6 V, f = 800 MHz, Z_0 = 50 Ω



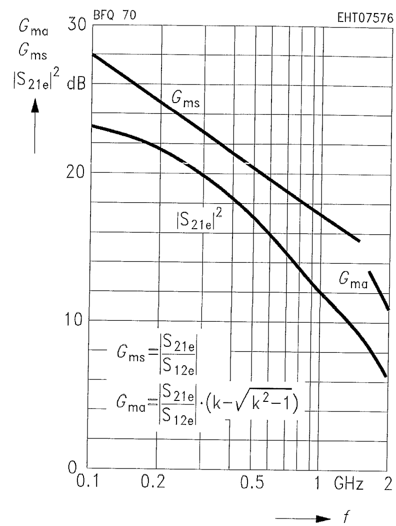
Power gain G_{ma}, $|S_{21e}|^2 = f(I_C)$
V_{CE} = 6 V, f = 1.5 GHz, Z_0 = 50 Ω



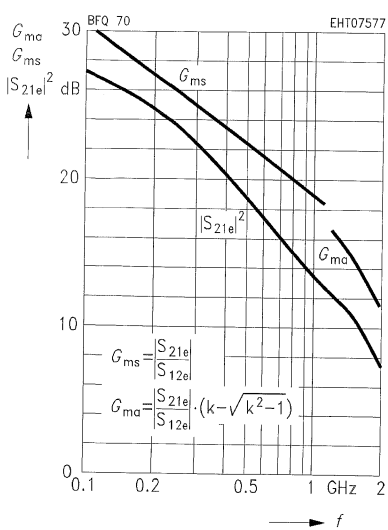
Power gain G_{ms}, $|S_{21e}|^2 = f(f)$
I_C = 2 mA, V_{CE} = 6 V, Z_0 = 50 Ω



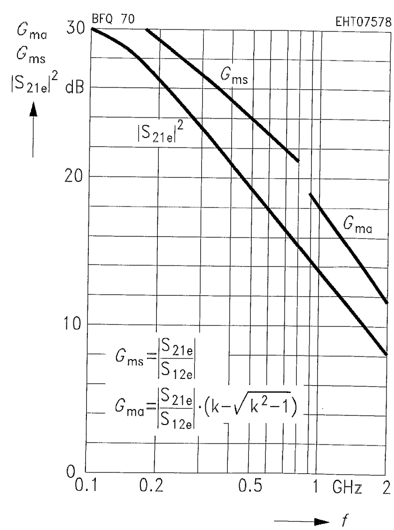
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
I_C = 5 mA, V_{CE} = 6 V, Z_0 = 50 Ω



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



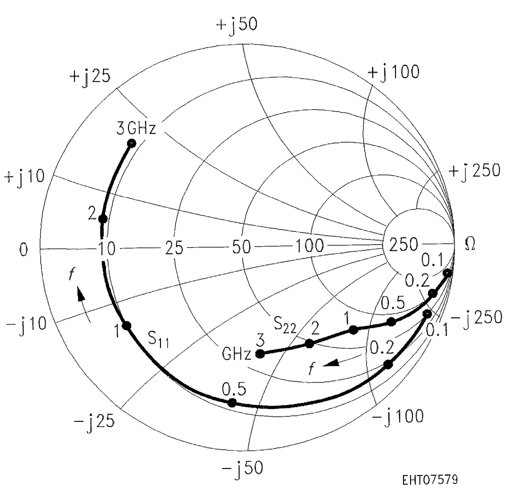
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
I_C = 20 mA, V_{CE} = 6 V, Z_0 = 50 Ω



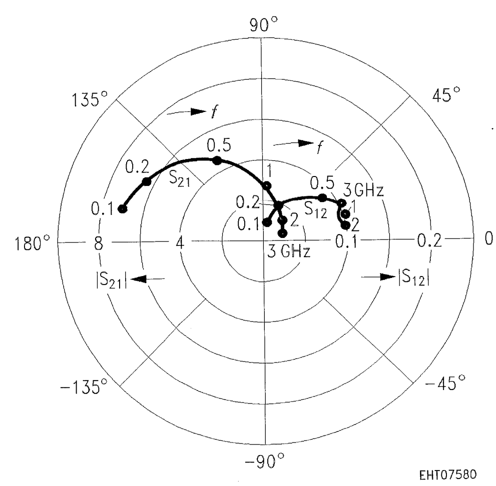
Common Emitter S Parameters

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_C = 2 mA, V_{CE} = 6 V, Z_0 = 50 Ω								
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



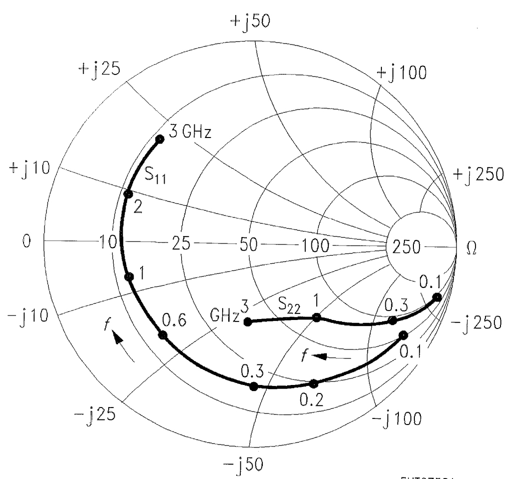
S_{12}, S_{21} = $f(f)$
I_C = 2 mA, V_{CE} = 6 V, Z_0 = 50 Ω



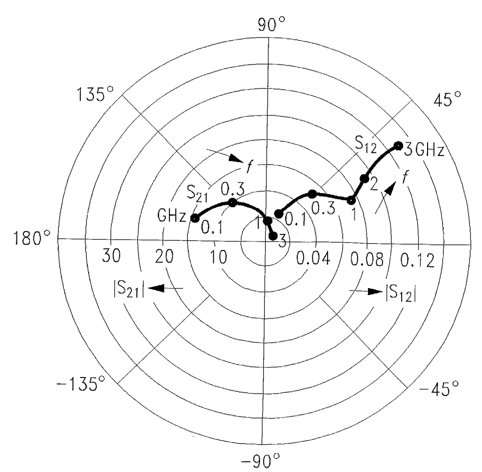
Common Emitter S Parameters (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_C = 5 mA, V_{CE} = 6 V, Z_0 = 50 Ω								
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



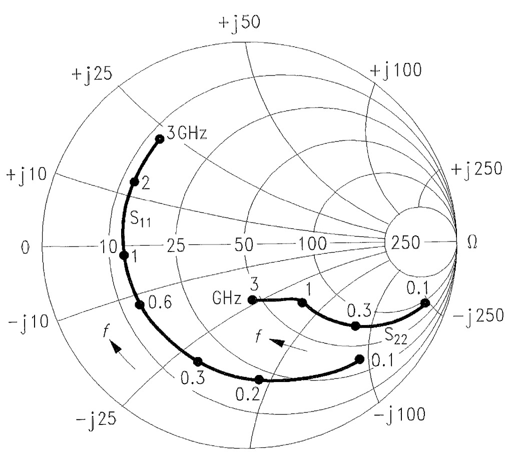
S_{12}, S_{21} = f (f)
I_C = 5 mA, V_{CE} = 6 V, Z_0 = 50 Ω



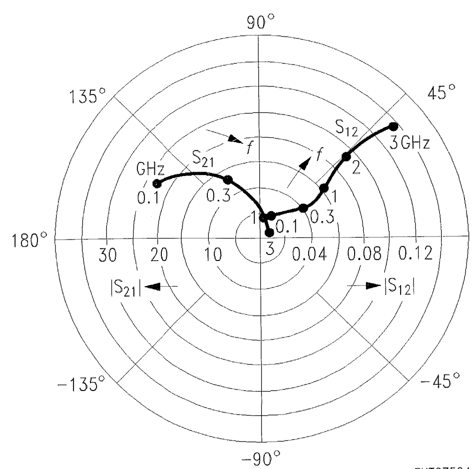
Common Emitter S Parameters (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_C = 10 mA, V_{CE} = 6 V, Z_0 = 50 Ω								
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



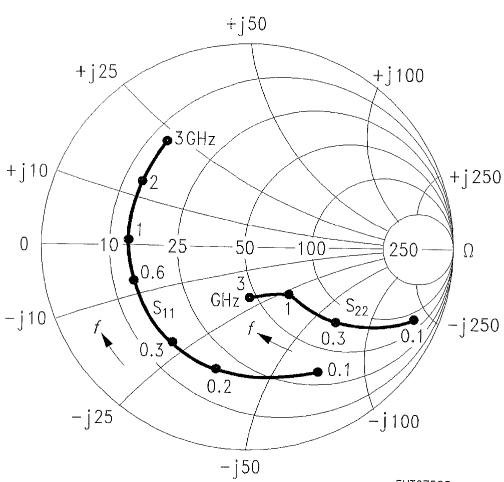
$S_{12}, S_{21} = f(f)$
I_C = 10 mA, V_{CE} = 6 V, Z_0 = 50 Ω



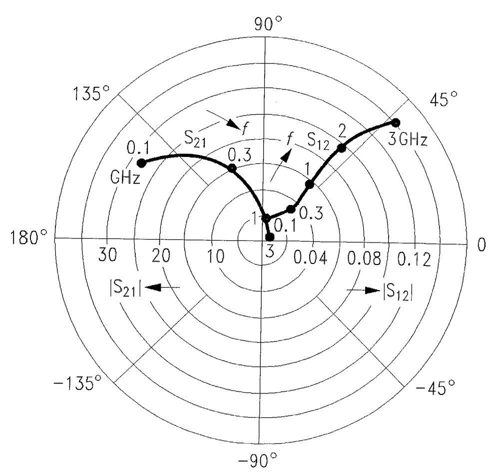
Common Emitter S Parameters (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_C = 15 mA, V_{CE} = 6 V, Z_0 = 50 Ω								
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



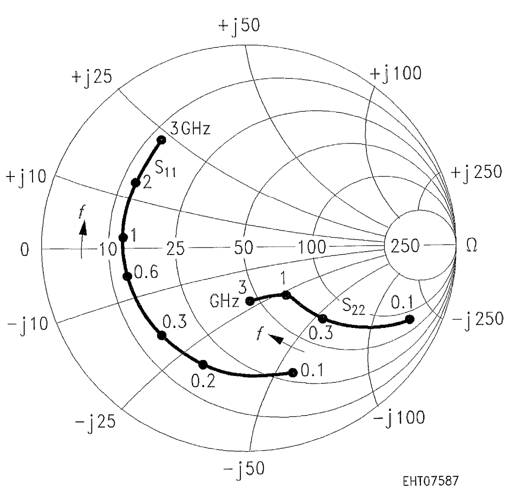
$S_{12}, S_{21} = f(f)$
I_C = 15 mA, V_{CE} = 6 V, Z_0 = 50 Ω



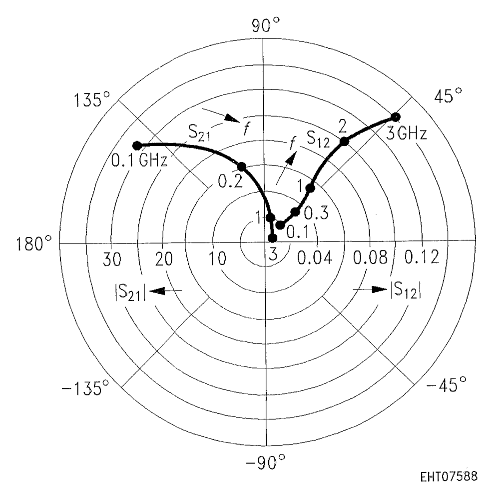
Common Emitter S Parameters (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**
I_C = 20 mA, V_{CE} = 6 V, Z_0 = 50 Ω								
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



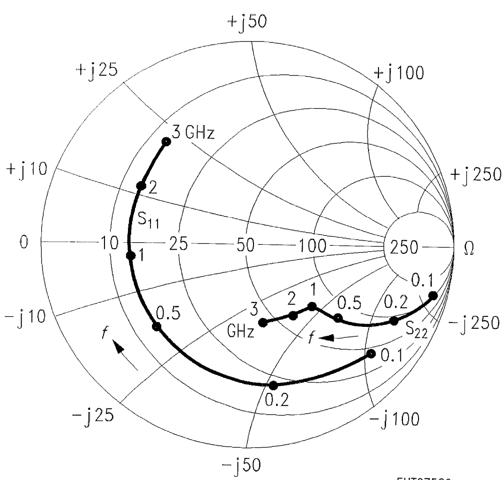
$S_{12}, S_{21} = f(f)$
I_C = 20 mA, V_{CE} = 6 V, Z_0 = 50 Ω



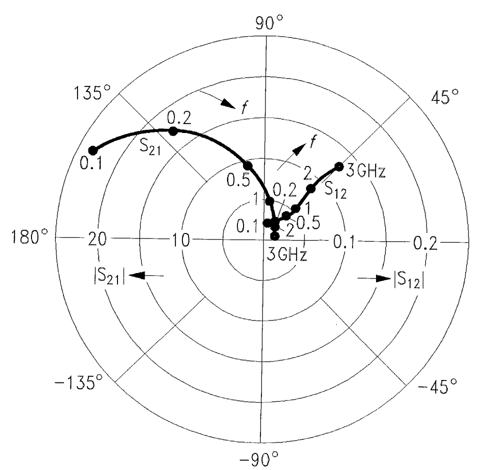
Common Emitter S Parameters (continued)

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	0.75	– 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

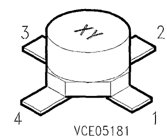


SIEMENS

NPN Silicon RF Transistor

BFQ 71

- For broadband amplifiers up to 2 GHz and fast non-saturated switches at collector currents from 1 mA to 20 mA.
- Hermetically sealed ceramic package.
- HiRel/Mil screening available.
- CECC-type available: CECC 50002/260.



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 71	71	Q62702-F775	B	E	C	E	Cerec-X

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CEO}	15	V
Collector-emitter voltage, $V_{BE} = 0$	V_{CES}	20	
Collector-base voltage	V_{CBO}	20	
Emitter-base voltage	V_{EBO}	2.5	
Collector current	I_C	30	mA
Base current	I_B	4	
Total power dissipation, $T_S \leq 103$ ˚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)]	$R_{th\,JA}$	≤ 320	K/W
Junction - soldering point[3)]	$R_{th\,JS}$	≤ 240	

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.

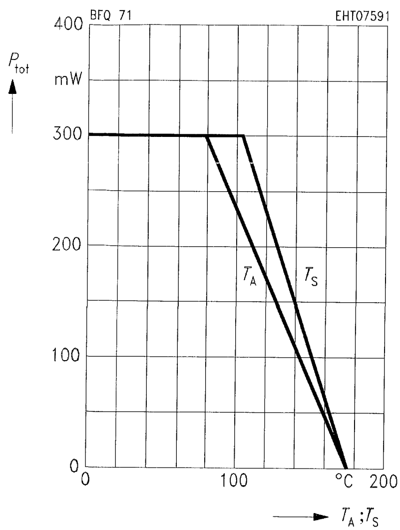
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CEO}$	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	–	

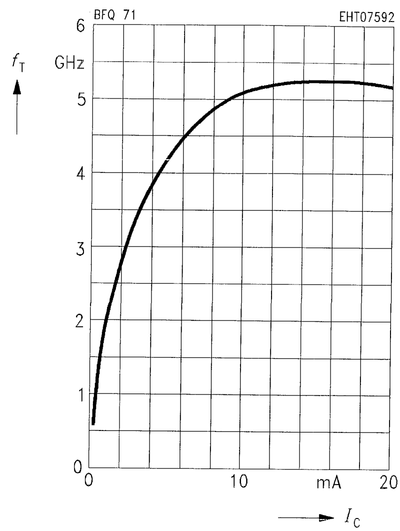
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
AC Characteristics					
Transition frequency	f_T				GHz
I_C = 5 mA, V_{CE} = 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	–	
Input capacitance V_{EB} = 0.5 V, I_C = i_c = 0, f = 1 MHz	C_{ibo}	–	1.2	–	
Output capacitance V_{CE} = 6 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{obs}	–	0.86	1.2	
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	–	
Transducer gain I_C = 20 mA, V_{CE} = 6 V, f = 1 GHz, Z_0 = 50 Ω	$\|S_{21e}\|^2$	–	13.4	–	
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

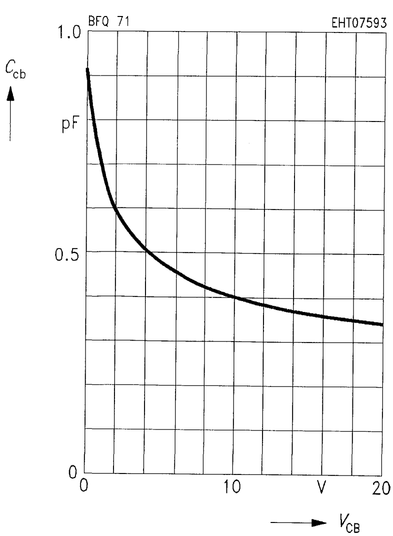
Total power dissipation $P_{tot} = f(T_A^*; T_S)$
*Package mounted on alumina



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



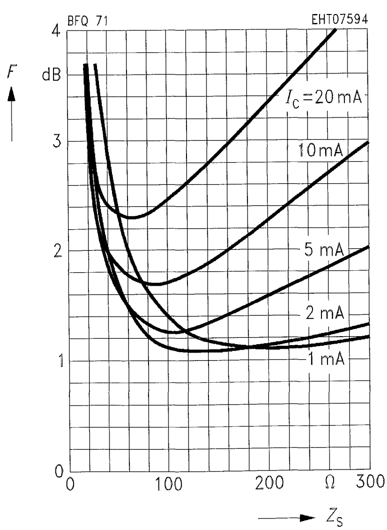
Collector-base capacitance $C_{cb} = f(V_{CB})$
$V_{BE} = v_{be} = 0$, f = 1 MHz



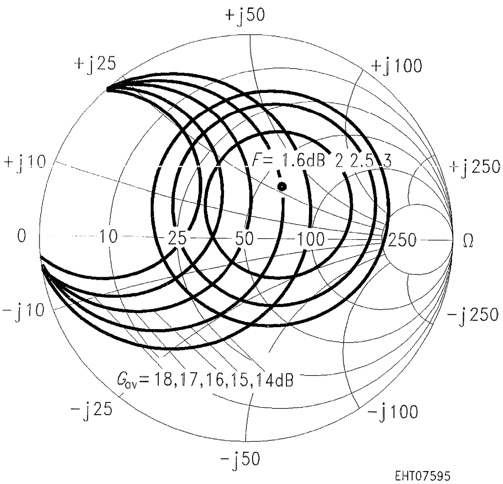
Common Emitter Noise Parameters

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 = 2 mA, V_{CE} = 6 V, Z_0 = 50 Ω								
0.01	1.1	–	(Z_S = 150 Ω)		–	–	1.6	–
I_C = 5 mA, V_{CE} = 10 V, Z_0 = 50 Ω								
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	–	–

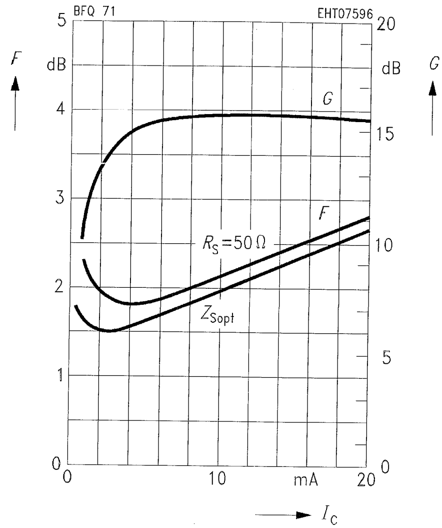
Noise figure $F = f\,(Z_S)$
V_{CE} = 6 V, f = 10 MHz



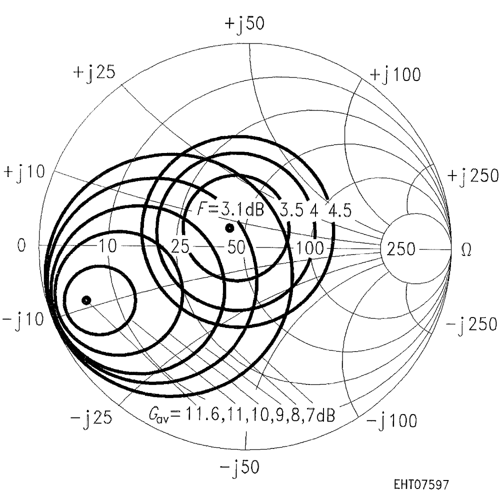
Circles of constant noise figure $F = f(Z_S)$ and available power gain $G_{av} = f(Z_S)$
I_C = 5 mA, V_{CE} = 10 V, f = 800 MHz



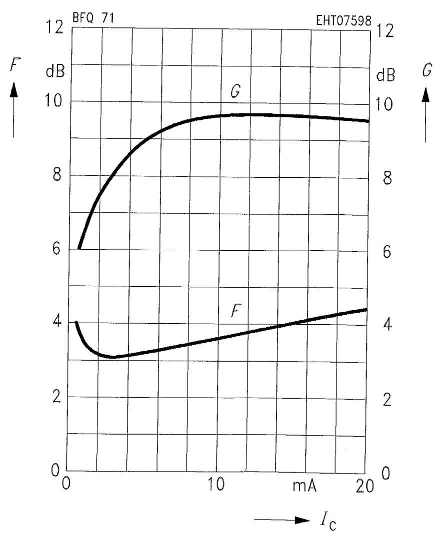
Noise figure $F = f(I_C)$
Power gain $G = f(I_C)$
V_{CE} = 10 V, f = 800 MHz, Z_{Lopt} (G)



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

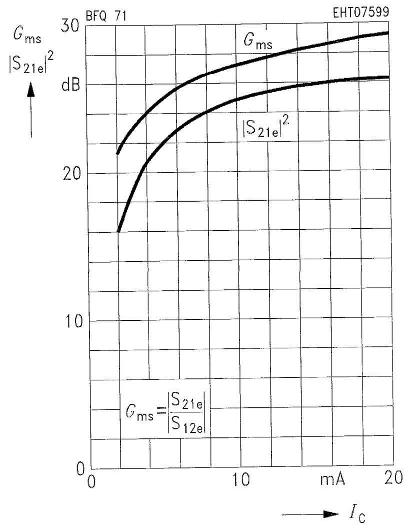


Noise figure $F = f(I_C)$
Power gain $G = f(I_C)$
V_{CE} = 10 V, f = 2 GHz, Z_{Lopt} (G)

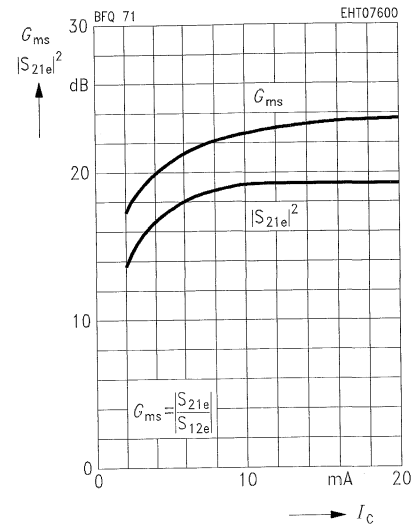


Common Emitter Power Gain

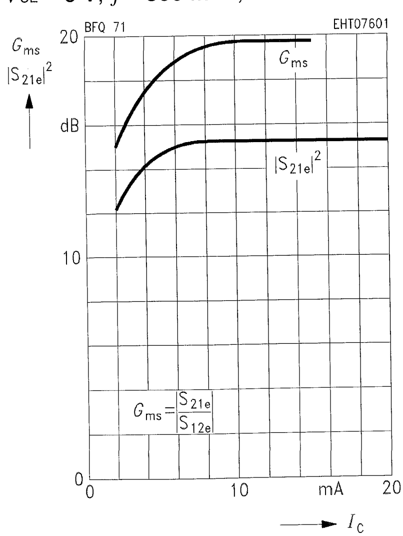
Power gain G_{ms}, $|S_{21e}|^2 = f(I_C)$
V_{CE} = 6 V, f = 200 MHz, Z_0 = 50 Ω



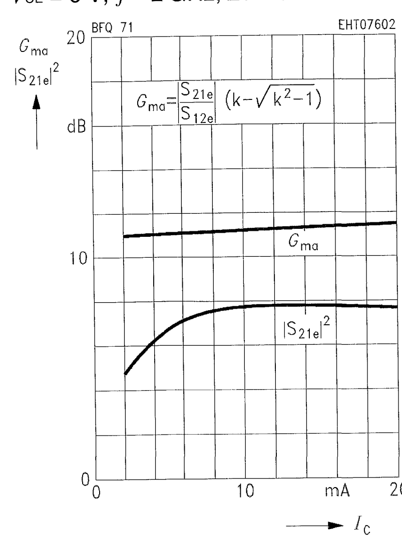
Power gain G_{ms}, $|S_{21e}|^2 = f(I_C)$
V_{CE} = 6 V, f = 500 MHz, Z_0 = 50 Ω



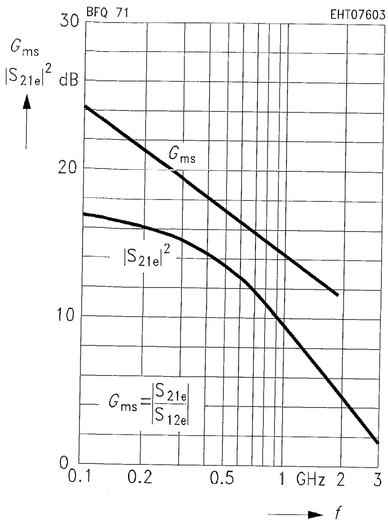
Power gain G_{ms}, $|S_{21e}|^2 = f(I_C)$
V_{CE} = 6 V, f = 800 MHz, Z_0 = 50 Ω



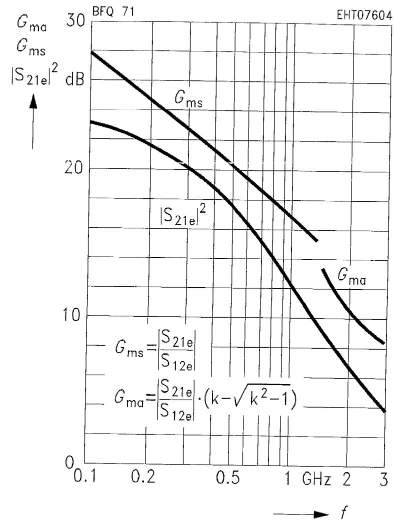
Power gain G_{ma}, $|S_{21e}|^2 = f(I_C)$
V_{CE} = 6 V, f = 2 GHz, Z_0 = 50 Ω



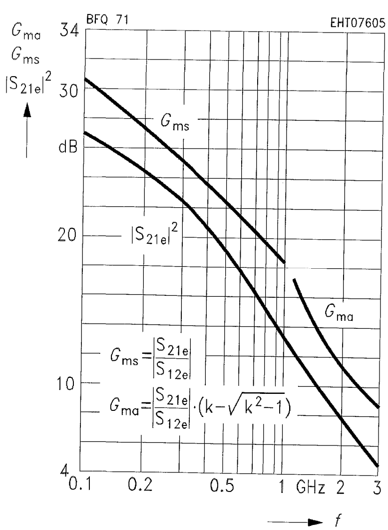
Power gain G_{ms}, $|S_{21e}|^2 = f(f)$
I_C = 2 mA, V_{CE} = 6 V, Z_0 = 50 Ω



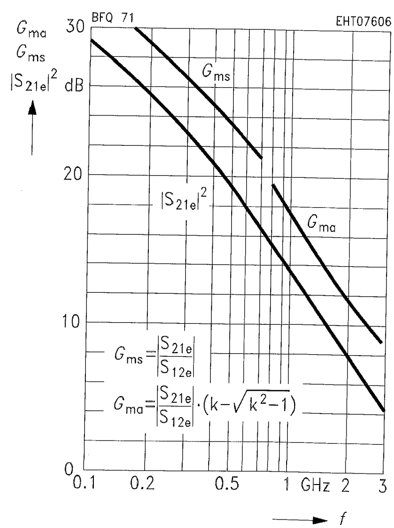
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
I_C = 5 mA, V_{CE} = 6 V, Z_0 = 50 Ω



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



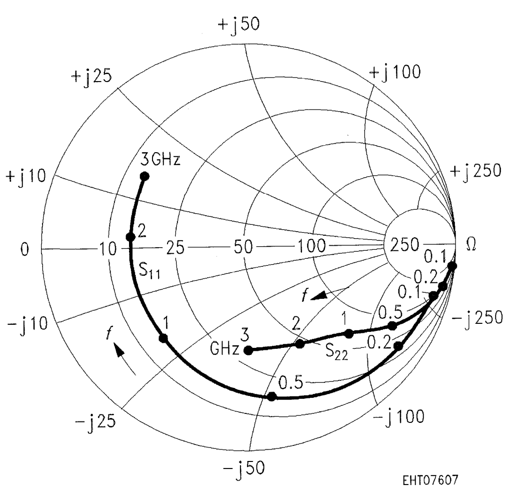
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
I_C = 20 mA, V_{CE} = 6 V, Z_0 = 50 Ω



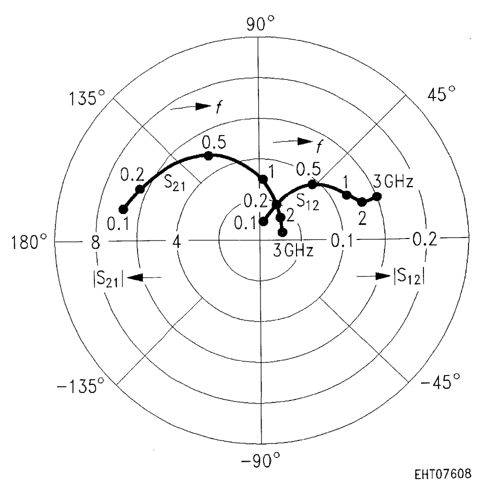
Common Emitter S Parameters

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_C = 2 mA, V_{CE} = 6 V, Z_0 = 50 Ω								
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



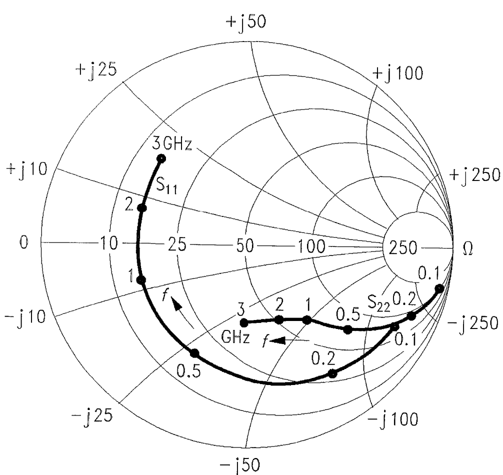
S_{12}, S_{21} = *f* (*f*)
I_C = 2 mA, V_{CE} = 6 V, Z_0 = 50 Ω



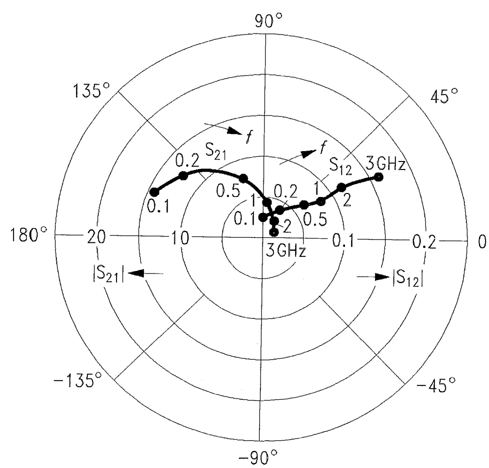
Common Emitter S Parameters (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_C = 5 mA, V_{CE} = 6 V, Z_0 = 50 Ω								
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



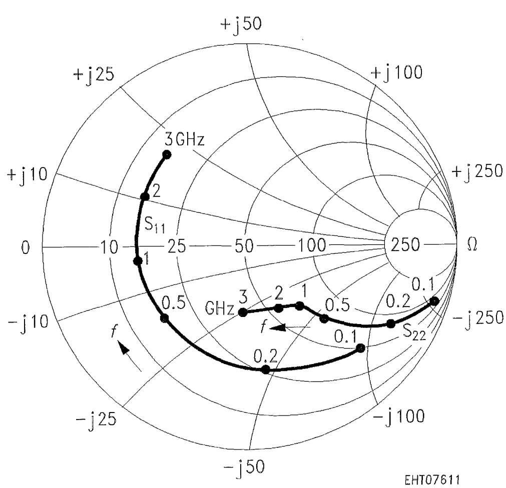
$S_{12}, S_{21} = f(f)$
I_C = 5 mA, V_{CE} = 6 V, Z_0 = 50 Ω



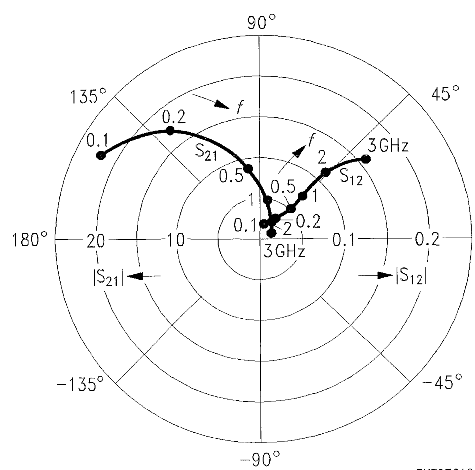
Common Emitter S Parameters (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**
I_C = 10 mA, V_{CE} = 6 V, Z_0 = 50 Ω								
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



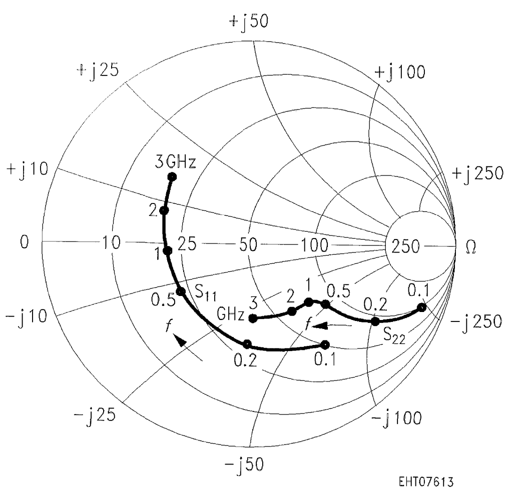
S_{12}, S_{21} = f (f)
I_C = 10 mA, V_{CE} = 6 V, Z_0 = 50 Ω



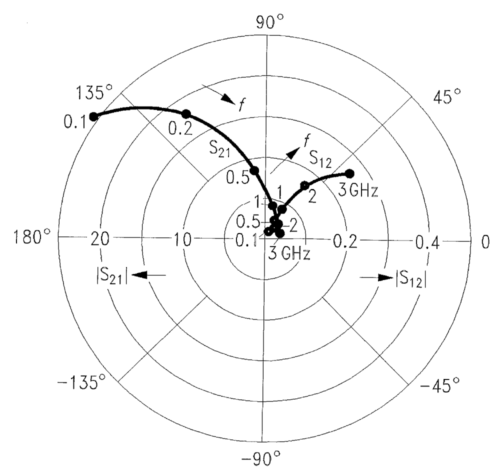
Common Emitter S Parameters (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_C = 15 mA, V_{CE} = 6 V, Z_0 = 50 Ω								
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



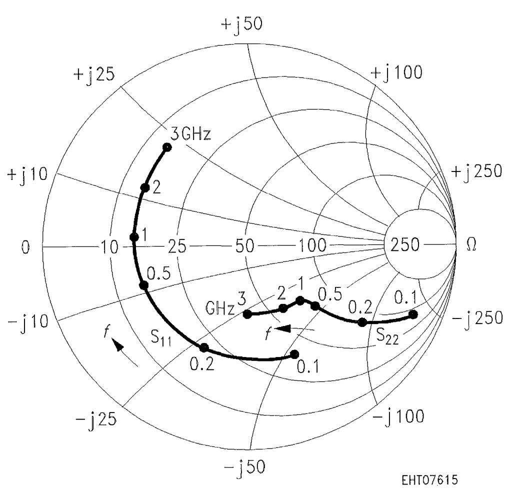
S_{12}, S_{21} = $f(f)$
I_C = 15 mA, V_{CE} = 6 V, Z_0 = 50 Ω



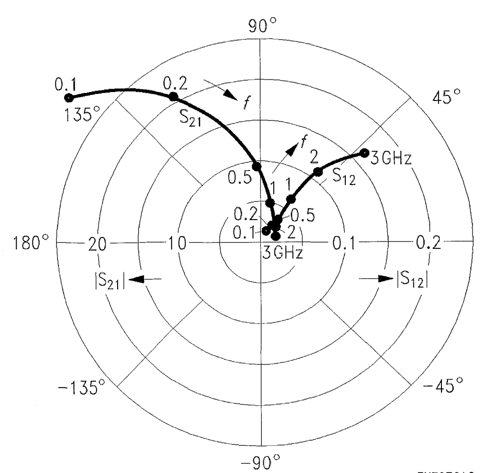
Common Emitter S Parameters (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**
I_C = 20 mA, V_{CE} = 6 V, Z_0 = 50 Ω								
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



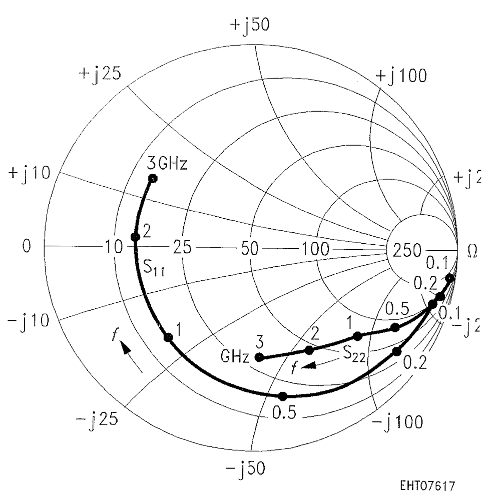
$S_{12}, S_{21} = f(f)$
I_C = 20 mA, V_{CE} = 6 V, Z_0 = 50 Ω



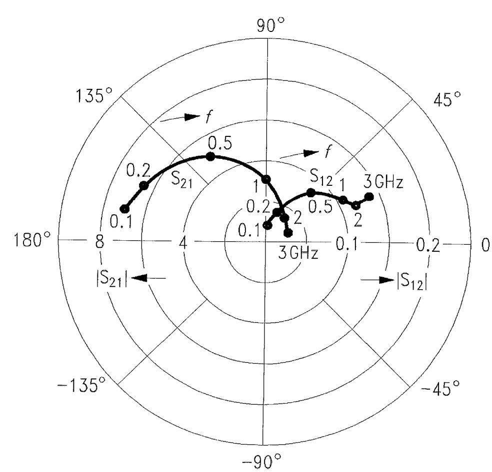
Common Emitter S Parameters (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_C = 2 mA, V_{CE} = 10 V, Z_0 = 50 Ω								
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



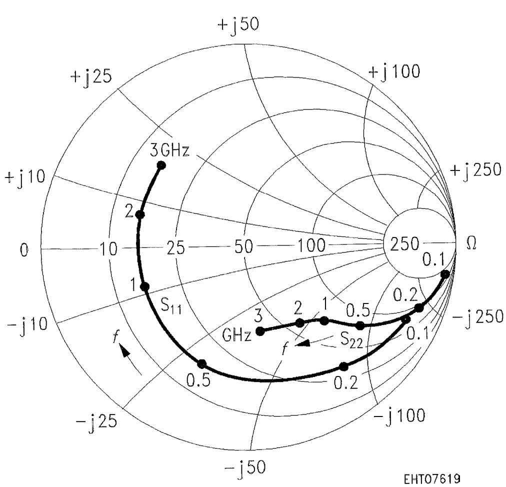
S_{12}, S_{21} = f (f)
I_C = 2 mA, V_{CE} = 10 V, Z_0 = 50 Ω



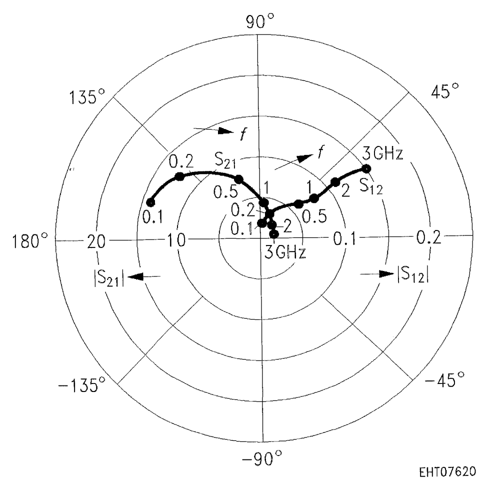
Common Emitter S Parameters (continued)

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	0.80	– 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



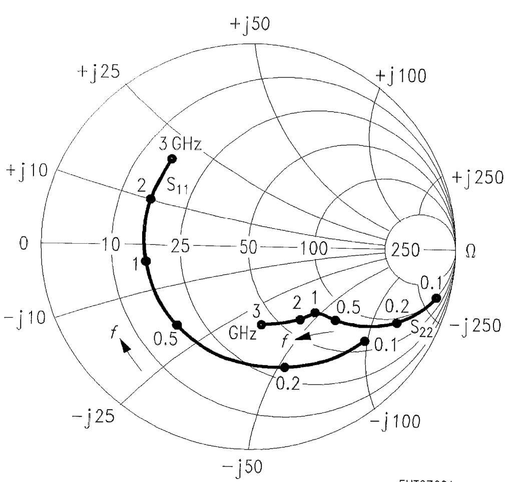
S_{12}, S_{21} = f (f)
I_C = 5 mA, V_{CE} = 10 V, Z_0 = 50 Ω



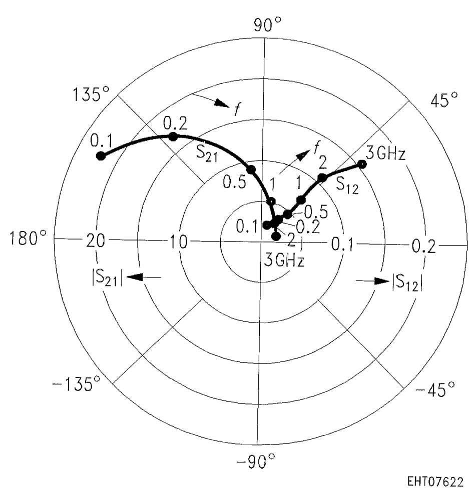
Common Emitter S Parameters (continued)

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	0.68	– 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



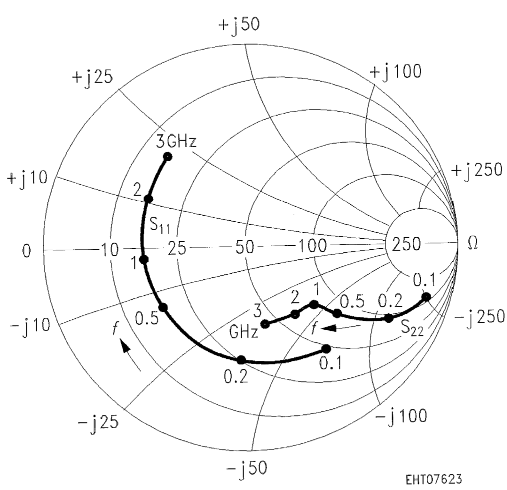
$S_{12}, S_{21} = f(f)$
I_C = 10 mA, V_{CE} = 10 V, Z_0 = 50 Ω



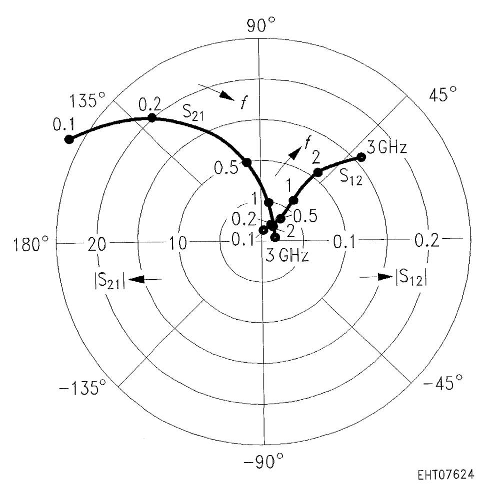
Common Emitter S Parameters (continued)

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	0.62	– 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



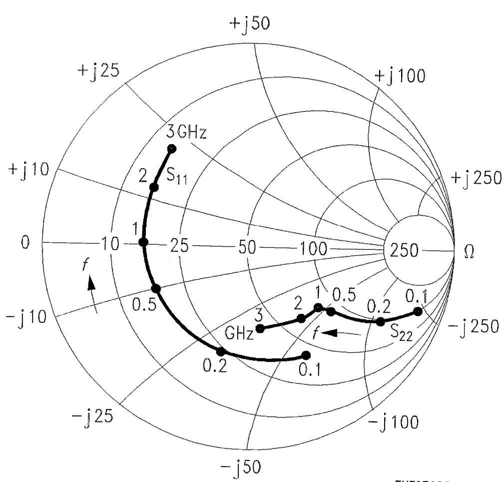
S_{12}, S_{21} = $f(f)$
I_C = 15 mA, V_{CE} = 10 V, Z_0 = 50 Ω



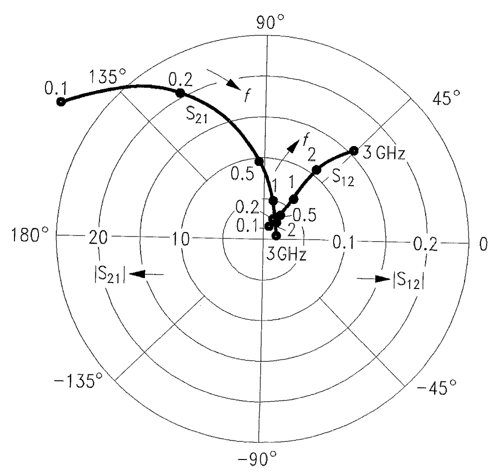
Common Emitter S Parameters (continued)

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	0.57	– 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

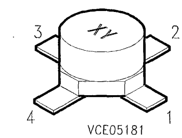


SIEMENS

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.



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 72	72	Q62702-F776	B	E	C	E	Cerec-X

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CEO}	15	V
Collector-emitter voltage, $V_{BE} = 0$	V_{CES}	20	
Collector-base voltage	V_{CBO}	20	
Emitter-base voltage	V_{EBO}	2.5	
Collector current	I_C	50	mA
Base current	I_B	10	
Total power dissipation, $T_S \leq 112$ °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.

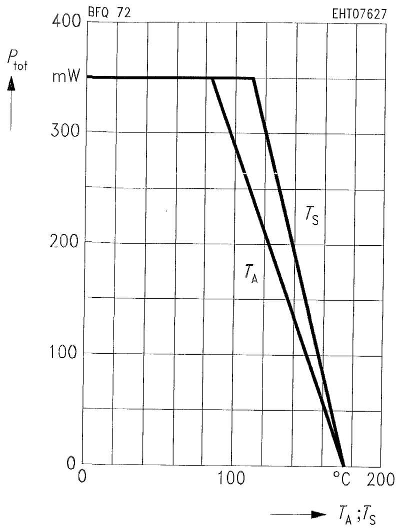
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
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	–	

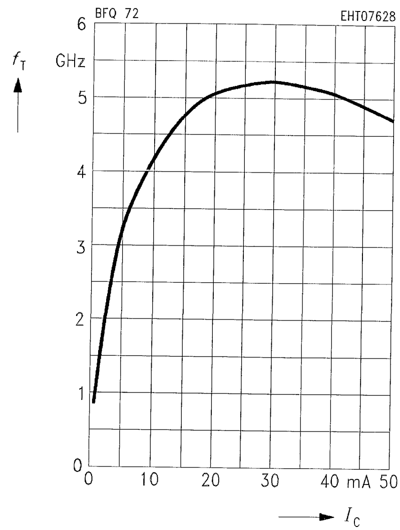
Electrical Characteristics
at T_A = 25 ˚C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
AC Characteristics					
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

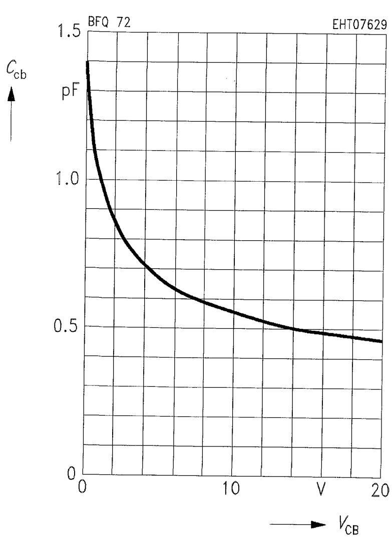
Total power dissipation $P_{tot} = f(T_A^*; T_S)$
*Package mounted on alumina



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**	Ω	–	**dB**	**dB**

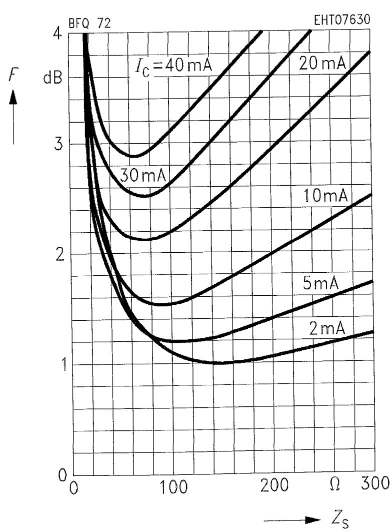
I_C = 2 mA, V_{CE} = 8 V, Z_0 = 50 Ω

0.01	1.0	–	(Z_S = 150 Ω)		–	–	1.6	–

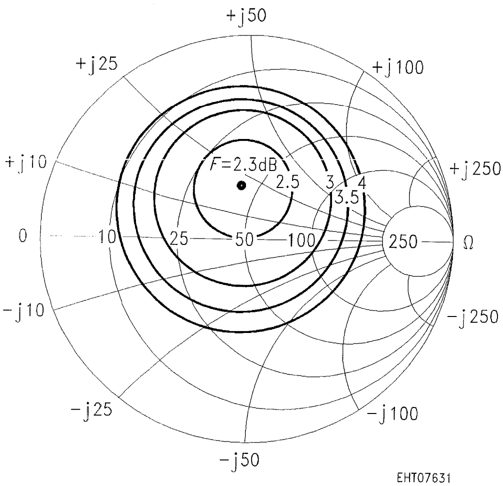
I_C = 10 mA, V_{CE} = 8 V, Z_0 = 50 Ω

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

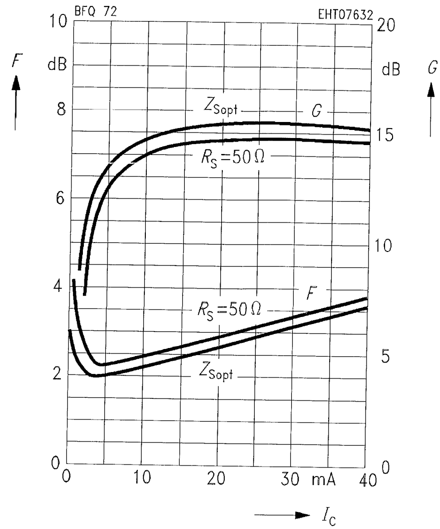
Noise figure $F = f(Z_S)$
V_{CE} = 8 V, f = 10 MHz



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

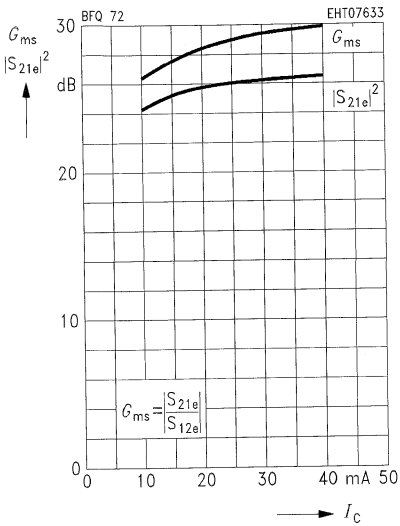


Noise figure $F = f(I_C)$
Power gain $G = f(I_C)$
V_{CE} = 8 V, f = 800 MHz, Z_{Lopt} (G)

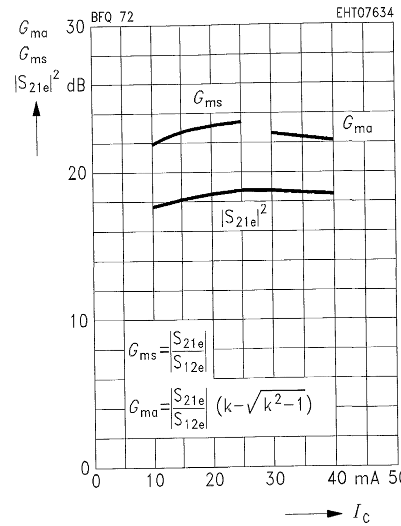


Common Emitter Power Gain

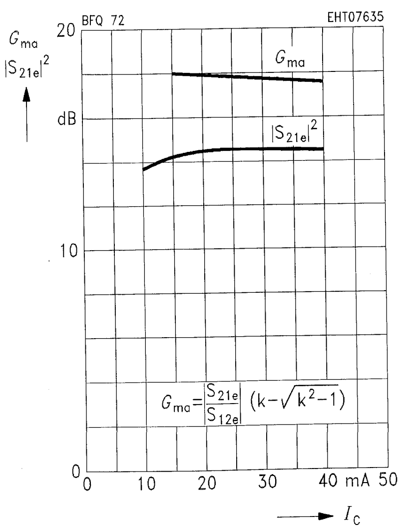
Power gain G_{ms}, $|S_{21e}|^2 = f(I_C)$
V_{CE} = 8 V, f = 200 MHz, Z_0 = 50 Ω



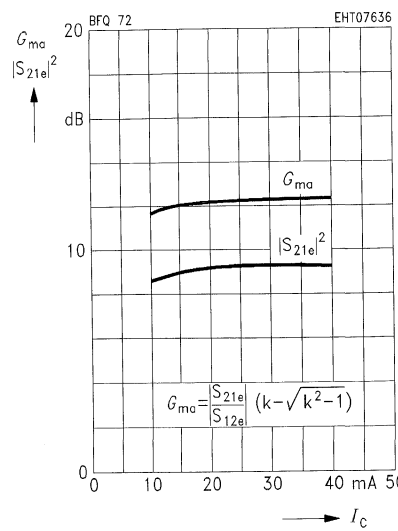
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(I_C)$
V_{CE} = 8 V, f = 500 MHz, Z_0 = 50 Ω



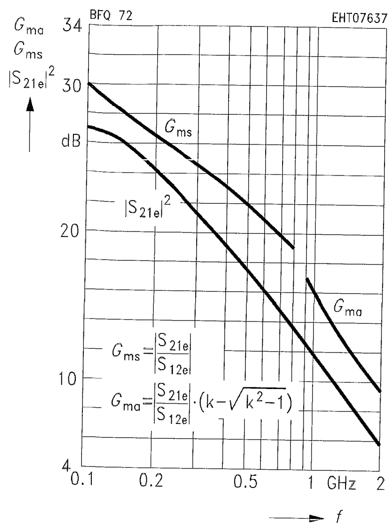
Power gain G_{ma}, $|S_{21e}|^2 = f(I_C)$
V_{CE} = 8 V, f = 800 MHz, Z_0 = 50 Ω



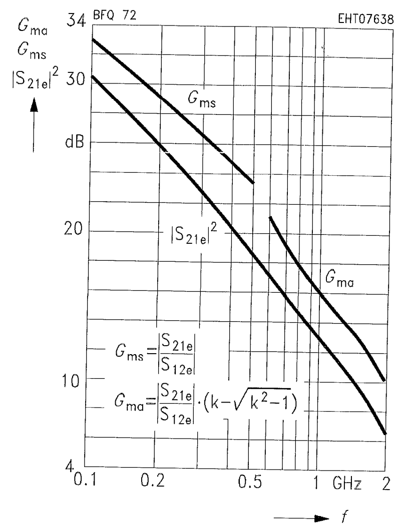
Power gain G_{ma}, $|S_{21e}|^2 = f(I_C)$
V_{CE} = 8 V, f = 1.5 GHz, Z_0 = 50 Ω



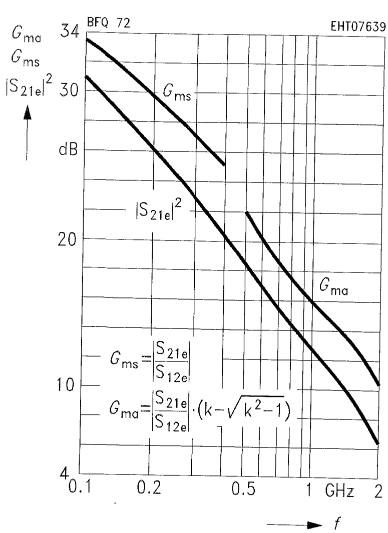
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
I_C = 10 mA, V_{CE} = 8 V, Z_0 = 50 Ω



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



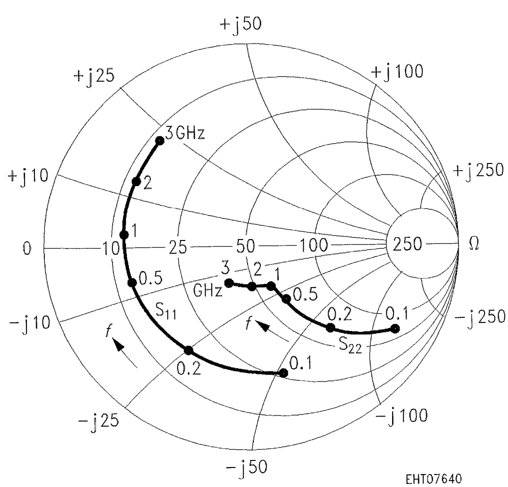
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
I_C = 40 mA, V_{CE} = 8 V, Z_0 = 50 Ω



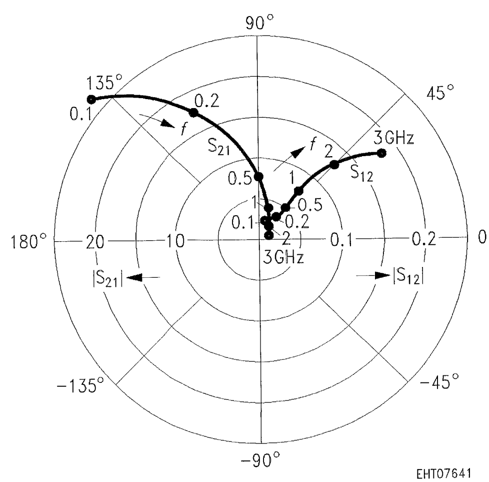
Common Emitter S Parameters

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



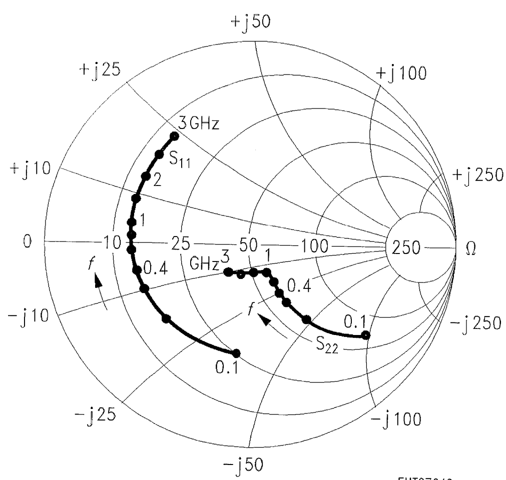
$S_{12}, S_{21} = f(f)$
I_C = 15 mA, V_{CE} = 5 V, Z_0 = 50 Ω



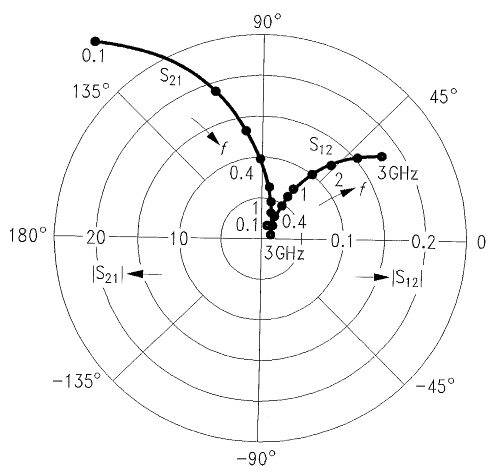
Common Emitter S Parameters (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_C = 25 mA, V_{CE} = 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



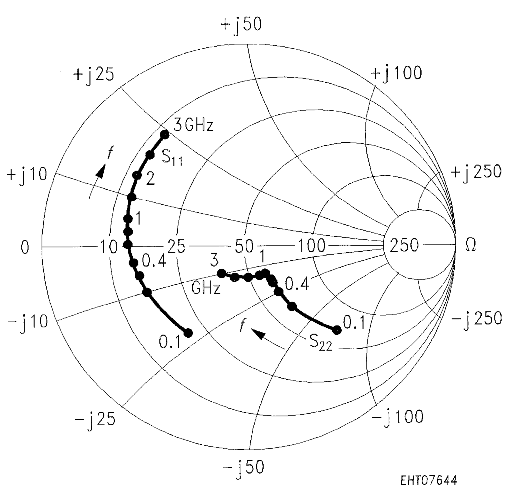
S_{12}, $S_{21} = f(f)$
I_C = 25 mA, V_{CE} = 5 V, Z_0 = 50 Ω



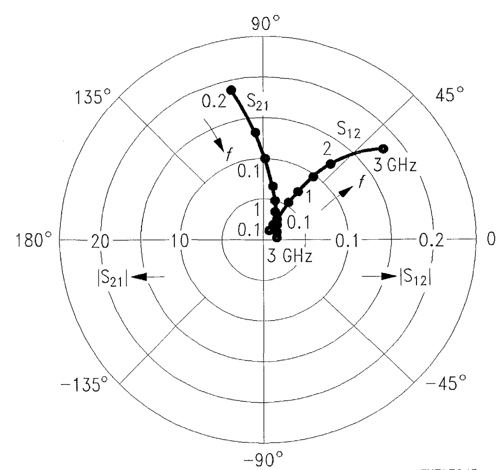
Common Emitter S Parameters (continued)

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



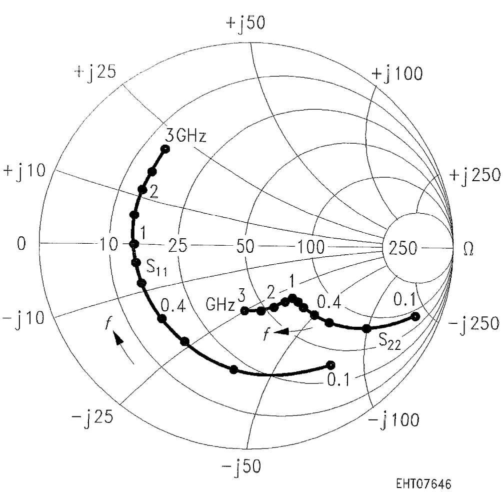
$S_{12}, S_{21} = f(f)$
I_C = 50 mA, V_{CE} = 5 V, Z_0 = 50 Ω



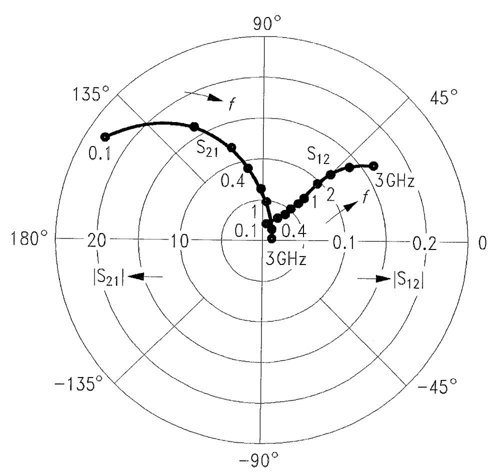
Common Emitter S Parameters (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**
I_C = 10 mA, V_{CE} = 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



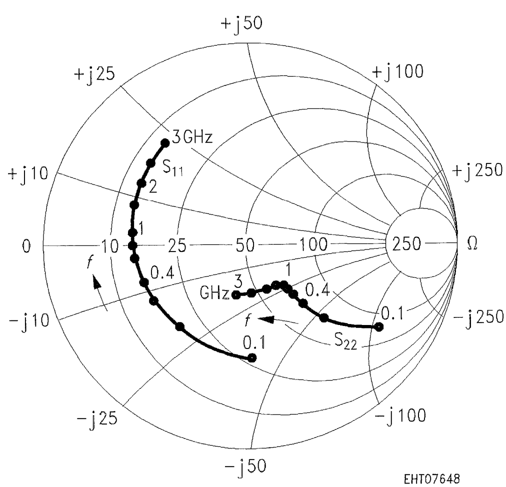
S_{12}, S_{21} = $f(f)$
I_C = 10 mA, V_{CE} = 8 V, Z_0 = 50 Ω



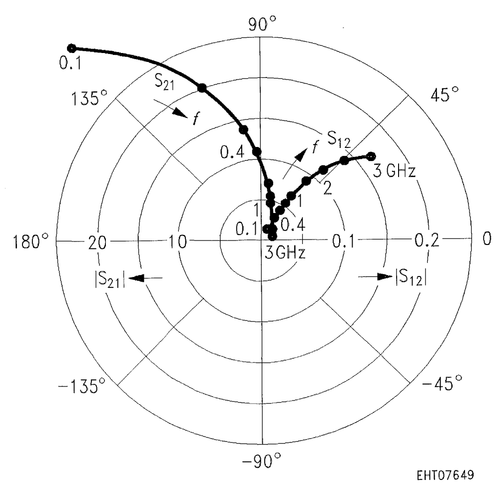
Common Emitter S Parameters (continued)

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



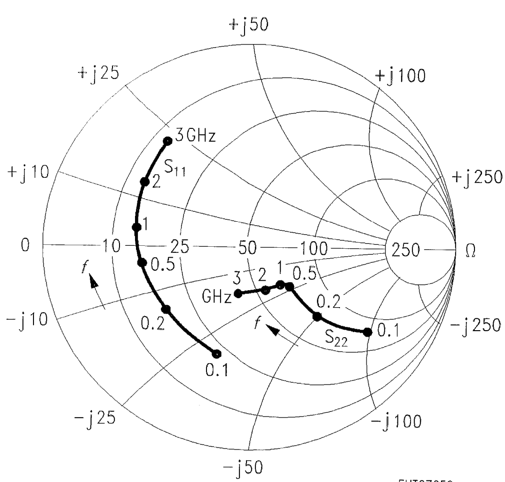
S_{12}, S_{21} = f (f)
I_C = 25 mA, V_{CE} = 8 V, Z_0 = 50 Ω



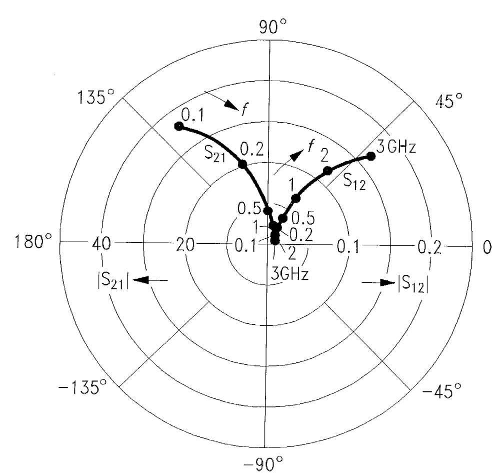
Common Emitter S Parameters (continued)

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

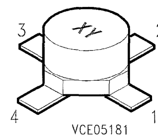


SIEMENS

NPN Silicon RF Transistor

BFQ 73S

- For low-noise, low-distortion broadband amplifiers in antenna and telecommunications systems up to 2 GHz at collector currents from 10 mA to 70 mA.
- Hermetically sealed ceramic package.
- HiRel/Mil screening available.
- CECC-type available: CECC 50002/261.



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 73S	73S	Q62702-F1104	B	E	C	E	Cerec-X

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CE0}	15	V
Collector-base voltage	V_{CB0}	20	
Emitter-base voltage	V_{EB0}	3	
Collector current	I_C	100	mA
Total power dissipation, $T_S \le 110$ °C[3]	P_{tot}	500	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]	$R_{th\,JA}$	$\le$ 210	K/W
Junction - soldering point[3]	$R_{th\,JS}$	$\le$ 130	

1) For detailed information 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.

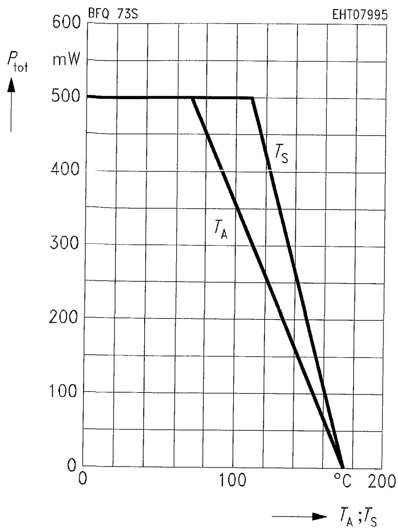
Electrical Characteristics
at T_A = 25 ˚C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CE0}$	15	–	–	V
Collector-base cutoff current V_{CB} = 10 V, I_E = 0	I_{CB0}	–	–	100	nA
Emitter-base cutoff current V_{EB} = 2 V, I_C = 0	I_{EB0}	–	–	10	µA
DC current gain I_C = 50 mA, V_{CE} = 5 V	h_{FE}	30	90	250	–
Collector-emitter saturation voltage I_C = 75 mA, I_B = 7.5 mA	V_{CEsat}	–	0.2	0.5	V

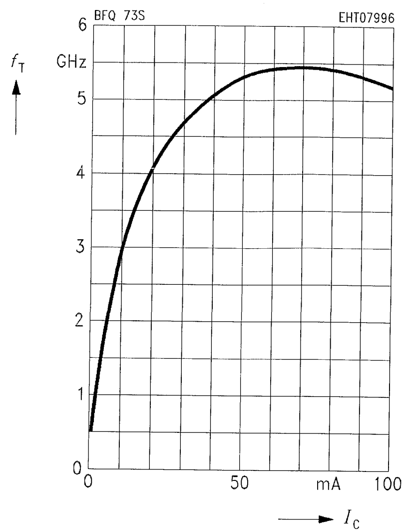
Electrical Characteristics
at $T_A = 25\ ^\circ C$, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
AC Characteristics					
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	–	
Input capacitance $V_{EB} = 0.5$ V, $I_C = i_c = 0, f = 1$ MHz	C_{ibo}	–	5	–	
Output capacitance $V_{CE} = 10$ V, $V_{BE} = v_{be} = 0, f = 1$ MHz	C_{obs}	–	1.3	–	
Noise figure $I_C = 5$ mA, $V_{CE} = 10$ V, $f = 10$ MHz, $Z_S = 50\ \Omega$ $I_C = 50$ mA, $V_{CE} = 5$ V, $f = 800$ MHz, $Z_S = Z_{Sopt}$	F	 – –	 0.9 2.5	 – –	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	–	
Transducer gain $I_C = 50$ mA, $V_{CE} = 5$ V, $f = 1$ GHz, $Z_0 = 50\ \Omega$	$\lvert S_{21e}\rvert^2$	–	10.5	–	
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, $Z_S = Z_L = 50\ \Omega$	$V_{o1} = V_{o2}$	–	400	–	mV
Third order intercept point $I_C = 50$ mA, $V_{CE} = 10$ V, $f = 800$ MHz	IP_3	–	35	–	dBm

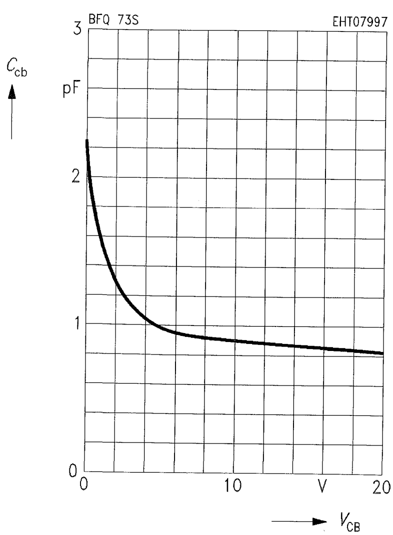
Total power dissipation $P_{tot} = f(T_A^*; T_S)$
* Package mounted on alumina



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



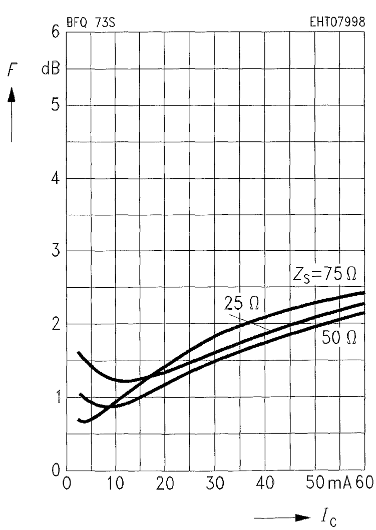
Collector-base capacitance $C_{cb} = f(V_{CB})$
$V_{BE} = v_{be} = 0$, f = 1 MHz



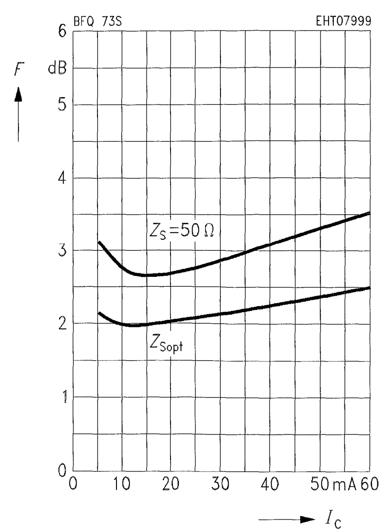
Common Emitter Noise Parameters

f	F_{min}	$G_p (F_{min})$	Γ_{opt}		R_N	N	$F_{50\Omega}$	$G_p (F_{50\Omega})$
GHz	dB	dB	MAG	ANG	Ω	–	dB	dB
I_C = 5 mA, V_{CE} = 5 V, Z_0 = 50 Ω								
0.01	0.9	–	(Z_S = 50 Ω)		–	–	–	–
I_C = 50 mA, V_{CE} = 5 V, Z_0 = 50 Ω								
0.01	2.0	–	(Z_S = 50 Ω)		–	–	–	–
0.8	2.5	14	0.41	163	9	0.39	3.8	–

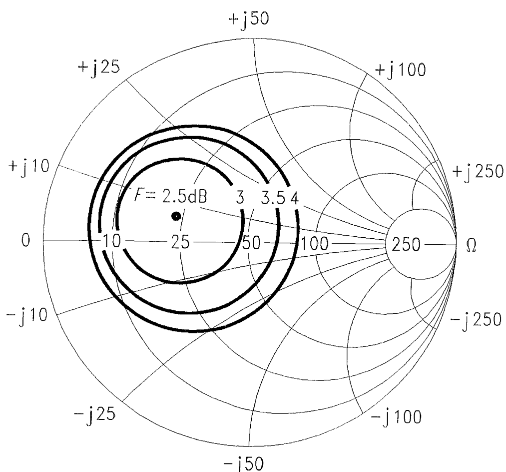
Noise figure $F = f (I_C)$
V_{CE} = 10 V, f = 10 MHz, Z_S = 50 Ω



Noise figure $F = f (I_C)$
V_{CE} = 5 V, f = 800 MHz

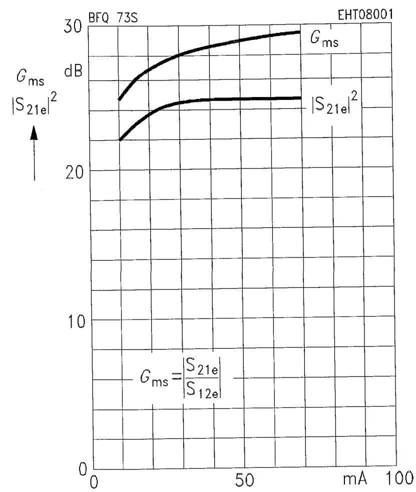


Circles of constant noise figure $F = f(Z_S)$ and available power gain $G_{av} = f(Z_S)$
I_C = 50 mA, V_{CE} = 5 V, f = 800 MHz,
Z_0 = 50 Ω

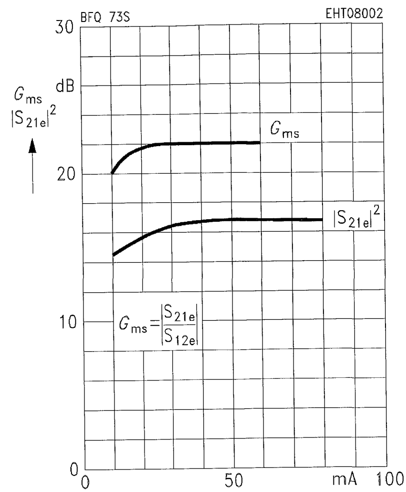


Common Emitter Power Gain

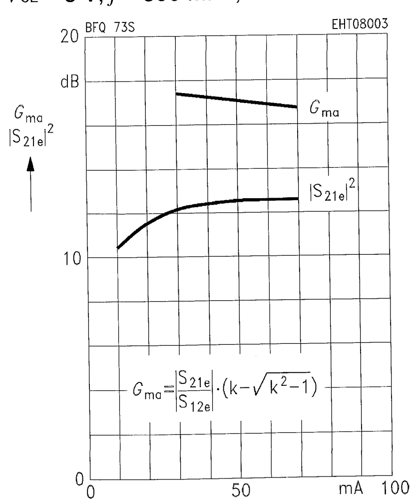
Power gain G_{ms}, $|S_{21e}|^2 = f(I_C)$
V_{CE} = 5 V, f = 200 MHz, Z_0 = 50 Ω



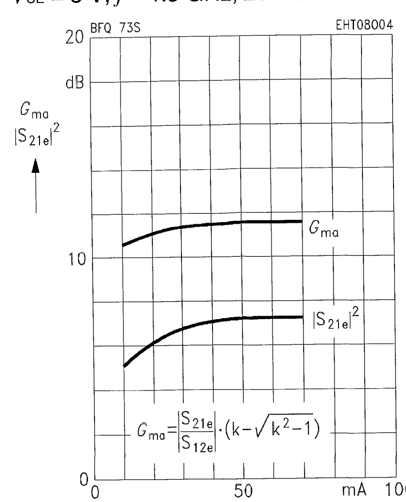
Power gain G_{ms}, $|S_{21e}|^2 = f(I_C)$
V_{CE} = 5 V, f = 500 MHz, Z_0 = 50 Ω



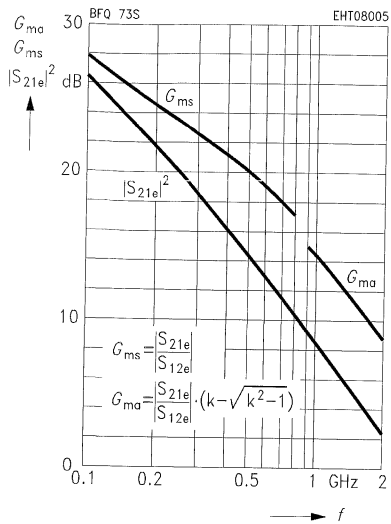
Power gain G_{ma}, $|S_{21e}|^2 = f(I_C)$
V_{CE} = 5 V, f = 800 MHz, Z_0 = 50 Ω



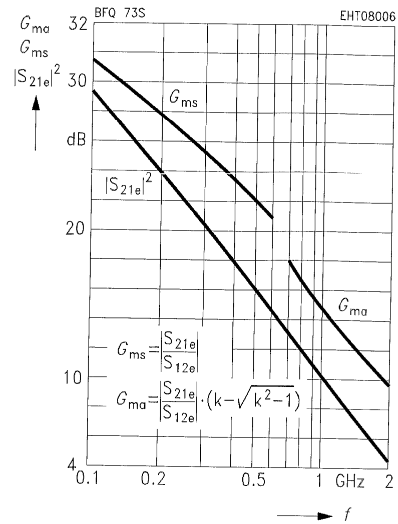
Power gain G_{ma}, $|S_{21e}|^2 = f(I_C)$
V_{CE} = 5 V, f = 1.5 GHz, Z_0 = 50 Ω



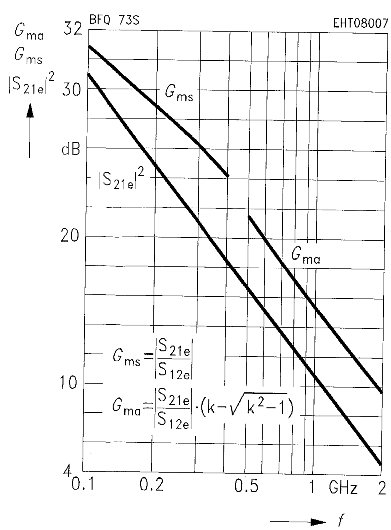
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
I_C = 10 mA, V_{CE} = 5 V, Z_0 = 50 Ω



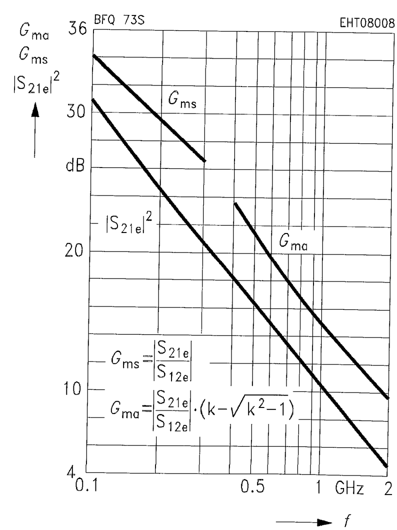
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
I_C = 30 mA, V_{CE} = 5 V, Z_0 = 50 Ω



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



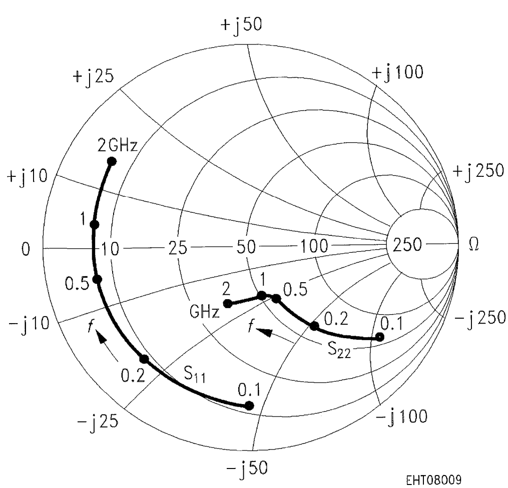
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
I_C = 70 mA, V_{CE} = 5 V, Z_0 = 50 Ω



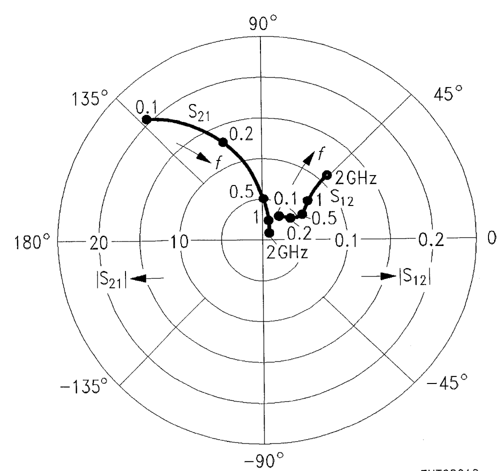
Common Emitter S Parameters

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_C = 10 mA, V_{CE} = 5 V, Z_0 = 50 Ω								
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



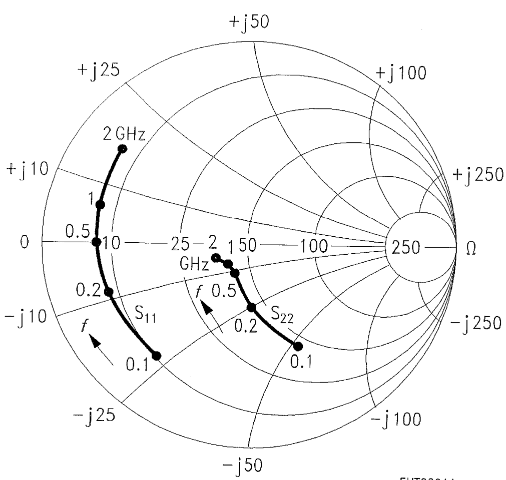
$S_{12}, S_{21} = f(f)$
I_C = 10 mA, V_{CE} = 5 V, Z_0 = 50 Ω



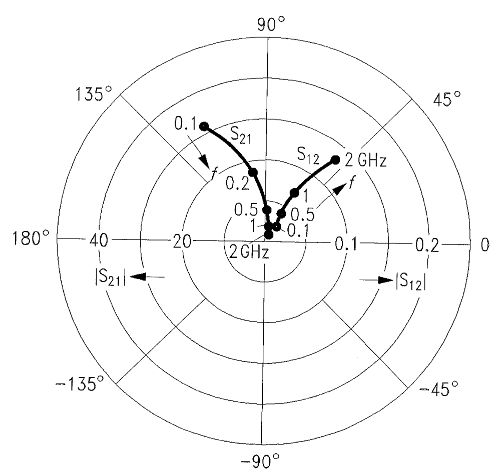
Common Emitter S Parameters (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**
I_C = 30 mA, V_{CE} = 5 V, Z_0 = 50 Ω								
0.1	0.72	– 30	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



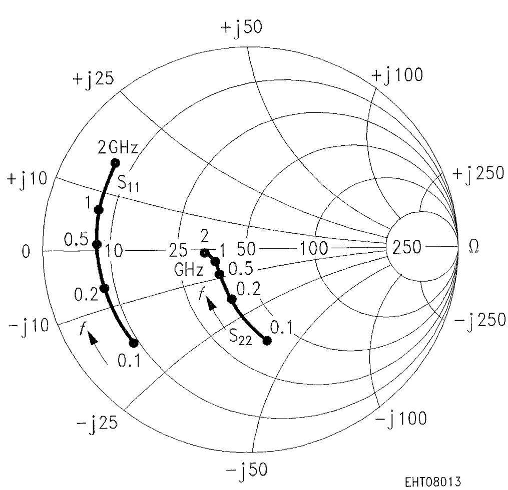
S_{12}, S_{21} = f (f)
I_C = 30 mA, V_{CE} = 5 V, Z_0 = 50 Ω



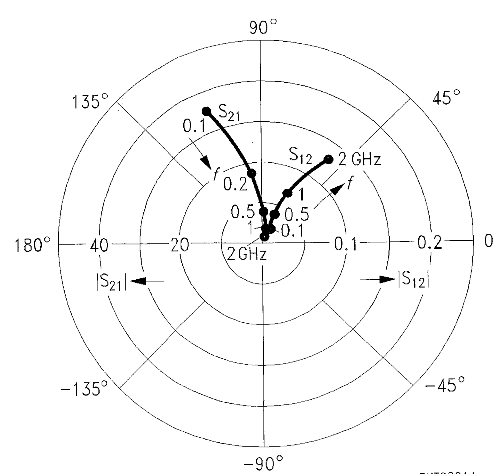
Common Emitter S Parameters (continued)

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	0.72	– 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	0.75	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



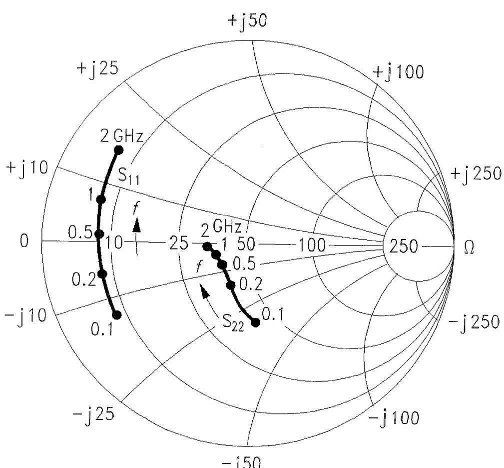
$S_{12}, S_{21} = f(f)$
I_C = 50 mA, V_{CE} = 5 V, Z_0 = 50 Ω



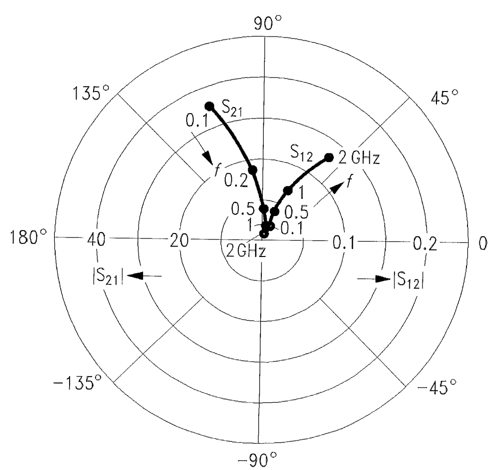
Common Emitter S Parameters (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_C = 70 mA, V_{CE} = 5 V, Z_0 = 50 Ω								
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

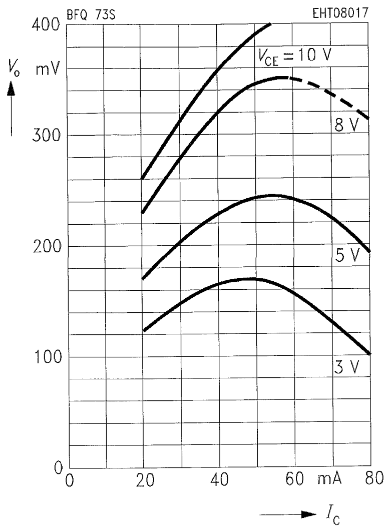


S_{12}, S_{21} = f (f)
I_C = 70 mA, V_{CE} = 5 V, Z_0 = 50 Ω



Common Emitter Large Signal Parameters

Linear output voltage $V_o = f\ (I_C)$
$d_{IM} = 60$ dB, $f_1 = 806$ MHz,
$f_2 = 810$ MHz, $Z_S = Z_L = 50\ \Omega$



Note:

The transistor is driven by 2 adjacent signals f_1, f_2 with equal output power levels P_o for each carrier.

The distance d_{IM} between P_o and the third order intermodulation products P_{IM} ($2f_1 - f_2$ or $2f_2 - f_1$) is:

$d_{IM} = P_o - P_{IM}$
where $P_o = 10 \log (V_o^2/(50\ \Omega \cdot 1\ \text{mW}))$ (dBm)
and V_o = linear output voltage of each carrier.

The 3rd order intercept point IP_3 will be found by extrapolation to the point where P_{IM} would be identical to P_o:

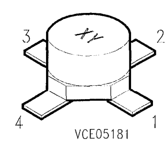
IP_3 (output) $= P_o + d_{IM}/2$.

Linear output voltages for other d_{IM} (e.g. 50 dB) can be calculated thereby.

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

Parameter	Symbol	Values	Unit
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	–	

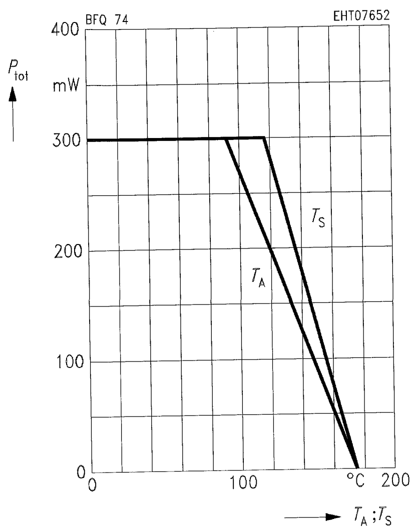
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
AC Characteristics					
Transition frequency 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	$\vert S_{21e} \vert^2$	–	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

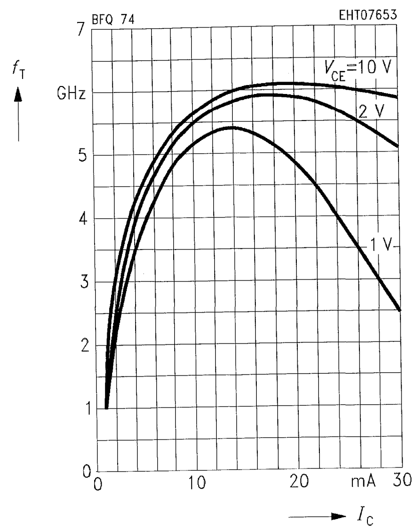
1) $G_{ma} = \left| \frac{S_{21e}}{S_{12e}} \right| (k - \sqrt{k^2 - 1})$

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

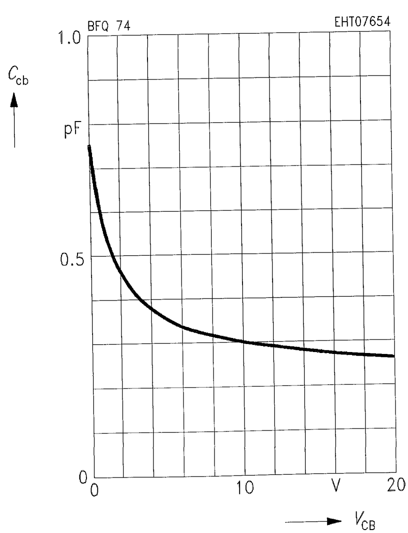
Total power dissipation $P_{tot} = f(T_A^*; T_S)$
*Package mounted on alumina



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



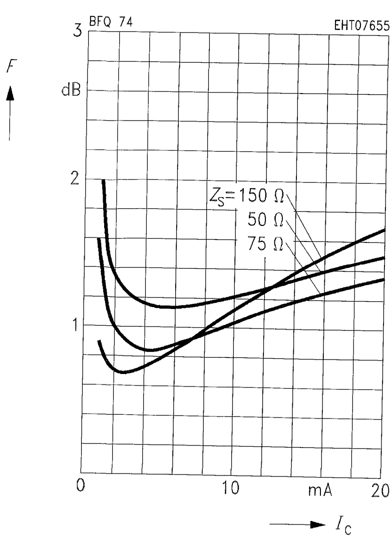
Collector-base capacitance $C_{cb} = f(V_{CB})$
$V_{BE} = v_{be} = 0, f = 1$ MHz



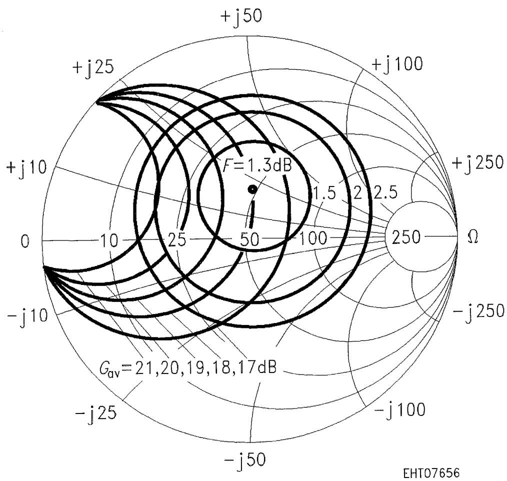
Common Emitter Noise Parameters

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

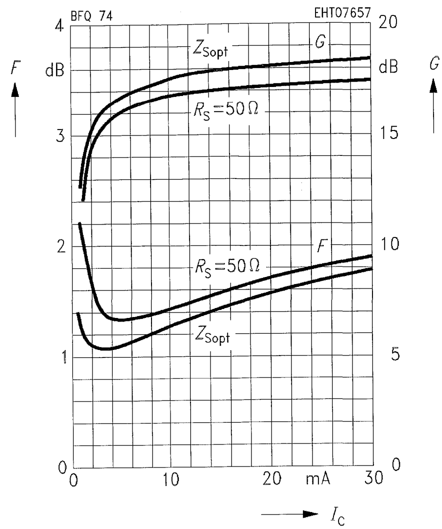
Noise figure $F = f(I_C)$
V_{CE} = 10 V, f = 10 MHz



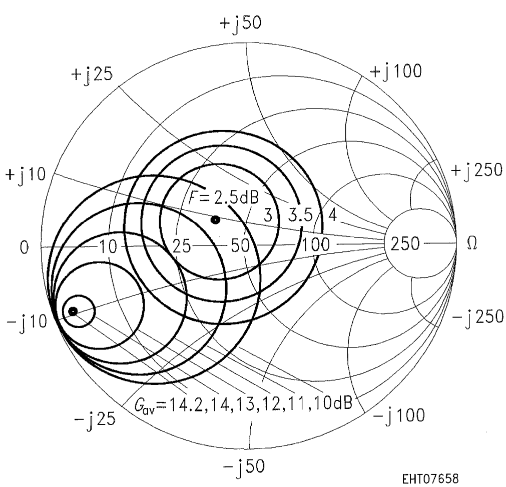
Circles of constant noise figure $F = f(Z_S)$ and available power gain $G_{av} = f(Z_S)$
I_C = 10 mA, V_{CE} = 10 V, f = 800 MHz



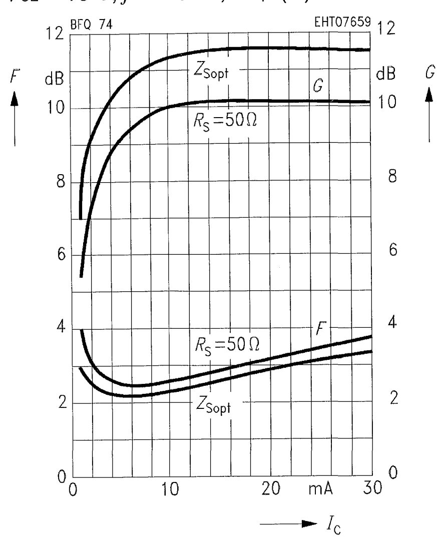
Noise figure $F = f(I_C)$
Power gain $G = f(I_C)$
V_{CE} = 10 V, f = 800 MHz, Z_{Lopt} (G)



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

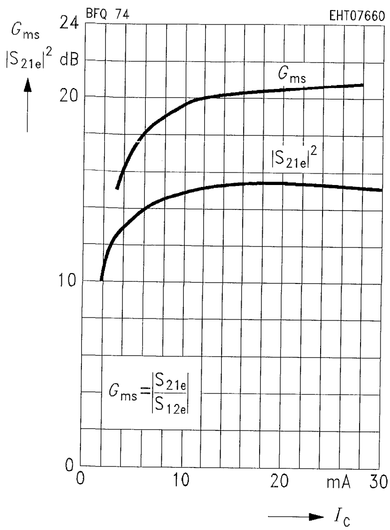


Noise figure $F = f(I_C)$
Power gain $G = f(I_C)$
V_{CE} = 10 V, f = 2 GHz, Z_{Lopt} (G)

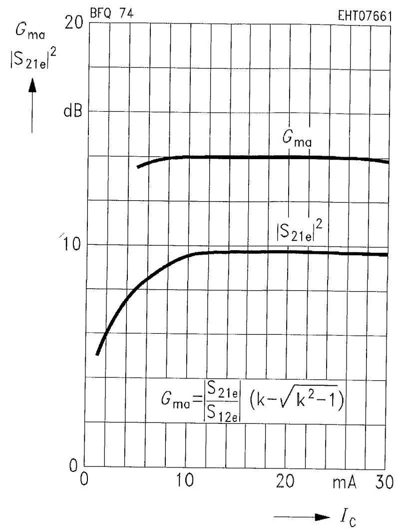


Common Emitter Power Gain

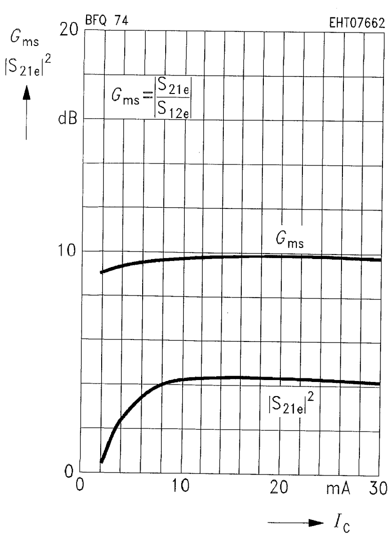
Power gain G_{ms}, $|S_{21e}|^2 = f(I_C)$
V_{CE} = 10 V, f = 1 GHz, Z_0 = 50 Ω



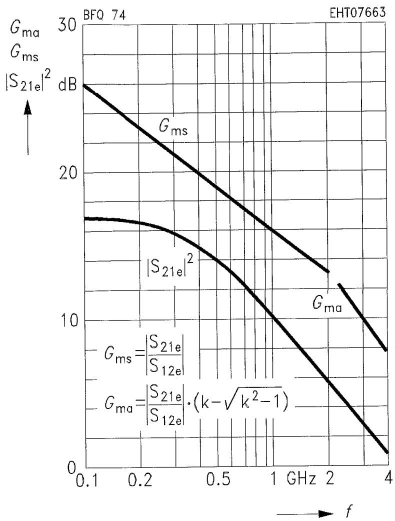
Power gain G_{ma}, $|S_{21e}|^2 = f(I_C)$
V_{CE} = 10 V, f = 2 GHz, Z_0 = 50 Ω



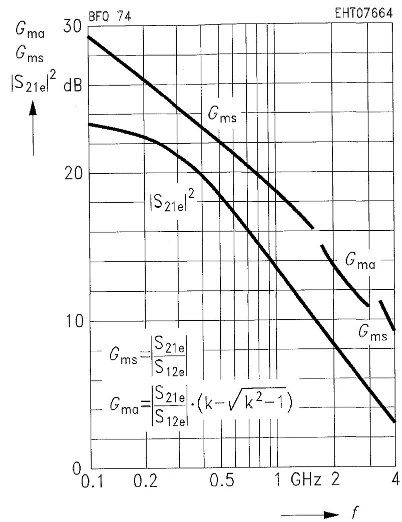
Power gain G_{ms}, $|S_{21e}|^2 = f(I_C)$
V_{CE} = 10 V, f = 4 GHz, Z_0 = 50 Ω



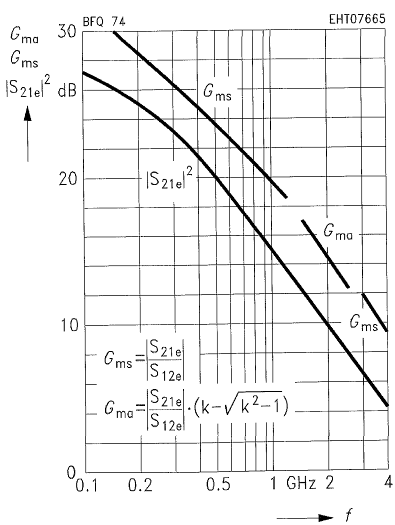
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
I_C = 2 mA, V_{CE} = 10 V, Z_0 = 50 Ω



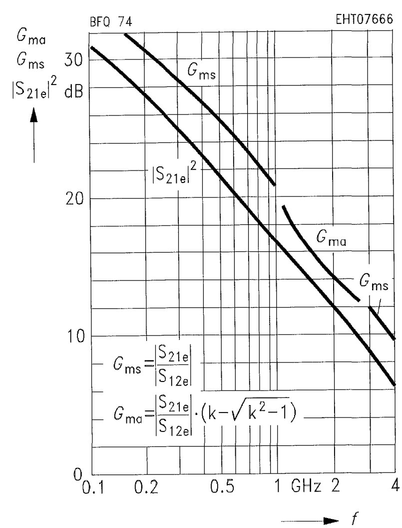
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
I_C = 5 mA, V_{CE} = 10 V, Z_0 = 50 Ω



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



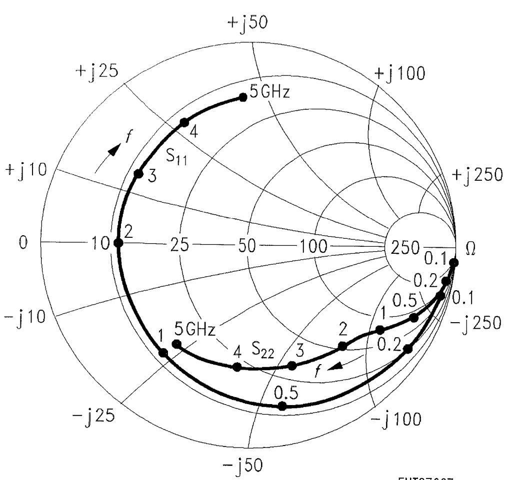
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
I_C = 25 mA, V_{CE} = 10 V, Z_0 = 50 Ω



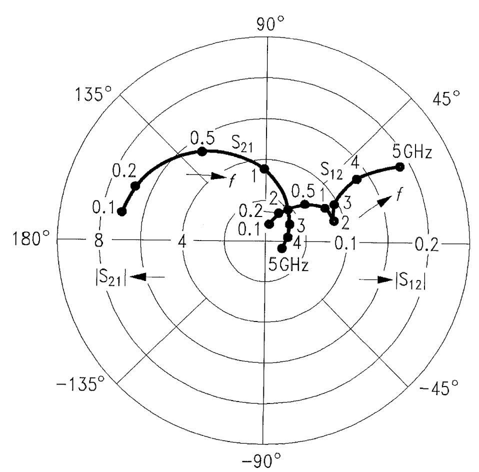
Common Emitter S Parameters

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



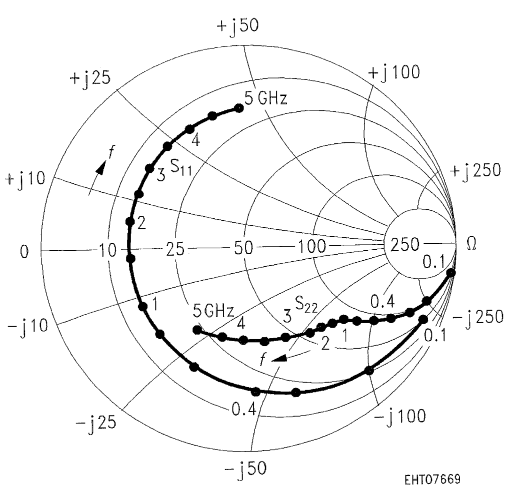
S_{12}, S_{21} = f (f)
I_C = 2 mA, V_{CE} = 10 V, Z_0 = 50 Ω



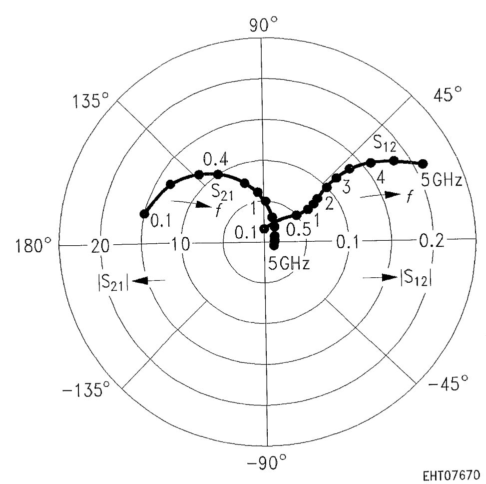
Common Emitter S Parameters (continued)

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



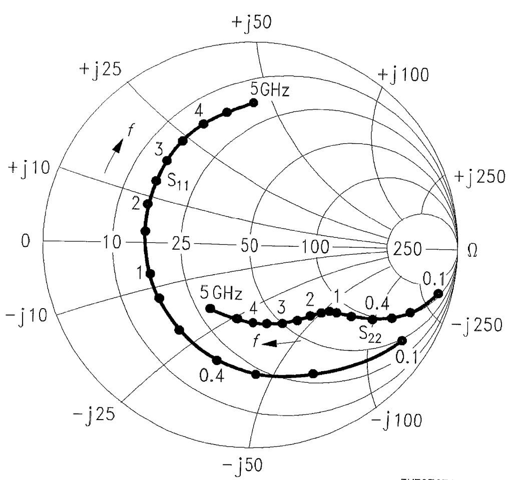
$S_{12}, S_{21} = f(f)$
I_C = 5 mA, V_{CE} = 10 V, Z_0 = 50 Ω



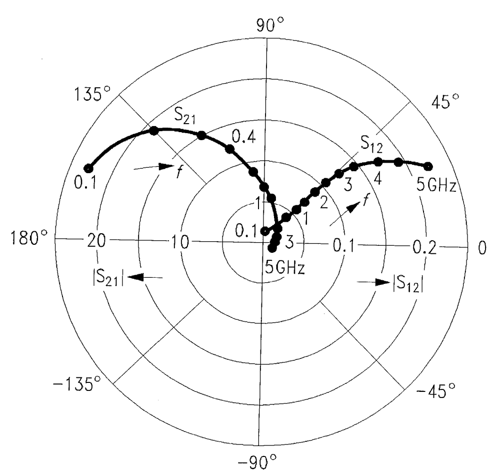
Common Emitter S Parameters (continued)

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



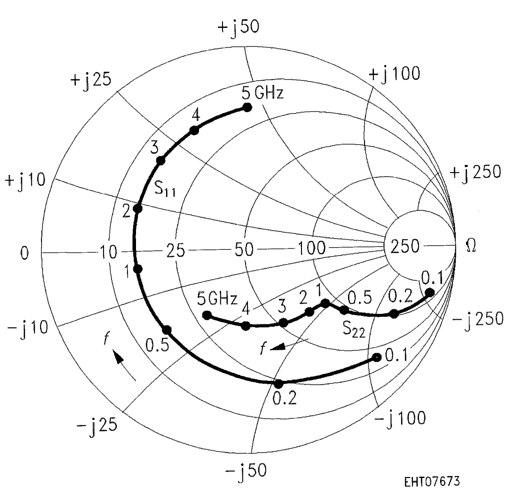
$S_{12}, S_{21} = f(f)$
I_C = 10 mA, V_{CE} = 10 V, Z_0 = 50 Ω



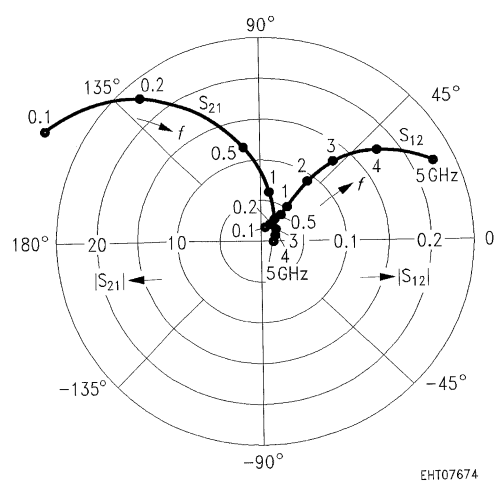
Common Emitter S Parameters (continued)

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



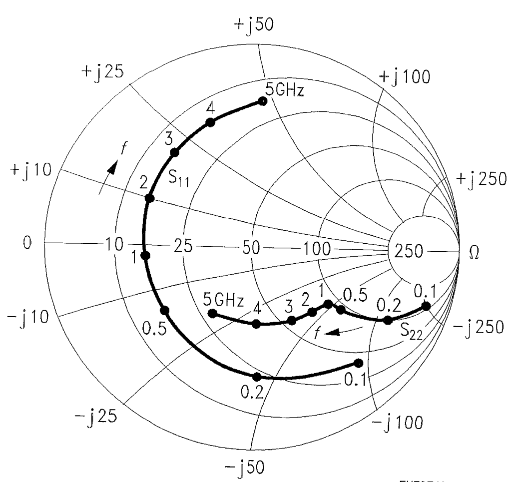
S_{12}, $S_{21} = f(f)$
I_C = 15 mA, V_{CE} = 10 V, Z_0 = 50 Ω



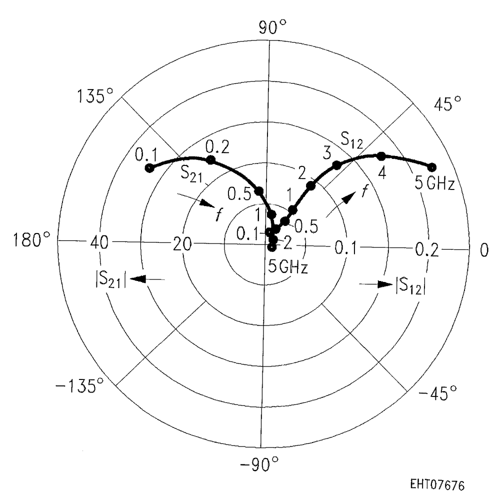
Common Emitter S Parameters (continued)

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



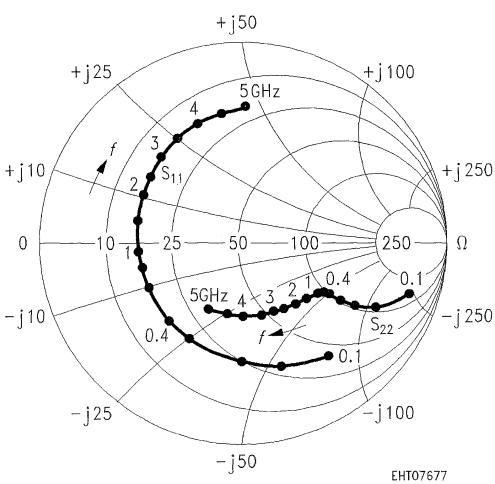
S_{12}, S_{21} = $f(f)$
I_C = 20 mA, V_{CE} = 10 V, Z_0 = 50 Ω



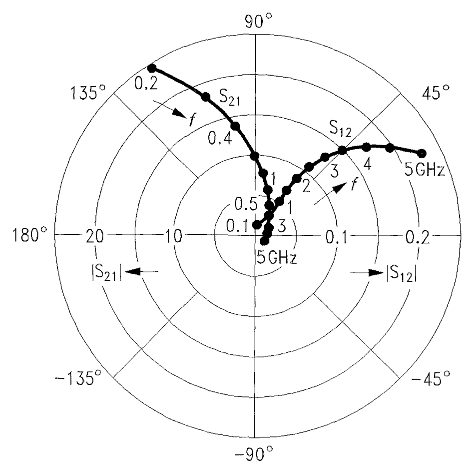
Common Emitter S Parameters (continued)

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



S_{12}, S_{21} = *f* (*f*)
I_C = 25 mA, V_{CE} = 10 V, Z_0 = 50 Ω

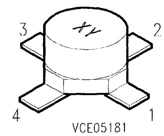


SIEMENS

PNP Silicon RF Transistor

BFQ 75

- For broadband amplifiers up to 2 GHz at collector currents from 5 mA to 30 mA.
- Complementary type: BFQ 72 (NPN).



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 75	75	Q62702-F803	B	E	C	E	Cerec-X

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CEO}	12	V
Collector-emitter voltage, $V_{BE} = 0$	V_{CES}	1	
Collector-base voltage	V_{CBO}	15	
Emitter-base voltage	V_{EBO}	2	
Collector current	I_C	50	mA
Total power dissipation, $T_S \leq 112$ ˚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

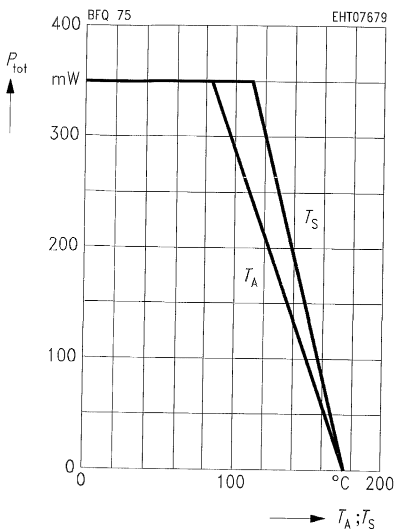
Junction - ambient[2)]	$R_{th\,JA}$	≤ 260	K/W
Junction - soldering point[3)]	$R_{th\,JS}$	≤ 180	

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.

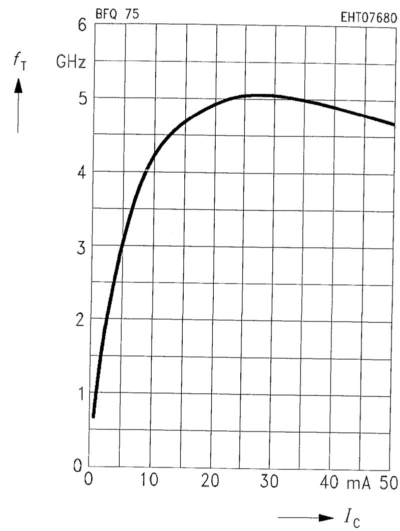
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CEO}$	12	–	–	V
Collector-base cutoff current V_{CB} = 5 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 = 30 mA, V_{CE} = 5 V	h_{FE}	20	50	–	–
AC Characteristics					
Transition frequency I_C = 30 mA, V_{CE} = 5 V, f = 500 MHz	f_T	–	5	–	GHz
Collector-base capacitance V_{CB} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{cb}	–	0.75	–	pF
Input capacitance V_{EB} = 0.5 V, I_C = i_c = 0, f = 1 MHz	C_{ibo}	–	1.6	–	
Output capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{obs}	–	1.1	–	
Noise figure I_C = 10 mA, V_{CE} = 8 V, f = 10 MHz, Z_S = 50 Ω I_C = 10 mA, V_{CE} = 8 V, f = 800 MHz, Z_S = 50 Ω	F	 – –	 2.2 3	 – –	dB
Power gain I_C = 30 mA, V_{CE} = 8 V, f = 800 MHz, Z_S = Z_{Sopt}, Z_L = Z_{Lopt}	G_{pe}	–	14	–	

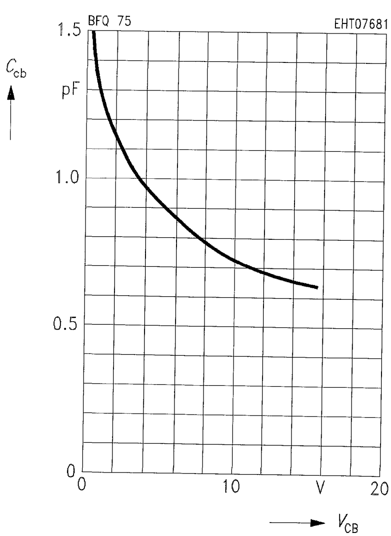
Total power dissipation $P_{tot} = f\,(T_A{}^*;\ T_S)$
*Package mounted on alumina



Transition frequency $f_T = f\,(I_C)$
V_{CE} = 5 V, f = 500 MHz



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

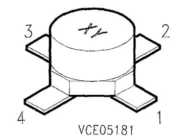


SIEMENS

PNP Silicon RF Transistor

BFQ 76

- For broadband amplifiers up to 2 GHz at collector currents up to 20 mA.
- Complementary type: BFQ 71 (NPN).



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 76	76	Q62702-F804	B	E	C	E	Cerec-X

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CEO}	15	V
Collector-base voltage	V_{CBO}	20	
Emitter-base voltage	V_{EBO}	2	
Collector current	I_C	30	mA
Total power dissipation, $T_S \leq 116$ °C[3]	P_{tot}	250	mW
Junction temperature	T_j	175	°C
Ambient temperature range	T_A	– 65 ... + 175	
Storage temperature range	T_{stg}	– 65 ... + 175	

Thermal Resistance

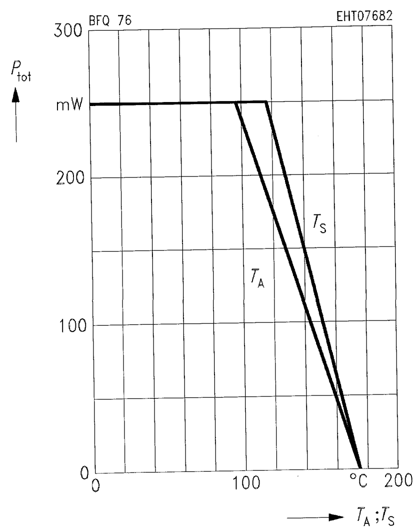
Junction - ambient[2]	$R_{th\,JA}$	≤ 315	K/W
Junction - soldering point[3]	$R_{th\,JS}$	≤ 235	

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.

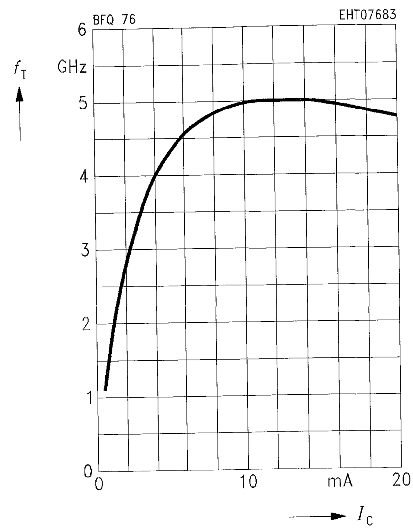
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CE0}$	15	–	–	V
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 = 14 mA, V_{CE} = 10 V	h_{FE}	20	50	–	–
AC Characteristics					
Transition frequency I_C = 14 mA, V_{CE} = 10 V, f = 500 MHz	f_T	–	5	–	GHz
Collector-base capacitance V_{CB} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{cb}	–	0.55	–	pF
Input capacitance V_{EB} = 0.5 V, I_C = i_c = 0, f = 1 MHz	C_{ibo}	–	1.2	–	
Output capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{obs}	–	0.9	–	
Noise figure I_C = 5 mA, V_{CE} = 6 V, f = 10 MHz, Z_S = 75 Ω I_C = 4 mA, V_{CE} = 10 V, f = 800 MHz, Z_S = Z_{Sopt}	F	 – –	 1.8 2.5	 – –	dB
Power gain I_C = 14 mA, V_{CE} = 10 V, f = 800 MHz, Z_S = Z_{Sopt}, Z_L = Z_{Lopt}	G_{pe}	–	17	–	

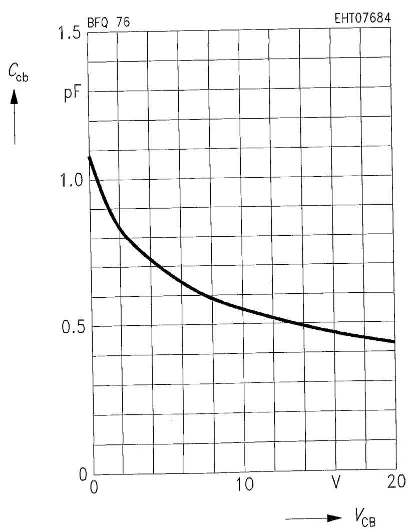
Total power dissipation $P_{tot} = f(T_A^*; T_S)$
*Package mounted on alumina



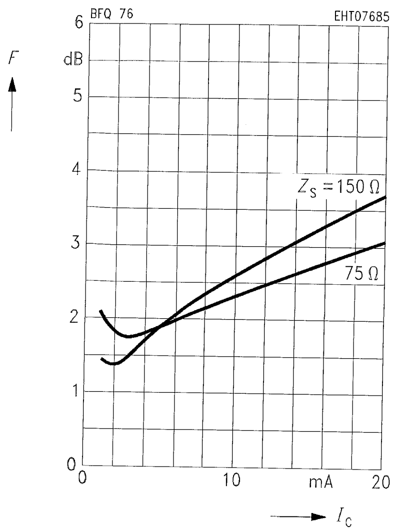
Transition frequency $f_T = f(I_C)$
V_{CE} = 10 V, f = 200 MHz



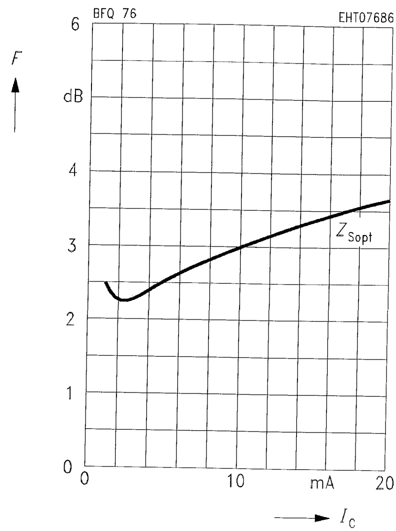
Collector-base capacitance $C_{cb} = f(V_{CB})$
$V_{BE} = v_{be} = 0$, f = 1 MHz



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



Noise figure $F = f(I_C)$
V_{CE} = 10 V, f = 900 MHz

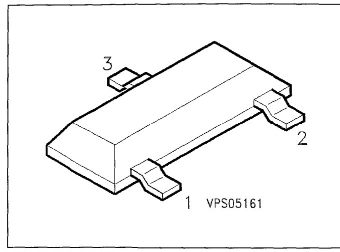


SIEMENS

NPN Silicon RF Transistor

BFQ 81

- For low-noise amplifiers up to 2 GHz and broadband analog and digital applications in telecommunications systems at collector currents from 0.5 mA to 20 mA.



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

Type	Marking	Ordering Code (tape and reel)	Pin Configuration 1	2	3	Package[1]
BFQ 81	RA	Q62702-F1049	B	E	C	SOT-23

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CEO}	16	V
Collector-base voltage	V_{CBO}	25	
Emitter-base voltage	V_{EBO}	2	
Collector current	I_C	30	mA
Total power dissipation, $T_S \leq 59$ °C[3]	P_{tot}	280	mW
Junction temperature	T_j	150	°C
Ambient temperature range	T_A	– 65 ... + 150	
Storage temperature range	T_{stg}	– 65 ... + 150	

Thermal Resistance

Junction - ambient[2]	$R_{th\,JA}$	≤ 405	K/W
Junction - soldering point[3]	$R_{th\,JS}$	≤ 325	

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.

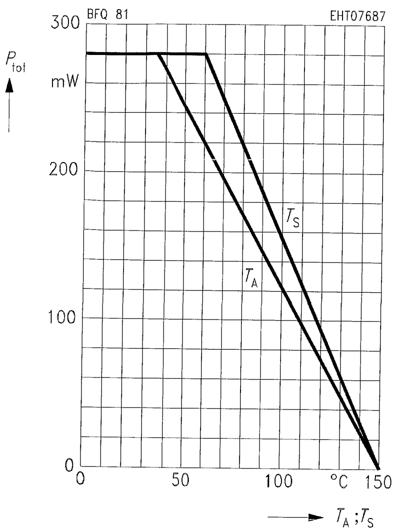
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

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-base cutoff current V_{CB} = 15 V, I_E = 0	I_{CB0}	–	–	100	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}	–	0.2	0.4	V
Base-emitter voltage I_C = 10 mA, V_{CE} = 10 V	V_{BE}	–	0.78	–	

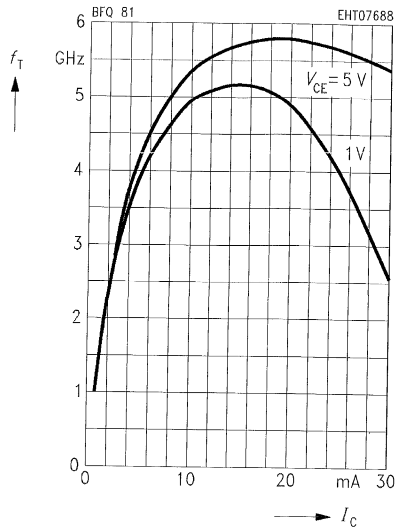
Electrical Characteristics
at T_A = 25 ˚C, unless otherwise specified.

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		–	4.2	–	
I_C = 15 mA, V_{CE} = 10 V, f = 200 MHz		–	5.8	–	
Collector-base capacitance V_{CB} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{cb}	–	0.38	–	pF
Collector-emitter capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{ce}	–	0.22	–	
Input capacitance V_{EB} = 0.5 V, I_C = i_c = 0, f = 1 MHz	C_{ibo}	–	1.27	–	
Output capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{obs}	–	0.6	–	
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	–	
Power gain I_C = 5 mA, V_{CE} = 10 V, f = 800 MHz, Z_S = 50 Ω, Z_L = Z_{Lopt}	G_{pe}	–	15	–	
Transducer gain I_C = 20 mA, V_{CE} = 10 V, f = 1 GHz, Z_0 = 50 Ω	$\lvert S_{21e} \rvert^2$	–	12.4	–	
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

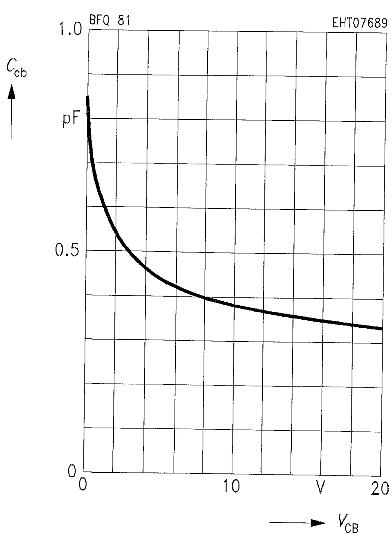
Total power dissipation $P_{tot} = f(T_A^*; T_S)$
*Package mounted on alumina



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



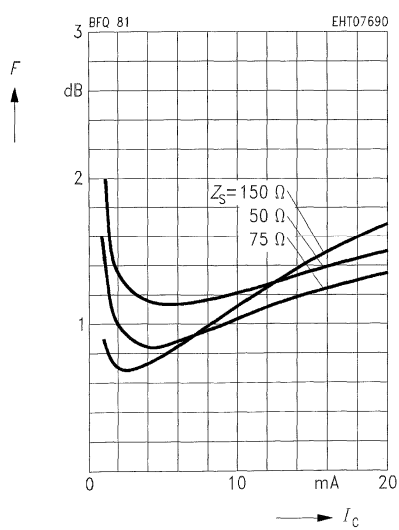
Collector-base capacitance $C_{cb} = f(V_{CB})$
$V_{BE} = v_{be} = 0, f = 1$ MHz



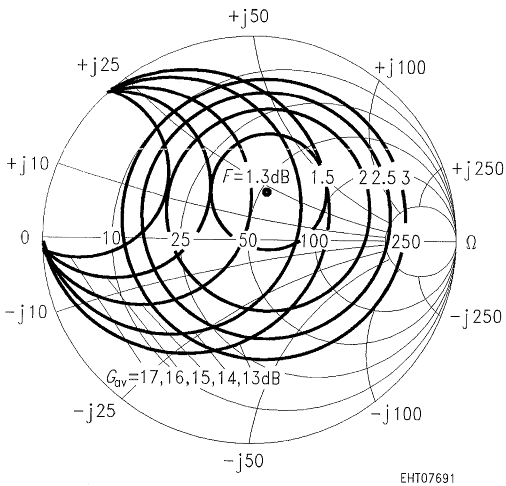
Common Emitter Noise Parameters

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 = 5 mA, V_{CE} = 10 V, Z_0 = 50 Ω								
0.01	0.8	–	(Z_S = 150 Ω)		–	–	1.15	–
0.8	1.3	14.2	0.22	71.5	11.7	0.19	1.4	14
I_C = 10 mA, V_{CE} = 10 V, Z_0 = 50 Ω								
2.0	2.5	8.5	0.27	– 139	14.2	0.39	2.8	–

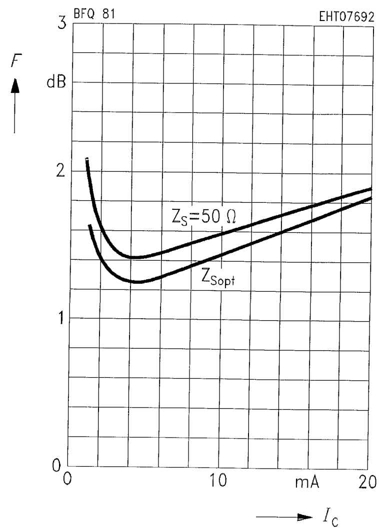
Noise figure $F = f(I_C)$
V_{CE} = 10 V, f = 10 MHz



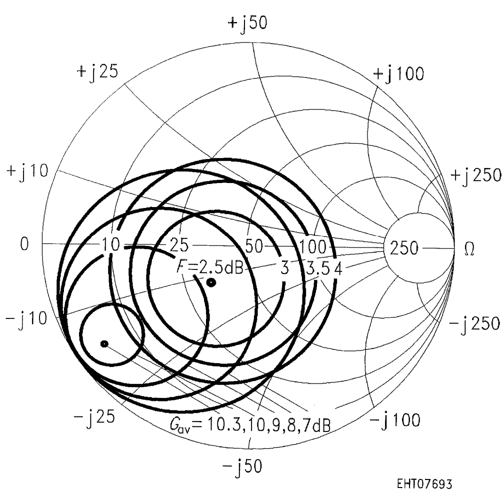
Circles of constant noise figure $F = f(Z_S)$ and available power gain $G_{av} = f(Z_S)$
I_C = 5 mA, V_{CE} = 10 V, f = 800 MHz



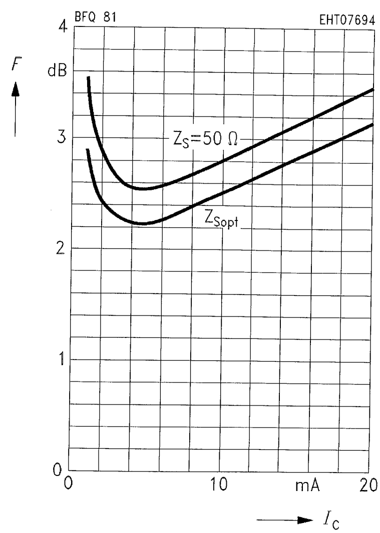
Noise figure $F = f(I_C)$
V_{CE} = 10 V, f = 800 MHz, Z_{Lopt} (G)



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

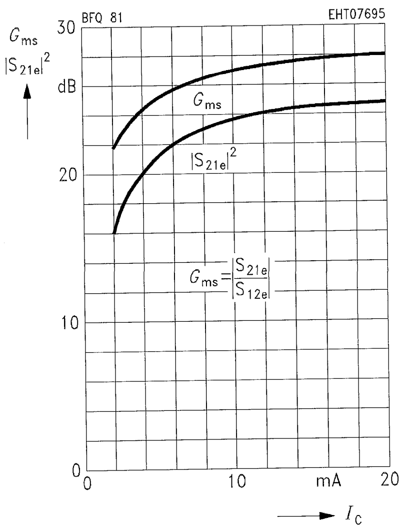


Noise figure $F = f(I_C)$
V_{CE} = 10 V, f = 2 GHz, Z_{Lopt} (G)

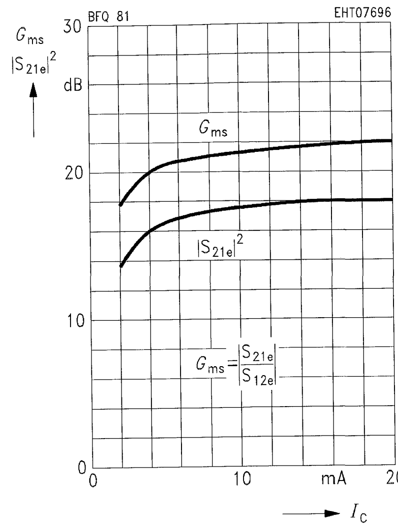


Common Emitter Power Gain

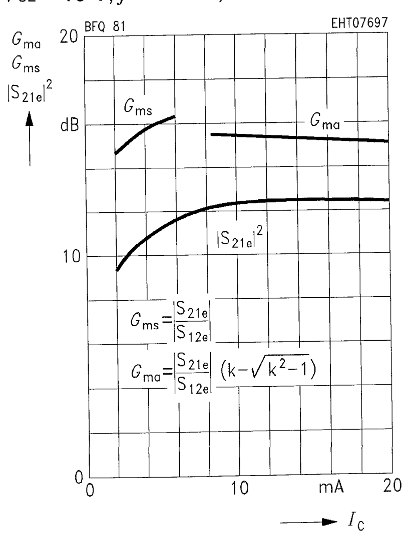
Power gain G_{ms}, $|S_{21e}|^2 = f\,(I_C)$
V_{CE} = 10 V, f = 200 MHz, Z_0 = 50 Ω



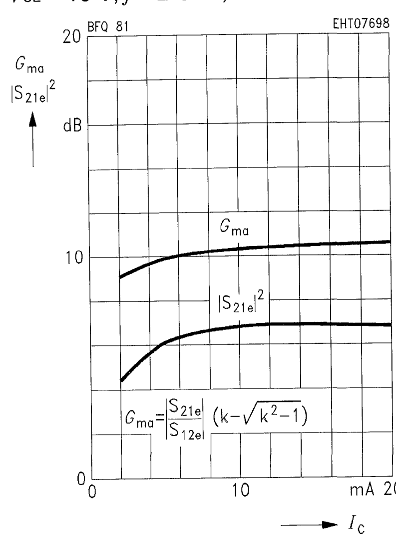
Power gain G_{ms}, $|S_{21e}|^2 = f\,(I_C)$
V_{CE} = 10 V, f = 500 MHz, Z_0 = 50 Ω



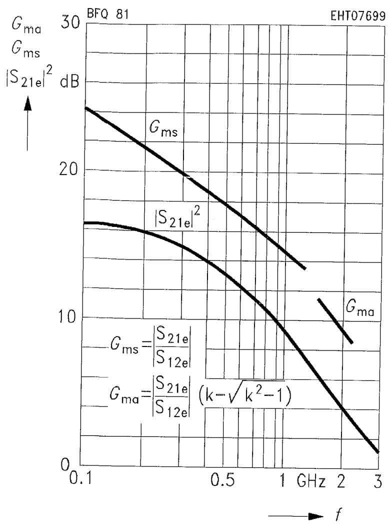
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f\,(I_C)$
V_{CE} = 10 V, f = 1 GHz, Z_0 = 50 Ω



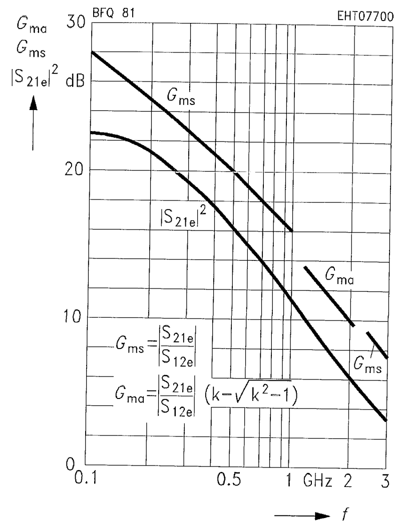
Power gain G_{ma}, $|S_{21e}|^2 = f\,(I_C)$
V_{CE} = 10 V, f = 2 GHz, Z_0 = 50 Ω



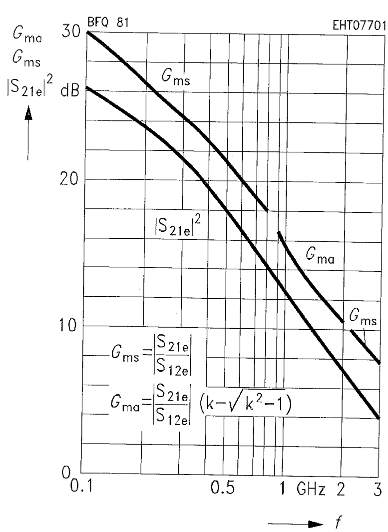
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f\,(f)$
I_C = 2 mA, V_{CE} = 10 V, Z_0 = 50 Ω



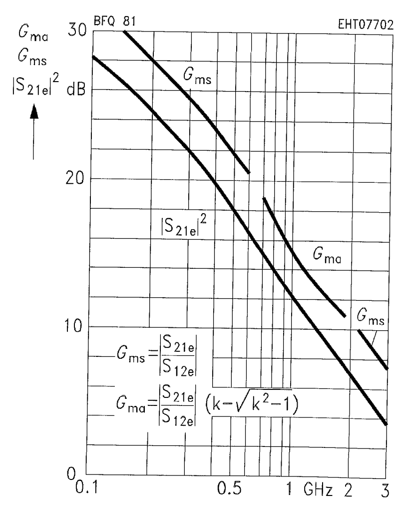
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f\,(f)$
I_C = 5 mA, V_{CE} = 10 V, Z_0 = 50 Ω



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 = 20 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
$I_C = 1$ mA, $V_{CE} = 1$ V, $Z_0 = 50\ \Omega$								
0.10	0.950	– 18.8	3.58	165.3	0.046	78.6	0.980	– 8.6
0.15	0.931	– 28.0	3.51	158.2	0.067	73.2	0.962	– 12.5
0.20	0.910	– 36.9	3.42	151.3	0.087	68.1	0.939	– 16.3
0.25	0.882	– 45.5	3.30	144.8	0.105	63.2	0.913	– 19.8
0.30	0.854	– 53.6	3.17	138.6	0.120	58.7	0.885	– 22.9
0.40	0.797	– 68.8	2.90	127.5	0.145	50.9	0.827	– 28.3
0.50	0.743	– 82.4	2.64	117.9	0.163	44.6	0.775	– 32.7
0.60	0.700	– 94.9	2.41	109.3	0.175	39.5	0.729	– 36.2
0.70	0.659	– 106.5	2.21	101.8	0.184	35.3	0.690	– 39.1
0.80	0.636	– 116.6	2.04	94.9	0.190	31.7	0.657	– 41.4
0.90	0.612	– 126.7	1.90	88.6	0.192	28.9	0.628	– 43.6
1.00	0.590	– 136.0	1.76	82.7	0.192	26.9	0.603	– 45.5
1.20	0.566	– 152.5	1.54	72.7	0.190	24.5	0.567	– 49.0
1.40	0.551	– 167.0	1.37	64.2	0.185	24.1	0.544	– 52.7
1.50	0.546	– 173.7	1.31	60.6	0.182	24.9	0.535	– 54.6
1.60	0.547	– 179.7	1.25	56.7	0.181	26.0	0.529	– 56.6
1.80	0.548	168.9	1.15	49.8	0.179	29.1	0.518	– 60.8
2.00	0.559	158.6	1.06	43.5	0.180	33.3	0.506	– 65.5
$I_C = 2$ mA, $V_{CE} = 1$ V, $Z_0 = 50\ \Omega$								
0.10	0.904	– 25.9	6.71	160.4	0.045	75.4	0.955	– 13.1
0.15	0.869	– 38.1	6.42	151.4	0.064	68.8	0.917	– 18.8
0.20	0.829	– 49.5	6.06	143.2	0.081	63.1	0.870	– 23.8
0.25	0.784	– 60.0	5.67	135.9	0.094	58.1	0.823	– 28.1
0.30	0.742	– 69.7	5.27	129.2	0.106	53.9	0.776	– 31.7
0.40	0.668	– 86.8	4.57	118.2	0.122	47.5	0.692	– 37.2
0.50	0.611	– 101.3	3.99	109.1	0.133	43.1	0.627	– 41.0
0.60	0.569	– 114.0	3.51	101.5	0.141	40.2	0.575	– 43.8
0.70	0.535	– 125.4	3.14	95.0	0.147	38.3	0.535	– 46.0
0.80	0.518	– 135.0	2.83	89.1	0.152	37.0	0.503	– 47.6
0.90	0.501	– 144.8	2.59	83.8	0.156	36.4	0.476	– 49.2
1.00	0.488	– 153.4	2.37	78.9	0.159	36.3	0.454	– 50.4
1.20	0.476	– 168.4	2.04	70.6	0.166	37.3	0.422	– 53.0
1.40	0.472	178.6	1.79	63.3	0.173	38.9	0.401	– 56.0
1.50	0.468	172.8	1.69	60.0	0.178	40.1	0.395	– 57.6
1.60	0.473	167.8	1.62	56.6	0.183	41.1	0.390	– 59.4
1.80	0.477	157.8	1.48	50.5	0.195	43.0	0.380	– 63.2
2.00	0.493	149.4	1.36	44.7	0.209	44.7	0.367	– 67.8

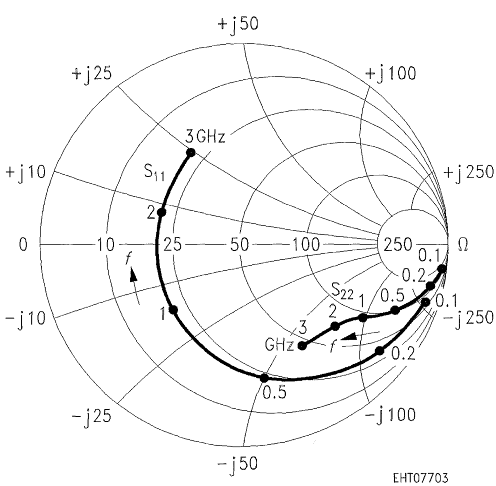
Common Emitter S Parameters (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**
I_C = 2 mA, V_{CE} = 3 V, Z_0 = 50 Ω								
0.10	0.916	– 21.7	6.74	163.0	0.032	77.8	0.970	– 9.3
0.15	0.886	– 32.2	6.52	155.0	0.046	72.3	0.943	– 13.4
0.20	0.851	– 42.0	6.25	147.6	0.058	67.2	0.911	– 17.1
0.25	0.810	– 51.2	5.92	140.8	0.069	62.8	0.875	– 20.3
0.30	0.770	– 59.9	5.58	134.5	0.078	58.9	0.840	– 23.1
0.40	0.695	– 75.5	4.94	123.8	0.093	52.8	0.773	– 27.2
0.50	0.629	– 89.2	4.37	114.9	0.102	48.4	0.718	– 30.2
0.60	0.580	– 101.6	3.90	107.3	0.110	45.6	0.673	– 32.4
0.70	0.534	– 112.8	3.51	100.7	0.115	43.8	0.639	– 34.0
0.80	0.511	– 122.7	3.18	94.8	0.120	42.5	0.611	– 35.2
0.90	0.486	– 132.7	2.91	89.5	0.123	42.0	0.586	– 36.3
1.00	0.466	– 141.9	2.68	84.6	0.126	42.1	0.567	– 37.2
1.20	0.444	– 158.1	2.30	76.2	0.132	43.2	0.538	– 39.1
1.40	0.431	– 172.8	2.03	68.9	0.139	45.4	0.520	– 41.3
1.50	0.424	– 179.2	1.91	65.6	0.143	46.9	0.515	– 42.5
1.60	0.427	175.2	1.82	62.3	0.148	48.3	0.511	– 43.9
1.80	0.426	164.1	1.66	56.3	0.159	50.9	0.503	– 46.8
2.00	0.440	154.8	1.52	50.5	0.172	53.1	0.491	– 50.2
2.50	0.491	133.9	1.26	38.6	0.216	57.5	0.465	– 60.6
3.00	0.518	117.9	1.10	28.4	0.273	57.9	0.457	– 71.6
I_C = 5 mA, V_{CE} = 3 V, Z_0 = 50 Ω								
0.10	0.807	– 34.6	14.10	153.1	0.029	72.7	0.912	– 16.5
0.15	0.741	– 49.5	12.83	142.1	0.040	66.2	0.842	– 22.4
0.20	0.673	– 62.5	11.53	132.9	0.049	61.7	0.773	– 26.7
0.25	0.611	– 73.9	10.31	125.4	0.055	58.6	0.711	– 29.8
0.30	0.558	– 84.1	9.23	119.2	0.061	56.4	0.659	– 31.8
0.40	0.479	– 101.1	7.55	109.4	0.070	54.3	0.579	– 34.0
0.50	0.425	– 115.1	6.33	102.1	0.078	54.0	0.527	– 35.1
0.60	0.389	– 127.2	5.44	96.1	0.085	54.4	0.491	– 35.4
0.70	0.363	– 138.1	4.77	90.9	0.093	55.2	0.465	– 35.9
0.80	0.351	– 146.9	4.24	86.5	0.101	55.8	0.447	– 36.1
0.90	0.340	– 156.1	3.82	82.3	0.108	56.6	0.431	– 36.6
1.00	0.335	– 164.3	3.47	78.5	0.116	57.5	0.418	– 36.9
1.20	0.331	– 178.1	2.95	72.0	0.132	58.6	0.399	– 38.1
1.40	0.333	168.8	2.57	66.0	0.149	59.3	0.388	– 39.8
1.50	0.329	163.5	2.41	63.3	0.158	59.6	0.386	– 40.9
1.60	0.335	159.1	2.29	60.5	0.168	59.7	0.383	– 42.2
1.80	0.341	150.4	2.07	55.3	0.186	59.5	0.378	– 45.3
2.00	0.359	143.3	1.89	50.4	0.205	59.0	0.366	– 48.6
2.50	0.413	126.8	1.57	39.6	0.255	57.2	0.336	– 58.4
3.00	0.444	114.2	1.37	29.7	0.308	54.0	0.326	– 69.1

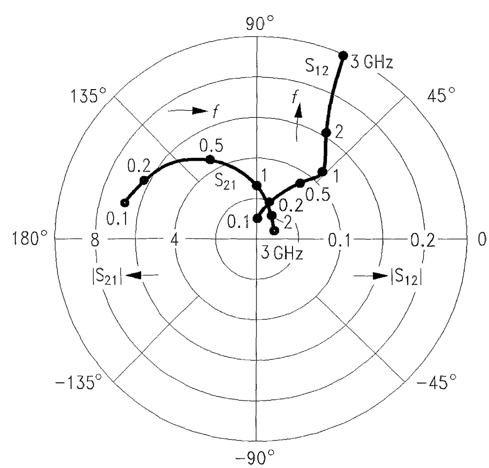
Common Emitter S Parameters (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**
I_C = 2 mA, V_{CE} = 6 V, Z_0 = 50 Ω								
0.10	0.924	– 20.0	6.69	164.0	0.026	78.8	0.976	– 7.7
0.15	0.896	– 29.6	6.50	156.5	0.038	73.5	0.954	– 11.2
0.20	0.863	– 38.8	6.25	149.4	0.048	69.0	0.927	– 14.2
0.25	0.824	– 47.5	5.96	142.8	0.058	64.8	0.898	– 16.9
0.30	0.785	– 55.6	5.64	136.7	0.066	61.1	0.868	– 19.2
0.40	0.709	– 70.5	5.04	126.2	0.079	55.1	0.811	– 22.8
0.50	0.642	– 83.6	4.49	117.4	0.088	51.0	0.763	– 25.4
0.60	0.588	– 95.6	4.03	109.8	0.094	48.2	0.723	– 27.2
0.70	0.539	– 106.7	3.64	103.2	0.099	46.4	0.692	– 28.6
0.80	0.511	– 116.4	3.31	97.3	0.104	45.2	0.667	– 29.7
0.90	0.481	– 126.5	3.04	92.0	0.107	44.7	0.645	– 30.6
1.00	0.457	– 135.8	2.80	87.1	0.110	44.9	0.627	– 31.4
1.20	0.427	– 152.6	2.41	78.7	0.115	46.3	0.602	– 33.1
1.40	0.410	– 167.9	2.12	71.3	0.121	48.7	0.586	– 35.0
1.50	0.402	– 174.6	2.00	68.0	0.125	50.5	0.582	– 36.1
1.60	0.403	179.4	1.90	64.7	0.129	52.0	0.579	– 37.2
1.80	0.402	167.6	1.72	58.7	0.139	55.1	0.573	– 39.8
2.00	0.415	157.7	1.58	53.1	0.151	57.8	0.563	– 42.7
2.50	0.465	135.6	1.31	41.0	0.193	63.0	0.540	– 51.7
3.00	0.492	119.2	1.14	30.7	0.248	64.1	0.535	– 61.2

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



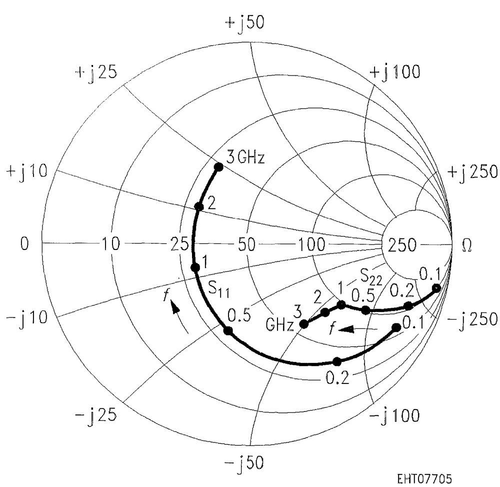
$S_{12}, S_{21} = f\,(f)$
I_C = 2 mA, V_{CE} = 6 V, Z_0 = 50 Ω



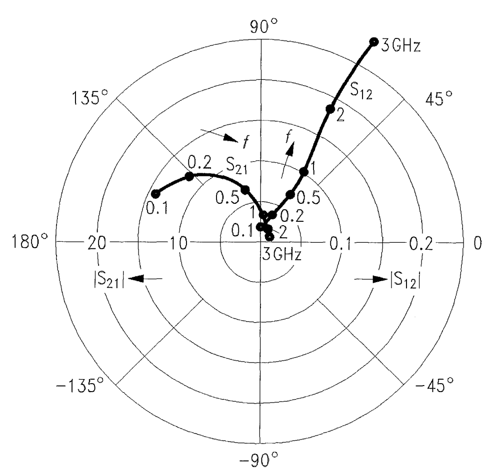
Common Emitter S Parameters (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_C = 5 mA, V_{CE} = 6 V, Z_0 = 50 Ω								
0.10	0.827	– 31.1	13.95	154.8	0.024	74.1	0.929	– 13.4
0.15	0.764	– 44.7	12.83	144.3	0.034	68.3	0.872	– 18.3
0.20	0.698	– 56.7	11.65	135.4	0.041	63.9	0.813	– 21.9
0.25	0.634	– 67.4	10.51	127.9	0.048	60.7	0.759	– 24.4
0.30	0.577	– 76.8	9.48	121.7	0.053	58.5	0.713	– 26.1
0.40	0.490	– 93.0	7.83	111.8	0.061	56.2	0.641	– 27.8
0.50	0.426	– 106.3	6.60	104.3	0.068	55.7	0.594	– 28.6
0.60	0.385	– 118.4	5.69	98.2	0.075	56.2	0.561	– 29.0
0.70	0.352	– 129.1	4.99	93.0	0.081	57.0	0.538	– 29.2
0.80	0.332	– 138.4	4.45	88.5	0.088	57.7	0.521	– 29.5
0.90	0.318	– 147.9	4.02	84.3	0.095	58.6	0.507	– 29.9
1.00	0.308	– 156.8	3.66	80.5	0.102	59.4	0.497	– 30.2
1.20	0.300	– 171.9	3.10	74.0	0.116	61.0	0.480	– 31.3
1.40	0.297	173.9	2.70	68.0	0.131	61.9	0.470	– 32.9
1.50	0.294	168.2	2.53	65.2	0.139	62.5	0.469	– 33.8
1.60	0.298	162.9	2.40	62.6	0.147	62.7	0.467	– 35.0
1.80	0.303	153.6	2.17	57.4	0.164	63.0	0.463	– 37.6
2.00	0.321	146.0	1.98	52.6	0.181	62.8	0.453	– 40.4
2.50	0.379	128.4	1.65	41.8	0.228	61.8	0.426	– 48.6
3.00	0.408	115.3	1.43	31.9	0.278	59.4	0.419	– 57.5

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



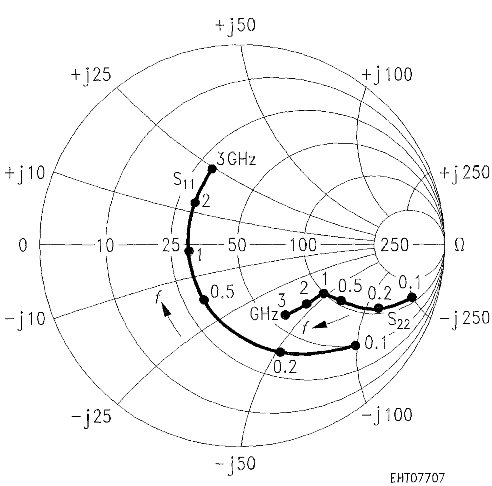
S_{12}, S_{21} = f (f)
I_C = 5 mA, V_{CE} = 6 V, Z_0 = 50 Ω



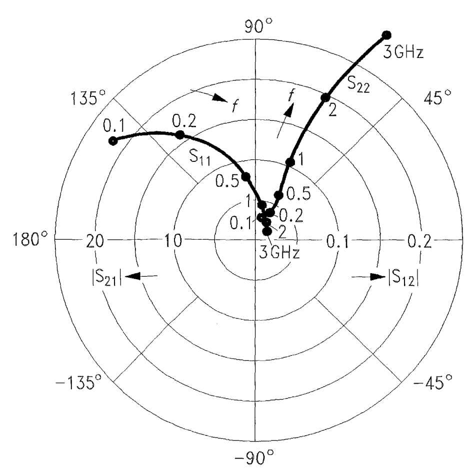
Common Emitter S Parameters (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**
I_C = 10 mA, V_{CE} = 6 V, Z_0 = 50 Ω								
0.10	0.704	– 43.8	21.34	144.8	0.022	70.4	0.855	– 19.0
0.15	0.610	– 60.5	18.27	132.6	0.029	65.1	0.763	– 23.8
0.20	0.529	– 74.2	15.62	123.4	0.035	62.6	0.687	– 26.4
0.25	0.465	– 85.5	13.44	116.4	0.039	61.7	0.629	– 27.5
0.30	0.415	– 95.3	11.72	110.9	0.044	61.3	0.586	– 27.8
0.40	0.348	– 111.8	9.26	102.7	0.052	62.1	0.528	– 27.5
0.50	0.304	– 125.2	7.62	96.6	0.060	63.3	0.496	– 27.1
0.60	0.278	– 137.0	6.46	91.6	0.068	64.6	0.474	– 26.7
0.70	0.261	– 147.1	5.61	87.4	0.077	65.6	0.461	– 26.8
0.80	0.254	– 156.0	4.96	83.7	0.086	66.1	0.451	– 26.9
0.90	0.248	– 164.7	4.45	80.3	0.094	66.6	0.442	– 27.2
1.00	0.248	– 172.2	4.04	77.0	0.103	67.0	0.436	– 27.5
1.20	0.250	174.1	3.41	71.4	0.121	67.2	0.424	– 28.8
1.40	0.256	161.4	2.96	66.0	0.139	66.9	0.418	– 30.5
1.50	0.255	156.4	2.78	63.6	0.148	66.8	0.418	– 31.6
1.60	0.260	152.1	2.63	61.2	0.158	66.4	0.417	– 32.8
1.80	0.266	144.3	2.37	56.5	0.177	65.6	0.413	– 35.7
2.00	0.286	138.5	2.16	52.2	0.195	64.4	0.403	– 38.6
2.50	0.346	123.8	1.79	41.9	0.244	61.5	0.375	– 46.7
3.00	0.377	112.9	1.55	32.4	0.293	57.8	0.366	– 55.6

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



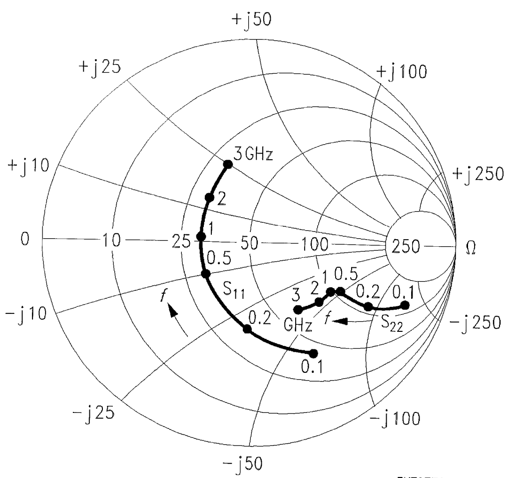
$S_{12}, S_{21} = f(f)$
I_C = 10 mA, V_{CE} = 6 V, Z_0 = 50 Ω



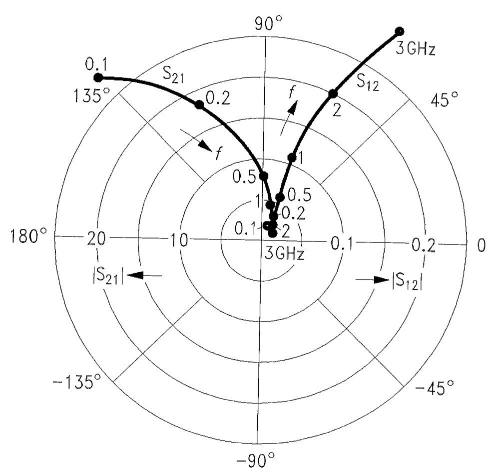
Common Emitter S Parameters (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_C = 20 mA, V_{CE} = 6 V, Z_0 = 50 Ω								
0.10	0.566	– 59.2	27.49	134.2	0.019	67.5	0.760	– 22.9
0.15	0.464	– 78.4	21.82	121.9	0.024	64.6	0.655	– 25.9
0.20	0.394	– 93.3	17.76	113.6	0.029	64.7	0.584	– 26.3
0.25	0.345	– 105.1	14.82	107.7	0.034	65.3	0.538	– 25.9
0.30	0.311	– 115.2	12.67	103.1	0.038	66.3	0.507	– 25.1
0.40	0.271	– 131.9	9.78	96.4	0.047	68.2	0.469	– 23.6
0.50	0.247	– 144.7	7.93	91.4	0.056	69.6	0.451	– 22.9
0.60	0.236	– 155.3	6.68	87.2	0.065	70.6	0.439	– 22.6
0.70	0.229	– 164.1	5.78	83.6	0.075	71.1	0.431	– 22.8
0.80	0.228	– 171.4	5.09	80.4	0.084	71.2	0.426	– 23.2
0.90	0.231	– 178.8	4.56	77.3	0.094	71.3	0.421	– 23.8
1.00	0.232	174.7	4.13	74.4	0.103	71.2	0.417	– 24.3
1.20	0.242	163.6	3.48	69.3	0.122	70.6	0.409	– 25.9
1.40	0.253	152.6	3.02	64.3	0.141	69.7	0.404	– 27.9
1.50	0.253	148.5	2.83	62.0	0.151	69.3	0.405	– 29.1
1.60	0.258	144.9	2.68	59.7	0.161	68.6	0.404	– 30.5
1.80	0.266	138.1	2.41	55.2	0.180	67.3	0.401	– 33.6
2.00	0.284	133.9	2.19	51.0	0.200	65.8	0.391	– 36.7
2.50	0.345	121.1	1.82	41.0	0.249	62.2	0.363	– 44.8
3.00	0.374	110.8	1.58	31.7	0.297	58.1	0.353	– 53.9

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



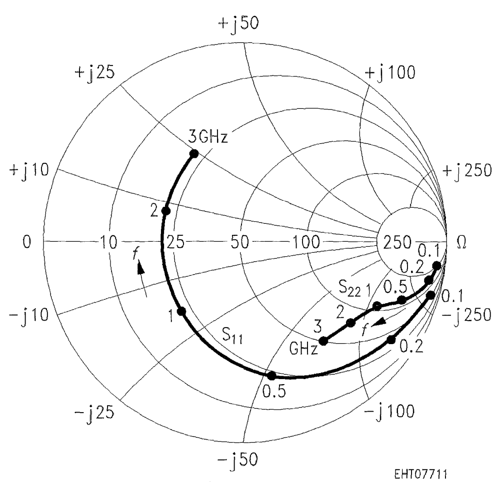
S_{12}, S_{21} = f (f)
I_C = 20 mA, V_{CE} = 6 V, Z_0 = 50 Ω



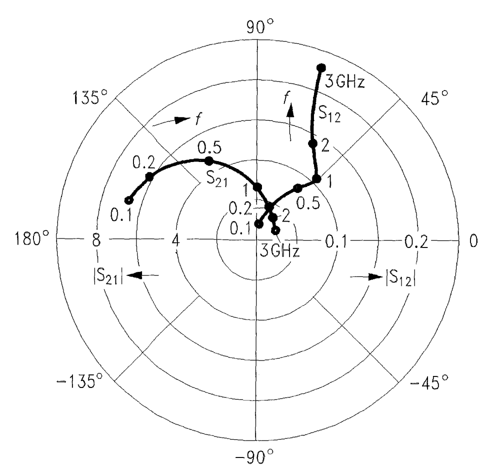
Common Emitter S Parameters (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**
I_C = 2 mA, V_{CE} = 10 V, Z_0 = 50 Ω								
0.10	0.931	– 18.9	6.59	164.6	0.023	79.4	0.978	– 6.7
0.15	0.905	– 28.2	6.41	157.4	0.034	74.4	0.960	– 9.8
0.20	0.874	– 36.9	6.19	150.4	0.043	70.0	0.937	– 12.5
0.25	0.836	– 45.2	5.92	144.1	0.052	65.9	0.911	– 14.9
0.30	0.796	– 53.0	5.62	138.0	0.059	62.5	0.884	– 17.0
0.40	0.722	– 67.4	5.05	127.7	0.071	56.5	0.833	– 20.1
0.50	0.654	– 80.2	4.52	118.9	0.079	52.4	0.789	– 22.4
0.60	0.597	– 91.9	4.06	111.3	0.085	49.7	0.753	– 24.1
0.70	0.544	– 102.7	3.68	104.7	0.090	47.9	0.725	– 25.4
0.80	0.513	– 112.3	3.35	98.9	0.094	46.6	0.702	– 26.3
0.90	0.481	– 122.3	3.09	93.5	0.097	46.2	0.681	– 27.2
1.00	0.455	– 131.7	2.85	88.5	0.100	46.5	0.666	– 27.9
1.20	0.421	– 148.7	2.45	80.0	0.105	47.9	0.642	– 29.5
1.40	0.399	– 164.4	2.16	72.6	0.110	50.5	0.628	– 31.2
1.50	0.390	– 171.2	2.03	69.4	0.114	52.4	0.625	– 32.2
1.60	0.390	– 177.8	1.93	66.1	0.118	54.0	0.622	– 33.3
1.80	0.385	170.4	1.76	60.1	0.127	57.3	0.617	– 35.6
2.00	0.398	160.0	1.61	54.4	0.138	60.2	0.609	– 38.2
2.50	0.447	136.9	1.33	42.3	0.177	66.0	0.589	– 46.2
3.00	0.478	119.7	1.15	31.8	0.229	67.7	0.587	– 54.8

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



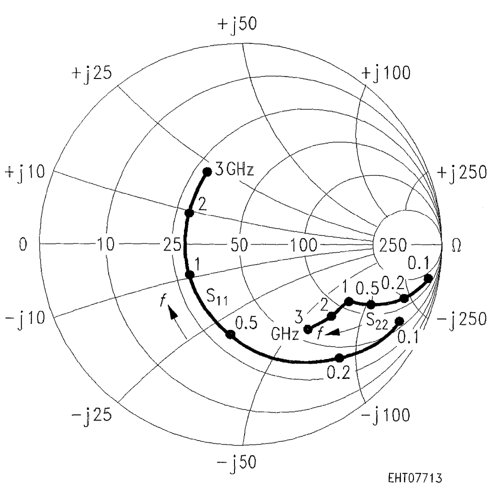
$S_{12}, S_{21} = f(f)$
I_C = 2 mA, V_{CE} = 10 V, Z_0 = 50 Ω



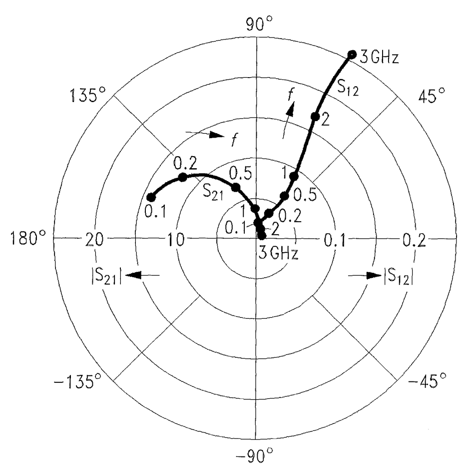
Common Emitter S Parameters (continued)

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								
0.10	0.847	– 28.9	13.60	156.0	0.022	75.1	0.939	– 11.5
0.15	0.786	– 41.7	12.60	145.9	0.030	69.5	0.889	– 15.8
0.20	0.721	– 53.1	11.53	137.1	0.038	65.1	0.837	– 19.0
0.25	0.657	– 63.1	10.46	129.7	0.043	61.9	0.790	– 21.2
0.30	0.599	– 72.1	9.48	123.4	0.048	59.7	0.747	– 22.7
0.40	0.506	– 87.6	7.89	113.5	0.056	57.2	0.682	– 24.3
0.50	0.437	– 100.4	6.68	105.9	0.062	56.7	0.639	– 25.0
0.60	0.389	– 112.2	5.77	99.6	0.069	57.0	0.607	– 25.3
0.70	0.351	– 122.8	5.08	94.4	0.075	57.8	0.586	– 25.6
0.80	0.329	– 132.0	4.53	89.8	0.081	58.5	0.570	– 25.9
0.90	0.310	– 141.8	4.10	85.6	0.087	59.4	0.557	– 26.2
1.00	0.296	– 150.7	3.73	81.7	0.093	60.4	0.548	– 26.5
1.20	0.283	– 166.8	3.17	75.2	0.106	61.9	0.532	– 27.6
1.40	0.278	178.1	2.76	69.1	0.120	63.1	0.524	– 29.0
1.50	0.273	171.8	2.58	66.4	0.127	63.9	0.523	– 29.9
1.60	0.278	166.1	2.45	63.7	0.134	64.2	0.522	– 31.0
1.80	0.280	156.3	2.21	58.7	0.150	64.8	0.518	– 33.3
2.00	0.298	148.3	2.02	53.8	0.166	64.9	0.510	– 35.9
2.50	0.357	129.4	1.67	42.9	0.209	64.6	0.487	– 43.1
3.00	0.390	116.1	1.45	33.1	0.257	62.8	0.482	– 51.1

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



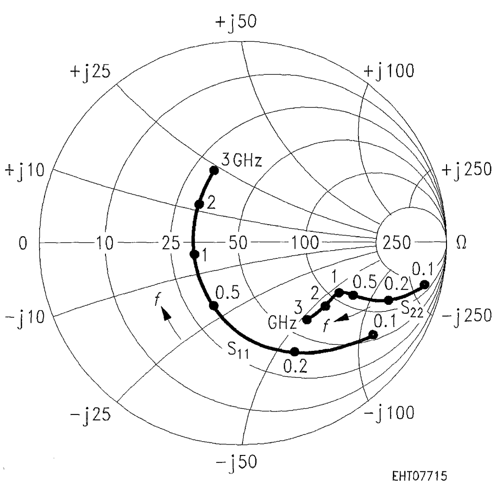
S_{12}, S_{21} = f (f)
I_C = 5 mA, V_{CE} = 10 V, Z_0 = 50 Ω



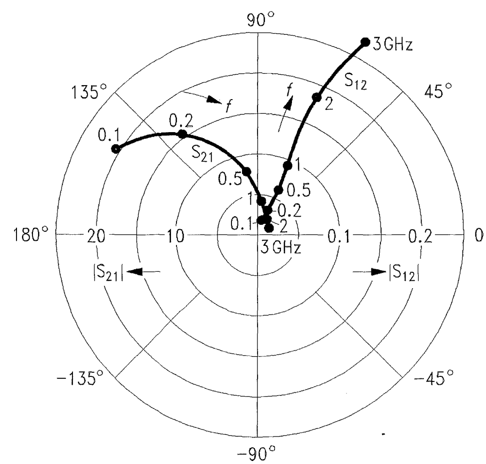
Common Emitter S Parameters (continued)

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								
0.10	0.744	– 39.7	20.56	146.8	0.020	71.5	0.877	– 16.2
0.15	0.650	– 55.4	17.86	134.8	0.027	66.3	0.798	– 20.4
0.20	0.566	– 68.1	15.44	125.6	0.032	63.4	0.729	– 22.7
0.25	0.497	– 78.7	13.39	118.5	0.037	62.1	0.675	– 23.8
0.30	0.441	– 88.0	11.74	112.8	0.041	61.7	0.635	– 24.1
0.40	0.362	– 103.8	9.33	104.4	0.048	62.2	0.580	– 23.9
0.50	0.310	– 116.5	7.70	98.1	0.055	63.3	0.549	– 23.6
0.60	0.277	– 128.3	6.54	93.0	0.063	64.6	0.529	– 23.3
0.70	0.254	– 138.5	5.70	88.6	0.071	65.7	0.516	– 23.4
0.80	0.242	– 147.7	5.04	84.9	0.079	66.3	0.507	– 23.6
0.90	0.234	– 157.0	4.52	81.4	0.086	67.0	0.499	– 23.9
1.00	0.229	– 165.8	4.10	78.1	0.094	67.5	0.493	– 24.2
1.20	0.227	179.4	3.46	72.4	0.111	67.9	0.483	– 25.4
1.40	0.232	165.5	3.01	67.1	0.127	67.8	0.477	– 27.0
1.50	0.231	159.6	2.82	64.6	0.135	68.0	0.477	– 28.0
1.60	0.237	155.1	2.67	62.2	0.144	67.7	0.476	– 29.1
1.80	0.242	146.5	2.40	57.6	0.161	67.2	0.474	– 31.7
2.00	0.261	140.5	2.19	53.2	0.179	66.3	0.465	– 34.3
2.50	0.324	124.8	1.82	42.9	0.224	64.0	0.440	– 41.4
3.00	0.355	113.5	1.57	33.4	0.270	61.0	0.433	– 49.3

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



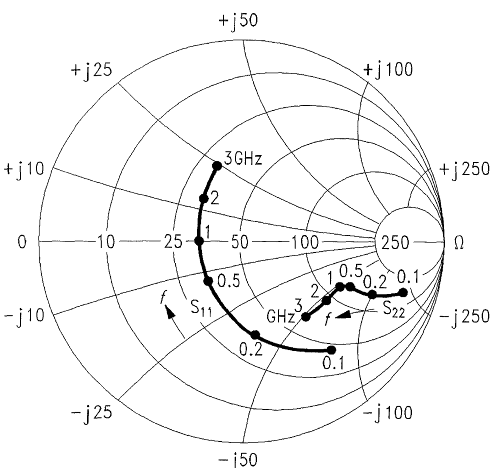
$S_{12}, S_{21} = f(f)$
I_C = 10 mA, V_{CE} = 10 V, Z_0 = 50 Ω



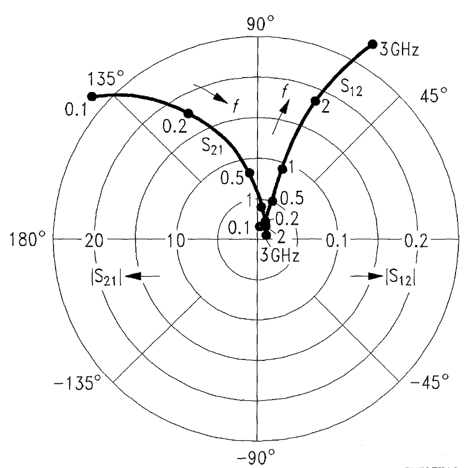
Common Emitter S Parameters (continued)

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								
0.10	0.628	– 52.7	26.24	137.1	0.018	68.5	0.800	– 19.4
0.15	0.517	– 70.3	21.27	124.7	0.023	65.1	0.705	– 22.1
0.20	0.435	– 84.1	17.51	116.0	0.028	64.3	0.639	– 22.7
0.25	0.376	– 95.1	14.71	109.8	0.032	64.8	0.595	– 22.4
0.30	0.332	– 104.6	12.62	105.0	0.036	65.6	0.565	– 21.8
0.40	0.277	– 121.1	9.79	98.0	0.044	67.3	0.528	– 20.6
0.50	0.243	– 133.6	7.97	92.7	0.052	68.9	0.510	– 20.1
0.60	0.227	– 145.2	6.72	88.4	0.060	70.0	0.498	– 19.9
0.70	0.215	– 155.2	5.82	84.7	0.069	70.7	0.492	– 20.1
0.80	0.211	– 163.0	5.13	81.4	0.078	71.0	0.486	– 20.5
0.90	0.210	– 171.5	4.59	78.3	0.086	71.2	0.481	– 21.0
1.00	0.210	– 179.1	4.16	75.4	0.095	71.3	0.477	– 21.6
1.20	0.218	168.5	3.50	70.1	0.112	71.1	0.470	– 23.0
1.40	0.227	156.3	3.04	65.0	0.130	70.4	0.466	– 24.9
1.50	0.228	151.2	2.84	62.7	0.139	70.2	0.467	– 26.0
1.60	0.234	147.5	2.69	60.4	0.147	69.7	0.467	– 27.3
1.80	0.241	140.0	2.42	56.0	0.165	68.7	0.465	– 30.0
2.00	0.260	135.5	2.21	51.7	0.183	67.5	0.456	– 32.8
2.50	0.324	122.0	1.83	41.7	0.229	64.5	0.431	– 40.0
3.00	0.355	111.7	1.58	32.3	0.275	61.1	0.424	– 48.1

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

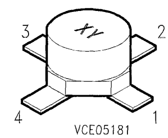


SIEMENS

NPN Silicon RF Transistor

BFQ 82

- For low-noise, high-gain amplifiers up to 2 GHz.
- Linear broadband applications at collector currents up to 40 mA.
- Hermetically sealed ceramic package.
- f_T = 8 GHz
  F = 1.1 dB at 800 MHz



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 82	82	Q62702-F1189	B	E	C	E	Cerec-X

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CEO}	12	V
Collector-emitter voltage, $V_{BE} = 0$	V_{CES}	20	
Collector-base voltage	V_{CBO}	20	
Emitter-base voltage	V_{EBO}	2	
Collector current	I_C	80	mA
Peak collector current, $f \geq 10$ MHz	I_{CM}	80	
Base current	I_B	10	
Peak base current, $f \geq 10$ MHz	I_{BM}	10	
Total power dissipation, $T_S \leq 95$ ˚C[3]	P_{tot}	500	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]	$R_{th\,JA}$	≤ 240	K/W
Junction - case[3]	$R_{th\,JS}$	≤ 160	

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

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

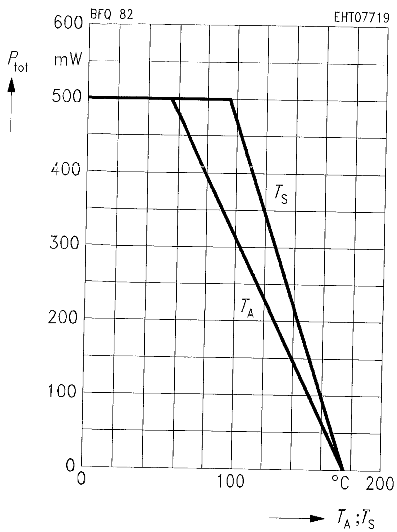
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CE0}$	12	–	–	V
Collector-emitter cutoff current V_{CE} = 20 V, V_{BE} = 0	I_{CES}	–	–	100	µA
Collector-base cutoff current V_{CB} = 10 V, I_E = 0 V_{CB} = 10 V, I_E = 0, T_A = 125 °C	I_{CB0}	 – –	 – –	 0.05 5	
Emitter-base cutoff current V_{EB} = 1 V, I_C = 0	I_{EB0}	–	–	1	
DC current gain I_C = 5 mA, V_{CE} = 8 V I_C = 30 mA, V_{CE} = 8 V	h_{FE}	 – 50	 110 120	 – 250	–

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

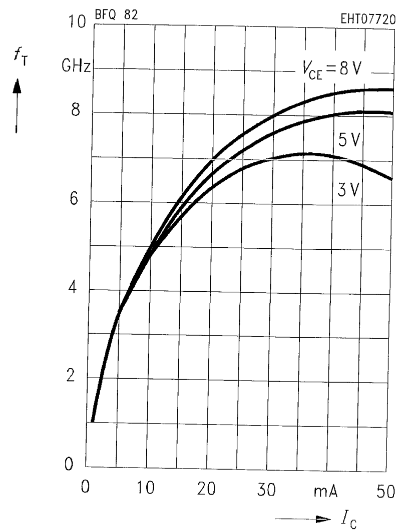
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
AC Characteristics					
Transition frequency	f_T				GHz
I_C = 5 mA, V_{CE} = 8 V, f = 500 MHz		–	3.6	–	
I_C = 30 mA, V_{CE} = 8 V, f = 500 MHz		–	8	–	
Collector-base capacitance V_{CB} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{cb}	–	0.62	–	pF
Collector-emitter 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}	–	2.5	–	
Output capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{obs}	–	1.0	–	
Noise figure	F				dB
I_C = 5 mA, V_{CE} = 8 V, f = 10 MHz, Z_S = 75 Ω		–	0.7	–	
I_C = 30 mA, V_{CE} = 8 V, f = 800 MHz, Z_S = Z_{Sopt}		–	1.6	–	
I_C = 10 mA, V_{CE} = 8 V, f = 2 GHz, Z_S = Z_{Sopt}		–	2.3	–	
Power gain	G_{ma} 1)				
I_C = 30 mA, V_{CE} = 8 V, f = 1 GHz, Z_0 = 50 Ω		–	17	–	
I_C = 30 mA, V_{CE} = 8 V, f = 2 GHz, Z_0 = 50 Ω		–	11	–	
Transducer gain I_C = 30 mA, V_{CE} = 8 V, f = 1 GHz, Z_0 = 50 Ω	$\|S_{21e}\|^2$	–	13.5	–	
Linear output voltage two-tone intermodulation test I_C = 40 mA, V_{CE} = 8 V, d_{IM} = 60 dB, f_1 = 806 MHz, f_2 = 810 MHz, Z_S = Z_L = 50 Ω	V_{o1} = V_{o2}	–	280	–	mV
Third order intercept point I_C = 40 mA, V_{CE} = 8 V, f = 800 MHz	IP_3	–	32	–	dBm

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

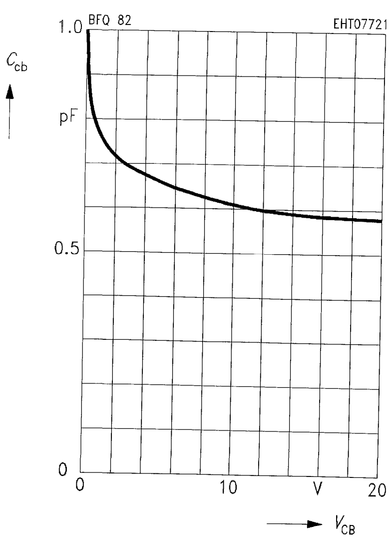
Total power dissipation $P_{tot} = f(T_A^*; T_S)$
* Package mounted on alumina



Transition frequency $f_T = f(I_C)$
f = 500 MHz



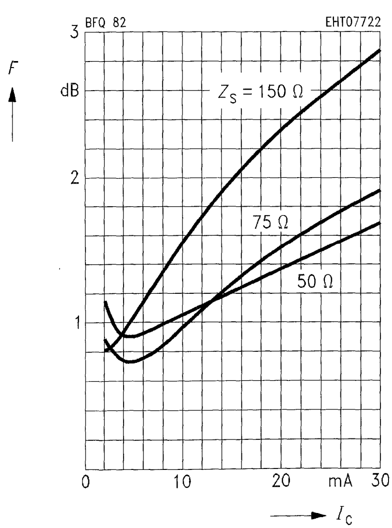
Collector-base capacitance $C_{cb} = f(V_{CB})$
$V_{BE} = v_{be} = 0, f = 1$ MHz



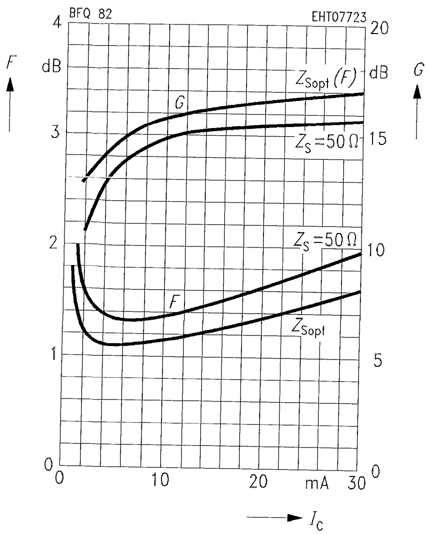
Common Emitter Noise Parameters

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 = 10 mA, V_{CE} = 8 V, Z_0 = 50 Ω								
0.01	1	–	(Z_S = 75 Ω)		–	–	1.05	–
0.8	1.15	15.7	–	–	–	–	1.35	14.7
2.0	2.3	9.5	–	–	–	–	2.8	7.5
I_C = 30 mA, V_{CE} = 8 V, Z_0 = 50 Ω								
0.01	1.65	–	(Z_S = 50 Ω)		–	–	1.65	–
0.8	1.6	17	–	–	–	–	1.95	15.8
2.0	2.6	10	–	–	–	–	3.3	8

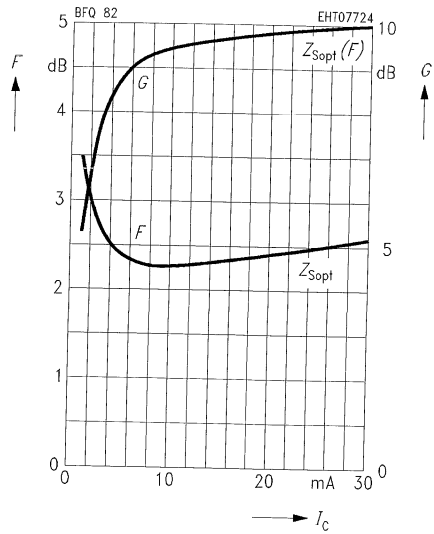
Noise figure $F = f\ (I_C)$
V_{CE} = 8 V, f = 10 MHz



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

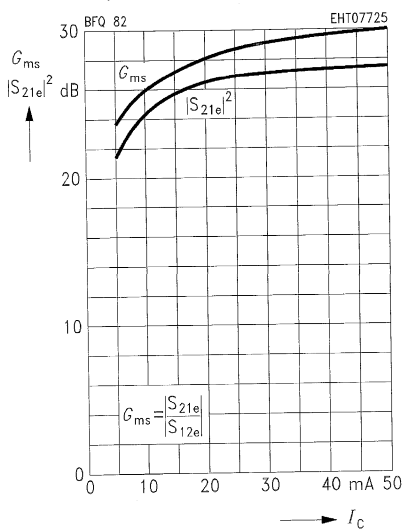


Noise figure $F = f\,(I_C)$
Power gain $G = f\,(I_C)$
V_{CE} = 8 V, f = 2 GHz, Z_{Lopt} (G)

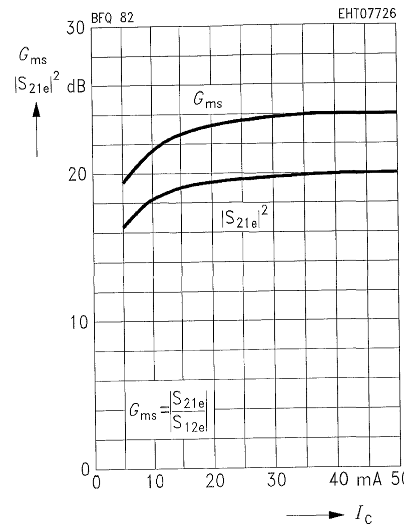


Common Emitter Power Gain

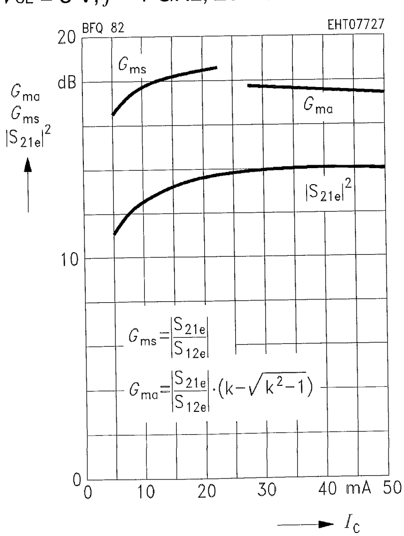
Power gain G_{ms}, $|S_{21e}|^2 = f(I_C)$
V_{CE} = 8 V, f = 200 MHz, Z_0 = 50 Ω



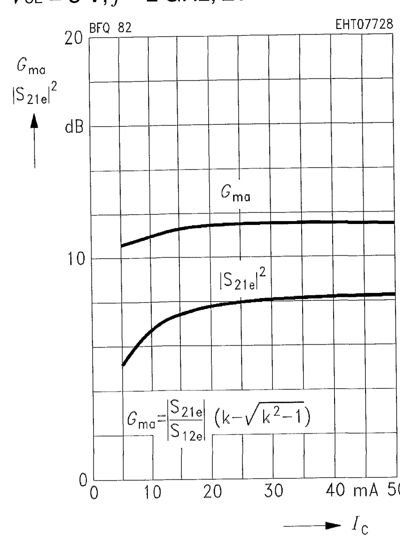
Power gain G_{ms}, $|S_{21e}|^2 = f(I_C)$
V_{CE} = 8 V, f = 500 MHz, Z_0 = 50 Ω



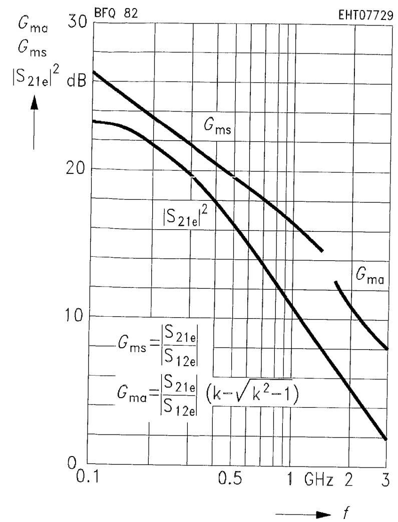
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(I_C)$
V_{CE} = 8 V, f = 1 GHz, Z_0 = 50 Ω



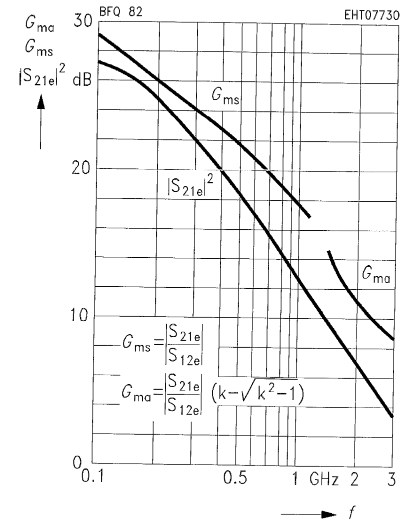
Power gain G_{ma}, $|S_{21e}|^2 = f(I_C)$
V_{CE} = 8 V, f = 2 GHz, Z_0 = 50 Ω



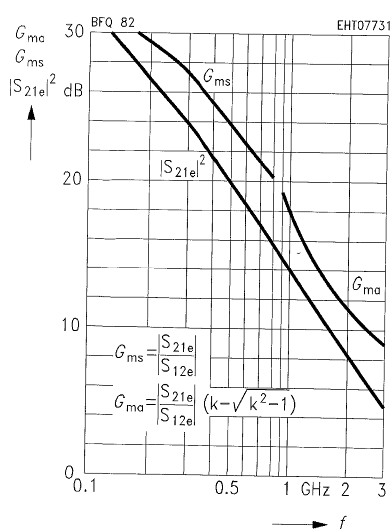
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
I_C = 5 mA, V_{CE} = 8 V, Z_0 = 50 Ω



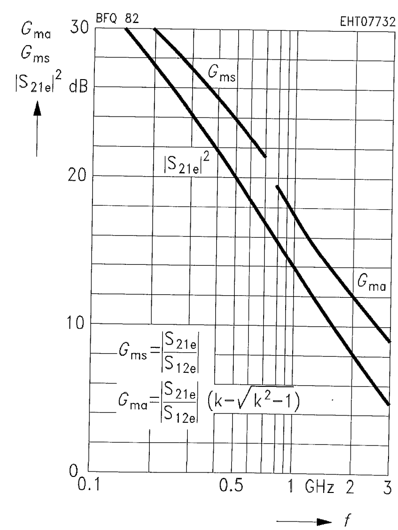
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
I_C = 10 mA, V_{CE} = 8 V, Z_0 = 50 Ω



Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
I_C = 30 mA, V_{CE} = 8 V, Z_0 = 50 Ω



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



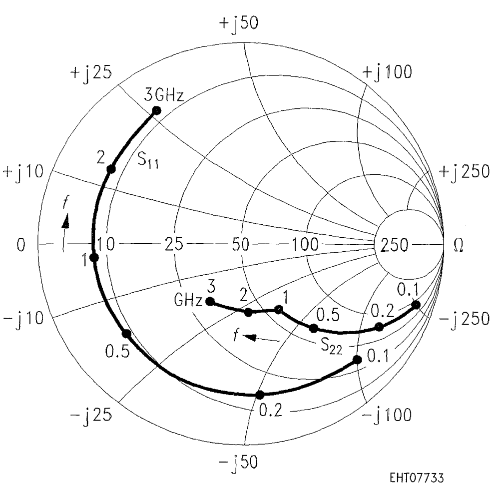
Common Emitter S Parameters

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_C = 10 mA, V_{CE} = 3 V, Z_0 = 50 Ω								
0.10	0.549	– 117.0	34.54	127.9	0.020	53.4	0.627	– 55.5
0.15	0.598	– 136.2	26.39	116.1	0.023	48.5	0.486	– 69.3
0.20	0.620	– 147.9	20.98	108.4	0.026	47.7	0.394	– 79.1
0.25	0.633	– 155.9	17.29	103.0	0.028	47.7	0.333	– 86.8
0.30	0.641	– 161.4	14.67	98.9	0.031	48.7	0.288	– 93.1
0.40	0.651	– 169.7	11.21	92.7	0.035	51.2	0.234	– 103.1
0.50	0.655	– 175.5	9.06	87.8	0.040	53.3	0.203	– 110.8
0.60	0.657	– 180.0	7.60	83.8	0.045	54.9	0.183	– 117.4
0.70	0.661	175.8	6.53	80.1	0.051	56.1	0.170	– 123.1
0.80	0.665	172.6	5.74	76.6	0.056	56.9	0.161	– 127.8
0.90	0.671	169.6	5.09	73.6	0.061	57.2	0.154	– 132.8
1.00	0.673	166.7	4.58	70.6	0.067	57.5	0.149	– 136.9
1.20	0.680	161.2	3.82	65.6	0.078	57.4	0.142	– 145.3
1.40	0.679	155.8	3.31	60.6	0.089	56.7	0.139	– 150.8
1.50	0.680	153.4	3.10	58.1	0.095	55.8	0.140	– 152.4
1.60	0.683	151.1	2.92	55.3	0.101	55.1	0.141	– 154.4
1.80	0.688	146.7	2.59	49.9	0.112	53.1	0.146	– 159.0
2.00	0.701	143.0	2.33	45.3	0.122	51.3	0.151	– 165.6
2.50	0.729	133.3	1.90	35.3	0.150	46.8	0.175	– 178.4
3.00	0.735	122.1	1.62	23.5	0.177	40.6	0.199	174.5
I_C = 30 mA, V_{CE} = 3 V, Z_0 = 50 Ω								
0.10	0.664	– 71.4	22.66	142.7	0.029	59.7	0.815	– 33.7
0.15	0.666	– 94.9	19.20	130.2	0.038	50.7	0.694	– 44.5
0.20	0.666	– 112.0	16.25	121.0	0.043	44.9	0.593	– 52.4
0.25	0.664	– 124.8	13.90	113.9	0.046	40.9	0.514	– 58.2
0.30	0.666	– 134.3	12.07	108.4	0.049	38.5	0.452	– 62.5
0.40	0.670	– 148.4	9.48	99.9	0.052	36.1	0.366	– 68.6
0.50	0.670	– 158.0	7.78	93.6	0.056	35.7	0.313	– 72.8
0.60	0.671	– 165.3	6.57	88.4	0.058	35.9	0.275	– 76.1
0.70	0.675	– 171.5	5.67	83.8	0.061	36.6	0.249	– 79.0
0.80	0.679	– 176.4	5.01	79.6	0.064	37.4	0.231	– 81.3
0.90	0.684	179.2	4.45	76.0	0.067	38.2	0.214	– 83.7
1.00	0.686	175.4	4.01	72.5	0.070	39.5	0.203	– 85.8
1.20	0.693	168.4	3.35	66.5	0.077	41.3	0.185	– 90.5
1.40	0.691	162.0	2.90	60.9	0.084	42.8	0.177	– 94.9
1.50	0.692	159.3	2.72	58.1	0.089	43.0	0.177	– 97.2
1.60	0.697	156.5	2.56	55.1	0.093	43.3	0.177	– 99.6
1.80	0.703	151.4	2.28	49.3	0.101	43.3	0.177	– 105.1
2.00	0.713	147.0	2.05	44.2	0.109	43.3	0.176	– 112.0
2.50	0.741	136.2	1.67	33.1	0.133	42.5	0.188	– 130.5
3.00	0.748	124.5	1.42	20.7	0.157	39.0	0.215	– 144.6

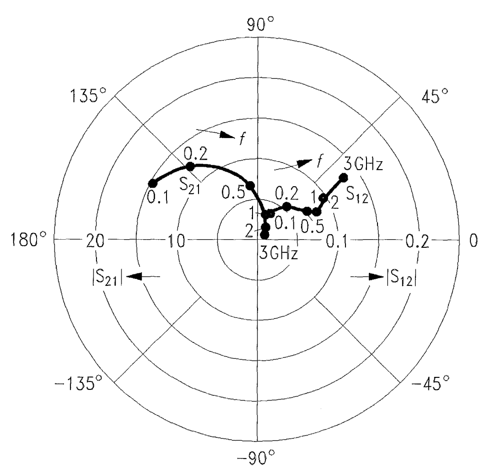
Common Emitter S Parameters (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**
I_C = 5 mA, V_{CE} = 5 V, Z_0 = 50 Ω								
0.10	0.783	– 48.9	14.66	152.0	0.033	66.4	0.904	– 21.5
0.15	0.763	– 68.9	13.27	140.7	0.045	57.1	0.827	– 29.7
0.20	0.745	– 85.7	11.86	131.3	0.054	49.8	0.748	– 36.1
0.25	0.732	– 99.4	10.58	123.5	0.060	44.0	0.677	– 41.1
0.30	0.722	– 110.7	9.45	117.2	0.065	39.6	0.616	– 44.8
0.40	0.708	– 128.3	7.69	107.1	0.070	33.5	0.525	– 50.0
0.50	0.701	– 141.0	6.43	99.4	0.074	29.7	0.462	– 53.2
0.60	0.697	– 151.0	5.50	93.0	0.076	27.3	0.420	– 55.7
0.70	0.698	– 158.9	4.80	87.4	0.078	25.9	0.388	– 57.6
0.80	0.700	– 165.5	4.24	82.6	0.079	24.9	0.366	– 59.2
0.90	0.703	– 171.2	3.81	78.1	0.080	24.6	0.348	– 61.0
1.00	0.704	– 176.4	3.43	74.1	0.081	24.6	0.333	– 62.8
1.20	0.710	174.6	2.88	66.9	0.082	25.4	0.314	– 66.2
1.40	0.713	166.9	2.49	60.5	0.085	27.0	0.304	– 69.9
1.50	0.709	163.8	2.34	57.4	0.087	28.0	0.302	– 72.3
1.60	0.711	160.3	2.20	54.1	0.089	28.8	0.301	– 74.6
1.80	0.719	154.2	1.97	47.7	0.093	30.4	0.300	– 79.8
2.00	0.727	148.8	1.77	42.0	0.097	31.9	0.296	– 85.6
2.50	0.755	137.2	1.43	30.0	0.114	36.1	0.300	– 102.2
3.00	0.758	124.0	1.22	16.2	0.135	36.2	0.322	– 118.6

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



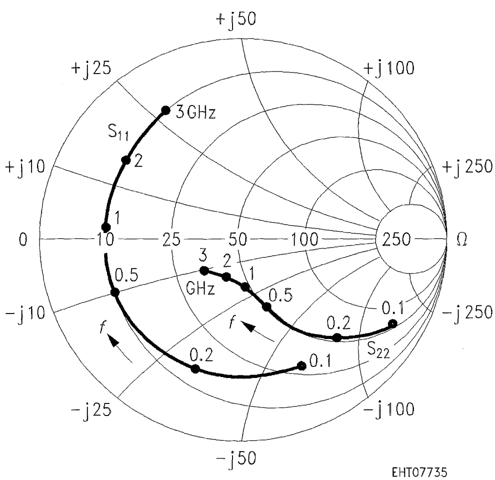
S_{12}, $S_{21} = f(f)$
I_C = 5 mA, V_{CE} = 5 V, Z_0 = 50 Ω



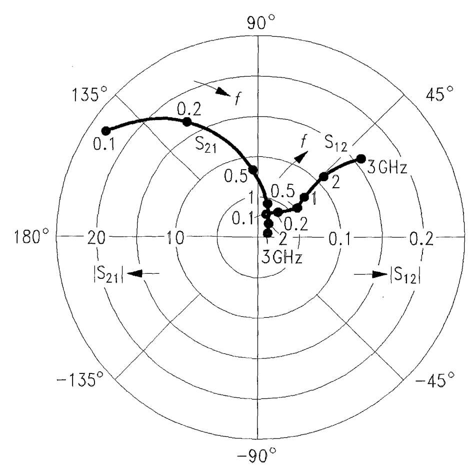
Common Emitter S Parameters (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**
I_C = 10 mA, V_{CE} = 5 V, Z_0 = 50 Ω								
0.10	0.670	– 68.9	23.03	143.5	0.028	60.6	0.822	– 32.5
0.15	0.664	– 92.4	19.59	131.0	0.037	51.4	0.705	– 43.2
0.20	0.661	– 109.9	16.65	121.7	0.042	45.5	0.604	– 51.1
0.25	0.660	– 122.6	14.30	114.5	0.045	41.6	0.525	– 56.7
0.30	0.660	– 132.6	12.45	108.9	0.048	39.1	0.462	– 60.9
0.40	0.658	– 147.1	9.79	100.3	0.052	36.6	0.376	– 66.9
0.50	0.660	– 157.1	8.04	93.9	0.055	35.8	0.319	– 70.8
0.60	0.662	– 164.9	6.80	88.6	0.058	36.1	0.283	– 73.9
0.70	0.664	– 171.0	5.88	83.9	0.061	36.8	0.256	– 76.4
0.80	0.669	– 176.3	5.17	79.8	0.064	37.4	0.237	– 78.5
0.90	0.672	179.2	4.62	76.0	0.067	38.4	0.222	– 80.8
1.00	0.675	175.0	4.16	72.5	0.070	39.2	0.209	– 83.1
1.20	0.682	167.4	3.48	66.2	0.076	40.8	0.191	– 87.2
1.40	0.687	160.9	3.00	60.5	0.084	41.9	0.182	– 91.0
1.50	0.684	158.2	2.82	57.7	0.088	42.5	0.181	– 93.2
1.60	0.684	155.1	2.65	54.7	0.092	42.6	0.180	– 95.5
1.80	0.693	149.8	2.37	48.8	0.101	42.6	0.181	– 101.1
2.00	0.701	144.9	2.13	43.6	0.108	42.2	0.179	– 107.6
2.50	0.732	134.5	1.73	32.6	0.132	41.4	0.188	– 124.6
3.00	0.735	122.0	1.47	19.2	0.156	37.4	0.215	– 139.6

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



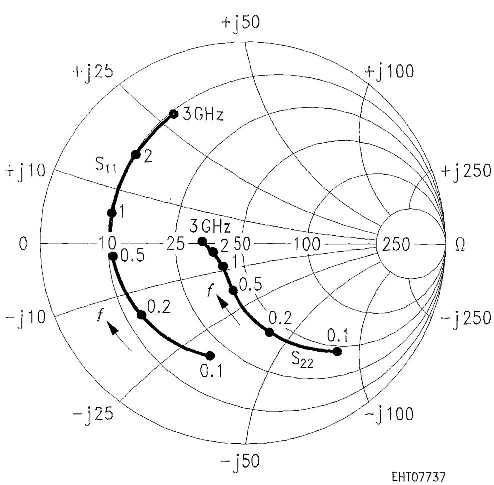
S_{12}, $S_{21} = f(f)$
I_C = 10 mA, V_{CE} = 5 V, Z_0 = 50 Ω



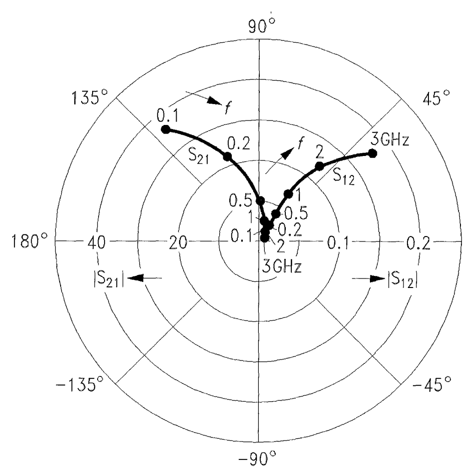
Common Emitter S Parameters (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_C = 30 mA, V_{CE} = 5 V, Z_0 = 50 Ω								
0.10	0.545	– 111.4	35.72	129.0	0.020	54.2	0.642	– 53.6
0.15	0.584	– 132.2	27.43	117.1	0.023	49.3	0.501	– 67.2
0.20	0.605	– 145.0	21.91	109.2	0.026	47.9	0.407	– 76.8
0.25	0.617	– 153.2	18.11	103.7	0.029	47.9	0.342	– 84.3
0.30	0.625	– 159.3	15.39	99.5	0.031	48.7	0.297	– 90.3
0.40	0.631	– 168.3	11.77	93.0	0.035	50.9	0.239	– 100.0
0.50	0.637	– 174.7	9.54	88.2	0.040	52.8	0.205	– 107.7
0.60	0.641	– 179.7	7.99	84.0	0.046	54.4	0.184	– 113.8
0.70	0.644	176.4	6.87	80.2	0.051	55.6	0.171	– 119.2
0.80	0.648	172.8	6.03	76.8	0.056	56.2	0.161	– 123.9
0.90	0.652	169.5	5.36	73.6	0.061	56.4	0.154	– 128.3
1.00	0.657	166.4	4.82	70.7	0.067	56.6	0.148	– 133.2
1.20	0.665	160.2	4.03	65.4	0.078	56.3	0.140	– 140.9
1.40	0.671	154.6	3.47	60.3	0.089	55.5	0.134	– 146.8
1.50	0.665	152.3	3.26	57.8	0.095	54.8	0.135	– 148.8
1.60	0.666	149.6	3.06	55.0	0.101	54.0	0.136	– 150.7
1.80	0.674	145.0	2.73	49.7	0.112	51.9	0.141	– 155.2
2.00	0.682	141.1	2.45	44.8	0.122	49.9	0.146	– 161.6
2.50	0.713	131.4	1.99	34.7	0.150	45.3	0.164	– 174.4
3.00	0.715	119.8	1.69	22.1	0.175	38.8	0.191	178.0

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



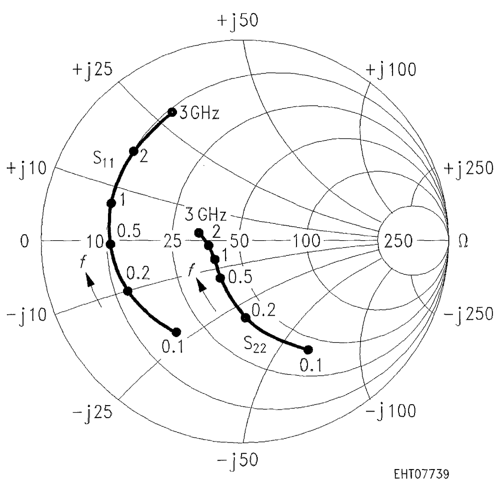
S_{12}, S_{21} = f (f)
I_C = 30 mA, V_{CE} = 5 V, Z_0 = 50 Ω



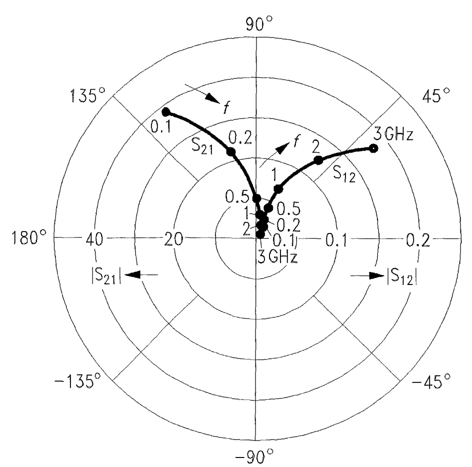
Common Emitter S Parameters (continued)

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								
0.10	0.541	– 128.9	38.90	123.5	0.016	53.8	0.560	– 62.3
0.15	0.587	– 145.8	28.86	112.3	0.020	51.3	0.425	– 76.6
0.20	0.609	– 155.7	22.67	105.3	0.022	51.6	0.344	– 87.0
0.25	0.622	– 162.0	18.56	100.5	0.025	53.0	0.291	– 95.2
0.30	0.629	– 166.9	15.69	96.7	0.027	54.7	0.255	– 101.9
0.40	0.635	– 173.9	11.94	90.9	0.032	57.5	0.212	– 112.8
0.50	0.640	– 179.2	9.64	86.4	0.038	59.3	0.186	– 121.3
0.60	0.645	176.3	8.07	82.5	0.044	60.4	0.172	– 127.8
0.70	0.649	173.1	6.93	79.0	0.050	61.1	0.164	– 133.4
0.80	0.651	169.8	6.08	75.8	0.055	61.2	0.157	– 138.2
0.90	0.656	167.0	5.41	72.7	0.061	61.1	0.153	– 142.6
1.00	0.660	164.0	4.85	69.9	0.067	60.8	0.151	– 147.3
1.20	0.668	158.5	4.05	64.7	0.079	59.9	0.147	– 154.8
1.40	0.673	153.1	3.49	59.9	0.091	58.5	0.143	– 160.5
1.50	0.668	150.9	3.28	57.3	0.097	57.6	0.144	– 162.2
1.60	0.671	148.3	3.09	54.7	0.103	56.5	0.145	– 163.8
1.80	0.676	143.8	2.75	49.4	0.115	53.9	0.150	– 167.6
2.00	0.685	140.1	2.46	44.6	0.125	51.5	0.157	– 173.2
2.50	0.716	130.6	2.00	34.7	0.153	46.4	0.177	175.7
3.00	0.717	119.1	1.70	22.2	0.179	39.2	0.202	169.6

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



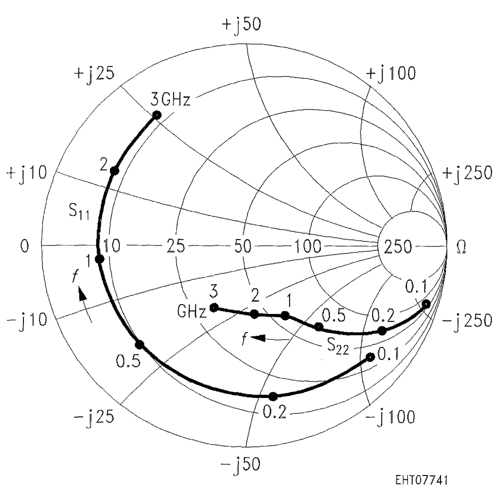
S_{12}, S_{21} = f (f)
I_C = 50 mA, V_{CE} = 5 V, Z_0 = 50 Ω



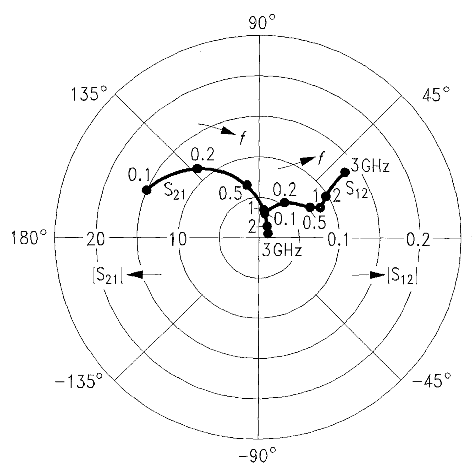
Common Emitter S Parameters (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**
I_C = 5 mA, V_{CE} = 8 V, Z_0 = 50 Ω								
0.10	0.792	– 47.3	14.67	152.6	0.033	66.9	0.908	– 20.9
0.15	0.771	– 67.0	13.33	141.4	0.044	57.6	0.833	– 28.9
0.20	0.751	– 83.6	11.96	132.1	0.053	50.5	0.756	– 35.2
0.25	0.736	– 97.1	10.69	124.4	0.059	44.8	0.686	– 40.1
0.30	0.724	– 108.5	9.57	118.0	0.064	40.3	0.626	– 43.9
0.40	0.707	– 126.2	7.82	107.8	0.070	34.1	0.535	– 49.0
0.50	0.699	– 139.2	6.55	100.1	0.073	30.1	0.472	– 52.3
0.60	0.695	– 149.4	5.61	93.6	0.076	27.6	0.428	– 54.7
0.70	0.695	– 157.5	4.90	88.1	0.077	26.3	0.397	– 56.6
0.80	0.696	– 164.3	4.33	83.2	0.079	25.1	0.374	– 58.2
0.90	0.698	– 170.0	3.89	78.7	0.080	24.9	0.355	– 59.9
1.00	0.699	– 175.4	3.51	74.6	0.080	24.8	0.340	– 61.6
1.20	0.704	175.4	2.95	67.4	0.082	25.5	0.320	– 64.9
1.40	0.708	167.6	2.54	61.0	0.085	27.0	0.310	– 68.6
1.50	0.706	164.5	2.39	58.0	0.086	27.9	0.308	– 70.9
1.60	0.705	160.9	2.25	54.6	0.088	28.8	0.307	– 73.1
1.80	0.715	154.8	2.01	48.3	0.093	30.3	0.305	– 78.3
2.00	0.723	149.3	1.81	42.6	0.096	31.9	0.301	– 83.9
2.50	0.750	137.4	1.47	30.6	0.113	35.9	0.303	– 100.1
3.00	0.755	124.3	1.25	16.8	0.134	36.1	0.323	– 116.5

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



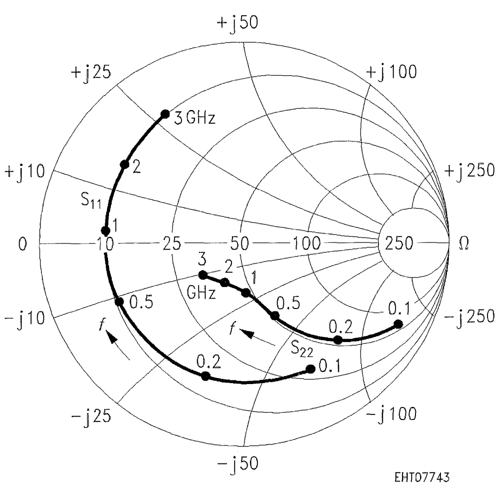
S_{12}, S_{21} = $f\,(f)$
I_C = 5 mA, V_{CE} = 8 V, Z_0 = 50 Ω



Common Emitter S Parameters (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_C = 10 mA, V_{CE} = 8 V, Z_0 = 50 Ω								
0.10	0.686	– 65.8	23.05	144.4	0.028	61.2	0.829	– 31.5
0.15	0.673	– 89.1	19.74	132.0	0.036	52.4	0.715	– 42.0
0.20	0.665	– 106.6	16.85	122.6	0.042	46.2	0.616	– 49.8
0.25	0.661	– 119.6	14.51	115.5	0.045	42.1	0.537	– 55.4
0.30	0.659	– 129.8	12.67	109.8	0.048	39.5	0.474	– 59.6
0.40	0.654	– 144.7	10.00	101.1	0.052	36.8	0.386	– 65.5
0.50	0.654	– 155.3	8.22	94.6	0.055	35.9	0.328	– 69.4
0.60	0.656	– 163.2	6.95	89.2	0.058	35.9	0.291	– 72.4
0.70	0.659	– 169.5	6.02	84.5	0.061	36.6	0.264	– 74.9
0.80	0.661	– 175.1	5.30	80.3	0.064	37.1	0.243	– 76.9
0.90	0.666	– 179.6	4.74	76.5	0.067	38.0	0.227	– 79.1
1.00	0.668	176.1	4.26	73.0	0.070	38.8	0.213	– 81.4
1.20	0.674	168.4	3.56	66.7	0.077	40.4	0.196	– 85.1
1.40	0.680	161.7	3.07	61.0	0.084	41.5	0.185	– 88.8
1.50	0.677	158.9	2.88	58.2	0.088	42.0	0.184	– 91.0
1.60	0.676	155.7	2.72	55.3	0.092	42.2	0.183	– 93.2
1.80	0.687	150.4	2.42	49.4	0.100	42.1	0.183	– 98.7
2.00	0.693	145.5	2.18	44.1	0.108	41.8	0.180	– 105.0
2.50	0.724	134.9	1.77	33.1	0.131	41.1	0.187	– 122.0
3.00	0.726	122.3	1.51	19.8	0.154	37.2	0.212	– 137.2

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



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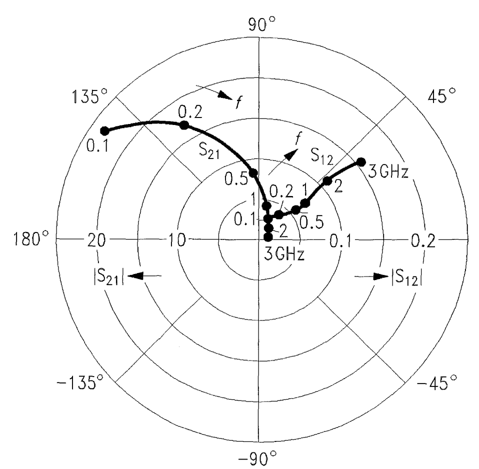
$S_{12}, S_{21} = f(f)$
I_C = 10 mA, V_{CE} = 8 V, Z_0 = 50 Ω



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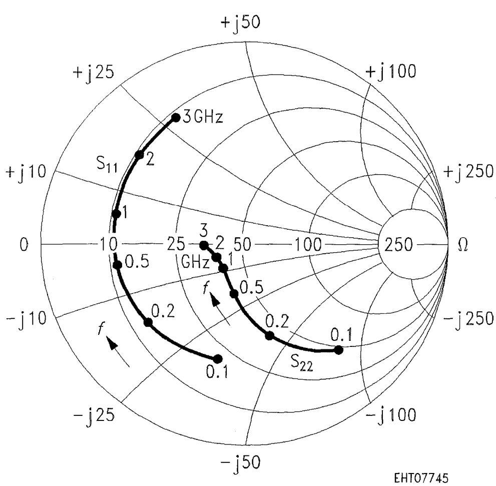
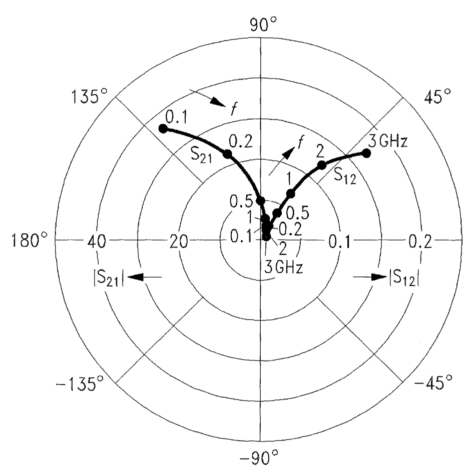
Common Emitter S Parameters (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**
I_C = 30 mA, V_{CE} = 8 V, Z_0 = 50 Ω								
0.10	0.559	– 105.0	36.41	130.0	0.020	54.4	0.651	– 52.3
0.15	0.585	– 127.1	28.14	117.9	0.024	49.3	0.510	– 65.9
0.20	0.600	– 140.8	22.54	110.0	0.027	47.2	0.415	– 75.6
0.25	0.610	– 149.6	18.67	104.4	0.029	47.2	0.350	– 82.9
0.30	0.616	– 156.3	15.87	100.1	0.032	47.8	0.303	– 89.0
0.40	0.621	– 166.0	12.17	93.5	0.036	50.2	0.244	– 98.6
0.50	0.626	– 172.7	9.86	88.6	0.041	51.9	0.208	– 106.2
0.60	0.628	– 178.1	8.27	84.4	0.046	53.2	0.187	– 112.3
0.70	0.633	177.6	7.11	80.7	0.051	54.6	0.172	– 117.8
0.80	0.636	173.8	6.24	77.2	0.056	55.2	0.161	– 122.5
0.90	0.641	170.7	5.55	74.1	0.062	55.6	0.154	– 127.0
1.00	0.646	167.3	4.99	71.1	0.067	55.7	0.148	– 131.9
1.20	0.653	161.1	4.17	65.8	0.078	55.6	0.138	– 139.8
1.40	0.657	155.4	3.59	60.8	0.089	54.8	0.132	– 145.8
1.50	0.655	153.1	3.37	58.2	0.095	54.2	0.132	– 147.8
1.60	0.654	150.4	3.17	55.5	0.101	53.3	0.133	– 149.8
1.80	0.663	145.8	2.82	50.2	0.112	51.3	0.138	– 154.5
2.00	0.671	141.6	2.53	45.3	0.122	49.2	0.142	– 161.1
2.50	0.702	132.0	2.06	35.3	0.149	44.8	0.159	– 174.2
3.00	0.706	120.2	1.75	22.6	0.174	38.3	0.185	178.2

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



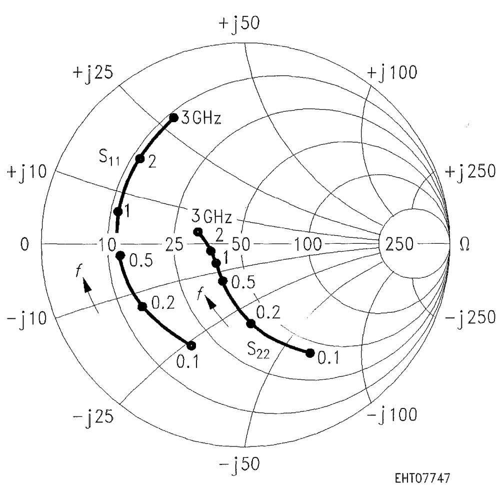
S_{12}, S_{21} = f (f)
I_C = 30 mA, V_{CE} = 8 V, Z_0 = 50 Ω



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} = 8 V, Z_0 = 50 Ω								
0.10	0.548	– 120.2	39.95	124.5	0.017	53.4	0.569	– 60.7
0.15	0.582	– 139.4	29.82	113.2	0.020	50.0	0.434	– 75.0
0.20	0.599	– 150.9	23.47	106.0	0.023	50.2	0.351	– 85.2
0.25	0.610	– 158.0	19.26	101.1	0.026	51.5	0.296	– 93.2
0.30	0.616	– 163.4	16.29	97.3	0.028	53.1	0.259	– 99.9
0.40	0.621	– 171.5	12.41	91.4	0.033	55.7	0.213	– 110.7
0.50	0.625	– 177.3	10.01	86.9	0.039	57.7	0.186	– 119.1
0.60	0.629	178.2	8.39	83.0	0.045	58.9	0.171	– 125.6
0.70	0.632	174.6	7.20	79.4	0.050	59.7	0.162	– 131.4
0.80	0.636	171.1	6.32	76.2	0.056	59.9	0.155	– 136.2
0.90	0.640	168.1	5.62	73.1	0.062	59.9	0.151	– 140.8
1.00	0.644	165.1	5.05	70.3	0.067	59.7	0.147	– 145.6
1.20	0.652	159.2	4.21	65.2	0.079	58.9	0.142	– 153.4
1.40	0.657	153.8	3.63	60.4	0.091	57.5	0.138	– 159.4
1.50	0.653	151.6	3.41	57.8	0.097	56.6	0.138	– 161.1
1.60	0.655	149.0	3.21	55.1	0.103	55.5	0.139	– 162.8
1.80	0.663	144.5	2.85	49.9	0.115	53.0	0.145	– 166.7
2.00	0.670	140.8	2.56	45.1	0.125	50.8	0.151	– 172.7
2.50	0.700	131.2	2.08	35.3	0.153	45.6	0.169	176.0
3.00	0.704	119.6	1.77	22.7	0.178	38.6	0.193	169.8

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



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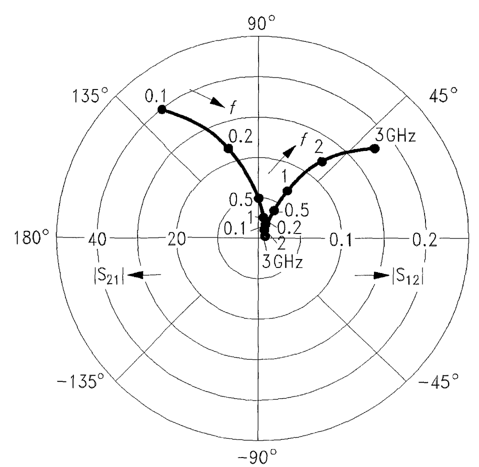
S_{12}, S_{21} = f (f)
I_C = 50 mA, V_{CE} = 8 V, Z_0 = 50 Ω



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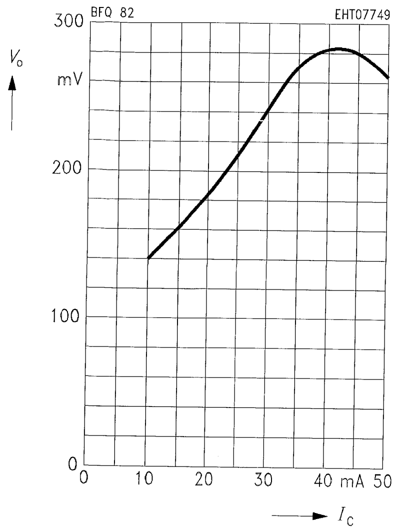
Common Emitter Large Signal Parameters

Linear output voltage $V_o = f\,(I_C)$

V_{CE} = 8 V, d_{IM} = 60 dB, f_1 = 806 MHz,
f_2 = 810 MHz, $Z_S = Z_L$ = 50 Ω



Note:

The transistor is driven by 2 adjacent signals f_1, f_2 with equal <u>output</u> power levels P_o for each carrier.
The distance d_{IM} between P_o and the third order intermodulation products P_{IM}
($2f_1 - f_2$ or $2f_2 - f_1$) is:

$d_{IM} = P_o - P_{IM}$
where $P_o = 10 \log (V_o^2/(50\ \Omega \cdot 1\ \text{mW}))$ (dBm)
and V_o = linear <u>output</u> voltage of each carrier.

The 3rd order intercept point IP_3 will be found by extrapolation to the point where P_{IM} would be identical to P_o:

IP_3 (output) = $P_o + d_{IM}/2$.

Linear output voltages for other d_{IM} (e.g. 50 dB) can be calculated thereby.

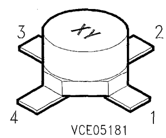
SIEMENS

NPN Silicon RF Transistor

BFQ 181

Preliminary Data

- For low-noise, high-gain broadband amplifiers at collector currents from 0.5 mA to 12 mA.
- f_T = 8 GHz
  F = 1.3 dB at 900 MHz



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 181	181	Q62702-F1295	B	E	C	E	Cerec-X

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CEO}	12	V
Collector-emitter voltage, $V_{BE} = 0$	V_{CES}	20	
Collector-base voltage	V_{CBO}	20	
Emitter-base voltage	V_{EBO}	2	
Collector current	I_C	20	mA
Peak collector current, $f \geq 10$ MHz	I_{CM}	35	
Base current	I_B	2	
Peak base current, $f \geq 10$ MHz	I_{BM}	3	
Total power dissipation, $T_S \leq 113$ ˚C[3)]	P_{tot}	175	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)]	$R_{th\,JA}$	≤ 435	K/W
Junction - soldering point[3)]	$R_{th\,JS}$	≤ 355	

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

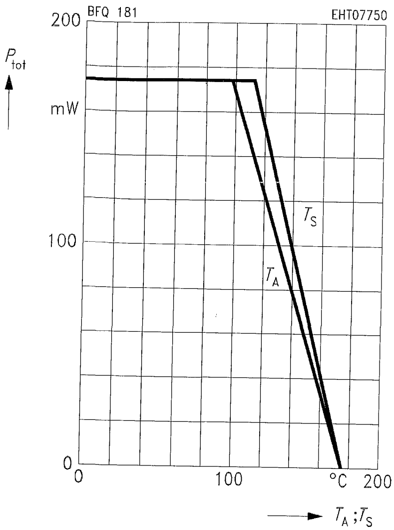
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CE0}$	12	–	–	V
Collector-emitter cutoff current V_{CE} = 20 V, V_{BE} = 0	I_{CES}	–	–	100	µA
Collector-base cutoff current V_{CB} = 10 V, I_E = 0 V_{CB} = 10 V, I_E = 0, T_A = 125 °C	I_{CB0}	 – –	 – –	 0.1 5	
Emitter-base cutoff current V_{EB} = 1 V, I_C = 0	I_{EB0}	–	–	1	
DC current gain I_C = 5 mA, V_{CE} = 6 V I_C = 10 mA, V_{CE} = 6 V	h_{FE}	 50 –	 100 100	 250 –	–
Collector-emitter saturation voltage I_C = 15 mA, I_B = 1.5 mA	V_{CEsat}	–	0.15	0.4	V

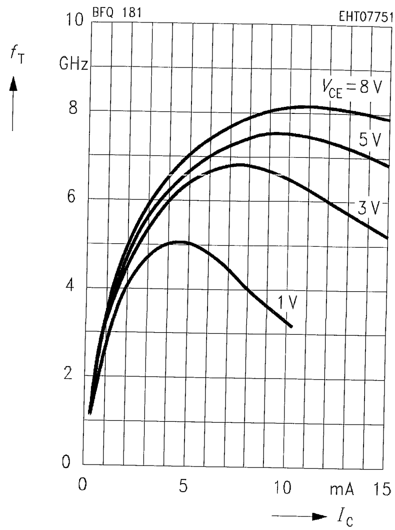
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
AC Characteristics					
Transition frequency	f_T				GHz
I_C = 6 mA, V_{CE} = 3 V, f = 500 MHz		–	6.7	–	
I_C = 10 mA, V_{CE} = 8 V, f = 500 MHz		–	8	–	
Collector-base capacitance V_{CB} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{cb}	–	0.22	–	pF
Collector-emitter capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{ce}	–	0.32	–	
Input capacitance V_{EB} = 0.5 V, I_C = i_c = 0, f = 1 MHz	C_{ibo}	–	0.6	–	
Output capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{obs}	–	0.55	–	
Noise figure	F				dB
I_C = 3 mA, V_{CE} = 5 V, f = 10 MHz, Z_S = 75 Ω		–	1.1	–	
I_C = 3 mA, V_{CE} = 5 V, f = 900 MHz, Z_S = Z_{Sopt}		–	1.3	–	
I_C = 3 mA, V_{CE} = 5 V, f = 1.75 GHz, Z_S = Z_{Sopt}		–	1.8	–	

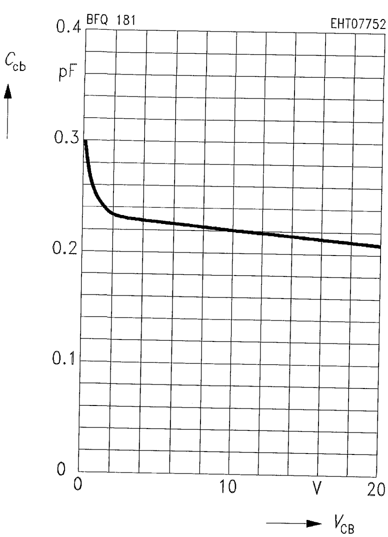
Total power dissipation $P_{tot} = f\,(T_A{}^*;\, T_S)$
* Package mounted on alumina



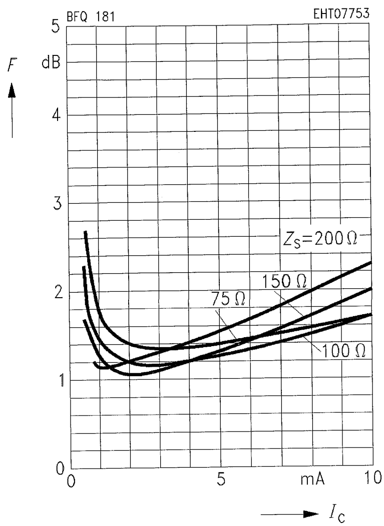
Transition frequency $f_T = f\,(I_C)$
f = 500 MHz



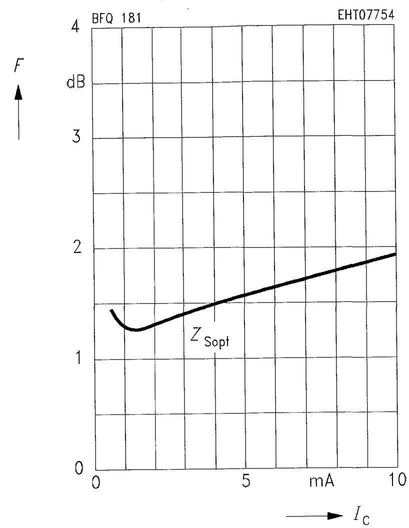
Collector-base capacitance $C_{cb} = f\,(V_{CB})$
$V_{BE} = v_{be} = 0$, f = 1 MHz



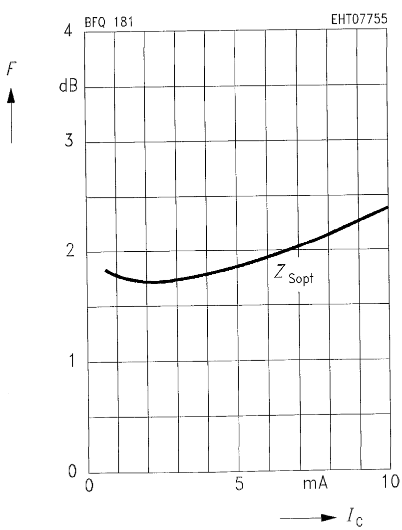
Noise figure $F = f\,(I_C)$
V_{CE} = 5 V, f = 10 MHz



Noise figure $F = f\,(I_C)$
V_{CE} = 5 V, f = 900 MHz



Noise figure $F = f\,(I_C)$
V_{CE} = 5 V, f = 1.75 GHz, $Z_{Lopt}\,(G)$



Common Emitter S Parameters

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_C = 2 mA, V_{CE} = 2.5 V, Z_0 = 50 Ω								
0.10	0.918	– 11.0	6.55	171.1	0.013	83.2	0.991	– 4.7
0.20	0.901	– 21.8	6.44	162.6	0.025	77.2	0.978	– 9.2
0.30	0.876	– 32.1	6.25	154.4	0.037	71.2	0.957	– 13.5
0.40	0.845	– 42.1	6.01	146.5	0.047	65.6	0.931	– 17.5
0.50	0.810	– 51.7	5.74	139.0	0.056	60.6	0.903	– 21.0
0.60	0.774	– 60.7	5.45	132.2	0.064	55.8	0.873	– 24.2
0.70	0.738	– 69.2	5.15	125.8	0.071	51.9	0.844	– 27.1
0.80	0.713	– 77.1	4.87	119.8	0.077	48.0	0.816	– 29.6
0.90	0.671	– 84.8	4.60	114.2	0.081	45.1	0.790	– 31.9
0.95	0.655	– 88.6	4.47	111.6	0.083	43.6	0.779	– 32.9
1.00	0.640	– 92.2	4.34	109.1	0.085	42.1	0.768	– 34.0
1.20	0.589	– 105.5	3.88	99.8	0.092	37.5	0.728	– 37.7
1.40	0.548	– 117.6	3.50	91.6	0.096	33.7	0.695	– 40.9
1.60	0.518	– 128.3	3.17	84.4	0.100	30.6	0.671	– 44.1
1.70	0.507	– 134.2	3.03	80.8	0.102	29.4	0.660	– 45.6
1.75	0.500	– 136.5	2.96	79.1	0.103	28.8	0.654	– 46.4
1.80	0.492	– 138.5	2.89	77.5	0.104	28.2	0.649	– 47.1
2.00	0.478	– 148.5	2.67	71.1	0.107	26.2	0.633	– 50.2
2.50	0.452	– 169.1	2.22	56.7	0.113	22.6	0.604	– 58.2
3.00	0.443	173.2	1.93	43.0	0.119	20.3	0.581	– 66.0
I_C = 5 mA, V_{CE} = 2.5 V, Z_0 = 50 Ω								
0.10	0.810	– 18.8	13.52	165.9	0.012	80.2	0.975	– 7.5
0.20	0.770	– 36.4	12.75	153.0	0.023	71.2	0.933	– 14.3
0.30	0.719	– 52.4	11.71	141.8	0.032	63.9	0.880	– 19.8
0.40	0.667	– 66.7	10.61	132.0	0.039	58.1	0.824	– 24.0
0.50	0.618	– 79.4	9.57	123.5	0.044	53.6	0.773	– 27.2
0.60	0.575	– 90.7	8.63	116.4	0.048	50.1	0.729	– 29.6
0.70	0.541	– 100.6	7.82	110.2	0.052	47.7	0.692	– 31.5
0.80	0.516	– 109.6	7.11	104.6	0.055	45.8	0.662	– 33.0
0.90	0.489	– 117.8	6.50	99.7	0.058	44.4	0.636	– 34.2
0.95	0.479	– 121.8	6.24	97.5	0.059	43.8	0.626	– 34.8
1.00	0.470	– 125.6	5.98	95.3	0.061	43.3	0.617	– 35.5
1.20	0.443	– 138.7	5.14	87.6	0.065	42.0	0.586	– 37.7
1.40	0.426	– 149.9	4.51	80.8	0.070	41.1	0.564	– 40.0
1.60	0.416	– 159.5	4.00	74.7	0.075	40.5	0.548	– 42.4
1.70	0.415	– 164.7	3.79	71.8	0.077	40.3	0.542	– 43.8
1.75	0.413	– 166.7	3.70	70.4	0.078	40.2	0.538	– 44.4
1.80	0.409	– 168.4	3.60	69.1	0.079	40.0	0.535	– 45.0
2.00	0.409	– 176.7	3.28	63.7	0.084	39.5	0.526	– 47.8
2.50	0.409	166.7	2.67	51.4	0.097	37.7	0.509	– 55.7
3.00	0.415	153.0	2.28	39.6	0.110	35.6	0.497	– 63.6

Common Emitter S Parameters (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
$I_C = 2$ mA, $V_{CE} = 5$ V, $Z_0 = 50\ \Omega$								
0.10	0.923	– 10.4	6.53	171.4	0.012	83.6	0.992	– 4.5
0.20	0.906	– 20.6	6.43	163.2	0.024	77.7	0.979	– 8.9
0.30	0.884	– 30.6	6.26	155.3	0.035	71.8	0.961	– 13.0
0.40	0.854	– 40.1	6.03	147.7	0.045	66.5	0.936	– 16.9
0.50	0.819	– 49.3	5.78	140.4	0.054	61.7	0.910	– 20.4
0.60	0.784	– 58.0	5.51	133.6	0.061	57.1	0.882	– 23.6
0.70	0.749	– 66.2	5.23	127.4	0.068	53.1	0.854	– 26.4
0.80	0.723	– 74.0	4.95	121.4	0.075	49.4	0.827	– 29.0
0.90	0.681	– 81.4	4.69	115.9	0.079	46.3	0.802	– 31.3
0.95	0.664	– 85.1	4.57	113.3	0.081	44.8	0.790	– 32.4
1.00	0.650	– 88.6	4.44	110.8	0.083	43.4	0.779	– 33.4
1.20	0.596	– 101.7	3.99	101.5	0.090	38.7	0.739	– 37.2
1.40	0.553	– 113.5	3.61	93.3	0.095	34.8	0.707	– 40.6
1.60	0.520	– 124.4	3.27	86.1	0.099	31.6	0.681	– 43.7
1.70	0.507	– 130.2	3.13	82.4	0.101	30.3	0.670	– 45.3
1.75	0.500	– 132.4	3.06	80.7	0.102	29.7	0.664	– 46.0
1.80	0.492	– 134.4	2.99	79.2	0.103	29.1	0.659	– 46.7
2.00	0.475	– 144.5	2.76	72.7	0.106	27.1	0.642	– 49.8
2.50	0.444	– 165.5	2.30	58.3	0.112	23.1	0.611	– 57.7
3.00	0.431	176.4	2.00	44.6	0.118	20.7	0.588	– 65.3
$I_C = 5$ mA, $V_{CE} = 5$ V, $Z_0 = 50\ \Omega$								
0.10	0.824	– 17.3	13.54	166.7	0.012	80.4	0.978	– 7.2
0.20	0.785	– 33.6	12.86	154.5	0.022	72.2	0.940	– 13.7
0.30	0.737	– 48.6	11.91	143.6	0.031	65.4	0.891	– 19.1
0.40	0.684	– 62.0	10.88	134.1	0.038	59.7	0.838	– 23.5
0.50	0.634	– 74.2	9.89	125.7	0.043	55.2	0.788	– 26.8
0.60	0.589	– 85.1	8.97	118.5	0.048	51.6	0.744	– 29.4
0.70	0.552	– 94.9	8.16	112.3	0.052	49.1	0.706	– 31.4
0.80	0.522	– 103.6	7.45	106.7	0.055	46.9	0.675	– 33.1
0.90	0.493	– 111.8	6.84	101.7	0.058	45.5	0.649	– 34.4
0.95	0.482	– 115.6	6.57	99.5	0.059	44.9	0.638	– 35.1
1.00	0.471	– 119.5	6.31	97.3	0.060	44.3	0.628	– 35.7
1.20	0.439	– 132.7	5.44	89.5	0.065	42.7	0.594	– 38.0
1.40	0.418	– 144.4	4.78	82.6	0.070	41.6	0.570	– 40.3
1.60	0.402	– 154.1	4.25	76.5	0.075	40.8	0.553	– 42.7
1.70	0.401	– 159.6	4.02	73.6	0.077	40.6	0.546	– 44.0
1.75	0.398	– 161.5	3.92	72.1	0.078	40.3	0.542	– 44.6
1.80	0.393	– 163.3	3.82	70.8	0.079	40.2	0.538	– 45.2
2.00	0.392	– 172.1	3.49	65.4	0.084	39.5	0.528	– 48.0
2.50	0.390	170.8	2.84	53.1	0.097	37.6	0.509	– 55.5
3.00	0.395	156.1	2.43	41.4	0.109	35.5	0.495	– 63.2

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} = 5 V, Z_0 = 50 Ω								
0.10	0.697	– 26.2	20.63	161.3	0.011	77.3	0.954	– 10.0
0.20	0.640	– 49.6	18.51	145.4	0.019	67.7	0.882	– 17.9
0.30	0.581	– 69.2	16.11	132.7	0.026	60.7	0.803	– 23.3
0.40	0.529	– 85.7	13.92	122.6	0.031	56.3	0.734	– 26.7
0.50	0.490	– 99.5	12.10	114.5	0.034	53.7	0.680	– 28.8
0.60	0.457	– 111.1	10.61	107.9	0.037	51.8	0.639	– 30.1
0.70	0.436	– 121.1	9.41	102.4	0.041	51.0	0.607	– 31.2
0.80	0.421	– 129.8	8.43	97.6	0.043	50.5	0.583	– 32.0
0.90	0.408	– 137.5	7.62	93.3	0.046	50.3	0.564	– 32.8
0.95	0.402	– 141.1	7.27	91.4	0.047	50.2	0.556	– 33.2
1.00	0.398	– 144.7	6.94	89.4	0.049	50.1	0.549	– 33.6
1.20	0.386	– 156.3	5.89	82.8	0.054	50.2	0.528	– 35.3
1.40	0.382	– 165.9	5.12	76.8	0.060	50.1	0.512	– 37.4
1.60	0.378	– 173.8	4.52	71.3	0.065	49.8	0.501	– 39.8
1.70	0.383	– 178.4	4.27	68.8	0.069	49.5	0.497	– 41.1
1.75	0.381	– 179.9	4.16	67.5	0.070	49.4	0.495	– 41.7
1.80	0.378	178.7	4.05	66.3	0.071	49.2	0.492	– 42.4
2.00	0.384	171.4	3.68	61.4	0.077	48.5	0.486	– 45.2
2.50	0.392	157.6	2.98	50.1	0.093	46.0	0.474	– 53.2
3.00	0.402	145.7	2.53	39.3	0.108	43.0	0.464	– 61.2
I_C = 10 mA, V_{CE} = 8 V, Z_0 = 50 Ω								
0.10	0.727	– 24.0	20.65	162.2	0.011	78.1	0.957	– 9.7
0.20	0.669	– 45.5	18.73	146.9	0.019	68.7	0.890	– 17.6
0.30	0.606	– 64.0	16.47	134.5	0.026	61.8	0.814	– 23.2
0.40	0.549	– 79.7	14.35	124.4	0.031	57.4	0.745	– 26.9
0.50	0.503	– 93.1	12.55	116.3	0.035	54.6	0.689	– 29.3
0.60	0.465	– 104.5	11.05	109.6	0.038	52.6	0.645	– 30.8
0.70	0.439	– 114.5	9.83	104.0	0.042	51.4	0.611	– 32.0
0.80	0.419	– 123.3	8.83	99.1	0.044	50.9	0.585	– 33.0
0.90	0.402	– 131.1	7.99	94.8	0.047	50.5	0.564	– 33.7
0.95	0.395	– 134.8	7.63	92.8	0.048	50.4	0.555	– 34.1
1.00	0.389	– 138.4	7.30	90.8	0.050	50.3	0.548	– 34.6
1.20	0.373	– 150.5	6.20	84.1	0.056	50.0	0.524	– 36.3
1.40	0.365	– 160.7	5.40	78.0	0.061	49.7	0.507	– 38.3
1.60	0.358	– 169.2	4.77	72.6	0.067	49.3	0.495	– 40.5
1.70	0.362	– 173.9	4.51	70.0	0.070	49.0	0.490	– 41.8
1.75	0.360	– 175.7	4.39	68.7	0.072	48.9	0.488	– 42.4
1.80	0.357	– 177.2	4.28	67.6	0.073	48.8	0.485	– 43.0
2.00	0.362	175.3	3.88	62.6	0.079	47.9	0.478	– 45.7
2.50	0.368	160.6	3.15	51.4	0.094	45.3	0.464	– 53.4
3.00	0.379	148.1	2.67	40.6	0.109	42.0	0.453	– 61.2

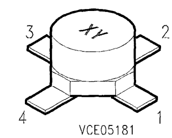
SIEMENS

NPN Silicon RF Transistor

BFQ 182

Preliminary Data

- For low-noise, high-gain broadband amplifiers at collector currents from 1 mA to 20 mA.
- f_T = 8 GHz
  F = 1.25 dB at 900 MHz



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 182	182	Q62702-F1355	B	E	C	E	Cerec-X

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CEO}	12	V
Collector-emitter voltage, $V_{BE} = 0$	V_{CES}	20	
Collector-base voltage	V_{CBO}	20	
Emitter-base voltage	V_{EBO}	2	
Collector current	I_C	35	mA
Peak collector current, $f \geq 10$ MHz	I_{CM}	50	
Base current	I_B	4	
Peak base current, $f \geq 10$ MHz	I_{BM}	5	
Total power dissipation, $T_S \leq 107$ ˚C[3]	P_{tot}	250	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]	$R_{th\,JA}$	≤ 350	K/W
Junction - soldering point[3]	$R_{th\,JS}$	≤ 270	

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

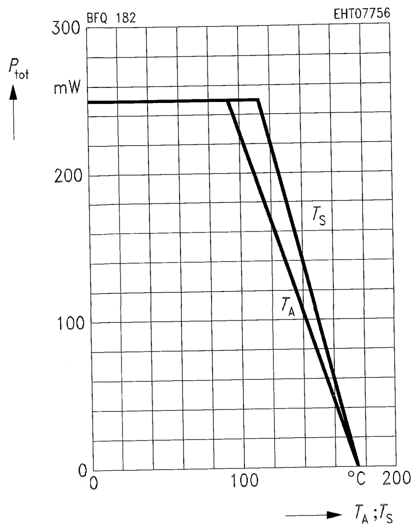
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CE0}$	12	–	–	V
Collector-emitter cutoff current V_{CE} = 20 V, V_{BE} = 0	I_{CES}	–	–	100	µA
Collector-base cutoff current V_{CB} = 10 V, I_E = 0 V_{CB} = 10 V, I_E = 0, T_A = 125 °C	I_{CB0}	 – –	 – –	 0.1 5	
Emitter-base cutoff current V_{EB} = 1 V, I_C = 0	I_{EB0}	–	–	1	
DC current gain I_C = 5 mA, V_{CE} = 6 V I_C = 20 mA, V_{CE} = 8 V	h_{FE}	 50 –	 90 100	 250 –	–
Collector-emitter saturation voltage I_C = 15 mA, I_B = 1.5 mA	V_{CEsat}	–	0.1	0.4	V
AC Characteristics					
Transition frequency I_C = 15 mA, V_{CE} = 6 V, f = 500 MHz I_C = 20 mA, V_{CE} = 8 V, f = 500 MHz	f_T	 – –	 8 8.3	 – –	GHz
Collector-base capacitance V_{CB} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{cb}	–	0.28	–	pF
Noise figure I_C = 6 mA, V_{CE} = 5 V, f = 10 MHz, Z_S = 75 Ω I_C = 6 mA, V_{CE} = 5 V, f = 900 MHz, Z_S = Z_{Sopt} I_C = 6 mA, V_{CE} = 5 V, f = 1.75 GHz, Z_S = Z_{Sopt}	F	 – – –	 1.1 1.25 1.7	 – – –	dB
Power gain I_C = 15 mA, V_{CE} = 6 V, f = 900 MHz, Z_0 = 50 Ω I_C = 15 mA, V_{CE} = 6 V, f = 1.75 GHz, Z_0 = 50 Ω	 G_{ms} 1) G_{ma} 2)	 – –	 22.5 16	 – –	
Transducer gain I_C = 15 mA, V_{CE} = 6 V, f = 900 MHz, Z_0 = 50 Ω	$\lvert S_{21e} \rvert^2$	–	17.5	–	

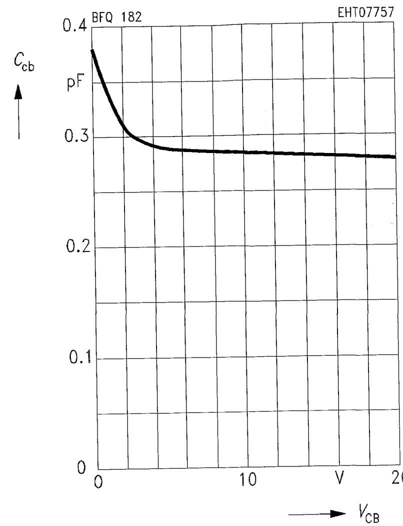
1) $G_{ms} = \left| \frac{S_{21e}}{S_{12e}} \right|$

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

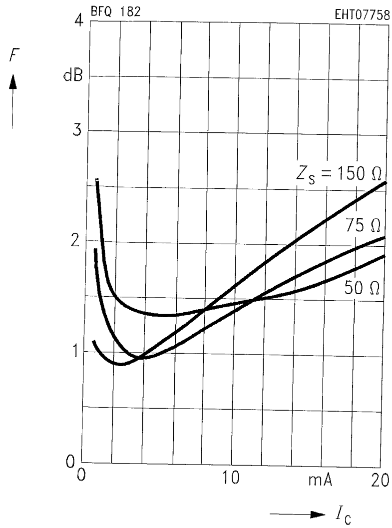
Total power dissipation $P_{tot} = f(T_A{}^*; T_S)$
* Package on alumina



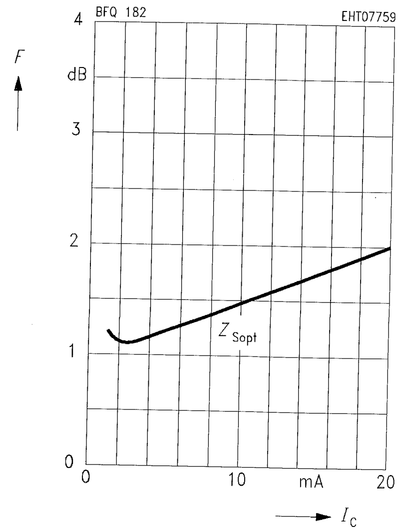
Collector-base capacitance $C_{cb} = f(V_{CB})$
$V_{BE} = v_{be} = 0, f = 1$ MHz



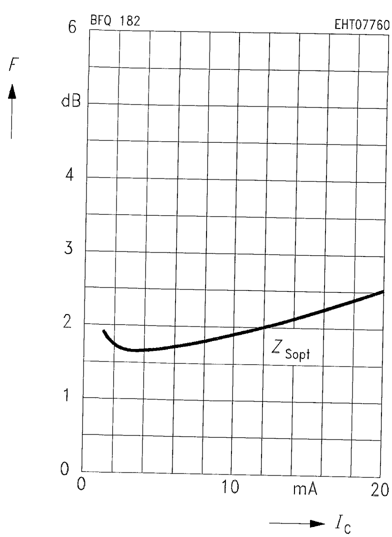
Noise figure $F = f(I_C)$
V_{CE} = 5 V, f = 10 MHz



Noise figure $F = f(I_C)$
V_{CE} = 5 V, f = 900 MHz, $Z_{Lopt}(G)$



Noise figure $F = f(I_C)$
V_{CE} = 5 V, f = 1.75 GHz, $Z_{Lopt}(G)$



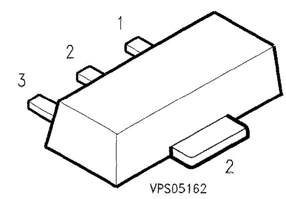
SIEMENS

NPN Silicon RF Transistor

BFQ 193

Preliminary Data

- For low-noise, high-gain amplifiers up to 2 GHz at collector currents up to 50 mA.
- For linear broadband amplifiers.
- f_T = 7.5 GHz
  F = 1.2 dB at 800 MHz



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

Type	Marking	Ordering Code (tape and reel)	Pin Configuration 1	2	3	Package[1]
BFQ 193	RCs	Q62702-F1312	B	C	E	SOT-89

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CEO}	12	V
Collector-emitter voltage, V_{BE} = 0	V_{CES}	20	
Collector-base voltage	V_{CBO}	20	
Emitter-base voltage	V_{EBO}	2	
Collector current	I_C	80	mA
Peak collector current, $f \geq$ 10 MHz	I_{CM}	80	
Base current	I_B	10	
Peak base current, $f \geq$ 10 MHz	I_{BM}	10	
Total power dissipation, $T_S \leq$ 93 ˚C[3]	P_{tot}	600	mW
Junction temperature	T_j	150	˚C
Ambient temperature range	T_A	– 65 ... + 150	
Storage temperature range	T_{stg}	– 65 ... + 150	

Thermal Resistance

Junction - ambient[2]	$R_{th\,JA}$	≤ 175	K/W
Junction - soldering point[3]	$R_{th\,JS}$	≤ 95	

1) For detailed information 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

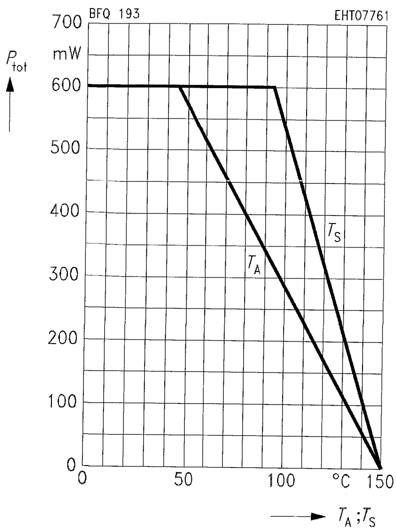
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CEO}$	12	–	–	V
Collector-emitter cutoff current V_{CE} = 20 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} = 1 V, I_C = 0	I_{EBO}	–	–	1	µA
DC current gain I_C = 5 mA, V_{CE} = 8 V I_C = 30 mA, V_{CE} = 8 V	h_{FE}	 – 50	 90 100	 – 250	–
Collector-emitter saturation voltage I_C = 50 mA, I_B = 5 mA	V_{CEsat}	–	0.1	0.4	V

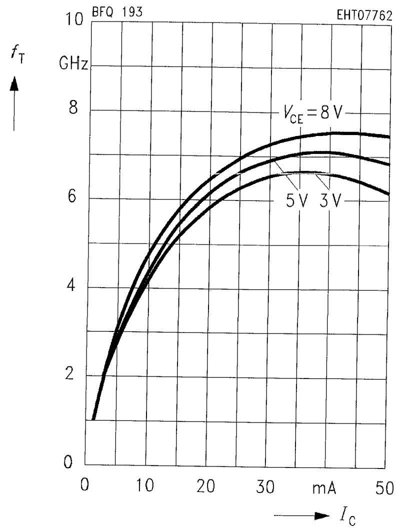
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
AC Characteristics					
Transition frequency	f_T				GHz
I_C = 20 mA, V_{CE} = 8 V, f = 500 MHz		–	6.5	–	
I_C = 50 mA, V_{CE} = 8 V, f = 500 MHz		–	7.5	–	
Collector-base capacitance V_{CB} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{cb}	–	0.78	–	pF
Collector-emitter capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{ce}	–	0.36	–	
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}	–	1.2	–	
Noise figure	F				dB
I_C = 5 mA, V_{CE} = 8 V, f = 10 MHz, Z_S = 75 Ω		–	0.8	–	
I_C = 7 mA, V_{CE} = 8 V, f = 800 MHz, Z_S = Z_{Sopt}		–	1.2	–	
I_C = 30 mA, V_{CE} = 8 V, f = 1 GHz, Z_S = Z_{Sopt}		–	1.8	–	
Power gain I_C = 40 mA, V_{CE} = 8 V, f = 500 MHz, Z_S = Z_{Sopt}, Z_L = Z_{Lopt}	G_{pe}	–	17	–	
Transducer gain I_C = 40 mA, V_{CE} = 8 V, f = 1 GHz, Z_0 = 50 Ω	$\|S_{21e}\|^2$	–	11	–	
Linear output voltage two-tone intermodulation test I_C = 50 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}	–	460	–	mV
Third order intercept point I_C = 50 mA, V_{CE} = 8 V, f = 800 MHz	IP_3	–	36	–	dBm

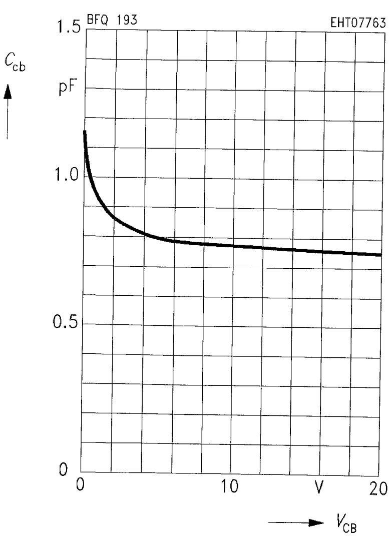
Total power dissipation $P_{tot} = f(T_A{}^*; T_S)$
* Package mounted on alumina



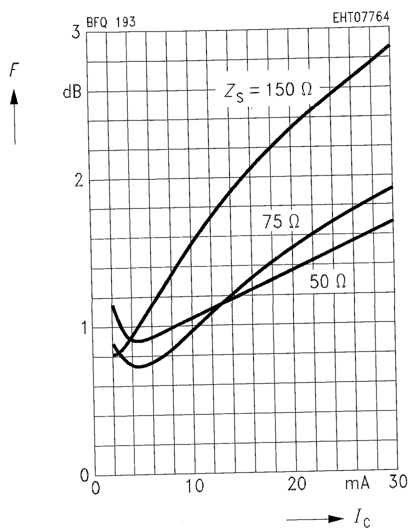
Transition frequency $f_T = f(I_C)$
f = 500 MHz



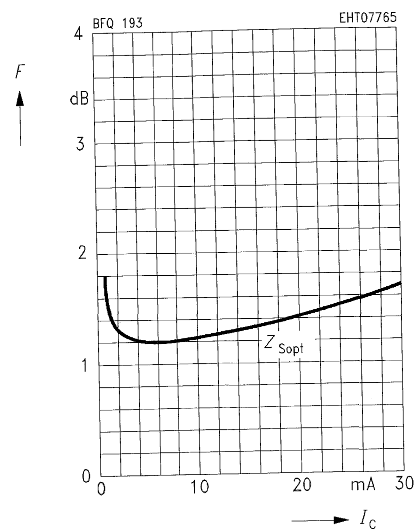
Collector-base capacitance $C_{cb} = f(V_{CB})$
$V_{BE} = v_{be} = 0, f = 1$ MHz



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



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



Common Emitter S Parameters

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_C = 10 mA, V_{CE} = 3 V, Z_0 = 50 Ω								
0.10	0.777	– 37.2	12.06	152.3	0.043	71.2	0.908	– 22.5
0.20	0.651	– 67.2	9.82	131.5	0.072	59.2	0.752	– 38.2
0.30	0.544	– 90.3	7.85	116.9	0.089	52.9	0.622	– 47.9
0.40	0.471	– 109.0	6.42	106.4	0.102	50.1	0.533	– 54.1
0.50	0.424	– 124.5	5.40	98.4	0.112	49.0	0.474	– 58.4
0.60	0.392	– 137.7	4.63	91.7	0.123	48.7	0.432	– 61.8
0.70	0.375	– 149.9	4.06	85.9	0.132	48.7	0.402	– 64.7
0.80	0.366	– 160.3	3.62	80.7	0.142	48.8	0.380	– 67.2
0.90	0.363	– 170.0	3.26	76.0	0.152	48.9	0.362	– 69.4
1.00	0.361	– 178.0	2.96	71.7	0.162	49.1	0.349	– 71.4
1.20	0.365	166.9	2.51	64.1	0.183	49.2	0.332	– 75.2
1.40	0.366	153.3	2.19	57.3	0.204	49.0	0.328	– 79.1
1.60	0.375	142.7	1.96	50.9	0.226	48.1	0.331	– 83.4
1.80	0.388	133.3	1.77	44.9	0.247	46.9	0.332	– 87.6
2.00	0.410	126.6	1.62	39.6	0.268	45.8	0.331	– 92.0
2.50	0.455	108.7	1.37	28.0	0.326	41.9	0.341	– 103.4
3.00	0.483	92.2	1.20	17.1	0.379	36.5	0.366	– 113.1
I_C = 20 mA, V_{CE} = 3 V, Z_0 = 50 Ω								
0.10	0.605	– 56.3	18.77	140.1	0.037	66.2	0.797	– 33.4
0.20	0.462	– 93.3	13.05	117.9	0.056	58.6	0.576	– 49.4
0.30	0.384	– 118.2	9.57	105.4	0.070	57.4	0.449	– 56.9
0.40	0.346	– 136.9	7.49	97.0	0.083	57.8	0.378	– 61.1
0.50	0.324	– 151.3	6.13	90.7	0.096	58.6	0.338	– 64.0
0.60	0.312	– 162.8	5.19	85.3	0.109	59.0	0.311	– 66.6
0.70	0.311	– 173.4	4.50	80.6	0.123	59.2	0.294	– 69.2
0.80	0.312	178.5	3.98	76.3	0.136	59.1	0.283	– 71.5
0.90	0.319	170.6	3.56	72.4	0.149	58.7	0.272	– 73.9
1.00	0.321	163.9	3.23	68.8	0.163	58.3	0.266	– 75.9
1.20	0.334	151.7	2.73	62.4	0.189	57.0	0.257	– 80.2
1.40	0.338	139.8	2.38	56.2	0.216	55.2	0.260	– 84.2
1.60	0.349	131.0	2.12	50.4	0.242	53.0	0.268	– 88.8
1.80	0.362	123.1	1.91	45.1	0.266	50.8	0.272	– 93.2
2.00	0.382	118.2	1.76	40.1	0.291	48.6	0.273	– 98.2
2.50	0.427	102.7	1.48	29.0	0.351	42.5	0.285	– 109.4
3.00	0.448	87.7	1.30	18.5	0.403	35.7	0.310	– 118.6

Common Emitter S Parameters (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_C = 30 mA, V_{CE} = 3 V, Z_0 = 50 Ω								
0.10	0.503	– 70.0	22.07	133.1	0.033	64.6	0.715	– 39.7
0.20	0.386	– 109.9	14.15	111.8	0.050	60.6	0.482	– 54.4
0.30	0.336	– 134.2	10.07	100.7	0.064	61.4	0.370	– 60.4
0.40	0.316	– 151.6	7.77	93.3	0.078	62.7	0.313	– 63.6
0.50	0.306	– 164.3	6.32	87.7	0.092	63.3	0.282	– 66.2
0.60	0.300	– 174.7	5.33	82.9	0.107	63.5	0.263	– 68.6
0.70	0.304	176.6	4.61	78.6	0.122	63.3	0.251	– 71.2
0.80	0.308	169.6	4.07	74.6	0.136	62.8	0.244	– 73.7
0.90	0.316	163.0	3.64	71.0	0.151	62.2	0.237	– 76.2
1.00	0.321	157.1	3.29	67.6	0.165	61.3	0.233	– 78.5
1.20	0.335	146.0	2.78	61.5	0.193	59.4	0.228	– 83.0
1.40	0.340	134.9	2.43	55.6	0.221	57.2	0.233	– 87.0
1.60	0.352	126.9	2.16	50.0	0.248	54.5	0.244	– 91.8
1.80	0.361	119.7	1.95	44.8	0.274	51.9	0.250	– 96.4
2.00	0.382	115.4	1.79	40.0	0.299	49.4	0.251	– 101.6
2.50	0.424	100.7	1.51	29.1	0.360	42.7	0.265	– 112.9
3.00	0.445	86.2	1.32	18.8	0.412	35.5	0.291	– 121.7
I_C = 20 mA, V_{CE} = 5 V, Z_0 = 50 Ω								
0.10	0.516	– 67.6	22.24	133.4	0.032	65.1	0.725	– 37.3
0.20	0.388	– 106.6	14.32	112.1	0.048	60.9	0.497	– 50.7
0.30	0.329	– 131.1	10.21	101.0	0.062	61.6	0.387	– 55.6
0.40	0.307	– 148.5	7.89	93.6	0.075	62.8	0.331	– 58.1
0.50	0.294	– 161.8	6.42	87.9	0.089	63.6	0.301	– 60.2
0.60	0.287	– 172.5	5.41	83.2	0.103	63.9	0.282	– 62.2
0.70	0.291	178.3	4.68	78.9	0.117	63.7	0.270	– 64.6
0.80	0.294	171.0	4.13	75.0	0.131	63.3	0.263	– 66.9
0.90	0.302	164.0	3.70	71.3	0.145	62.6	0.256	– 69.2
1.00	0.307	157.9	3.34	67.9	0.159	62.0	0.252	– 71.4
1.20	0.321	146.5	2.82	61.8	0.186	60.1	0.247	– 75.7
1.40	0.329	135.6	2.46	56.0	0.214	58.1	0.253	– 79.9
1.60	0.339	127.0	2.19	50.3	0.240	55.5	0.263	– 84.9
1.80	0.350	119.7	1.97	45.2	0.265	53.1	0.269	– 89.7
2.00	0.371	115.5	1.81	40.4	0.290	50.6	0.270	– 94.9
2.50	0.416	100.5	1.52	29.5	0.351	44.1	0.283	– 106.5
3.00	0.437	86.4	1.33	19.1	0.403	37.1	0.311	– 116.0

Common Emitter S Parameters (continued)

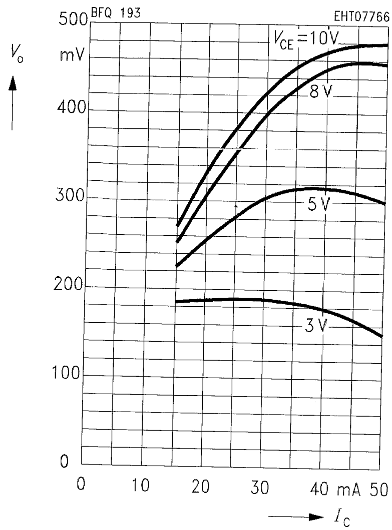
f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_C = 30 mA, V_{CE} = 5 V, Z_0 = 50 Ω								
0.10	0.568	– 59.6	20.97	137.4	0.034	66.0	0.767	– 35.6
0.20	0.423	– 96.8	14.10	115.5	0.053	60.0	0.540	– 51.3
0.30	0.347	– 121.4	10.21	103.7	0.067	59.6	0.418	– 58.2
0.40	0.313	– 139.7	7.94	95.8	0.080	60.6	0.352	– 62.1
0.50	0.294	– 154.2	6.49	89.8	0.094	61.2	0.315	– 64.9
0.60	0.283	– 165.8	5.47	84.8	0.108	61.5	0.292	– 67.4
0.70	0.283	– 176.0	4.74	80.3	0.122	61.4	0.276	– 70.0
0.80	0.285	175.9	4.20	76.3	0.136	61.1	0.266	– 72.4
0.90	0.292	168.4	3.75	72.6	0.150	60.5	0.256	– 74.8
1.00	0.296	161.6	3.40	69.1	0.164	59.9	0.251	– 77.0
1.20	0.308	149.2	2.87	62.8	0.191	58.2	0.243	– 81.2
1.40	0.315	137.5	2.50	56.9	0.219	56.2	0.246	– 85.1
1.60	0.327	128.5	2.23	51.3	0.245	53.7	0.255	– 89.7
1.80	0.337	121.1	2.00	46.0	0.270	51.3	0.260	– 94.3
2.00	0.359	116.6	1.84	41.3	0.294	48.8	0.260	– 99.4
2.50	0.405	101.2	1.56	30.3	0.354	42.5	0.270	– 110.3
3.00	0.426	86.6	1.36	19.8	0.405	35.4	0.296	– 119.2
I_C = 40 mA, V_{CE} = 5 V, Z_0 = 50 Ω								
0.10	0.584	– 58.1	20.69	138.2	0.035	65.9	0.767	– 36.1
0.20	0.435	– 95.0	14.05	116.2	0.054	59.6	0.539	– 52.4
0.30	0.356	– 119.6	10.20	104.2	0.068	59.2	0.415	– 59.8
0.40	0.319	– 138.2	7.95	96.2	0.082	60.1	0.348	– 64.0
0.50	0.298	– 152.6	6.50	90.2	0.096	60.7	0.311	– 67.0
0.60	0.286	– 164.2	5.48	85.1	0.110	61.0	0.286	– 69.7
0.70	0.285	– 174.8	4.75	80.6	0.124	61.0	0.271	– 72.4
0.80	0.287	177.1	4.20	76.5	0.138	60.6	0.260	– 74.9
0.90	0.293	169.1	3.76	72.8	0.152	60.1	0.250	– 77.3
1.00	0.296	162.5	3.40	69.3	0.166	59.5	0.244	– 79.5
1.20	0.310	149.8	2.88	63.0	0.194	57.8	0.236	– 83.8
1.40	0.315	138.0	2.51	57.0	0.221	55.7	0.239	– 87.6
1.60	0.326	129.2	2.23	51.5	0.248	53.2	0.248	– 92.2
1.80	0.335	121.5	2.01	46.1	0.272	50.8	0.252	– 96.7
2.00	0.358	116.7	1.85	41.3	0.297	48.4	0.253	– 101.8
2.50	0.402	101.3	1.56	30.3	0.357	41.9	0.263	– 112.6
3.00	0.424	86.9	1.37	19.9	0.408	34.9	0.288	– 121.2

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} = 8 V, Z_0 = 50 Ω								
0.10	0.639	– 52.1	19.26	141.1	0.035	67.1	0.806	– 31.8
0.20	0.478	– 86.9	13.55	119.0	0.055	59.3	0.590	– 47.3
0.30	0.383	– 111.1	9.99	106.4	0.069	58.0	0.463	– 54.5
0.40	0.333	– 129.8	7.83	98.0	0.081	58.5	0.392	– 58.4
0.50	0.305	– 144.7	6.42	91.6	0.094	59.0	0.350	– 61.2
0.60	0.287	– 157.1	5.43	86.3	0.108	59.5	0.323	– 63.6
0.70	0.283	– 168.2	4.72	81.6	0.121	59.6	0.305	– 66.0
0.80	0.283	– 177.3	4.18	77.4	0.134	59.5	0.294	– 68.3
0.90	0.287	174.2	3.74	73.5	0.147	59.1	0.282	– 70.5
1.00	0.290	166.7	3.39	69.9	0.160	58.7	0.275	– 72.5
1.20	0.300	153.5	2.86	63.5	0.186	57.3	0.266	– 76.5
1.40	0.305	141.0	2.49	57.4	0.212	55.6	0.268	– 80.4
1.60	0.318	131.5	2.22	51.7	0.238	53.3	0.276	– 85.1
1.80	0.328	123.6	2.00	46.3	0.262	51.2	0.280	– 89.5
2.00	0.353	118.4	1.84	41.5	0.286	49.0	0.279	– 94.4
2.50	0.398	102.6	1.55	30.5	0.345	43.0	0.289	– 105.6
3.00	0.421	87.6	1.35	19.8	0.396	36.3	0.315	– 114.8
I_C = 40 mA, V_{CE} = 8 V, Z_0 = 50 Ω								
0.10	0.530	– 65.5	23.58	132.9	0.032	65.0	0.706	– 39.4
0.20	0.382	– 103.1	15.08	111.7	0.048	61.4	0.476	– 53.5
0.30	0.315	– 127.7	10.72	100.9	0.063	62.4	0.366	– 58.9
0.40	0.286	– 145.8	8.27	93.6	0.077	63.6	0.311	– 61.8
0.50	0.271	– 159.6	6.73	88.1	0.091	64.2	0.281	– 64.1
0.60	0.263	– 170.7	5.66	83.5	0.106	64.3	0.262	– 66.4
0.70	0.265	179.3	4.90	79.3	0.121	64.0	0.251	– 69.0
0.80	0.267	171.8	4.33	75.5	0.135	63.5	0.244	– 71.4
0.90	0.276	164.3	3.87	71.9	0.150	62.6	0.236	– 73.9
1.00	0.279	158.1	3.50	68.6	0.164	61.8	0.233	– 76.1
1.20	0.293	146.0	2.96	62.6	0.193	59.8	0.227	– 80.5
1.40	0.301	134.7	2.57	56.9	0.220	57.5	0.232	– 84.5
1.60	0.312	126.0	2.29	51.4	0.247	54.7	0.242	– 89.4
1.80	0.321	118.9	2.06	46.3	0.272	52.1	0.248	– 94.0
2.00	0.344	114.5	1.89	41.5	0.297	49.5	0.249	– 99.3
2.50	0.389	99.9	1.59	30.8	0.357	42.8	0.260	– 110.4
3.00	0.412	85.6	1.40	20.3	0.408	35.6	0.287	– 119.2

Common Emitter Large Signal Parameters

Linear output voltage $V_o = f\ (I_C)$
d_{IM} = 60 dB, f_1 = 806 MHz,
f_2 = 810 MHz, $Z_S = Z_L$ = 50 Ω



Note:

The transistor is driven by 2 adjacent signals f_1, f_2 with equal output power levels P_o for each carrier.

The distance d_{IM} between P_o and the third order intermodulation products P_{IM} ($2f_1 - f_2$ or $2f_2 - f_1$) is:

$d_{IM} = P_o - P_{IM}$
where $P_o = 10 \log (V_o^2/(50\ \Omega \cdot 1\ \text{mW}))$ (dBm)
and V_o = linear output voltage of each carrier.

The 3rd order intercept point IP_3 will be found by extrapolation to the point where P_{IM} would be identical to P_o:

IP_3 (output) $= P_o + d_{IM}/2$.

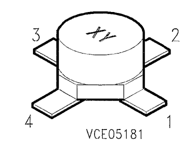
Linear output voltages for other d_{IM} (e.g. 50 dB) can be calculated thereby.

SIEMENS

PNP Silicon RF Transistor — BFQ 194

Preliminary Data

- For low-distortion broadband amplifiers in antenna and telecommunications systems up to 1.5 GHz at collector currents from 20 mA to 80 mA.
- f_T = 4.5 GHz
- Complementary type: BFQ 73S (NPN).



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 194	194	Q62702-F1345	B	E	C	E	Cerec-X

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CEO}	15	V
Collector-base voltage	V_{CBO}	20	
Emitter-base voltage	V_{EBO}	3	
Collector current	I_C	100	mA
Peak collector current, $f \geq 10$ MHz	I_{CM}	120	
Base current	I_B	10	
Peak base current, $f \geq 10$ MHz	I_{BM}	12	
Total power dissipation, $T_S \leq 91$ °C[3]	P_{tot}	650	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]	$R_{th\,JA}$	≤ 210	K/W
Junction - soldering point[3]	$R_{th\,JS}$	≤ 130	

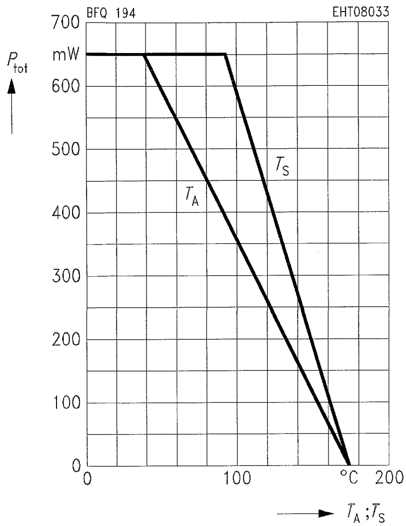
1) For detailed information see chapter Package Outlines.
2) Package mounted on alumina 15 mm × 16.7 mm × 0.7 mm.
3) T_S is measured on the collector lead at the soldering point to the pcb.

Electrical Characteristics

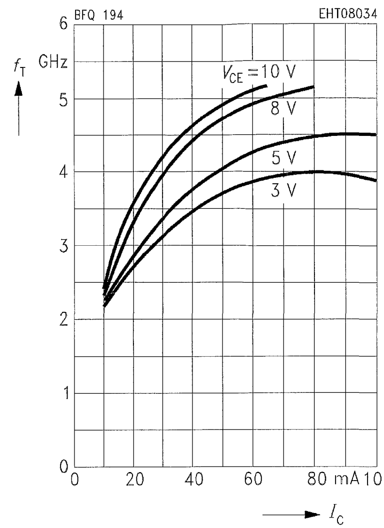
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CE0}$	15	–	–	V
Collector-base cutoff current V_{CB} = 10 V, I_E = 0	I_{CB0}	–	–	100	nA
Emitter-base cutoff current V_{EB} = 2 V, I_C = 0	I_{EB0}	–	–	1	µA
DC current gain I_C = 50 mA, V_{CE} = 10 V I_C = 70 mA, V_{CE} = 10 V	h_{FE}	 20 20	 50 50	 150 –	–
Collector-emitter saturation voltage I_C = 75 mA, I_B = 7.5 mA	V_{CEsat}	–	–	0.5	V
AC Characteristics					
Transition frequency I_C = 65 mA, V_{CE} = 10 V, f = 500 MHz	f_T	–	5.0	–	GHz
Collector-base capacitance V_{CB} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{cb}	–	1.45	–	pF

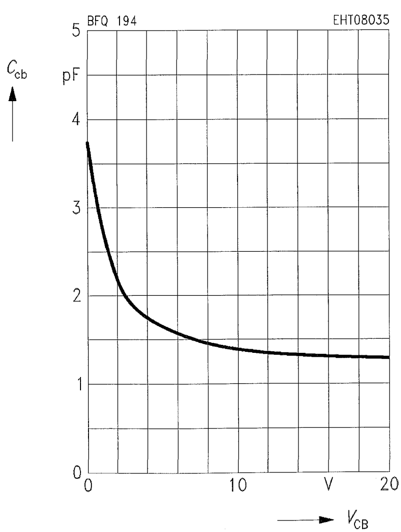
Total power dissipation $P_{tot} = f(T_A^*; T_S)$
* Package mounted on alumina



Transition frequency $f_T = f(I_C)$
f = 500 MHz



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

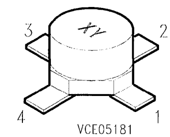


SIEMENS

NPN Silicon RF Transistor — BFQ 196

Preliminary Data

- For low-noise, low-distortion broadband amplifiers in antenna and telecommunications systems up to 1.5 GHz at collector currents from 20 mA to 80 mA.
- f_T = 7.5 GHz
  F = 1.3 dB at 900 MHz



ESD: Electro**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 196	196	Q62702-F1348	B	E	C	E	Cerec-X

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CE0}	12	V
Collector-emitter voltage, V_{BE} = 0	V_{CES}	20	
Collector-base voltage	V_{CB0}	20	
Emitter-base voltage	V_{EB0}	2	
Collector current	I_C	100	mA
Peak collector current, $f \geq$ 10 MHz	I_{CM}	150	
Base current	I_B	12	
Peak base current, $f \geq$ 10 MHz	I_{BM}	15	
Total power dissipation, $T_S \leq$ 91 ˚C[3)]	P_{tot}	650	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)]	$R_{th JA}$	≤ 210	K/W
Junction - soldering point[3)]	$R_{th JS}$	≤ 130	

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

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

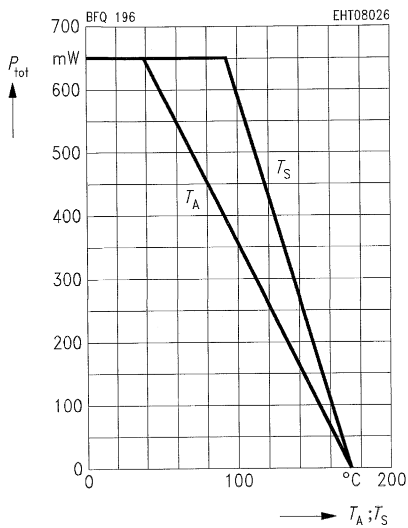
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CE0}$	12	–	–	V
Collector-emitter cutoff current V_{CE} = 20 V, V_{BE} = 0	I_{CES}	–	–	100	µA
Collector-base cutoff current V_{CB} = 10 V, I_E = 0 V_{CB} = 10 V, I_E = 0, T_A = 125 °C	I_{CB0}	 – –	 – –	 0.05 5	
Emitter-base cutoff current V_{EB} = 1 V, I_C = 0	I_{EB0}	–	–	1	
DC current gain I_C = 50 mA, V_{CE} = 5 V	h_{FE}	50	90	250	–
Collector-emitter saturation voltage I_C = 75 mA, I_B = 7.5 mA	V_{CEsat}	–	0.1	0.5	V

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

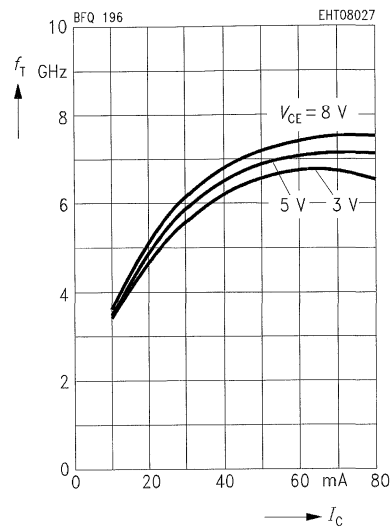
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
AC Characteristics					
Transition frequency I_C = 50 mA, V_{CE} = 5 V, f = 500 MHz I_C = 70 mA, V_{CE} = 5 V, f = 500 MHz	f_T	 – –	 6.9 7.2	 – –	GHz
Collector-base capacitance V_{CB} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{cb}	–	1	–	pF
Collector-emitter capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{ce}	–	0.45	–	
Input capacitance V_{EB} = 0.5 V, I_C = i_c = 0, f = 1 MHz	C_{ibo}	–	4.4	–	
Output capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{obs}	–	1.45	–	
Noise figure I_C = 10 mA, V_{CE} = 8 V, f = 10 MHz, Z_S = 50 Ω I_C = 10 mA, V_{CE} = 8 V, f = 900 MHz, Z_S = Z_{Sopt} I_C = 50 mA, V_{CE} = 8 V, f = 1 GHz, Z_S = Z_{Sopt}	F	 – – –	 0.95 1.3 1.9	 – – –	dB
Power gain I_C = 60 mA, V_{CE} = 8 V, f = 900 MHz, Z_0 = 50 Ω I_C = 60 mA, V_{CE} = 8 V, f = 1.75 GHz, Z_0 = 50 Ω	G_{ma} 1)	 – –	 17.5 11.5	 – –	
Transducer gain I_C = 60 mA, V_{CE} = 8 V, f = 900 MHz, Z_0 = 50 Ω	$\|S_{21e}\|^2$	–	12.5	–	
Linear output voltage two-tone intermodulation test I_C = 60 mA, V_{CE} = 8 V, d_{IM} = 60 dB, f_1 = 806 MHz, f_2 = 810 MHz, Z_S = Z_L = 50 Ω	V_{01} = V_{02}	–	430	–	mV
Third order intercept point I_C = 60 mA, V_{CE} = 8 V, f = 800 MHz	IP_3	–	35.5	–	dBm

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

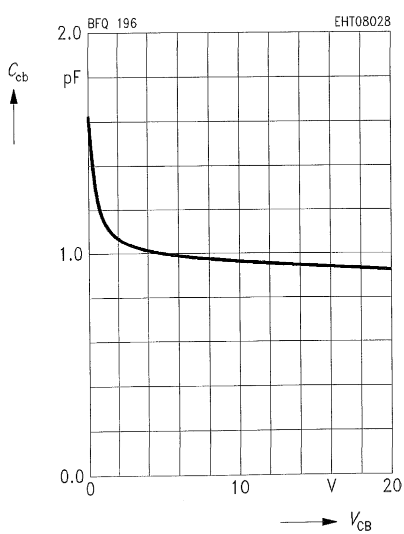
Total power dissipation $P_{tot} = f(T_A^*; T_S)$
* Package mounted on alumina



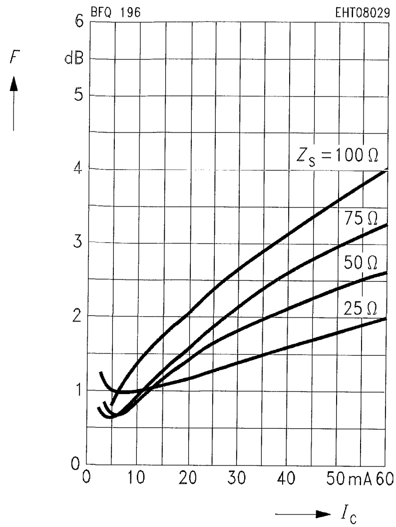
Transition frequency $f_T = f(I_C)$
f = 500 MHz



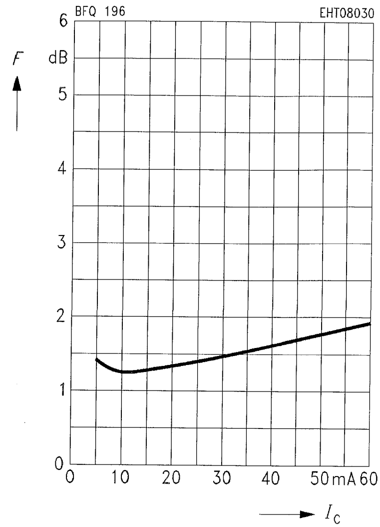
Collector-base capacitance $C_{cb} = f(V_{CB})$
$V_{BE} = v_{be} = 0, f = 1$ MHz



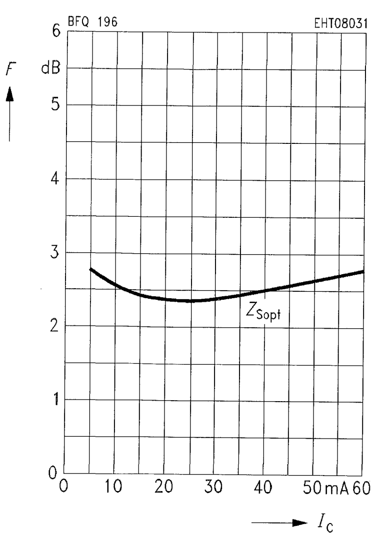
Noise figure $F = f\,(I_C)$
V_{CE} = 5 V, f = 10 MHz



Noise figure $F = f\,(I_C)$
V_{CE} = 8 V, f = 900 MHz, Z_{Lopt} (G)



Noise figure $F = f\,(I_C)$
V_{CE} = 8 V, f = 1.75 GHz, Z_{Sopt} (G)



Common Emitter S Parameters

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**
I_C = 20 mA, V_{CE} = 2.5 V, Z_0 = 50 Ω								
0.10	0.687	– 124.9	26.01	122.2	0.030	42.8	0.584	– 73.3
0.20	0.753	– 152.9	15.05	104.2	0.036	34.4	0.392	– 104.4
0.30	0.769	– 164.6	10.38	95.4	0.039	34.3	0.322	– 122.0
0.40	0.776	– 171.8	7.88	89.5	0.042	36.2	0.291	– 133.6
0.50	0.781	– 176.7	6.34	84.9	0.045	38.8	0.277	– 141.5
0.60	0.781	179.2	5.30	81.0	0.049	40.9	0.269	– 147.5
0.70	0.784	175.7	4.56	77.5	0.053	43.0	0.266	– 152.1
0.80	0.787	172.7	4.00	74.3	0.057	44.6	0.266	– 155.7
0.90	0.788	170.1	3.56	71.2	0.061	45.8	0.265	– 158.5
0.95	0.786	168.7	3.37	69.7	0.064	46.4	0.265	– 159.8
1.00	0.788	167.2	3.20	68.2	0.066	46.9	0.266	– 161.0
1.20	0.790	162.5	2.68	62.6	0.075	48.1	0.271	– 164.8
1.40	0.794	158.0	2.31	57.2	0.084	48.4	0.278	– 168.3
1.60	0.792	154.0	2.03	52.0	0.094	48.4	0.288	– 170.9
1.70	0.801	151.5	1.92	49.5	0.098	48.2	0.292	– 172.2
1.75	0.800	150.5	1.86	48.2	0.101	47.9	0.294	– 172.9
1.80	0.798	149.9	1.81	47.1	0.103	47.9	0.297	– 173.4
2.00	0.803	145.5	1.64	42.3	0.113	47.0	0.308	– 175.9
2.50	0.809	135.9	1.33	30.7	0.138	44.0	0.341	178.7
3.00	0.813	126.6	1.13	19.9	0.162	40.0	0.374	172.8
I_C = 50 mA, V_{CE} = 2.5 V, Z_0 = 50 Ω								
0.10	0.708	– 151.6	30.18	112.7	0.019	43.0	0.485	– 100.7
0.20	0.764	– 167.8	16.32	98.5	0.023	44.1	0.380	– 132.7
0.30	0.779	– 174.9	11.09	91.7	0.028	48.7	0.353	– 147.7
0.40	0.782	– 179.6	8.36	86.9	0.033	52.7	0.343	– 156.5
0.50	0.786	177.0	6.71	83.1	0.038	55.7	0.340	– 162.3
0.60	0.786	173.9	5.60	79.7	0.043	57.3	0.339	– 166.7
0.70	0.789	171.2	4.81	76.7	0.049	58.4	0.339	– 170.0
0.80	0.791	168.7	4.22	73.8	0.055	59.1	0.340	– 172.7
0.90	0.792	166.6	3.75	71.1	0.061	59.3	0.341	– 175.0
0.95	0.791	165.3	3.56	69.7	0.064	59.3	0.341	– 176.0
1.00	0.792	164.0	3.38	68.3	0.066	59.3	0.341	– 177.1
1.20	0.794	159.7	2.83	63.1	0.078	58.5	0.345	179.7
1.40	0.799	155.5	2.44	58.1	0.089	57.2	0.350	176.6
1.60	0.796	151.7	2.14	53.3	0.101	55.7	0.356	174.1
1.70	0.803	149.4	2.02	50.9	0.106	54.7	0.359	172.8
1.75	0.802	148.4	1.97	49.7	0.109	54.3	0.360	172.2
1.80	0.800	147.9	1.92	48.8	0.112	53.8	0.363	171.7
2.00	0.807	143.6	1.74	44.1	0.122	51.9	0.369	169.4
2.50	0.809	134.3	1.42	33.1	0.150	46.7	0.390	164.3
3.00	0.810	125.2	1.21	22.9	0.176	41.2	0.412	159.1

Common Emitter S Parameters (continued)

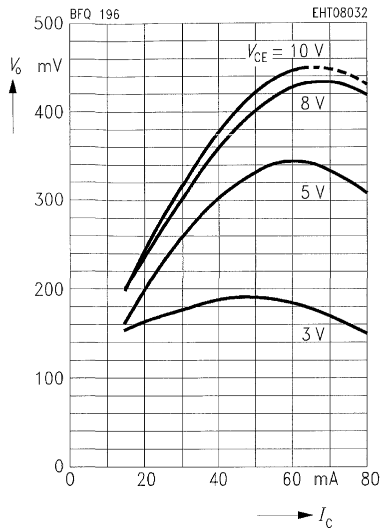
f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_C = 30 mA, V_{CE} = 5 V, Z_0 = 50 Ω								
0.10	0.681	– 133.5	30.12	119.0	0.024	42.9	0.542	– 81.7
0.20	0.742	– 158.0	16.98	102.3	0.029	38.0	0.377	– 114.1
0.30	0.759	– 168.1	11.64	94.3	0.033	40.3	0.324	– 131.6
0.40	0.764	– 174.4	8.81	88.8	0.037	43.4	0.301	– 142.6
0.50	0.769	– 178.7	7.08	84.7	0.041	46.3	0.291	– 150.0
0.60	0.768	177.3	5.92	81.0	0.045	48.6	0.286	– 155.6
0.70	0.772	174.3	5.08	77.8	0.050	50.4	0.284	– 159.8
0.80	0.775	171.4	4.46	74.8	0.055	51.7	0.284	– 163.1
0.90	0.776	168.9	3.97	71.8	0.060	52.6	0.284	– 165.9
0.95	0.774	167.6	3.76	70.5	0.062	52.8	0.284	– 167.1
1.00	0.777	166.2	3.57	69.0	0.065	53.0	0.285	– 168.3
1.20	0.778	161.6	2.99	63.7	0.075	53.4	0.289	– 172.0
1.40	0.782	157.2	2.57	58.6	0.086	53.0	0.295	– 175.4
1.60	0.782	153.3	2.26	53.6	0.096	52.2	0.302	– 177.9
1.70	0.789	151.0	2.14	51.3	0.101	51.6	0.305	– 179.2
1.75	0.788	149.9	2.08	49.9	0.103	51.2	0.306	– 179.9
1.80	0.786	149.2	2.02	49.0	0.106	51.0	0.309	179.5
2.00	0.792	145.0	1.83	44.3	0.116	49.5	0.318	177.2
2.50	0.796	135.5	1.49	33.0	0.142	45.5	0.343	172.1
3.00	0.798	126.3	1.26	22.6	0.167	40.6	0.369	166.7
I_C = 50 mA, V_{CE} = 5 V, Z_0 = 50 Ω								
0.10	0.691	– 146.5	32.61	114.1	0.019	43.2	0.491	– 96.0
0.20	0.747	– 165.1	17.78	99.4	0.024	43.6	0.371	– 128.4
0.30	0.762	– 172.9	12.08	92.4	0.028	48.0	0.339	– 144.3
0.40	0.766	– 178.1	9.13	87.5	0.033	51.8	0.327	– 153.7
0.50	0.769	178.2	7.32	83.7	0.038	54.7	0.322	– 159.9
0.60	0.770	174.9	6.11	80.3	0.043	56.5	0.320	– 164.6
0.70	0.773	172.1	5.25	77.3	0.049	57.7	0.320	– 168.2
0.80	0.776	169.5	4.61	74.5	0.054	58.4	0.321	– 171.0
0.90	0.776	167.2	4.10	71.7	0.060	58.6	0.321	– 173.5
0.95	0.775	165.9	3.88	70.4	0.063	58.7	0.321	– 174.6
1.00	0.775	164.7	3.69	69.0	0.066	58.7	0.322	– 175.6
1.20	0.778	160.3	3.08	64.0	0.077	58.0	0.326	– 179.0
1.40	0.783	156.1	2.65	59.0	0.088	56.8	0.331	177.7
1.60	0.781	152.1	2.33	54.2	0.099	55.3	0.336	175.2
1.70	0.788	150.0	2.20	51.9	0.104	54.5	0.339	173.9
1.75	0.787	148.9	2.14	50.7	0.107	54.0	0.340	173.2
1.80	0.786	148.3	2.09	49.7	0.110	53.5	0.343	172.7
2.00	0.793	144.1	1.89	45.2	0.121	51.6	0.349	170.4
2.50	0.796	134.7	1.54	34.2	0.147	46.6	0.370	165.3
3.00	0.797	125.6	1.31	24.1	0.173	41.1	0.391	160.1

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 = 70 mA, V_{CE} = 5 V, Z_0 = 50 Ω								
0.10	0.702	– 152.8	33.31	111.6	0.017	44.4	0.464	– 103.9
0.20	0.752	– 168.5	17.88	97.9	0.021	47.6	0.370	– 135.4
0.30	0.765	– 175.3	12.12	91.4	0.026	52.6	0.347	– 149.9
0.40	0.768	– 179.8	9.14	86.8	0.031	56.2	0.338	– 158.4
0.50	0.773	176.8	7.33	83.2	0.037	59.0	0.336	– 163.9
0.60	0.772	173.7	6.12	79.9	0.042	60.3	0.335	– 168.1
0.70	0.775	171.0	5.26	77.0	0.048	61.1	0.335	– 171.4
0.80	0.778	168.6	4.61	74.2	0.054	61.5	0.337	– 174.0
0.90	0.779	166.4	4.10	71.5	0.060	61.4	0.337	– 176.3
0.95	0.777	165.2	3.88	70.2	0.063	61.3	0.337	– 177.4
1.00	0.779	164.0	3.69	68.8	0.066	61.1	0.338	– 178.4
1.20	0.779	159.7	3.08	63.9	0.078	60.1	0.341	178.4
1.40	0.786	155.6	2.66	59.0	0.089	58.5	0.346	175.3
1.60	0.782	151.7	2.33	54.3	0.101	56.8	0.351	172.7
1.70	0.791	149.6	2.21	52.0	0.106	55.7	0.353	171.5
1.75	0.789	148.5	2.15	50.8	0.109	55.2	0.354	170.8
1.80	0.786	147.7	2.09	49.9	0.112	54.7	0.357	170.3
2.00	0.793	143.7	1.89	45.3	0.113	52.6	0.363	168.0
2.50	0.797	134.3	1.54	34.5	0.150	47.2	0.382	162.9
3.00	0.798	125.3	1.31	24.5	0.176	41.4	0.401	157.8
I_C = 70 mA, V_{CE} = 8 V, Z_0 = 50 Ω								
0.10	0.696	– 147.6	34.54	112.1	0.018	43.0	0.462	– 102.5
0.20	0.742	– 165.9	18.58	98.2	0.022	45.5	0.364	– 134.2
0.30	0.755	– 173.5	12.60	91.7	0.027	50.3	0.340	– 148.9
0.40	0.758	– 178.6	9.50	87.0	0.032	54.2	0.331	– 157.6
0.50	0.763	177.8	7.62	83.4	0.037	56.9	0.328	– 163.3
0.60	0.762	174.6	6.37	80.1	0.043	58.5	0.327	– 167.7
0.70	0.765	171.8	5.47	77.1	0.049	59.5	0.327	– 171.0
0.80	0.768	169.2	4.79	74.5	0.055	60.0	0.329	– 173.7
0.90	0.768	167.0	4.26	71.8	0.060	60.1	0.329	– 176.1
0.95	0.767	165.7	4.04	70.5	0.063	60.0	0.329	– 177.1
1.00	0.768	164.5	3.84	69.1	0.066	59.8	0.330	– 178.2
1.20	0.770	160.1	3.21	64.1	0.078	59.0	0.333	178.5
1.40	0.774	155.9	2.76	59.3	0.089	57.5	0.337	175.3
1.60	0.772	152.1	2.43	54.6	0.100	55.8	0.342	172.8
1.70	0.780	149.9	2.30	52.4	0.106	54.8	0.344	171.5
1.75	0.779	148.8	2.23	51.1	0.108	54.3	0.345	170.8
1.80	0.776	148.2	2.17	50.3	0.111	53.9	0.348	170.4
2.00	0.784	143.9	1.96	45.8	0.122	51.8	0.354	168.0
2.50	0.787	134.7	1.60	34.8	0.149	46.5	0.372	162.9
3.00	0.787	125.6	1.37	24.7	0.174	40.8	0.390	157.8

Common Emitter Large Signal Parameters

Linear output voltage $V_O = f\ (I_C)$
$d_{IM} = 60$ dB, $f_1 = 806$ MHz,
$f_2 = 810$ MHz, $Z_S = Z_L = 50\ \Omega$



Note:

The transistor is driven by 2 adjacent signals f_1, f_2 with equal output power levels P_o for each carrier.
The distance d_{IM} between P_o and the third order intermodulation products P_{IM} ($2f_1 - f_2$ or $2f_2 - f_1$) is:

$d_{IM} = P_o - P_{IM}$
where $P_o = 10 \log (V_o^2/(50\ \Omega \cdot 1\,\text{mW}))$ (dBm)
and V_o = linear output voltage of each carrier.

The 3rd order intercept point IP_3 will be found by extrapolation to the point where P_{IM} would be identical to P_o:

IP_3 (output) $= P_o + d_{IM}/2$.

Linear output voltages for other d_{IM} (e.g. 50 dB) can be calculated thereby.

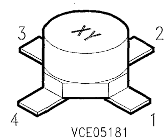
SIEMENS

NPN Silicon RF Transistor

BFQ 645

Preliminary Data

- For low-noise, high-gain amplifiers and medium power oscillators at collector currents up to 20 mA.
- f_T = 9 GHz
  F = 1.9 dB at 2 GHz



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 645	645	Q62702-F1283	B	E	C	E	Cerec-X

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CEO}	12	V
Collector-emitter voltage, V_{BE} = 0	V_{CES}	20	
Collector-base voltage	V_{CBO}	25	
Emitter-base voltage	V_{EBO}	2	
Collector current	I_C	40	mA
Peak collector current, $f \geq$ 10 MHz	I_{CM}	65	
Base current	I_B	4	
Peak base current, $f \geq$ 10 MHz	I_{BM}	5	
Total power dissipation, $T_S \leq$ 77 ˚C[3)]	P_{tot}	400	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)]	$R_{th\,JA}$	$\leq$ 325	K/W
Junction - soldering point[3)]	$R_{th\,JS}$	$\leq$ 245	

1) For detailed information 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.

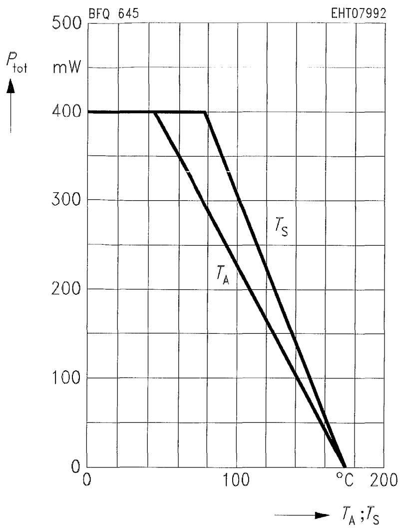
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CEO}$	12	–	–	V
Collector-base cutoff current V_{CB} = 10 V, I_E = 0 V_{CB} = 10 V, I_E = 0, T_A = 125°C	I_{CBO}	 – –	 – –	 0.05 5	µA
Emitter-base cutoff current V_{EB} = 1 V, I_C = 0	I_{EBO}	–	–	50	nA
DC current gain I_C = 7 mA, V_{CE} = 8 V	h_{FE}	50	100	250	–
Collector-emitter saturation voltage I_C = 30 mA, I_B = 3 mA	V_{CEsat}	–	0.15	0.4	V

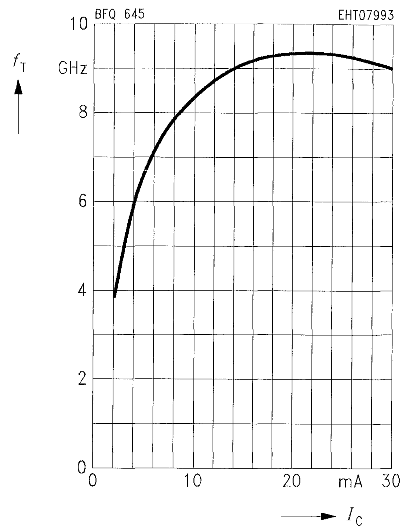
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
AC Characteristics					
Transition frequency I_C = 15 mA, V_{CE} = 8 V, f = 500 MHz	f_T	–	9	–	GHz
Collector-base capacitance V_{CB} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{cb}	–	0.25	0.45	pF
Collector-emitter capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{ce}	–	0.33	–	
Input capacitance V_{EB} = 0.5 V, I_C = i_c = 0, f = 1 MHz	C_{ibo}	–	0.9	–	
Output capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{obs}	–	0.6	–	
Noise figure I_C = 3 mA, V_{CE} = 8 V, f = 10 MHz, Z_S = 75 Ω I_C = 7 mA, V_{CE} = 8 V, f = 800 MHz, Z_S = Z_{Sopt} I_C = 7 mA, V_{CE} = 8 V, f = 2 GHz, Z_S = Z_{Sopt}	F	 – – –	 0.9 1.1 1.9	 – – 2.5	dB
Power gain I_C = 7 mA, V_{CE} = 8 V, f = 800 MHz, Z_S = $Z_{Sopt}(F)$, Z_L = Z_{Lopt} I_C = 7 mA, V_{CE} = 8 V, f = 2 GHz, Z_S = $Z_{Sopt}(F)$, Z_{Lopt}	G_{pe}	 – – 	 18 11 	 – – 	
Linear output voltage two-tone intermodulation test I_C ≐ 20 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}	–	110	–	mV
Third order intercept point I_C = 20 mA, V_{CE} = 8 V, f = 800 MHz	IP_3	–	24	–	dBm

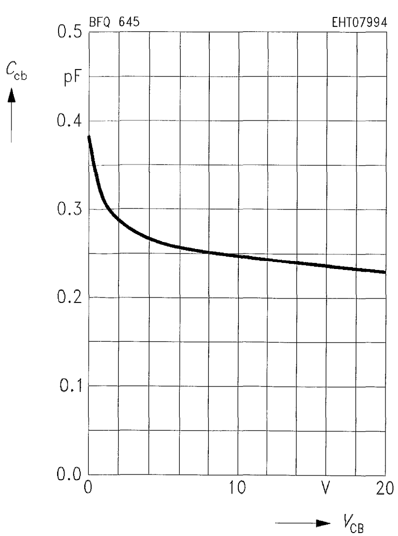
Total power dissipation $P_{tot} = f\,(T_A^*;\, T_S)$
*Package mounted on alumina



Transition frequency $f_T = f\,(I_C)$
V_{CE} = 8 V, f = 500 MHz



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



Common Emitter S Parameters

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**
I_C = 5 mA, V_{CE} = 3 V, Z_0 = 50 Ω								
0.10	0.798	– 24.1	14.84	163.7	0.016	78.0	0.965	– 10.2
0.20	0.758	– 46.2	13.72	149.2	0.029	67.3	0.903	– 18.9
0.30	0.708	– 65.6	12.28	136.9	0.040	58.8	0.827	– 25.7
0.40	0.663	– 82.1	10.86	126.7	0.047	52.7	0.756	– 30.6
0.50	0.627	– 96.2	9.63	118.4	0.053	48.0	0.696	– 34.3
0.60	0.598	– 108.0	8.55	111.4	0.057	44.7	0.646	– 36.9
0.70	0.577	– 119.0	7.69	105.2	0.060	42.1	0.604	– 39.0
0.80	0.567	– 128.0	6.96	99.8	0.063	40.5	0.571	– 40.5
0.90	0.559	– 136.4	6.33	95.0	0.065	39.1	0.542	– 41.7
1.00	0.552	– 143.9	5.79	90.6	0.067	38.4	0.519	– 42.6
1.20	0.543	– 156.3	4.92	83.1	0.070	37.8	0.483	– 44.3
1.40	0.527	– 166.4	4.28	76.6	0.074	38.0	0.462	– 46.0
1.60	0.527	– 174.9	3.82	70.7	0.078	38.6	0.449	– 48.4
1.80	0.531	177.1	3.43	64.7	0.082	39.0	0.436	– 51.2
2.00	0.547	170.5	3.11	59.4	0.086	39.4	0.421	– 53.8
2.50	0.573	155.5	2.53	47.8	0.099	41.6	0.395	– 62.4
3.00	0.581	142.1	2.18	35.9	0.115	41.8	0.387	– 72.8
I_C = 5 mA, V_{CE} = 5 V, Z_0 = 50 Ω								
0.10	0.810	– 23.1	14.78	164.2	0.015	78.1	0.967	– 9.8
0.20	0.770	– 44.3	13.72	150.1	0.029	68.2	0.909	– 18.3
0.30	0.718	– 63.0	12.35	137.9	0.039	59.8	0.836	– 25.0
0.40	0.671	– 79.1	10.98	127.8	0.046	53.5	0.766	– 29.9
0.50	0.631	– 93.0	9.77	119.5	0.052	49.0	0.707	– 33.7
0.60	0.601	– 104.8	8.70	112.5	0.056	45.5	0.657	– 36.4
0.70	0.578	– 115.8	7.84	106.3	0.060	42.9	0.615	– 38.5
0.80	0.567	– 124.9	7.12	100.8	0.062	41.0	0.582	– 40.1
0.90	0.556	– 133.5	6.48	95.9	0.065	39.6	0.552	– 41.4
1.00	0.546	– 140.8	5.93	91.5	0.067	38.8	0.528	– 42.3
1.20	0.536	– 153.7	5.05	84.0	0.070	38.1	0.492	– 44.0
1.40	0.519	– 164.2	4.40	77.5	0.073	38.2	0.470	– 45.7
1.60	0.516	– 172.8	3.92	71.5	0.078	38.7	0.456	– 48.1
1.80	0.521	179.1	3.52	65.6	0.082	39.1	0.442	– 50.8
2.00	0.536	172.3	3.20	60.3	0.086	39.5	0.427	– 53.4
2.50	0.561	156.9	2.61	48.6	0.098	41.4	0.400	– 61.7
3.00	0.569	143.3	2.24	36.8	0.114	41.5	0.392	– 71.9

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} = 5 V, Z_0 = 50 Ω								
0.10	0.676	– 34.6	23.80	157.8	0.014	74.7	0.931	– 14.4
0.20	0.625	– 64.0	20.51	140.0	0.024	63.3	0.822	– 25.1
0.30	0.575	– 87.1	17.15	126.7	0.031	56.0	0.713	– 31.8
0.40	0.539	– 104.9	14.41	116.8	0.036	52.0	0.630	– 35.7
0.50	0.516	– 118.9	12.30	109.1	0.040	49.6	0.569	– 38.0
0.60	0.499	– 129.9	10.65	103.0	0.043	48.6	0.523	– 39.4
0.70	0.492	– 139.7	9.38	97.7	0.046	48.2	0.488	– 40.5
0.80	0.491	– 147.5	8.37	93.1	0.049	48.2	0.462	– 41.2
0.90	0.491	– 154.4	7.53	89.1	0.051	48.3	0.439	– 41.8
1.00	0.489	– 160.5	6.83	85.3	0.054	48.8	0.422	– 42.2
1.20	0.490	– 170.9	5.76	79.0	0.060	49.5	0.396	– 43.1
1.40	0.484	– 179.5	4.98	73.4	0.066	50.4	0.381	– 44.3
1.60	0.486	173.7	4.41	68.0	0.072	51.0	0.373	– 46.6
1.80	0.493	167.4	3.94	62.7	0.079	50.9	0.363	– 49.4
2.00	0.511	162.2	3.57	58.0	0.086	50.9	0.351	– 52.1
2.50	0.542	149.4	2.90	47.5	0.104	50.4	0.326	– 60.3
3.00	0.552	137.2	2.49	36.3	0.124	48.1	0.320	– 71.0
I_C = 20 mA, V_{CE} = 5 V, Z_0 = 50 Ω								
0.10	0.513	– 53.3	33.10	150.1	0.012	70.8	0.871	– 19.5
0.20	0.490	– 91.1	25.84	129.8	0.020	60.3	0.710	– 30.5
0.30	0.474	– 115.6	20.10	116.7	0.024	56.1	0.591	– 35.4
0.40	0.468	– 132.1	16.18	107.9	0.028	55.0	0.513	– 37.1
0.50	0.464	– 143.7	13.45	101.3	0.032	55.2	0.464	– 37.9
0.60	0.462	– 152.3	11.44	96.1	0.035	56.0	0.430	– 38.2
0.70	0.464	– 159.8	9.95	91.6	0.038	56.7	0.406	– 38.5
0.80	0.469	– 165.5	8.81	87.7	0.042	57.3	0.388	– 38.7
0.90	0.475	– 170.7	7.87	84.2	0.045	57.9	0.373	– 39.0
1.00	0.479	– 175.1	7.11	81.0	0.049	58.6	0.362	– 39.2
1.20	0.487	176.9	5.96	75.4	0.056	59.2	0.344	– 39.9
1.40	0.484	169.7	5.15	70.3	0.063	59.5	0.335	– 41.2
1.60	0.487	164.4	4.55	65.5	0.071	59.4	0.331	– 43.8
1.80	0.495	159.1	4.05	60.5	0.079	58.5	0.324	– 46.9
2.00	0.513	155.4	3.66	56.1	0.087	57.8	0.314	– 49.7
2.50	0.546	144.4	2.98	46.1	0.108	55.7	0.291	– 58.3
3.00	0.557	133.2	2.55	35.3	0.129	51.8	0.285	– 69.7

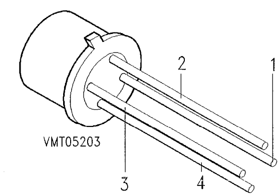
Common Emitter S Parameters (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**
I_C = 7 mA, V_{CE} = 8 V, Z_0 = 50 Ω								
0.10	0.774	– 26.4	18.74	161.8	0.015	77.2	0.953	– 11.6
0.20	0.722	– 50.1	16.96	146.4	0.027	66.4	0.876	– 21.1
0.30	0.664	– 70.3	14.85	133.6	0.035	58.3	0.788	– 28.1
0.40	0.615	– 87.2	12.91	123.4	0.042	52.9	0.710	– 32.8
0.50	0.576	– 101.2	11.30	115.4	0.046	49.3	0.648	– 36.1
0.60	0.549	– 112.8	9.93	108.7	0.050	46.8	0.597	– 38.4
0.70	0.529	– 123.7	8.85	102.9	0.053	45.0	0.557	– 40.1
0.80	0.520	– 132.3	7.98	97.8	0.056	44.1	0.526	– 41.3
0.90	0.512	– 140.5	7.23	93.3	0.058	43.5	0.498	– 42.3
1.00	0.507	– 147.4	6.58	89.1	0.061	43.3	0.476	– 43.0
1.20	0.499	– 159.5	5.58	82.2	0.065	43.3	0.443	– 44.2
1.40	0.484	– 169.6	4.84	76.1	0.070	43.9	0.423	– 45.6
1.60	0.485	– 177.5	4.30	70.5	0.075	44.6	0.412	– 47.9
1.80	0.490	175.0	3.86	64.9	0.081	44.9	0.399	– 50.5
2.00	0.509	168.9	3.49	59.9	0.086	44.9	0.385	– 53.0
2.50	0.533	154.5	2.84	48.8	0.102	45.7	0.358	– 60.9
3.00	0.544	141.5	2.45	37.5	0.119	44.2	0.350	– 71.2

SIEMENS

NPN Silicon RF Transistor — BFR 15A

- For broadband amplifiers up to 1 GHz at collector currents up to 20 mA.



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

Type	Marking	Ordering Code	Pin Configuration				Package[1)]
			1	2	3	4	
BFR 15A	BFR 15A	Q62702-F460	E	B	Case	C	TO-72

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CEO}	12	V
Collector-emitter voltage, V_{BE} = 0	V_{CES}	20	
Collector-base voltage	V_{CBO}	20	
Emitter-base voltage	V_{EBO}	2.5	
Collector current	I_C	30	mA
Base current	I_B	4	
Total power dissipation, $T_A \leq 60$ ˚C	P_{tot}	200	mW
Junction temperature	T_j	200	˚C
Ambient temperature range	T_A	– 65 … + 175	
Storage temperature range	T_{stg}	– 65 … + 175	

Thermal Resistance

Junction - ambient	$R_{th\,JA}$	≤ 700	K/W
Junction - case	$R_{th\,JC}$	≤ 400	

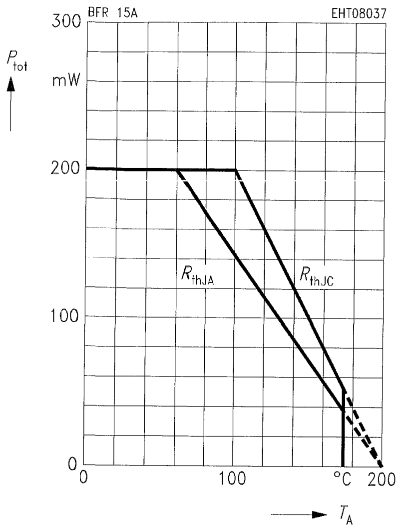
1) For detailed information see chapter Package Outlines.

Electrical Characteristics

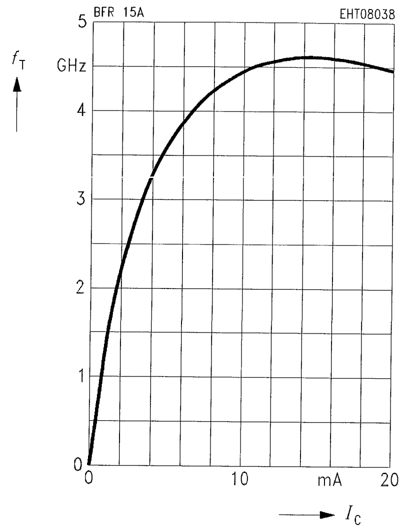
at T_A = 25 ˚C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CE0}$	12	–	–	V
Collector-emitter cutoff current V_{CE} = 20 V, V_{BE} = 0	I_{CES}	–	–	100	µA
Collector-base cutoff current V_{CB} = 10 V, I_E = 0	I_{CB0}	–	–	50	nA
Emitter-base cutoff current V_{EB} = 2.5 V, I_C = 0	I_{EB0}	–	–	100	µA
DC current gain I_C = 5 mA, V_{CE} = 6 V I_C = 20 mA, V_{CE} = 6 V	h_{FE}	 25 25	 – –	 – –	–
AC Characteristics					
Transition frequency I_C = 10 mA, V_{CE} = 6 V, f = 200 MHz	f_T	–	4.5	–	GHz
Collector-base capacitance V_{CB} = 6 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{cb}	–	0.42	–	pF
Output capacitance V_{CB} = 10 V, I_E = i_e = 0, f = 1 MHz	C_{obo}	–	–	1.1	
Noise figure I_C = 2 mA, V_{CE} = 6 V, f = 10 MHz, Z_S = 75 Ω I_C = 2 mA, V_{CE} = 6 V, f = 200 MHz, Z_S = 75 Ω I_C = 2 mA, V_{CE} = 6 V, f = 800 MHz, Z_S = 60 Ω	F	 – – –	 1.8 2 3	 – – –	dB
Power gain I_C = 10 mA, V_{CE} = 6 V, f = 800 MHz, Z_S = 60 Ω, Z_L = Z_{Lopt}	G_{pe}	–	12	–	
Linear output voltage two-tone intermodulation test I_C = 15 mA, V_{CE} = 5 V, d_{IM} = 60 dB, f_1 = 806 MHz, f_2 = 810 MHz, Z_S = Z_L = 50 Ω	V_{o1} = V_{o2}	–	140	–	mV
Third order intercept point I_C = 15 mA, V_{CE} = 5 V, f = 800 MHz	IP_3	–	26	–	dBm

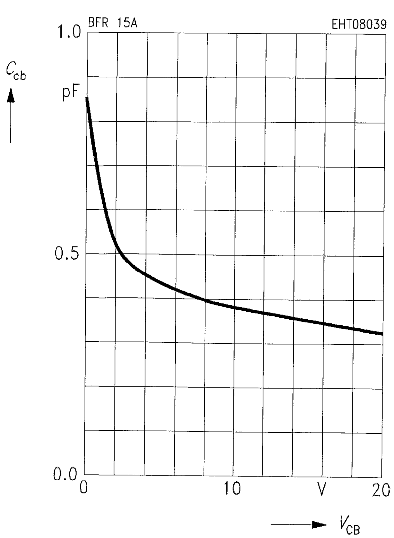
Total power dissipation $P_{tot} = f(T_A)$



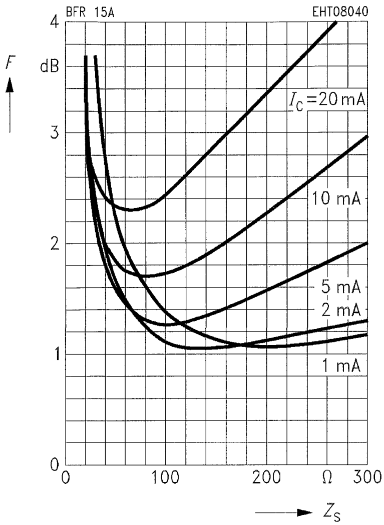
Transition frequency $f_T = f(I_C)$
V_{CE} = 6 V, f = 200 MHz



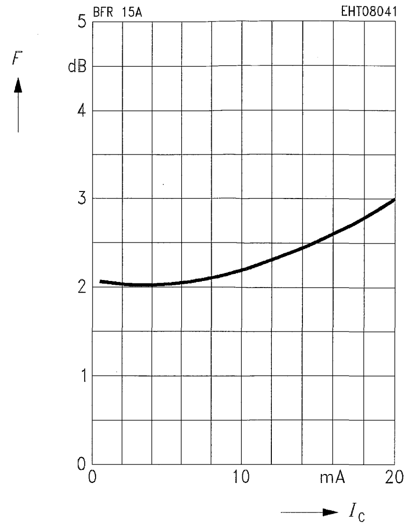
Collector-base capacitance $C_{cb} = f(V_{CB})$
$V_{BE} = v_{be} = 0$, f = 1 MHz



Noise figure $F = f(Z_S)$
V_{CE} = 6 V, f = 10 MHz



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

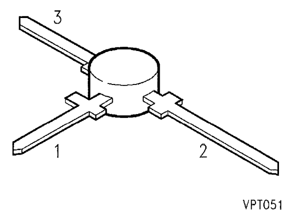


SIEMENS

NPN Silicon RF Transistor

BFR 34A

- For broadband amplifiers up to 2 GHz at collector currents from 1 mA to 20 mA.



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

Type	Marking	Ordering Code	Pin Configuration 1	2	3	Package[1]
BFR 34A	BFR 34A	Q62702-F346-S1	E	C	B	T-plast

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CE0}	12	V
Collector-emitter voltage, $V_{BE} = 0$	V_{CES}	20	
Emitter-base voltage	V_{EB0}	2.5	
Collector current	I_C	30	mA
Base current	I_B	4	
Total power dissipation, $T_S \leq 94$ ˚C[3]	P_{tot}	280	mW
Junction temperature	T_j	150	˚C
Ambient temperature range	T_A	– 65 … + 150	
Storage temperature range	T_{stg}	– 65 … + 150	

Thermal Resistance

Junction - ambient[2]	$R_{th\,JA}$	≤ 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.

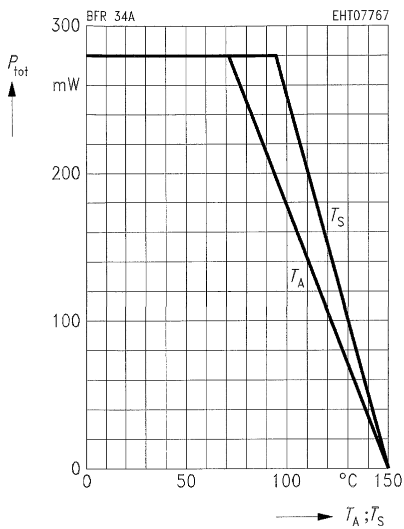
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CEO}$	12	–	–	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} = 2,5 V, I_C = 0	I_{EBO}	–	–	100	µA
DC current gain I_C = 5 mA, V_{CE} = 6 V I_C = 25 mA, V_{CE} = 6 V	h_{FE}	 40 40	 – –	 – –	–

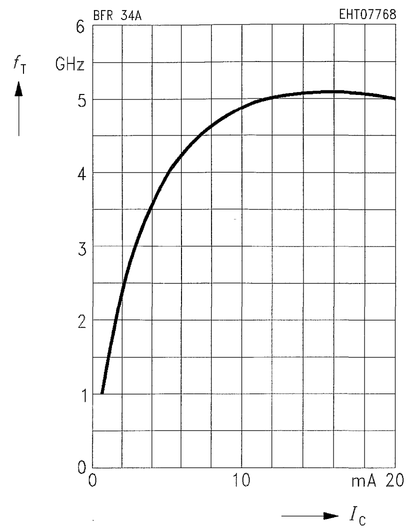
Electrical Characteristics
at T_A = 25 ˚C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
AC Characteristics					
Transition frequency I_C = 20 mA, V_{CE} = 10 V, f = 200 MHz	f_T	–	5	–	GHz
Collector-base capacitance V_{CB} = 6 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{cb}	–	0.44	–	pF
Collector-emitter capacitance V_{CE} = 6 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{ce}	–	0.3	–	
Output capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{obs}	–	0.75	–	
Noise figure I_C = 2 mA, V_{CE} = 6 V, f = 10 MHz, Z_S = 150 Ω I_C = 2 mA, V_{CE} = 6 V, f = 200 MHz, Z_S = 100 Ω I_C = 2 mA, V_{CE} = 6 V, f = 800 MHz, Z_S = 60 Ω I_C = 3 mA, V_{CE} = 10 V, f = 2 GHz, Z_S = Z_{Sopt}	F	 – – – –	 1.1 2 2 4	 – – – –	dB
Power gain I_C = 15 mA, V_{CE} = 6 V, f = 800 MHz, Z_S = 60 Ω, Z_L = Z_{Lopt}	G_{pe}	–	14	–	
Transducer gain I_C = 5 mA, V_{CE} = 6 V, f = 500 MHz, Z_0 = 50 Ω	$\|S_{21e}\|^2$	–	16.2	–	
Linear output voltage two-tone intermodulation test I_C = 15 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}	–	100	–	mV
Third order intercept point I_C = 15 mA, V_{CE} = 6 V, f = 800 MHz	IP_3	–	23	–	dBm

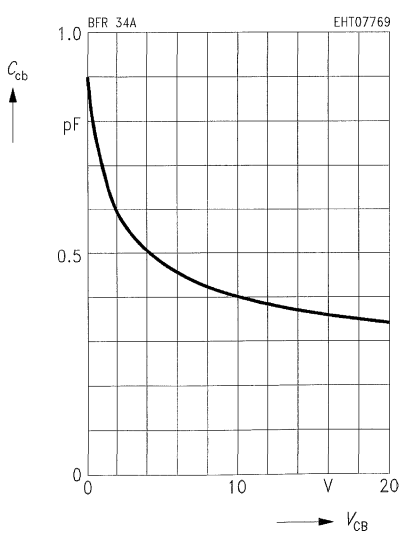
Total power dissipation $P_{tot} = f(T_A; T_S)$
Package mounted on alumina



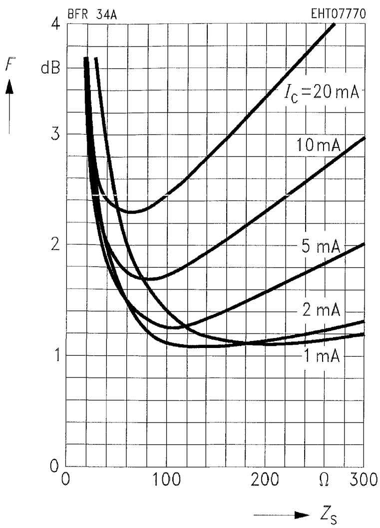
Transition frequency $f_T = f(I_C)$
V_{CE} = 10 V, f = 200 MHz



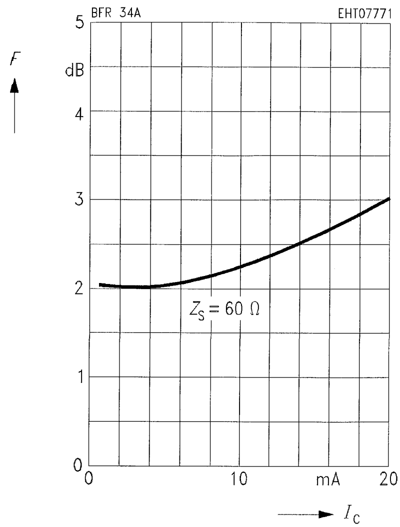
Collector-base capacitance $C_{cb} = f(V_{CB})$
$V_{BE} = v_{be} = 0$, f = 1 MHz



Noise figure $F = f(Z_S)$
$V_{CE} = 6$ V, $f = 10$ MHz



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



Common Emitter S Parameters

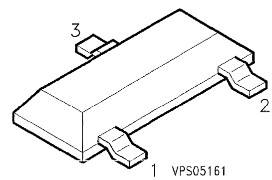
f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**
I_C = 5 mA, V_{CE} = 6 V, Z_0 = 50 Ω								
0.1	0.794	– 27	13.08	153	0.021	75	0.930	– 13
0.2	0.663	– 52	11.38	136	0.037	62	0.843	– 20
0.3	0.535	– 71	9.11	121	0.047	58	0.697	– 27
0.4	0.420	– 89	7.70	110	0.054	57	0.691	– 27
0.5	0.385	– 103	6.50	103	0.062	58	0.595	– 26
0.6	0.306	– 113	5.57	97	0.068	58	0.577	– 30
0.7	0.287	– 131	4.95	91	0.076	58	0.546	– 31
0.8	0.272	– 138	4.35	86	0.084	58	0.539	– 33
0.9	0.254	– 153	3.96	83	0.089	60	0.543	– 34
1.0	0.264	– 158	3.51	79	0.095	60	0.520	– 33
1.1	0.256	– 169	3.29	75	0.104	60	0.502	– 37
1.2	0.268	– 175	3.03	72	0.111	61	0.504	– 38
1.3	0.271	177	2.82	69	0.120	61	0.488	– 42
1.4	0.280	171	2.60	66	0.125	60	0.508	– 42
1.5	0.236	158	2.30	62	0.121	53	0.439	– 46
1.6	0.314	165	2.36	60	0.139	62	0.467	– 46
1.7	0.328	161	2.21	59	0.148	64	0.469	– 46
1.8	0.345	157	2.07	54	0.154	61	0.439	– 50
1.9	0.354	156	1.99	52	0.162	62	0.452	– 53
2.0	0.374	153	1.90	49	0.169	60	0.435	– 55

SIEMENS

NPN Silicon RF Transistor

BFR 35AP

- For broadband amplifiers up to 2 GHz and fast non-saturated switches at collector currents from 0.5 mA to 20 mA.



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

Type	Marking	Ordering Code (tape and reel)	Pin Configuration 1	2	3	Package[1]
BFR 35AP	GE	Q62702-F938	B	E	C	SOT-23

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CE0}	12	V
Collector-emitter voltage, $V_{BE} = 0$	V_{CES}	20	
Emitter-base voltage	V_{EB0}	2.5	
Collector current	I_C	30	mA
Base current	I_B	4	
Total power dissipation, $T_S \leq 48$ °C[3]	P_{tot}	280	mW
Junction temperature	T_j	150	°C
Ambient temperature range	T_A	– 65 ... + 150	
Storage temperature range	T_{stg}	– 65 ... + 150	

Thermal Resistance

Junction - ambient[2]	$R_{th\,JA}$	≤ 445	K/W
Junction - soldering point[3]	$R_{th\,JS}$	≤ 365	

1) For detailed information 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.

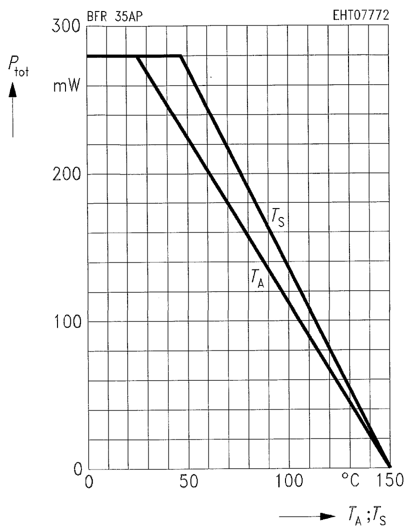
Electrical Characteristics
at T_A = 25 ˚C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CEO}$	12	–	–	V
Collector-emitter cutoff current V_{CE} = 20 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} = 2.5 V, I_C = 0	I_{EBO}	–	–	100	µA
DC current gain I_C = 5 mA, V_{CE} = 6 V I_C = 20 mA, V_{CE} = 6 V	h_{FE}	 40 40	 85 90	 – –	–
Collector-emitter saturation voltage I_C = 30 mA, I_B = 3 mA	V_{CEsat}	–	0.16	0.4	V

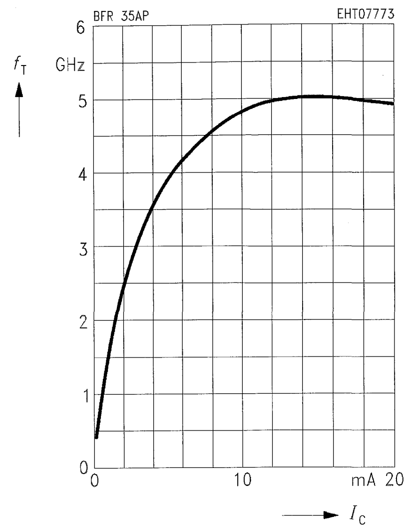
Electrical Characteristics
at T_A = 25 ˚C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
AC Characteristics					
Transition frequency	f_T				GHz
I_C = 5 mA, V_{CE} = 6 V, f = 200 MHz		–	3.8	–	
I_C = 20 mA, V_{CE} = 6 V, f = 200 MHz		3.6	4.9	–	
Collector-base capacitance V_{CB} = 6 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{cb}	–	0.56	0.7	pF
Collector-emitter capacitance V_{CE} = 6 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{ce}	–	0.27	–	
Input capacitance V_{EB} = 0.5 V, I_C = i_c = 0, f = 1 MHz	C_{ibo}	–	0.9	–	
Output capacitance V_{CE} = 6 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{obs}	–	0.85	–	
Noise figure	F				dB
I_C = 5 mA, V_{CE} = 6 V, f = 10 MHz, Z_S = 75 Ω		–	1.5	–	
I_C = 2 mA, V_{CE} = 6 V, f = 800 MHz, Z_S = Z_{Sopt}		–	1.5	–	
I_C = 3 mA, V_{CE} = 10 V, f = 2 GHz, Z_S = Z_{Sopt}		–	3.9	–	
Power gain I_C = 15 mA, V_{CE} = 6 V, f = 800 MHz, Z_S = 50 Ω, Z_L = Z_{Lopt}	G_{pe}	–	14	–	
Transducer gain I_C = 15 mA, V_{CE} = 6 V, f = 1 GHz, Z_0 = 50 Ω	$\|S_{21e}\|^2$	–	11	–	
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

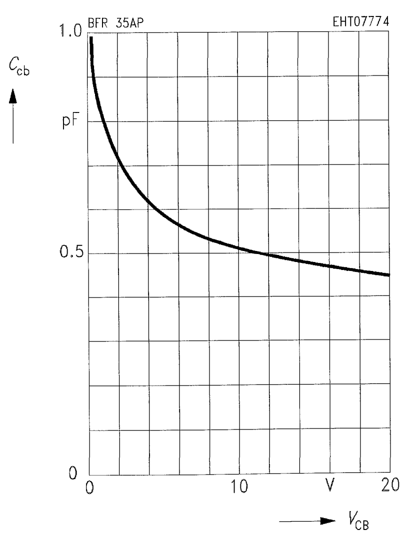
Total power dissipation $P_{tot} = f\,(T_A{}^*;\,T_S)$
*Package mounted on alumina



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



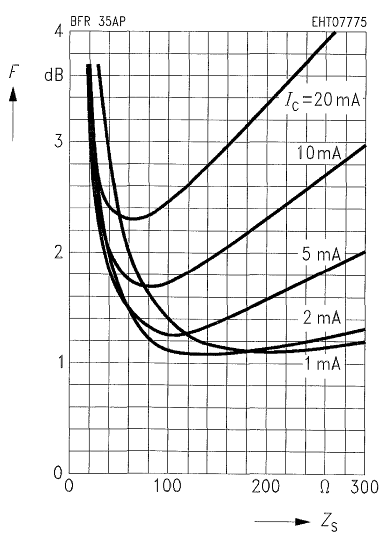
Collector-base capacitance $C_{cb} = f\,(V_{CB})$
$V_{BE} = v_{be} = 0$, f = 1 MHz



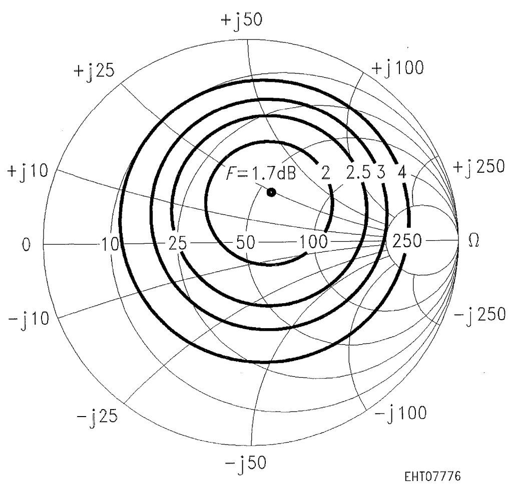
Common Emitter Noise Parameters

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 = 2 mA, V_{CE} = 6 V, Z_0 = 50 Ω								
0.01	1.05	–	(Z_S = 150 Ω)		–	–	3	–
I_C = 5 mA, V_{CE} = 6 V, Z_0 = 50 Ω								
0.01	1.3	–	(Z_S = 100 Ω)		–	–	1.6	–
0.8	1.7	14.3	0.25	58.5	16.9	0.24	1.9	14

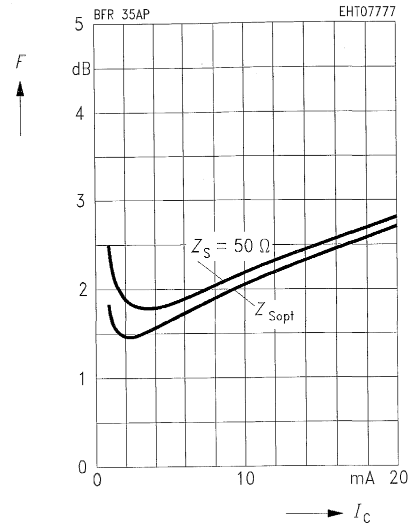
Noise figure $F = f(Z_S)$
V_{CE} = 6 V, f = 10 MHz



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



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



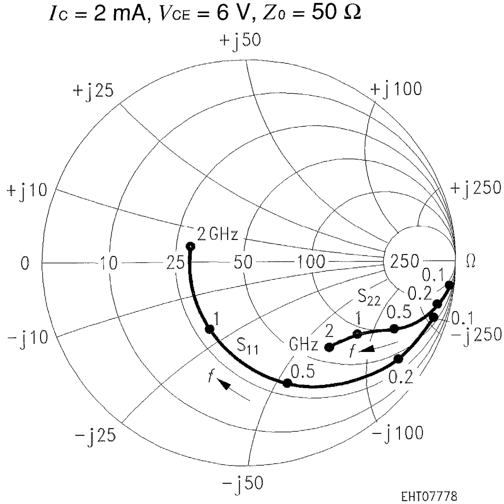
Common Emitter S Parameters

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_C = 0.5 mA, V_{CE} = 1 V, Z_0 = 50 Ω								
0.10	0.967	– 12.3	1.83	168.2	0.050	81.5	0.990	– 6.7
0.15	0.956	– 18.4	1.82	162.3	0.075	77.4	0.982	– 10.0
0.20	0.941	– 24.3	1.81	156.4	0.098	73.2	0.970	– 13.0
0.25	0.923	– 30.2	1.78	150.8	0.120	69.3	0.955	– 16.2
0.30	0.903	– 35.9	1.75	145.2	0.141	65.4	0.939	– 19.1
0.40	0.859	– 47.0	1.68	134.7	0.177	58.2	0.902	– 24.5
0.50	0.812	– 57.2	1.59	125.1	0.207	51.8	0.864	– 29.4
0.60	0.765	– 67.2	1.51	116.1	0.231	46.2	0.826	– 33.6
0.70	0.717	– 76.5	1.44	108.0	0.249	41.2	0.790	– 37.4
0.80	0.686	– 85.5	1.36	100.3	0.265	36.3	0.757	– 40.7
0.90	0.645	– 94.5	1.31	93.3	0.275	32.3	0.725	– 43.8
1.00	0.610	– 103.1	1.25	86.6	0.281	28.6	0.695	– 46.4
I_C = 1 mA, V_{CE} = 1 V, Z_0 = 50 Ω								
0.10	0.938	– 16.4	3.51	165.6	0.050	79.4	0.981	– 9.4
0.15	0.917	– 24.5	3.45	158.7	0.073	74.4	0.962	– 13.8
0.20	0.892	– 32.2	3.37	151.9	0.095	69.6	0.938	– 17.9
0.25	0.862	– 39.7	3.26	145.5	0.114	65.1	0.910	– 21.9
0.30	0.829	– 46.7	3.13	139.4	0.132	60.8	0.881	– 25.5
0.40	0.763	– 60.1	2.88	128.5	0.160	53.5	0.819	– 31.7
0.50	0.699	– 72.0	2.64	118.9	0.182	47.6	0.761	– 37.0
0.60	0.643	– 83.2	2.41	110.4	0.198	42.8	0.709	– 41.2
0.70	0.591	– 93.4	2.22	102.9	0.209	38.9	0.665	– 44.7
0.80	0.557	– 103.0	2.05	96.1	0.219	35.5	0.626	– 47.5
0.90	0.521	– 112.6	1.92	89.8	0.225	32.9	0.591	– 50.2
1.00	0.490	– 121.7	1.79	84.0	0.229	30.8	0.559	– 52.4

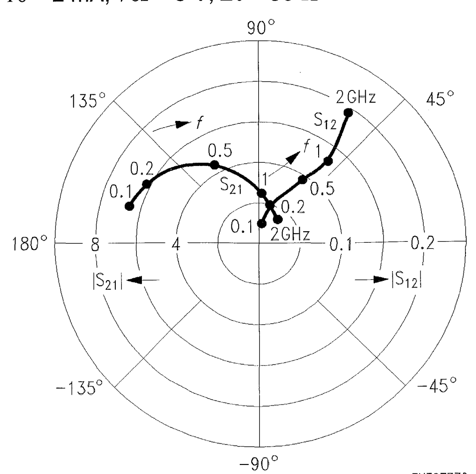
Common Emitter S Parameters (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**
I_C = 2 mA, V_{CE} = 6 V, Z_0 = 50 Ω								
0.1	0.91	– 15	6.49	161	0.03	79	0.97	– 6
0.3	0.79	– 46	5.25	139	0.08	64	0.88	– 22
0.5	0.66	– 71	4.49	120	0.11	55	0.77	– 30
0.8	0.46	– 102	3.29	98	0.13	47	0.64	– 35
1.0	0.40	– 119	2.80	88	0.15	46	0.60	– 38
1.2	0.36	– 134	2.43	80	0.15	45	0.56	– 40
1.5	0.31	– 156	2.03	69	0.17	48	0.53	– 43
1.8	0.29	– 178	1.77	60	0.19	49	0.51	– 48
2.0	0.29	168	1.66	54	0.20	51	0.49	– 49

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



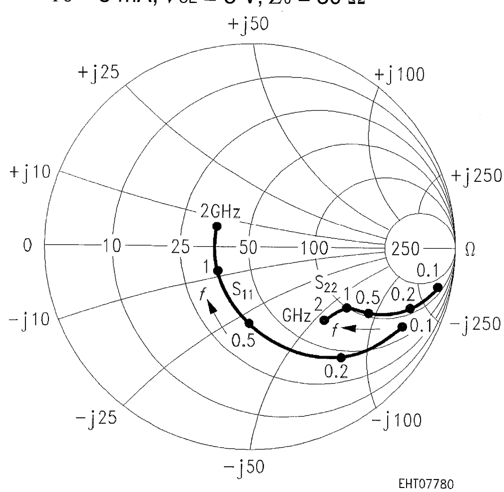
$S_{12}, S_{21} = f(f)$
I_C = 2 mA, V_{CE} = 6 V, Z_0 = 50 Ω



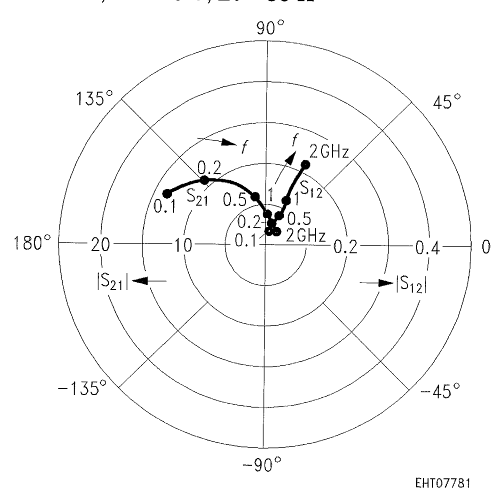
Common Emitter S Parameters (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_C = 5 mA, V_{CE} = 6 V, Z_0 = 50 Ω								
0.1	0.80	– 24	12.96	150	0.03	75	0.92	– 11
0.3	0.58	– 66	8.56	123	0.06	61	0.74	– 29
0.5	0.44	– 97	6.27	106	0.08	58	0.59	– 35
0.8	0.28	– 128	4.19	88	0.11	57	0.49	– 35
1.0	0.26	– 144	3.45	81	0.13	59	0.49	– 36
1.2	0.24	– 160	2.93	74	0.14	58	0.45	– 38
1.5	0.22	179	2.43	65	0.17	59	0.44	– 40
1.8	0.23	159	2.08	57	0.20	59	0.43	– 45
2.0	0.25	146	1.93	52	0.22	58	0.40	– 46

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



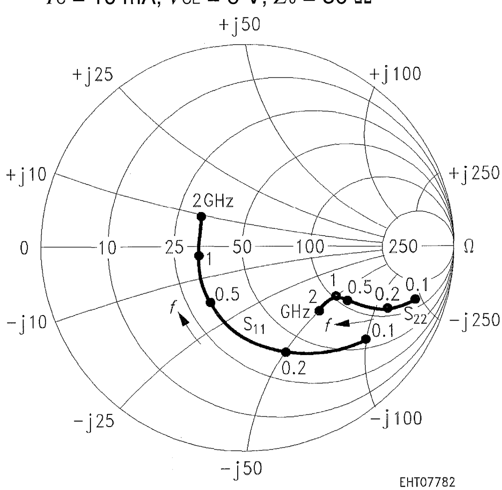
$S_{12}, S_{21} = f(f)$
I_C = 5 mA, V_{CE} = 6 V, Z_0 = 50 Ω



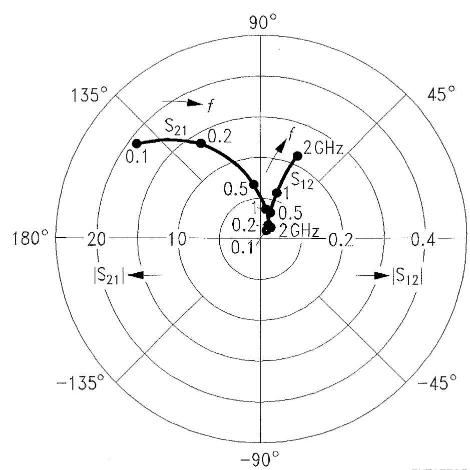
Common Emitter S Parameters (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**
I_C = 10 mA, V_{CE} = 6 V, Z_0 = 50 Ω								
0.1	0.66	– 35	18.62	140	0.03	73	0.85	– 15
0.3	0.42	– 85	10.32	113	0.05	62	0.62	– 31
0.5	0.32	– 116	6.92	98	0.07	63	0.50	– 33
0.8	0.22	– 149	4.49	83	0.10	64	0.44	– 31
1.0	0.21	– 164	3.65	77	0.12	65	0.43	– 32
1.2	0.21	– 178	3.09	71	0.14	64	0.41	– 34
1.5	0.21	164	2.54	63	0.17	63	0.41	– 36
1.8	0.22	147	2.18	55	0.21	62	0.40	– 41
2.0	0.24	136	2.02	51	0.22	61	0.38	– 42

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



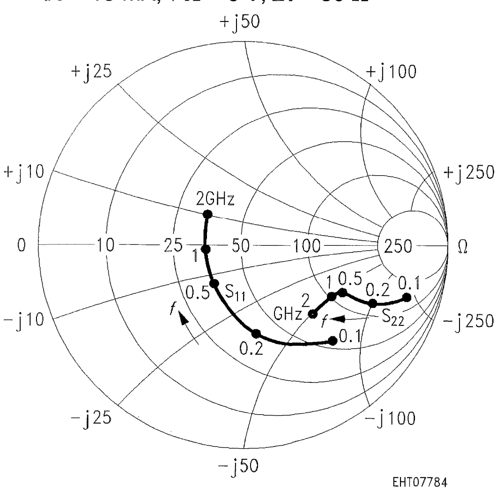
S_{12}, S_{21} = f (f)
I_C = 10 mA, V_{CE} = 6 V, Z_0 = 50 Ω



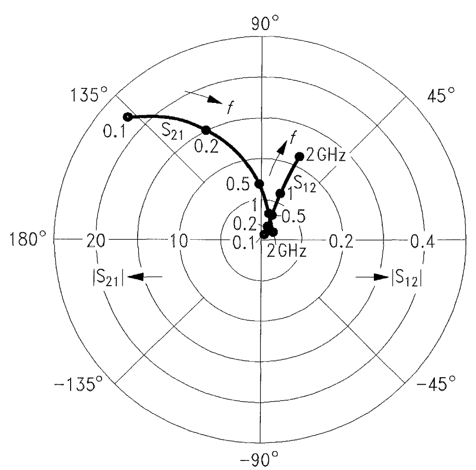
Common Emitter S Parameters (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**
I_C = 15 mA, V_{CE} = 6 V, Z_0 = 50 Ω								
0.1	0.57	– 43	20.30	137	0.02	71	0.81	– 16
0.3	0.35	– 95	10.53	109	0.05	54	0.58	– 29
0.5	0.27	– 127	7.00	95	0.07	66	0.48	– 29
0.8	0.21	– 162	4.49	80	0.10	67	0.43	– 27
1.0	0.21	– 174	3.65	75	0.12	68	0.43	– 29
1.2	0.21	174	3.09	70	0.14	66	0.41	– 31
1.5	0.22	158	2.54	61	0.17	65	0.41	– 34
1.8	0.24	142	2.15	54	0.21	64	0.41	– 40
2.0	0.26	133	2.00	50	0.23	63	0.39	– 40

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



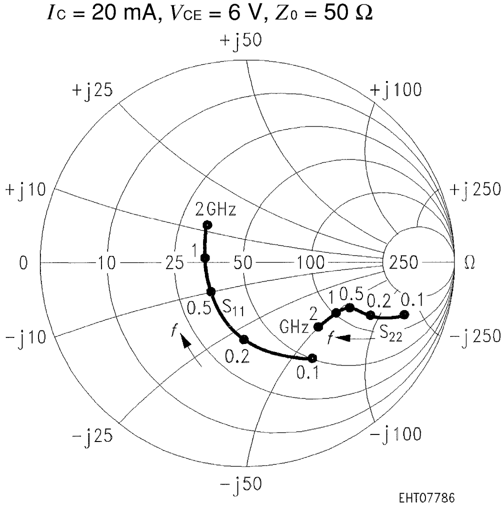
S_{12}, S_{21} = f (f)
I_C = 15 mA, V_{CE} = 6 V, Z_0 = 50 Ω



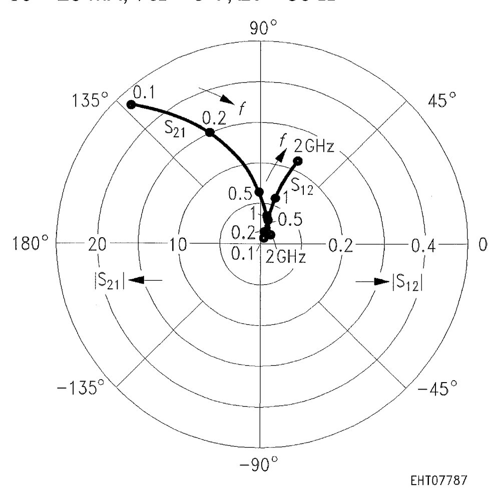
Common Emitter S Parameters (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**
I_C = 20 mA, V_{CE} = 6 V, Z_0 = 50 Ω								
0.1	0.51	– 49	21.13	133	0.02	70	0.79	– 16
0.3	0.32	– 106	10.35	106	0.05	65	0.56	– 27
0.5	0.27	– 138	6.76	92	0.07	67	0.48	– 27
0.8	0.22	– 171	4.34	78	0.09	68	0.45	– 25
1.0	0.22	179	3.49	74	0.12	69	0.44	– 28
1.2	0.23	169	2.97	68	0.14	68	0.43	– 30
1.5	0.24	153	2.43	60	0.17	66	0.43	– 33
1.8	0.26	139	2.07	53	0.21	65	0.42	– 39
2.0	0.28	131	1.93	48	0.22	64	0.40	– 39

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



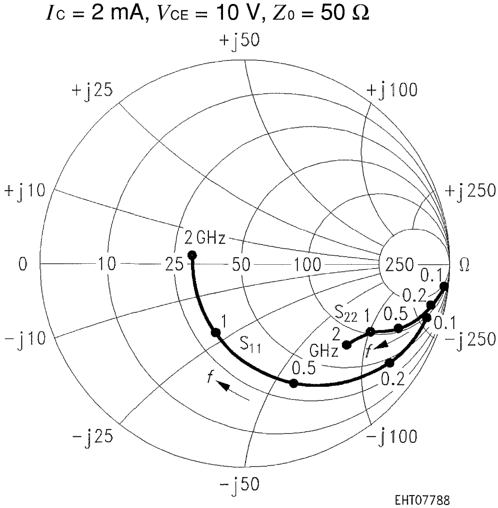
$S_{12}, S_{21} = f(f)$
I_C = 20 mA, V_{CE} = 6 V, Z_0 = 50 Ω



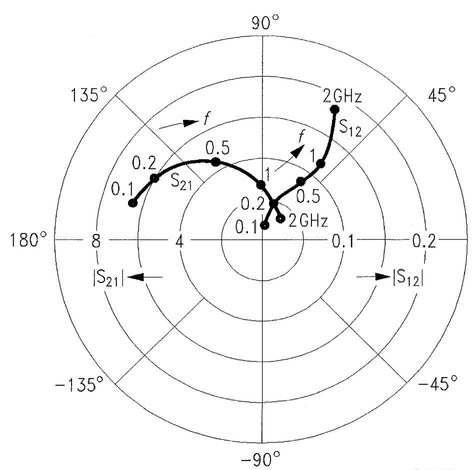
Common Emitter S Parameters (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_C = 2 mA, V_{CE} = 10 V, Z_0 = 50 Ω								
0.1	0.92	– 14	6.46	161	0.03	80	0.98	– 6
0.3	0.81	– 43	5.28	140	0.07	66	0.90	– 19
0.5	0.69	– 65	4.54	122	0.10	57	0.80	– 27
0.8	0.48	– 95	3.35	99	0.12	49	0.68	– 33
1.0	0.42	– 111	2.87	90	0.14	48	0.64	– 35
1.2	0.36	– 125	2.45	83	0.15	47	0.61	– 38
1.5	0.30	– 146	2.07	71	0.16	49	0.58	– 40
1.8	0.28	– 170	1.81	62	0.18	50	0.56	– 45
2.0	0.27	175	1.68	56	0.19	52	0.54	– 46

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



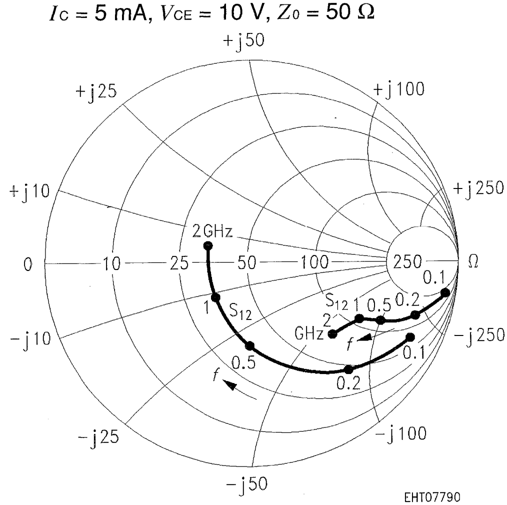
$S_{12}, S_{21} = f(f)$
I_C = 2 mA, V_{CE} = 10 V, Z_0 = 50 Ω



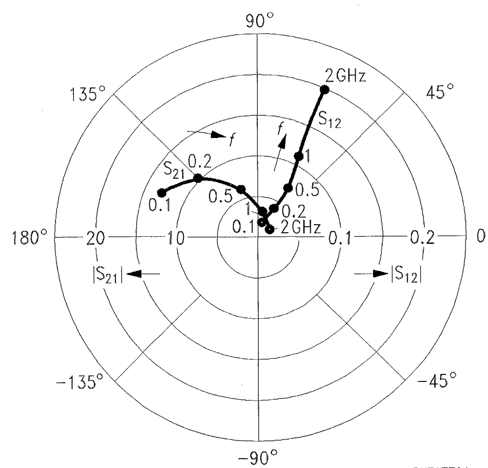
Common Emitter S Parameters (continued)

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	0.83	– 19	12.74	152	0.03	78	0.95	– 9
0.3	0.65	– 57	8.56	125	0.06	63	0.80	– 25
0.5	0.49	– 84	6.35	107	0.08	58	0.67	– 31
0.8	0.31	– 112	4.29	89	0.10	55	0.56	– 33
1.0	0.27	– 129	3.53	82	0.13	57	0.54	– 35
1.2	0.24	– 144	2.97	77	0.14	57	0.51	– 36
1.5	0.21	– 167	2.45	67	0.16	58	0.50	– 38
1.8	0.21	170	2.13	59	0.19	58	0.48	– 43
2.0	0.22	155	1.96	54	0.21	58	0.47	– 43

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



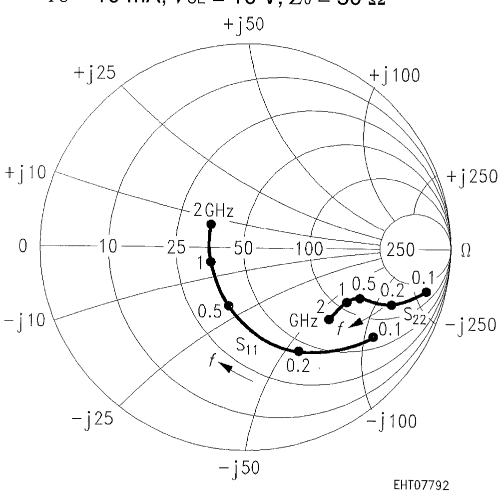
$S_{12}, S_{21} = f(f)$
I_C = 5 mA, V_{CE} = 10 V, Z_0 = 50 Ω



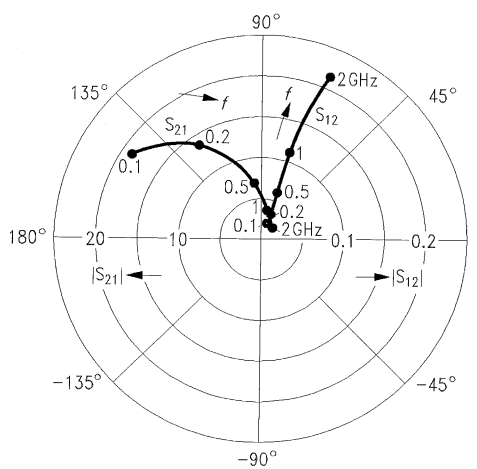
Common Emitter S Parameters (continued)

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	0.75	– 28	18.20	142	0.02	74	0.88	– 13
0.3	0.52	– 71	10.23	114	0.05	63	0.67	– 27
0.5	0.37	– 99	7.00	99	0.07	63	0.56	– 29
0.8	0.23	– 129	4.57	84	0.09	63	0.50	– 28
1.0	0.21	– 146	3.72	78	0.12	65	0.48	– 29
1.2	0.20	– 163	3.11	74	0.13	65	0.47	– 31
1.5	0.18	177	2.56	64	0.16	64	0.46	– 34
1.8	0.19	157	2.19	57	0.19	63	0.46	– 39
2.0	0.20	143	2.03	53	0.21	62	0.44	– 39

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



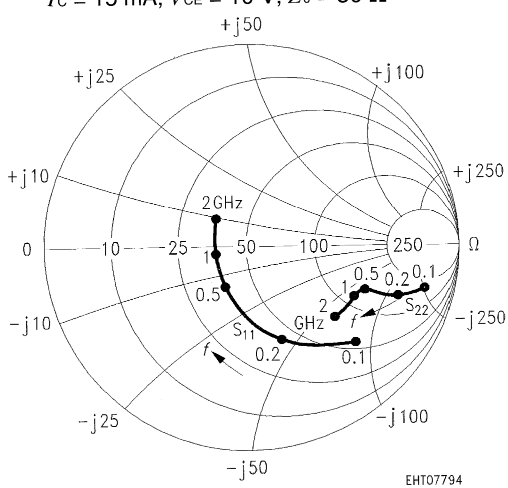
$S_{12}, S_{21} = f(f)$
I_C = 10 mA, V_{CE} = 10 V, Z_0 = 50 Ω



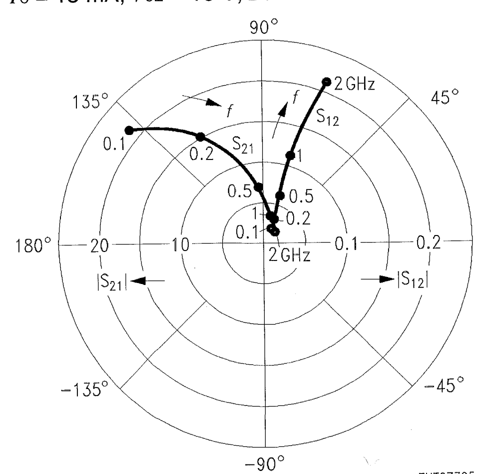
Common Emitter S Parameters (continued)

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	0.64	– 37	19.16	140	0.02	72	0.85	– 14
0.3	0.38	– 87	10.29	112	0.04	64	0.63	– 26
0.5	0.28	– 117	7.00	96	0.06	66	0.53	– 26
0.8	0.19	– 151	4.49	81	0.09	67	0.49	– 25
1.0	0.19	– 166	3.65	76	0.11	68	0.49	– 27
1.2	0.19	180	3.09	71	0.13	67	0.47	– 29
1.5	0.19	162	2.53	62	0.16	66	0.47	– 32
1.8	0.21	145	2.15	55	0.19	65	0.47	– 37
2.0	0.22	134	2.01	51	0.21	64	0.45	– 38

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



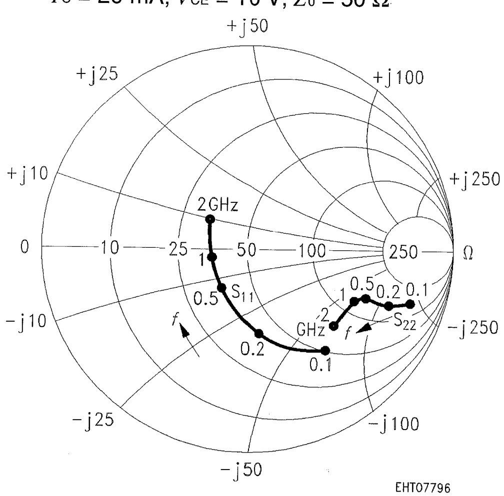
$S_{12}, S_{21} = f(f)$
I_C = 15 mA, V_{CE} = 10 V, Z_0 = 50 Ω



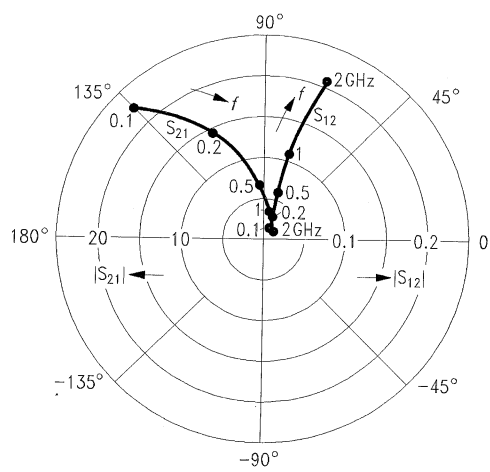
Common Emitter S Parameters (continued)

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	0.58	– 45	20.30	135	0.02	71	0.82	– 14
0.3	0.34	– 98	10.12	108	0.04	65	0.61	– 23
0.5	0.27	– 129	6.72	94	0.06	68	0.54	– 23
0.8	0.20	– 163	4.32	79	0.09	69	0.49	– 49
1.0	0.20	– 176	3.47	74	0.11	70	0.50	– 25
1.2	0.21	173	2.93	69	0.13	69	0.50	– 27
1.5	0.21	156	2.41	60	0.16	68	0.49	– 30
1.8	0.23	140	2.05	53	0.19	67	0.49	– 36
2.0	0.25	131	1.92	49	0.21	65	0.47	– 37

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

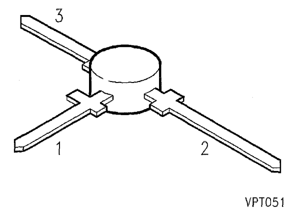


SIEMENS

NPN Silicon RF Transistor

BFR 90

- For broadband amplifiers up to 2 GHz at collector currents from 1 mA to 20 mA.



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

Type	Marking	Ordering Code	Pin Configuration 1	2	3	Package[1]
BFR 90	BFR 90	Q62702-F560	E	C	B	T-plast

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CE0}	15	V
Collector-emitter voltage, $V_{BE} = 0$	V_{CES}	20	
Emitter-base voltage	V_{EB0}	2.5	
Collector current	I_C	30	mA
Base current	I_B	4	
Total power dissipation, $T_S \leq 100$ °C[3]	P_{tot}	280	mW
Junction temperature	T_j	150	°C
Ambient temperature range	T_A	– 65 ... + 150	
Storage temperature range	T_{stg}	– 65 ... + 150	

Thermal Resistance

Junction - ambient[2]	$R_{th\,JA}$	≤ 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.

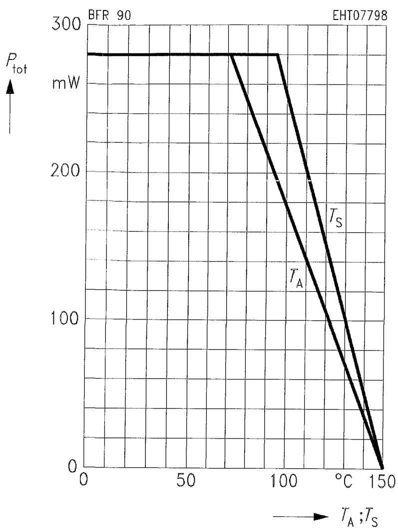
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CEO}$	15	–	–	V
Collector-emitter cutoff current V_{CE} = 20 V, V_{BE} = 0	I_{CES}	–	–	10	µA
Collector-base cutoff current V_{CB} = 10 V, I_E = 0	I_{CBO}	–	–	50	nA
Emitter-base cutoff current V_{EB} = 2.5 V, I_C = 0	I_{EBO}	–	–	100	µA
DC current gain	h_{FE}				–
I_C = 5 mA, V_{CE} = 6 V		40	–	–	
I_C = 25 mA, V_{CE} = 6 V		40	–	–	

Electrical Characteristics

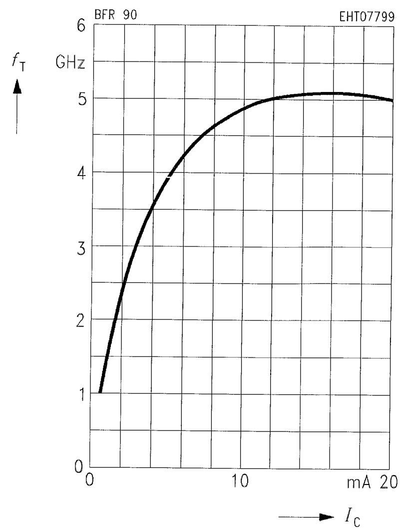
at $T_A = 25\,^\circ C$, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
AC Characteristics					
Transition frequency $I_C = 20$ mA, $V_{CE} = 10$ V, $f = 200$ MHz	f_T	–	5	–	GHz
Collector-base capacitance $V_{CB} = 6$ V, $V_{BE} = v_{be} = 0$, $f = 1$ MHz	C_{cb}	–	0.44	–	pF
Collector-emitter capacitance $V_{CE} = 6$ V, $V_{BE} = v_{be} = 0$, $f = 1$ MHz	C_{ce}	–	0.3	–	
Output capacitance $V_{CE} = 10$ V, $V_{BE} = v_{be} = 0$, $f = 1$ MHz	C_{obs}	–	0.75	–	
Noise figure $I_C = 2$ mA, $V_{CE} = 6$ V, $f = 10$ MHz, $Z_S = 150\ \Omega$ $I_C = 2$ mA, $V_{CE} = 6$ V, $f = 200$ MHz, $Z_S = 100\ \Omega$ $I_C = 2$ mA, $V_{CE} = 6$ V, $f = 800$ MHz, $Z_S = 60\ \Omega$ $I_C = 3$ mA, $V_{CE} = 10$ V, $f = 2$ GHz, $Z_S = Z_{Sopt}$	F	 – – – –	 1.1 2 2 4	 – – – –	dB
Power gain $I_C = 15$ mA, $V_{CE} = 6$ V, $f = 800$ MHz, $Z_S = 60\ \Omega$, $Z_L = Z_{Lopt}$	G_{pe}	–	14	–	
Transducer gain $I_C = 5$ mA, $V_{CE} = 6$ V, $f = 500$ MHz, $Z_0 = 50\ \Omega$	$\lvert S_{21e} \rvert^2$	–	17	–	
Linear output voltage two-tone intermodulation test $I_C = 15$ mA, $V_{CE} = 6$ V, $d_{IM} = 60$ dB, $f_1 = 806$ MHz, $f_2 = 810$ MHz, $Z_S = Z_L = 50\ \Omega$	$V_{o1} = V_{o2}$	–	100	–	mV
Third order intercept point $I_C = 15$ mA, $V_{CE} = 6$ V, $f = 800$ MHz	IP_3	–	23	–	dBm

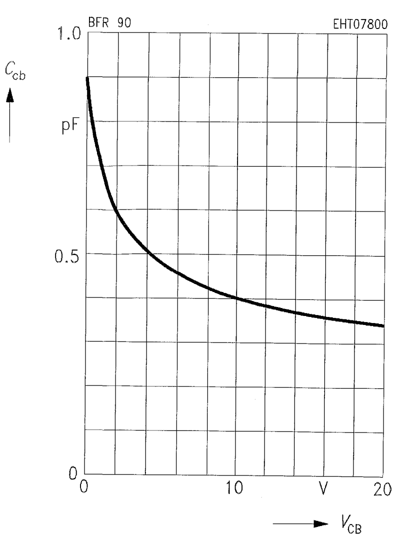
Total power dissipation $P_{tot} = f(T_A^*; T_S)$
*Package mounted on alumina



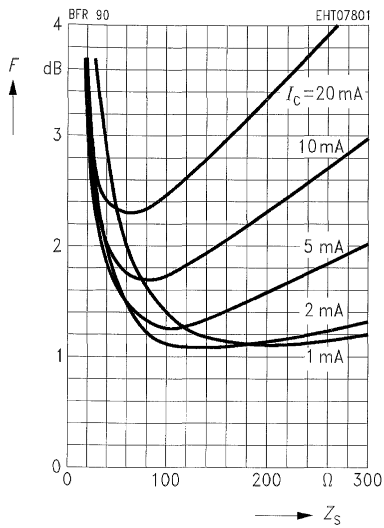
Transition frequency $f_T = f(I_C)$
V_{CE} = 10 V, f = 200 MHz



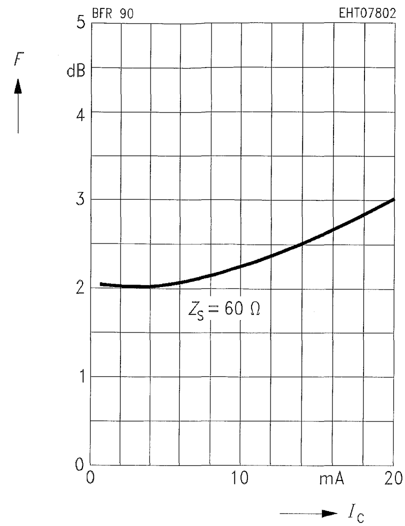
Collector-base capacitance $C_{cb} = f(V_{CB})$
$V_{BE} = v_{be} = 0, f = 1$ MHz



Noise figure $F = f(Z_S)$
V_{CE} = 6 V, f = 10 MHz



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



Common Emitter S Parameters

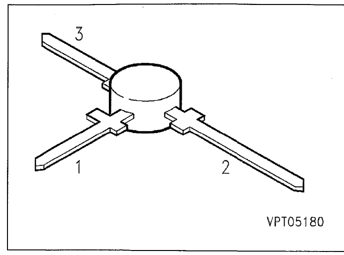
f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_C = 15 mA, V_{CE} = 6 V, Z_0 = 50 Ω								
0.1	0.300	– 35	19.93	146	0.015	78	0.894	– 16
0.2	0.201	– 65	14.93	123	0.027	73	0.695	– 21
0.3	0.139	– 89	11.26	110	0.038	72	0.558	– 29
0.4	0.103	– 109	8.90	102	0.047	76	0.584	– 33
0.5	0.077	– 131	7.23	97	0.058	76	0.599	– 25
0.6	0.074	– 160	6.14	92	0.068	75	0.492	– 21
0.7	0.068	177	5.39	87	0.079	75	0.476	– 32
0.8	0.063	162	4.67	34	0.091	73	0.531	– 33
0.9	0.113	160	4.31	31	0.101	76	0.487	– 23
1.0	0.114	153	3.88	78	0.111	74	0.467	– 33
1.1	0.123	143	3.55	75	0.120	74	0.472	– 34
1.2	0.143	137	3.27	72	0.131	72	0.451	– 36
1.3	0.161	133	2.35	70	0.142	72	0.445	– 36
1.4	0.187	131	2.36	63	0.154	72	0.440	– 42
1.5	0.195	130	2.66	65	0.161	71	0.444	– 42
1.6	0.213	127	2.53	63	0.173	70	0.433	– 43
1.7	0.214	127	2.38	61	0.182	69	0.427	– 44
1.8	0.244	123	2.25	58	0.191	69	0.337	– 50
1.9	0.265	123	2.15	56	0.200	67	0.494	– 53
2.0	0.253	126	2.08	53	0.212	65	0.394	– 51

SIEMENS

NPN Silicon RF Transistor

BFR 91

- For low-distortion broadband amplifiers up to 1 GHz at collector currents from 10 mA to 30 mA.



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

Type	Marking	Ordering Code	Pin Configuration 1	2	3	Package[1]
BFR 91	BFR 91	Q62702-F569	E	C	B	T-plast

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CEO}	15	V
Collector-emitter voltage, $V_{BE} = 0$	V_{CES}	20	
Emitter-base voltage	V_{EBO}	2.5	
Collector current	I_C	50	mA
Base current	I_B	10	
Total power dissipation, $T_S \leq 94$ ˚C[3]	P_{tot}	400	mW
Junction temperature	T_j	150	˚C
Ambient temperature range	T_A	– 65 … + 150	
Storage temperature range	T_{stg}	– 65 … + 150	

Thermal Resistance

Junction - ambient[2]	$R_{th\,JA}$	≤ 220	K/W
Junction - soldering point[3]	$R_{th\,JS}$	≤ 140	

[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.

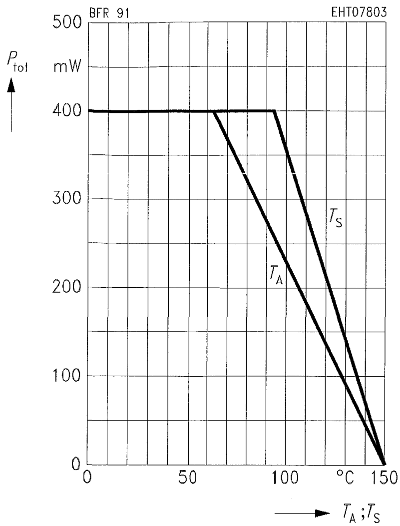
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CE0}$	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} = 2.5 V, I_C = 0	I_{EB0}	–	–	100	µA
DC current gain I_C = 25 mA, V_{CE} = 8 V I_C = 50 mA, V_{CE} = 5 V	h_{FE}	 30 30	 – –	 – –	–

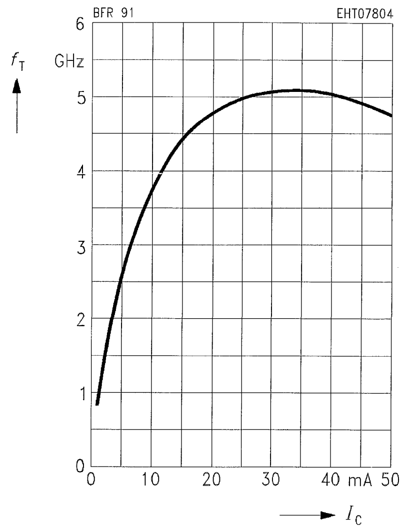
Electrical Characteristics
at T_A = 25 ˚C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
AC Characteristics					
Transition frequency I_C = 25 mA, V_{CE} = 8 V, f = 200 MHz	f_T	–	5	–	GHz
Collector-base capacitance V_{CB} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{cb}	–	0.53	–	pF
Collector-emitter capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{ce}	–	0.3	–	
Output capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{obs}	–	0.85	–	
Noise figure I_C = 2 mA, V_{CE} = 8 V, f = 500 MHz, Z_S = Z_{Sopt}	F	–	1.9	–	dB
Power gain I_C = 30 mA, V_{CE} = 5 V, f = 500 MHz, Z_S = 60 Ω, Z_L = Z_{Lopt}	G_{pe}	–	17	–	
Transducer gain I_C = 30 mA, V_{CE} = 5 V, f = 800 MHz, Z_0 = 50 Ω	$\|S_{21e}\|^2$	–	12.4	–	
Linear output voltage two-tone intermodulation test I_C = 25 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}	–	240	–	mV
Third order intercept point I_C = 25 mA, V_{CE} = 8 V, f = 800 MHz	IP_3	–	30.5	–	dBm

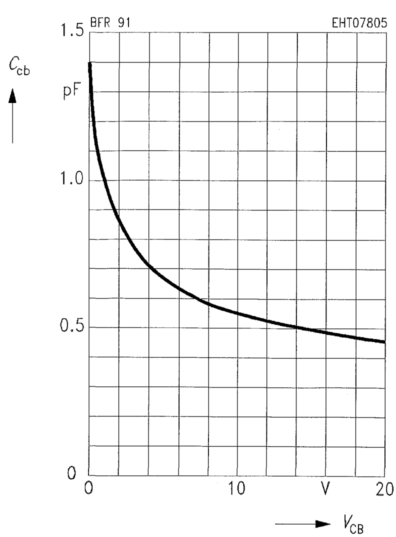
Total power dissipation $P_{tot} = f\,(T_A{}^*;\ T_S)$
*Package mounted on alumina



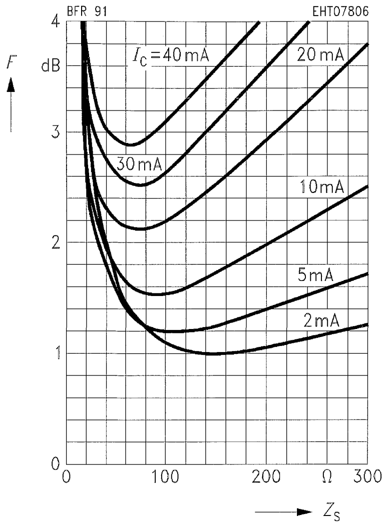
Transition frequency $f_T = f\,(I_C)$
V_{CE} = 5 V, f = 200 MHz



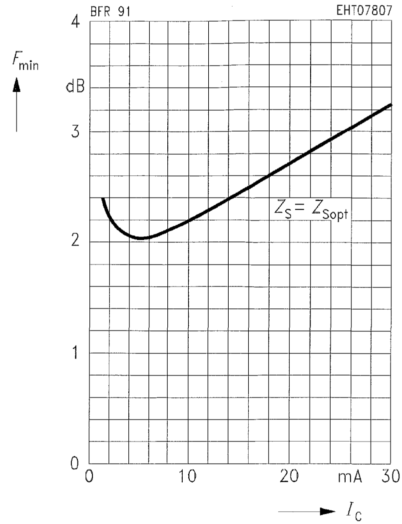
Collector-base capacitance $C_{cb} = f\,(V_{CB})$
$V_{BE} = v_{be} = 0$, f = 1 MHz



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



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



Common Emitter S Parameters

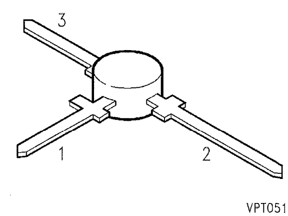
f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**
I_C = 30 mA, V_{CE} = 5 V, Z_0 = 50 Ω								
0.1	0.353	– 107	27.43	120	0.020	61	0.553	– 42
0.2	0.329	– 144	15.97	103	0.033	68	0.385	– 46
0.3	0.329	– 160	10.79	95	0.044	69	0.296	– 41
0.4	0.335	– 169	8.25	88	0.057	69	0.241	– 42
0.5	0.338	– 176	6.65	84	0.070	70	0.220	– 48
0.6	0.345	176	5.61	81	0.084	72	0.234	– 50
0.7	0.356	171	4.81	78	0.095	71	0.221	– 43
0.8	0.364	168	4.18	74	0.107	70	0.176	– 48
0.9	0.370	165	3.74	71	0.119	69	0.193	– 63
1.0	0.378	162	3.35	67	0.131	68	0.213	– 58

SIEMENS

NPN Silicon RF Transistor

BFR 91A

- For low-distortion broadband amplifiers and oscillators up to 2 GHz at collector currents from 5 mA to 30 mA.



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

Type	Marking	Ordering Code	Pin Configuration 1	2	3	Package[1]
BFR 91A	BFR 91A	Q62702-F735	E	C	B	T-plast

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CE0}	12	V
Collector-base voltage	V_{CB0}	15	
Emitter-base voltage	V_{EB0}	2	
Collector current	I_C	35	mA
Peak collector current, $f \geq 10$ MHz	I_{CM}	50	
Peak base current, $f \geq 10$ MHz	I_{BM}	10	
Total power dissipation, $T_S \leq 100$ °C[3]	P_{tot}	400	mW
Junction temperature	T_j	150	°C
Ambient temperature range	T_A	– 65 ... + 150	
Storage temperature range	T_{stg}	– 65 ... + 150	

Thermal Resistance

Junction - ambient[2]	$R_{th\,JA}$	≤ 205	K/W
Junction - soldering point[3]	$R_{th\,JS}$	≤ 125	

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.

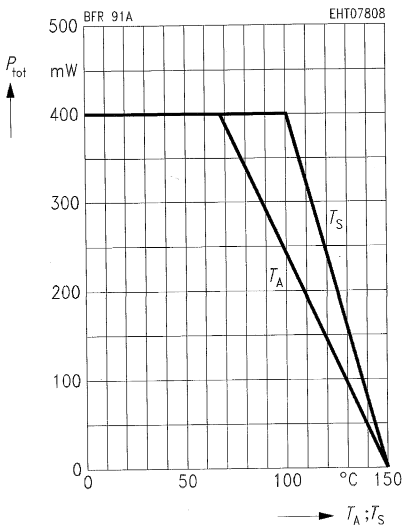
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CEO}$	12	–	–	V
Collector-base cutoff current V_{CB} = 5 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 = 30 mA, V_{CE} = 5 V	h_{FE}	40	90	–	–
Collector-emitter saturation voltage I_C = 50 mA, I_B = 5 mA	V_{CEsat}	–	0.13	0.4	V

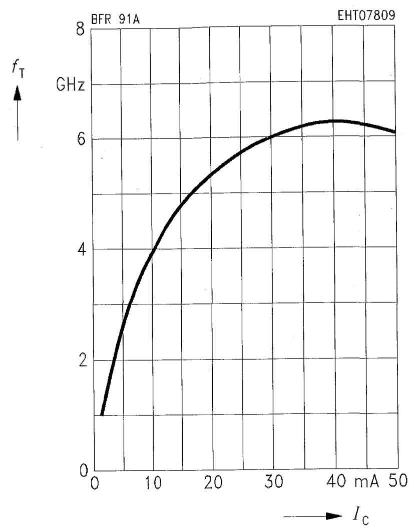
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
AC Characteristics					
Transition frequency I_C = 30 mA, V_{CE} = 5 V, f = 500 MHz I_C = 50 mA, V_{CE} = 5 V, f = 500 MHz	f_T	 – –	 6 6.2	 – –	GHz
Collector-base capacitance V_{CB} = 5 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{cb}	–	0.52	–	pF
Collector-emitter capacitance V_{CE} = 5 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{ce}	–	0.3	–	
Input capacitance V_{EB} = 0.5 V, I_C = i_c = 0, f = 1 MHz	C_{ibo}	–	2.3	–	
Output capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{obs}	–	0.8	–	
Noise figure I_C = 5 mA, V_{CE} = 8 V, f = 10 MHz, Z_S = 50 Ω I_C = 5 mA, V_{CE} = 8 V, f = 800 MHz, Z_S = Z_{Sopt}	F	 – –	 1.1 1.6	 – –	dB
Power gain I_C = 30 mA, V_{CE} = 8 V, f = 800 MHz, Z_0 = 50 Ω, Z_L = Z_{Lopt}	G_{pe}	–	14	–	
Linear output voltage two tone intermodulation test I_C = 30 mA, V_{CE} = 8 V, d_{IM} = 60 dB, f_1 = 806 MHz, f_2 = 810 MHz, Z_S = Z_L = 50 Ω	V_{o1} = V_{o2}	–	280	–	mV
Third order intercept point I_C = 30 mA, V_{CE} = 8 V, f = 800 MHz	IP_3	–	32	–	dBm

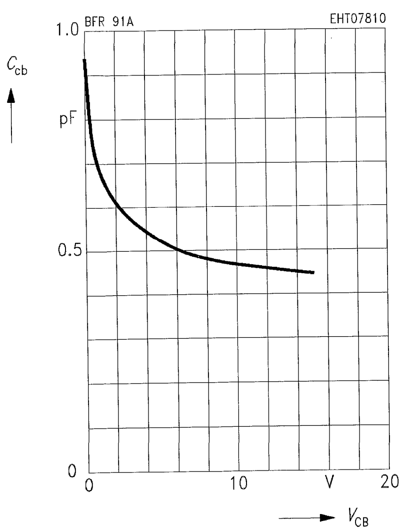
Total power dissipation $P_{tot} = f(T_A^*; T_S)$
*Package mounted on alumina



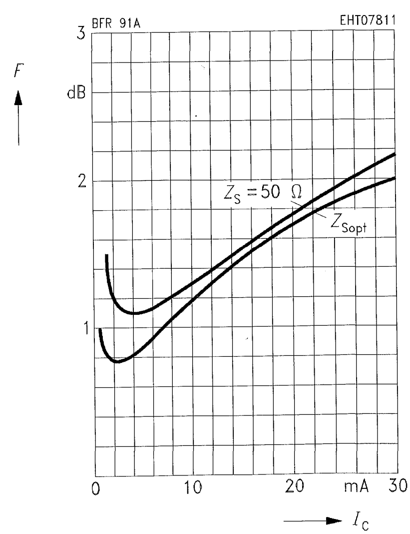
Transition frequency $f_T = f(I_C)$
V_{CE} = 5 V, f = 500 MHz



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



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

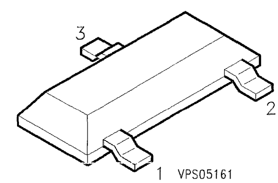


SIEMENS

NPN Silicon RF Transistor

BFR 92P

- For broadband amplifiers up to 2 GHz and fast non-saturated switches at collector currents from 0.5 mA to 20 mA.
- Complementary type: BFT 92 (PNP).
- CECC-type available: CECC 50002/249.



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

Type	Marking	Ordering Code (tape and reel)	Pin Configuration 1	2	3	Package[1]
BFR 92P	GF	Q62702-F1050	B	E	C	SOT-23

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CE0}	15	V
Collector-base voltage	V_{CB0}	20	
Emitter-base voltage	V_{EB0}	2.5	
Collector current	I_C	30	mA
Base current	I_B	4	
Total power dissipation, $T_S \leq 48$ °C[3]	P_{tot}	280	mW
Junction temperature	T_j	150	°C
Ambient temperature range	T_A	– 65 ... + 150	
Storage temperature range	T_{stg}	– 65 ... + 150	

Thermal Resistance

Junction - ambient[2]	$R_{th\,JA}$	≤ 445	K/W
Junction - soldering point[3]	$R_{th\,JS}$	≤ 365	

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.

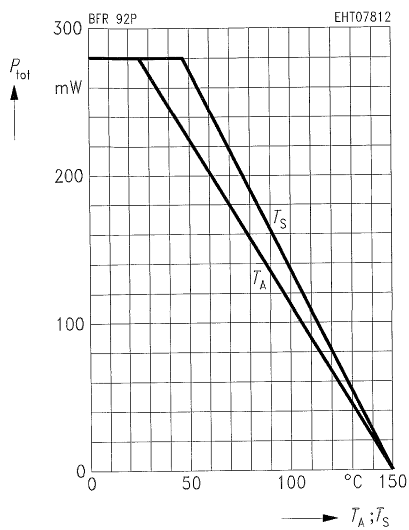
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CEO}$	15	–	–	V
Collector-base cutoff current V_{CB} = 10 V, I_E = 0 V_{CB} = 20 V, I_E = 0	I_{CBO}	 – –	 – –	 0.05 10	µA
Emitter-base cutoff current V_{EB} = 2.5 V, I_C = 0	I_{EBO}	–	–	100	
DC current gain I_C = 14 mA, V_{CE} = 10 V	h_{FE}	40	100	–	–
Collector-emitter saturation voltage I_C = 30 mA, I_B = 3 mA	V_{CEsat}	–	–	0.4	V

Electrical Characteristics

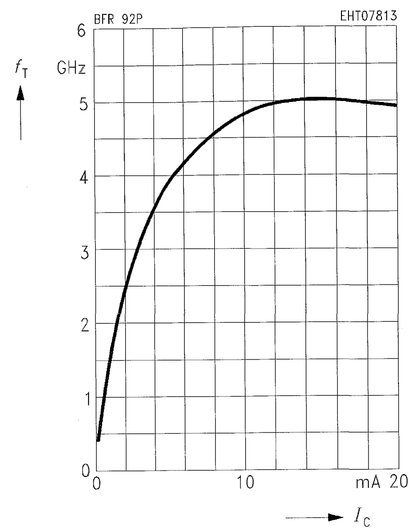
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
AC Characteristics					
Transition frequency I_C = 5 mA, V_{CE} = 10 V, f = 200 MHz I_C = 14 mA, V_{CE} = 10 V, f = 200 MHz	f_T	 – –	 3.8 5	 – –	GHz
Collector-base capacitance V_{CB} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{cb}	–	0.5	0.7	pF
Collector-emitter capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{ce}	–	0.27	–	
Input capacitance V_{EB} = 0.5 V, I_C = i_c = 0, f = 1 MHz	C_{ibo}	–	0.9	–	
Output capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{obs}	–	0.77	–	
Noise figure I_C = 5 mA, V_{CE} = 6 V, f = 10 MHz, Z_S = 75 Ω I_C = 2 mA, V_{CE} = 6 V, f = 800 MHz, Z_S = Z_{Sopt} I_C = 3 mA, V_{CE} = 10 V, f = 2 GHz, Z_S = Z_{Sopt}	F	 – – –	 1.5 1.5 3.9	 – – –	dB
Power gain I_C = 15 mA, V_{CE} = 6 V, f = 800 MHz, Z_S = 50 Ω, Z_L = Z_{Lopt}	G_{pe}	–	14	–	
Transducer gain I_C = 15 mA, V_{CE} = 6 V, f = 1 GHz, Z_0 = 50 Ω	$\lvert S_{21e} \rvert^2$	–	11	–	
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

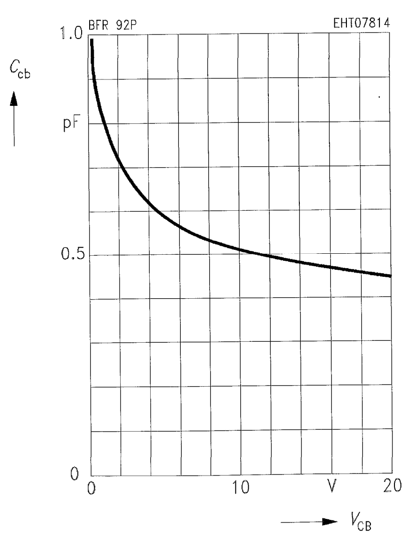
Total power dissipation $P_{tot} = f(T_A^*; T_S)$
*Package mounted on alumina



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



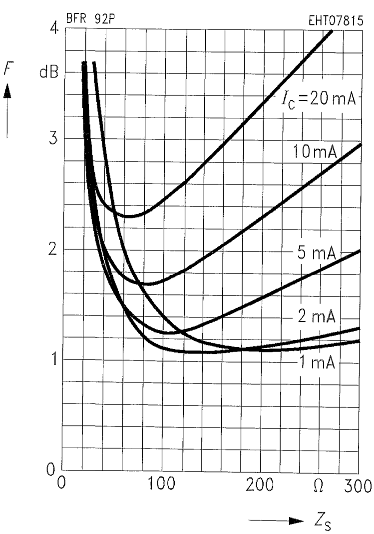
Collector-base capacitance $C_{cb} = f(V_{CB})$
$V_{BE} = v_{be} = 0$, f = 1 MHz



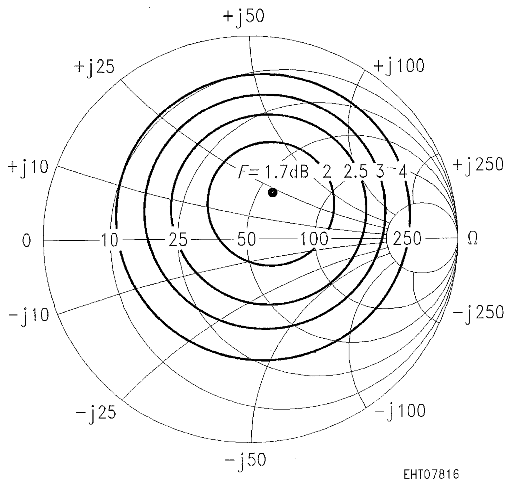
Common Emitter Noise Parameters

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 = 2 mA, V_{CE} = 6 V, Z_0 = 50 Ω								
0.01	1.05	–	(Z_S = 150 Ω)		–	–	3	–
I_C = 5 mA, V_{CE} = 6 V, Z_0 = 50 Ω								
0.01	1.3	–	(Z_S = 100 Ω)		–	–	1.6	–
0.8	1.7	14.3	0.25	58.5	16.9	0.24	1.9	14

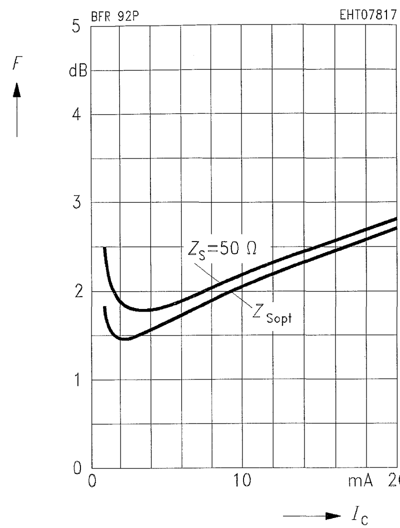
Noise figure $F = f(Z_S)$
V_{CE} = 6 V, f = 10 MHz



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



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



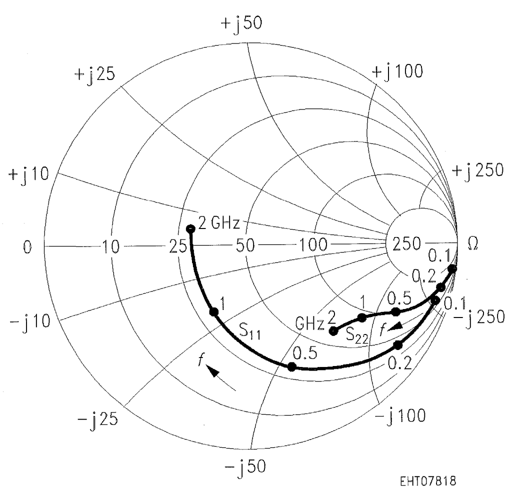
Common Emitter S Parameters

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_C = 0.5 mA, V_{CE} = 1 V, Z_0 = 50 Ω								
0.10	0.967	– 12.3	1.83	168.2	0.050	81.5	0.990	– 6.7
0.15	0.956	– 18.4	1.82	162.3	0.075	77.4	0.982	– 10.0
0.20	0.941	– 24.3	1.81	156.4	0.098	73.2	0.970	– 13.0
0.25	0.923	– 30.2	1.78	150.8	0.120	69.3	0.955	– 16.2
0.30	0.903	– 35.9	1.75	145.2	0.141	65.4	0.939	– 19.1
0.40	0.859	– 47.0	1.68	134.7	0.177	58.2	0.902	– 24.5
0.50	0.812	– 57.2	1.59	125.1	0.207	51.8	0.864	– 29.4
0.60	0.765	– 67.2	1.51	116.1	0.231	46.2	0.826	– 33.6
0.70	0.717	– 76.5	1.44	108.0	0.249	41.2	0.790	– 37.4
0.80	0.686	– 85.5	1.36	100.3	0.265	36.3	0.757	– 40.7
0.90	0.645	– 94.5	1.31	93.3	0.275	32.3	0.725	– 43.8
1.00	0.610	– 103.1	1.25	86.6	0.281	28.6	0.695	– 46.4
I_C = 1 mA, V_{CE} = 1 V, Z_0 = 50 Ω								
0.10	0.938	– 16.4	3.51	165.6	0.050	79.4	0.981	– 9.4
0.15	0.917	– 24.5	3.45	158.7	0.073	74.4	0.962	– 13.8
0.20	0.892	– 32.2	3.37	151.9	0.095	69.6	0.938	– 17.9
0.25	0.862	– 39.7	3.26	145.5	0.114	65.1	0.910	– 21.9
0.30	0.829	– 46.7	3.13	139.4	0.132	60.8	0.881	– 25.5
0.40	0.763	– 60.1	2.88	128.5	0.160	53.5	0.819	– 31.7
0.50	0.699	– 72.0	2.64	118.9	0.182	47.6	0.761	– 37.0
0.60	0.643	– 83.2	2.41	110.4	0.198	42.8	0.709	– 41.2
0.70	0.591	– 93.4	2.22	102.9	0.209	38.9	0.665	– 44.7
0.80	0.557	– 103.0	2.05	96.1	0.219	35.5	0.626	– 47.5
0.90	0.521	– 112.6	1.92	89.8	0.225	32.9	0.591	– 50.2
1.00	0.490	– 121.7	1.79	84.0	0.229	30.8	0.559	– 52.4

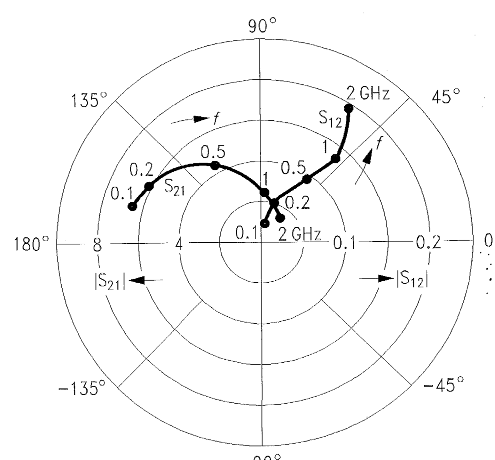
Common Emitter S Parameters (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**
I_C = 2 mA, V_{CE} = 6 V, Z_0 = 50 Ω								
0.1	0.91	– 15	6.49	161	0.03	79	0.97	– 6
0.3	0.79	– 46	5.25	139	0.08	64	0.88	– 22
0.5	0.66	– 71	4.49	120	0.11	55	0.77	– 30
0.8	0.46	– 102	3.29	98	0.13	47	0.64	– 35
1.0	0.40	– 119	2.80	88	0.15	46	0.60	– 38
1.2	0.36	– 134	2.43	80	0.15	45	0.56	– 40
1.5	0.31	– 156	2.03	69	0.17	48	0.53	– 43
1.8	0.29	– 178	1.77	60	0.19	49	0.51	– 48
2.0	0.29	168	1.66	54	0.20	51	0.49	– 49

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



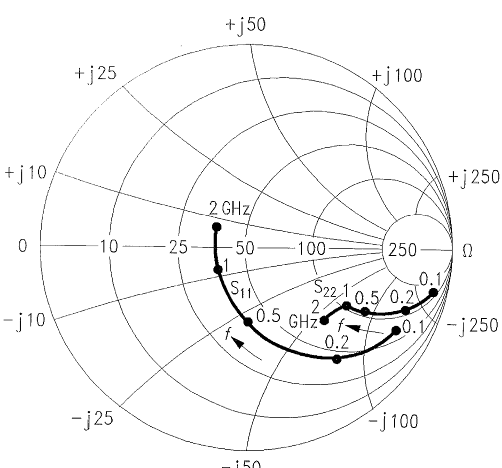
S_{12}, S_{21} = f (f)
I_C = 2 mA, V_{CE} = 6 V, Z_0 = 50 Ω



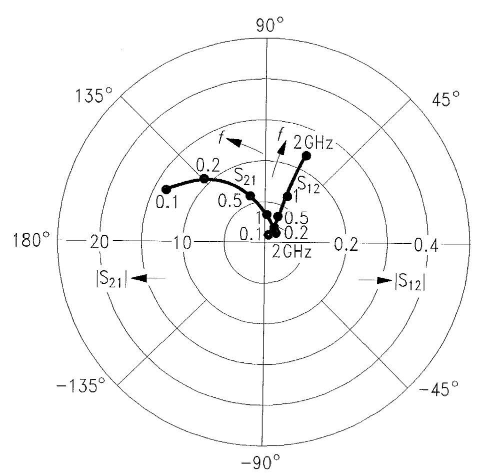
Common Emitter S Parameters (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**
I_C = 5 mA, V_{CE} = 6 V, Z_0 = 50 Ω								
0.1	0.80	– 24	12.96	150	0.03	75	0.92	– 11
0.3	0.58	– 66	8.56	123	0.06	61	0.74	– 29
0.5	0.44	– 97	6.27	106	0.08	58	0.59	– 35
0.8	0.28	– 128	4.19	88	0.11	57	0.49	– 35
1.0	0.26	– 144	3.45	81	0.13	59	0.49	– 36
1.2	0.24	– 160	2.93	74	0.14	58	0.45	– 38
1.5	0.22	179	2.43	65	0.17	59	0.44	– 40
1.8	0.23	159	2.08	57	0.20	59	0.43	– 45
2.0	0.25	146	1.93	52	0.22	58	0.40	– 46

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



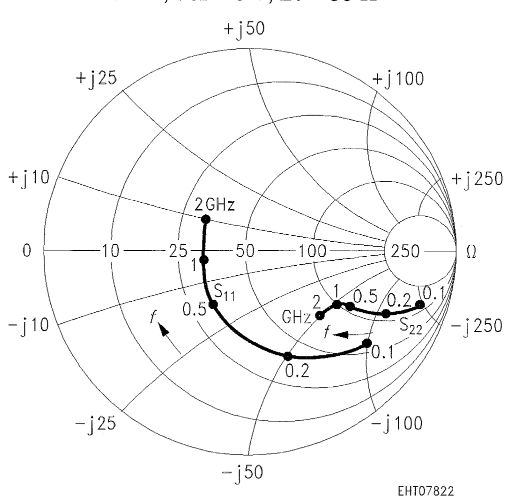
$S_{12}, S_{21} = f(f)$
I_C = 5 mA, V_{CE} = 6 V, Z_0 = 50 Ω



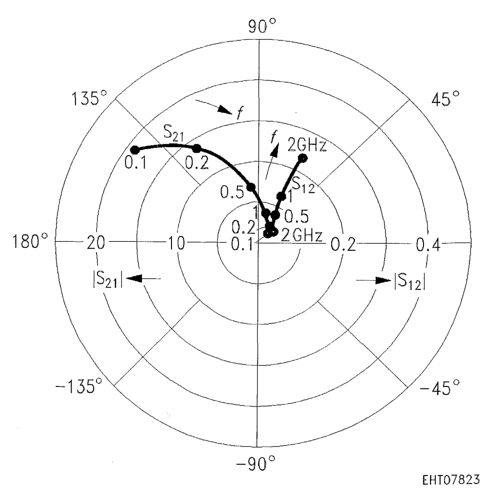
Common Emitter S Parameters (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**
I_C = 10 mA, V_{CE} = 6 V, Z_0 = 50 Ω								
0.1	0.66	– 35	18.62	140	0.03	73	0.85	– 15
0.3	0.42	– 85	10.32	113	0.05	62	0.62	– 31
0.5	0.32	– 116	6.92	98	0.07	63	0.50	– 33
0.8	0.22	– 149	4.49	83	0.10	64	0.44	– 31
1.0	0.21	– 164	3.65	77	0.12	65	0.43	– 32
1.2	0.21	– 178	3.09	71	0.14	64	0.41	– 34
1.5	0.21	164	2.54	63	0.17	63	0.41	– 36
1.8	0.22	147	2.18	55	0.21	62	0.40	– 41
2.0	0.24	136	2.02	51	0.22	61	0.38	– 42

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



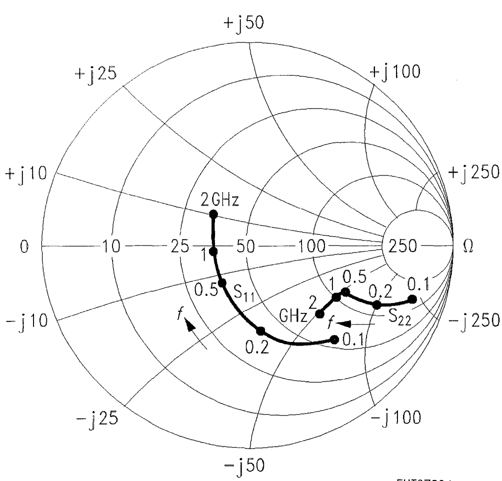
S_{12}, S_{21} = f (f)
I_C = 10 mA, V_{CE} = 6 V, Z_0 = 50 Ω



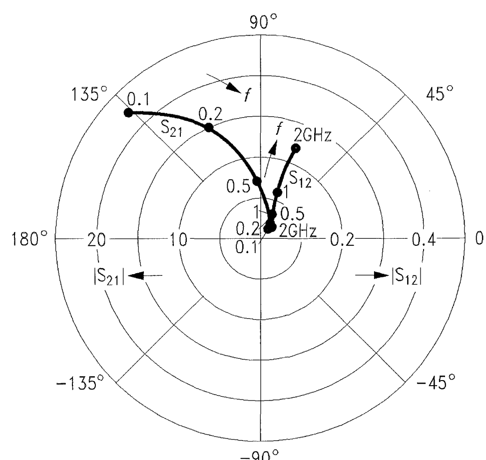
Common Emitter S Parameters (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**
I_C = 15 mA, V_{CE} = 6 V, Z_0 = 50 Ω								
0.1	0.57	– 43	20.30	137	0.02	71	0.81	– 16
0.3	0.35	– 95	10.53	109	0.05	54	0.58	– 29
0.5	0.27	– 127	7.00	95	0.07	66	0.48	– 29
0.8	0.21	– 162	4.49	80	0.10	67	0.43	– 27
1.0	0.21	– 174	3.65	75	0.12	68	0.43	– 29
1.2	0.21	174	3.09	70	0.14	66	0.41	– 31
1.5	0.22	158	2.54	61	0.17	65	0.41	– 34
1.8	0.24	142	2.15	54	0.21	64	0.41	– 40
2.0	0.26	133	2.00	50	0.23	63	0.39	– 40

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



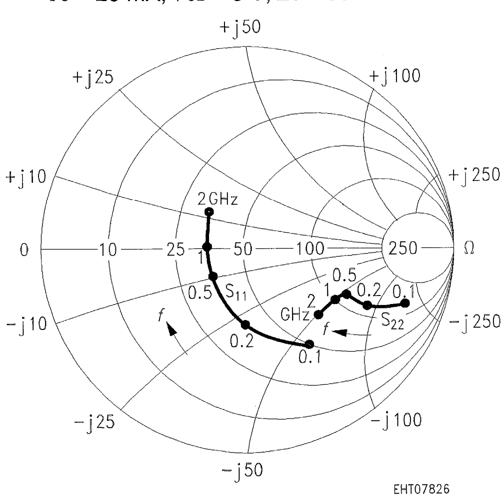
$S_{12}, S_{21} = f(f)$
I_C = 15 mA, V_{CE} = 6 V, Z_0 = 50 Ω



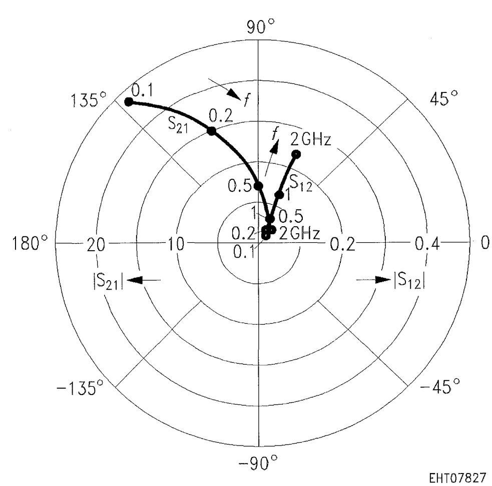
Common Emitter S Parameters (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**
I_C = 20 mA, V_{CE} = 6 V, Z_0 = 50 Ω								
0.1	0.51	– 49	21.13	133	0.02	70	0.79	– 16
0.3	0.32	– 106	10.35	106	0.05	65	0.56	– 27
0.5	0.27	– 138	6.76	92	0.07	67	0.48	– 27
0.8	0.22	– 171	4.34	78	0.09	68	0.45	– 25
1.0	0.22	179	3.49	74	0.12	69	0.44	– 28
1.2	0.23	169	2.97	68	0.14	68	0.43	– 30
1.5	0.24	153	2.43	60	0.17	66	0.43	– 33
1.8	0.26	139	2.07	53	0.21	65	0.42	– 39
2.0	0.28	131	1.93	48	0.22	64	0.40	– 39

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



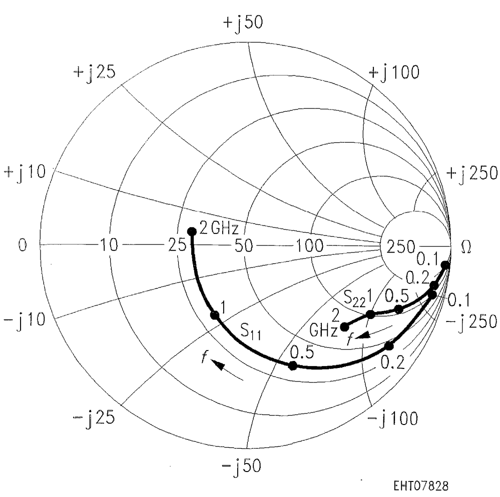
S_{12}, S_{21} = f (f)
I_C = 20 mA, V_{CE} = 6 V, Z_0 = 50 Ω



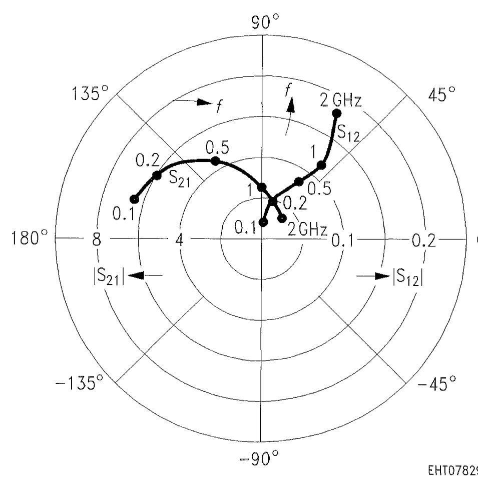
Common Emitter S Parameters (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**
I_C = 2 mA, V_{CE} = 10 V, Z_0 = 50 Ω								
0.1	0.92	– 14	6.46	161	0.03	80	0.98	– 6
0.3	0.81	– 43	5.28	140	0.07	66	0.90	– 19
0.5	0.69	– 65	4.54	122	0.10	57	0.80	– 27
0.8	0.48	– 95	3.35	99	0.12	49	0.68	– 33
1.0	0.42	– 111	2,87	90	0.14	48	0.64	– 35
1.2	0.36	– 125	2.45	83	0.15	47	0.61	– 38
1.5	0.30	– 146	2.07	71	0.16	49	0.58	– 40
1.8	0.28	– 170	1.81	62	0.18	50	0.56	– 45
2.0	0.27	175	1.68	56	0.19	52	0.54	– 46

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



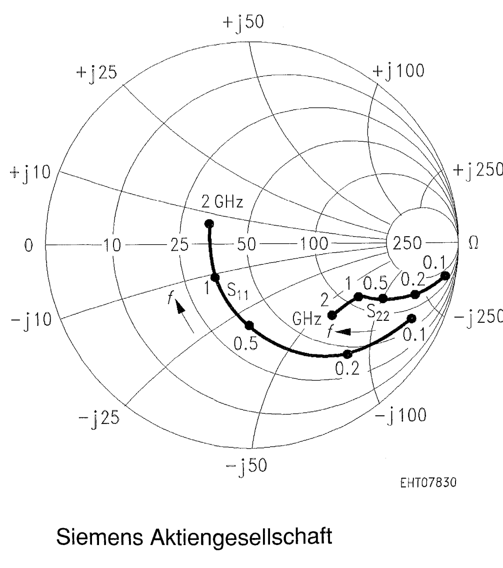
S_{12}, S_{21} = f (f)
I_C = 2 mA, V_{CE} = 10 V, Z_0 = 50 Ω



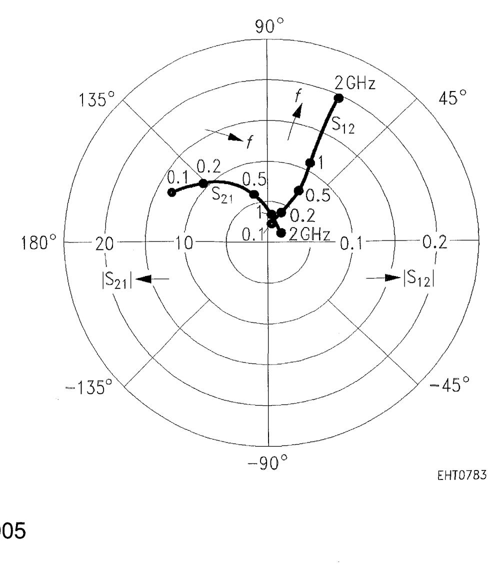
Common Emitter S Parameters (continued)

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	0.83	– 19	12.74	152	0.03	78	0.95	– 9
0.3	0.65	– 57	8.56	125	0.06	63	0.80	– 25
0.5	0.49	– 84	6.35	107	0.08	58	0.67	– 31
0.8	0.31	– 112	4.29	89	0.10	55	0.56	– 33
1.0	0.27	– 129	3.53	82	0.13	57	0.54	– 35
1.2	0.24	– 144	2.97	77	0.14	57	0.51	– 36
1.5	0.21	– 167	2.45	67	0.16	58	0.50	– 38
1.8	0.21	170	2.13	59	0.19	58	0.48	– 43
2.0	0.22	155	1.96	54	0.21	58	0.47	– 43

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



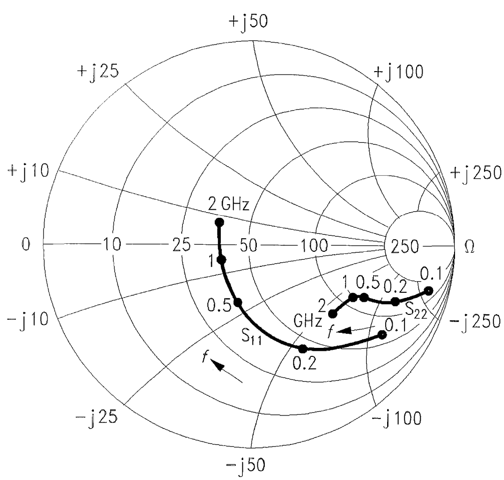
S_{12}, S_{21} = f (f)
I_C = 5 mA, V_{CE} = 10 V, Z_0 = 50 Ω



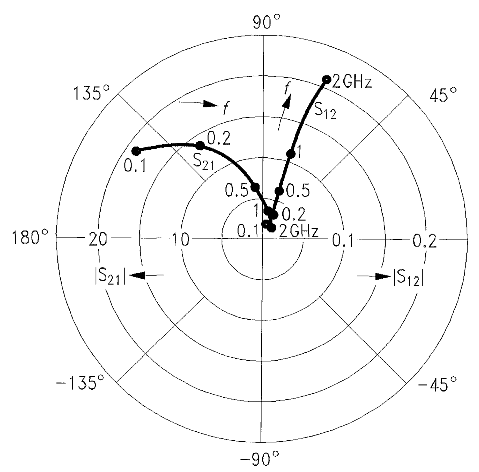
Common Emitter S Parameters (continued)

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	0.75	– 28	18.20	142	0.02	74	0.88	– 13
0.3	0.52	– 71	10.23	114	0.05	63	0.67	– 27
0.5	0.37	– 99	7.00	99	0.07	63	0.56	– 29
0.8	0.23	– 129	4.57	84	0.09	63	0.50	– 28
1.0	0.21	– 146	3.72	78	0.12	65	0.48	– 29
1.2	0.20	– 163	3.11	74	0.13	65	0.47	– 31
1.5	0.18	177	2.56	64	0.16	64	0.46	– 34
1.8	0.19	157	2.19	57	0.19	63	0.46	– 39
2.0	0.20	143	2.03	53	0.21	62	0.44	– 39

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



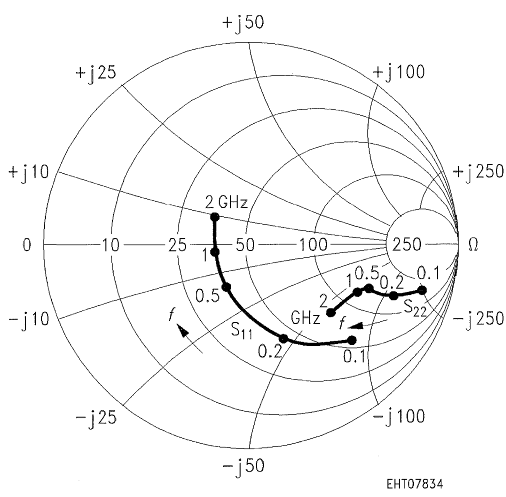
S_{12}, S_{21} = f (f)
I_C = 10 mA, V_{CE} = 10 V, Z_0 = 50 Ω



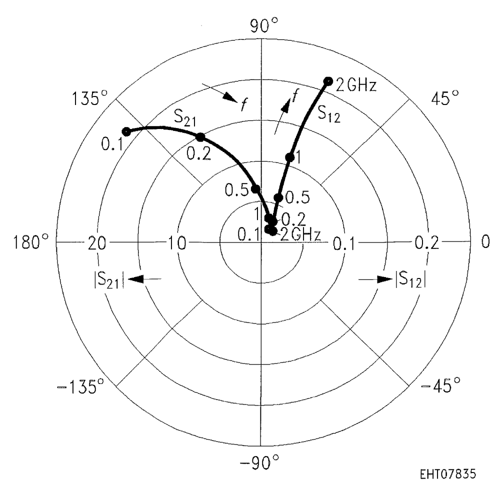
Common Emitter S Parameters (continued)

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	0.64	– 37	19.16	140	0.02	72	0.85	– 14
0.3	0.38	– 87	10.29	112	0.04	64	0.63	– 26
0.5	0.28	– 117	7.00	96	0.06	66	0.53	– 26
0.8	0.19	– 151	4.49	81	0.09	67	0.49	– 25
1.0	0.19	– 166	3.65	76	0.11	68	0.49	– 27
1.2	0.19	180	3.09	71	0.13	67	0.47	– 29
1.5	0.19	162	2.53	62	0.16	66	0.47	– 32
1.8	0.21	145	2.15	55	0.19	65	0.47	– 37
2.0	0.22	134	2.01	51	0.21	64	0.45	– 38

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



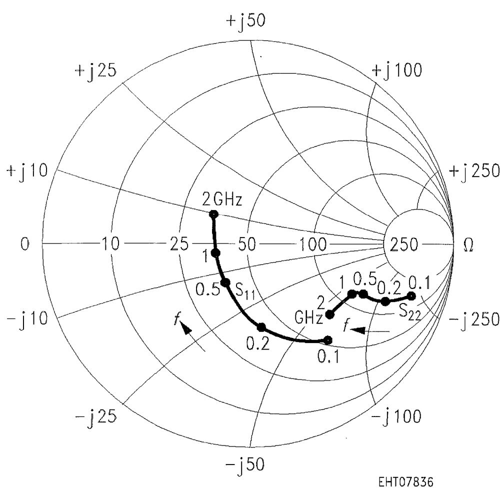
S_{12}, S_{21} = f (f)
I_C = 15 mA, V_{CE} = 10 V, Z_0 = 50 Ω



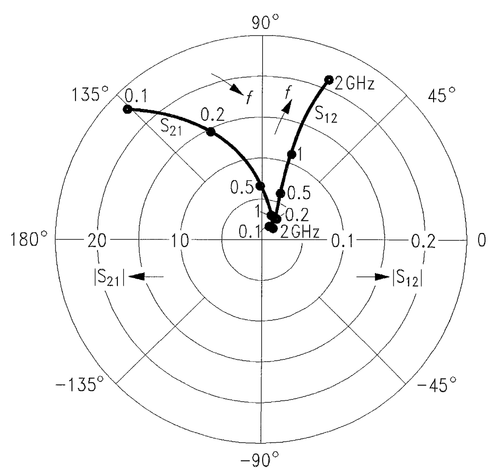
Common Emitter S Parameters (continued)

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	0.58	– 45	20.30	135	0.02	71	0.82	– 14
0.3	0.34	– 98	10.12	108	0.04	65	0.61	– 23
0.5	0.27	– 129	6.72	94	0.06	68	0.54	– 23
0.8	0.20	– 163	4.32	79	0.09	69	0.49	– 49
1.0	0.20	– 176	3.47	74	0.11	70	0.50	– 25
1.2	0.21	173	2.93	69	0.13	69	0.50	– 27
1.5	0.21	156	2.41	60	0.16	68	0.49	– 30
1.8	0.23	140	2.05	53	0.19	67	0.49	– 36
2.0	0.25	131	1.92	49	0.21	65	0.47	– 37

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



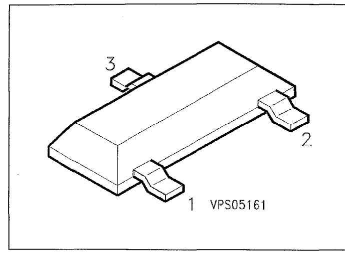
$S_{12}, S_{21} = f(f)$
I_C = 20 mA, V_{CE} = 10 V, Z_0 = 50 Ω



SIEMENS

NPN Silicon RF Transistor — BFR 93 A

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



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

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

Maximum Ratings

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

Thermal Resistance

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

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

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

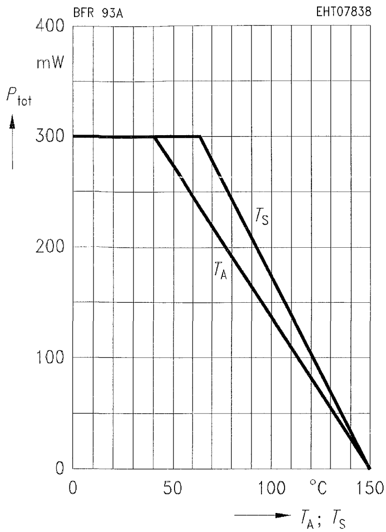
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CE0}$	12	–	–	V
Collector-base cutoff current V_{CB} = 5 V, I_E = 0	I_{CB0}	–	–	50	nA
Emitter-base cutoff current V_{EB} = 2 V, I_C = 0	I_{EB0}	–	–	10	µA
DC current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

Electrical Characteristics

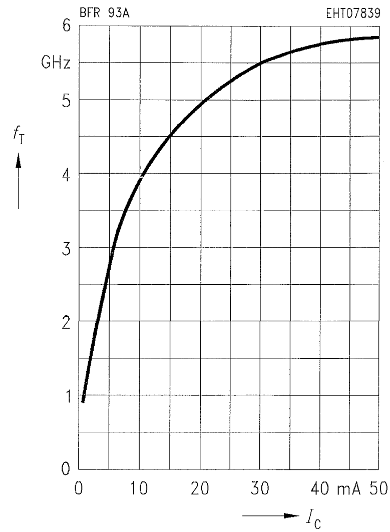
at T_A = 25 °C, unless otherwise specified.

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

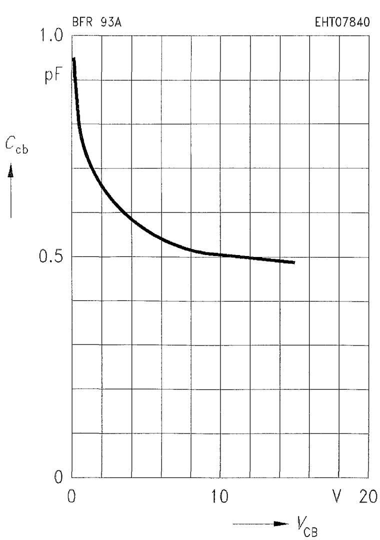
Total power dissipation $P_{tot} = f(T_A^*; T_S)$
*Package mounted on alumina



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



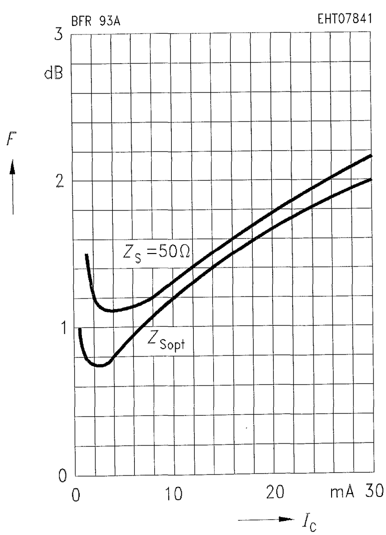
Collector-base capacitance $C_{cb} = f(V_{CB})$
$V_{BE} = v_{be} = 0$, f = 1 MHz



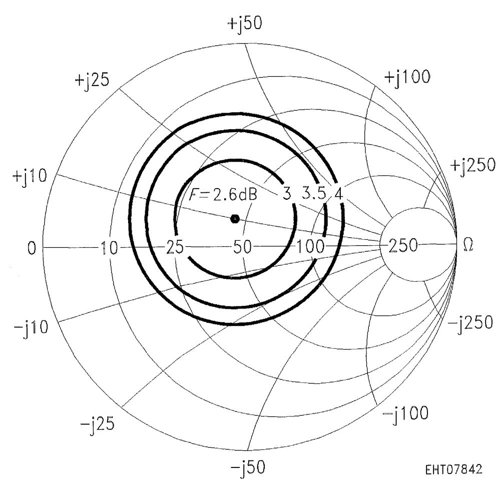
Common Emitter Noise Parameters

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

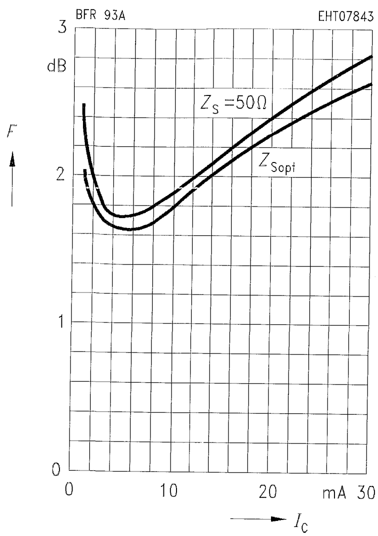
Noise figure $F = f(I_C)$
V_{CE} = 8 V, f = 10 MHz



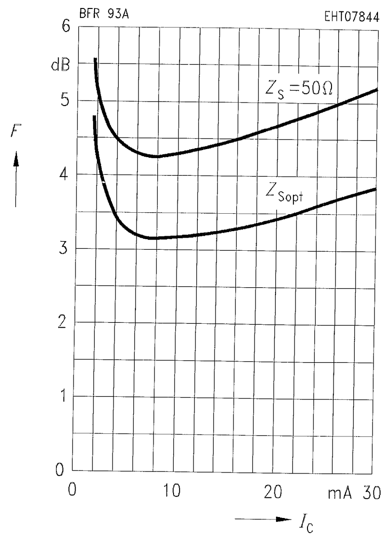
Circles of constant noise figure $F = f(Z_S)$
in Z_S-plane, I_C = 30 mA, V_{CE} = 8 V,
f = 800 MHz



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



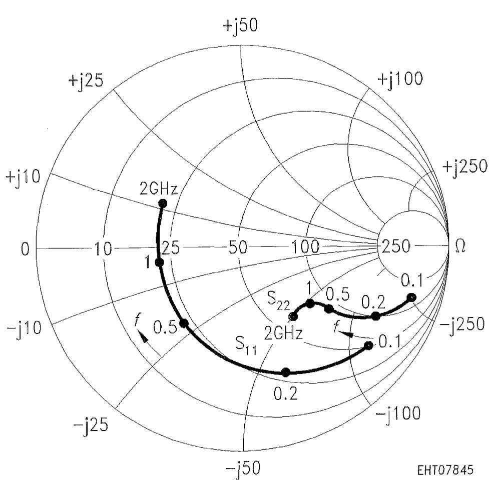
Noise figure $F = f\ (I_C)$
V_{CE} = 8 V, f = 2 GHz, Z_{Lopt} (G)



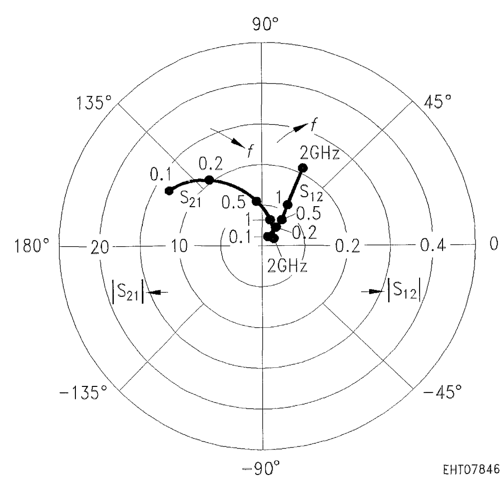
Common Emitter S Parameters

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

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



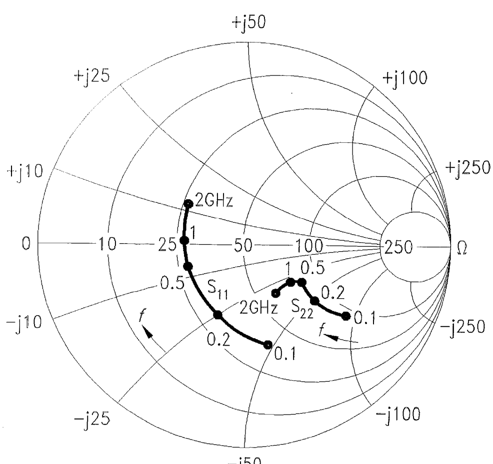
S_{12}, S_{21} = $f\,(f)$
I_C = 5 mA, V_{CE} = 8 V, Z_0 = 50 Ω



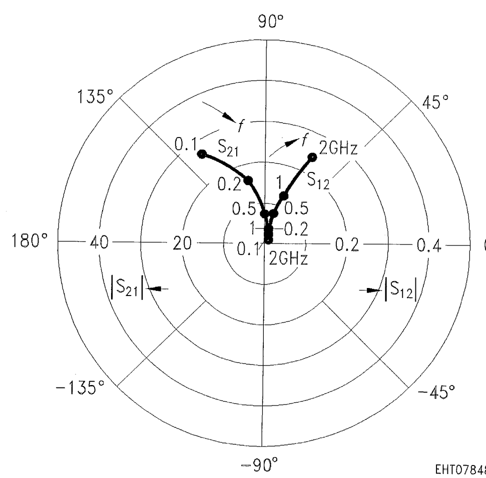
Common Emitter S Parameters (continued)

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

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



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

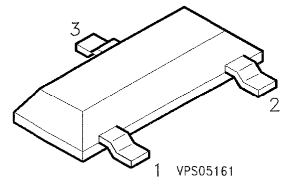


SIEMENS

NPN Silicon RF Transistor

BFR 93P

- For low-distortion broadband amplifiers up to 1 GHz at collector currents from 2 mA to 30 mA.
- CECC-type available: CECC 50002/256.



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

Type	Marking	Ordering Code (tape and reel)	Pin Configuration 1	2	3	Package[1]
BFR 93P	GG	Q62702-F1051	B	E	C	SOT-23

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CEO}	15	V
Collector-base voltage	V_{CBO}	20	
Emitter-base voltage	V_{EBO}	2.5	
Collector current	I_C	50	mA
Base current	I_B	10	
Total power dissipation, $T_S \le 65$ °C[3]	P_{tot}	280	mW
Junction temperature	T_j	150	°C
Ambient temperature range	T_A	– 65 ... + 150	
Storage temperature range	T_{stg}	– 65 ... + 150	

Thermal Resistance

Junction - ambient[2]	$R_{th\,JA}$	≤ 385	K/W
Junction - soldering point[3]	$R_{th\,JS}$	≤ 305	

1) For detailed information 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.

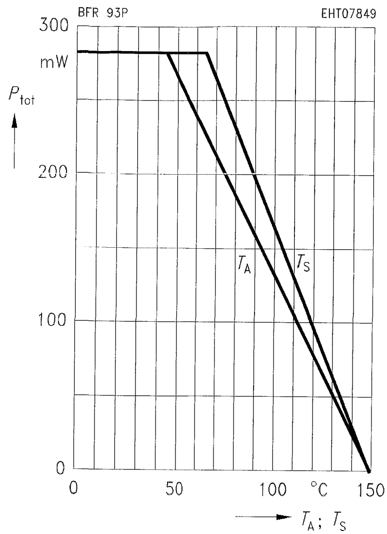
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CEO}$	15	–	–	V
Collector-base cutoff current V_{CB} = 10 V, I_E = 0 V_{CB} = 20 V, I_E = 0	I_{CBO}	 – –	 – –	 0.05 10	µA
Emitter-base cutoff current V_{EB} = 2.5 V, I_C = 0	I_{EBO}	–	–	100	
DC current gain I_C = 25 mA, V_{CE} = 5 V	h_{FE}	30	100	–	–
Collector-emitter saturation voltage I_C = 50 mA, I_B = 5 mA	V_{CEsat}	–	0.2	0.5	V

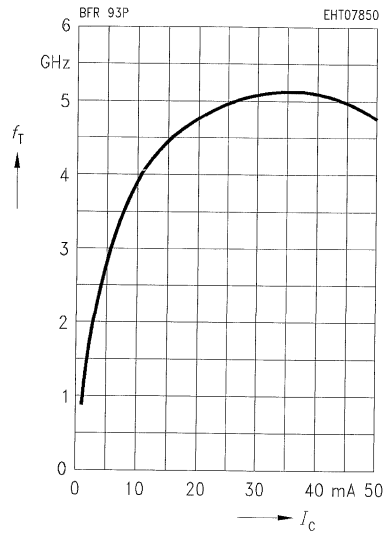
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
AC Characteristics					
Transition frequency I_C = 30 mA, V_{CE} = 5 V, f = 200 MHz I_C = 50 mA, V_{CE} = 5 V, f = 200 MHz	f_T	 – –	 5 4.7	 – –	GHz
Collector-base capacitance V_{CB} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{cb}	–	0.6	0.75	pF
Collector-emitter capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{ce}	–	0.28	–	
Input capacitance V_{EB} = 0.5 V, I_C = i_c = 0, f = 1 MHz	C_{ibo}	–	2.1	–	
Output capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{obs}	–	0.9	–	
Noise figure I_C = 10 mA, V_{CE} = 8 V, f = 10 MHz, Z_S = 75 Ω I_C = 5 mA, V_{CE} = 8 V, f = 500 MHz, Z_S = Z_{Sopt} I_C = 10 mA, V_{CE} = 8 V, f = 800 MHz, Z_S = 50 Ω	F	 – – –	 1.7 1.9 2.4	 – – –	dB
Power gain I_C = 25 mA, V_{CE} = 8 V, f = 800 MHz, Z_S = Z_{Sopt}, Z_L = Z_{Lopt}	G_{pe}	–	13	–	
Transducer gain I_C = 25 mA, V_{CE} = 8 V, f = 500 MHz, Z_0 = 50 Ω	$\vert S_{21e} \vert^2$	–	15.8	–	
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

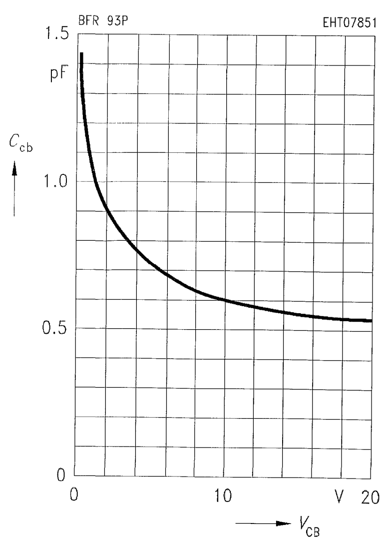
Total power dissipation $P_{tot} = f(T_A{}^*; T_S)$
* Package mounted on alumina



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



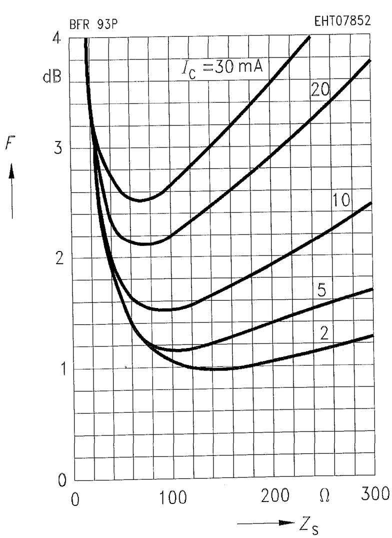
Collector-base capacitance $C_{cb} = f(V_{CB})$
$V_{BE} = v_{be} = 0$, f = 1 MHz



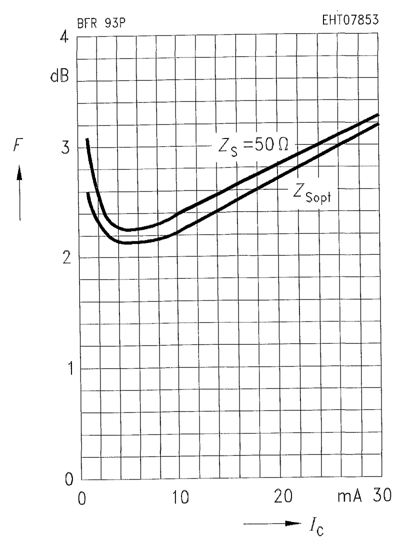
Common Emitter Noise Parameters

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	Ω	–	dB	dB
I_C = 2 mA, V_{CE} = 8 V, Z_0 = 50 Ω								
0.01	1.0	–	(Z_S = 150 Ω)		–	–	1.6	–
I_C = 10 mA, V_{CE} = 8 V, Z_0 = 50 Ω								
0.01	1.5	–	(Z_S = 90 Ω)		–	–	1.7	–
0.8	2.3	–	(Z_S = Z_{Sopt})		–	–	2.4	–

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



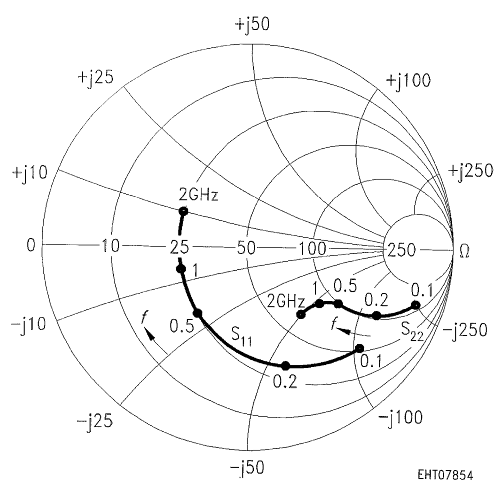
Noise figure $F = f$ (I_C)
V_{CE} = 8 V, f = 800 MHz, Z_{Lopt} (G)



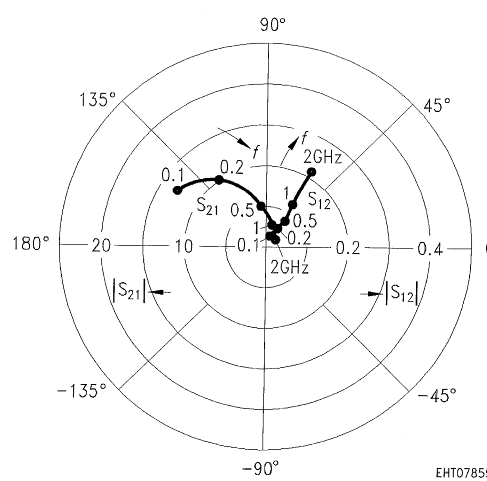
Common Emitter S Parameters

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_C = 5 mA, V_{CE} = 8 V, Z_0 = 50 Ω								
0.1	0.74	– 34	12.96	143	0.03	70	0.87	– 14
0.3	0.51	– 92	7.50	113	0.06	55	0.65	– 31
0.5	0.40	– 125	5.13	97	0.08	55	0.54	– 33
0.8	0.32	– 157	3.35	78	0.10	57	0.48	– 32
1.0	0.31	– 171	2.71	72	0.12	59	0.48	– 35
1.2	0.31	177	2.32	65	0.14	60	0.46	– 38
1.4	0.31	166	2.05	59	0.16	62	0.45	– 41
1.6	0.32	156	1.84	52	0.18	61	0.45	– 46
1.8	0.33	146	1.64	47	0.20	61	0.45	– 49
2.0	0.35	137	1.52	42	0.22	61	0.44	– 52

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



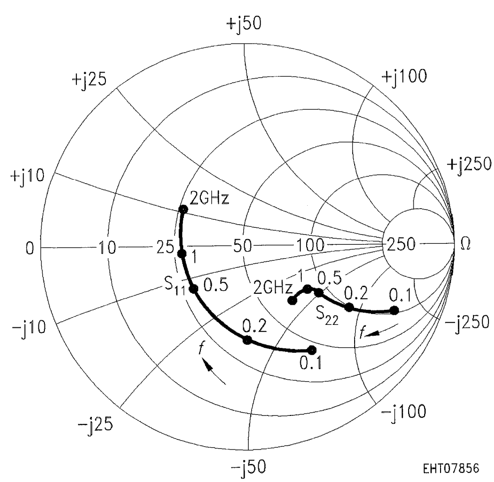
S_{12}, S_{21} = f (f)
I_C = 5 mA, V_{CE} = 8 V, Z_0 = 50 Ω



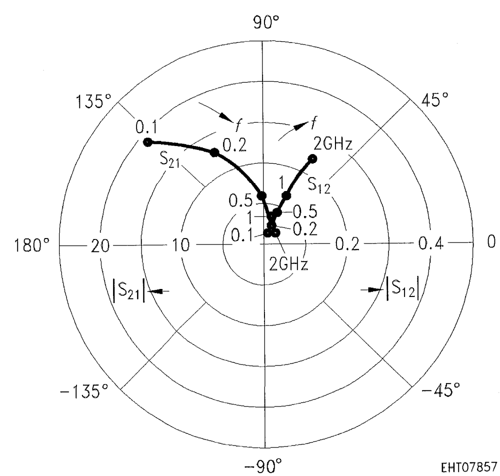
Common Emitter S Parameters (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**
I_C = 10 mA, V_{CE} = 8 V, Z_0 = 50 Ω								
0.1	0.58	– 49	18.73	133	0.03	68	0.77	– 19
0.3	0.37	– 108	9.17	105	0.05	60	0.53	– 32
0.5	0.30	– 139	5.92	90	0.07	63	0.45	– 32
0.8	0.25	– 170	3.85	76	0.10	65	0.41	– 31
1.0	0.25	180	3.09	70	0.13	65	0.40	– 34
1.2	0.26	169	2.63	64	0.15	64	0.39	– 37
1.4	0.26	160	2.33	58	0.17	64	0.38	– 40
1.6	0.28	151	2.07	52	0.20	62	0.38	– 44
1.8	0.29	142	1.84	48	0.22	61	0.38	– 47
2.0	0.31	133	1.72	43	0.24	60	0.36	– 49

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



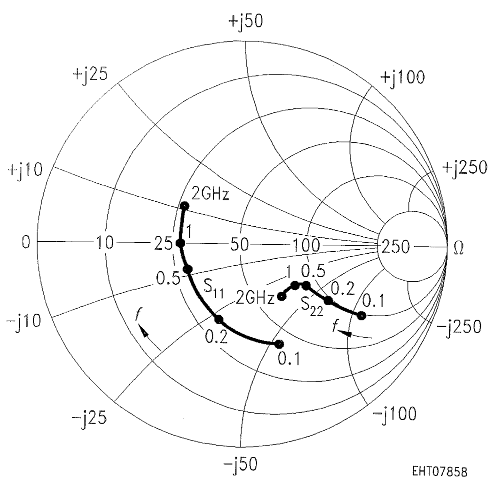
$S_{12}, S_{21} = f(f)$
I_C = 10 mA, V_{CE} = 8 V, Z_0 = 50 Ω



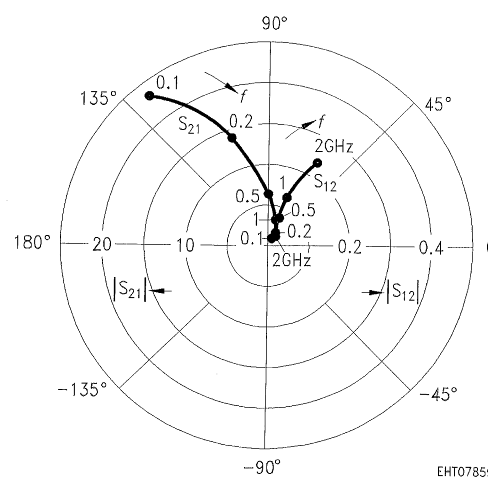
Common Emitter S Parameters (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**
I_C = 20 mA, V_{CE} = 8 V, Z_0 = 50 Ω								
0.1	0.41	– 64	22.91	123	0.02	67	0.67	– 22
0.3	0.28	– 123	9.89	98	0.05	66	0.46	– 30
0.5	0.25	– 151	6.24	86	0.07	68	0.40	– 30
0.8	0.23	– 179	4.03	74	0.11	68	0.37	– 28
1.0	0.23	172	3.22	69	0.13	68	0.37	– 32
1.2	0.25	164	2.74	63	0.16	66	0.35	– 35
1.4	0.25	155	2.41	57	0.18	66	0.35	– 38
1.6	0.27	147	2.14	51	0.20	63	0.35	– 43
1.8	0.28	139	1.92	47	0.23	61	0.35	– 46
2.0	0.30	131	1.79	42	0.25	60	0.33	– 48

S_{11}, S_{22} = f (f)
I_C = 20 mA, V_{CE} = 8 V, Z_0 = 50 Ω



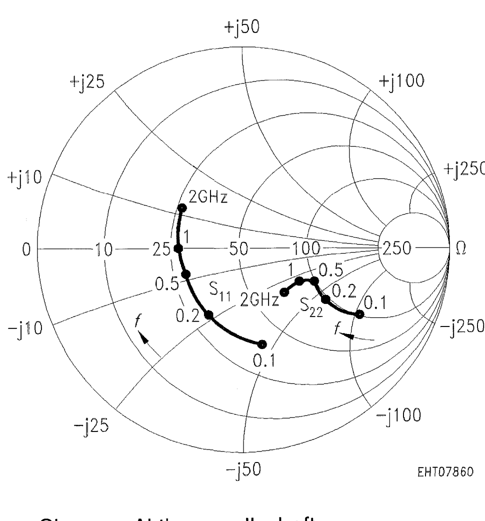
S_{12}, S_{21} = f (f)
I_C = 20 mA, V_{CE} = 8 V, Z_0 = 50 Ω



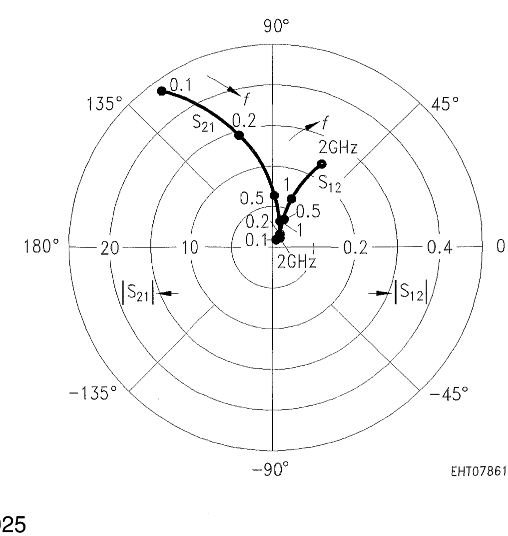
Common Emitter S Parameters (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**
I_C = 25 mA, V_{CE} = 8 V, Z_0 = 50 Ω								
0.1	0.37	– 68	23.71	120	0.02	67	0.64	– 22
0.3	0.26	– 127	9.89	97	0.05	67	0.44	– 29
0.5	0.24	– 154	6.20	85	0.07	70	0.39	– 28
0.8	0.22	179	3.98	73	0.11	69	0.37	– 27
1.0	0.23	170	3.18	68	0.13	68	0.37	– 31
1.2	0.24	162	2.71	62	0.16	66	0.36	– 35
1.4	0.25	153	2.37	57	0.18	66	0.36	– 37
1.6	0.27	146	2.11	51	0.20	63	0.35	– 42
1.8	0.28	138	1.89	47	0.23	62	0.35	– 46
2.0	0.30	130	1.77	42	0.25	60	0.34	– 48

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

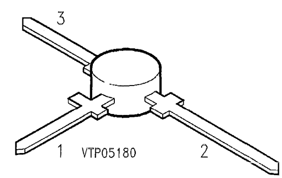


SIEMENS

NPN Silicon RF Transistor

BFR 96S

- For low-noise, low-distortion broadband amplifiers in antenna and telecommunications systems up to 2 GHz at collector currents from 10 mA to 70 mA.



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

Type	Marking	Ordering Code	Pin Configuration 1	2	3	Package[1]
BFR 96S	BFR 96S	Q68000-A5689	E	C	B	T-plast

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CE0}	15	V
Collector-base voltage	V_{CB0}	20	
Emitter-base voltage	V_{EB0}	3	
Collector current	I_C	100	mA
Total power dissipation, $T_S \leq 87$ °C[3]	P_{tot}	700	mW
Junction temperature	T_j	150	°C
Ambient temperature range	T_A	– 65 ... + 150	
Storage temperature range	T_{stg}	– 65 ... + 150	
Thermal Resistance			
Junction - ambient[2]	$R_{th\,JA}$	≤ 170	K/W
Junction - soldering point[3]	$R_{th\,JS}$	≤ 90	

[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.

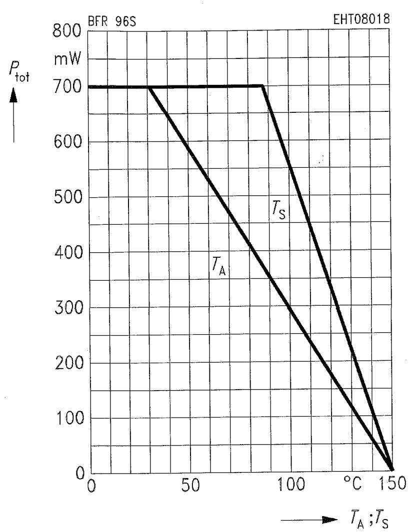
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CE0}$	15	–	–	V
Collector-base cutoff current V_{CB} = 10 V, I_E = 0	I_{CB0}	–	–	100	nA
Emitter-base cutoff current V_{EB} = 3 V, I_C = 0	I_{EB0}	–	–	100	µA
DC current gain I_C = 70 mA, V_{CE} = 10 V	h_{FE}	25	75	–	–
Collector-emitter saturation voltage I_C = 75 mA, I_B = 7.5 mA	V_{CEsat}	–	0.13	0.5	V

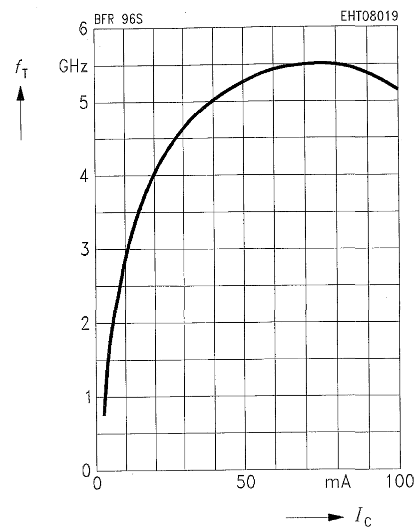
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
AC Characteristics					
Transition frequency	f_T				GHz
I_C = 50 mA, V_{CE} = 10 V, f = 200 MHz		–	5.3	–	
I_C = 70 mA, V_{CE} = 10 V, f = 200 MHz		–	5.5	–	
Collector-base capacitance V_{CB} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{cb}	–	0.95	–	pF
Collector-emitter capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{ce}	–	0.3	–	
Input capacitance V_{EB} = 0.5 V, I_C = i_c = 0, f = 1 MHz	C_{ibo}	–	5	–	
Output capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{obs}	–	1.25	–	
Noise figure	F				dB
I_C = 5 mA, V_{CE} = 10 V, f = 10 MHz, Z_S = 50 Ω		–	0.9	–	
I_C = 70 mA, V_{CE} = 10 V, f = 800 MHz, Z_S = Z_{Sopt}		–	2.9	–	
Power gain I_C = 70 mA, V_{CE} = 10 V, f = 800 MHz, Z_S = Z_{Sopt}, Z_L = Z_{Lopt}	G_{pe}	–	11.5	–	
Transducer gain I_C = 70 mA, V_{CE} = 10 V, f = 500 MHz, Z_0 = 50 Ω	$\lvert S_{21e} \rvert^2$	–	14.8	–	
Linear output voltage two-tone intermodulation test I_C = 70 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}	–	500	–	mV
Third order intercept point I_C = 70 mA, V_{CE} = 10 V, f = 800 MHz	IP_3	–	37	–	dBm

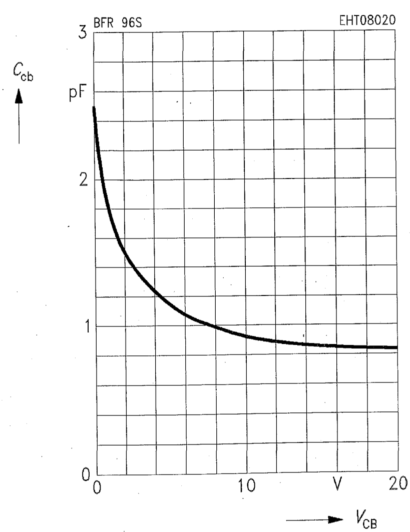
Total power dissipation $P_{tot} = f(T_A^*; T_S)$
* Package mounted on alumina



Transition frequency $f_T = f(I_C)$
V_{CE} = 10 V, f = 200 MHz



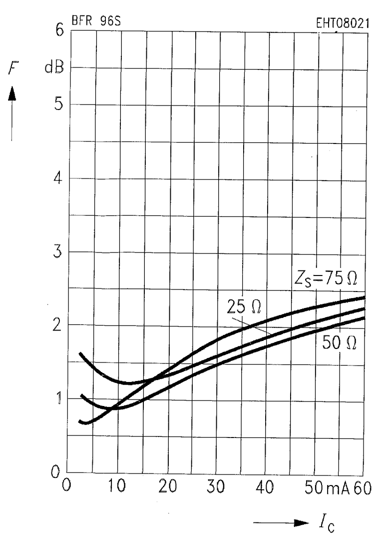
Collector-base capacitance $C_{cb} = f(V_{CB})$
$V_{BE} = v_{be} = 0$, f = 1 MHz



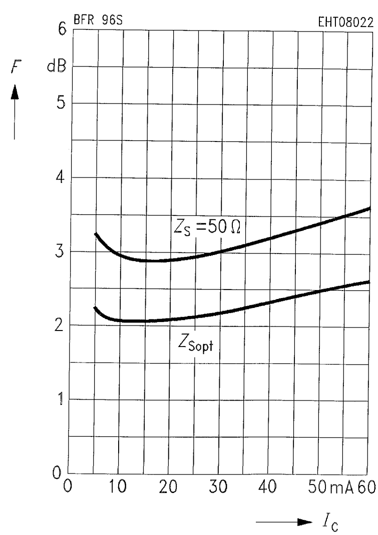
Common Emitter Noise Parameters

f	F_{min}	$G_p (F_{min})$	Γ_{opt}		R_N	N	$F_{50\Omega}$	$G_p (F_{50\Omega})$
GHz	dB	dB	MAG	ANG	Ω	–	dB	dB
I_C = 10 mA, V_{CE} = 10 V, Z_0 = 50 Ω								
0.01	–	–	–	–	–	–	1.05	–
0.8	2.2	–	0.41	– 170.3	6.6	0.31	2.8	–
I_C = 70 mA, V_{CE} = 10 V, Z_0 = 50 Ω								
0.01	–	–	–	–	–	–	2.3	–
0.8	2.9	–	0.43	– 163	10	0.45	2.9	–

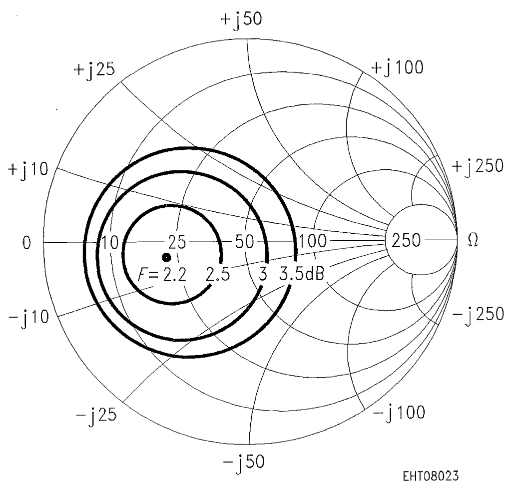
Noise figure $F = f(I_C)$
V_{CE} = 10 V, f = 10 MHz



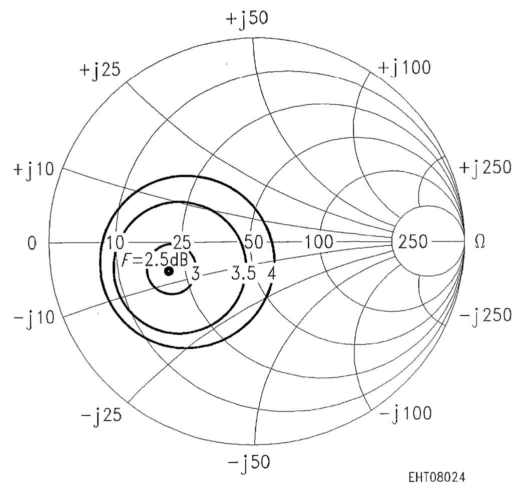
Noise figure $F = f(I_C)$
V_{CE} = 10 V, f = 800 MHz



Circles of constant noise figure $F = f\,(Z_S)$
I_C = 10 mA, V_{CE} = 10 V, f = 800 MHz,
R_N = 6.6 Ω, N = 0.31, Γ_{opt} = 0.41 < – 170°



Circles of constant noise figure $F = f\,(Z_S)$
I_C = 70 mA, V_{CE} = 10 V, f = 800 MHz,
R_N = 10 Ω, F_{min} = 2.9 dB, Γ_{opt} = 0.43 < – 163°



Common Emitter S Parameters

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	0.42	– 143.2	26.24	104.5	0.022	64.4	0.31	– 63.9
0.2	0.40	– 167.1	13.22	91.6	0.040	69.7	0.17	– 67.8
0.3	0.41	– 178.2	8.81	84.0	0.058	71.1	0.12	– 68.9
0.4	0.41	173.9	6.60	78.5	0.076	70.5	0.10	– 70.4
0.5	0.42	167.2	5.30	73.4	0.094	69.0	0.09	– 72.9
0.6	0.43	161.5	4.44	68.6	0.112	67.1	0.08	– 77.8
0.7	0.44	155.8	3.82	64.0	0.129	65.2	0.07	– 82.7
0.8	0.44	151.1	3.34	59.8	0.147	63.7	0.07	– 84.6
0.9	0.44	147.0	2.99	55.6	0.166	61.0	0.07	– 93.6
1.0	0.45	142.2	2.71	51.5	0.182	58.5	0.06	– 104.2
1.1	0.46	138.1	2.49	47.5	0.199	56.0	0.06	– 115.7
1.2	0.47	133.9	2.29	43.6	0.215	53.6	0.06	– 127.8
1.3	0.49	129.6	2.14	39.7	0.231	51.2	0.06	– 140.0
1.4	0.49	125.5	2.00	35.9	0.246	48.7	0.07	– 151.7
1.5	0.51	121.6	1.89	32.1	0.262	46.2	0.07	– 160.1
1.6	0.51	118.0	1.79	28.3	0.276	43.6	0.08	– 167.6
1.7	0.53	114.6	1.69	24.7	0.290	40.9	0.09	– 175.5
1.8	0.54	111.4	1.61	21.3	0.303	38.4	0.10	176.9
1.9	0.55	108.6	1.54	17.9	0.316	36.0	0.11	170.1
2.0	0.57	105.4	1.47	14.6	0.328	33.6	0.12	163.6
I_C = 10 mA, V_{CE} = 10 V, Z_0 = 50 Ω								
0.1	0.63	– 89.9	18.56	124.5	0.033	54.7	0.66	– 33.9
0.2	0.51	– 131.0	10.78	102.9	0.046	50.1	0.45	– 38.3
0.3	0.48	– 153.7	7.43	91.4	0.056	52.9	0.38	– 37.4
0.4	0.47	– 166.9	5.64	83.6	0.066	55.4	0.34	– 36.8
0.5	0.47	– 177.9	4.55	77.1	0.078	57.1	0.32	– 37.3
0.6	0.48	173.4	3.82	71.2	0.090	58.1	0.31	– 38.8
0.7	0.48	165.9	3.29	65.9	0.101	58.7	0.30	– 40.7
0.8	0.48	159.6	2.89	61.0	0.114	59.4	0.30	– 42.6
0.9	0.49	154.1	2.59	56.3	0.128	58.9	0.29	– 45.9
1.0	0.50	148.3	2.35	51.7	0.141	58.0	0.28	– 49.4
1.1	0.51	143.2	2.16	47.4	0.155	57.0	0.28	– 53.1
1.2	0.52	138.3	1.99	43.2	0.168	56.0	0.27	– 56.9
1.3	0.53	133.2	1.86	38.9	0.182	54.8	0.26	– 61.0
1.4	0.54	128.8	1.74	34.8	0.196	53.5	0.25	– 65.4
1.5	0.55	124.6	1.64	30.9	0.210	52.0	0.25	– 70.2
1.6	0.56	120.4	1.55	26.9	0.224	50.3	0.25	– 75.7
1.7	0.57	116.7	1.47	23.1	0.238	48.5	0.24	– 81.8
1.8	0.58	113.1	1.40	19.6	0.252	46.8	0.24	– 87.5
1.9	0.59	109.7	1.33	16.2	0.266	45.0	0.23	– 94.1
2.0	0.61	106.2	1.28	12.7	0.280	43.2	0.23	– 101.3

Common Emitter S Parameters (continued)

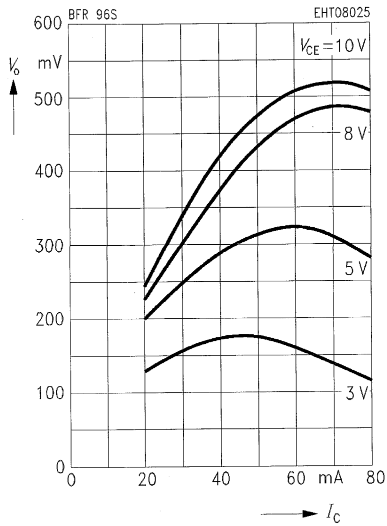
f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**
I_C = 30 mA, V_{CE} = 10 V, Z_0 = 50 Ω								
0.1	0.44	– 120.4	25.96	110.4	0.024	58.3	0.43	– 48.5
0.2	0.40	– 154.1	13.48	94.9	0.039	64.6	0.27	– 48.0
0.3	0.39	– 169.6	9.04	86.3	0.054	67.4	0.21	– 45.3
0.4	0.39	– 179.2	6.79	80.3	0.070	67.6	0.19	– 43.8
0.5	0.39	172.5	5.45	74.9	0.086	67.1	0.17	– 43.7
0.6	0.40	165.9	4.57	69.9	0.101	65.8	0.16	– 45.3
0.7	0.41	159.7	3.93	65.2	0.117	64.6	0.15	– 46.9
0.8	0.41	154.4	3.44	60.9	0.133	63.5	0.15	– 48.1
0.9	0.42	150.3	3.08	56.7	0.150	61.4	0.15	– 52.2
1.0	0.43	144.7	2.79	52.5	0.165	59.3	0.14	– 56.7
1.1	0.44	140.3	2.56	48.5	0.180	57.2	0.13	– 61.0
1.2	0.45	136.1	2.36	44.6	0.195	55.1	0.12	– 66.0
1.3	0.46	131.3	2.20	40.6	0.209	53.0	0.11	– 71.1
1.4	0.47	127.3	2.06	36.7	0.224	50.8	0.10	– 77.2
1.5	0.48	123.6	1.94	33.0	0.238	48.6	0.10	– 84.1
1.6	0.49	120.0	1.84	29.1	0.253	46.3	0.10	– 92.9
1.7	0.51	116.5	1.74	25.5	0.266	43.9	0.09	– 103.1
1.8	0.52	113.1	1.66	22.0	0.279	41.6	0.09	– 112.9
1.9	0.53	110.2	1.58	18.7	0.291	39.4	0.09	– 124.1
2.0	0.55	106.9	1.51	15.3	0.304	37.2	0.09	– 136.5
I_C = 50 mA, V_{CE} = 10 V, Z_0 = 50 Ω								
0.1	0.42	– 130.9	27.43	106.3	0.022	62.0	0.35	– 52.7
0.2	0.37	– 161.1	13.90	92.6	0.038	68.5	0.21	– 50.4
0.3	0.37	– 173.9	9.28	84.8	0.055	70.4	0.17	– 47.3
0.4	0.37	178.1	6.95	79.2	0.072	70.1	0.15	– 45.8
0.5	0.38	170.2	5.58	74.1	0.089	68.8	0.14	– 46.0
0.6	0.39	164.4	4.67	69.3	0.105	67.1	0.13	– 48.0
0.7	0.40	158.5	4.02	64.8	0.121	65.5	0.12	– 49.6
0.8	0.40	153.4	3.52	60.6	0.138	64.0	0.12	– 50.7
0.9	0.40	149.3	3.15	56.4	0.156	61.6	0.11	– 55.8
1.0	0.42	144.4	2.86	52.3	0.171	59.3	0.11	– 61.0
1.1	0.43	140.1	2.61	48.3	0.186	56.9	0.10	– 66.2
1.2	0.44	135.7	2.41	44.5	0.202	54.7	0.09	– 72.4
1.3	0.45	131.2	2.25	40.6	0.216	52.4	0.08	– 79.1
1.4	0.46	127.2	2.11	36.7	0.231	50.0	0.07	– 87.3
1.5	0.47	123.3	1.98	33.0	0.246	47.7	0.07	– 96.1
1.6	0.48	119.7	1.87	29.2	0.260	45.2	0.07	– 107.4
1.7	0.50	116.2	1.78	25.6	0.274	42.8	0.07	– 120.3
1.8	0.51	113.1	1.69	22.2	0.286	40.4	0.07	– 132.8
1.9	0.52	110.0	1.61	18.8	0.299	38.1	0.07	– 145.6
2.0	0.54	106.9	1.54	15.4	0.311	35.9	0.08	– 158.7

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 = 70 mA, V_{CE} = 10 V, Z_0 = 50 Ω								
0.1	0.40	– 138.5	27.66	103.9	0.021	63.4	0.32	– 53.6
0.2	0.37	– 164.1	13.87	91.3	0.038	70.6	0.19	– 50.1
0.3	0.36	– 176.2	9.22	83.9	0.055	71.5	0.15	– 46.9
0.4	0.37	176.1	6.91	78.6	0.073	70.9	0.13	– 45.6
0.5	0.38	169.2	5.54	73.5	0.089	69.5	0.12	– 45.8
0.6	0.39	163.2	4.64	68.8	0.107	67.7	0.11	– 48.0
0.7	0.40	157.6	3.99	64.3	0.122	65.8	0.11	– 50.0
0.8	0.40	152.9	3.49	60.2	0.140	64.3	0.10	– 51.2
0.9	0.41	149.0	3.12	56.0	0.157	61.8	0.10	– 56.8
1.0	0.42	144.0	2.83	51.9	0.173	59.4	0.09	– 62.5
1.1	0.43	139.8	2.59	48.1	0.188	57.0	0.08	– 68.5
1.2	0.44	135.7	2.39	44.2	0.203	54.7	0.08	– 75.7
1.3	0.45	130.9	2.23	40.3	0.218	52.4	0.07	– 83.7
1.4	0.46	126.9	2.09	36.5	0.233	50.1	0.06	– 93.4
1.5	0.48	123.4	1.96	32.7	0.248	47.7	0.06	– 103.5
1.6	0.49	119.8	1.86	29.0	0.262	45.2	0.06	– 116.6
1.7	0.50	116.3	1.76	25.4	0.275	42.7	0.06	– 130.7
1.8	0.51	113.0	1.67	22.0	0.288	40.3	0.07	– 144.0
1.9	0.53	110.1	1.60	18.6	0.300	38.0	0.07	– 157.3
2.0	0.55	107.0	1.53	15.3	0.312	35.8	0.08	– 169.5

Common Emitter Large Signal Parameters

Linear output voltage $V_o = f\ (I_C)$
d_{IM} = 60 dB, f_1 = 806 MHz,
f_2 = 810 MHz, $Z_S = Z_L$ = 50 Ω



Note:

The transistor is driven by 2 adjacent signals f_1, f_2 with equal <u>output</u> power levels P_o for each carrier.

The distance d_{IM} between P_o and the third order intermodulation products P_{IM} ($2f_1 - f_2$ or $2f_2 - f_1$) is:

$d_{IM} = P_o - P_{IM}$
where $P_o = 10 \log (V_o^2/(50\ \Omega \cdot 1\ \text{mW}))$ (dBm)
and V_o = linear <u>output</u> voltage of each carrier.

The 3rd order intercept point IP_3 will be found by extrapolation to the point where P_{IM} would be identical to P_o:

IP_3 (output) = $P_o + d_{IM}/2$.

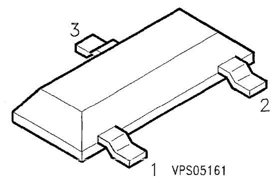
Linear output voltages for other d_{IM} (e.g. 50 dB) can be calculated thereby.

SIEMENS

NPN Silicon RF Transistor

BFR 106

- For low-noise, high-gain amplifiers
- For linear broadband amplifiers
- Special application: antenna amplifiers
- Complementary type: BFR 194 (PNP)



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

Type	Marking	Ordering Code (tape and reel)	Pin Configuration 1	2	3	Package[1]
BFR 106	R7	Q62702-F1219	B	E	C	SOT-23

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CE0}	15	V
Collector-base voltage	V_{CB0}	20	
Emitter-base voltage	V_{EB0}	3	
Collector current	I_C	100	mA
Total power dissipation, $T_S \leq 73$ °C[3]	P_{tot}	700	mW
Junction temperature	T_j	150	°C
Ambient temperature range	T_A	– 65 ... + 150	
Storage temperature range	T_{stg}	– 65 ... + 150	

Thermal Resistance

Junction - ambient[2]	$R_{th\,JA}$	≤ 190	K/W
Junction - soldering point[3]	$R_{th\,JS}$	≤ 110	

1) For detailed information 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.

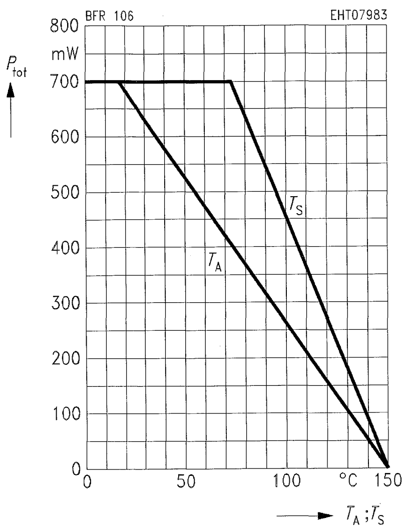
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CE0}$	15	–	–	V
Collector-base cutoff current V_{CB} = 10 V, I_E = 0	I_{CB0}	–	–	100	nA
Emitter-base cutoff current V_{EB} = 2 V, I_C = 0	I_{EB0}	–	–	10	µA
DC current gain I_C = 5 mA, V_{CE} = 6 V I_C = 30 mA, V_{CE} = 6 V	h_{FE}	 25 25	 – 90	 – 250	–
Collector-emitter saturation voltage I_C = 50 mA, I_B = 5 mA	V_{CEsat}	–	–	0.4	V

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

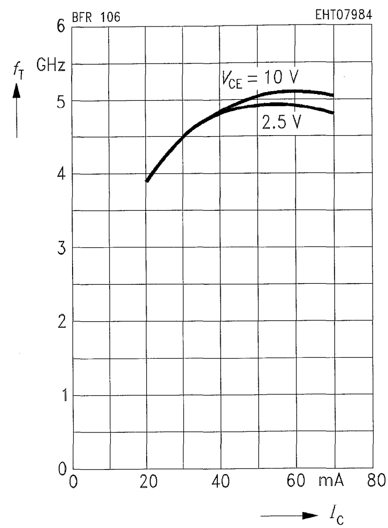
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
AC Characteristics					
Transition frequency	f_T				GHz
I_C = 20 mA, V_{CE} = 8 V, f = 200 MHz		–	3.9	–	
I_C = 70 mA, V_{CE} = 8 V, f = 200 MHz		–	4.9	–	
Collector-base capacitance V_{CB} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{cb}	–	0.95	–	pF
Collector-emitter capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{ce}	–	0.24	–	
Input capacitance V_{EB} = 0.5 V, I_C = i_c = 0, f = 1 MHz	C_{ibo}	–	4.5	–	
Output capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{obs}	–	1.2	–	
Noise figure	F				dB
I_C = 30 mA, V_{CE} = 8 V, f = 10 MHz, Z_S = 50 Ω		–	1.5	–	
I_C = 30 mA, V_{CE} = 8 V, f = 800 MHz, Z_S = Z_{Sopt}		–	2.3	–	
Power gain	G_{ma} 1)				
I_C = 70 mA, V_{CE} = 8 V, f = 500 MHz, Z_0 = 50 Ω		–	17	–	
I_C = 70 mA, V_{CE} = 8 V, f = 900 MHz, Z_0 = 50 Ω		–	12.5	–	
Transducer gain I_C = 70 mA, V_{CE} = 8 V, f = 900 MHz, Z_0 = 50 Ω	$\|S_{21e}\|^2$	–	10	–	
Linear output voltage two-tone intermodulation test I_C = 70 mA, V_{CE} = 8 V, d_{IM} = 60 dB f_1 = 806 MHz, f_2 = 810 MHz, Z_S = Z_L = 50 Ω	$V_{o1} = V_{o2}$	–	430	–	mV
Third order intercept point I_C = 70 mA, V_{CE} = 8 V, f = 800 MHz	IP_3	–	35.5	–	dBm

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

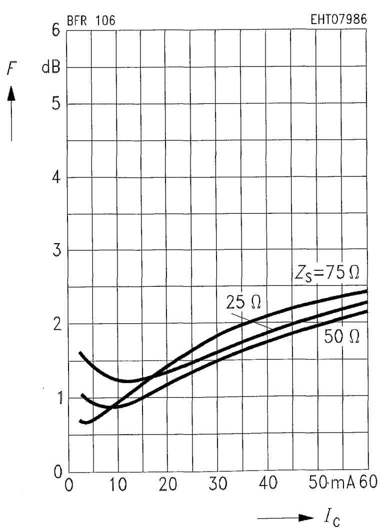
Total power dissipation $P_{tot} = f\,(T_A^*;\ T_S)$
* Package mounted on alumina



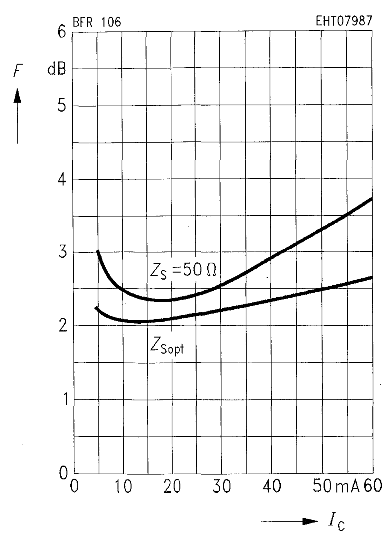
Transition frequency $f_T = f\,(I_C)$
f = 200 MHz



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



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



Common Emitter S Parameters

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_C = 50 mA, V_{CE} = 2.5 V, Z_0 = 50 Ω								
0.10	0.528	– 154.1	22.05	103.7	0.026	61.1	0.300	– 99.3
0.20	0.541	– 170.5	11.42	92.7	0.043	68.7	0.200	– 125.6
0.30	0.547	– 178.0	7.69	86.9	0.061	71.5	0.175	– 139.7
0.40	0.550	176.5	5.81	82.5	0.079	72.4	0.166	– 148.0
0.50	0.550	172.7	4.69	78.8	0.098	72.3	0.163	– 153.1
0.60	0.551	168.9	3.95	75.3	0.116	71.6	0.163	– 156.7
0.70	0.551	165.5	3.41	72.0	0.134	70.7	0.163	– 159.4
0.80	0.554	162.7	3.00	68.7	0.152	69.6	0.164	– 161.6
0.90	0.556	160.0	2.69	65.7	0.169	68.4	0.166	– 164.1
0.95	0.557	158.2	2.56	64.1	0.177	67.8	0.166	– 165.2
1.00	0.558	156.9	2.45	62.7	0.186	67.2	0.167	– 166.6
1.20	0.567	151.2	2.08	57.3	0.220	64.6	0.170	– 170.5
1.40	0.572	145.1	1.83	52.1	0.253	61.8	0.175	– 173.1
1.50	0.569	142.4	1.74	49.6	0.270	60.4	0.178	– 173.3
1.60	0.568	140.0	1.65	46.9	0.285	58.9	0.181	– 174.1
1.70	0.576	137.7	1.58	44.4	0.300	57.4	0.186	– 175.1
1.75	0.575	136.2	1.54	43.2	0.308	56.6	0.188	– 175.9
1.80	0.572	135.0	1.51	41.8	0.315	55.8	0.189	– 176.5
2.00	0.583	130.7	1.39	37.5	0.343	52.8	0.200	– 179.9
I_C = 30 mA, V_{CE} = 5 V, Z_0 = 50 Ω								
0.10	0.487	– 130.7	24.29	110.8	0.026	57.8	0.398	– 59.5
0.20	0.480	– 157.5	13.00	96.8	0.039	64.0	0.228	– 65.7
0.30	0.482	– 168.9	8.81	89.9	0.053	67.9	0.170	– 66.8
0.40	0.483	– 176.4	6.67	85.0	0.068	69.9	0.143	– 67.0
0.50	0.483	178.6	5.38	81.0	0.083	70.7	0.129	– 68.2
0.60	0.486	174.1	4.52	77.3	0.098	70.9	0.122	– 69.6
0.70	0.486	170.3	3.90	73.9	0.113	70.7	0.118	– 71.2
0.80	0.489	167.0	3.44	70.5	0.128	70.1	0.116	– 73.5
0.90	0.492	164.1	3.08	67.5	0.143	69.5	0.113	– 76.1
0.95	0.493	162.2	2.93	65.9	0.150	69.1	0.112	– 76.9
1.00	0.495	160.7	2.79	64.4	0.158	68.7	0.111	– 78.3
1.20	0.506	154.7	2.36	59.0	0.186	67.0	0.109	– 83.5
1.40	0.513	148.4	2.07	53.7	0.215	65.0	0.113	– 89.5
1.50	0.511	145.6	1.95	51.1	0.230	64.0	0.118	– 91.9
1.60	0.512	143.3	1.85	48.5	0.244	62.8	0.122	– 95.5
1.70	0.521	140.8	1.77	46.0	0.258	61.7	0.126	– 98.3
1.75	0.521	139.4	1.72	44.7	0.265	61.0	0.126	– 100.5
1.80	0.518	138.4	1.69	43.3	0.272	60.4	0.129	– 102.0
2.00	0.534	133.9	1.55	38.8	0.298	58.0	0.133	– 110.1

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								
0.10	0.464	– 143.0	25.58	106.5	0.023	62.1	0.322	– 66.7
0.20	0.468	– 164.3	13.40	94.5	0.038	69.2	0.180	– 73.8
0.30	0.472	– 173.7	9.05	88.5	0.053	72.1	0.132	– 76.4
0.40	0.475	– 180.0	6.83	83.9	0.069	73.2	0.110	– 78.1
0.50	0.476	175.9	5.51	80.2	0.085	73.3	0.100	– 80.5
0.60	0.477	171.9	4.62	76.7	0.101	73.0	0.095	– 82.6
0.70	0.479	168.4	3.99	73.5	0.116	72.4	0.092	– 84.9
0.80	0.481	165.3	3.52	70.3	0.132	71.4	0.091	– 87.6
0.90	0.485	162.6	3.14	67.3	0.147	70.4	0.090	– 90.7
0.95	0.487	160.9	2.99	65.7	0.155	70.0	0.089	– 91.7
1.00	0.489	159.5	2.85	64.4	0.162	69.5	0.088	– 93.3
1.20	0.499	153.7	2.41	59.0	0.192	67.3	0.088	– 99.0
1.40	0.506	147.5	2.11	53.9	0.221	65.0	0.092	– 104.8
1.50	0.506	144.8	1.99	51.4	0.237	63.8	0.098	– 106.5
1.60	0.505	142.4	1.89	48.7	0.251	62.5	0.102	– 109.8
1.70	0.514	140.2	1.80	46.3	0.265	61.2	0.106	– 112.4
1.75	0.515	138.7	1.76	45.0	0.272	60.6	0.108	– 114.4
1.80	0.512	137.8	1.72	43.7	0.279	59.9	0.110	– 115.7
2.00	0.527	133.5	1.58	39.2	0.305	57.3	0.116	– 123.8
I_C = 70 mA, V_{CE} = 5 V, Z_0 = 50 Ω								
0.10	0.463	– 149.5	25.62	104.3	0.022	64.6	0.282	– 70.2
0.20	0.471	– 167.9	13.30	93.3	0.037	71.5	0.157	– 77.8
0.30	0.476	– 176.0	8.96	87.6	0.053	73.9	0.115	– 81.3
0.40	0.481	178.4	6.77	83.3	0.069	74.6	0.097	– 83.9
0.50	0.478	174.5	5.45	79.7	0.086	74.4	0.089	– 86.9
0.60	0.482	170.8	4.58	76.3	0.102	73.8	0.085	– 89.4
0.70	0.483	167.3	3.95	73.1	0.118	73.0	0.083	– 91.9
0.80	0.486	164.5	3.48	69.9	0.133	72.0	0.083	– 94.8
0.90	0.490	161.9	3.11	67.0	0.149	70.9	0.083	– 98.2
0.95	0.491	160.3	2.96	65.4	0.157	70.4	0.082	– 99.4
1.00	0.493	158.8	2.82	64.1	0.164	69.8	0.081	– 101.2
1.20	0.504	153.0	2.39	58.8	0.195	67.5	0.082	– 107.0
1.40	0.512	147.1	2.09	53.7	0.224	65.1	0.088	– 112.6
1.50	0.510	144.3	1.97	51.1	0.239	63.8	0.093	– 113.9
1.60	0.511	142.1	1.87	48.5	0.254	62.5	0.098	– 116.8
1.70	0.521	139.8	1.79	46.1	0.268	61.2	0.103	– 119.2
1.75	0.520	138.3	1.74	44.8	0.275	60.5	0.104	– 121.3
1.80	0.517	137.3	1.70	43.5	0.282	59.8	0.107	– 122.5
2.00	0.532	133.0	1.56	39.0	0.308	57.1	0.114	– 130.3

Common Emitter S Parameters (continued)

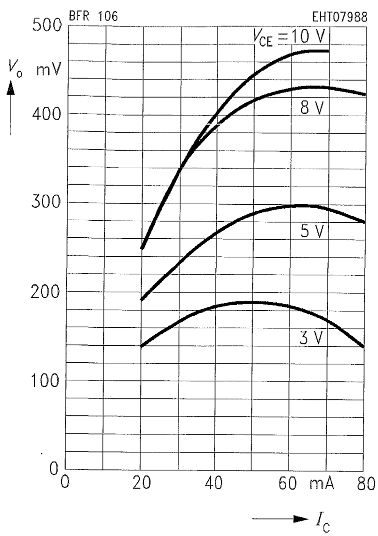
f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**
I_C = 30 mA, V_{CE} = 8 V, Z_0 = 50 Ω								
0.10	0.479	– 123.0	25.34	112.4	0.024	58.1	0.434	– 50.5
0.20	0.455	– 152.6	13.68	97.8	0.037	63.6	0.266	– 51.7
0.30	0.453	– 165.5	9.29	90.7	0.050	67.8	0.210	– 49.4
0.40	0.454	– 173.5	7.04	85.7	0.064	69.9	0.185	– 47.5
0.50	0.453	– 179.0	5.67	81.6	0.078	70.8	0.173	– 47.3
0.60	0.455	176.2	4.77	77.9	0.092	71.1	0.166	– 47.8
0.70	0.456	172.3	4.12	74.5	0.106	71.1	0.162	– 48.7
0.80	0.460	168.8	3.62	71.2	0.120	70.7	0.160	– 50.3
0.90	0.463	165.8	3.24	68.1	0.133	70.1	0.157	– 52.1
0.95	0.466	164.0	3.08	66.6	0.140	69.8	0.156	– 52.8
1.00	0.467	162.4	2.94	65.2	0.147	69.5	0.154	– 53.6
1.20	0.478	156.3	2.49	59.6	0.174	68.0	0.151	– 57.6
1.40	0.486	149.8	2.17	54.4	0.201	66.3	0.152	– 63.0
1.50	0.486	147.0	2.05	51.8	0.215	65.4	0.156	– 65.8
1.60	0.486	144.7	1.94	49.2	0.229	64.3	0.158	– 69.2
1.70	0.496	142.2	1.85	46.7	0.242	63.3	0.161	– 72.2
1.75	0.496	140.9	1.80	45.4	0.249	62.6	0.160	– 73.9
1.80	0.495	139.8	1.76	44.0	0.255	62.1	0.162	– 75.6
2.00	0.511	135.4	1.61	39.5	0.281	59.9	0.162	– 82.8
I_C = 50 mA, V_{CE} = 8 V, Z_0 = 50 Ω								
0.10	0.448	– 134.7	26.72	108.0	0.022	61.5	0.356	– 55.1
0.20	0.439	– 159.5	14.09	95.4	0.036	68.4	0.214	– 54.9
0.30	0.440	– 170.2	9.52	89.1	0.050	71.6	0.168	– 52.3
0.40	0.443	– 177.1	7.20	84.5	0.065	72.9	0.148	– 50.4
0.50	0.443	178.3	5.80	80.7	0.080	73.3	0.138	– 50.5
0.60	0.445	174.0	4.87	77.2	0.094	73.0	0.133	– 51.2
0.70	0.446	170.5	4.20	74.0	0.109	72.5	0.130	– 52.4
0.80	0.449	167.4	3.70	70.8	0.124	71.8	0.128	– 54.2
0.90	0.453	164.6	3.31	67.8	0.138	71.0	0.126	– 56.3
0.95	0.456	162.7	3.14	66.3	0.145	70.5	0.125	– 57.0
1.00	0.458	161.3	3.00	64.9	0.152	70.1	0.124	– 57.8
1.20	0.469	155.3	2.54	59.6	0.180	68.1	0.121	– 62.2
1.40	0.477	149.1	2.21	54.3	0.207	66.1	0.123	– 68.0
1.50	0.477	146.3	2.09	51.8	0.222	65.1	0.127	– 70.9
1.60	0.478	144.0	1.98	49.2	0.235	63.9	0.130	– 74.5
1.70	0.487	141.7	1.89	46.8	0.249	62.7	0.132	– 77.7
1.75	0.488	140.4	1.84	45.5	0.256	62.1	0.132	– 79.7
1.80	0.486	139.5	1.79	44.2	0.262	61.5	0.134	– 81.3
2.00	0.504	135.2	1.64	39.8	0.287	59.2	0.134	– 89.3

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 = 70 mA, V_{CE} = 8 V, Z_0 = 50 Ω								
0.10	0.443	– 140.8	26.70	105.7	0.021	63.4	0.316	– 56.2
0.20	0.439	– 162.9	13.95	94.1	0.035	70.2	0.191	– 54.6
0.30	0.442	– 172.4	9.40	88.2	0.050	73.1	0.152	– 51.6
0.40	0.446	– 178.8	7.11	83.8	0.065	74.1	0.135	– 49.9
0.50	0.445	177.0	5.72	80.1	0.080	74.2	0.127	– 50.2
0.60	0.447	173.0	4.80	76.7	0.095	73.7	0.123	– 51.2
0.70	0.450	169.6	4.14	73.5	0.110	73.1	0.121	– 52.6
0.80	0.453	166.6	3.64	70.3	0.125	72.2	0.120	– 54.7
0.90	0.457	163.9	3.26	67.4	0.139	71.3	0.118	– 57.0
0.95	0.459	162.2	3.10	65.8	0.146	70.8	0.117	– 57.8
1.00	0.462	160.8	2.95	64.5	0.153	70.3	0.116	– 58.7
1.20	0.473	155.0	2.50	59.1	0.182	68.3	0.114	– 63.5
1.40	0.483	148.9	2.18	53.9	0.209	66.2	0.116	– 69.6
1.50	0.483	146.2	2.06	51.5	0.224	65.1	0.121	– 72.7
1.60	0.484	143.9	1.95	48.9	0.237	63.9	0.123	– 76.6
1.70	0.495	141.6	1.86	46.5	0.251	62.7	0.126	– 79.8
1.75	0.495	140.1	1.81	45.1	0.258	62.1	0.126	– 81.9
1.80	0.492	139.1	1.77	43.8	0.264	61.5	0.128	– 83.5
2.00	0.510	134.9	1.62	39.4	0.289	59.1	0.129	– 91.8

Common Emitter Large Signal Parameters

Linear output voltage $V_o = f\ (I_C)$
$d_{IM} = 60$ dB, $f_1 = 806$ MHz,
$f_2 = 810$ MHz, $Z_S = Z_L = 50\ \Omega$



Note:

The transistor is driven by 2 adjacent signals f_1, f_2 with equal output power levels P_o for each carrier.

The distance d_{IM} between P_o and the third order intermodulation products P_{IM} ($2f_1 - f_2$ or $2f_2 - f_1$) is:

$d_{IM} = P_o - P_{IM}$
where $P_o = 10 \log (V_o^2/(50\ \Omega \cdot 1\ \text{mW}))$ (dBm)
and V_o = linear output voltage of each carrier.

The 3rd order intercept point IP_3 will be found by extrapolation to the point where P_{IM} would be identical to P_o:

IP_3 (output) $= P_o + d_{IM}/2$.

Linear output voltages for other d_{IM} (e.g. 50 dB) can be calculated thereby.

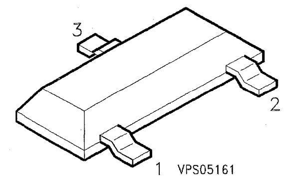
SIEMENS

NPN Silicon RF Transistor

BFR 180

Preliminary Data

- For low-power amplifiers in mobile communication systems (pager) at collector currents from 0.2 mA to 2.5 mA.
- f_T = 6 GHz
  F = 2.1 dB at 900 MHz



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

Type	Marking	Ordering Code (tape and reel)	Pin Configuration 1	2	3	Package[1]
BFR 180	RDs	Q62702-F1296	B	E	C	SOT-23

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CEO}	8	V
Collector-emitter voltage, $V_{BE} = 0$	V_{CES}	10	
Collector-base voltage	V_{CBO}	10	
Emitter-base voltage	V_{EBO}	2	
Collector current	I_C	4	mA
Peak collector current, $f \geq 10$ MHz	I_{CM}	5	
Base current	I_B	0.5	
Peak base current, $f \geq 10$ MHz	I_{BM}	0.75	
Total power dissipation, $T_S \leq 127$ ˚C[3]	P_{tot}	30	mW
Junction temperature	T_j	150	˚C
Ambient temperature range	T_A	– 65 … + 150	
Storage temperature range	T_{stg}	– 65 … + 150	

Thermal Resistance

Junction - ambient[2]	$R_{th\,JA}$	≤ 860	K/W
Junction - soldering point[3]	$R_{th\,JS}$	≤ 780	

1) For detailed information 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	$V_{(BR)CEO}$	8	–	–	V
Collector-emitter cutoff current V_{CE} = 10 V, V_{BE} = 0	I_{CES}	–	–	100	µA
Collector-base cutoff current V_{CB} = 8 V, I_E = 0	I_{CB0}	–	–	100	nA
Emitter-base cutoff current V_{EB} = 1 V, I_C = 0	I_{EB0}	–	–	2	µA
DC current gain I_C = 0.25 mA, V_{CE} = 1 V I_C = 1 mA, V_{CE} = 1 V	h_{FE}	 30 30	 90 100	 200 –	–
Collector-emitter saturation voltage I_C = 3 mA, I_B = 0.3 mA	V_{CEsat}	–	0.1	0.4	V

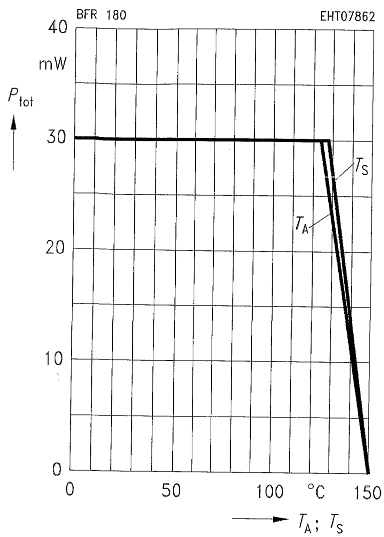
Electrical Characteristics

at T_A = 25 °C, unless otherwise specified.

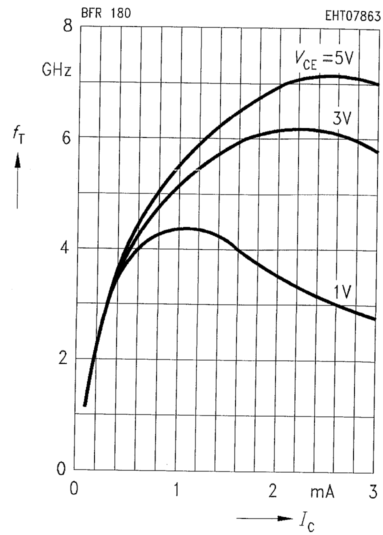
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
AC Characteristics					
Transition frequency I_C = 1 mA, V_{CE} = 1 V, f = 500 MHz I_C = 2 mA, V_{CE} = 3 V, f = 500 MHz	f_T	 – –	 4.4 6.2	 – –	GHz
Collector-base capacitance V_{CB} = 1 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{cb}	–	0.22	–	pF
Collector-emitter capacitance V_{CE} = 1 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{ce}	–	0.18	–	
Input capacitance V_{EB} = 0.5 V, I_C = i_c = 0, f = 1 MHz	C_{ibo}	–	0.15	–	
Output capacitance V_{CE} = 1 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{obs}	–	0.4	–	
Noise figure I_C = 1 mA, V_{CE} = 1 V, f = 900 MHz, $Z_S = Z_{Sopt}$	F	 –	 2.1	 –	dB
Power gain I_C = 1 mA, V_{CE} = 1 V, f = 900 MHz, Z_0 = 50 Ω I_C = 2 mA, V_{CE} = 3 V, f = 900 MHz, Z_0 = 50 Ω	G_{ms}[1]	 – –	 12 14.5	 – –	
Transducer gain I_C = 2 mA, V_{CE} = 3 V, f = 450 MHz, Z_0 = 50 Ω	$\lvert S_{21e} \rvert^2$	–	12.5	–	

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

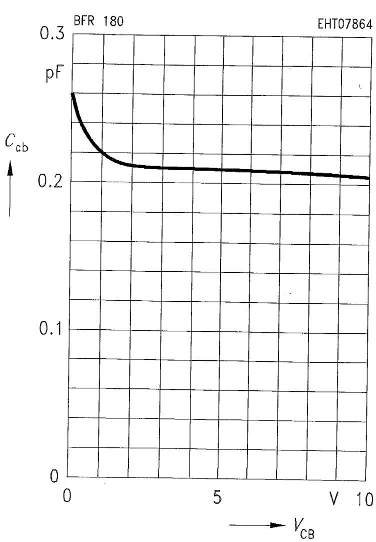
Total power dissipation $P_{tot} = f\,(T_A{}^*;\ T_S)$
* Package mounted on alumina



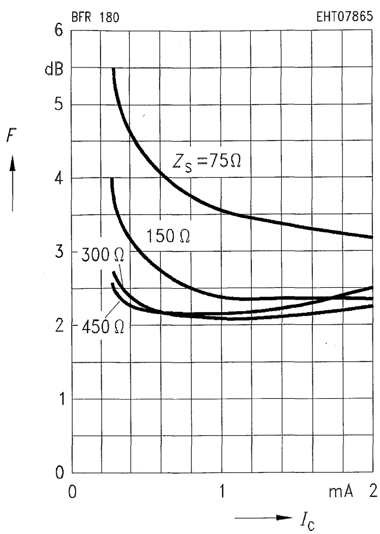
Transition frequency $f_T = f\,(I_C)$
f = 500 MHz



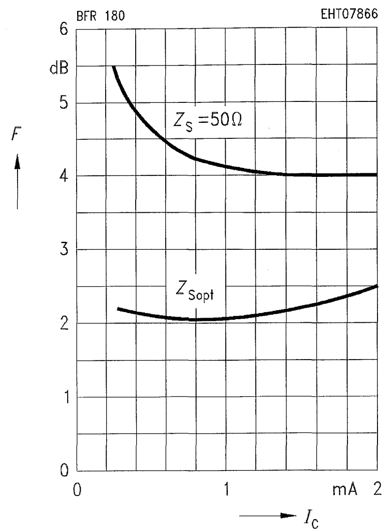
Collector-base capacitance $C_{cb} = f\,(V_{CB})$
$V_{BE} = v_{be} = 0, f = 1$ MHz



Noise figure $F = f\ (I_C)$
V_{CE} = 1 V, f = 10 MHz



Noise figure $F = f\ (I_C)$
V_{CE} = 1 V, f = 900 MHz, $Z_{Lopt}\ (G)$



Common Emitter S Parameters

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_C = 0.5 mA, V_{CE} = 1 V, Z_0 = 50 Ω								
0.10	0.975	– 3.5	1.68	175.0	0.016	86.9	0.996	– 2.5
0.20	0.969	– 6.9	1.67	169.8	0.033	84.5	0.993	– 5.0
0.30	0.960	– 10.2	1.67	164.6	0.048	81.6	0.988	– 7.5
0.40	0.948	– 13.5	1.66	159.3	0.064	79.2	0.981	– 9.9
0.50	0.937	– 16.8	1.64	154.4	0.079	76.6	0.973	– 12.2
0.60	0.921	– 19.9	1.62	149.6	0.094	74.4	0.965	– 14.6
0.70	0.913	– 23.1	1.60	144.8	0.108	72.0	0.954	– 16.8
0.80	0.884	– 26.1	1.56	140.5	0.121	69.7	0.944	– 18.9
0.90	0.867	–29.1	1.57	135.9	0.134	67.3	0.930	– 21.0
0.95	0.854	– 30.7	1.56	133.6	0.140	66.2	0.923	– 22.0
1.00	0.845	– 32.0	1.55	131.4	0.146	65.2	0.917	– 22.9
1.20	0.793	– 37.6	1.52	122.3	0.168	61.2	0.889	– 26.6
1.40	0.741	– 42.4	1.47	114.1	0.187	57.8	0.864	– 30.1
1.60	0.695	– 46.5	1.40	106.9	0.205	54.9	0.840	– 33.2
1.70	0.674	– 48.9	1.39	103.7	0.214	53.4	0.828	– 34.8
1.75	0.664	– 50.0	1.38	102.0	0.218	52.9	0.822	– 35.6
1.80	0.652	– 51.0	1.38	100.4	0.222	52.3	0.815	– 36.3
2.00	0.607	– 55.9	1.35	93.8	0.237	49.6	0.788	– 39.2
2.50	0.477	– 66.6	1.26	77.6	0.268	44.0	0.730	– 46.1
3.00	0.388	– 75.0	1.19	65.4	0.291	39.6	0.688	– 52.1
I_C = 0.75 mA, V_{CE} = 1 V, Z_0 = 50 Ω								
0.10	0.961	– 4.3	2.38	174.2	0.016	86.6	0.995	– 2.9
0.20	0.953	– 8.5	2.37	168.1	0.033	83.7	0.989	– 5.7
0.30	0.939	– 12.6	2.34	162.1	0.048	80.4	0.981	– 8.5
0.40	0.921	– 16.6	2.31	156.1	0.063	77.7	0.971	– 11.2
0.50	0.901	– 20.4	2.27	150.5	0.078	75.0	0.958	– 13.7
0.60	0.879	– 24.0	2.21	145.2	0.091	72.5	0.945	– 16.2
0.70	0.858	– 27.6	2.17	139.9	0.105	70.0	0.930	– 18.5
0.80	0.825	– 31.0	2.10	135.0	0.117	67.7	0.915	– 20.7
0.90	0.799	– 34.2	2.08	130.2	0.129	65.4	0.897	– 22.8
0.95	0.781	– 35.9	2.05	127.8	0.134	64.3	0.888	– 23.7
1.00	0.770	– 37.4	2.03	125.5	0.139	63.3	0.880	– 24.6
1.20	0.705	– 43.2	1.94	116.1	0.158	59.7	0.846	– 28.0
1.40	0.643	– 47.7	1.82	107.7	0.175	56.8	0.817	– 31.2
1.50	0.616	– 49.6	1.76	104.0	0.183	55.6	0.803	– 32.6
1.60	0.591	– 51.4	1.71	100.6	0.190	54.5	0.791	– 34.0
1.70	0.565	– 53.5	1.68	97.5	0.197	53.4	0.779	– 35.3
1.75	0.554	– 54.5	1.66	95.8	0.201	53.0	0.772	– 36.1
1.80	0.543	– 55.5	1.64	94.2	0.205	52.5	0.766	– 36.7
2.00	0.495	– 60.0	1.59	87.9	0.219	50.5	0.740	– 39.2
2.50	0.367	– 68.9	1.43	72.7	0.249	46.5	0.686	– 45.2
3.00	0.286	– 75.4	1.32	61.3	0.275	43.3	0.652	– 50.8

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 = 1 mA, V_{CE} = 1 V, Z_0 = 50 Ω								
0.10	0.948	– 5.1	2.98	173.2	0.016	86.0	0.993	– 3.2
0.20	0.937	– 10.0	2.95	166.3	0.032	82.9	0.985	– 6.3
0.30	0.917	– 14.8	2.90	159.5	0.048	79.4	0.973	– 9.3
0.40	0.891	– 19.3	2.84	152.8	0.062	76.4	0.959	– 12.1
0.50	0.864	– 23.6	2.76	146.6	0.076	73.5	0.943	– 14.8
0.60	0.834	– 27.6	2.67	140.8	0.089	71.0	0.925	– 17.3
0.70	0.804	– 31.5	2.58	135.1	0.101	68.6	0.906	– 19.6
0.80	0.766	– 35.0	2.48	129.9	0.112	66.3	0.888	– 21.7
0.90	0.733	– 38.5	2.42	124.9	0.123	64.2	0.867	– 23.7
0.95	0.714	– 40.1	2.38	122.4	0.128	63.1	0.857	– 24.5
1.00	0.699	– 41.7	2.34	120.0	0.132	62.3	0.848	– 25.4
1.20	0.626	– 47.2	2.19	110.6	0.149	59.2	0.811	– 28.3
1.40	0.559	– 51.3	2.02	102.4	0.165	56.8	0.782	– 31.2
1.60	0.507	– 54.2	1.88	95.5	0.179	55.2	0.758	– 33.6
1.70	0.483	– 56.0	1.83	92.4	0.186	54.2	0.747	– 34.8
1.75	0.471	– 56.9	1.80	90.8	0.190	53.9	0.742	– 35.4
1.80	0.458	– 57.9	1.78	89.2	0.193	53.6	0.735	– 36.0
2.00	0.413	– 61.7	1.69	83.3	0.207	52.1	0.712	– 38.3
2.50	0.292	– 69.2	1.49	69.0	0.238	49.0	0.665	– 43.9
3.00	0.221	– 73.4	1.36	58.1	0.267	46.2	0.637	– 49.4
I_C = 0.5 mA, V_{CE} = 3 V, Z_0 = 50 Ω								
0.10	0.977	– 3.2	1.67	175.3	0.015	87.0	0.997	– 2.4
0.20	0.972	– 6.3	1.67	170.5	0.030	84.8	0.994	– 4.7
0.30	0.964	– 9.4	1.67	165.6	0.044	82.2	0.989	– 7.0
0.40	0.953	– 12.4	1.66	160.6	0.059	80.0	0.984	– 9.3
0.50	0.943	– 15.4	1.64	156.0	0.072	77.6	0.977	– 11.5
0.60	0.930	– 18.3	1.62	151.5	0.086	75.5	0.969	– 13.7
0.70	0.923	– 21.2	1.61	147.0	0.099	73.2	0.960	– 15.8
0.80	0.898	– 24.0	1.57	143.0	0.112	71.1	0.952	– 17.8
0.90	0.881	– 26.8	1.58	138.6	0.124	68.9	0.939	– 19.8
0.95	0.871	– 28.3	1.57	136.4	0.130	67.8	0.933	– 20.7
1.00	0.862	– 29.6	1.57	134.4	0.135	66.8	0.927	– 21.7
1.20	0.816	– 34.8	1.54	125.7	0.156	63.1	0.902	– 25.2
1.40	0.769	– 39.3	1.49	117.7	0.175	59.8	0.879	– 28.6
1.60	0.728	– 43.2	1.43	110.7	0.192	57.0	0.857	– 31.7
1.70	0.706	– 45.3	1.42	107.7	0.200	55.6	0.846	– 33.2
1.75	0.696	– 46.4	1.41	106.0	0.205	55.0	0.840	– 34.0
1.80	0.687	– 47.4	1.40	104.4	0.208	54.5	0.834	– 34.7
2.00	0.645	– 52.1	1.38	98.1	0.224	51.9	0.808	– 37.6
2.50	0.518	– 62.1	1.30	82.1	0.255	46.3	0.751	– 44.4
3.00	0.433	– 70.1	1.23	70.0	0.278	41.9	0.709	– 50.4

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 = 1 mA, V_{CE} = 3 V, Z_0 = 50 Ω								
0.10	0.953	– 4.4	3.00	173.9	0.015	86.5	0.995	– 3.0
0.20	0.943	– 8.7	2.99	167.7	0.029	83.8	0.988	– 5.8
0.30	0.927	– 12.9	2.95	161.5	0.043	80.5	0.979	– 8.7
0.40	0.908	– 16.9	2.89	155.4	0.057	77.8	0.967	– 11.3
0.50	0.885	– 20.8	2.83	149.8	0.070	75.3	0.953	– 13.9
0.60	0.859	– 24.3	2.75	144.4	0.082	72.9	0.938	– 16.3
0.70	0.835	– 27.9	2.68	139.1	0.094	70.6	0.921	– 18.5
0.80	0.802	– 31.2	2.58	134.2	0.104	68.4	0.905	– 20.6
0.90	0.773	– 34.3	2.53	129.5	0.115	66.3	0.886	– 22.6
0.95	0.756	– 35.9	2.50	127.1	0.119	65.4	0.876	– 23.4
1.00	0.743	– 37.3	2.46	124.9	0.124	64.5	0.868	– 24.3
1.20	0.676	– 42.6	2.32	115.8	0.141	61.4	0.832	– 27.4
1.40	0.614	– 46.6	2.17	107.7	0.156	58.9	0.803	– 30.3
1.60	0.563	– 49.4	2.02	101.0	0.170	57.1	0.779	– 32.8
1.70	0.540	– 51.3	1.96	98.0	0.177	56.2	0.767	– 34.0
1.75	0.529	– 52.2	1.94	96.4	0.181	55.9	0.762	– 34.6
1.80	0.519	– 53.0	1.92	94.8	0.184	55.5	0.754	– 35.2
2.00	0.472	– 56.8	1.83	89.0	0.197	53.9	0.730	– 37.5
2.50	0.352	– 63.8	1.62	74.6	0.228	50.6	0.680	– 43.0
3.00	0.282	– 68.0	1.48	63.8	0.255	47.8	0.649	– 48.1
I_C = 1 mA, V_{CE} = 5 V, Z_0 = 50 Ω								
0.10	0.957	– 4.2	2.99	174.0	0.015	86.5	0.994	– 2.9
0.20	0.948	– 8.3	2.97	168.1	0.029	83.9	0.988	– 5.8
0.30	0.933	– 12.4	2.94	162.0	0.043	80.8	0.979	– 8.5
0.40	0.913	– 16.2	2.89	156.1	0.056	78.2	0.968	– 11.2
0.50	0.892	– 19.9	2.83	150.6	0.069	75.6	0.954	– 13.7
0.60	0.869	– 23.3	2.75	145.3	0.081	73.4	0.940	– 16.1
0.70	0.846	– 26.8	2.68	140.1	0.093	71.1	0.924	– 18.4
0.80	0.814	– 29.9	2.59	135.4	0.103	69.0	0.908	– 20.4
0.90	0.787	– 33.0	2.55	130.7	0.114	66.9	0.889	– 22.4
0.95	0.771	– 34.6	2.51	128.4	0.119	65.9	0.880	– 23.3
1.00	0.756	– 35.9	2.48	126.1	0.123	65.1	0.871	– 24.2
1.20	0.693	– 41.1	2.35	117.1	0.140	61.9	0.836	– 27.3
1.40	0.632	– 44.9	2.19	109.2	0.156	59.4	0.807	– 30.2
1.60	0.585	– 47.9	2.04	102.5	0.170	57.6	0.782	– 32.8
1.70	0.560	– 49.4	1.99	99.5	0.177	56.7	0.771	– 34.0
1.75	0.549	– 50.4	1.96	97.9	0.181	56.3	0.765	– 34.7
1.80	0.539	– 51.2	1.94	96.4	0.184	55.9	0.758	– 35.3
2.00	0.495	– 55.0	1.86	90.5	0.198	54.3	0.733	– 37.6
2.50	0.376	– 61.9	1.65	76.2	0.229	50.8	0.681	– 43.1
3.00	0.306	– 65.9	1.51	65.4	0.256	47.8	0.649	– 48.2

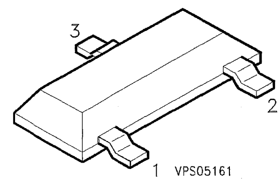
SIEMENS

NPN Silicon RF Transistor

BFR 181

Preliminary Data

- For low-noise, high-gain broadband amplifiers at collector currents from 0.5 mA to 12 mA.
- f_T = 8 GHz
  F = 1.4 dB at 900 MHz



ESD: Electrostatic discharge sensitive device, observe handling precautions!

Type	Marking	Ordering Code (tape and reel)	Pin Configuration 1	2	3	Package[1]
BFR 181	RFs	Q62702-F1314	B	E	C	SOT-23

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CE0}	12	V
Collector-emitter voltage, $V_{BE} = 0$	V_{CES}	20	
Collector-base voltage	V_{CB0}	20	
Emitter-base voltage	V_{EB0}	2	
Collector current	I_C	20	mA
Peak collector current, $f \geq 10$ MHz	I_{CM}	35	
Base current	I_B	2	
Peak base current, $f \geq 10$ MHz	I_{BM}	3	
Total power dissipation, $T_S \leq 91$ ˚C[3]	P_{tot}	175	mW
Junction temperature	T_j	150	˚C
Ambient temperature range	T_A	– 65 ... + 150	
Storage temperature range	T_{stg}	– 65 ... + 150	

Thermal Resistance

Junction - ambient[2]	$R_{th\,JA}$	≤ 415	K/W
Junction - soldering point[3]	$R_{th\,JS}$	≤ 335	

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

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

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CE0}$	12	–	–	V
Collector-emitter cutoff current V_{CE} = 20 V, V_{BE} = 0	I_{CES}	–	–	100	µA
Collector-base cutoff current V_{CB} = 10 V, I_E = 0	I_{CB0}	–	–	100	nA
Emitter-base cutoff current V_{EB} = 1 V, I_C = 0	I_{EB0}	–	–	1	µA
DC current gain I_C = 5 mA, V_{CE} = 6 V I_C = 10 mA, V_{CE} = 6 V	h_{FE}	 50 –	 100 100	 250 –	–
Collector-emitter saturation voltage I_C = 15 mA, I_B = 1.5 mA	V_{CEsat}	–	0.1	0.4	V

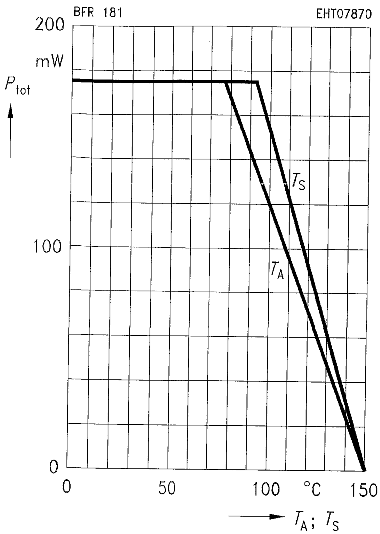
Electrical Characteristics
at T_A = 25 ˚C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
AC Characteristics					
Transition frequency	f_T				GHz
I_C = 6 mA, V_{CE} = 3 V, f = 500 MHz		–	6.7	–	
I_C = 10 mA, V_{CE} = 8 V, f = 500 MHz		–	8	–	
Collector-base capacitance V_{CB} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{cb}	–	0.27	–	pF
Collector-emitter capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{ce}	–	0.18	–	
Input capacitance V_{EB} = 0.5 V, I_C = i_c = 0, f = 1 MHz	C_{ibo}	–	0.4	–	
Output capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{obs}	–	0.45	–	
Noise figure	F				dB
I_C = 3 mA, V_{CE} = 5 V, f = 10 MHz, Z_S = 75 Ω		–	1.1	–	
I_C = 3 mA, V_{CE} = 5 V, f = 900 MHz, Z_S = Z_{Sopt}		–	1.4	–	
I_C = 3 mA, V_{CE} = 5 V, f = 1.75 GHz, Z_S = Z_{Sopt}		–	1.8	–	
Power gain					
I_C = 8 mA, V_{CE} = 8 V, f = 900 MHz, Z_0 = 50 Ω	G_{ms} [1]	–	18	–	
I_C = 8 mA, V_{CE} = 8 V, f = 1.75 GHz, Z_0 = 50 Ω	G_{ma} [2]	–	12	–	
Transducer gain I_C = 8 mA, V_{CE} = 8 V, f = 900 MHz, Z_0 = 50 Ω	$\lvert S_{21e} \rvert^2$	–	14.5	–	

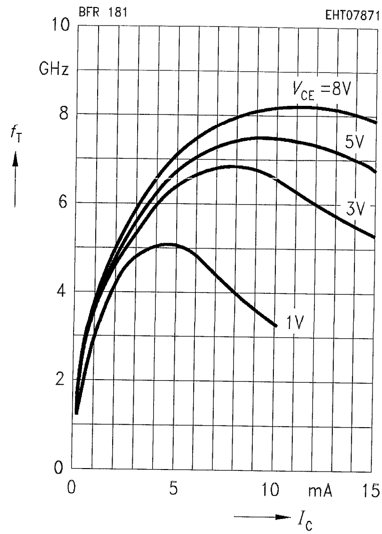
1) $G_{ms} = \left| \frac{S_{21e}}{S_{12e}} \right|$

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

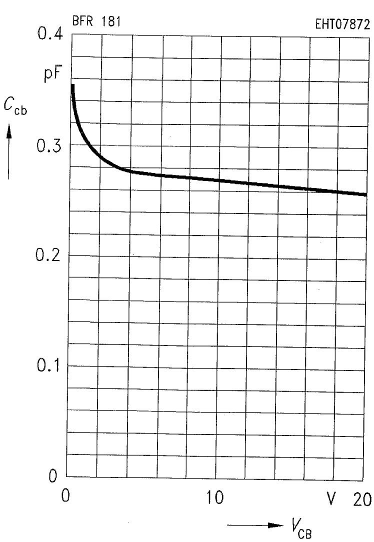
Total power dissipation $P_{tot} = f(T_A^*; T_S)$
* Package mounted on alumina



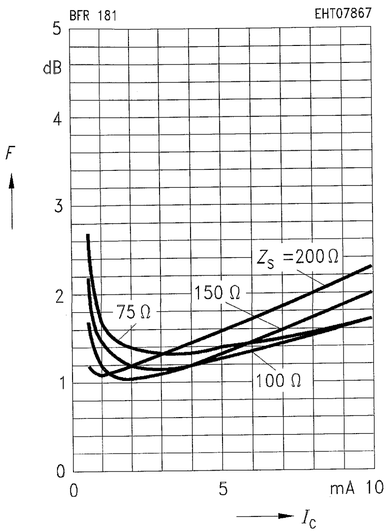
Transition frequency $f_T = f(I_C)$
f = 500 MHz



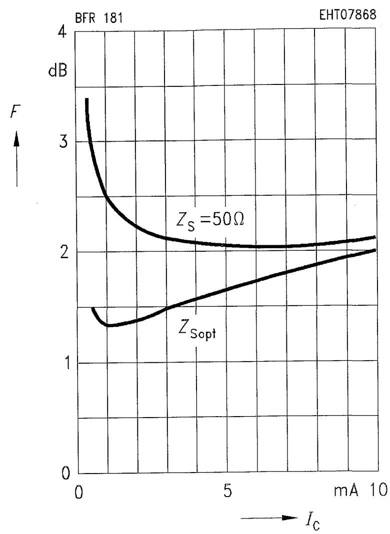
Collector-base capacitance $C_{cb} = f(V_{CB})$
$V_{BE} = v_{be} = 0$, f = 1 MHz



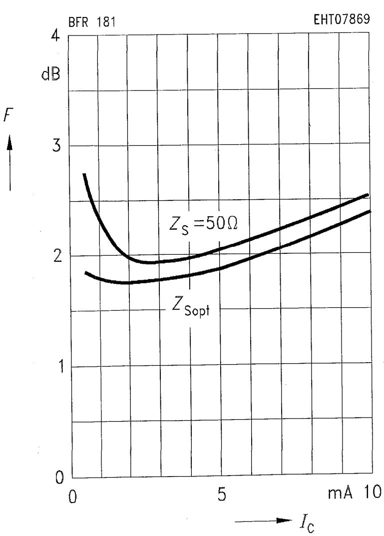
Noise figure $F = f(I_C)$
V_{CE} = 5 V, f = 10 MHz



Noise figure $F = f(I_C)$
V_{CE} = 5 V, f = 900 MHz, Z_{Lopt} (G)



Noise figure $F = f(I_C)$
V_{CE} = 5 V, f = 1.75 GHz, Z_{Lopt} (G)



Common Emitter S Parameters

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**
I_C = 2 mA, V_{CE} = 2.5 V, Z_0 = 50 Ω								
0.10	0.914	– 11.3	6.41	169.1	0.017	83.6	0.988	– 5.2
0.20	0.877	– 22.1	6.19	158.4	0.034	77.2	0.963	– 10.1
0.30	0.827	– 32.4	5.88	148.7	0.049	71.8	0.928	– 14.3
0.40	0.767	– 41.5	5.49	139.7	0.061	67.4	0.889	– 17.8
0.50	0.707	– 49.8	5.09	131.9	0.071	63.7	0.850	– 20.7
0.60	0.647	– 57.5	4.73	124.7	0.080	61.0	0.814	– 22.9
0.70	0.593	– 64.2	4.39	118.6	0.088	59.0	0.783	– 24.7
0.80	0.541	– 70.8	4.09	112.9	0.094	57.5	0.754	– 26.1
0.90	0.493	– 77.0	3.81	107.8	0.100	56.3	0.728	– 27.4
0.95	0.472	– 79.8	3.68	105.3	0.103	55.9	0.717	– 27.8
1.00	0.449	– 82.9	3.56	103.0	0.106	55.5	0.705	– 28.2
1.20	0.374	– 94.5	3.13	94.6	0.116	54.8	0.668	– 29.7
1.40	0.311	– 105.3	2.79	87.4	0.125	54.9	0.642	– 31.2
1.60	0.262	– 114.8	2.51	81.1	0.134	55.8	0.628	– 32.5
1.70	0.242	– 121.1	2.40	78.3	0.139	56.0	0.623	– 33.3
1.75	0.234	– 123.2	2.34	76.9	0.142	56.3	0.620	– 33.6
1.80	0.228	– 126.6	2.31	75.6	0.145	56.6	0.616	– 34.1
2.00	0.206	– 139.6	2.13	70.4	0.156	57.2	0.600	– 35.9
2.50	0.183	– 178.5	1.80	58.2	0.185	58.6	0.568	– 40.8
3.00	0.191	152.6	1.57	48.3	0.219	59.2	0.555	– 46.4
I_C = 5 mA, V_{CE} = 2.5 V, Z_0 = 50 Ω								
0.10	0.807	– 19.1	12.92	161.5	0.017	80.3	0.962	– 8.7
0.20	0.716	– 35.5	11.57	145.5	0.030	72.6	0.893	– 15.4
0.30	0.617	– 49.1	10.07	132.9	0.041	67.7	0.818	– 19.7
0.40	0.526	– 59.6	8.67	122.8	0.050	65.2	0.755	– 22.1
0.50	0.450	– 68.5	7.53	115.0	0.057	64.0	0.708	– 23.3
0.60	0.387	– 76.1	6.62	108.6	0.064	63.6	0.672	– 24.1
0.70	0.338	– 82.4	5.89	103.3	0.071	63.7	0.646	– 24.6
0.80	0.296	– 88.8	5.31	98.7	0.077	64.1	0.626	– 24.9
0.90	0.260	– 95.0	4.82	94.6	0.084	64.4	0.609	– 25.3
0.95	0.244	– 97.7	4.59	92.7	0.087	64.5	0.602	– 25.4
1.00	0.229	– 101.2	4.40	90.9	0.090	64.7	0.595	– 25.5
1.20	0.181	– 114.4	3.76	84.4	0.104	65.3	0.574	– 26.2
1.40	0.142	– 128.5	3.29	78.7	0.117	65.6	0.561	– 27.3
1.60	0.114	– 142.2	2.92	73.7	0.131	66.2	0.558	– 28.5
1.70	0.107	– 151.1	2.77	71.4	0.139	66.1	0.555	– 29.4
1.75	0.102	– 154.8	2.69	70.3	0.142	66.3	0.554	– 29.7
1.80	0.103	– 159.4	2.64	69.2	0.146	66.3	0.552	– 30.3
2.00	0.104	– 175.5	2.42	65.1	0.161	66.0	0.542	– 32.2
2.50	0.138	146.4	2.02	54.9	0.199	64.7	0.516	– 37.3
3.00	0.164	125.8	1.75	46.2	0.240	62.6	0.506	– 43.3

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 = 2 mA, V_{CE} = 5 V, Z_0 = 50 Ω								
0.10	0.918	– 10.8	6.42	169.3	0.017	83.8	0.989	– 5.1
0.20	0.884	– 21.1	6.21	159.0	0.033	77.9	0.965	– 9.8
0.30	0.835	– 30.9	5.92	149.5	0.047	72.4	0.931	– 13.9
0.40	0.777	– 39.6	5.54	140.6	0.059	68.1	0.893	– 17.4
0.50	0.717	– 47.7	5.15	132.9	0.070	64.6	0.856	– 20.2
0.60	0.658	– 55.0	4.80	125.8	0.078	61.9	0.821	– 22.5
0.70	0.605	– 61.4	4.46	119.8	0.086	59.9	0.790	– 24.3
0.80	0.554	– 67.7	4.17	114.2	0.093	58.3	0.762	– 25.7
0.90	0.505	– 73.6	3.89	109.0	0.099	57.2	0.736	– 27.0
0.95	0.482	– 76.4	3.76	106.6	0.102	56.7	0.724	– 27.5
1.00	0.460	– 79.3	3.63	104.2	0.104	56.3	0.712	– 27.9
1.20	0.382	– 89.9	3.21	95.8	0.114	55.5	0.675	– 29.5
1.40	0.317	– 100.0	2.86	88.7	0.123	55.5	0.649	– 31.0
1.60	0.265	– 108.6	2.58	82.4	0.133	56.3	0.634	– 32.2
1.70	0.245	– 114.4	2.47	79.6	0.138	56.5	0.628	– 33.0
1.75	0.235	– 116.6	2.40	78.3	0.141	56.7	0.625	– 33.2
1.80	0.228	– 119.3	2.36	76.9	0.143	57.0	0.621	– 33.8
2.00	0.202	– 131.8	2.19	71.8	0.154	57.6	0.605	– 35.5
2.50	0.167	– 171.8	1.84	59.6	0.183	58.8	0.571	– 40.3
3.00	0.169	157.2	1.62	49.8	0.217	59.4	0.559	– 45.6
I_C = 10 mA, V_{CE} = 5 V, Z_0 = 50 Ω								
0.10	0.700	– 25.0	19.00	155.0	0.015	78.6	0.930	– 11.4
0.20	0.572	– 44.1	15.69	136.0	0.026	71.6	0.823	– 18.2
0.30	0.458	– 57.7	12.73	123.0	0.035	69.0	0.734	– 21.0
0.40	0.370	– 67.1	10.45	113.7	0.043	68.5	0.674	– 21.8
0.50	0.304	– 74.7	8.80	106.9	0.050	68.7	0.636	– 22.0
0.60	0.254	– 81.3	7.57	101.4	0.057	69.3	0.610	– 22.0
0.70	0.216	– 86.5	6.63	97.0	0.064	69.8	0.592	– 22.0
0.80	0.184	– 92.0	5.90	93.2	0.072	70.3	0.579	– 22.2
0.90	0.159	– 98.0	5.32	89.7	0.079	70.6	0.568	– 22.4
0.95	0.146	– 100.2	5.06	88.1	0.083	70.7	0.564	– 22.5
1.00	0.135	– 104.1	4.83	86.6	0.086	70.8	0.559	– 22.5
1.20	0.099	– 119.1	4.10	81.1	0.102	70.9	0.546	– 23.3
1.40	0.071	– 137.6	3.56	76.2	0.117	70.6	0.537	– 24.5
1.60	0.052	– 157.6	3.15	71.7	0.132	70.5	0.537	– 25.9
1.70	0.052	– 172.8	2.99	69.7	0.140	70.1	0.536	– 26.9
1.75	0.049	– 177.9	2.90	68.7	0.144	70.0	0.535	– 27.2
1.80	0.052	178.4	2.84	67.7	0.148	69.9	0.533	– 27.9
2.00	0.061	159.8	2.60	64.1	0.164	69.2	0.525	– 29.9
2.50	0.112	128.4	2.16	54.8	0.204	66.7	0.499	– 35.0
3.00	0.142	113.9	1.87	46.7	0.245	63.8	0.490	– 41.0

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} = 5 V, Z_0 = 50 Ω								
0.10	0.612	– 30.8	21.88	150.3	0.014	77.2	0.900	– 12.9
0.20	0.469	– 52.5	16.99	129.9	0.024	71.2	0.776	– 18.9
0.30	0.361	– 67.0	13.23	117.3	0.032	69.8	0.690	– 20.5
0.40	0.283	– 77.2	10.61	108.7	0.040	70.4	0.638	– 20.4
0.50	0.229	– 85.9	8.81	102.4	0.047	71.1	0.608	– 20.2
0.60	0.189	– 93.6	7.52	97.5	0.054	71.8	0.589	– 20.0
0.70	0.159	– 99.8	6.54	93.5	0.062	72.4	0.577	– 20.0
0.80	0.136	– 107.7	5.80	90.0	0.070	72.9	0.568	– 20.2
0.90	0.117	– 116.2	5.21	86.8	0.077	73.1	0.560	– 20.5
0.95	0.108	– 119.8	4.95	85.3	0.081	73.1	0.556	– 20.7
1.00	0.101	– 125.9	4.73	83.9	0.085	73.2	0.553	– 20.8
1.20	0.082	– 148.3	4.00	78.7	0.100	73.0	0.542	– 21.8
1.40	0.071	– 173.4	3.47	74.0	0.116	72.5	0.536	– 23.2
1.60	0.066	165.0	3.07	69.8	0.131	72.2	0.537	– 24.8
1.70	0.071	155.7	2.91	67.8	0.139	71.8	0.536	– 25.9
1.75	0.073	152.3	2.82	66.8	0.144	71.7	0.536	– 26.3
1.80	0.075	151.2	2.76	65.9	0.148	71.5	0.534	– 27.0
2.00	0.090	142.5	2.52	62.3	0.164	70.6	0.526	– 29.1
2.50	0.144	123.4	2.10	53.2	0.205	68.0	0.502	– 34.6
3.00	0.172	111.2	1.82	45.2	0.247	65.0	0.493	– 40.8
I_C = 15 mA, V_{CE} = 8 V, Z_0 = 50 Ω								
0.10	0.663	– 27.5	21.86	151.9	0.014	77.5	0.908	– 12.6
0.20	0.520	– 46.9	17.33	132.0	0.025	71.6	0.788	– 18.9
0.30	0.405	– 59.6	13.67	119.2	0.033	69.9	0.700	– 20.9
0.40	0.321	– 68.0	11.03	110.5	0.041	70.3	0.645	– 21.1
0.50	0.260	– 74.5	9.20	104.1	0.048	70.8	0.611	– 20.9
0.60	0.214	– 79.9	7.87	99.1	0.056	71.4	0.590	– 20.8
0.70	0.181	– 84.0	6.86	95.0	0.063	72.0	0.576	– 20.7
0.80	0.153	– 88.8	6.09	91.4	0.071	72.3	0.565	– 20.9
0.90	0.129	– 93.8	5.48	88.2	0.079	72.5	0.556	– 21.1
0.95	0.118	– 95.4	5.21	86.7	0.082	72.5	0.553	– 21.3
1.00	0.108	– 99.2	4.97	85.3	0.086	72.5	0.549	– 21.4
1.20	0.075	– 113.7	4.21	80.1	0.102	72.3	0.537	– 22.1
1.40	0.049	– 133.2	3.65	75.4	0.117	71.7	0.530	– 23.4
1.60	0.031	– 159.1	3.23	71.2	0.133	71.4	0.531	– 25.0
1.70	0.030	179.6	3.06	69.3	0.141	70.9	0.530	– 26.0
1.75	0.029	172.1	2.97	68.4	0.145	70.8	0.529	– 26.4
1.80	0.031	168.4	2.91	67.4	0.149	70.7	0.528	– 27.0
2.00	0.045	149.6	2.66	63.9	0.165	69.7	0.519	– 29.0
2.50	0.099	122.4	2.21	54.8	0.206	66.9	0.494	– 34.2
3.00	0.129	110.0	1.91	47.0	0.247	63.8	0.484	– 40.2

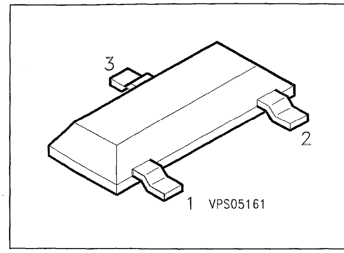
SIEMENS

NPN Silicon RF Transistor

BFR 182

Preliminary Data

- For low-noise, high-gain broadband amplifiers at collector currents from 1 mA to 20 mA.
- f_T = 8 GHz
  F = 1.2 dB at 900 MHz



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

Type	Marking	Ordering Code (tape and reel)	Pin Configuration 1	2	3	Package[1]
BFR 182	RGs	Q62702-F1315	B	E	C	SOT-23

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CEO}	12	V
Collector-emitter voltage, $V_{BE} = 0$	V_{CES}	20	
Collector-base voltage	V_{CBO}	20	
Emitter-base voltage	V_{EBO}	2	
Collector current	I_C	35	mA
Peak collector current, $f \geq$ 10 MHz	I_{CM}	50	
Base current	I_B	4	
Peak base current, $f \geq$ 10 MHz	I_{BM}	5	
Total power dissipation, $T_S \leq$ 88 °C[3]	P_{tot}	250	mW
Junction temperature	T_j	150	°C
Ambient temperature range	T_A	– 65 ... + 150	
Storage temperature range	T_{stg}	– 65 ... + 150	

Thermal Resistance

Junction - ambient[2]	$R_{th\,JA}$	$\leq$ 330	K/W
Junction - soldering point[3]	$R_{th\,JS}$	$\leq$ 250	

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

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

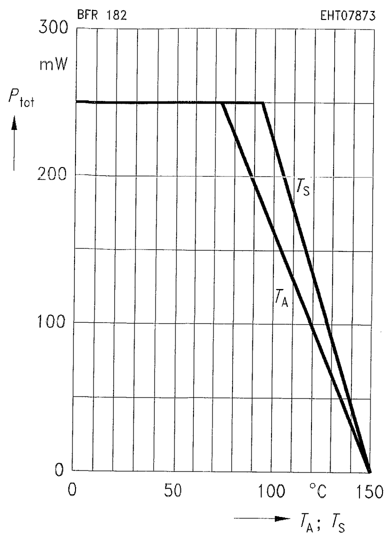
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CE0}$	12	–	–	V
Collector-emitter cutoff current V_{CE} = 20 V, V_{BE} = 0	I_{CES}	–	–	100	µA
Collector-base cutoff current V_{CB} = 10 V, I_E = 0	I_{CB0}	–	–	100	nA
Emitter-base cutoff current V_{EB} = 1 V, I_C = 0	I_{EB0}	–	–	1	µA
DC current gain I_C = 5 mA, V_{CE} = 6 V I_C = 20 mA, V_{CE} = 8 V	h_{FE}	 50 –	 90 100	 250 –	–
Collector-emitter saturation voltage I_C = 15 mA, I_B = 1.5 mA	V_{CEsat}	–	0.1	0.4	V

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

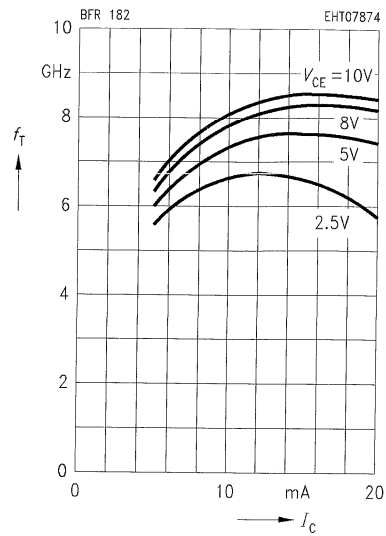
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
AC Characteristics					
Transition frequency	f_T				GHz
I_C = 15 mA, V_{CE} = 6 V, f = 500 MHz		–	8	–	
I_C = 20 mA, V_{CE} = 8 V, f = 500 MHz		–	8.2	–	
Collector-base capacitance V_{CB} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{cb}	–	0.32	–	pF
Collector-emitter capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{ce}	–	0.18	–	
Input capacitance V_{EB} = 0.5 V, I_C = i_c = 0, f = 1 MHz	C_{ibo}	–	0.75	–	
Output capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{obs}	–	0.5	–	
Noise figure	F				dB
I_C = 6 mA, V_{CE} = 5 V, f = 10 MHz, Z_S = 75 Ω		–	1.1	–	
I_C = 6 mA, V_{CE} = 5 V, f = 900 MHz		–	1.3	–	
I_C = 6 mA, V_{CE} = 5 V, f = 1.75 GHz		–	1.75	–	
Power gain	G_{ms}[1]				
I_C = 15 mA, V_{CE} = 6 V, f = 900 MHz, Z_0 = 50 Ω		–	18	–	
I_C = 15 mA, V_{CE} = 6 V, f = 1.75 GHz, Z_0 = 50 Ω		–	12	–	
Transducer gain I_C = 15 mA, V_{CE} = 6 V, f = 900 MHz, Z_0 = 50 Ω	$\lvert S_{21e} \rvert^2$	–	14.5	–	

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

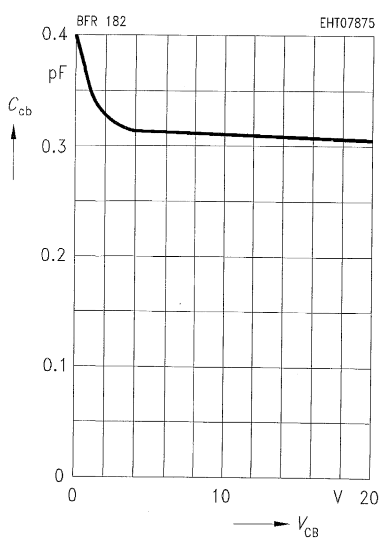
Total power dissipation $P_{tot} = f(T_A^*; T_S)$
*Package mounted on alumina



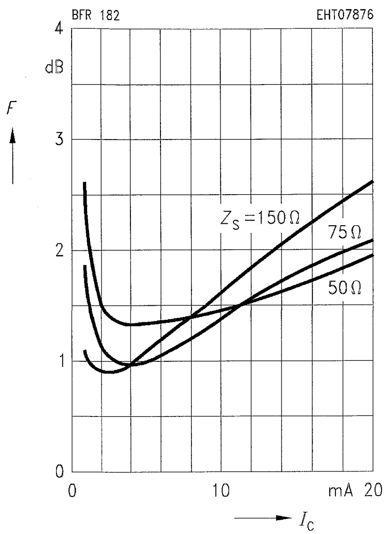
Transition frequency $f_T = f(I_C)$
f = 500 MHz



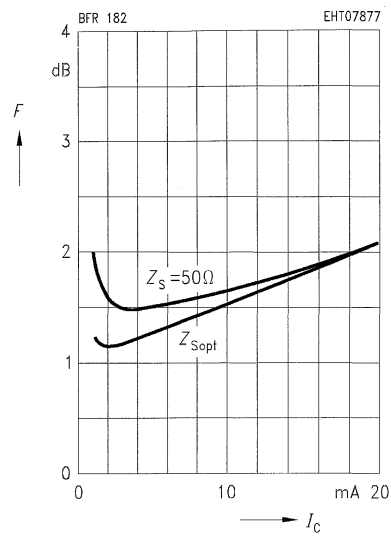
Collector-base capacitance $C_{cb} = f(V_{CB})$
$V_{BE} = v_{be} = 0$, f = 1 MHz



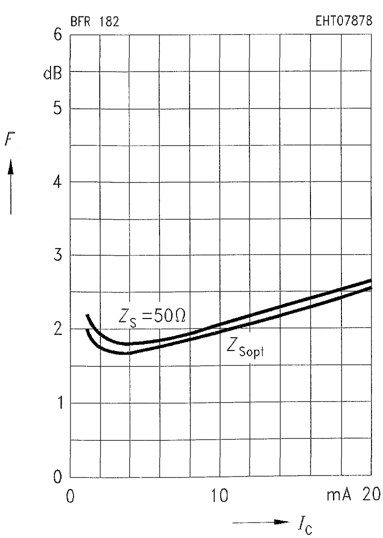
Noise figure $F = f\,(I_C)$
V_{CE} = 5 V, f = 10 MHz



Noise figure $F = f\,(I_C)$
V_{CE} = 5 V, f = 900 MHz



Noise figure $F = f\,(I_C)$
V_{CE} = 5 V, f = 1.75 GHz, Z_{Lopt} (G)



Common Emitter S Parameters

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_C = 5 mA, V_{CE} = 2.5 V, Z_0 = 50 Ω								
0.10	0.803	– 21.7	12.80	160.8	0.019	78.7	0.956	– 9.9
0.20	0.708	– 40.5	11.43	143.9	0.034	70.7	0.879	– 17.5
0.30	0.604	– 56.3	9.90	131.1	0.045	65.0	0.795	– 22.2
0.40	0.510	– 69.3	8.49	120.8	0.054	62.0	0.727	– 24.8
0.50	0.434	– 80.1	7.34	112.7	0.062	60.8	0.677	– 26.2
0.60	0.375	– 89.9	6.44	106.3	0.068	60.1	0.638	– 27.0
0.70	0.332	– 97.9	5.71	101.2	0.075	60.8	0.610	– 27.6
0.80	0.295	– 106.5	5.12	96.3	0.081	60.8	0.589	– 28.0
0.90	0.264	– 115.7	4.66	92.2	0.088	61.7	0.572	– 28.4
0.95	0.251	– 120.8	4.44	90.1	0.091	61.5	0.564	– 28.6
1.00	0.238	– 124.4	4.25	88.4	0.094	61.9	0.558	– 28.8
1.20	0.208	– 142.2	3.63	81.8	0.108	62.6	0.535	– 29.7
1.40	0.181	– 159.3	3.16	75.8	0.121	63.3	0.519	– 30.6
1.60	0.168	– 175.2	2.80	70.7	0.135	63.8	0.514	– 31.6
1.70	0.168	178.2	2.66	68.4	0.142	64.2	0.512	– 32.5
1.75	0.170	173.5	2.60	67.1	0.146	64.1	0.512	– 33.0
1.80	0.170	170.5	2.54	65.8	0.150	64.2	0.511	– 33.6
2.00	0.186	158.6	2.32	61.3	0.166	64.3	0.505	– 36.2
2.50	0.235	134.4	1.93	50.9	0.206	62.9	0.470	– 41.7
3.00	0.263	117.8	1.67	41.7	0.247	61.5	0.474	– 48.2
I_C = 10 mA, V_{CE} = 2.5 V, Z_0 = 50 Ω								
0.10	0.668	– 30.6	19.05	153.1	0.017	76.1	0.912	– 13.8
0.20	0.533	– 54.1	15.41	133.0	0.030	68.5	0.786	– 21.6
0.30	0.422	– 71.8	12.30	120.0	0.039	65.8	0.687	– 24.6
0.40	0.340	– 85.5	10.01	110.6	0.047	65.5	0.623	– 25.4
0.50	0.275	– 97.2	8.38	103.7	0.054	66.1	0.582	– 25.5
0.60	0.240	– 107.6	7.17	98.4	0.062	66.6	0.554	– 25.4
0.70	0.211	– 116.4	6.27	94.2	0.069	67.6	0.536	– 25.4
0.80	0.187	– 126.5	5.57	90.1	0.077	68.1	0.523	– 25.6
0.90	0.174	– 136.6	5.02	86.6	0.085	68.6	0.513	– 25.9
0.95	0.167	– 142.7	4.77	84.9	0.089	68.6	0.508	– 26.1
1.00	0.160	– 147.2	4.55	83.4	0.093	68.6	0.504	– 26.3
1.20	0.149	– 166.0	3.85	77.9	0.108	68.9	0.488	– 27.2
1.40	0.144	175.0	3.35	72.5	0.125	68.6	0.477	– 28.2
1.60	0.143	159.7	2.95	67.9	0.141	68.2	0.476	– 29.5
1.70	0.146	155.3	2.80	65.8	0.148	68.2	0.476	– 30.5
1.75	0.154	151.7	2.73	64.6	0.153	68.0	0.476	– 31.1
1.80	0.153	149.5	2.66	63.6	0.157	67.9	0.475	– 31.8
2.00	0.174	141.9	2.44	59.4	0.175	67.2	0.469	– 34.7
2.50	0.227	124.5	2.03	49.8	0.218	64.2	0.435	– 40.3
3.00	0.259	110.8	1.75	41.2	0.261	61.7	0.439	– 47.2

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} = 2.5 V, Z_0 = 50 Ω								
0.10	0.573	– 38.1	22.08	148.0	0.016	74.8	0.873	– 16.0
0.20	0.430	– 65.2	16.70	126.8	0.027	68.3	0.727	– 22.9
0.30	0.332	– 84.5	12.79	114.4	0.036	67.1	0.632	– 24.4
0.40	0.265	– 99.8	10.19	105.8	0.044	67.9	0.576	– 24.3
0.50	0.222	– 113.8	8.42	99.5	0.052	68.9	0.544	– 23.8
0.60	0.197	– 125.3	7.16	94.8	0.060	69.4	0.523	– 23.6
0.70	0.178	– 135.2	6.22	90.9	0.068	70.6	0.510	– 23.6
0.80	0.166	– 145.7	5.50	87.1	0.076	71.0	0.501	– 23.8
0.90	0.160	– 157.2	4.94	83.9	0.084	71.3	0.493	– 24.2
0.95	0.160	– 162.3	4.70	82.3	0.088	71.1	0.489	– 24.4
1.00	0.157	– 166.1	4.48	80.9	0.092	71.3	0.486	– 24.7
1.20	0.159	177.3	3.79	75.6	0.109	71.0	0.474	– 25.8
1.40	0.160	161.0	3.29	70.5	0.126	70.6	0.465	– 27.0
1.60	0.165	149.3	2.89	66.1	0.143	69.8	0.465	– 28.6
1.70	0.168	145.1	2.74	64.1	0.151	69.6	0.465	– 29.7
1.75	0.177	142.4	2.68	62.9	0.155	69.4	0.465	– 30.3
1.80	0.177	140.9	2.61	61.8	0.160	69.2	0.465	– 31.1
2.00	0.198	134.8	2.39	57.8	0.178	68.4	0.459	– 34.1
2.50	0.250	121.3	1.98	48.3	0.222	65.0	0.425	– 40.1
3.00	0.281	109.1	1.71	39.7	0.266	62.0	0.430	– 47.3
I_C = 20 mA, V_{CE} = 2.5 V, Z_0 = 50 Ω								
0.10	0.500	– 46.9	23.00	143.8	0.016	72.0	0.832	– 17.4
0.20	0.368	– 78.9	16.49	122.3	0.026	67.7	0.679	– 23.1
0.30	0.290	– 101.1	12.28	110.4	0.035	67.6	0.592	– 23.5
0.40	0.245	– 119.0	9.66	102.4	0.043	68.8	0.546	– 22.8
0.50	0.215	– 134.1	7.93	96.5	0.051	70.2	0.521	– 22.2
0.60	0.203	– 145.4	6.71	92.0	0.059	70.9	0.504	– 22.0
0.70	0.195	– 154.8	5.81	88.3	0.067	71.9	0.495	– 22.2
0.80	0.190	– 164.3	5.13	84.7	0.075	72.1	0.488	– 22.5
0.90	0.194	– 173.3	4.61	81.6	0.084	72.7	0.482	– 23.0
0.95	0.196	– 177.5	4.37	80.0	0.088	72.5	0.479	– 23.3
1.00	0.192	178.9	4.17	78.7	0.092	72.6	0.476	– 23.7
1.20	0.201	166.8	3.52	73.5	0.109	72.2	0.467	– 25.1
1.40	0.211	153.7	3.06	68.4	0.127	71.6	0.459	– 26.5
1.60	0.215	144.3	2.69	63.9	0.144	70.8	0.459	– 28.3
1.70	0.217	140.6	2.55	62.0	0.152	70.6	0.459	– 29.5
1.75	0.225	138.7	2.49	60.8	0.157	70.3	0.460	– 30.3
1.80	0.224	137.0	2.42	59.7	0.162	70.1	0.459	– 31.0
2.00	0.247	131.7	2.22	55.6	0.180	69.1	0.454	– 34.2
2.50	0.296	119.4	1.84	46.1	0.226	65.6	0.421	– 40.8
3.00	0.327	107.9	1.59	37.5	0.271	62.5	0.424	– 48.5

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} = 5 V, Z_0 = 50 Ω								
0.10	0.820	– 20.3	12.73	161.6	0.018	79.6	0.959	– 9.5
0.20	0.728	– 38.1	11.45	145.2	0.033	71.4	0.886	– 16.9
0.30	0.625	– 53.0	10.00	132.5	0.044	65.8	0.807	– 21.6
0.40	0.531	– 65.0	8.62	122.2	0.054	62.9	0.739	– 24.3
0.50	0.450	– 75.7	7.49	114.1	0.061	61.6	0.689	– 25.8
0.60	0.390	– 84.3	6.59	107.7	0.068	60.8	0.649	– 26.7
0.70	0.343	– 91.9	5.85	102.6	0.074	61.3	0.621	– 27.3
0.80	0.302	– 100.2	5.27	97.6	0.081	61.3	0.599	– 27.8
0.90	0.269	– 108.8	4.79	93.5	0.087	61.9	0.582	– 28.2
0.95	0.254	– 112.9	4.57	91.4	0.090	61.9	0.574	– 28.4
1.00	0.239	– 116.0	4.37	89.6	0.094	62.1	0.567	– 28.6
1.20	0.202	– 132.6	3.74	83.1	0.107	62.7	0.543	– 29.4
1.40	0.167	– 150.7	3.26	77.0	0.120	63.3	0.526	– 30.2
1.60	0.148	– 166.1	2.89	71.9	0.133	63.7	0.521	– 31.2
1.70	0.146	– 174.7	2.74	69.7	0.141	64.2	0.519	– 32.0
1.75	0.148	– 179.4	2.68	68.4	0.144	64.2	0.518	– 32.6
1.80	0.147	177.9	2.62	67.1	0.148	64.3	0.518	– 33.1
2.00	0.161	163.0	2.40	62.6	0.164	64.3	0.511	– 35.6
2.50	0.206	136.2	1.99	52.3	0.203	62.8	0.476	– 40.8
3.00	0.238	118.7	1.72	43.2	0.244	61.6	0.480	– 47.0
I_C = 10 mA, V_{CE} = 5 V, Z_0 = 50 Ω								
0.10	0.705	– 27.7	19.05	154.4	0.017	77.0	0.920	– 13.1
0.20	0.571	– 49.3	15.66	134.8	0.029	69.7	0.801	– 21.0
0.30	0.454	– 65.0	12.65	121.8	0.039	66.5	0.703	– 24.2
0.40	0.364	– 77.0	10.36	112.4	0.046	65.9	0.638	– 25.3
0.50	0.296	– 87.3	8.70	105.3	0.054	66.3	0.595	– 25.5
0.60	0.250	– 96.0	7.48	100.0	0.062	66.7	0.565	– 25.5
0.70	0.217	– 103.7	6.54	95.7	0.069	67.5	0.546	– 25.5
0.80	0.188	– 112.0	5.82	91.5	0.077	67.9	0.532	– 25.7
0.90	0.167	– 122.6	5.24	88.1	0.084	68.5	0.520	– 25.9
0.95	0.157	– 127.4	4.99	86.3	0.088	68.5	0.515	– 26.1
1.00	0.146	– 131.0	4.76	84.8	0.092	68.7	0.510	– 26.2
1.20	0.126	– 152.1	4.04	79.3	0.108	68.6	0.495	– 27.0
1.40	0.112	– 174.2	3.51	73.9	0.124	68.5	0.483	– 28.0
1.60	0.108	168.0	3.09	69.4	0.139	68.0	0.481	– 29.2
1.70	0.109	161.2	2.93	67.5	0.147	68.0	0.480	– 30.1
1.75	0.114	157.6	2.86	66.3	0.152	67.6	0.480	– 30.7
1.80	0.113	154.0	2.79	65.1	0.156	67.6	0.480	– 31.3
2.00	0.138	143.5	2.55	61.1	0.173	67.0	0.474	– 34.1
2.50	0.189	125.2	2.12	51.4	0.215	64.0	0.439	– 39.4
3.00	0.219	110.1	1.83	42.9	0.257	61.4	0.443	– 45.9

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} = 5 V, Z_0 = 50 Ω								
0.10	0.629	– 33.0	22.43	150.1	0.016	75.7	0.889	– 15.1
0.20	0.481	– 56.4	17.40	129.3	0.027	69.4	0.750	– 22.4
0.30	0.369	– 72.7	13.53	116.7	0.036	67.8	0.652	– 24.5
0.40	0.288	– 84.9	10.86	107.9	0.044	68.0	0.593	– 24.6
0.50	0.230	– 96.4	9.01	101.5	0.052	69.1	0.558	– 24.3
0.60	0.195	– 105.2	7.68	96.7	0.060	69.5	0.534	– 24.0
0.70	0.170	– 113.3	6.68	92.7	0.068	70.5	0.520	– 24.0
0.80	0.144	– 122.6	5.92	89.0	0.076	70.8	0.509	– 24.2
0.90	0.135	– 134.7	5.32	85.8	0.084	71.1	0.500	– 24.4
0.95	0.129	– 140.8	5.06	84.1	0.088	71.0	0.496	– 24.6
1.00	0.120	– 143.8	4.82	82.8	0.092	71.1	0.492	– 24.8
1.20	0.110	– 166.4	4.08	77.6	0.108	70.7	0.479	– 25.8
1.40	0.106	171.5	3.54	72.5	0.125	70.2	0.469	– 26.8
1.60	0.106	155.0	3.12	68.2	0.142	69.4	0.469	– 28.2
1.70	0.111	148.9	2.95	66.3	0.150	69.2	0.468	– 29.2
1.75	0.120	145.9	2.88	65.1	0.154	68.9	0.469	– 29.8
1.80	0.120	141.8	2.81	64.0	0.158	68.8	0.468	– 30.5
2.00	0.140	135.9	2.57	60.2	0.176	68.0	0.462	– 33.4
2.50	0.192	120.6	2.13	50.8	0.220	64.5	0.428	– 38.8
3.00	0.227	107.7	1.84	42.4	0.262	61.6	0.432	– 45.6
I_C = 20 mA, V_{CE} = 5 V, Z_0 = 50 Ω								
0.10	0.576	– 37.1	24.28	146.9	0.016	75.5	0.864	– 16.3
0.20	0.422	– 62.6	18.06	125.7	0.026	69.4	0.715	– 22.8
0.30	0.318	– 79.7	13.73	113.5	0.035	68.8	0.622	– 23.9
0.40	0.248	– 93.3	10.89	105.2	0.043	69.5	0.570	– 23.6
0.50	0.198	– 105.3	8.98	99.2	0.050	70.8	0.539	– 23.0
0.60	0.171	– 116.0	7.62	94.6	0.059	71.1	0.520	– 22.7
0.70	0.149	– 124.9	6.61	90.9	0.067	72.0	0.508	– 22.7
0.80	0.132	– 136.3	5.85	87.3	0.075	72.2	0.499	– 23.0
0.90	0.126	– 148.4	5.25	84.2	0.083	72.6	0.492	– 23.3
0.95	0.123	– 155.2	4.99	82.7	0.088	72.3	0.489	– 23.5
1.00	0.117	– 158.7	4.76	81.3	0.092	72.4	0.485	– 23.8
1.20	0.118	– 178.2	4.02	76.3	0.109	71.8	0.474	– 24.8
1.40	0.121	161.8	3.49	71.4	0.126	71.2	0.465	– 26.1
1.60	0.124	147.2	3.07	67.1	0.142	70.2	0.466	– 27.6
1.70	0.128	143.2	2.91	65.2	0.151	70.0	0.466	– 28.6
1.75	0.133	140.3	2.84	64.1	0.155	69.7	0.466	– 29.3
1.80	0.134	138.0	2.77	63.0	0.159	69.5	0.466	– 30.0
2.00	0.157	132.9	2.53	59.1	0.177	68.6	0.460	– 33.0
2.50	0.211	119.1	2.10	50.0	0.221	65.0	0.425	– 38.6
3.00	0.243	106.7	1.81	41.5	0.264	61.9	0.429	– 45.6

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} = 8 V, Z_0 = 50 Ω								
0.10	0.839	– 19.4	12.60	162.1	0.018	79.8	0.960	– 9.2
0.20	0.749	– 36.2	11.39	146.0	0.033	71.7	0.891	– 16.5
0.30	0.647	– 50.6	10.02	133.5	0.044	66.3	0.813	– 21.3
0.40	0.553	– 62.2	8.68	123.3	0.054	63.4	0.747	– 24.1
0.50	0.470	– 71.8	7.56	115.1	0.061	61.7	0.696	– 25.7
0.60	0.406	– 80.4	6.67	108.7	0.068	61.0	0.656	– 26.7
0.70	0.357	– 87.6	5.93	103.5	0.075	61.3	0.627	– 27.3
0.80	0.313	– 95.0	5.35	98.5	0.081	61.3	0.604	– 27.9
0.90	0.278	– 103.1	4.86	94.3	0.087	61.9	0.586	– 28.2
0.95	0.260	– 107.3	4.65	92.3	0.091	61.7	0.578	– 28.5
1.00	0.246	– 109.8	4.44	90.5	0.094	62.0	0.570	– 28.7
1.20	0.202	– 125.5	3.80	84.0	0.107	62.6	0.546	– 29.5
1.40	0.161	– 142.2	3.32	77.9	0.120	63.2	0.528	– 30.2
1.60	0.139	– 158.4	2.94	72.7	0.134	63.5	0.523	– 31.2
1.70	0.135	– 166.6	2.79	70.6	0.141	63.9	0.520	– 31.9
1.75	0.134	– 172.3	2.73	69.2	0.144	63.8	0.520	– 32.5
1.80	0.135	– 175.5	2.67	67.9	0.148	64.0	0.519	– 33.0
2.00	0.146	168.9	2.45	63.4	0.164	63.9	0.512	– 35.4
2.50	0.187	138.3	2.03	53.1	0.202	62.4	0.476	– 40.5
3.00	0.220	119.9	1.76	44.1	0.242	61.3	0.480	– 46.5
I_C = 10 mA, V_{CE} = 8 V, Z_0 = 50 Ω								
0.10	0.741	– 26.1	18.86	155.3	0.017	77.5	0.922	– 12.7
0.20	0.606	– 46.3	15.67	135.9	0.030	70.2	0.808	– 20.6
0.30	0.484	– 61.4	12.76	123.0	0.039	66.6	0.711	– 24.1
0.40	0.389	– 72.5	10.50	113.4	0.047	65.9	0.645	– 25.3
0.50	0.316	– 81.4	8.85	106.3	0.054	66.2	0.601	– 25.6
0.60	0.266	– 89.3	7.61	100.9	0.062	66.2	0.570	– 25.7
0.70	0.229	– 95.7	6.66	96.6	0.070	67.4	0.550	– 25.7
0.80	0.197	– 102.9	5.93	92.4	0.077	67.6	0.535	– 25.9
0.90	0.170	– 111.9	5.35	88.9	0.085	68.1	0.523	– 26.1
0.95	0.158	– 116.5	5.09	87.1	0.089	68.1	0.518	– 26.3
1.00	0.147	– 120.0	4.86	85.7	0.093	68.3	0.512	– 26.4
1.20	0.119	– 139.2	4.13	80.1	0.108	68.2	0.496	– 27.2
1.40	0.097	– 160.4	3.58	74.8	0.124	68.1	0.483	– 28.0
1.60	0.086	177.4	3.16	70.3	0.140	67.5	0.481	– 29.1
1.70	0.088	169.8	2.99	68.3	0.148	67.5	0.481	– 30.0
1.75	0.093	164.3	2.93	67.1	0.151	67.3	0.481	– 30.6
1.80	0.092	160.1	2.85	66.0	0.156	67.2	0.480	– 31.3
2.00	0.111	148.1	2.61	62.0	0.173	66.5	0.473	– 33.9
2.50	0.165	125.0	2.17	52.4	0.215	63.6	0.438	– 39.0
3.00	0.195	110.6	1.87	44.0	0.256	61.1	0.442	– 45.4

Common Emitter S Parameters (continued)

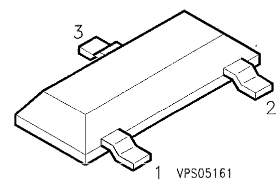
f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_C = 15 mA, V_{CE} = 8 V, Z_0 = 50 Ω								
0.10	0.679	– 30.6	22.35	151.0	0.016	76.3	0.893	– 14.7
0.20	0.524	– 52.4	17.54	130.5	0.028	69.6	0.758	– 22.1
0.30	0.402	– 67.3	13.75	117.8	0.037	67.6	0.660	– 24.5
0.40	0.317	– 78.0	11.07	109.0	0.045	68.0	0.599	– 24.7
0.50	0.252	– 87.6	9.21	102.5	0.052	68.6	0.563	– 24.5
0.60	0.210	– 95.4	7.86	97.6	0.060	69.0	0.538	– 24.3
0.70	0.180	– 101.4	6.84	93.6	0.068	70.0	0.522	– 24.2
0.80	0.152	– 110.0	6.07	89.8	0.076	70.3	0.511	– 24.4
0.90	0.134	– 120.4	5.46	86.6	0.084	70.7	0.501	– 24.6
0.95	0.124	– 126.5	5.19	84.9	0.088	70.4	0.497	– 24.8
1.00	0.113	– 128.9	4.95	83.6	0.093	70.5	0.493	– 25.0
1.20	0.095	– 150.8	4.19	78.4	0.109	70.2	0.479	– 25.8
1.40	0.083	– 178.2	3.64	73.4	0.125	69.7	0.469	– 26.8
1.60	0.082	161.0	3.20	69.0	0.142	68.9	0.469	– 28.1
1.70	0.083	154.8	3.03	67.2	0.150	68.8	0.468	– 29.1
1.75	0.089	150.4	2.96	66.0	0.154	68.5	0.468	– 29.7
1.80	0.089	146.4	2.89	64.9	0.158	68.2	0.468	– 30.4
2.00	0.110	138.9	2.64	61.1	0.176	67.4	0.462	– 33.2
2.50	0.166	120.4	2.20	51.8	0.219	64.0	0.427	– 38.4
3.00	0.199	107.7	1.89	43.5	0.260	61.1	0.430	– 44.9
I_C = 20 mA, V_{CE} = 8 V, Z_0 = 50 Ω								
0.10	0.634	– 34.2	24.40	147.9	0.016	75.1	0.870	– 15.9
0.20	0.470	– 57.4	18.39	126.9	0.026	69.5	0.724	– 22.6
0.30	0.353	– 72.3	14.08	114.6	0.035	68.4	0.629	– 24.0
0.40	0.272	– 83.7	11.19	106.2	0.043	69.2	0.575	– 23.8
0.50	0.215	– 93.0	9.25	100.1	0.051	70.2	0.544	– 23.3
0.60	0.178	– 101.3	7.86	95.5	0.059	70.6	0.523	– 23.0
0.70	0.151	– 109.2	6.83	91.8	0.067	71.7	0.510	– 23.0
0.80	0.131	– 118.5	6.04	88.2	0.076	71.7	0.501	– 23.2
0.90	0.114	– 129.2	5.43	85.1	0.084	72.0	0.493	– 23.5
0.95	0.109	– 136.6	5.16	83.5	0.088	71.7	0.490	– 23.7
1.00	0.101	– 141.0	4.92	82.2	0.092	71.8	0.486	– 23.9
1.20	0.092	– 163.6	4.16	77.2	0.109	71.4	0.474	– 24.9
1.40	0.085	170.5	3.60	72.3	0.126	70.7	0.465	– 26.0
1.60	0.090	151.8	3.17	68.1	0.143	69.6	0.465	– 27.4
1.70	0.090	146.0	3.01	66.3	0.151	69.5	0.465	– 28.5
1.75	0.098	142.3	2.94	65.1	0.155	69.2	0.465	– 29.1
1.80	0.099	140.6	2.86	64.1	0.159	68.9	0.465	– 29.8
2.00	0.122	133.8	2.62	60.2	0.177	68.0	0.459	– 32.7
2.50	0.176	118.7	2.17	51.1	0.220	64.4	0.424	– 38.1
3.00	0.209	106.3	1.87	42.8	0.262	61.4	0.428	– 44.8

SIEMENS

NPN Silicon RF Transistor — BFR 183

Preliminary Data

- For low-noise, high-gain broadband amplifiers at collector currents from 2 mA to 28 mA.
- f_T = 8 GHz
  F = 1.2 dB at 900 MHz



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

Type	Marking	Ordering Code (tape and reel)	Pin Configuration 1	2	3	Package[1)]
BFR 183	RHs	Q62702-F1316	B	E	C	SOT-23

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CE0}	12	V
Collector-emitter voltage, V_{BE} = 0	V_{CES}	20	
Collector-base voltage	V_{CB0}	20	
Emitter-base voltage	V_{EB0}	2	
Collector current	I_C	65	mA
Peak collector current, $f \geq$ 10 MHz	I_{CM}	100	
Base current	I_B	5	
Peak base current, $f \geq$ 10 MHz	I_{BM}	8	
Total power dissipation, $T_S \leq$ 60 °C[3)]	P_{tot}	450	mW
Junction temperature	T_j	150	°C
Ambient temperature range	T_A	– 65 ... + 150	
Storage temperature range	T_{stg}	– 65 ... + 150	

Thermal Resistance

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

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

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

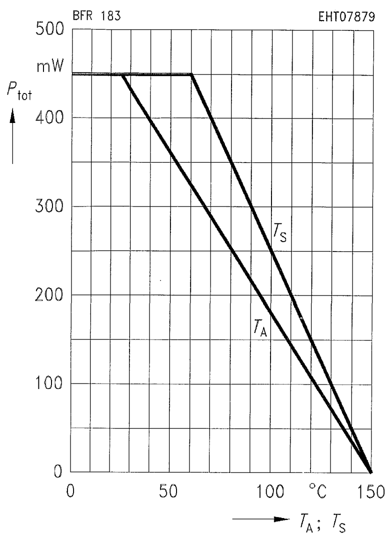
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CE0}$	12	–	–	V
Collector-emitter cutoff current V_{CE} = 20 V, V_{BE} = 0	I_{CES}	–	–	100	µA
Collector-base cutoff current V_{CB} = 10 V, I_E = 0	I_{CB0}	–	–	100	nA
Emitter-base cutoff current V_{EB} = 1 V, I_C = 0	I_{EB0}	–	–	1	µA
DC current gain I_C = 5 mA, V_{CE} = 6 V I_C = 20 mA, V_{CE} = 8 V	h_{FE}	 50 50	 90 110	 250 –	–
Collector-emitter saturation voltage I_C = 30 mA, I_B = 3 mA	V_{CEsat}	–	0.1	0.4	V

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

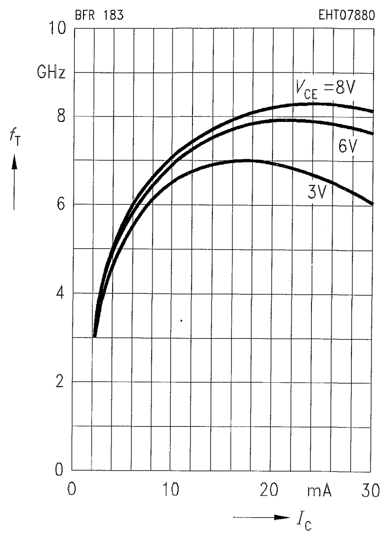
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
AC Characteristics					
Transition frequency I_C = 15 mA, V_{CE} = 8 V, f = 500 MHz I_C = 30 mA, V_{CE} = 8 V, f = 500 MHz	f_T	 – –	 7.8 8	 – –	GHz
Collector-base capacitance V_{CB} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{cb}	–	0.38	–	pF
Collector-emitter capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{ce}	–	0.21	–	
Input capacitance V_{EB} = 0.5 V, I_C = i_c = 0, f = 1 MHz	C_{ibo}	–	1	–	
Output capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{obs}	–	0.6	–	
Noise figure I_C = 5 mA, V_{CE} = 6 V, f = 10 MHz, Z_S = 75 Ω I_C = 5 mA, V_{CE} = 6 V, f = 900 MHz, Z_S = Z_{Sopt} I_C = 5 mA, V_{CE} = 6 V, f = 1.75 GHz, Z_S = Z_{Sopt}	F	 – – –	 0.9 1.2 1.75	 – – –	dB
Power gain I_C = 30 mA, V_{CE} = 8 V, f = 900 MHz, Z_0 = 50 Ω I_C = 30 mA, V_{CE} = 8 V, f = 1.75 GHz, Z_0 = 50 Ω	G_{ma} 1)	 – –	 18.5 11.5	 – –	
Transducer gain I_C = 30 mA, V_{CE} = 8 V, f = 900 MHz, Z_0 = 50 Ω	$\vert S_{21e} \vert^2$	–	15	–	
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}	–	200	–	mV
Third order intercept point I_C = 25 mA, V_{CE} = 8 V, f = 800 MHz	IP_3	–	29	–	dBm

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

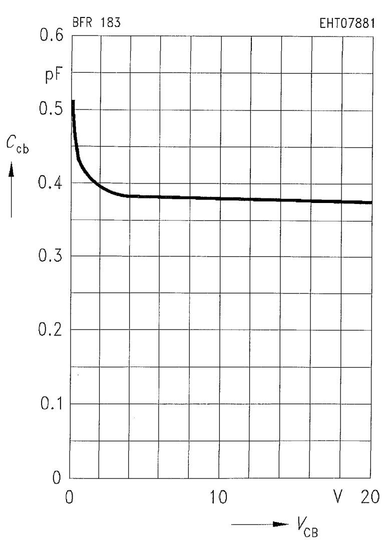
Total power dissipation $P_{tot} = f(T_A^*; T_S)$
*Package mounted on alumina



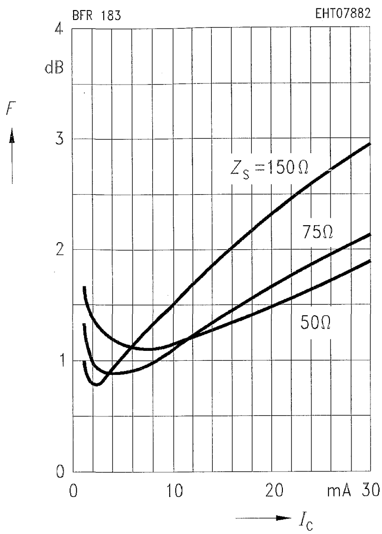
Transition frequency $f_T = f(I_C)$
f = 500 MHz



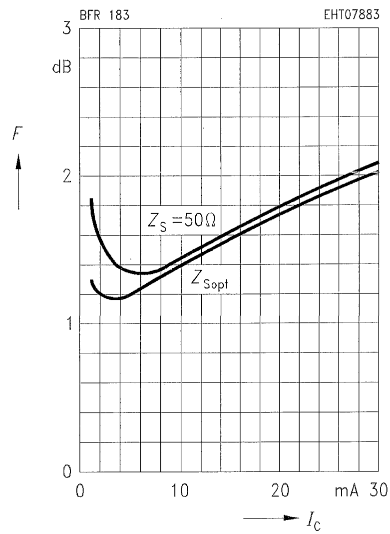
Collector-base capacitance $C_{cb} = f(V_{CB})$
$V_{BE} = v_{be} = 0$, f = 1 MHz



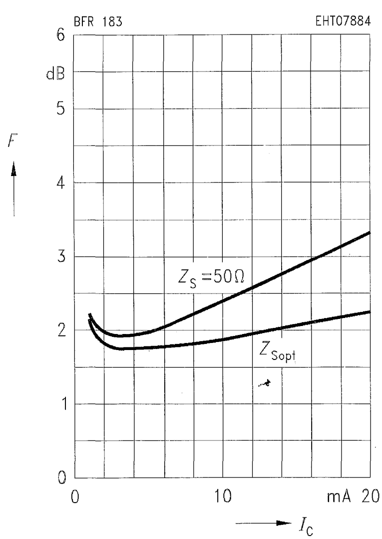
Noise figure $F = f(I_C)$
V_{CE} = 6 V, f = 10 MHz



Noise figure $F = f(I_C)$
V_{CE} = 6 V, f = 900 MHz, Z_{Lopt} (G)



Noise figure $F = f(I_C)$
V_{CE} = 6 V, f = 1.75 GHz, Z_{Lopt} (G)



Common Emitter S Parameters

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_C = 2 mA, V_{CE} = 2.5 V, Z_0 = 50 Ω								
0.10	0.900	– 18.9	6.75	165.4	0.027	79.6	0.979	– 8.0
0.20	0.850	– 36.7	6.36	151.8	0.050	70.0	0.932	– 15.0
0.30	0.784	– 52.9	5.82	139.8	0.069	62.2	0.874	– 20.7
0.40	0.716	– 67.6	5.26	129.3	0.082	56.1	0.814	– 25.0
0.50	0.657	– 80.1	4.72	120.9	0.093	51.6	0.761	– 28.2
0.60	0.607	– 91.8	4.27	113.4	0.100	48.4	0.716	– 30.6
0.70	0.564	– 102.1	3.88	107.0	0.106	46.1	0.680	– 32.3
0.80	0.533	– 111.9	3.54	101.2	0.110	44.6	0.649	– 33.6
0.90	0.505	– 120.7	3.25	96.1	0.114	43.6	0.624	– 34.8
0.95	0.494	– 125.3	3.12	93.5	0.115	43.4	0.612	– 35.2
1.00	0.483	– 129.3	3.00	91.2	0.117	43.3	0.602	– 35.6
1.20	0.449	– 145.1	2.59	83.0	0.122	43.8	0.570	– 37.3
1.40	0.427	– 159.0	2.28	75.8	0.127	45.5	0.550	– 39.2
1.60	0.413	– 170.7	2.05	69.5	0.134	48.0	0.539	– 41.4
1.70	0.415	– 176.2	1.96	66.7	0.138	49.3	0.535	– 42.5
1.75	0.414	– 179.2	1.91	65.0	0.141	49.9	0.532	– 43.1
1.80	0.409	178.7	1.86	63.6	0.143	50.6	0.530	– 43.7
2.00	0.420	168.8	1.71	58.2	0.152	53.1	0.519	– 46.2
2.50	0.457	148.2	1.43	46.6	0.186	58.7	0.496	– 54.5
3.00	0.472	131.0	1.24	36.5	0.232	61.0	0.491	– 62.8
I_C = 5 mA, V_{CE} = 2.5 V, Z_0 = 50 Ω								
0.10	0.774	– 30.4	14.30	156.6	0.024	75.2	0.935	– 14.3
0.20	0.666	– 55.9	12.13	137.9	0.042	64.6	0.817	– 24.1
0.30	0.565	– 76.3	10.02	124.3	0.054	58.9	0.709	– 29.7
0.40	0.488	– 93.0	8.35	114.3	0.063	56.3	0.629	– 32.4
0.50	0.434	– 106.2	7.07	106.9	0.070	55.4	0.572	– 33.8
0.60	0.396	– 118.0	6.12	100.9	0.077	55.5	0.531	– 34.5
0.70	0.368	– 128.2	5.38	95.8	0.083	56.1	0.503	– 34.9
0.80	0.351	– 137.4	4.80	91.3	0.090	56.8	0.481	– 35.2
0.90	0.339	– 145.4	4.33	87.4	0.096	57.4	0.464	– 35.5
0.95	0.333	– 149.9	4.13	85.5	0.099	57.9	0.456	– 35.5
1.00	0.329	– 153.6	3.94	83.7	0.103	58.2	0.449	– 35.6
1.20	0.319	– 167.7	3.35	77.4	0.117	59.6	0.429	– 36.3
1.40	0.312	179.8	2.91	71.6	0.131	60.8	0.417	– 37.8
1.60	0.308	170.0	2.59	66.5	0.147	61.6	0.412	– 39.8
1.70	0.314	165.6	2.46	64.2	0.155	61.7	0.410	– 40.8
1.75	0.314	163.3	2.40	62.8	0.160	61.7	0.408	– 41.4
1.80	0.313	161.6	2.34	61.6	0.163	61.8	0.406	– 42.0
2.00	0.327	154.0	2.14	57.1	0.180	61.6	0.398	– 44.5
2.50	0.373	138.1	1.78	46.9	0.224	60.8	0.374	– 52.4
3.00	0.390	124.2	1.54	37.6	0.271	58.6	0.368	– 60.3

Common Emitter S Parameters (continued)

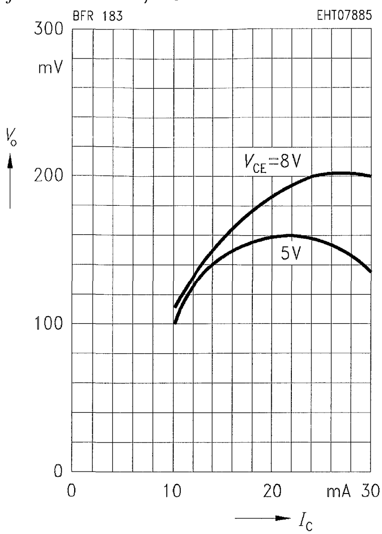
f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_C = 2 mA, V_{CE} = 5 V, Z_0 = 50 Ω								
0.10	0.905	– 18.2	6.73	165.9	0.025	80.0	0.980	– 7.6
0.20	0.857	– 35.3	6.36	152.6	0.048	70.7	0.937	– 14.3
0.30	0.793	– 51.1	5.85	140.8	0.066	63.0	0.881	– 19.8
0.40	0.725	– 65.2	5.31	130.5	0.079	57.0	0.824	– 24.0
0.50	0.664	– 77.6	4.78	122.0	0.089	52.5	0.773	– 27.1
0.60	0.613	– 89.0	4.33	114.7	0.097	49.3	0.730	– 29.4
0.70	0.570	– 99.3	3.94	108.2	0.103	47.0	0.693	– 31.2
0.80	0.535	– 108.9	3.61	102.4	0.107	45.4	0.663	– 32.5
0.90	0.507	– 117.7	3.32	97.3	0.111	44.5	0.638	– 33.7
0.95	0.492	– 122.3	3.19	94.7	0.112	44.2	0.626	– 34.1
1.00	0.482	– 126.5	3.06	92.4	0.114	44.1	0.616	– 34.5
1.20	0.446	– 142.2	2.65	84.2	0.119	44.5	0.584	– 36.1
1.40	0.420	– 156.4	2.33	77.0	0.124	46.2	0.564	– 38.0
1.60	0.404	– 168.2	2.09	70.7	0.131	48.7	0.553	– 40.1
1.70	0.406	– 174.0	2.00	67.9	0.135	50.0	0.549	– 41.1
1.75	0.405	– 177.0	1.95	66.3	0.137	50.6	0.546	– 41.7
1.80	0.400	– 179.1	1.91	64.9	0.139	51.3	0.543	– 42.3
2.00	0.410	170.7	1.75	59.5	0.149	53.8	0.533	– 44.7
2.50	0.445	149.4	1.46	47.8	0.181	59.5	0.510	– 52.6
3.00	0.458	131.9	1.27	37.8	0.226	62.0	0.505	– 60.6
I_C = 10 mA, V_{CE} = 5 V, Z_0 = 50 Ω								
0.10	0.638	– 41.1	22.21	148.1	0.021	72.7	0.872	– 19.7
0.20	0.498	– 71.0	16.84	127.3	0.034	64.6	0.701	– 29.3
0.30	0.401	– 92.5	12.91	114.5	0.043	62.5	0.585	– 32.6
0.40	0.340	– 109.4	10.30	106.0	0.051	62.9	0.513	– 33.1
0.50	0.302	– 122.8	8.50	99.9	0.059	63.8	0.470	– 33.0
0.60	0.278	– 133.7	7.24	94.9	0.067	64.9	0.442	– 32.7
0.70	0.263	– 143.5	6.30	90.8	0.075	65.7	0.423	– 32.4
0.80	0.253	– 152.0	5.57	87.2	0.084	66.3	0.409	– 32.4
0.90	0.249	– 159.4	5.00	83.9	0.092	66.8	0.398	– 32.4
0.95	0.246	– 163.4	4.76	82.3	0.097	67.0	0.393	– 32.4
1.00	0.246	– 167.0	4.54	80.9	0.101	67.1	0.388	– 32.4
1.20	0.247	179.8	3.83	75.5	0.118	67.3	0.375	– 33.0
1.40	0.247	168.3	3.32	70.5	0.136	67.1	0.367	– 34.5
1.60	0.245	159.7	2.94	66.0	0.154	66.7	0.365	– 36.6
1.70	0.252	155.9	2.79	64.0	0.163	66.3	0.364	– 37.7
1.75	0.253	153.8	2.72	62.8	0.168	66.0	0.361	– 38.3
1.80	0.251	152.3	2.65	61.7	0.173	65.8	0.361	– 39.0
2.00	0.267	145.8	2.42	57.7	0.191	64.7	0.353	– 41.5
2.50	0.315	133.1	2.01	48.3	0.237	62.0	0.328	– 49.1
3.00	0.332	120.5	1.74	39.5	0.283	58.3	0.321	– 56.7

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} = 5 V, Z_0 = 50 Ω								
0.10	0.462	– 57.6	29.58	138.0	0.018	70.5	0.776	– 25.5
0.20	0.341	– 92.8	19.80	117.2	0.028	67.4	0.577	– 32.4
0.30	0.280	– 115.8	14.33	106.3	0.037	68.4	0.477	– 32.6
0.40	0.250	– 132.9	11.13	99.3	0.046	69.8	0.425	– 31.3
0.50	0.234	– 144.8	9.06	94.4	0.056	71.0	0.397	– 30.4
0.60	0.226	– 154.7	7.65	90.3	0.065	71.8	0.379	– 29.7
0.70	0.221	– 163.2	6.62	86.9	0.074	72.2	0.368	– 29.3
0.80	0.220	– 170.0	5.83	83.7	0.084	72.2	0.359	– 29.4
0.90	0.221	– 175.7	5.22	81.0	0.093	72.1	0.352	– 29.6
0.95	0.222	– 179.1	4.96	79.5	0.098	72.0	0.349	– 29.6
1.00	0.223	178.1	4.72	78.2	0.103	71.9	0.345	– 29.7
1.20	0.232	167.2	3.98	73.4	0.122	71.2	0.336	– 30.5
1.40	0.235	157.4	3.45	68.9	0.141	70.3	0.331	– 32.2
1.60	0.236	150.1	3.05	64.7	0.161	69.2	0.330	– 34.7
1.70	0.243	147.2	2.89	62.8	0.170	68.4	0.330	– 36.1
1.75	0.244	145.5	2.82	61.6	0.176	68.1	0.328	– 36.7
1.80	0.242	144.2	2.74	60.6	0.180	67.7	0.328	– 37.5
2.00	0.259	139.5	2.50	56.8	0.199	66.1	0.320	– 40.3
2.50	0.307	128.5	2.08	47.9	0.247	62.3	0.294	– 48.2
3.00	0.324	117.5	1.79	39.4	0.294	57.9	0.288	– 56.2
I_C = 30 mA, V_{CE} = 8 V, Z_0 = 50 Ω								
0.10	0.427	– 62.7	32.49	134.2	0.017	70.3	0.730	– 27.0
0.20	0.306	– 98.2	20.84	114.0	0.027	68.9	0.535	– 32.1
0.30	0.252	– 121.0	14.85	103.9	0.036	70.5	0.447	– 31.2
0.40	0.227	– 137.6	11.46	97.5	0.045	72.1	0.403	– 29.4
0.50	0.213	– 149.0	9.30	92.9	0.055	73.0	0.379	– 28.4
0.60	0.206	– 158.8	7.83	89.1	0.065	73.6	0.365	– 27.7
0.70	0.203	– 166.5	6.77	85.8	0.074	73.7	0.356	– 27.4
0.80	0.204	– 173.0	5.96	82.9	0.084	73.6	0.349	– 27.6
0.90	0.204	– 178.8	5.33	80.2	0.094	73.4	0.343	– 27.9
0.95	0.206	178.0	5.06	78.9	0.098	73.2	0.341	– 28.0
1.00	0.207	175.5	4.82	77.7	0.103	73.1	0.338	– 28.0
1.20	0.216	165.1	4.06	73.1	0.123	72.0	0.330	– 29.0
1.40	0.222	155.0	3.52	68.6	0.142	70.9	0.325	– 30.8
1.60	0.222	147.9	3.11	64.6	0.162	69.6	0.325	– 33.4
1.70	0.229	145.4	2.95	62.8	0.172	68.9	0.325	– 34.8
1.75	0.229	143.9	2.87	61.6	0.177	68.5	0.323	– 35.5
1.80	0.228	142.4	2.79	60.6	0.181	68.1	0.322	– 36.2
2.00	0.245	138.0	2.55	56.9	0.201	66.4	0.314	– 39.1
2.50	0.294	127.8	2.11	48.1	0.248	62.4	0.288	– 47.0
3.00	0.312	116.5	1.83	39.7	0.295	57.9	0.282	– 54.9

Common Emitter Large Signal Parameters

Linear output voltage $V_O = f\ (I_C)$
d_{IM} = 60 dB, f_1 = 806 MHz,
f_2 = 810 MHz, $Z_S = Z_L$ = 50 Ω



Note:

The transistor is driven by 2 adjacent signals f_1, f_2 with equal output power levels P_o for each carrier.
The distance d_{IM} between P_o and the third order intermodulation products P_{IM} ($2f_1 - f_2$ or $2f_2 - f_1$) is:

$d_{IM} = P_o - P_{IM}$
where P_o = 10 log (V_o^2/ (50 Ω · 1 mW)) (dBm)
and V_o = linear output voltage of each carrier.

The 3rd order intercept point IP_3 will be found by extrapolation to the point where P_{IM} would be identical to P_o:

IP_3 (output) = $P_o + d_{IM}/2$.

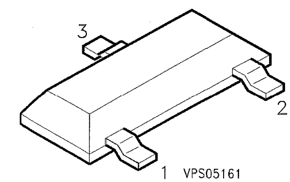
Linear output voltages for other d_{IM} (e.g. 50 dB) can be calculated thereby.

SIEMENS

NPN Silicon RF Transistor — BFR 193

Preliminary Data

- For low-noise, high-gain amplifiers up to 2 GHz.
- For linear broadband amplifiers.
- f_T = 8 GHz
  F = 1.2 dB at 800 MHz



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

Type	Marking	Ordering Code (tape and reel)	Pin Configuration			Package[1]
			1	2	3	
BFR 193	RCs	Q62702-F1218	B	E	C	SOT-23

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CE0}	12	V
Collector-emitter voltage, $V_{BE} = 0$	V_{CES}	20	
Collector-base voltage	V_{CB0}	20	
Emitter-base voltage	V_{EB0}	2	
Collector current	I_C	80	mA
Peak collector current, $f \geq 10$ MHz	I_{CM}	80	
Base current	I_B	10	
Peak base current, $f \geq 10$ MHz	I_{BM}	80	
Total power dissipation, $T_S \leq 69$ ˚C[3]	P_{tot}	580	mW
Junction temperature	T_j	150	˚C
Ambient temperature range	T_A	– 65 … + 150	
Storage temperature range	T_{stg}	– 65 … + 150	

Thermal Resistance

Junction - ambient[2]	$R_{th\,JA}$	≤ 220	K/W
Junction - soldering point[3]	$R_{th\,JS}$	≤ 140	

1) For detailed information 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.

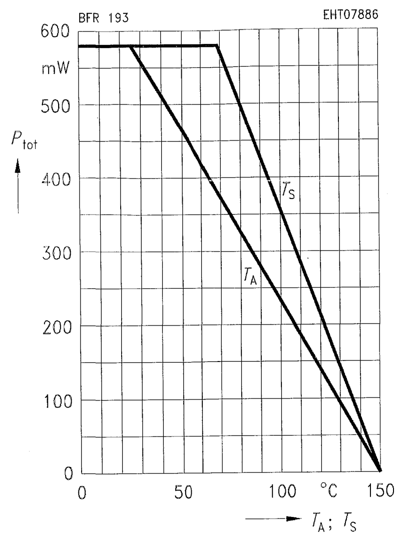
Electrical Characteristics
at $T_A = 25\ ^\circ C$, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-emitter breakdown voltage $I_C = 1$ mA, $I_B = 0$	$V_{(BR)CEO}$	12	–	–	V
Collector-emitter cutoff current $V_{CE} = 20$ V, $V_{BE} = 0$	I_{CES}	–	–	100	µA
Collector-base cutoff current $V_{CB} = 10$ V, $I_E = 0$	I_{CB0}	–	–	50	nA
Emitter-base cutoff current $V_{EB} = 1$ V, $I_C = 0$	I_{EB0}	–	–	1	µA
DC current gain $I_C = 5$ mA, $V_{CE} = 8$ V $I_C = 30$ mA, $V_{CE} = 8$ V	h_{FE}	 – 50	 90 100	 – 250	–
Collector-emitter saturation voltage $I_C = 50$ mA, $I_B = 5$ mA	V_{CEsat}	–	–	0.4	V

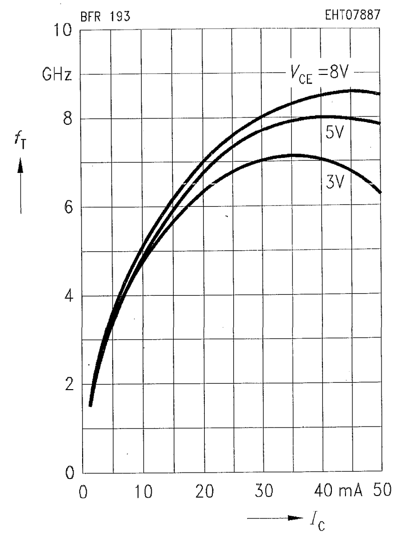
Electrical Characteristics
at T_A = 25 ˚C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
AC Characteristics					
Transition frequency	f_T				GHz
I_C = 5 mA, V_{CE} = 8 V, f = 500 MHz		–	3.5	–	
I_C = 30 mA, V_{CE} = 8 V, f = 500 MHz		–	8	–	
Collector-base capacitance V_{CB} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{cb}	–	0.66	–	pF
Collector-emitter capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{ce}	–	0.24	–	
Input capacitance V_{EB} = 0.5 V, I_C = i_c = 0, f = 1 MHz	C_{ibo}	–	2.2	–	
Output capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{obs}	–	0.9	–	
Noise figure	F				dB
I_C = 5 mA, V_{CE} = 8 V, f = 10 MHz, Z_S = 75 Ω		–	0.8	–	
I_C = 30 mA, V_{CE} = 8 V, f = 800 MHz, Z_S = Z_{Sopt}		–	1.7	–	
I_C = 30 mA, V_{CE} = 8 V, f = 1 GHz, Z_S = 50 Ω		–	2	–	
Power gain I_C = 30 mA, V_{CE} = 8 V, f = 800 MHz, Z_S = 50 Ω, Z_L = Z_{Lopt}	G_{pe}	–	13.5	–	
Transducer gain I_C = 30 mA, V_{CE} = 8 V, f = 1 GHz, Z_0 = 50 Ω	$\|S_{21e}\|^2$	–	11.5	–	
Linear output voltage two-tone intermodulation test I_C = 50 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}	–	385	–	mV
Third order intercept point I_C = 50 mA, V_{CE} = 8 V, f = 800 MHz	IP_3	–	34.5	–	dBm

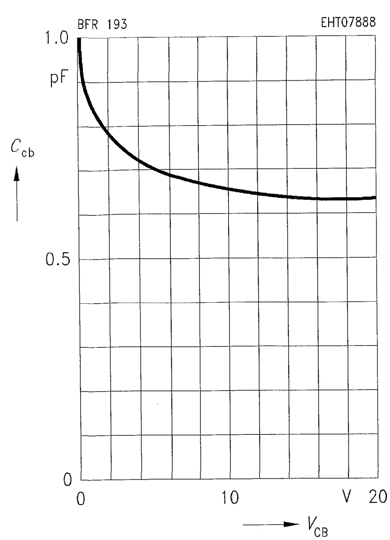
Total power dissipation $P_{tot} = f(T_A^*; T_S)$
*Package mounted on alumina



Transition frequency $f_T = f(I_C)$
f = 500 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

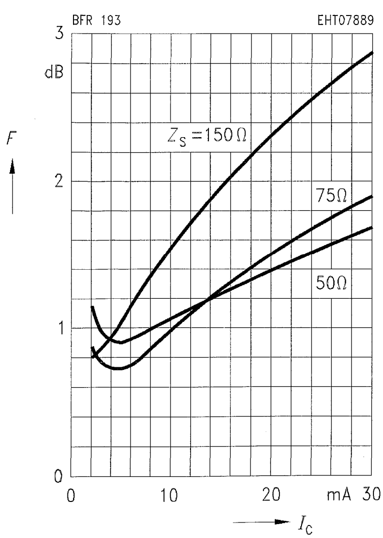
I_C = 10 mA, V_{CE} = 8 V, Z_0 = 50 Ω

0.01	1	–	(Z_S = 75 Ω)		–	–	1.05	–
0.8	1.25	13.5	–	–	–	–	1.35	12.4
2.0	2.4	7	–	–	–	–	–	–

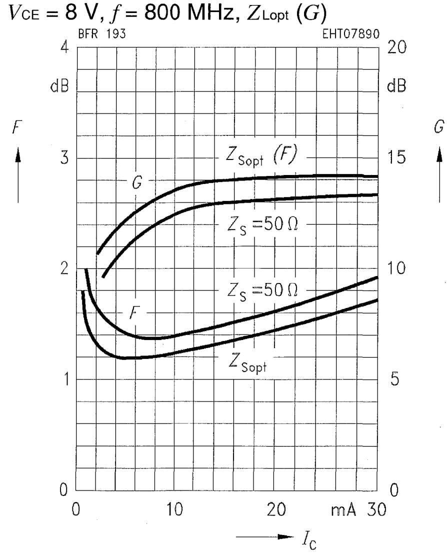
I_C = 30 mA, V_{CE} = 8 V, Z_0 = 50 Ω

0.01	1.65	–	(Z_S = 50 Ω)		–	–	1.65	–
0.8	1.7	14.2	–	–	–	–	1.95	13.3
2.0	2.7	7.5	–	–	–	–	–	–

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

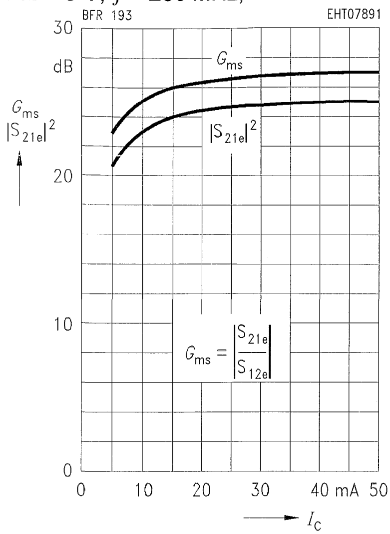


Noise figure $F = f(I_C)$
Power gain $G = f(I_C)$
V_{CE} = 8 V, f = 800 MHz, Z_{Lopt} (G)

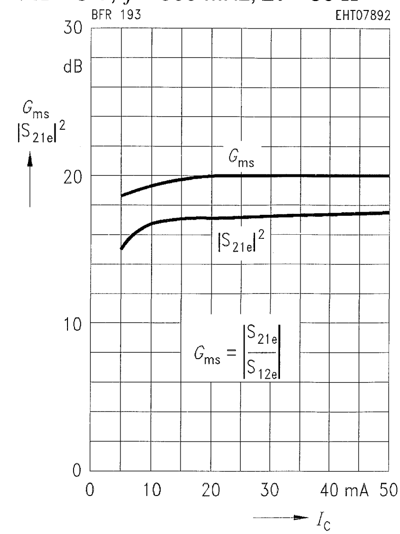


Common Emitter Power Gain

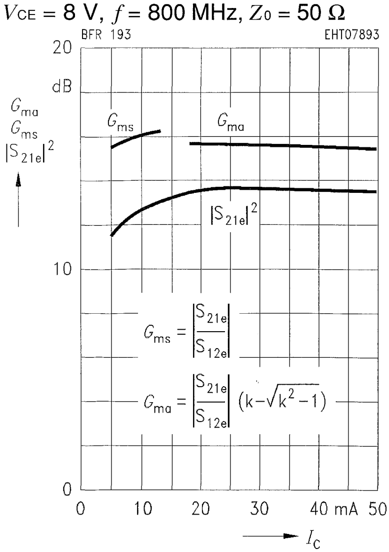
Power gain G_{ms}, $|S_{21e}|^2 = f(I_C)$
V_{CE} = 8 V, f = 200 MHz, Z_0 = 50 Ω



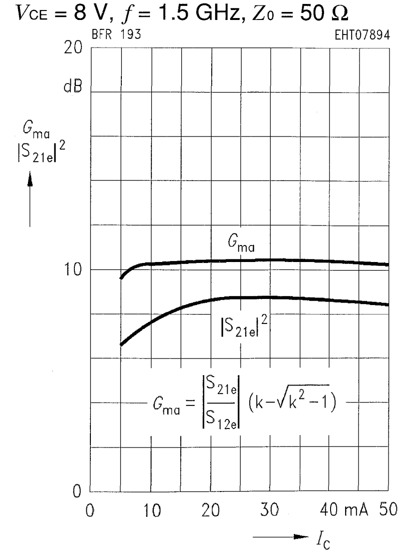
Power gain G_{ms}, $|S_{21e}|^2 = f(I_C)$
V_{CE} = 8 V, f = 500 MHz, Z_0 = 50 Ω



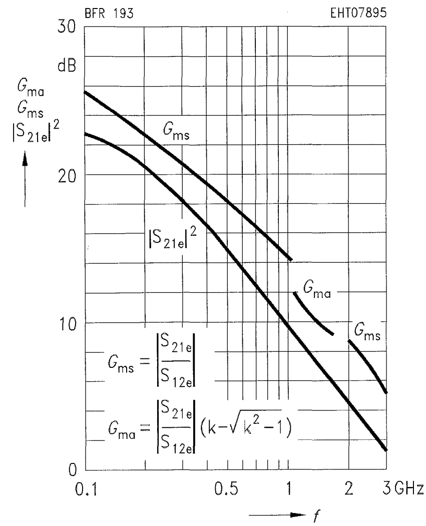
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(I_C)$
V_{CE} = 8 V, f = 800 MHz, Z_0 = 50 Ω



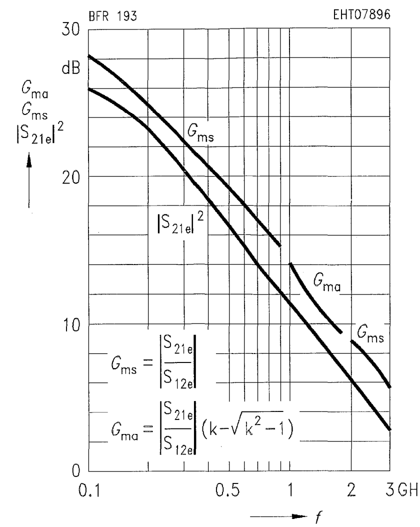
Power gain G_{ma}, $|S_{21e}|^2 = f(I_C)$
V_{CE} = 8 V, f = 1.5 GHz, Z_0 = 50 Ω



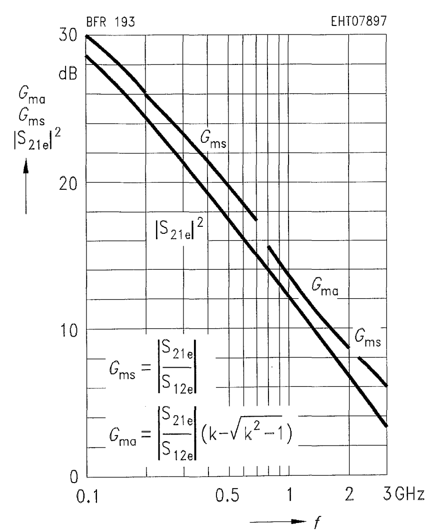
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
I_C = 5 mA, V_{CE} = 8 V, Z_0 = 50 Ω



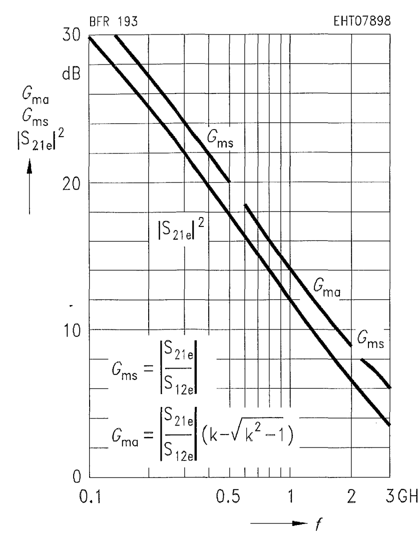
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
I_C = 10 mA, V_{CE} = 8 V, Z_0 = 50 Ω



Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
I_C = 20 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



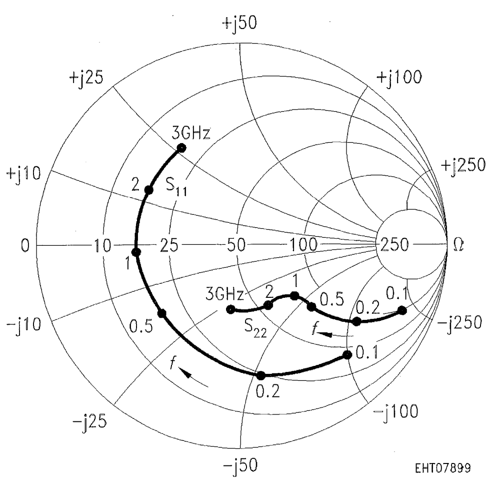
Common Emitter S Parameters

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**
I_C = 10 mA, V_{CE} = 3 V, Z_0 = 50 Ω								
0.10	0.594	– 64.8	20.60	137.8	0.031	64.3	0.770	– 31.2
0.15	0.530	– 87.0	16.80	125.1	0.039	59.3	0.643	– 38.6
0.20	0.484	– 103.6	13.87	116.4	0.046	57.5	0.547	– 42.7
0.25	0.451	– 116.9	11.67	109.8	0.051	57.1	0.478	– 44.9
0.30	0.431	– 127.0	10.04	104.9	0.056	57.5	0.428	– 45.8
0.40	0.409	– 142.4	7.80	97.5	0.066	59.4	0.363	– 46.2
0.50	0.397	– 153.2	6.38	91.9	0.077	61.2	0.326	– 46.3
0.60	0.388	– 161.6	5.38	87.3	0.087	62.7	0.302	– 46.3
0.70	0.386	– 168.7	4.66	83.4	0.098	63.8	0.285	– 46.7
0.80	0.388	– 174.1	4.13	79.7	0.109	64.5	0.275	– 47.2
0.90	0.390	– 179.3	3.70	76.4	0.120	65.1	0.264	– 48.0
1.00	0.392	176.2	3.35	73.3	0.132	65.4	0.256	– 48.8
1.20	0.400	167.6	2.83	67.9	0.155	65.5	0.241	– 50.9
1.40	0.399	159.6	2.47	62.7	0.179	65.2	0.235	– 53.7
1.50	0.398	156.0	2.33	60.2	0.191	64.8	0.236	– 55.6
1.60	0.401	153.3	2.20	57.7	0.203	64.4	0.236	– 57.8
1.80	0.405	147.6	1.99	52.8	0.228	63.1	0.234	– 62.7
2.00	0.420	143.1	1.82	48.6	0.252	61.6	0.225	– 68.2
2.50	0.461	131.3	1.53	39.0	0.313	57.9	0.206	– 85.0
3.00	0.473	120.0	1.34	30.0	0.376	53.0	0.208	– 100.0
I_C = 30 mA, V_{CE} = 3 V, Z_0 = 50 Ω								
0.10	0.375	– 101.9	29.20	122.8	0.023	65.8	0.564	– 46.0
0.15	0.355	– 124.1	21.58	111.8	0.030	66.1	0.429	– 51.8
0.20	0.346	– 138.3	16.90	105.0	0.036	67.9	0.348	– 54.0
0.25	0.340	– 148.1	13.80	100.3	0.043	69.3	0.297	– 54.8
0.30	0.338	– 155.1	11.65	96.7	0.049	70.5	0.261	– 54.6
0.40	0.338	– 165.5	8.88	91.3	0.063	72.0	0.219	– 53.8
0.50	0.336	– 172.6	7.19	87.2	0.077	72.7	0.196	– 53.3
0.60	0.334	– 178.1	6.03	83.6	0.091	72.8	0.182	– 53.1
0.70	0.336	177.0	5.20	80.4	0.104	72.5	0.172	– 53.7
0.80	0.338	173.5	4.60	77.3	0.118	72.1	0.166	– 54.6
0.90	0.344	169.7	4.11	74.6	0.132	71.5	0.159	– 55.6
1.00	0.347	166.4	3.71	72.0	0.146	70.7	0.153	– 56.9
1.20	0.358	159.7	3.13	67.2	0.173	69.1	0.141	– 59.5
1.40	0.359	152.7	2.73	62.5	0.200	67.2	0.136	– 62.5
1.50	0.359	149.4	2.57	60.2	0.213	66.3	0.138	– 64.8
1.60	0.361	147.5	2.43	58.0	0.227	65.2	0.139	– 67.5
1.80	0.362	142.8	2.20	53.5	0.253	62.9	0.138	– 74.1
2.00	0.380	139.3	2.01	49.5	0.278	60.6	0.131	– 81.9
2.50	0.419	128.7	1.68	40.5	0.340	55.1	0.117	– 105.4
3.00	0.431	118.8	1.47	31.6	0.398	49.3	0.125	– 122.4

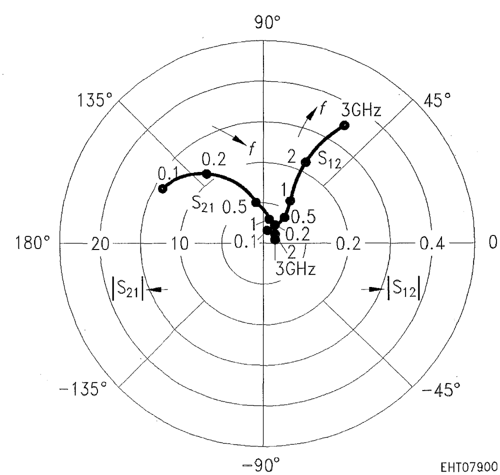
Common Emitter S Parameters (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**
I_C = 5 mA, V_{CE} = 5 V, Z_0 = 50 Ω								
0.10	0.762	– 45.7	13.63	148.8	0.036	68.4	0.885	– 20.5
0.15	0.698	– 64.3	12.06	136.9	0.048	61.1	0.798	– 27.3
0.20	0.643	– 80.1	10.57	127.4	0.056	56.1	0.716	– 32.0
0.25	0.597	– 93.2	9.26	119.9	0.063	53.0	0.649	– 35.1
0.30	0.560	– 104.4	8.18	113.8	0.068	51.1	0.594	– 37.0
0.40	0.515	– 122.1	6.56	104.5	0.076	49.6	0.516	– 39.0
0.50	0.485	– 135.6	5.44	97.5	0.083	50.0	0.468	– 40.0
0.60	0.470	– 146.3	4.65	91.7	0.090	51.3	0.436	– 40.7
0.70	0.460	– 155.3	4.06	86.8	0.097	52.7	0.415	– 41.4
0.80	0.456	– 162.4	3.60	82.5	0.104	54.1	0.399	– 42.0
0.90	0.454	– 169.4	3.24	78.4	0.112	55.6	0.386	– 43.0
1.00	0.454	– 175.5	2.94	74.7	0.120	57.0	0.375	– 43.9
1.20	0.458	174.0	2.50	68.2	0.137	59.4	0.360	– 46.3
1.40	0.461	164.5	2.18	62.4	0.155	61.1	0.351	– 49.4
1.50	0.458	160.4	2.05	59.7	0.166	61.9	0.350	– 51.1
1.60	0.461	156.9	1.95	56.9	0.176	62.3	0.351	– 53.1
1.80	0.466	149.9	1.77	51.8	0.199	62.7	0.349	– 57.4
2.00	0.479	143.8	1.62	46.9	0.221	62.4	0.341	– 62.4
2.50	0.519	129.6	1.35	36.9	0.284	61.0	0.320	– 77.1
3.00	0.539	117.5	1.18	27.5	0.353	57.1	0.324	– 91.7

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



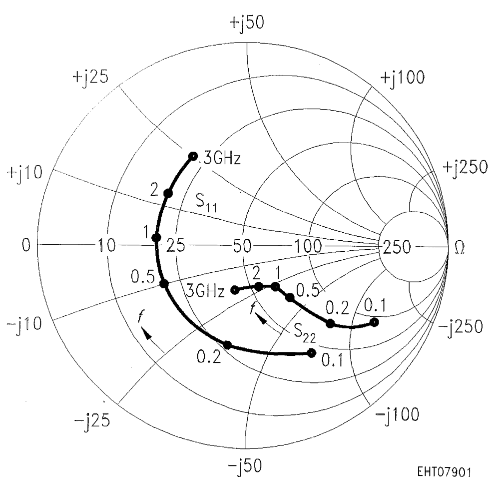
S_{12}, S_{21} = *f* (*f*)
I_C = 5 mA, V_{CE} = 5 V, Z_0 = 50 Ω



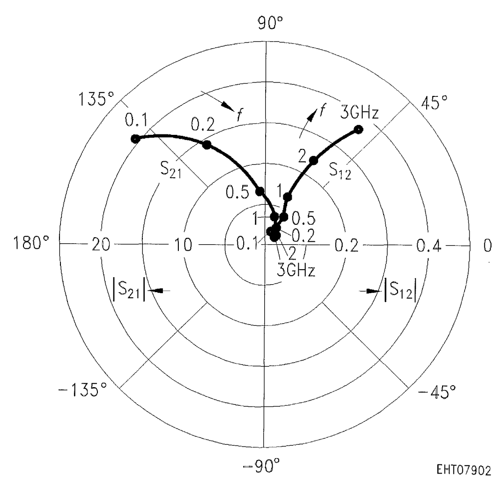
Common Emitter S Parameters (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**
I_C = 10 mA, V_{CE} = 5 V, Z_0 = 50 Ω								
0.10	0.620	– 61.0	20.54	139.2	0.031	65.2	0.787	– 29.7
0.15	0.547	– 82.5	16.91	126.6	0.040	60.0	0.664	– 37.2
0.20	0.497	– 99.3	14.07	117.6	0.046	57.7	0.568	– 41.4
0.25	0.459	– 112.3	11.90	111.0	0.051	57.0	0.498	– 43.6
0.30	0.434	– 122.8	10.25	105.9	0.057	57.3	0.446	– 44.7
0.40	0.407	– 138.9	7.99	98.3	0.066	58.8	0.379	– 45.4
0.50	0.390	– 150.4	6.53	92.6	0.076	60.5	0.339	– 45.4
0.60	0.384	– 159.4	5.52	87.9	0.087	62.0	0.315	– 45.4
0.70	0.379	– 166.9	4.79	83.9	0.098	63.1	0.299	– 45.7
0.80	0.379	– 172.8	4.23	80.2	0.109	63.7	0.286	– 46.1
0.90	0.382	– 178.6	3.79	76.7	0.120	64.4	0.276	– 46.8
1.00	0.385	176.2	3.44	73.5	0.131	64.7	0.267	– 47.4
1.20	0.391	167.2	2.91	67.9	0.154	64.7	0.253	– 49.5
1.40	0.393	158.5	2.53	62.7	0.177	64.4	0.245	– 52.3
1.50	0.392	154.9	2.38	60.2	0.189	64.1	0.246	– 53.9
1.60	0.395	152.0	2.26	57.6	0.201	63.6	0.246	– 55.9
1.80	0.402	145.9	2.05	52.9	0.226	62.3	0.244	– 60.5
2.00	0.415	140.9	1.87	48.4	0.249	60.8	0.236	– 65.8
2.50	0.457	128.0	1.56	38.6	0.310	57.0	0.213	– 81.2
3.00	0.477	117.6	1.37	29.3	0.370	52.1	0.217	– 96.3

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



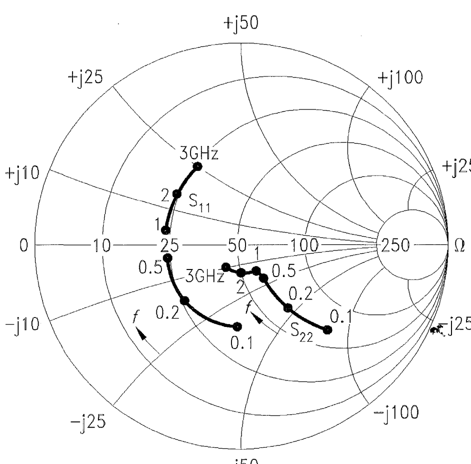
S_{12}, S_{21} = $f\,(f)$
I_C = 10 mA, V_{CE} = 5 V, Z_0 = 50 Ω



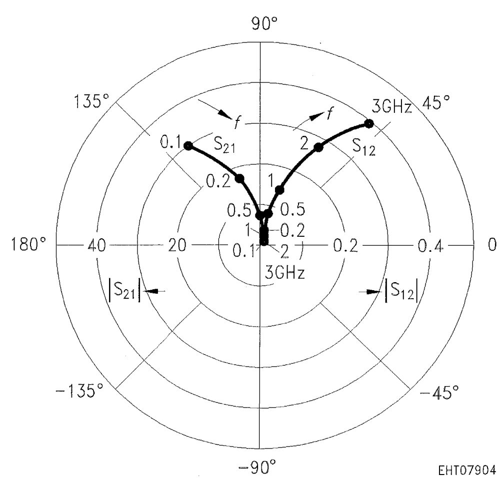
Common Emitter S Parameters (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**
I_C = 30 mA, V_{CE} = 5 V, Z_0 = 50 Ω								
0.10	0.403	– 93.0	29.73	124.4	0.023	65.7	0.588	– 44.1
0.15	0.363	– 115.9	22.16	113.1	0.030	65.3	0.452	– 50.1
0.20	0.346	– 131.4	17.44	106.0	0.036	66.8	0.368	– 52.4
0.25	0.335	– 142.0	14.29	101.2	0.043	68.3	0.314	– 53.1
0.30	0.327	– 150.2	12.07	97.5	0.049	69.5	0.277	– 53.0
0.40	0.324	– 161.7	9.21	92.0	0.063	70.9	0.232	– 52.1
0.50	0.319	– 169.8	7.44	87.7	0.076	71.7	0.208	– 51.4
0.60	0.320	– 176.2	6.25	84.1	0.090	72.0	0.194	– 51.2
0.70	0.321	178.8	5.40	80.8	0.104	71.8	0.184	– 51.6
0.80	0.323	174.5	4.76	77.8	0.117	71.3	0.176	– 52.1
0.90	0.327	170.2	4.25	74.9	0.131	70.7	0.170	– 53.0
1.00	0.332	166.2	3.85	72.2	0.144	70.0	0.163	– 53.9
1.20	0.340	158.8	3.25	67.3	0.171	68.4	0.152	– 56.4
1.40	0.346	151.3	2.83	62.6	0.197	66.5	0.145	– 59.5
1.50	0.344	148.5	2.66	60.4	0.211	65.6	0.147	– 61.2
1.60	0.347	146.0	2.52	58.1	0.224	64.4	0.148	– 63.6
1.80	0.351	141.1	2.28	53.7	0.250	62.1	0.147	– 69.5
2.00	0.367	137.1	2.08	49.4	0.275	59.8	0.140	– 77.0
2.50	0.408	125.9	1.74	40.4	0.335	54.3	0.120	– 98.2
3.00	0.431	116.6	1.52	31.1	0.392	48.5	0.129	– 115.6

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



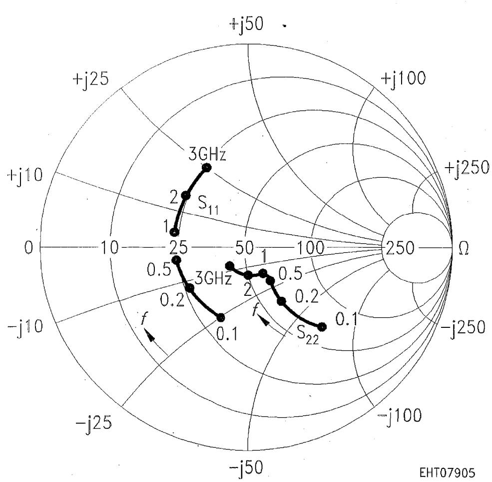
$S_{12}, S_{21} = f(f)$
I_C = 30 mA, V_{CE} = 5 V, Z_0 = 50 Ω



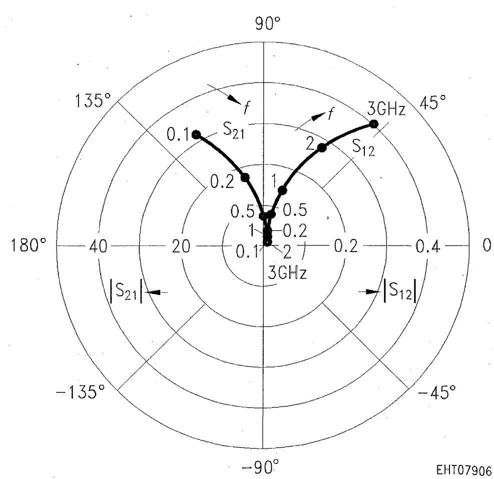
Common Emitter S Parameters (continued)

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								
0.10	0.358	– 106.3	31.26	120.1	0.022	66.9	0.518	– 48.1
0.15	0.337	– 128.1	22.75	109.7	0.028	67.9	0.390	– 53.3
0.20	0.330	– 141.8	17.72	103.3	0.035	69.9	0.314	– 54.9
0.25	0.325	– 151.1	14.43	98.9	0.042	71.4	0.268	– 55.2
0.30	0.322	– 158.2	12.16	95.5	0.049	72.4	0.236	– 54.8
0.40	0.322	– 167.9	9.25	90.5	0.063	73.5	0.198	– 53.8
0.50	0.318	– 174.8	7.46	86.4	0.077	73.7	0.178	– 53.0
0.60	0.321	179.8	6.25	83.0	0.091	73.7	0.166	– 52.9
0.70	0.322	175.0	5.40	79.9	0.106	73.2	0.158	– 53.6
0.80	0.325	171.4	4.76	77.0	0.120	72.4	0.152	– 54.2
0.90	0.330	167.4	4.25	74.2	0.134	71.7	0.146	– 55.4
1.00	0.335	163.9	3.84	71.5	0.148	70.8	0.140	– 56.6
1.20	0.344	156.8	3.24	66.8	0.175	68.9	0.130	– 59.5
1.40	0.348	149.6	2.82	62.1	0.202	66.8	0.124	– 63.0
1.50	0.346	146.7	2.65	59.9	0.216	65.7	0.125	– 64.8
1.60	0.349	144.6	2.51	57.6	0.230	64.4	0.127	– 67.4
1.80	0.355	140.0	2.27	53.3	0.256	62.0	0.128	– 73.9
2.00	0.368	135.9	2.08	49.1	0.281	59.5	0.121	– 82.5
2.50	0.411	125.0	1.73	40.0	0.341	53.8	0.105	– 107.0
3.00	0.432	116.2	1.52	31.0	0.398	47.7	0.117	– 124.8

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



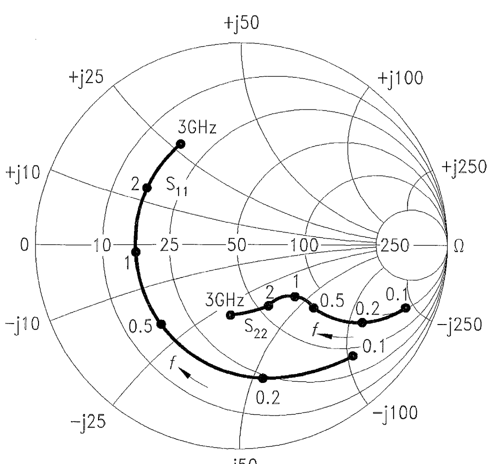
$S_{12}, S_{21} = f(f)$
I_C = 50 mA, V_{CE} = 5 V, Z_0 = 50 Ω



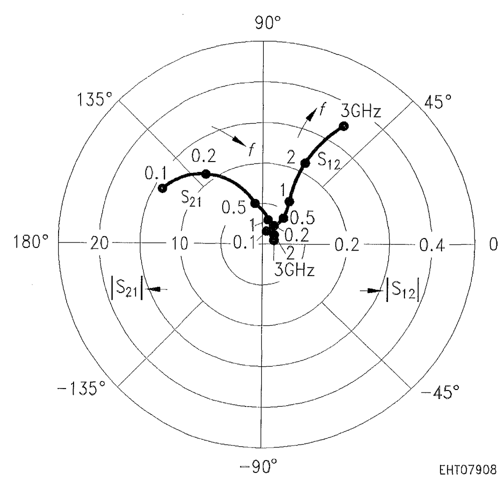
Common Emitter S Parameters (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**
I_C = 5 mA, V_{CE} = 8 V, Z_0 = 50 Ω								
0.10	0.774	– 44.4	13.63	149.3	0.035	68.7	0.889	– 20.0
0.15	0.709	– 62.6	12.11	137.5	0.047	61.5	0.804	– 26.7
0.20	0.652	– 78.1	10.64	128.1	0.056	56.6	0.724	– 31.3
0.25	0.602	– 91.0	9.35	120.6	0.062	53.3	0.657	– 34.4
0.30	0.565	– 102.0	8.26	114.5	0.067	51.3	0.602	– 36.3
0.40	0.515	– 119.9	6.65	105.1	0.075	49.9	0.525	– 38.4
0.50	0.482	– 133.3	5.52	98.0	0.082	50.1	0.476	– 39.4
0.60	0.465	– 144.3	4.72	92.3	0.089	51.3	0.444	– 40.0
0.70	0.454	– 153.5	4.12	87.4	0.096	52.8	0.422	– 40.7
0.80	0.448	– 160.9	3.66	83.0	0.103	54.1	0.407	– 41.3
0.90	0.447	– 167.9	3.29	78.9	0.111	55.6	0.394	– 42.2
1.00	0.447	– 174.3	2.99	75.2	0.119	57.0	0.382	– 43.0
1.20	0.449	175.0	2.54	68.7	0.135	59.3	0.367	– 45.3
1.40	0.450	165.4	2.22	62.9	0.154	61.0	0.358	– 48.3
1.50	0.448	161.3	2.08	60.2	0.164	61.9	0.357	– 50.0
1.60	0.453	157.5	1.98	57.4	0.174	62.3	0.357	– 51.8
1.80	0.458	150.5	1.80	52.3	0.196	62.8	0.356	– 56.1
2.00	0.468	144.4	1.64	47.4	0.219	62.5	0.347	– 60.9
2.50	0.512	130.1	1.37	37.3	0.281	61.2	0.326	– 75.2
3.00	0.529	117.9	1.20	28.0	0.348	57.5	0.329	– 89.5

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



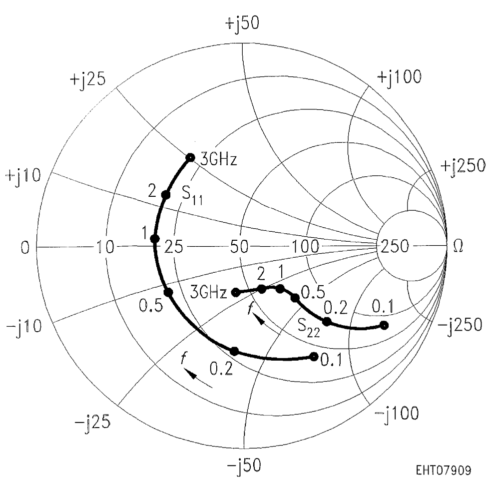
$S_{12}, S_{21} = f(f)$
I_C = 5 mA, V_{CE} = 8 V, Z_0 = 50 Ω



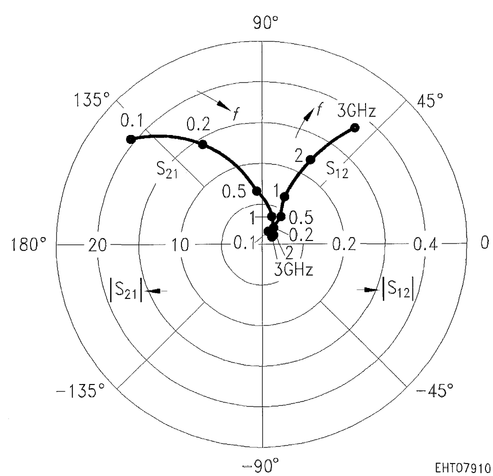
Common Emitter S Parameters (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_C = 10 mA, V_{CE} = 8 V, Z_0 = 50 Ω								
0.10	0.642	– 58.2	20.47	140.2	0.031	65.6	0.796	– 28.8
0.15	0.564	– 79.1	16.98	127.6	0.040	60.3	0.676	– 36.2
0.20	0.507	– 95.6	14.19	118.5	0.046	57.9	0.580	– 40.4
0.25	0.466	– 108.4	12.03	111.9	0.052	57.1	0.510	– 42.7
0.30	0.437	– 119.1	10.39	106.7	0.057	57.3	0.457	– 43.8
0.40	0.405	– 135.6	8.11	99.0	0.066	58.5	0.389	– 44.5
0.50	0.384	– 147.3	6.63	93.2	0.076	60.1	0.349	– 44.6
0.60	0.375	– 156.9	5.61	88.5	0.087	61.7	0.324	– 44.5
0.70	0.371	– 164.5	4.87	84.4	0.097	62.8	0.307	– 44.8
0.80	0.369	– 170.7	4.30	80.7	0.108	63.5	0.295	– 45.2
0.90	0.371	– 176.8	3.86	77.3	0.119	64.0	0.284	– 45.8
1.00	0.372	177.7	3.50	74.0	0.130	64.4	0.275	– 46.5
1.20	0.378	168.5	2.96	68.4	0.152	64.6	0.261	– 48.4
1.40	0.383	159.6	2.58	63.2	0.175	64.2	0.252	– 51.0
1.50	0.381	156.1	2.42	60.7	0.187	63.9	0.252	– 52.6
1.60	0.385	152.9	2.30	58.2	0.199	63.4	0.253	– 54.4
1.80	0.390	146.8	2.08	53.5	0.223	62.3	0.251	– 58.9
2.00	0.404	141.7	1.90	48.9	0.246	60.8	0.242	– 64.0
2.50	0.446	128.8	1.59	31.1	0.306	57.1	0.218	– 78.8
3.00	0.466	117.9	1.39	29.8	0.366	52.4	0.220	– 93.4

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



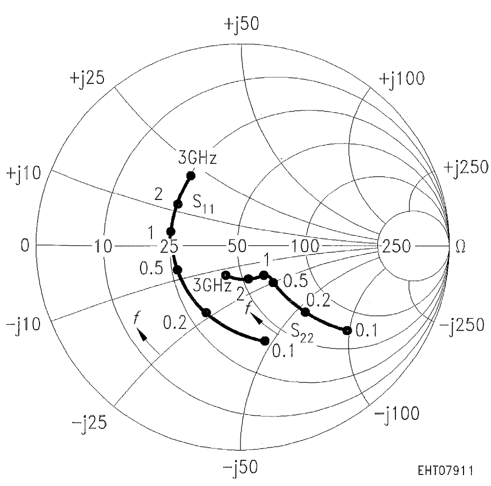
S_{12}, $S_{21} = f\,(f)$
I_C = 10 mA, V_{CE} = 8 V, Z_0 = 50 Ω



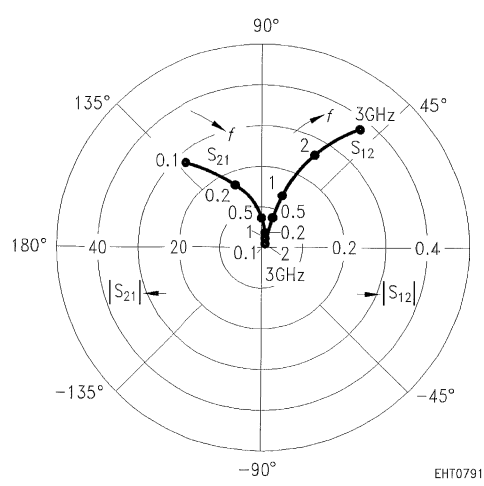
Common Emitter S Parameters (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_C = 20 mA, V_{CE} = 8 V, Z_0 = 50 Ω								
0.10	0.491	– 75.9	27.10	130.2	0.026	64.7	0.669	– 38.2
0.15	0.426	– 98.2	20.95	118.2	0.033	62.5	0.531	– 44.9
0.20	0.386	– 114.3	16.78	110.4	0.039	63.0	0.440	– 47.8
0.25	0.358	– 126.7	13.87	104.8	0.045	64.0	0.379	– 49.1
0.30	0.343	– 136.0	11.79	100.7	0.051	65.2	0.336	– 49.3
0.40	0.329	– 149.9	9.06	94.4	0.063	67.3	0.284	– 48.6
0.50	0.321	– 159.5	7.35	89.8	0.075	68.5	0.255	– 48.1
0.60	0.314	– 167.1	6.18	85.9	0.088	69.3	0.237	– 47.7
0.70	0.314	– 173.5	5.34	82.5	0.100	69.6	0.224	– 47.9
0.80	0.316	– 178.2	4.72	79.3	0.113	69.5	0.215	– 48.5
0.90	0.320	176.9	4.22	76.4	0.126	69.3	0.206	– 49.1
1.00	0.322	173.0	3.82	73.6	0.139	69.0	0.199	– 49.9
1.20	0.330	165.1	3.22	68.7	0.164	67.9	0.186	– 51.6
1.40	0.330	157.0	2.81	64.0	0.189	66.5	0.180	– 53.9
1.50	0.330	153.6	2.64	61.7	0.202	65.8	0.181	– 55.9
1.60	0.333	151.2	2.50	59.4	0.215	65.0	0.181	– 58.2
1.80	0.336	146.0	2.26	55.0	0.241	63.0	0.179	– 63.5
2.00	0.353	142.4	2.06	50.9	0.265	61.0	0.170	– 69.4
2.50	0.394	130.9	1.73	41.6	0.324	56.2	0.147	– 87.5
3.00	0.408	120.7	1.51	32.9	0.382	50.8	0.149	– 102.8

$S_{11}, S_{22} = f(f)$
I_C = 20 mA, V_{CE} = 8 V, Z_0 = 50 Ω



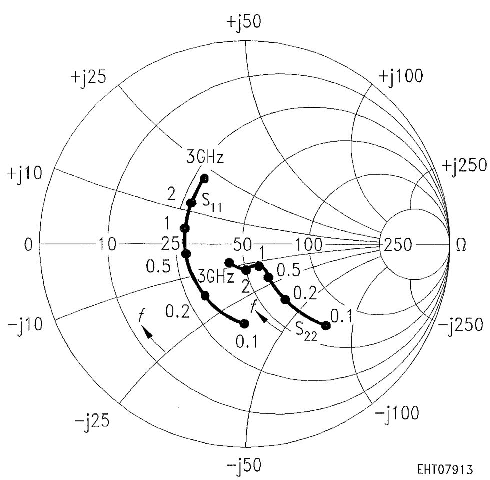
$S_{12}, S_{21} = f(f)$
I_C = 20 mA, V_{CE} = 8 V, Z_0 = 50 Ω



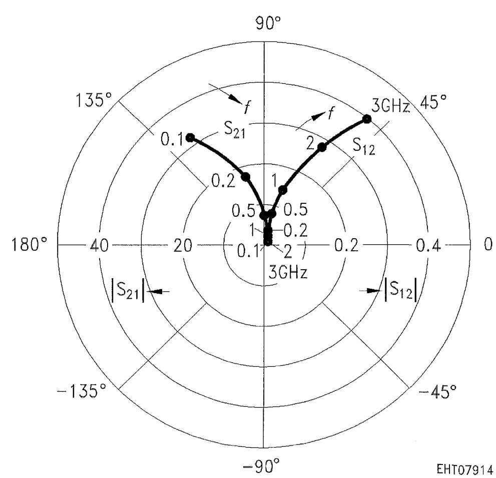
Common Emitter S Parameters (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**
I_C = 40 mA, V_{CE} = 8 V, Z_0 = 50 Ω								
0.10	0.395	– 92.9	31.23	122.5	0.023	65.6	0.553	– 45.3
0.15	0.351	– 115.2	23.03	111.6	0.029	66.2	0.442	– 50.5
0.20	0.327	– 130.1	18.02	105.0	0.036	68.1	0.343	– 52.3
0.25	0.313	– 141.2	14.70	100.3	0.042	69.6	0.293	– 52.7
0.30	0.306	– 149.0	12.41	96.8	0.049	70.6	0.259	– 52.2
0.40	0.300	– 160.6	9.46	91.6	0.062	72.3	0.219	– 50.9
0.50	0.297	– 168.5	7.65	87.5	0.076	72.7	0.198	– 50.1
0.60	0.293	– 174.7	6.42	84.1	0.090	72.9	0.184	– 49.7
0.70	0.295	179.9	5.54	81.0	0.104	72.6	0.175	– 50.1
0.80	0.296	176.0	4.89	78.1	0.117	72.1	0.169	– 50.9
0.90	0.302	172.1	4.37	75.3	0.131	71.4	0.161	– 51.7
1.00	0.306	168.5	3.95	72.8	0.145	70.8	0.155	– 52.8
1.20	0.314	161.3	3.33	68.3	0.172	69.1	0.143	– 54.8
1.40	0.318	153.8	2.90	63.7	0.198	67.2	0.139	– 57.5
1.50	0.315	150.5	2.73	61.5	0.211	66.2	0.140	– 59.6
1.60	0.317	148.7	2.58	59.3	0.225	65.2	0.141	– 62.3
1.80	0.321	143.9	2.33	54.9	0.251	62.9	0.139	– 68.5
2.00	0.337	140.9	2.13	51.0	0.275	60.6	0.131	– 75.8
2.50	0.378	129.8	1.78	42.0	0.335	55.2	0.112	– 98.3
3.00	0.392	120.2	1.56	33.3	0.392	49.4	0.117	– 115.1

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

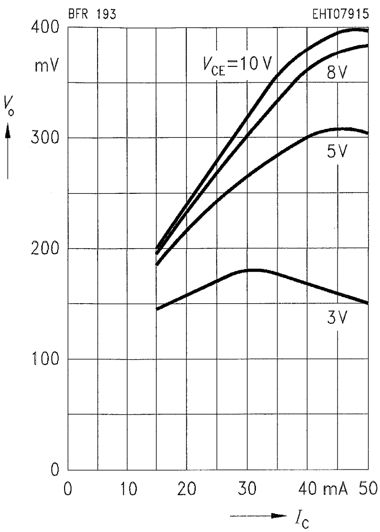


S_{12}, S_{21} = $f(f)$
I_C = 40 mA, V_{CE} = 8 V, Z_0 = 50 Ω



Common Emitter Large Signal Parameters

Linear output voltage $V_o = f\ (I_C)$
$d_{IM} = 60$ dB, $f_1 = 806$ MHz,
$f_2 = 810$ MHz, $Z_S = Z_L = 50\ \Omega$



Note:

The transistor is driven by 2 adjacent signals f_1, f_2 with equal <u>output</u> power levels P_o for each carrier.

The distance d_{IM} between P_o and the third order intermodulation products P_{IM} ($2f_1 - f_2$ or $2f_2 - f_1$) is:

$d_{IM} = P_o - P_{IM}$
where $P_o = 10 \log (V_o^2 / (50\ \Omega \cdot 1\ \text{mW}))$ (dBm)
and V_o = linear <u>output</u> voltage of each carrier.

The 3rd order intercept point IP_3 will be found by extrapolation to the point where P_{IM} would be identical to P_o:

IP_3 (output) $= P_o + d_{IM}/2$.

Linear output voltages for other d_{IM} (e.g. 50 dB) can be calculated thereby.

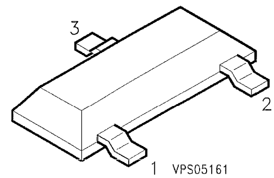
SIEMENS

PNP Silicon RF Transistor

BFR 194

Preliminary Data

- For low-distortion broadband amplifiers in antenna and telecommunications systems up to 1.5 GHz at collector currents from 20 mA to 80 mA.
- f_T = 4.5 GHz
- Complementary type: BFR 106 (NPN).



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

Type	Marking	Ordering Code (tape and reel)	Pin Configuration 1	2	3	Package[1]
BFR 194	RKs	Q62702-F1346	B	E	C	SOT-23

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CE0}	15	V
Collector-base voltage	V_{CB0}	20	
Emitter-base voltage	V_{EB0}	3	
Collector current	I_C	100	mA
Peak collector current, $f \geq 10$ MHz	I_{CM}	120	
Base current	I_B	10	
Peak base current, $f \geq 10$ MHz	I_{BM}	12	
Total power dissipation, $T_S \leq 73$ ˚C[3]	P_{tot}	700	mW
Junction temperature	T_j	150	˚C
Ambient temperature range	T_A	– 65 ... + 150	
Storage temperature range	T_{stg}	– 65 ... + 150	

Thermal Resistance

Junction - ambient[2]	$R_{th JA}$	≤ 190	K/W
Junction - soldering point[3]	$R_{th JS}$	≤ 110	

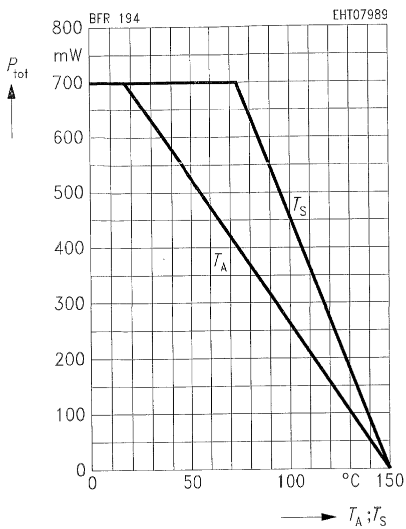
1) For detailed information see chapter Package Outlines.
2) Package mounted on alumina 15 mm × 16.7 mm × 0.7 mm.
3) T_S is measured on the collector lead at the soldering point to the pcb.

Electrical Characteristics

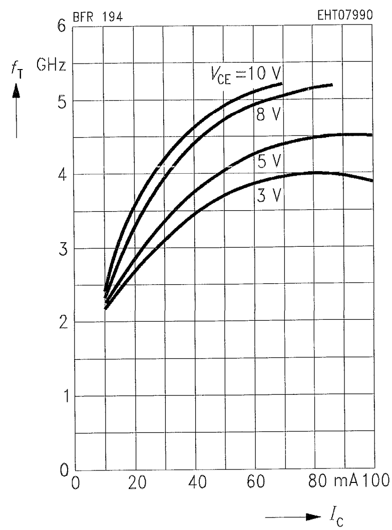
at T_A = 25 ˚C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CE0}$	15	–	–	V
Collector-base cutoff current V_{CB} = 10 V, I_E = 0	I_{CB0}	–	–	100	nA
Emitter-base cutoff current V_{EB} = 2 V, I_C = 0	I_{EB0}	–	–	1	µA
DC current gain I_C = 50 mA, V_{CE} = 10 V I_C = 70 mA, V_{CE} = 10 V	h_{FE}	 20 20	 50 50	 150 –	–
Collector-emitter saturation voltage I_C = 75 mA, I_B = 7.5 mA	V_{CEsat}	–	–	0.5	V
AC Characteristics					
Transition frequency I_C = 70 mA, V_{CE} = 10 V, f = 500 MHz	f_T	–	5	–	GHz
Collector-base capacitance V_{CB} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{cb}	–	1.5	–	pF

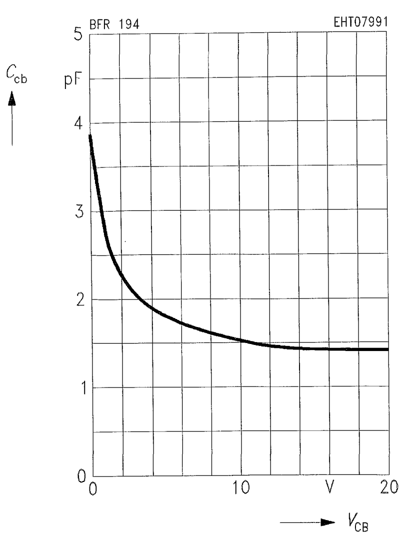
Total power dissipation $P_{tot} = f(T_A^*; T_S)$
*Package mounted on alumina



Transition frequency $f_T = f(I_C)$
f = 500 MHz



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

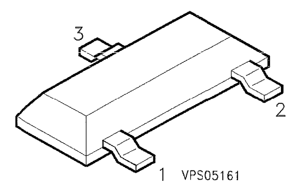


SIEMENS

NPN Silicon RF Transistor

BFR 280

Preliminary Data



- For low-noise, low-power amplifiers in mobile communication systems (pager, cordless telephone) at collector currents from 0.2 mA to 8 mA.
- f_T = 7 GHz
  F = 1.6 dB at 900 MHz

ESD: Electrostatic discharge sensitive device, observe handling precautions!

Type	Marking	Ordering Code (tape and reel)	Pin Configuration 1	2	3	Package[1)]
BFR 280	REs	Q62702-F1298	B	E	C	SOT-23

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CEO}	8	V
Collector-emitter voltage, V_{BE} = 0	V_{CES}	10	
Collector-base voltage	V_{CBO}	10	
Emitter-base voltage	V_{EBO}	2	
Collector current	I_C	10	mA
Peak collector current, $f \geq$ 10 MHz	I_{CM}	15	
Base current	I_B	1.2	
Peak base current, $f \geq$ 10 MHz	I_{BM}	1.5	
Total power dissipation, $T_S \leq$ 116 °C[3)]	P_{tot}	80	mW
Junction temperature	T_j	150	°C
Ambient temperature range	T_A	– 65 … + 150	
Storage temperature range	T_{stg}	– 65 … + 150	

Thermal Resistance

Junction - ambient[2)]	$R_{th\,JA}$	≤ 505	K/W
Junction - soldering point[3)]	$R_{th\,JS}$	≤ 425	

1) For detailed information 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.

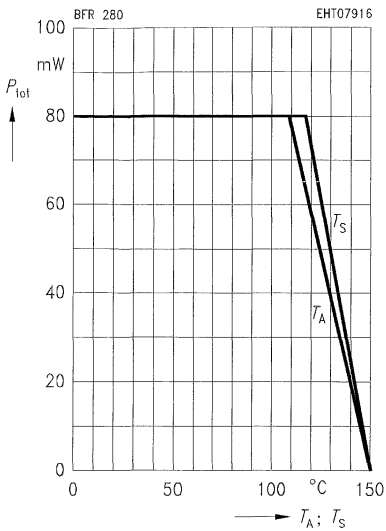
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CE0}$	8	–	–	V
Collector-emitter cutoff current V_{CE} = 10 V, V_{BE} = 0	I_{CES}	–	–	100	µA
Collector-base cutoff current V_{CB} = 8 V, I_E = 0	I_{CB0}	–	–	100	nA
Emitter-base cutoff current V_{EB} = 1 V, I_C = 0	I_{EB0}	–	–	2	µA
DC current gain I_C = 0.25 mA, V_{CE} = 1 V I_C = 3 mA, V_{CE} = 1 V	h_{FE}	 30 30	 90 100	 200 –	–
Collector-emitter saturation voltage I_C = 5 mA, I_B = 0.5 mA	V_{CEsat}	–	0.1	0.4	V

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

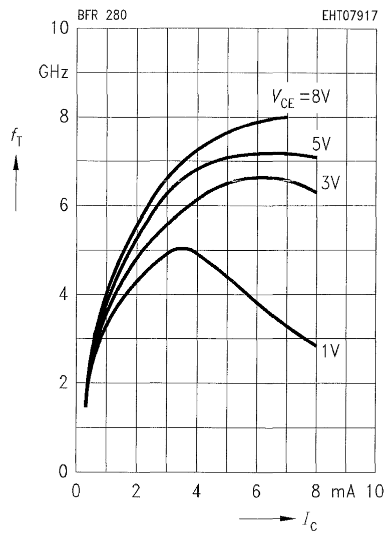
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
AC Characteristics					
Transition frequency	f_T				GHz
I_C = 3 mA, V_{CE} = 1 V, f = 500 MHz		–	5	–	
I_C = 6 mA, V_{CE} = 5 V, f = 500 MHz		–	7	–	
Collector-base capacitance V_{CB} = 1 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{cb}	–	0.27	–	pF
Collector-emitter capacitance V_{CE} = 1 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{ce}	–	0.19	–	
Input capacitance V_{EB} = 0.5 V, I_C = i_c = 0, f = 1 MHz	C_{ibo}	–	0.3	–	
Output capacitance V_{CE} = 1 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{obs}	–	0.46	–	
Noise figure	F				dB
I_C = 3 mA, V_{CE} = 1 V, f = 10 MHz, Z_S = 75 Ω		–	1.8	–	
I_C = 3 mA, V_{CE} = 1 V, f = 900 MHz, Z_S = Z_{Sopt}		–	1.6	–	
I_C = 3 mA, V_{CE} = 1 V, f = 1.75 GHz, Z_S = Z_{Sopt}		–	2.4	–	
Power gain	G_{ms} 1)				
I_C = 3 mA, V_{CE} = 1 V, f = 900 MHz, Z_0 = 50 Ω		–	12.5	–	
I_C = 6 mA, V_{CE} = 5 V, f = 900 MHz, Z_0 = 50 Ω		–	16.5	–	
Transducer gain I_C = 6 mA, V_{CE} = 5 V, f = 1 GHz, Z_0 = 50 Ω	$\lvert S_{21e} \rvert^2$	–	13	–	

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

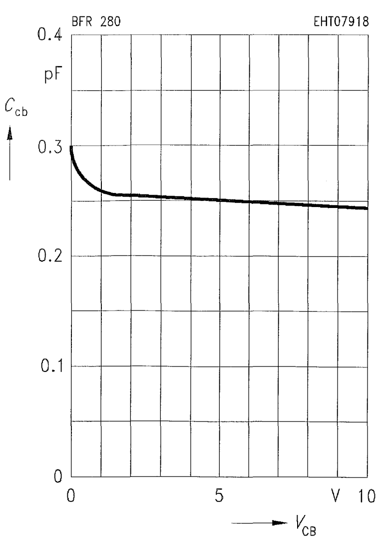
Total power dissipation $P_{tot} = f(T_A*; T_S)$
*Package mounted on alumina



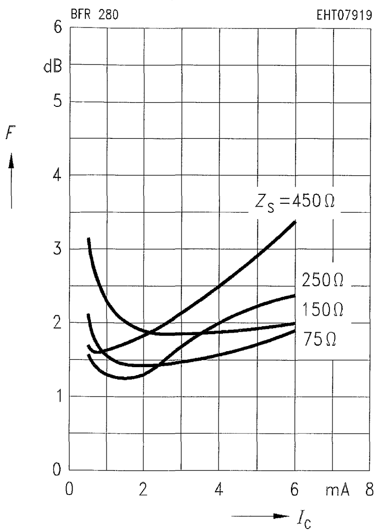
Transition frequency $f_T = f(I_C)$
f = 500 MHz



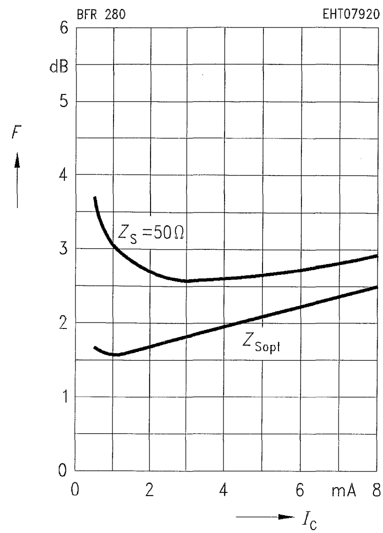
Collector-base capacitance $C_{cb} = f(V_{CB})$
$V_{BE} = v_{be} = 0$, f = 1 MHz



Noise figure $F = f\ (I_C)$
V_{CE} = 3 V, f = 10 MHz



Noise figure $F = f\ (I_C)$
V_{CE} = 3 V, f = 900 MHz, Z_{Lopt} (G)



Common Emitter S Parameters

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_C = 0.5 mA, V_{CE} = 1 V, Z_0 = 50 Ω								
0.10	0.968	– 5.3	1.79	174.2	0.021	86.0	0.996	– 3.1
0.20	0.961	– 10.5	1.78	168.2	0.041	82.5	0.991	– 6.1
0.30	0.948	– 15.7	1.77	162.1	0.061	78.6	0.984	– 9.1
0.40	0.932	– 20.7	1.75	156.1	0.080	75.1	0.975	– 12.0
0.50	0.915	– 25.6	1.73	150.6	0.098	71.7	0.963	– 14.8
0.60	0.895	– 30.4	1.70	145.1	0.115	68.6	0.951	– 17.5
0.70	0.876	– 35.2	1.67	139.7	0.131	65.4	0.936	– 20.1
0.80	0.847	– 40.1	1.63	134.7	0.146	62.2	0.922	– 22.5
0.90	0.825	– 44.7	1.63	129.6	0.160	59.2	0.903	– 24.9
0.95	0.808	– 47.2	1.62	127.0	0.166	57.7	0.894	– 26.0
1.00	0.797	– 49.3	1.60	124.5	0.172	56.3	0.885	– 27.2
1.20	0.733	– 58.6	1.55	114.6	0.192	51.2	0.849	– 31.1
1.40	0.672	– 66.7	1.48	105.7	0.209	46.9	0.819	– 34.8
1.60	0.617	– 74.1	1.41	98.0	0.222	43.4	0.790	– 38.2
1.70	0.590	– 78.4	1.39	94.5	0.228	41.6	0.776	– 39.9
1.75	0.580	– 80.3	1.37	92.6	0.231	40.9	0.769	– 40.7
1.80	0.568	– 82.4	1.37	90.8	0.233	40.1	0.761	– 41.5
2.00	0.520	– 91.5	1.33	83.7	0.242	37.1	0.732	– 44.2
2.50	0.401	– 115.5	1.21	67.2	0.250	32.3	0.673	– 51.2
3.00	0.332	– 139.0	1.12	54.6	0.252	30.5	0.636	– 57.5
I_C = 0.75 mA, V_{CE} = 1 V, Z_0 = 50 Ω								
0.10	0.955	– 6.3	2.60	173.4	0.021	85.6	0.995	– 3.6
0.20	0.944	– 12.4	2.58	166.7	0.041	81.5	0.988	– 7.1
0.30	0.926	– 18.5	2.55	159.9	0.060	77.2	0.976	– 10.5
0.40	0.902	– 24.3	2.50	153.3	0.078	73.4	0.961	– 13.8
0.50	0.878	– 30.0	2.45	147.3	0.095	69.8	0.944	– 16.9
0.60	0.849	– 35.4	2.38	141.4	0.111	66.5	0.925	– 19.9
0.70	0.819	– 40.8	2.32	135.7	0.126	63.3	0.905	– 22.6
0.80	0.786	– 46.1	2.23	130.3	0.139	60.1	0.885	– 25.1
0.90	0.753	– 51.2	2.20	125.1	0.151	57.2	0.861	– 27.5
0.95	0.735	– 53.8	2.17	122.5	0.156	55.8	0.849	– 28.6
1.00	0.720	– 56.2	2.14	120.0	0.161	54.5	0.837	– 29.6
1.20	0.645	– 65.8	2.01	110.1	0.177	50.1	0.795	– 33.3
1.40	0.575	– 74.3	1.88	101.4	0.191	46.6	0.760	– 36.7
1.60	0.516	– 81.7	1.76	94.0	0.202	44.0	0.729	– 39.7
1.70	0.489	– 86.1	1.72	90.6	0.207	42.7	0.714	– 41.2
1.75	0.477	– 88.1	1.69	88.9	0.209	42.3	0.708	– 41.9
1.80	0.466	– 90.2	1.68	87.0	0.211	41.8	0.700	– 42.5
2.00	0.421	– 99.6	1.60	80.4	0.219	39.9	0.671	– 44.9
2.50	0.311	– 125.6	1.41	65.0	0.232	37.5	0.616	– 51.1
3.00	0.254	– 150.8	1.29	53.1	0.244	37.2	0.583	– 56.8

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 = 1 mA, V_{CE} = 1 V, Z_0 = 50 Ω								
0.10	0.943	– 7.2	3.35	172.6	0.021	85.0	0.993	– 4.1
0.20	0.927	– 14.2	3.32	165.1	0.040	80.7	0.982	– 8.0
0.30	0.903	– 21.0	3.25	157.7	0.059	76.1	0.967	– 11.8
0.40	0.873	– 27.6	3.16	150.5	0.077	72.1	0.946	– 15.4
0.50	0.841	– 33.9	3.06	144.0	0.093	68.2	0.923	– 18.7
0.60	0.804	– 39.8	2.95	137.8	0.107	64.9	0.899	– 21.7
0.70	0.767	– 45.5	2.84	131.8	0.121	61.8	0.874	– 24.5
0.80	0.728	– 51.2	2.72	126.3	0.132	58.7	0.849	– 27.0
0.90	0.691	– 56.5	2.64	121.0	0.143	56.0	0.821	– 29.3
0.95	0.668	– 59.3	2.59	118.3	0.147	54.8	0.808	– 30.3
1.00	0.652	– 61.8	2.54	115.8	0.152	53.7	0.796	– 31.3
1.20	0.572	– 71.7	2.35	106.1	0.166	50.0	0.750	– 34.6
1.40	0.499	– 80.2	2.16	97.6	0.178	47.3	0.713	– 37.6
1.60	0.440	– 87.5	2.00	90.6	0.188	45.5	0.684	– 40.1
1.70	0.414	– 91.8	1.94	87.3	0.193	44.6	0.670	– 41.4
1.75	0.401	– 93.9	1.91	85.6	0.195	44.3	0.663	– 42.1
1.80	0.391	– 96.1	1.88	83.8	0.198	44.0	0.656	– 42.7
2.00	0.349	– 106.1	1.78	77.6	0.206	42.7	0.629	– 44.8
2.50	0.254	– 133.9	1.54	63.2	0.224	41.7	0.578	– 50.5
3.00	0.210	– 161.2	1.39	51.8	0.244	41.6	0.549	– 55.9
I_C = 2 mA, V_{CE} = 3 V, Z_0 = 50 Ω								
0.10	0.900	– 9.3	6.06	170.2	0.018	84.2	0.987	– 5.1
0.20	0.872	– 18.2	5.90	160.7	0.034	79.2	0.966	– 9.9
0.30	0.830	– 26.6	5.64	151.7	0.049	74.2	0.937	– 14.2
0.40	0.780	– 34.2	5.34	143.3	0.063	70.3	0.902	– 18.0
0.50	0.728	– 41.2	5.02	136.0	0.075	66.9	0.866	– 21.2
0.60	0.677	– 47.4	4.70	129.3	0.085	64.2	0.831	– 24.0
0.70	0.624	– 53.3	4.40	123.2	0.094	61.9	0.798	– 26.2
0.80	0.578	– 58.6	4.12	117.7	0.103	59.8	0.768	– 28.1
0.90	0.535	– 63.7	3.89	112.7	0.110	58.3	0.738	– 29.7
0.95	0.512	– 66.2	3.77	110.2	0.113	57.6	0.725	– 30.3
1.00	0.491	– 68.5	3.66	107.9	0.117	57.1	0.713	– 31.0
1.20	0.412	– 77.3	3.26	99.2	0.128	55.5	0.670	– 32.9
1.40	0.343	– 84.6	2.92	91.9	0.140	54.7	0.640	– 34.7
1.60	0.290	– 89.7	2.64	85.8	0.151	54.6	0.619	– 36.4
1.70	0.267	– 93.5	2.53	83.0	0.157	54.3	0.610	– 37.3
1.75	0.257	– 95.2	2.48	81.6	0.160	54.3	0.605	– 37.8
1.80	0.249	– 97.3	2.43	80.1	0.163	54.3	0.600	– 38.3
2.00	0.213	– 106.5	2.26	74.9	0.174	53.9	0.580	– 39.8
2.50	0.139	– 139.5	1.91	62.6	0.204	53.6	0.543	– 44.6
3.00	0.109	– 173.1	1.69	52.7	0.235	52.7	0.525	– 49.5

Common Emitter S Parameters (continued)

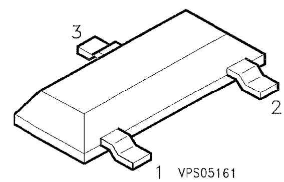
f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_C = 3 mA, V_{CE} = 5 V, Z_0 = 50 Ω								
0.10	0.869	– 11.0	8.22	168.2	0.017	83.6	0.980	– 6.1
0.20	0.828	– 21.4	7.87	157.0	0.032	77.9	0.949	– 11.7
0.30	0.770	– 30.7	7.38	146.8	0.046	72.9	0.906	– 16.5
0.40	0.706	– 39.0	6.81	137.7	0.058	69.2	0.860	– 20.3
0.50	0.644	– 46.1	6.27	130.0	0.068	66.3	0.815	– 23.3
0.60	0.586	– 52.0	5.74	123.3	0.077	64.2	0.775	– 25.7
0.70	0.530	– 57.6	5.29	117.2	0.085	62.6	0.739	– 27.5
0.80	0.482	– 62.6	4.87	112.0	0.093	61.4	0.709	– 28.9
0.90	0.439	– 67.1	4.53	107.2	0.100	60.5	0.681	– 30.0
0.95	0.416	– 69.5	4.37	104.9	0.103	60.1	0.668	– 30.4
1.00	0.398	– 71.5	4.22	102.8	0.107	59.9	0.657	– 30.9
1.20	0.325	– 79.3	3.70	94.9	0.119	59.2	0.620	– 32.2
1.40	0.263	– 85.2	3.27	88.2	0.131	58.9	0.595	– 33.5
1.60	0.217	– 88.8	2.93	82.7	0.144	59.0	0.579	– 34.9
1.70	0.196	– 91.9	2.80	80.1	0.151	58.8	0.571	– 35.7
1.75	0.189	– 93.1	2.73	78.8	0.155	58.8	0.568	– 36.2
1.80	0.181	– 95.5	2.68	77.5	0.158	58.7	0.563	– 36.6
2.00	0.152	– 104.8	2.48	72.8	0.171	58.3	0.547	– 38.0
2.50	0.087	– 143.3	2.07	61.6	0.205	57.3	0.515	– 42.6
3.00	0.070	173.9	1.82	52.4	0.240	55.5	0.500	– 47.5
I_C = 8 mA, V_{CE} = 5 V, Z_0 = 50 Ω								
0.10	0.716	– 18.4	14.57	160.9	0.015	80.8	0.949	– 9.5
0.20	0.633	– 33.7	12.93	144.6	0.028	74.3	0.874	– 16.6
0.30	0.538	– 45.8	11.12	131.9	0.039	70.3	0.795	– 21.1
0.40	0.454	– 54.8	9.53	122.0	0.048	68.5	0.730	– 23.5
0.50	0.387	– 62.0	8.24	114.5	0.055	67.6	0.681	– 24.8
0.60	0.334	– 67.2	7.22	108.5	0.063	67.3	0.645	– 25.6
0.70	0.287	– 72.5	6.40	103.3	0.070	67.4	0.618	– 26.1
0.80	0.250	– 76.9	5.75	98.9	0.078	67.3	0.597	– 26.5
0.90	0.220	– 81.0	5.22	95.0	0.085	67.3	0.579	– 26.8
0.95	0.205	– 83.4	4.98	93.2	0.089	67.4	0.572	– 26.8
1.00	0.192	– 85.0	4.77	91.5	0.092	67.4	0.566	– 26.9
1.20	0.142	– 93.9	4.08	85.2	0.107	67.4	0.546	– 27.5
1.40	0.100	– 101.6	3.55	79.7	0.122	67.2	0.535	– 28.6
1.60	0.071	– 103.3	3.15	75.1	0.137	67.0	0.529	– 30.0
1.70	0.059	– 110.6	2.99	73.0	0.145	66.6	0.525	– 30.9
1.75	0.055	– 112.6	2.91	72.0	0.149	66.5	0.524	– 31.4
1.80	0.051	– 118.2	2.84	70.9	0.153	66.3	0.521	– 31.8
2.00	0.042	– 145.5	2.61	66.9	0.168	65.5	0.511	– 33.6
2.50	0.065	138.7	2.17	57.3	0.208	63.2	0.489	– 38.6
3.00	0.091	117.0	1.88	48.9	0.247	60.2	0.479	– 44.1

SIEMENS

NPN Silicon RF Transistor

BFS 17P

- For broadband amplifiers up to 1 GHz at collector currents from 1 mA to 20 mA.
- CECC-type available: CECC 50002/248.



ESD: Electrostatic discharge sensitive device, observe handling precautions!

Type	Marking	Ordering Code (tape and reel)	Pin Configuration 1	2	3	Package[1]
BFS 17P	MC	Q62702-F940	B	E	C	SOT-23

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CE0}	15	V
Collector-base voltage	V_{CB0}	25	
Emitter-base voltage	V_{EB0}	2.5	
Collector current	I_C	25	mA
Peak collector current, $f \geq 10$ MHz	I_{CM}	50	
Total power dissipation, $T_S \leq 55$ °C[3]	P_{tot}	280	mW
Junction temperature	T_j	150	°C
Ambient temperature range	T_A	– 65 … + 150	
Storage temperature range	T_{stg}	– 65 … + 150	

Thermal Resistance

Junction - ambient[2]	$R_{th\,JA}$	≤ 420	K/W
Junction - soldering point[3]	$R_{th\,JS}$	≤ 340	

1) For detailed information 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.

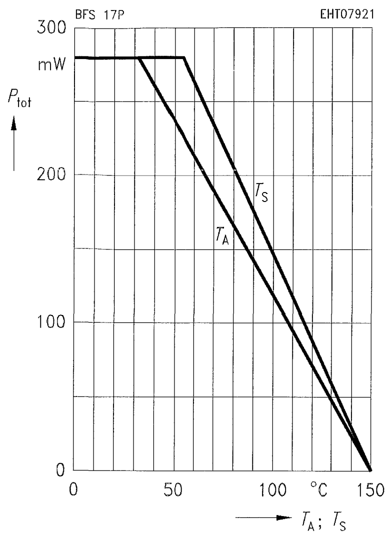
Electrical Characteristics
at T_A = 25 ˚C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CE0}$	15	–	–	V
Collector-base cutoff current V_{CB} = 15 V, I_E = 0 V_{CB} = 25 V, I_E = 0	I_{CB0}	 – –	 – –	 0.05 10	µA
Emitter-base cutoff current V_{EB} = 2.5 V, I_C = 0	I_{EB0}	–	–	100	
DC current gain I_C = 2 mA, V_{CE} = 1 V I_C = 25 mA, V_{CE} = 1 V	h_{FE}	 20 20	 – 70	 150 –	–
Collector-emitter saturation voltage I_C = 10 mA, I_B = 1 mA	V_{CEsat}	–	0.1	0.4	V

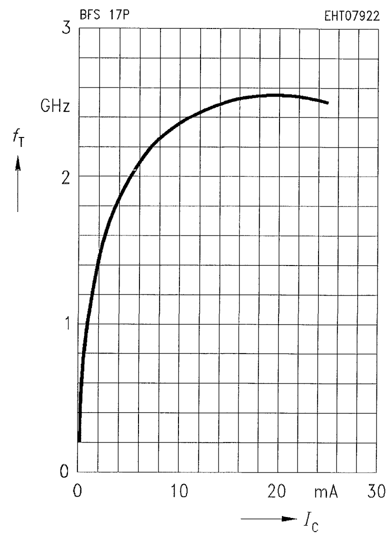
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
AC Characteristics					
Transition frequency I_C = 2 mA, V_{CE} = 5 V, f = 200 MHz I_C = 25 mA, V_{CE} = 5 V, f = 200 MHz	f_T	 1 1.3	 1.4 2.5	 – –	GHz
Collector-base capacitance V_{CB} = 5 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{cb}	–	0.55	0.8	pF
Collector-emitter capacitance V_{CE} = 5 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{ce}	–	0.28	–	
Input capacitance V_{EB} = 0.5 V, I_C = i_c = 0, f = 1 MHz	C_{ibo}	–	1.2	–	
Output capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{obs}	–	–	1.5	
Noise figure I_C = 2 mA, V_{CE} = 5 V, f = 800 MHz, Z_S = 75 Ω	F	–	3.5	5	dB
Transducer gain I_C = 20 mA, V_{CE} = 5 V, f = 500 MHz, Z_0 = 50 Ω	$\|S_{21e}\|^2$	–	12.7	–	
Linear output voltage two-tone intermodulation test I_C = 14 mA, V_{CE} = 5 V, d_{im} = 60 dB f_1 = 806 MHz, f_2 = 810 MHz, Z_S = Z_L = 50 Ω	V_{o1} = V_{o2}	–	100	–	mV
Third order intercept point I_C = 14 mA, V_{CE} = 5 V, f = 800 MHz	IP_3	–	23	–	dBm

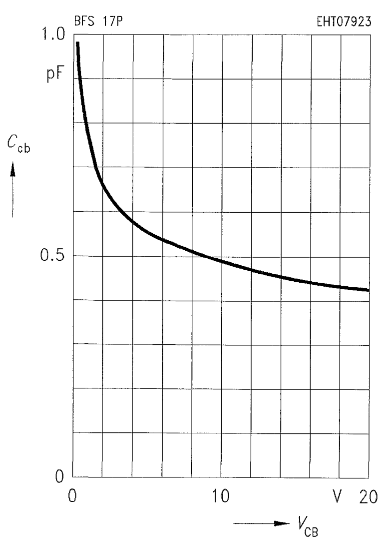
Total power dissipation $P_{tot} = f(T_A^*; T_S)$
*Package mounted on alumina



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



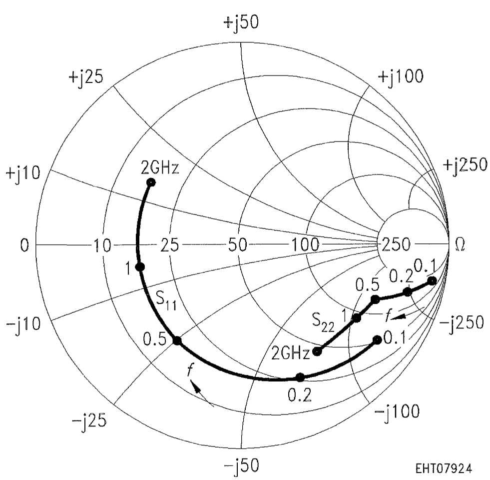
Collector-base capacitance $C_{cb} = f(V_{CB})$
$V_{BE} = v_{be} = 0$, f = 1 MHz



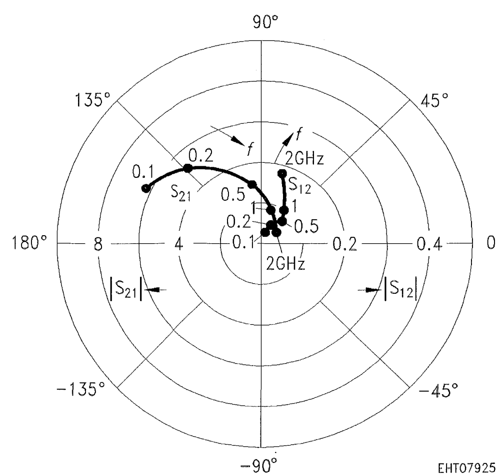
Common Emitter S Parameters

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
$I_C = 2$ mA, $V_{CE} = 5$ V, $Z_0 = 50\ \Omega$								
0.1	0.83	– 30	5.96	147	0.03	73	0.95	– 7
0.3	0.58	– 76	3.69	118	0.07	53	0.82	– 19
0.5	0.45	– 106	2.69	100	0.08	49	0.74	– 21
0.8	0.35	– 142	1.84	79	0.10	51	0.71	– 27
1.0	0.34	– 160	1.53	71	0.11	54	0.70	– 31
1.2	0.34	– 175	1.33	64	0.12	57	0.69	– 35
1.5	0.36	165	1.13	52	0.14	62	0.67	– 43
1.8	0.37	147	0.97	44	0.17	66	0.67	– 50
2.0	0.41	137	0.91	39	0.19	68	0.67	– 54

$S_{11}, S_{22} = f(f)$
$I_C = 2$ mA, $V_{CE} = 5$ V, $Z_0 = 50\ \Omega$



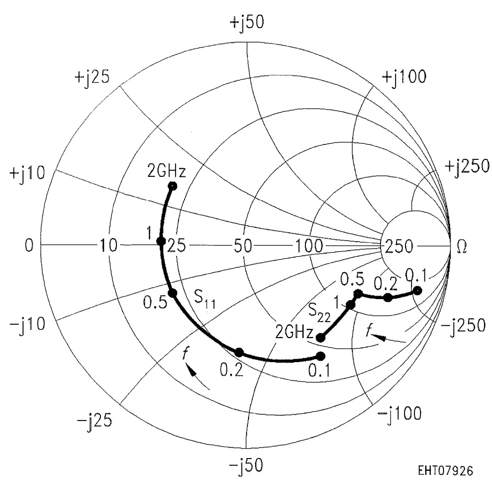
$S_{12}, S_{21} = f(f)$
$I_C = 2$ mA, $V_{CE} = 5$ V, $Z_0 = 50\ \Omega$



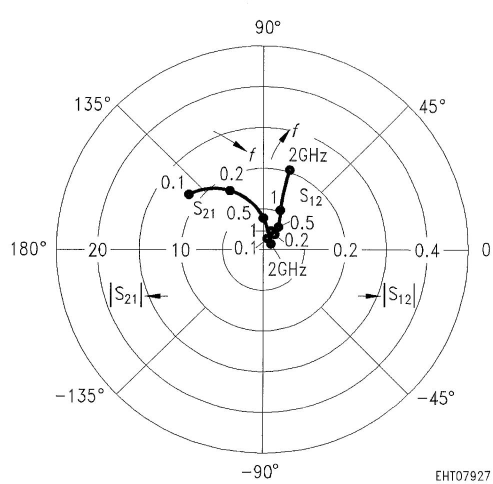
Common Emitter S Parameters (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**
I_C = 5 mA, V_{CE} = 5 V, Z_0 = 50 Ω								
0.1	0.63	– 44	10.78	134	0.03	69	0.87	– 11
0.3	0.38	– 98	5.37	107	0.05	57	0.70	– 20
0.5	0.32	– 130	3.59	92	0.07	60	0.64	– 21
0.8	0.28	– 161	2.39	74	0.09	63	0.62	– 25
1.0	0.29	– 177	1.94	68	0.11	65	0.62	– 29
1.2	0.30	170	1.67	61	0.13	66	0.60	– 33
1.5	0.33	155	1.40	50	0.15	67	0.59	– 41
1.8	0.35	140	1.18	43	0.19	69	0.60	– 47
2.0	0.39	132	1.11	38	0.21	69	0.59	– 51

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



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



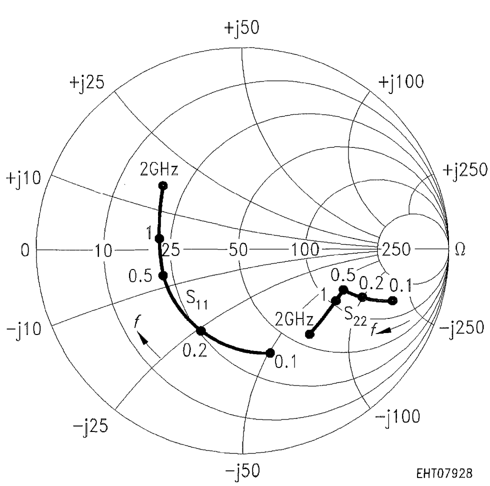
Common Emitter S Parameters (continued)

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

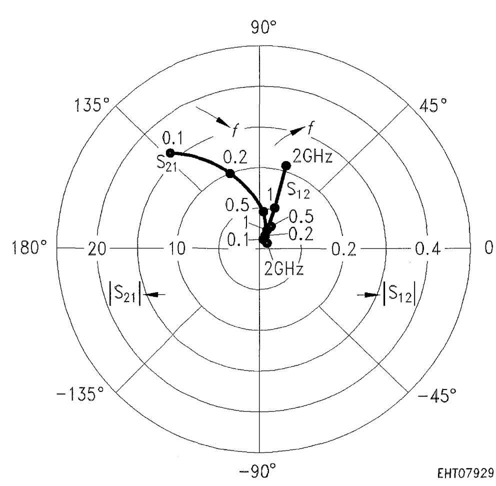
I_C = 10 mA, V_{CE} = 5 V, Z_0 = 50 Ω

0.1	0.44	– 60	14.21	125	0.02	69	0.79	– 14
0.3	0.29	– 117	6.35	100	0.04	64	0.63	– 19
0.5	0.27	– 148	4.10	88	0.06	68	0.58	– 19
0.8	0.26	– 176	2.69	72	0.09	69	0.57	– 23
1.0	0.28	173	2.18	66	0.12	70	0.57	– 27
1.2	0.30	163	1.86	60	0.13	70	0.56	– 31
1.5	0.32	150	1.55	49	0.16	69	0.55	– 38
1.8	0.35	136	1.30	42	0.20	69	0.56	– 45
2.0	0.38	128	1.22	37	0.22	69	0.56	– 49

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



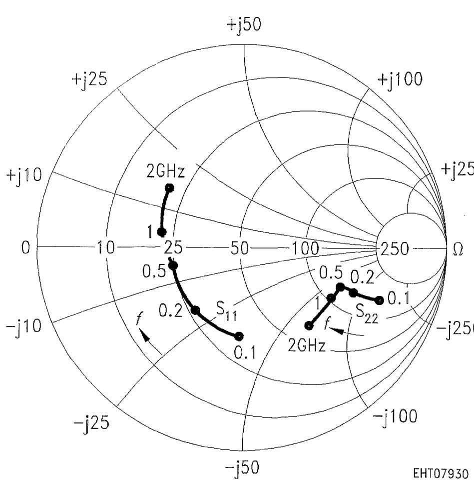
S_{12}, S_{21} = f (f)
I_C = 10 mA, V_{CE} = 5 V, Z_0 = 50 Ω



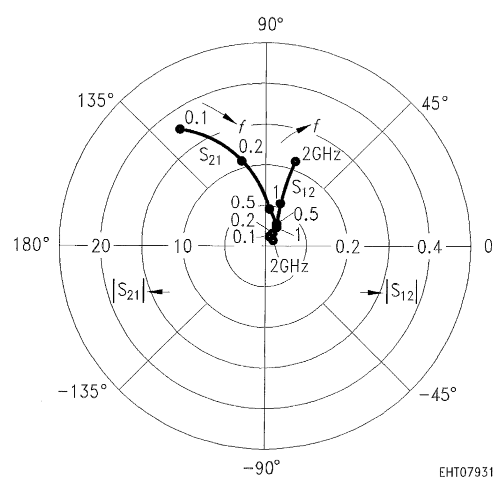
Common Emitter S Parameters (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_C = 15 mA, V_{CE} = 5 V, Z_0 = 50 Ω								
0.1	0.34	– 69	15.94	120	0.02	69	0.75	– 15
0.3	0.26	– 130	6.76	98	0.04	68	0.60	– 19
0.5	0.26	– 156	4.29	86	0.06	71	0.56	– 19
0.8	0.26	179	2.80	70	0.09	71	0.55	– 22
1.0	0.28	169	2.25	65	0.12	71	0.55	– 27
1.2	0.30	160	1.92	59	0.14	71	0.55	– 31
1.5	0.33	147	1.58	49	0.16	70	0.54	– 38
1.8	0.36	135	1.34	41	0.20	70	0.54	– 44
2.0	0.39	128	1.25	36	0.22	69	0.54	– 48

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



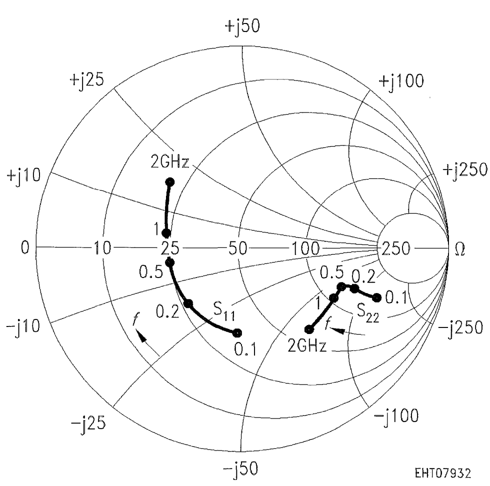
Common Emitter S Parameters (continued)

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

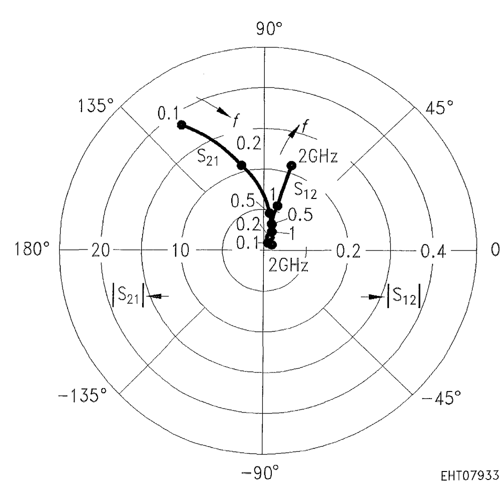
I_C = 20 mA, V_{CE} = 5 V, Z_0 = 50 Ω

0.1	0.27	– 77	16.69	117	0.02	70	0.72	– 14
0.3	0.25	– 138	6.88	96	0.04	69	0.58	– 17
0.5	0.26	– 161	4.34	84	0.06	72	0.54	– 18
0.8	0.27	175	2.82	69	0.09	71	0.54	– 22
1.0	0.29	166	2.26	64	0.12	72	0.54	– 26
1.2	0.31	157	1.93	58	0.14	71	0.53	– 29
1.5	0.34	146	1.59	48	0.16	70	0.53	– 37
1.8	0.36	133	1.34	40	0.20	70	0.54	– 44
2.0	0.40	125	1.26	35	0.22	70	0.53	– 47

S_{11}, S_{22} = $f(f)$
I_C = 20 mA, V_{CE} = 5 V, Z_0 = 50 Ω



S_{12}, S_{21} = $f(f)$
I_C = 20 mA, V_{CE} = 5 V, Z_0 = 50 Ω

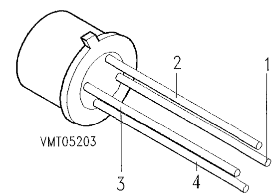


SIEMENS

NPN Silicon RF Transistor

BFS 55A

- For low-distortion broadband amplifiers up to 1 GHz at collector currents from 10 mA to 30 mA.



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

Type	Marking	Ordering Code	Pin Configuration 1	2	3	4	Package[1)]
BFS 55A	BFS 55A	Q62702-F454	E	B	Case	C	TO-72

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CEO}	15	V
Collector-emitter voltage, $V_{BE} = 0$	V_{CES}	20	
Collector-base voltage	V_{CBO}	20	
Emitter-base voltage	V_{EBO}	2.5	
Collector current	I_C	50	mA
Base current	I_B	10	
Total power dissipation, $T_A \leq 25$ ˚C	P_{tot}	250	mW
Junction temperature	T_j	200	˚C
Ambient temperature range	T_A	– 65 … + 175	
Storage temperature range	T_{stg}	– 65 … + 175	

Thermal Resistance

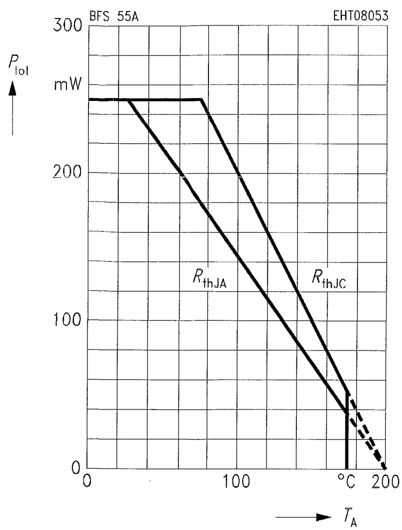
Junction - ambient	$R_{th\,JA}$	≤ 700	K/W
Junction - case	$R_{th\,JC}$	≤ 400	

1) For detailed information see chapter Package Outlines.

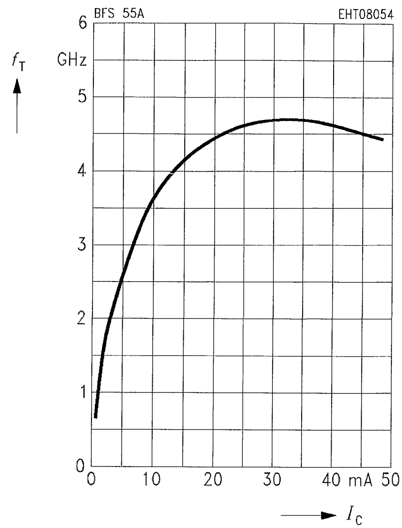
Electrical Characteristics
at T_A = 25 ˚C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CEO}$	15	–	–	V
Collector-emitter cutoff current V_{CE} = 20 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} = 2.5 V, I_C = 0	I_{EBO}	–	–	100	µA
DC current gain I_C = 25 mA, V_{CE} = 8 V I_C = 50 mA, V_{CE} = 5 V	h_{FE}	 30 30	 – –	 – –	–
AC Characteristics					
Transition frequency I_C = 25 mA, V_{CE} = 8 V, f = 200 MHz	f_T	–	4.5	–	GHz
Collector-base capacitance V_{CB} = 8 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{cb}	–	0.58	–	pF
Output capacitance V_{CB} = 8 V, I_E = i_e = 0, f = 1 MHz	C_{obo}	–	0.85	–	
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 = 60 Ω	F	 – –	 1.7 2.9	 – –	dB
Power gain I_C = 25 mA, V_{CE} = 8 V, f = 800 MHz, Z_S = 60 Ω	G_{pe}	–	10	–	
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}	–	350	–	mV
Third order intercept point I_C = 25 mA, V_{CE} = 8 V, f = 800 MHz	IP_3	–	33.5	–	dBm

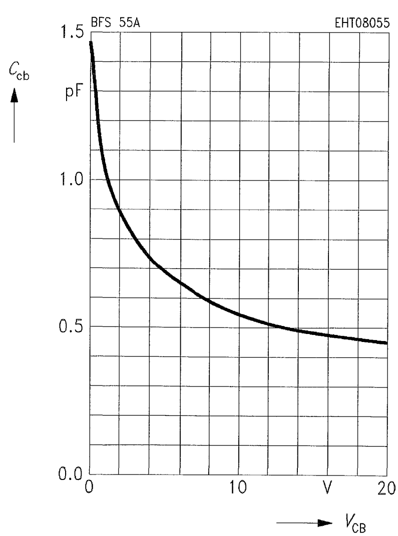
Total power dissipation $P_{tot} = f(T_A)$



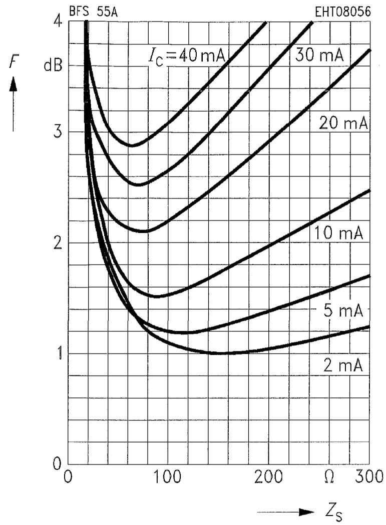
Transition frequency $f_T = f(I_C)$
V_{CE} = 8 V, f = 200 MHz



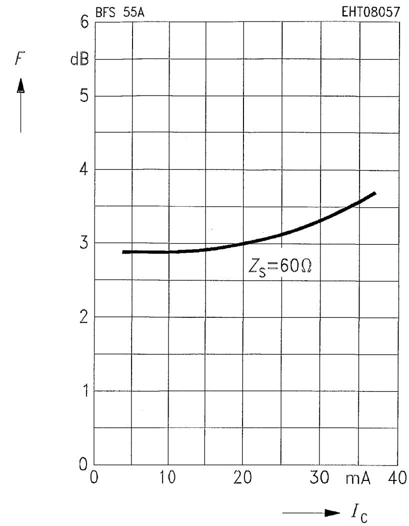
Collector-base capacitance $C_{cb} = f(V_{CB})$
$V_{BE} = v_{be} = 0$, f = 1 MHz



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



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

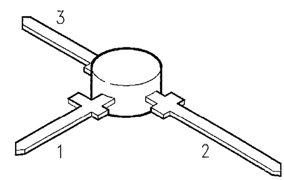


SIEMENS

NPN Silicon RF Transistor

BFT 65

- For low-distortion broadband amplifiers up to 1 GHz at collector currents from 10 mA to 30 mA.



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

Type	Marking	Ordering Code	Pin Configuration 1	2	3	Package[1]
BFT 65	BFT 65	Q62702-F451	E	C	B	T-plast

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CE0}	15	V
Collector-emitter voltage, $V_{BE} = 0$	V_{CES}	20	
Emitter-base voltage	V_{EB0}	2.5	
Collector current	I_C	50	mA
Base current	I_B	10	
Total power dissipation, $T_S \leq 94$ °C[3]	P_{tot}	400	mW
Junction temperature	T_j	150	°C
Ambient temperature range	T_A	– 65 … + 150	
Storage temperature range	T_{stg}	– 65 … + 150	

Thermal Resistance

Junction - ambient[2]	$R_{th\,JA}$	≤ 220	K/W
Junction - soldering point[3]	$R_{th\,JS}$	≤ 140	

1) For detailed information 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.

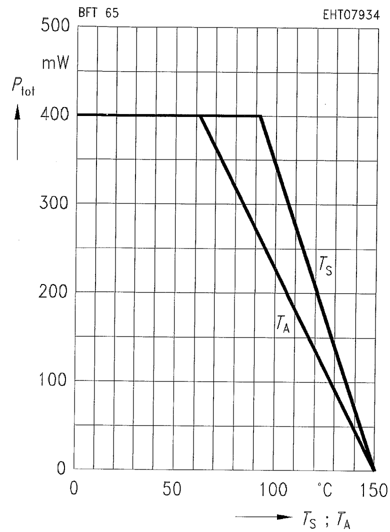
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CE0}$	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} = 2.5 V, I_C = 0	I_{EB0}	–	–	100	µA
DC current gain I_C = 25 mA, V_{CE} = 8 V I_C = 50 mA, V_{CE} = 5 V	h_{FE}	 30 30	 – –	 – –	–

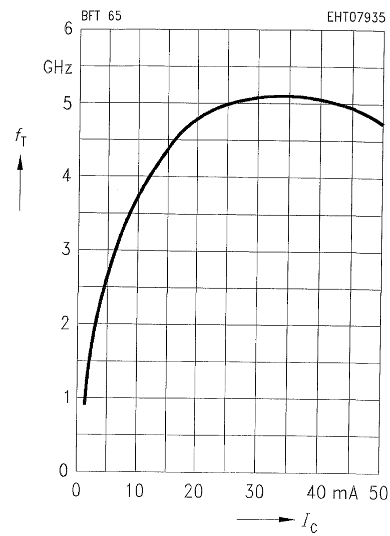
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
AC Characteristics					
Transition frequency I_C = 25 mA, V_{CE} = 8 V, f = 200 MHz	f_T	–	5	–	GHz
Collector-base capacitance V_{CB} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{cb}	–	0.53	–	pF
Collector-emitter capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{ce}	–	0.3	–	
Output capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{obs}	–	0.85	–	
Noise figure I_C = 10 mA, V_{CE} = 8 V, f = 800 MHz, Z_S = 60 Ω	F	–	2.8	–	dB
Power gain I_C = 25 mA, V_{CE} = 8 V, f = 800 MHz, Z_S = 60 Ω, Z_L = Z_{Lopt}	G_{pe}	–	12	–	
Transducer gain I_C = 25 mA, V_{CE} = 8 V, f = 500 MHz, Z_0 = 50 Ω	$\vert S_{21e} \vert^2$	–	16	–	
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

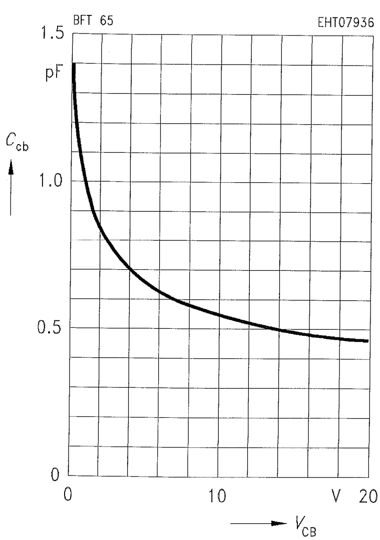
Total power dissipation $P_{tot} = f\,(T_A^*;\, T_S)$
*Package mounted on alumina



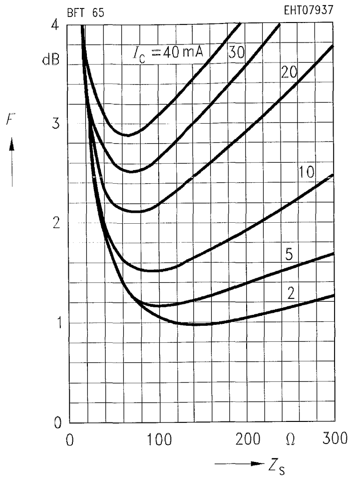
Transition frequency $f_T = f\,(I_C)$
V_{CE} = 5 V, f = 200 MHz



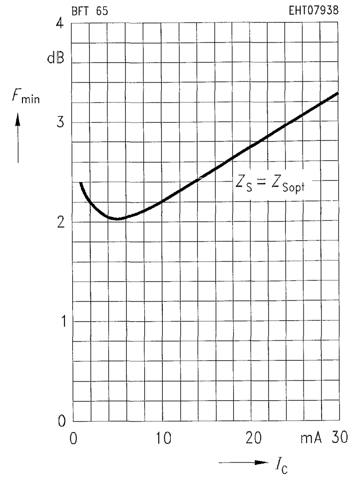
Collector-base capacitance $C_{cb} = f\,(V_{CB})$
$V_{BE} = v_{be} = 0$, f = 1 MHz



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



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



Common Emitter S Parameters

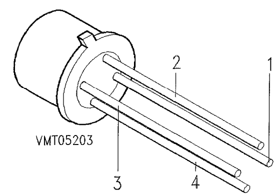
f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**
I_C = 25 mA, V_{CE} = 8 V, Z_0 = 50 Ω								
0.1	0.347	– 101	25.813	122	0.017	64	0.668	– 27
0.2	0.330	– 140	15.191	103	0.027	64	0.453	– 25
0.3	0.323	– 159	10.430	98	0.038	68	0.361	– 31
0.4	0.341	– 169	7.915	89	0.047	72	0.411	– 35
0.5	0.343	– 174	6.311	85	0.058	72	0.441	– 23
0.6	0.347	179	5.236	80	0.068	71	0.340	– 19
0.7	0.347	174	4.604	76	0.081	72	0.346	– 35
0.8	0.351	168	3.994	74	0.093	71	0.403	– 34
0.9	0.392	169	3.629	71	0.099	73	0.362	– 28
1.0	0.386	168	3.254	67	0.109	72	0.340	– 36
1.1	0.377	161	2.969	64	0.118	71	0.355	– 37
1.2	0.410	157	2.125	61	0.127	70	0.332	– 41
1.3	0.415	156	2.538	59	0.133	70	0.346	– 43
1.4	0.438	152	2.383	57	0.151	70	0.327	– 46
1.5	0.439	153	2.212	54	0.157	69	0.345	– 49
1.6	0.458	150	2.083	51	0.163	69	0.326	– 48
1.7	0.461	149	1.963	49	0.175	68	0.312	– 51
1.8	0.492	146	1.832	47	0.162	68	0.284	– 57
1.9	0.502	147	1.749	44	0.191	66	0.317	– 64
2.0	0.503	146	1.683	41	0.202	65	0.295	– 61

SIEMENS

NPN Silicon RF Transistor

BFT 66

- For small-signal broadband amplifiers up to 1 GHz at collector currents up to 20 mA.
- CECC-type available: CECC 50002/255.



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

Type	Marking	Ordering Code	Pin Configuration				Package[1]
			1	2	3	4	
BFT 66	BFT 66	Q62702-F456	E	B	Case	C	TO-72

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	30	mA
Base current	I_B	4	
Total power dissipation, $T_A \leq 60$ ˚C	P_{tot}	200	mW
Junction temperature	T_j	200	˚C
Ambient temperature range	T_A	– 65 … + 175	
Storage temperature range	T_{stg}	– 65 … + 175	

Thermal Resistance

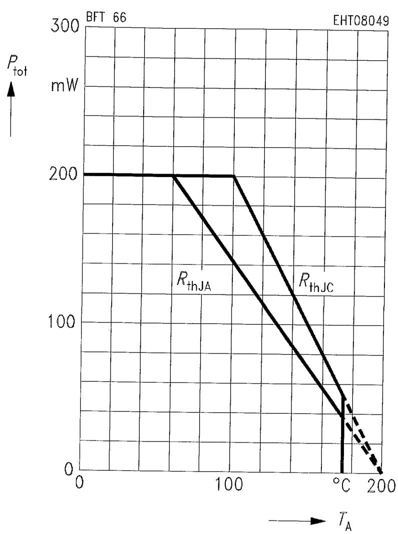
Junction - ambient	$R_{th\,JA}$	≤ 700	K/W
Junction - case	$R_{th\,JC}$	≤ 400	

1) For detailed information see chapter Package Outlines.

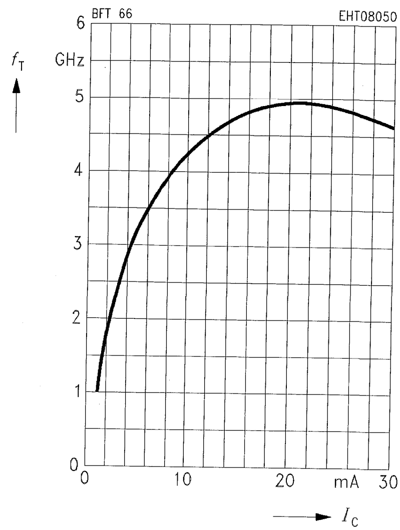
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CE0}$	15	–	–	V
Collector-emitter cutoff current V_{CE} = 20 V, V_{BE} = 0	I_{CES}	–	–	100	µA
Collector-base cutoff current V_{CB} = 10 V, I_E = 0	I_{CB0}	–	–	50	nA
Emitter-base cutoff current V_{EB} = 25 V, I_C = 0	I_{EB0}	–	–	100	µA
DC current gain I_C = 3 mA, V_{CE} = 6 V	h_{FE}	50	–	250	–
AC Characteristics					
Transition frequency I_C = 20 mA, V_{CE} = 6 V, f = 200 MHz	f_T	3.6	4.9	–	GHz
Collector-base capacitance V_{CB} = 6 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{cb}	–	0.55	0.65	pF
Input capacitance V_{EB} = 0.5 V, I_C = i_c = 0, f = 1 MHz	C_{ibo}	–	1.9	–	
Output capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{obs}	–	1.3	–	
Noise figure I_C = 3 mA, V_{CE} = 6 V, f = 10 MHz, Z_S = 75 Ω I_C = 4 mA, V_{CE} = 6 V, f = 800 MHz, Z_S = 50 Ω	F	 – –	 – 1.9	 1 –	dB
Power gain I_C = 10 mA, V_{CE} = 5 V, f = 500 MHz, Z_S = Z_{Sopt}, Z_L = Z_{Lopt}	G_{pe}	–	12	–	
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}	–	240	–	mV
Third order intercept point I_C = 20 mA, V_{CE} = 6 V, f = 800 MHz	IP_3	–	30.5	–	dBm

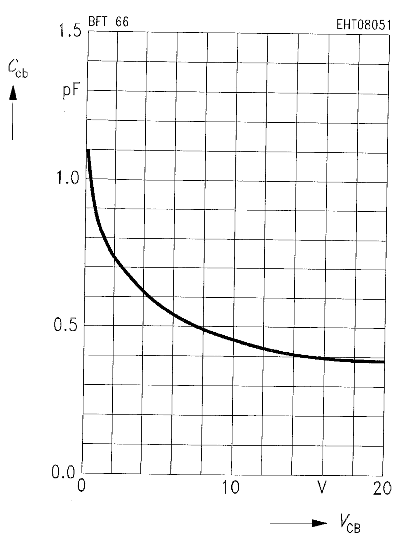
Total power dissipation $P_{tot} = f\ (T_A)$



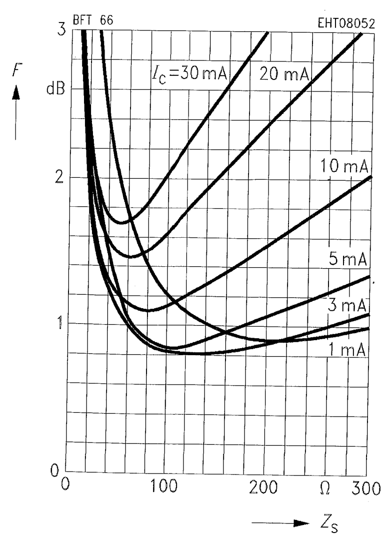
Transition frequency $f_T = f\ (I_C)$
V_{CE} = 6 V, f = 200 MHz



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



Noise figure $F = f\ (Z_S)$
V_{CE} = 6 V, f = 10 MHz

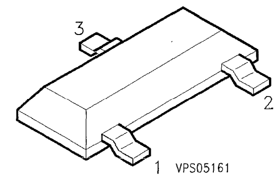


SIEMENS

PNP Silicon RF Transistor

BFT 92

- For broadband amplifiers up to 2 GHz at collector currents up to 20 mA.
- Complementary type: BFR 92P (NPN).



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

Type	Marking	Ordering Code (tape and reel)	Pin Configuration 1	2	3	Package[1)]
BFT 92	W 1	Q62702-F1062	B	E	C	SOT-23

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CEO}	15	V
Collector-base voltage	V_{CBO}	20	
Emitter-base voltage	V_{EBO}	2	
Collector current	I_C	25	mA
Peak collector current, $f \geq 10$ MHz	I_{CM}	35	
Total power dissipation, $T_S \leq 78$ °C[3)]	P_{tot}	200	mW
Junction temperature	T_j	150	°C
Ambient temperature range	T_A	– 65 … + 150	
Storage temperature range	T_{stg}	– 65 … + 150	

Thermal Resistance

Junction - ambient[2)]	$R_{th\,JA}$	≤ 440	K/W
Junction - soldering point[3)]	$R_{th\,JS}$	≤ 360	

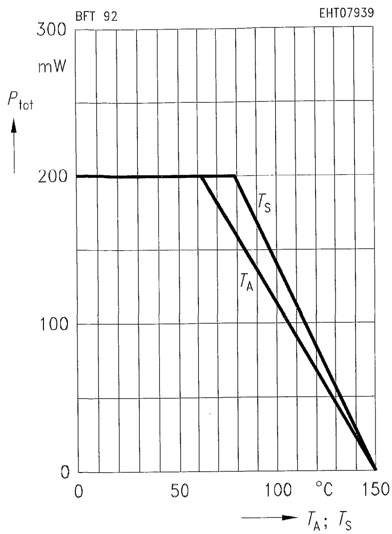
1) For detailed information see chapter Package Outlines.
2) Package mounted on alumina 15 mm × 16.7 mm × 0.7 mm.
3) T_S is measured on the collector lead at the soldering point to the pcb.

Electrical Characteristics

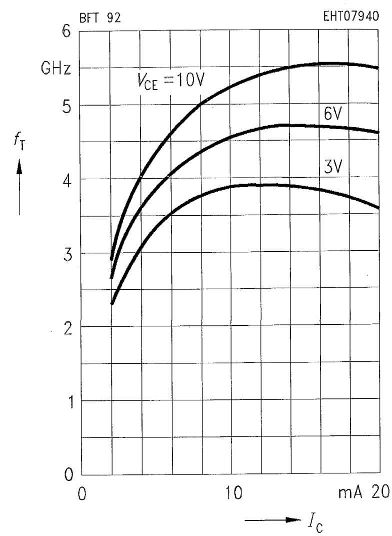
at T_A = 25 ˚C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CE0}$	12	–	–	V
Collector-base cutoff current V_{CB} = 10 V, I_E = 0	I_{CB0}	–	–	50	µA
DC current gain I_C = 14 mA, V_{CE} = 10 V	h_{FE}	20	50	–	–
AC Characteristics					
Transition frequency I_C = 14 mA, V_{CE} = 10 V, f = 500 MHz	f_T	–	5	–	GHz
Collector-base capacitance V_{CB} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{cb}	–	0.6	–	pF
Input capacitance V_{CE} = 0.5 V, I_C = i_c = 0, f = 1 MHz	C_{ibo}	–	0.8	–	
Noise figure I_C = 2 mA, V_{CE} = 10 V, f = 500 MHz	F	–	2.4	–	dB
Power gain I_C = 14 mA, V_{CE} = 10 V, f = 500 MHz	G_{pe}	–	18	–	

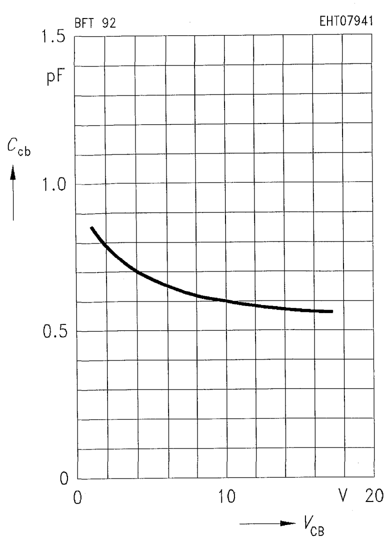
Total power dissipation $P_{tot} = f\,(T_A{}^*;\,T_S)$
*Package mounted on alumina



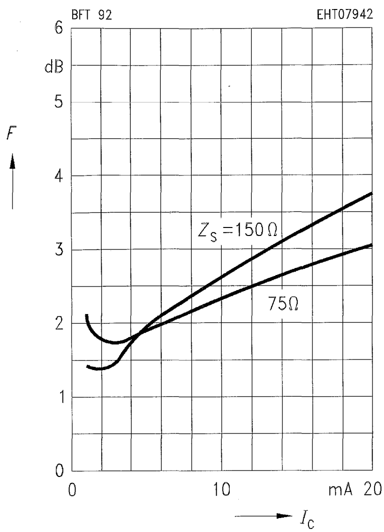
Transition frequency $f_T = f\,(I_C)$
f = 500 MHz



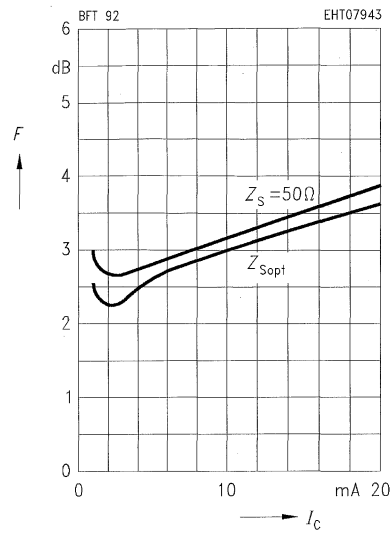
Collector-base capacitance $C_{cb} = f\,(V_{CB})$
$V_{BE} = v_{be} = 0$, f = 1 MHz



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



Noise figure $F = f\,(I_C)$
V_{CE} = 10 V, f = 900 MHz



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} = 3 V, Z_0 = 50 Ω								
0.10	0.788	– 26.5	5.92	160.2	0.047	73.4	0.943	– 13.6
0.20	0.715	– 49.8	5.31	143.6	0.082	60.9	0.849	– 23.9
0.30	0.635	– 69.4	4.62	129.9	0.105	52.1	0.753	– 31.0
0.40	0.571	– 86.1	4.02	119.1	0.120	46.5	0.673	– 35.7
0.50	0.522	– 99.6	3.53	110.4	0.130	43.0	0.614	– 38.9
0.60	0.485	– 111.6	3.13	103.0	0.138	40.7	0.568	– 41.2
0.70	0.460	– 122.3	2.81	96.5	0.144	39.3	0.532	– 42.9
0.80	0.441	– 132.1	2.57	90.8	0.148	38.9	0.506	– 44.5
0.90	0.430	– 141.1	2.34	85.4	0.152	38.8	0.484	– 45.6
1.00	0.420	– 149.0	2.15	80.7	0.157	39.2	0.467	– 46.9
1.20	0.413	– 163.1	1.86	72.4	0.165	40.7	0.442	– 49.5
1.40	0.403	– 175.3	1.66	65.1	0.174	42.7	0.428	– 52.7
1.50	0.399	179.2	1.57	61.7	0.180	44.0	0.425	– 54.2
1.60	0.401	174.2	1.50	58.5	0.187	45.2	0.422	– 56.5
1.80	0.404	164.7	1.38	52.2	0.201	47.2	0.416	– 60.7
2.00	0.421	156.7	1.27	46.8	0.216	48.8	0.408	– 65.2
I_C = 5 mA, V_{CE} = 3 V, Z_0 = 50 Ω								
0.10	0.573	– 44.5	10.81	150.9	0.039	68.9	0.869	– 21.8
0.20	0.492	– 78.5	8.60	130.7	0.063	57.1	0.698	– 34.3
0.30	0.434	– 102.7	6.81	117.1	0.077	52.1	0.570	– 40.2
0.40	0.400	– 121.0	5.57	107.5	0.087	50.6	0.486	– 42.6
0.50	0.379	– 134.3	4.68	100.3	0.096	50.6	0.436	– 43.7
0.60	0.366	– 145.1	4.04	94.2	0.104	51.3	0.400	– 44.2
0.70	0.358	– 154.2	3.55	89.0	0.113	52.1	0.377	– 44.6
0.80	0.358	– 162.1	3.18	84.3	0.122	53.1	0.360	– 45.3
0.90	0.358	– 168.9	2.87	80.0	0.130	53.9	0.347	– 45.6
1.00	0.360	– 174.9	2.62	76.1	0.140	54.8	0.337	– 46.4
1.20	0.367	174.6	2.24	69.2	0.159	56.0	0.322	– 48.4
1.40	0.367	164.8	1.97	62.9	0.179	56.7	0.315	– 51.2
1.50	0.366	160.6	1.87	59.9	0.189	57.0	0.316	– 52.6
1.60	0.369	157.0	1.78	57.0	0.200	57.1	0.315	– 55.1
1.80	0.376	149.7	1.62	51.4	0.222	56.7	0.311	– 59.5
2.00	0.393	144.5	1.49	46.6	0.243	56.3	0.305	– 64.1

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} = 3 V, Z_0 = 50 Ω								
0.10	0.377	– 68.8	14.28	143.2	0.032	67.1	0.786	– 28.0
0.20	0.361	– 109.9	10.29	122.1	0.049	59.2	0.577	– 40.1
0.30	0.353	– 133.6	7.72	109.7	0.061	58.0	0.453	– 43.5
0.40	0.351	– 148.8	6.13	101.3	0.072	58.8	0.384	– 43.9
0.50	0.348	– 159.1	5.07	95.0	0.083	60.0	0.346	– 43.4
0.60	0.345	– 167.1	4.33	89.7	0.093	61.1	0.321	– 42.9
0.70	0.346	– 173.9	3.78	85.0	0.105	61.8	0.306	– 42.8
0.80	0.350	– 179.5	3.37	80.8	0.116	62.4	0.296	– 43.1
0.90	0.355	175.6	3.03	77.0	0.127	62.7	0.288	– 43.3
1.00	0.359	171.3	2.76	73.4	0.138	63.0	0.281	– 44.1
1.20	0.369	163.3	2.35	67.2	0.161	63.0	0.272	– 46.0
1.40	0.371	155.5	2.07	61.2	0.184	62.5	0.269	– 49.0
1.50	0.371	151.7	1.95	58.4	0.196	62.2	0.271	– 50.6
1.60	0.376	148.7	1.85	55.6	0.208	61.8	0.271	– 53.3
1.80	0.382	142.7	1.68	50.2	0.232	60.6	0.270	– 58.2
2.00	0.396	138.7	1.55	45.6	0.254	59.3	0.264	– 63.1
I_C = 15 mA, V_{CE} = 3 V, Z_0 = 50 Ω								
0.10	0.292	– 91.9	15.37	139.6	0.028	67.6	0.737	– 30.5
0.20	0.333	– 130.8	10.60	118.5	0.043	62.3	0.521	– 41.5
0.30	0.348	– 150.2	7.80	106.7	0.055	62.5	0.407	– 43.5
0.40	0.356	– 162.1	6.13	98.7	0.067	63.7	0.346	– 42.9
0.50	0.358	– 170.2	5.05	92.7	0.079	64.9	0.315	– 41.8
0.60	0.358	– 176.6	4.30	87.7	0.090	65.6	0.296	– 41.0
0.70	0.360	177.9	3.75	83.2	0.102	66.0	0.284	– 40.8
0.80	0.364	173.7	3.34	79.1	0.114	66.2	0.277	– 41.1
0.90	0.370	169.5	3.00	75.4	0.126	66.3	0.271	– 41.4
1.00	0.375	166.0	2.72	72.0	0.138	66.2	0.267	– 42.3
1.20	0.387	159.1	2.32	65.8	0.162	65.6	0.260	– 44.5
1.40	0.388	151.7	2.04	59.9	0.186	64.8	0.258	– 47.7
1.50	0.389	148.5	1.92	57.1	0.198	64.3	0.261	– 49.6
1.60	0.392	145.7	1.83	54.4	0.210	63.7	0.262	– 52.4
1.80	0.398	140.3	1.66	49.0	0.235	62.3	0.261	– 57.6
2.00	0.414	136.3	1.52	44.4	0.258	60.8	0.256	– 62.8

Common Emitter S Parameters (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
$I_C = 2$ mA, $V_{CE} = 6$ V, $Z_0 = 50\ \Omega$								
0.10	0.824	– 22.2	6.07	162.4	0.037	77.7	0.961	– 10.8
0.20	0.764	– 42.4	5.59	147.0	0.067	67.1	0.896	– 19.8
0.30	0.687	– 60.4	4.98	133.5	0.090	58.9	0.818	– 26.7
0.40	0.617	– 75.9	4.40	122.5	0.106	53.1	0.745	– 31.6
0.50	0.559	– 89.0	3.89	113.6	0.117	49.4	0.687	– 35.1
0.60	0.511	– 100.4	3.46	106.0	0.126	46.8	0.639	– 37.8
0.70	0.478	– 110.9	3.11	99.4	0.133	45.0	0.602	– 39.8
0.80	0.450	– 120.9	2.85	93.5	0.139	44.3	0.571	– 41.8
0.90	0.431	– 130.1	2.60	88.1	0.144	43.8	0.547	– 42.9
1.00	0.415	– 138.5	2.39	83.3	0.149	43.9	0.527	– 44.3
1.20	0.395	– 153.6	2.06	74.9	0.158	44.9	0.497	– 46.8
1.40	0.378	– 166.6	1.83	67.6	0.169	46.6	0.479	– 49.7
1.50	0.369	– 172.7	1.73	64.3	0.174	47.6	0.475	– 51.1
1.60	0.369	– 177.9	1.65	61.0	0.181	48.5	0.471	– 53.2
1.80	0.370	– 171.5	1.51	54.9	0.195	50.1	0.461	– 56.9
2.00	0.383	– 162.9	1.40	49.5	0.210	51.5	0.451	– 60.8
$I_C = 5$ mA, $V_{CE} = 6$ V, $Z_0 = 50\ \Omega$								
0.10	0.635	– 35.3	11.38	154.1	0.032	73.7	0.905	– 17.3
0.20	0.548	– 64.3	9.43	134.4	0.054	63.2	0.769	– 28.8
0.30	0.466	– 86.7	7.64	120.3	0.068	57.9	0.652	– 35.2
0.40	0.411	– 104.5	6.28	110.1	0.079	55.9	0.568	– 38.4
0.50	0.376	– 118.2	5.31	102.5	0.089	55.5	0.513	– 40.2
0.60	0.349	– 129.8	4.58	96.3	0.098	55.8	0.473	– 41.2
0.70	0.335	– 140.1	4.02	90.9	0.107	56.2	0.445	– 42.1
0.80	0.326	– 148.7	3.60	86.2	0.116	56.9	0.424	– 42.9
0.90	0.322	– 156.8	3.25	81.8	0.125	57.5	0.407	– 43.5
1.00	0.320	– 163.6	2.95	78.0	0.134	58.0	0.394	– 44.4
1.20	0.321	– 176.0	2.52	71.2	0.153	58.8	0.373	– 46.2
1.40	0.317	172.6	2.21	64.9	0.173	59.2	0.363	– 48.7
1.50	0.314	167.8	2.08	62.1	0.183	59.4	0.362	– 49.9
1.60	0.317	163.9	1.98	59.2	0.193	59.4	0.359	– 52.1
1.80	0.322	155.7	1.80	53.8	0.215	59.0	0.353	– 55.9
2.00	0.341	150.0	1.66	49.0	0.235	58.3	0.344	– 59.9

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} = 6 V, Z_0 = 50 Ω								
0.10	0.449	– 51.0	15.60	146.6	0.027	71.8	0.836	– 22.8
0.20	0.382	– 87.7	11.73	125.3	0.044	64.2	0.657	– 34.2
0.30	0.338	– 112.4	8.92	112.0	0.056	62.3	0.535	– 38.6
0.40	0.317	– 130.3	7.11	103.2	0.067	62.6	0.461	– 40.0
0.50	0.303	– 142.8	5.88	96.6	0.078	63.5	0.418	– 40.4
0.60	0.293	– 152.8	5.00	91.1	0.089	64.2	0.388	– 40.6
0.70	0.291	– 161.1	4.36	86.5	0.100	64.7	0.368	– 40.9
0.80	0.291	– 167.9	3.88	82.4	0.110	65.1	0.354	– 41.5
0.90	0.295	– 174.3	3.48	78.6	0.122	65.3	0.342	– 41.9
1.00	0.297	– 179.3	3.16	75.1	0.133	65.4	0.333	– 42.7
1.20	0.309	171.0	2.68	69.0	0.155	65.1	0.318	– 44.4
1.40	0.308	161.7	2.35	63.2	0.178	64.5	0.311	– 46.8
1.50	0.308	157.6	2.21	60.5	0.189	64.1	0.312	– 48.2
1.60	0.312	154.6	2.10	57.9	0.201	63.6	0.311	– 50.5
1.80	0.319	147.7	1.90	52.7	0.224	62.2	0.307	– 54.7
2.00	0.336	143.2	1.75	48.1	0.247	60.9	0.299	– 58.8
I_C = 15 mA, V_{CE} = 6 V, Z_0 = 50 Ω								
0.10	0.347	– 64.1	17.40	142.8	0.024	71.5	0.792	– 25.2
0.20	0.317	– 104.4	12.45	121.1	0.040	66.2	0.600	– 35.9
0.30	0.301	– 128.6	9.24	108.6	0.051	65.8	0.485	– 38.9
0.40	0.295	– 144.7	7.28	100.3	0.063	66.7	0.419	– 39.4
0.50	0.292	– 155.3	5.98	94.2	0.074	67.5	0.383	– 39.3
0.60	0.288	– 163.8	5.07	89.1	0.086	68.1	0.359	– 39.1
0.70	0.288	– 170.8	4.41	84.6	0.098	68.4	0.343	– 39.3
0.80	0.291	– 176.5	3.91	80.7	0.109	68.5	0.332	– 39.8
0.90	0.298	178.3	3.51	77.0	0.121	68.4	0.322	– 40.2
1.00	0.300	174.0	3.18	73.7	0.133	68.2	0.314	– 41.1
1.20	0.313	165.6	2.70	67.8	0.156	67.4	0.302	– 42.9
1.40	0.316	157.1	2.36	62.2	0.180	66.4	0.297	– 45.4
1.50	0.317	153.5	2.22	59.5	0.191	65.9	0.299	– 46.9
1.60	0.319	150.7	2.11	56.9	0.203	65.2	0.298	– 49.3
1.80	0.327	144.6	1.91	51.7	0.227	63.6	0.294	– 53.6
2.00	0.345	140.7	1.75	47.3	0.249	62.1	0.287	– 57.9

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} = 6 V, Z_0 = 50 Ω								
0.10	0.285	– 77.0	18.09	140.4	0.023	71.8	0.761	– 26.5
0.20	0.290	– 117.9	12.58	118.7	0.037	67.7	0.565	– 36.2
0.30	0.292	– 140.4	9.23	106.6	0.049	68.2	0.457	– 38.4
0.40	0.295	– 154.1	7.22	98.5	0.061	69.1	0.398	– 38.2
0.50	0.295	– 163.3	5.91	92.7	0.073	69.9	0.366	– 37.8
0.60	0.294	– 170.5	5.01	87.8	0.085	70.4	0.345	– 37.6
0.70	0.297	– 176.7	4.35	83.4	0.096	70.4	0.332	– 37.8
0.80	0.301	178.7	3.85	79.5	0.108	70.3	0.322	– 38.3
0.90	0.308	173.9	3.46	76.0	0.120	70.0	0.314	– 38.8
1.00	0.313	170.3	3.13	72.7	0.132	69.8	0.307	– 39.7
1.20	0.326	162.7	2.65	66.8	0.156	68.7	0.297	– 41.7
1.40	0.330	154.8	2.32	61.2	0.180	67.5	0.293	– 44.4
1.50	0.330	151.2	2.18	58.5	0.192	66.9	0.296	– 46.0
1.60	0.334	148.5	2.07	55.9	0.204	66.2	0.295	– 48.5
1.80	0.339	142.8	1.87	50.8	0.227	64.5	0.292	– 53.0
2.00	0.357	139.1	1.72	46.3	0.250	62.9	0.285	– 57.4
I_C = 2 mA, V_{CE} = 10 V, Z_0 = 50 Ω								
0.10	0.858	– 19.8	5.99	163.6	0.034	78.8	0.964	– 9.8
0.20	0.802	– 38.1	5.58	148.9	0.063	69.2	0.908	– 18.2
0.30	0.724	– 54.5	5.03	135.8	0.086	61.4	0.838	– 24.9
0.40	0.651	– 68.9	4.49	124.9	0.102	55.7	0.770	– 29.8
0.50	0.588	– 81.1	4.00	116.0	0.115	51.9	0.714	– 33.4
0.60	0.534	– 91.8	3.58	108.3	0.124	49.1	0.666	– 36.2
0.70	0.492	– 102.0	3.24	101.6	0.132	47.1	0.628	– 38.4
0.80	0.457	– 111.5	2.97	95.7	0.138	46.1	0.596	– 40.3
0.90	0.431	– 120.6	2.71	90.1	0.144	45.3	0.570	– 41.6
1.00	0.411	– 128.9	2.50	85.3	0.149	45.2	0.549	– 42.9
1.20	0.382	– 144.4	2.16	76.8	0.160	45.6	0.516	– 45.4
1.40	0.356	– 157.7	1.92	69.3	0.170	46.8	0.497	– 48.1
1.50	0.347	– 163.8	1.81	66.0	0.175	47.5	0.492	– 49.4
1.60	0.343	– 169.5	1.73	62.7	0.182	48.4	0.487	– 51.3
1.80	0.341	179.4	1.58	56.5	0.196	49.6	0.477	– 54.8
2.00	0.354	169.9	1.46	50.9	0.210	50.7	0.466	– 58.4

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								
0.10	0.704	– 30.6	11.46	155.7	0.030	75.1	0.913	– 15.9
0.20	0.605	– 56.2	9.70	136.6	0.053	65.2	0.792	– 27.0
0.30	0.510	– 76.4	7.96	122.5	0.068	59.8	0.680	– 33.5
0.40	0.438	– 92.8	6.62	112.2	0.079	57.4	0.596	– 37.1
0.50	0.388	– 105.7	5.62	104.5	0.089	56.6	0.540	– 39.1
0.60	0.350	– 116.8	4.85	98.1	0.098	56.6	0.497	– 40.3
0.70	0.326	– 127.3	4.27	92.6	0.107	56.7	0.466	– 41.3
0.80	0.310	– 136.3	3.84	87.9	0.116	57.2	0.444	– 42.2
0.90	0.301	– 144.9	3.46	83.5	0.125	57.6	0.425	– 42.8
1.00	0.293	– 152.4	3.15	79.6	0.135	58.0	0.410	– 43.6
1.20	0.289	– 166.5	2.68	72.7	0.153	58.5	0.387	– 45.2
1.40	0.278	– 178.7	2.35	66.5	0.173	58.8	0.375	– 47.4
1.50	0.276	175.9	2.22	63.6	0.182	58.9	0.373	– 48.5
1.60	0.277	171.5	2.11	60.8	0.193	58.8	0.371	– 50.4
1.80	0.280	162.5	1.91	55.3	0.213	58.3	0.363	– 54.0
2.00	0.298	156.1	1.76	50.5	0.233	57.6	0.353	– 57.5
I_C = 10 mA, V_{CE} = 10 V, Z_0 = 50 Ω								
0.10	0.546	– 42.1	16.14	148.4	0.027	72.9	0.849	– 21.2
0.20	0.442	– 73.6	12.40	127.3	0.044	65.1	0.680	– 32.7
0.30	0.365	– 96.2	9.54	113.9	0.057	62.7	0.560	– 37.4
0.40	0.319	– 113.7	7.64	104.8	0.067	62.8	0.483	– 39.2
0.50	0.290	– 126.7	6.34	98.1	0.078	63.4	0.438	– 39.8
0.60	0.269	– 137.5	5.40	92.6	0.089	64.1	0.406	– 40.1
0.70	0.260	– 147.1	4.71	87.9	0.100	64.5	0.384	– 40.5
0.80	0.255	– 155.1	4.19	83.8	0.111	64.8	0.368	– 41.0
0.90	0.255	– 162.5	3.76	80.0	0.122	64.9	0.354	– 41.4
1.00	0.254	– 168.9	3.41	76.6	0.133	64.9	0.344	– 42.1
1.20	0.261	179.5	2.90	70.4	0.155	64.5	0.327	– 43.6
1.40	0.259	168.9	2.53	64.7	0.177	63.8	0.319	– 45.6
1.50	0.259	164.2	2.38	62.1	0.188	63.4	0.320	– 46.8
1.60	0.260	160.6	2.26	59.5	0.200	62.9	0.318	– 49.0
1.80	0.268	153.4	2.05	54.3	0.223	61.5	0.312	– 52.8
2.00	0.286	148.6	1.88	49.8	0.244	60.1	0.303	– 56.5

Common Emitter S Parameters (continued)

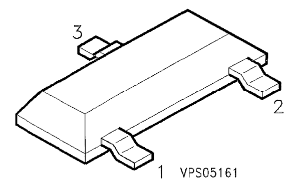
f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**
I_C = 15 mA, V_{CE} = 10 V, Z_0 = 50 Ω								
0.10	0.457	– 50.2	18.34	144.3	0.025	72.2	0.806	– 23.8
0.20	0.366	– 85.1	13.37	122.8	0.040	66.2	0.622	– 34.5
0.30	0.308	– 108.7	10.01	110.0	0.052	65.4	0.506	– 38.0
0.40	0.279	– 126.3	7.90	101.5	0.063	66.1	0.438	– 38.7
0.50	0.261	– 138.8	6.51	95.4	0.075	67.0	0.399	– 38.8
0.60	0.249	– 148.7	5.52	90.3	0.086	67.5	0.373	– 38.8
0.70	0.244	– 157.7	4.80	85.9	0.098	67.8	0.355	– 39.0
0.80	0.245	– 164.2	4.26	82.0	0.110	67.8	0.343	– 39.5
0.90	0.247	– 170.8	3.82	78.4	0.121	67.7	0.331	– 39.8
1.00	0.250	– 176.5	3.46	75.1	0.133	67.4	0.322	– 40.6
1.20	0.259	173.3	2.93	69.3	0.156	66.6	0.309	– 42.1
1.40	0.260	163.6	2.56	63.7	0.179	65.5	0.302	– 44.3
1.50	0.260	159.4	2.41	61.1	0.190	65.0	0.303	– 45.6
1.60	0.263	156.6	2.28	58.5	0.203	64.4	0.302	– 47.8
1.80	0.272	150.1	2.06	53.5	0.225	62.8	0.297	– 51.8
2.00	0.292	145.6	1.89	49.1	0.247	61.1	0.289	– 55.7
I_C = 20 mA, V_{CE} = 10 V, Z_0 = 50 Ω								
0.10	0.403	– 56.5	19.41	141.7	0.023	72.0	0.776	– 25.1
0.20	0.328	– 93.7	13.70	120.1	0.038	67.2	0.586	– 35.0
0.30	0.284	– 117.6	10.11	107.8	0.050	67.2	0.477	– 37.5
0.40	0.264	– 134.7	7.93	99.7	0.061	68.2	0.415	– 37.6
0.50	0.253	– 146.4	6.50	93.8	0.073	68.9	0.381	– 37.4
0.60	0.245	– 155.7	5.50	88.8	0.085	69.4	0.359	– 37.2
0.70	0.244	– 163.7	4.77	84.6	0.097	69.5	0.344	– 37.5
0.80	0.246	– 169.7	4.23	80.8	0.109	69.3	0.333	– 38.0
0.90	0.250	– 175.5	3.79	77.3	0.121	69.1	0.323	– 38.3
1.00	0.253	179.6	3.44	74.1	0.133	68.7	0.316	– 39.1
1.20	0.265	170.3	2.91	68.3	0.156	67.8	0.303	– 40.8
1.40	0.268	160.7	2.54	62.8	0.179	66.5	0.298	– 43.2
1.50	0.268	157.3	2.39	60.3	0.191	65.9	0.300	– 44.5
1.60	0.271	154.0	2.26	57.7	0.203	65.2	0.299	– 46.8
1.80	0.280	147.9	2.04	52.7	0.226	63.5	0.295	– 51.0
2.00	0.299	143.9	1.87	48.3	0.248	61.8	0.287	– 55.0

SIEMENS

PNP Silicon RF Transistor

BFT 93

- For low-distortion broadband amplifiers up to 1 GHz at collector currents from 2 mA to 30 mA.



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

Type	Marking	Ordering Code (tape and reel)	Pin Configuration 1	2	3	Package[1]
BFT 93	X1	Q62702-F1063	B	E	C	SOT-23

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CEO}	12	V
Collector-base voltage	V_{CBO}	15	
Emitter-base voltage	V_{EBO}	2	
Collector current	I_C	35	mA
Peak collector current, $f \geq 10$ MHz	I_{CM}	50	
Total power dissipation, $T_S \leq 89$ °C[3]	P_{tot}	200	mW
Junction temperature	T_j	150	°C
Ambient temperature range	T_A	– 65 ... + 150	
Storage temperature range	T_{stg}	– 65 ... + 150	

Thermal Resistance

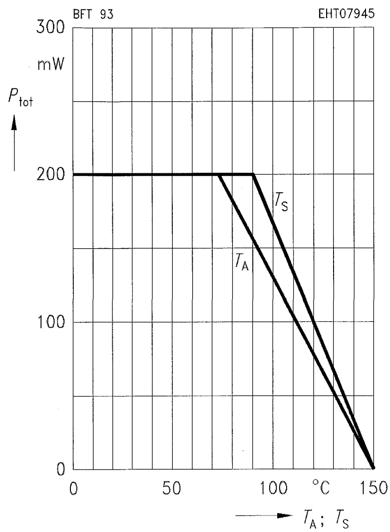
Parameter	Symbol	Values	Unit
Junction - ambient[2]	$R_{th\,JA}$	≤ 385	K/W
Junction - soldering point[3]	$R_{th\,JS}$	≤ 305	

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

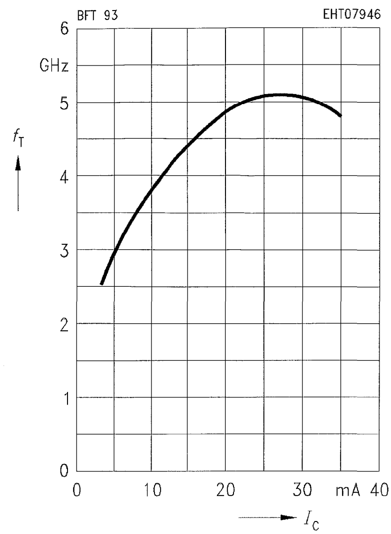
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CE0}$	12	–	–	V
Collector-base cutoff current V_{CB} = 5 V, I_E = 0	I_{CB0}	–	–	50	nA
DC current gain I_C = 30 mA, V_{CE} = 5 V	h_{FE}	20	50	–	–
AC Characteristics					
Transition frequency I_C = 30 mA, V_{CE} = 5 V, f = 500 MHz	f_T	–	5	–	GHz
Collector-base capacitance V_{CB} = 5 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{cb}	–	1	–	pF
Input capacitance V_{CE} = 0.5 V, I_C = i_c = 0, f = 1 MHz	C_{ibo}	–	1.8	–	
Noise figure I_C = 2 mA, V_{CE} = 5 V, f = 500 MHz, Z_S = Z_{Sopt}	F	–	2.4	–	dB
Power gain I_C = 30 mA, V_{CE} = 5 V, f = 500 MHz Z_S = Z_{Sopt}, Z_L = Z_{Lopt}	G_{pe}	–	16.5	–	

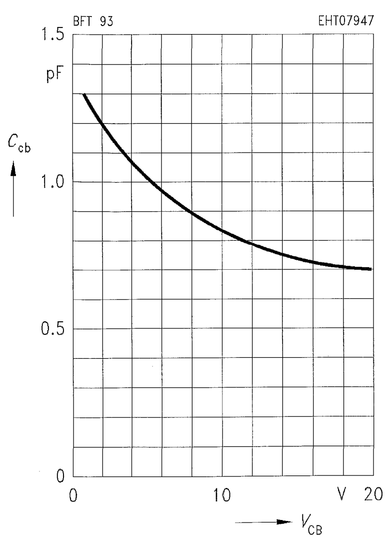
Total power dissipation $P_{tot} = f\,(T_A{}^*;\, T_S)$
* Package mounted on alumina



Transition frequency $f_T = f\,(I_C)$
V_{CE} = 5 V, f = 500 MHz



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

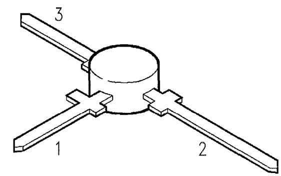


SIEMENS

NPN Silicon RF Transistor

BFT 97

- For low-noise IF and broadband amplifiers in antenna and telecommunications systems at collector currents from 2 mA to 20 mA.



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

Type	Marking	Ordering Code	Pin Configuration 1	2	3	Package[1]
BFT 97	BFT 97	Q62702-F514	E	C	B	T-plast

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CE0}	15	V
Collector-base voltage	V_{CB0}	20	
Emitter-base voltage	V_{EB0}	2.5	
Collector current	I_C	30	mA
Base current	I_B	4	
Total power dissipation, $T_S \leq 111$ ˚C[3]	P_{tot}	280	mW
Junction temperature	T_j	150	˚C
Ambient temperature range	T_A	– 65 ... + 150	
Storage temperature range	T_{stg}	– 65 ... + 150	

Thermal Resistance

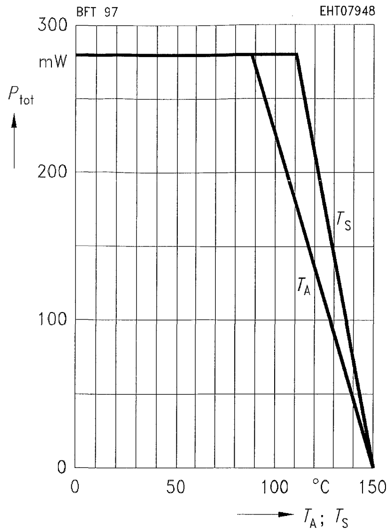
Junction - ambient[2]	$R_{th\,JA}$	≤ 220	K/W
Junction - soldering point[3]	$R_{th\,JS}$	≤ 140	

1) For detailed information 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.

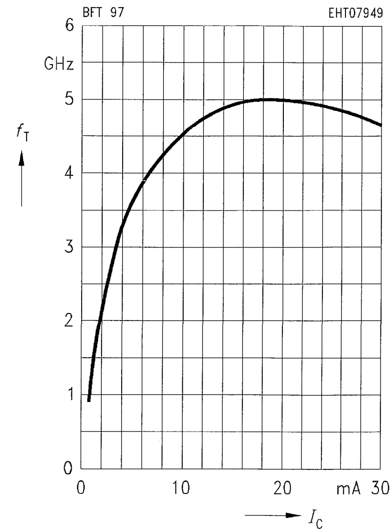
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CE0}$	15	–	–	V
Collector-emitter cutoff current V_{CE} = 20 V, V_{BE} = 0	I_{CES}	–	–	100	µA
Collector-base cutoff current V_{CB} = 10 V, I_E = 0	I_{CB0}	–	–	50	nA
Emitter-base cutoff current V_{EB} = 2.5 V, I_C = 0	I_{EB0}	–	–	100	µA
DC current gain I_C = 10 mA, V_{CE} = 6 V	h_{FE}	30	–	–	–
AC Characteristics					
Transition frequency I_C = 20 mA, V_{CE} = 6 V, f = 200 MHz	f_T	3.6	5	–	GHz
Collector-base capacitance V_{CB} = 6 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{cb}	–	0.49	–	pF
Collector-emitter capacitance V_{CE} = 6 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{ce}	–	0.32	–	
Output capacitance V_{CE} = 6 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{obs}	–	0.85	–	
Noise figure I_C = 3 mA, V_{CE} = 6 V, f = 10 MHz, Z_S = 75 Ω I_C = 3 mA, V_{CE} = 6 V, f = 200 MHz, Z_S = 75 Ω I_C = 4 mA, V_{CE} = 6 V, f = 800 MHz, Z_S = 60 Ω	F	 – – –	 0.9 1.2 2.1	 – – –	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

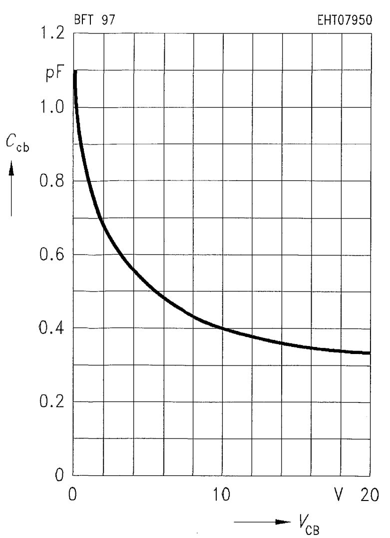
Total power dissipation $P_{tot} = f(T_A^*; T_S)$
* Package mounted on alumina



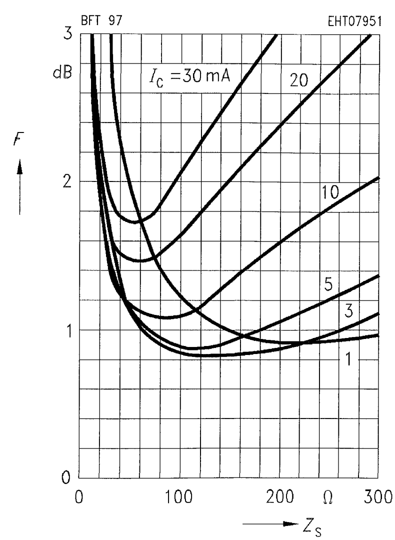
Transition frequency $f_T = f(I_C)$
V_{CE} = 6 V, f = 200 MHz



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



Noise figure $F = f(Z_S)$
V_{CE} = 6 V, f = 10 MHz

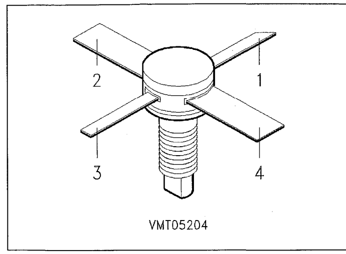


SIEMENS

NPN Silicon RF Transistors

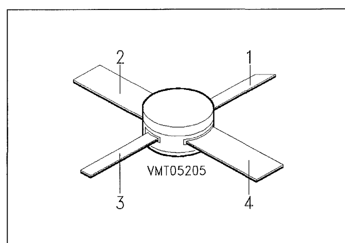
BFT 98
BFT 98B

- For low-distortion broadband amplifier output stages up to 1 GHz at collector currents up to 150 mA.
- With integrated emitter stabilizing resistors.



Type	Marking	Ordering Code	Pin Configuration 1	2	3	4	Package[1]
BFT 98	BFT 98	Q62702-F523	C	E	B	E	TO-117

- For low-distortion broadband amplifier output stages up to 1 GHz at collector currents up to 150 mA.
- With integrated emitter stabilizing resistors.



Type	Marking	Ordering Code	Pin Configuration 1	2	3	4	Package[1]
BFT 98B	BFT 98B	Q62702-F1084	C	E	B	E	TO-117

[1] For detailed information see chapter Package Outlines.

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CEO}	20	V
Collector-emitter voltage, $V_{BE} = 0$	V_{CES}	30	
Emitter-base voltage	V_{EBO}	3	
Collector current	I_C	200	mA
Peak collector current, $t \leq 100$ µs	I_{CM}	250	
Base current	I_B	50	
Total power dissipation, $T_C \leq 70$ °C[1)]	P_{tot}	2.25	W
Junction temperature	T_j	150	°C
Ambient temperature range	T_A	– 65 ... + 150	
Storage temperature range	T_{stg}	– 65 ... + 150	

Thermal Resistance

Junction - ambient	$R_{th\,JA}$	≤ 85	K/W
Junction - case (bottom plate)	$R_{th\,JC}$	≤ 35	

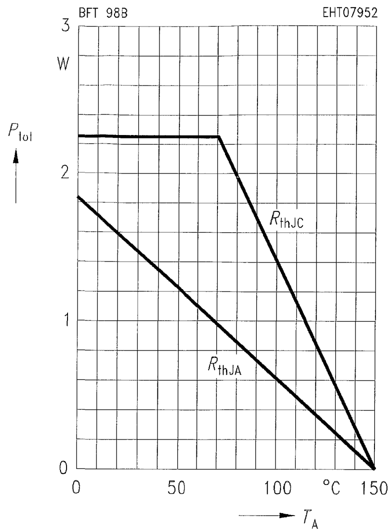
1) Package mounted on alumina 15 mm × 16.7 mm × 0.7 mm.

Electrical Characteristics

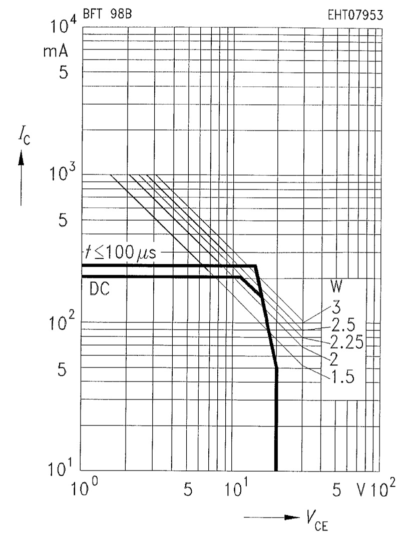
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
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
DC current gain I_C = 120 mA, V_{CE} = 5 V	h_{FE}	25	–	–	–
AC Characteristics					
Transition frequency I_C = 120 mA, V_{CE} = 5 V, f = 200 MHz	f_T	–	3.3	–	GHz
Collector-base capacitance V_{CB} = 15 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{cb}	–	0.75	1	pF
Power gain I_C = 120 mA, V_{CE} = 15 V, f = 800 MHz, $Z_S = Z_{Sopt}$, $Z_L = Z_{Lopt}$	G_{pe}	–	15	–	dB
Linear output voltage two-tone intermodulation test I_C = 120 mA, V_{CE} = 15 V, d_{IM} = 60 dB, f_1 = 806 MHz, f_2 = 810 MHz, $Z_S = Z_L$ = 50 Ω	$V_{o1} = V_{o2}$	–	800	–	mV
Third order intercept point I_C = 120 mA, V_{CE} = 15 V, f = 800 MHz	IP_3	–	41	–	dBm

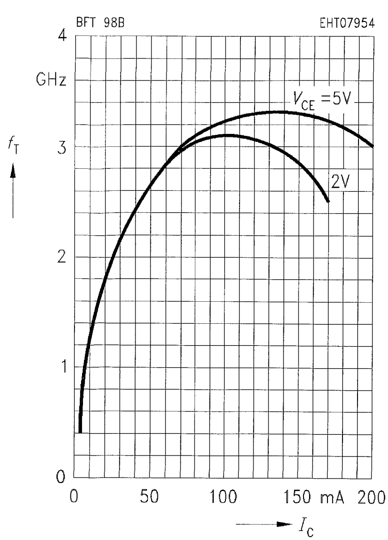
Total power dissipation $P_{tot} = f(T_A)$



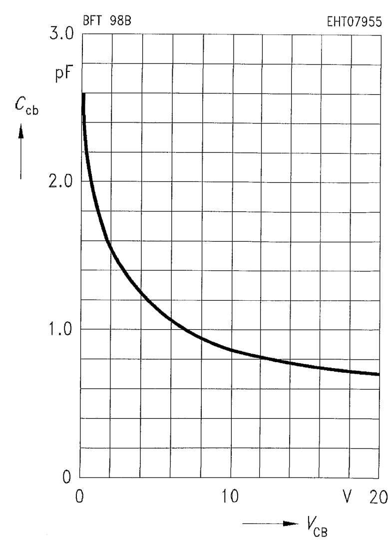
Operating range $I_C = f(V_{CE})$
T_C = 70 °C, $R_{th\,JC}$ = 35 K/W



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

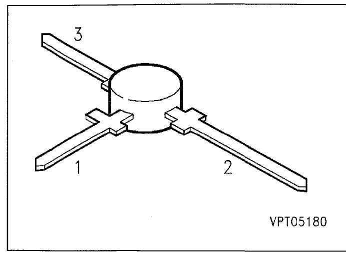


SIEMENS

NPN Silicon RF Transistor

BFT 98T

- For low-distortion broadband amplifier output stages up to 1 GHz at collector currents up to 120 mA and oscillators.



Type	Marking	Ordering Code	Pin Configuration 1	2	3	Package[1]
BFT 98T	BFT 98T	Q62702-F877	E	C	B	T-plast

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CEO}	20	V
Collector-emitter voltage, $V_{BE} = 0$	V_{CES}	30	
Emitter-base voltage	V_{EBO}	3	
Collector current	I_C	150	mA
Peak collector current, $f \geq 1$ MHz	I_{CM}	250	
Base current	I_B	50	
Total power dissipation, $T_A \leq 50$ ˚C[2]	P_{tot}	800	mW
Junction temperature	T_j	150	˚C
Ambient temperature range	T_A	– 65 … + 150	
Storage temperature range	T_{stg}	– 65 … + 150	

Thermal Resistance

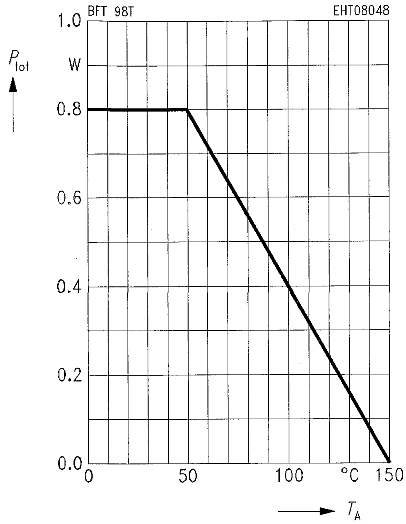
Junction - ambient[2]	$R_{th\,JA}$	≤ 125	K/W

1) For detailed information see chapter Package Outlines.
2) Package mounted on glass epoxy 35 mm × 35 mm × 1.5 mm.

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

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-base cutoff current V_{CB} = 15 V, I_E = 0	I_{CB0}	–	–	100	nA
DC current gain I_C = 80 mA, V_{CE} = 8 V	h_{FE}	25	50	–	–
AC Characteristics					
Transition frequency I_C = 80 mA, V_{CE} = 8 V, f = 200 MHz	f_T	–	3.2	–	GHz
Collector-base capacitance V_{CB} = 15 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{cb}	–	–	1	pF
Power gain I_C = 80 mA, V_{CE} = 8 V, f = 800 MHz, Z_S = Z_{Sopt}, Z_L = Z_{Lopt}	G_{pe}	–	12	–	dB
Linear output voltage two-tone intermodulation test I_C = 80 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}	–	420	–	mV
Third order intercept point I_C = 80 mA, V_{CE} = 8 V, f = 800 MHz	IP_3	–	35.5	–	dBm

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

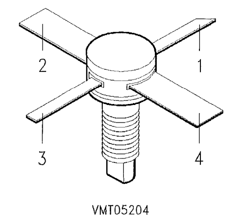


SIEMENS

NPN Silicon RF Transistors

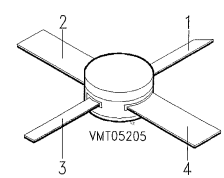
BFT 99
BFT 99A

- For low-distortion broadband amplifier output stages up to 1 GHz at collector currents up to 250 mA.
- With integrated emitter stabilizing resistors.



Type	Marking	Ordering Code	Pin Configuration 1	2	3	4	Package[1)]
BFT 99	BFT 99	Q62702-F524	C	E	B	E	TO-117

- For low-distortion broadband amplifier output stages up to 1 GHz at collector currents up to 250 mA.
- With integrated emitter stabilizing resistors.



Type	Marking	Ordering Code	Pin Configuration 1	2	3	4	Package[1)]
BFT 99A	BFT 99A	Q62702-F901	C	E	B	E	TO-117

1) For detailed information see chapter Package Outlines.

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CE0}	20	V
Collector-emitter voltage, $V_{BE} = 0$	V_{CES}	30	
Emitter-base voltage	V_{EB0}	3	
Collector current	I_C	350	mA
Peak collector current, $t \leq 100$ µs	I_{CM}	500	
Base current	I_B	50	
Total power dissipation, $T_C \leq 70$ ˚C[1]	P_{tot}	4	W
Junction temperature	T_j	150	˚C
Ambient temperature range	T_A	– 65 … + 150	
Storage temperature range	T_{stg}	– 65 … + 150	

Thermal Resistance

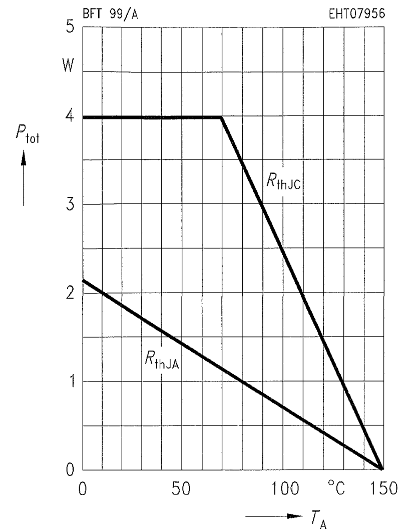
Parameter	Symbol	Values	Unit
Junction - ambient	$R_{th\,JA}$	≤ 70	K/W
Junction - case (bottom plate)	$R_{th\,JC}$	≤ 20	

1) Packages mounted on alumina 15 mm × 16.7 mm × 0.7 mm.

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

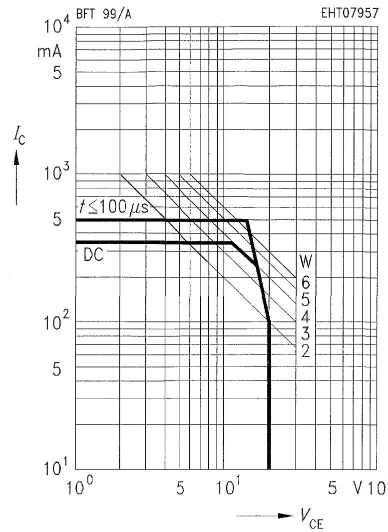
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-base cutoff current V_{CB} = 15 V, I_E = 0	I_{CB0}	–	–	200	nA
DC current gain I_C = 200 mA, V_{CE} = 15 V	h_{FE}	25	55	–	–
AC Characteristics					
Transition frequency I_C = 200 mA, V_{CE} = 15 V, f = 200 MHz	f_T	2.5	3.3	–	GHz
Collector-base capacitance V_{CB} = 15 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{cb}	–	1.5	1.9	pF
Power gain I_C = 240 mA, V_{CE} = 15 V, f = 800 MHz, $Z_S = Z_{Sopt}$, $Z_L = Z_{Lopt}$	G_{pe}	–	12	–	dB
Linear output voltage two-tone intermodulation test I_C = 240 mA, V_{CE} = 15 V, d_{IM} = 60 dB, f_1 = 806 MHz, f_2 = 810 MHz, $Z_S = Z_L$ = 50 Ω	$V_{o1} = V_{o2}$	–	1.4	–	V
Third order intercept point I_C = 240 mA, V_{CE} = 15 V, f = 800 MHz	IP_3	–	46	–	dBm

Total power dissipation $P_{tot} = f(T_A)$



Operating range $I_C = f(V_{CE})$

T_C = 70 °C, $R_{th\,JC} \leq$ 20 K/W

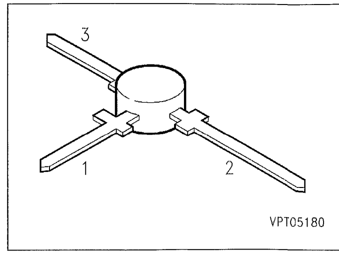


SIEMENS

NPN Silicon RF Transistor

BFW 92

- For broadband amplifiers up to 1 GHz at collector currents from 1 mA to 20 mA.



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

Type	Marking	Ordering Code	Pin Configuration 1	2	3	Package[1]
BFW 92	BFW 92	Q62702-F321	E	C	B	T-plast

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CE0}	15	V
Collector-base voltage	V_{CB0}	25	
Emitter-base voltage	V_{EB0}	2.5	
Collector current	I_C	25	mA
Peak base current, $f \geq 10$ MHz	I_{CM}	50	
Total power dissipation, $T_S \leq 101$ ˚C[3]	P_{tot}	280	mW
Junction temperature	T_j	150	˚C
Ambient temperature range	T_A	– 65 … + 150	
Storage temperature range	T_{stg}	– 65 … + 150	

Thermal Resistance

Junction - ambient[2]	$R_{th\,JA}$	≤ 255	K/W
Junction - soldering point[3]	$R_{th\,JS}$	≤ 175	

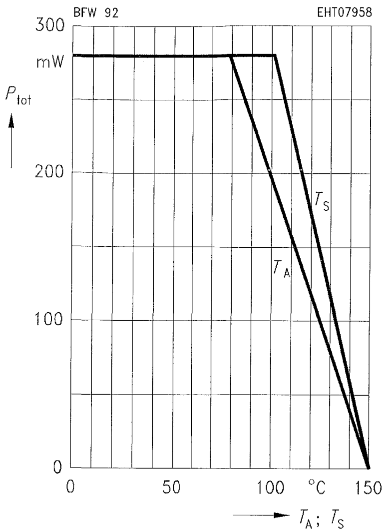
1) For detailed information see chapter Package Outlines.
2) Package mounted on alumina 15 mm × 16.7 mm × 0.7 mm.
3) T_S is measured on the collector lead at the soldering point to the pcb.

Electrical Characteristics

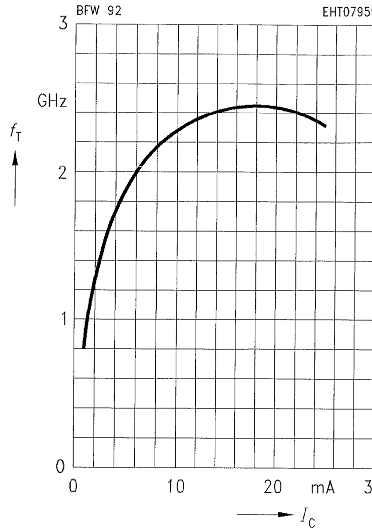
at T_A = 25 ˚C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CE0}$	15	–	–	V
Collector-base cutoff current V_{CB} = 10 V, I_E = 0	I_{CB0}	–	–	50	nA
Emitter-base cutoff current V_{EB} = 2.5 V, I_C = 0	I_{EB0}	–	–	100	µA
DC current gain I_C = 2 mA, V_{CE} = 1 V I_C = 25 mA, V_{CE} = 1 V	h_{FE}	 20 20	 – –	 150 –	–
Collector-emitter saturation voltage I_C = 20 mA, I_B = 1 mA	V_{CEsat}	–	–	0.75	V
AC Characteristics					
Transition frequency I_C = 14 mA, V_{CE} = 5 V, f = 200 MHz	f_T	–	2.4	–	GHz
Collector-base capacitance V_{CB} = 5 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{cb}	–	0.48	–	pF
Collector-emitter capacitance V_{CE} = 5 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{ce}	–	0.3	–	
Output capacitance V_{CE} = 5 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{obs}	–	0.8	–	
Noise figure I_C = 2 mA, V_{CE} = 5 V, f = 800 MHz, Z_S = 60 Ω	F	–	4	–	dB
Power gain I_C = 14 mA, V_{CE} = 5 V, f = 800 MHz, Z_S = 60 Ω, Z_L = Z_{Lopt}	G_{pe}	–	11	–	
Linear output voltage two-tone intermodulation test I_C = 14 mA, V_{CE} = 5 V, d_{IM} = 60 dB, f_1 = 806 MHz, f_2 = 810 MHz, Z_S = Z_L = 50 Ω	V_{o1} = V_{o2}	–	100	–	mV
Third order intercept point I_C = 14 mA, V_{CE} = 5 V, f = 800 MHz	IP_3	–	23	–	dBm

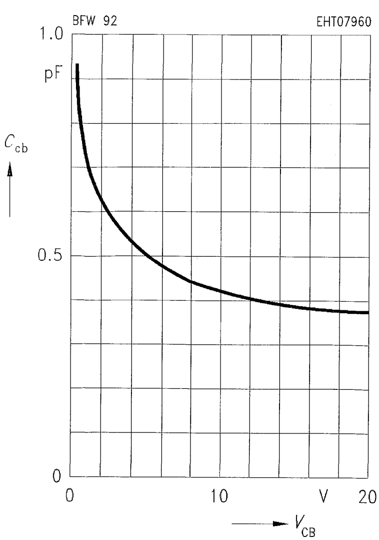
Total power dissipation $P_{tot} = f(T_A^*; T_S)$
*Package mounted on alumina



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

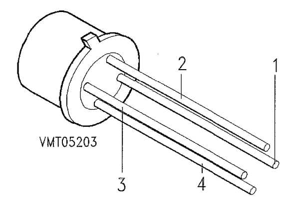


SIEMENS

NPN Silicon RF Transistor

BFX 59
BFX 59F

- For broadband amplifiers at collector currents up to 30 mA.



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

Type	Marking	Ordering Code	Pin Configuration 1	2	3	4	Package[1)]
BFX 59 BFX 59F	BFX 59 BFX 59F	Q60206-X59 Q60206-X59-S5	B	E	Case	C	TO-72

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CE0}	20	V
Collector-base voltage	V_{CB0}	30	
Emitter-base voltage	V_{EB0}	3	
Collector current	I_C	100	mA
Base current	I_B	30	
Total power dissipation, $T_A \leq 70$ ˚C	P_{tot}	370	mW
Junction temperature	T_j	200	˚C
Ambient temperature range	T_A	– 65 ... + 175	
Storage temperature range	T_{stg}	– 65 ... + 175	

Thermal Resistance

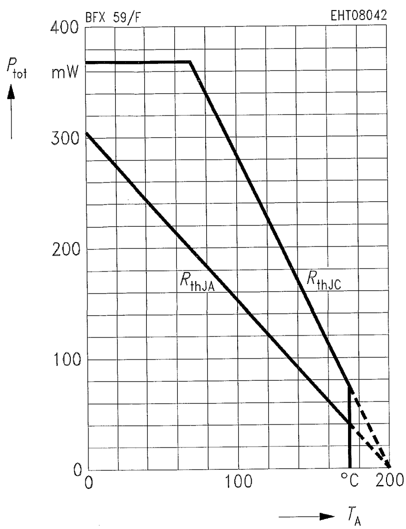
Junction - ambient	$R_{th\,JA}$	≤ 650	K/W
Junction - case	$R_{th\,JC}$	≤ 350	

1) For detailed information see chapter Package Outlines.

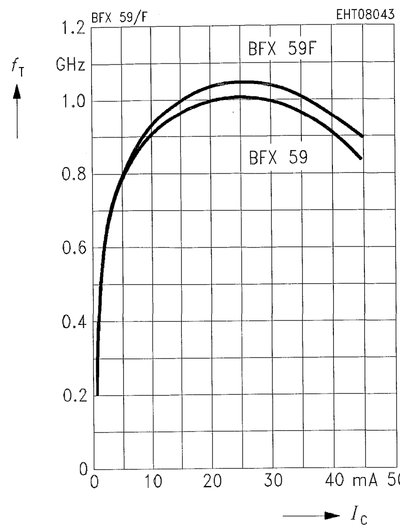
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CE0}$	20	–	–	V
Collector-base cutoff current V_{CB} = 20 V, I_E = 0	I_{CB0}	–	0.3	10	nA
Emitter-base cutoff current V_{EB} = 3 V, I_C = 0	I_{EB0}	–	–	10	µA
DC current gain I_C = 10 mA, V_{CE} = 10 V	h_{FE}	30	–	200	–
AC Characteristics					
Transition frequency I_C = 8 mA, V_{CE} = 10 V, f = 100 MHz I_C = 20 mA, V_{CE} = 10 V, f = 100 MHz BFX 59 BFX 59F I_C = 35 mA, V_{CE} = 10 V, f = 100 MHz BFX 59F	f_T	 600 700 700 700	 900 1000 1050 1000	 – – – –	GHz
Collector-base capacitance BFX 59 V_{CB} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz BFX 59F	C_{cb}	0.4 0.55	– –	0.7 0.9	pF
Noise figure I_C = 3 mA, V_{CE} = 10 V, f = 300 MHz, Z_S = 300 Ω I_C = 3 mA, V_{CE} = 10 V, f = 200 MHz, Z_S = 60 Ω	F	 – –	 2.6 3.4	 – 4.5	dB

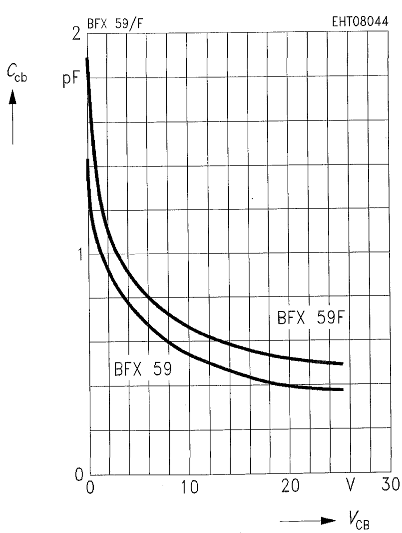
Total power dissipation $P_{tot} = f(T_A)$



Transition frequency $f_T = f(I_C)$
V_{CE} = 10 V, f = 100 MHz



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

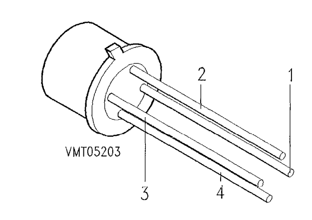


SIEMENS

NPN Silicon RF Transistor

BFX 60

- For broadband amplifiers at collector currents up to 15 mA.



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

Type	Marking	Ordering Code	Pin Configuration 1	2	3	4	Package[1]
BFX 60	BFX 60	Q60206-X60	E	B	Case	C	TO-72

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CE0}	25	V
Collector-base voltage	V_{CB0}	40	
Emitter-base voltage	V_{EB0}	4	
Collector current	I_C	25	mA
Total power dissipation, $T_A \leq 70$ °C	P_{tot}	370	mW
Junction temperature	T_j	200	°C
Ambient temperature range	T_A	– 65 ... + 175	
Storage temperature range	T_{stg}	– 65 ... + 175	

Thermal Resistance

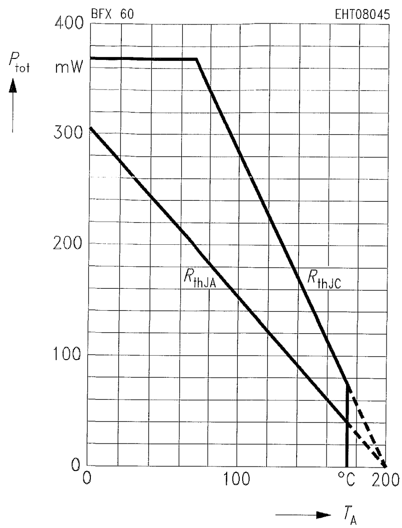
Junction - ambient	$R_{th JA}$	≤ 650	K/W
Junction - case	$R_{th JC}$	≤ 350	

1) For detailed information see chapter Package Outlines.

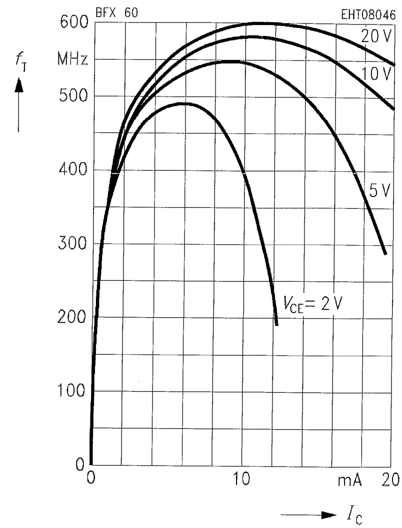
Electrical Characteristics
at T_A = 25 ˚C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-emitter breakdown voltage I_C = 2 mA, I_B = 0	$V_{(BR)CE0}$	25	–	–	V
Collector-emitter cutoff current V_{CE} = 40 V, V_{BE} = 0	I_{CES}	–	–	100	nA
Emitter-base cutoff current V_{EB} = 4 V, I_C = 0	I_{EB0}	–	–	1	µA
DC current gain I_C = 7 mA, V_{CE} = 10 V	h_{FE}	50	100	–	–
Base-emitter votage I_C = 7 mA, V_{CE} = 10 V	V_{BE}	–	0.74	0.9	V
AC Characteristics					
Transition frequency I_C = 5 mA, V_{CE} = 10 V, f = 100 MHz	f_T	400	550	–	MHz
Collector-base capacitance V_{CB} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{cb}	–	0.26	0.3	pF
Noise figure I_C = 2 mA, V_{CE} = 10 V, f = 200 MHz, Z_S = 60 Ω	F	–	5	–	dB

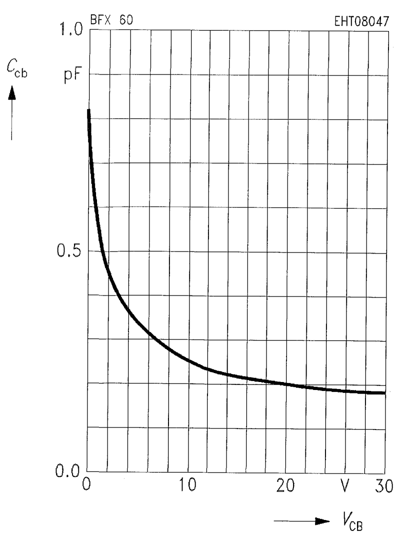
Total power dissipation $P_{tot} = f\ (T_A)$



Transition frequency $f_T = f\ (I_C)$
f = 100 MHz



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

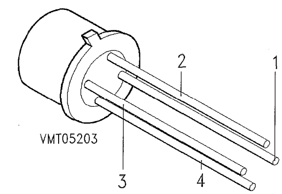


SIEMENS

NPN Silicon RF Transistor

BFY 90

- For broadband amplifiers up to 1 GHz and non-saturated switches at collector currents from 1 mA to 20 mA.
- CECC-type available: CECC 50002/253.



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]
BFY 90	BFY 90	Q62702-F297	B	E	Case	C	TO-72

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CE0}	15	V
Collector-base voltage	V_{CB0}	30	
Emitter-base voltage	V_{EB0}	2.5	
Collector current	I_C	25	mA
Peak collector current, $f \geq 10$ MHz	I_{CM}	50	
Total power dissipation, $T_A \leq 60$ ˚C	P_{tot}	200	mW
Junction temperature	T_j	200	˚C
Ambient temperature range	T_A	– 65 ... + 175	
Storage temperature range	T_{stg}	– 65 ... + 175	

Thermal Resistance

Junction - ambient	$R_{th\,JA}$	≤ 700	K/W
Junction - case	$R_{th\,JC}$	≤ 400	

[1] For detailed information see chapter Package Outlines.

Electrical Characteristics

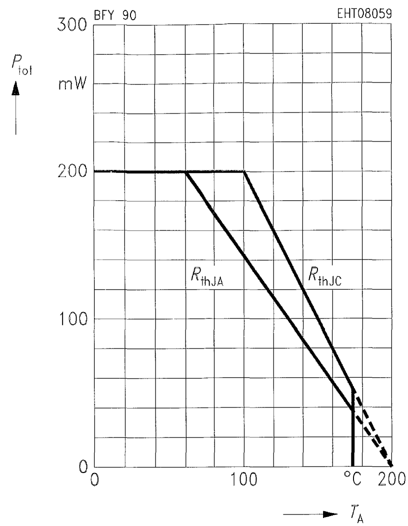
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CEO}$	15	–	–	V
Collector-base cutoff current V_{CB} = 15 V, I_E = 0	I_{CBO}	–	–	10	nA
Emitter-base cutoff current V_{EB} = 2 V, I_C = 0	I_{EBO}	–	–	0.05	µA
DC current gain I_C = 2 mA, V_{CE} = 1 V I_C = 25 mA, V_{CE} = 1 V	h_{FE}	 25 20	 – –	 150 125	–
Collector-emitter saturation voltage I_C = 20 mA, I_B = 1 mA	V_{CEsat}	–	–	0.75	V
Base-emitter voltage I_C = 2 mA, V_{BE} = 1 V	V_{BE}	–	–	0.8	

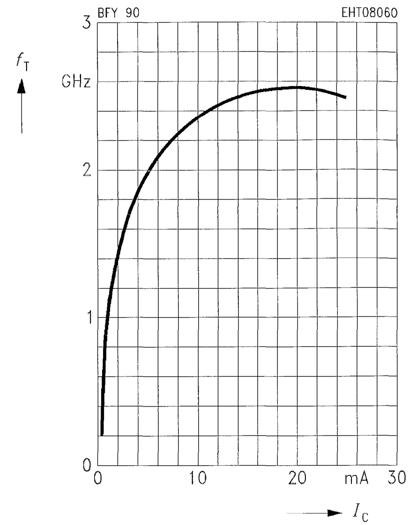
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
AC Characteristics					
Transition frequency I_C = 2 mA, V_{CE} = 5 V, f = 200 MHz I_C = 25 mA, V_{CE} = 5 V, f = 200 MHz	f_T	 1 1.5	 – –	 – –	GHz
Collector-base capacitance V_{CB} = 5 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{cb}	–	–	0.8	pF
Output capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{obs}	–	–	1.5	
Noise figure I_C = 2 mA, V_{CE} = 5 V, f = 800 MHz, Z_S = 50 Ω	F	–	–	6	
Power gain I_C = 14 mA, V_{CE} = 10 V, f = 200 MHz, Z_S = 60 Ω, Z_L = Z_{Lopt}	G_{pe}	–	23	–	dB
Transducer gain I_C = 12 mA, V_{CE} = 5 V, f = 500 MHz, Z_0 = 50 Ω	$\|S_{21e}\|^2$	–	10.3	–	
Linear output voltage two-tone intermodulation test I_C = 14 mA, V_{CE} = 5 V, d_{IM} = 60 dB, f_1 = 806 MHz, f_2 = 810 MHz, Z_S = Z_L = 50 Ω	V_{o1} = V_{o2}	–	150	–	mV
Third order intercept point I_C = 14 mA, V_{CE} = 5 V, f = 800 MHz	IP_3	–	26.5	–	dBm

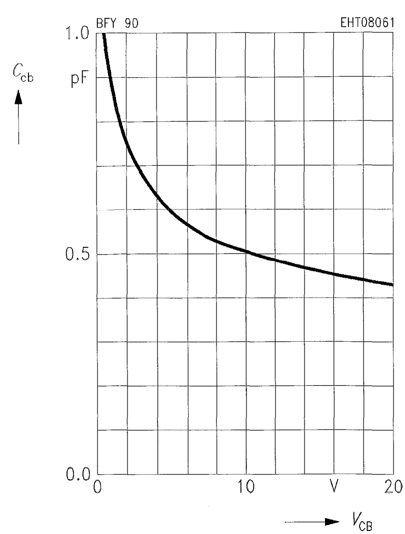
Total power dissipation $P_{tot} = f(T_A)$



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 S Parameters

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_C = 12 mA, V_{CE} = 5 V, Z_0 = 50 Ω								
0.2	0.252	– 77	7.354	107	0.056	77	0.596	– 13
0.3	0.156	– 97	5.142	97	0.078	81	0.535	– 12
0.4	0.127	– 119	3.970	91	0.102	85	0.524	– 9
0.5	0.125	– 136	3.287	86	0.123	87	0.483	– 9
0.6	0.136	– 147	2.821	83	0.146	88	0.477	– 11
0.7	0.144	– 152	2.434	81	0.168	90	0.469	– 13
0.8	0.155	– 156	2.155	76	0.187	91	0.472	– 15
0.9	0.156	– 155	2.026	74	0.210	91	0.483	– 17
1.0	0.149	– 153	1.850	72	0.229	93	0.490	– 20
1.1	0.135	– 148	1.692	70	0.249	94	0.525	– 21
1.2	0.117	– 141	1.578	68	0.267	96	0.537	– 21
1.3	0.095	– 130	1.468	65	0.273	96	0.575	– 23
1.4	0.077	– 111	1.373	62	0.286	95	0.608	– 24
1.5	0.072	– 87	1.275	58	0.300	95	0.644	– 25

GaAs FET

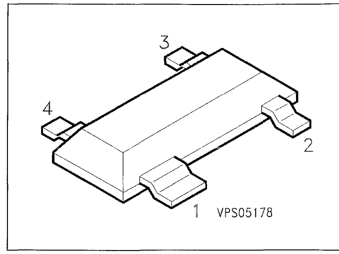
GaAs FET

SIEMENS

GaAs FET

CF 739

- N-channel dual-gate GaAs MES FET
- Depletion mode transistor for tuned small-signal applications up to 2 GHz, e. g. VHF, UHF, Sat-TV tuners
- Low noise
- High gain
- Low input capacitance



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]
CF 739	MS	Q62702-F1215	S	D	G_2	G_1	SOT-143

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	10	V
Gate 1-source voltage	$-V_{G1S}$	6	
Gate 2-source voltage	$-V_{G2S}$	6	
Drain current	I_D	80	mA
Gate 1-source peak current	$+I_{G1SM}$	1	
Gate 2-source peak current	$+I_{G2SM}$	1	
Total power dissipation, $T_S \leq 66$ ˚C[2]	P_{tot}	240	mW
Channel temperature	T_{ch}	150	˚C
Storage temperature range	T_{stg}	– 55 ... + 150	

Thermal Resistance

Channel - soldering point[3]	R_{thchs}	≤ 350	K/W

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

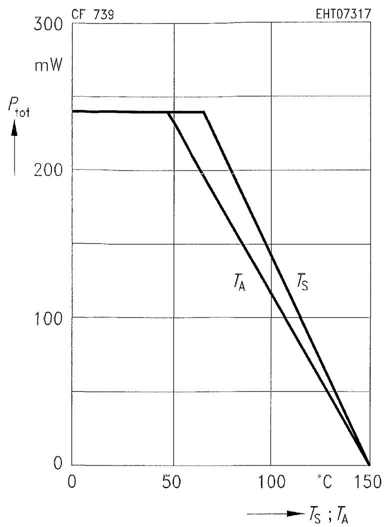
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Drain-source breakdown voltage I_D = 100 µA, $-V_{G1S} = -V_{G2S}$ = 4 V	$V_{(BR)DS}$	10	–	–	V
Gate 1 leakage current $-V_{G1S}$ = 5 V, $V_{G2S} = V_{DS}$ = 0	$-I_{G1SS}$	–	–	20	µA
Gate 2 leakage current $-V_{G2S}$ = 5 V, $V_{G1S} = V_{DS}$ = 0	$-I_{G2SS}$	–	–	20	
Drain current V_{G1S} = 0, V_{G2S} = 0, V_{DS} = 3 V	I_{DSS}	6	–	60	mA
Gate 1-source pinch-off voltage V_{G2S} = 0, V_{DS} = 5 V, I_D = 200 µA	$-V_{G1S(P)}$	–	–	2.5	V
Gate 2-source pinch-off voltage V_{G1S} = 0, V_{DS} = 5 V, I_D = 200 µA	$-V_{G2S(P)}$	–	–	2.5	

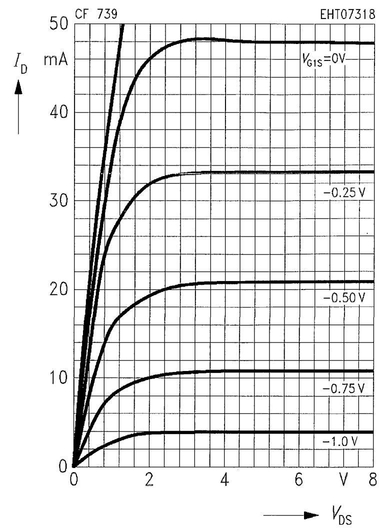
AC Characteristics

Parameter	Symbol	min.	typ.	max.	Unit
Forward transconductance V_{DS} = 5 V, V_{G2S} = 2 V, I_D = 10 mA, f = 1 kHz	g_{fs}	–	25	–	mS
Gate 1 input capacitance V_{G2S} = 2 V, V_{DS} = 5 V, I_D = 10 mA, f = 1 MHz	C_{gfss}	–	0.95	–	pF
Output capacitance V_{G2S} = 2 V, V_{DS} = 5 V, I_D = 10 mA, f = 1 MHz	C_{dss}	–	0.5	–	
Noise figure V_{G2S} = 2 V, V_{DS} = 5 V, I_D = 10 mA, f = 1.75 GHz V_{G2S} = 2 V, V_{DS} = 5 V, I_D = 10 mA, f = 800 MHz	F	 – –	 1.8 1.1	 – –	dB
Power gain V_{G2S} = 2 V, V_{DS} = 5 V, I_D = 10 mA, f = 1.75 GHz V_{G2S} = 2 V, V_{DS} = 5 V, I_D = 10 mA, f = 800 MHz	G_{ps}	 – –	 17 22	 – –	
Control range V_{G2S} = 2 V … – 3 V	ΔG_{psc}	–	50	–	

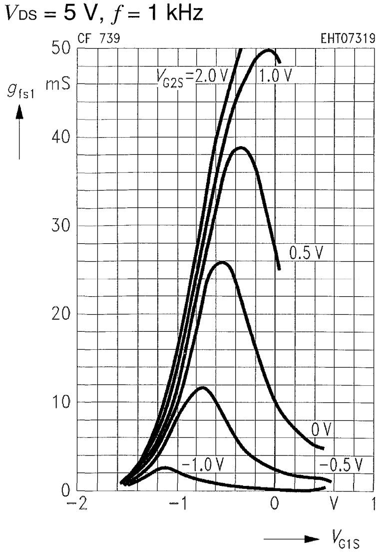
Total power dissipation $P_{tot} = f(T_A^*; T_S)$
*Package mounted on alumina



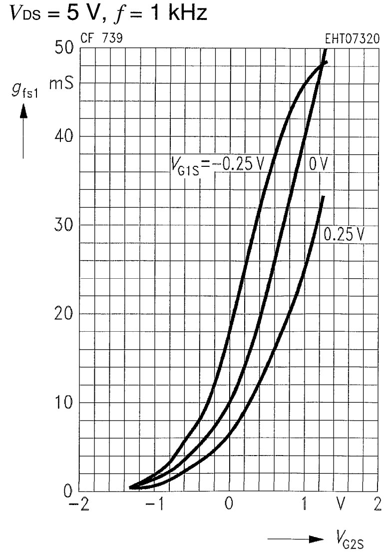
Output characteristics $I_D = f(V_{DS})$
V_{G2S} = 2 V



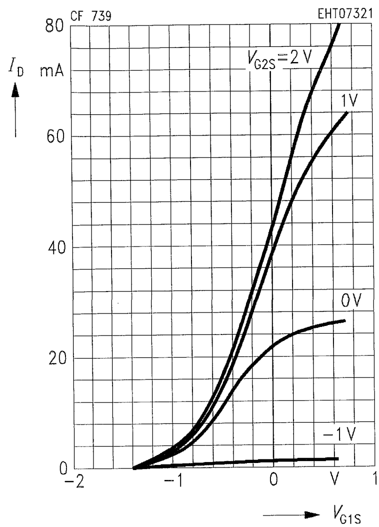
Gate 1 forward transconductance
$g_{fs1} = f(V_{G1S})$
V_{DS} = 5 V, f = 1 kHz



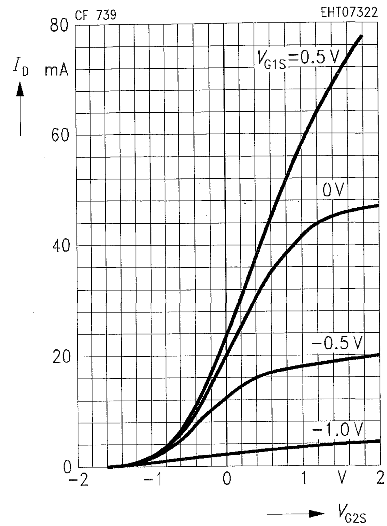
Gate 1 forward transconductance
$g_{fs1} = f(V_{G2S})$
V_{DS} = 5 V, f = 1 kHz



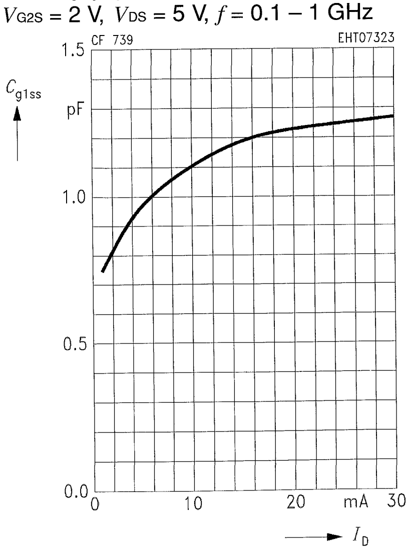
Drain current $I_D = f(V_{G1S})$
V_{DS} = 5 V



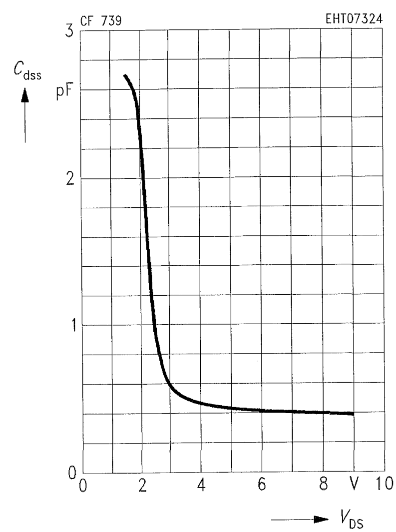
Drain current $I_D = f(V_{G2S})$
V_{DS} = 5 V



Gate 1 input transconductance $C_{g1ss} = f(I_D)$
V_{G2S} = 2 V, V_{DS} = 5 V, f = 0.1 – 1 GHz

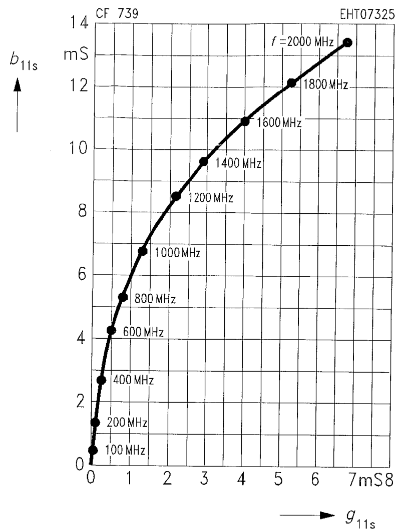


Output capacitance $C_{dss} = f(V_{DS})$
V_{G2S} = 2 V, I_D = 10 mA, f = 0.1 – 1 GHz

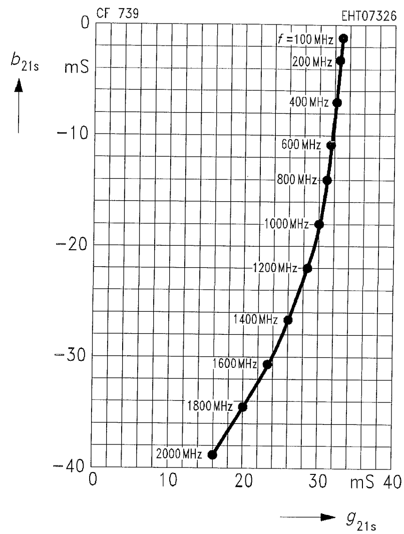


Common Source Admittance Parameters, G_2 RF grounded

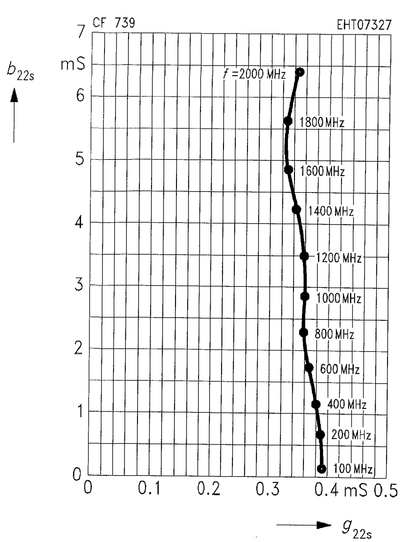
Gate 1 input admittance y_{11s}
V_{DS} = 5 V, V_{G2S} = 2 V, I_D = 10 mA



Gate 1 forward transfer admittance y_{21s}
V_{DS} = 5 V, V_{G2S} = 2 V, I_D = 10 mA



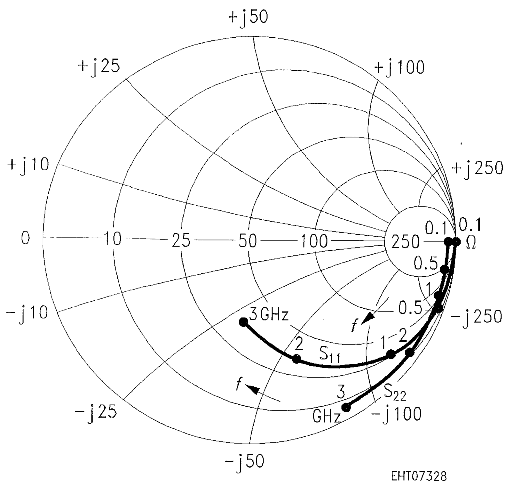
Output admittance y_{22s}
V_{DS} = 5 V, V_{G2S} = 2 V, I_D = 10 mA



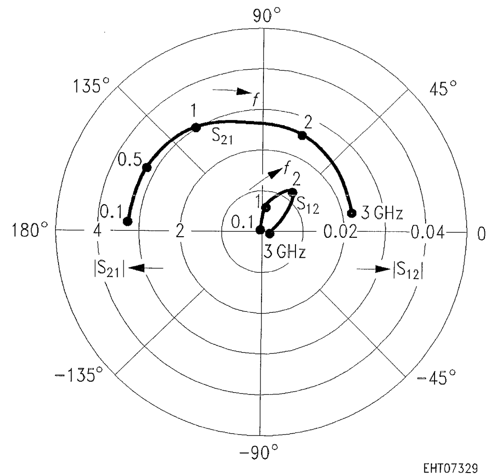
Common Source S-Parameters, G_2 RF grounded

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**
V_{DS} = 5 V, V_{G2S} = 2 V, I_D = 10 mA, Z_0 = 50 Ω								
0.06	0.999	– 2.4	3.21	176.9	0.001	81.8	0.963	– 1.0
0.08	0.998	– 3.2	3.21	175.5	0.001	85.8	0.963	– 1.4
0.10	0.998	– 4.1	3.21	174.3	0.001	90.8	0.962	– 1.7
0.15	0.997	– 6.0	3.22	171.4	0.002	84.2	0.962	– 2.5
0.20	0.993	– 8.0	3.22	168.4	0.002	88.1	0.962	– 3.4
0.25	0.989	– 10.1	3.21	165.5	0.003	84.4	0.962	– 4.3
0.30	0.987	– 12.1	3.21	162.5	0.003	83.3	0.962	– 5.2
0.40	0.975	– 16.0	3.18	156.6	0.004	79.6	0.961	– 6.8
0.50	0.965	– 19.9	3.15	150.7	0.005	78.6	0.960	– 8.5
0.60	0.951	– 23.8	3.12	145.0	0.006	78.0	0.960	– 10.3
0.70	0.935	– 27.5	3.09	139.3	0.007	76.6	0.961	– 12.0
0.80	0.918	– 31.4	3.05	134.0	0.008	73.3	0.958	– 13.7
0.90	0.900	– 35.2	3.03	128.5	0.009	70.4	0.956	– 15.4
1.00	0.877	– 39.0	3.02	122.9	0.009	69.5	0.955	– 17.0
1.20	0.883	– 46.6	2.96	111.4	0.010	66.4	0.953	– 20.6
1.40	0.773	– 53.7	2.85	99.7	0.011	59.9	0.949	– 24.3
1.50	0.744	– 56.8	2.77	94.4	0.012	59.9	0.949	– 26.2
1.60	0.720	– 60.1	2.74	89.2	0.012	57.5	0.949	– 27.9
1.80	0.666	– 66.2	2.64	78.9	0.012	54.1	0.948	– 31.5
2.00	0.614	– 72.8	2.59	68.6	0.012	49.2	0.945	– 35.3
2.20	0.556	– 80.3	2.53	57.4	0.012	43.7	0.941	– 39.4
2.40	0.497	– 87.2	2.45	45.6	0.010	39.4	0.937	– 44.4
2.50	0.466	– 90.2	2.38	40.0	0.009	35.2	0.936	– 47.0
2.60	0.449	– 92.8	2.34	34.5	0.008	32.2	0.936	– 49.6
2.80	0.408	– 97.1	2.24	23.6	0.005	25.1	0.937	– 54.6
3.00	0.375	– 101.7	2.17	12.2	0.002	– 25.0	0.934	– 59.1

S_{11}, $S_{22} = f(f)$, Z-plane
V_{DS} = 5 V, V_{G2S} = 2 V, I_D = 10 mA, Z_0 = 50 Ω



S_{12}, $S_{21} = f(f)$
V_{DS} = 5 V, V_{G2S} = 2 V, I_D = 10 mA, Z_0 = 50 Ω

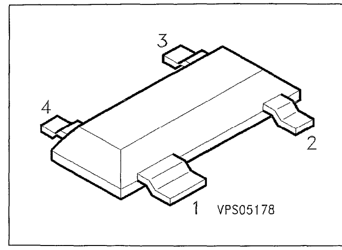


SIEMENS

GaAs FET

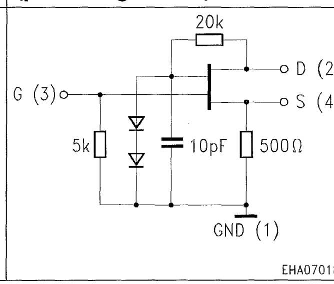
CF 750

Preliminary Data



- Biased dual gate GaAs FET
- For frequencies from 400 MHz to 3 GHz
- Mixer and amplifier applications in handheld equipment
- Low power, 2 mA operating current
- Operating voltage range: 3 to 6 V
- All gold metallisation
- Chip fully passivated
- Ion-implanted planar structure

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

Type	**Marking**	**Ordering Code**	**Circuit diagram (pin configuration)**	**Package**[1]
CF 750	MX	Q62702-F1391		SOT-143

Maximum Ratings

Parameter	**Symbol**	**Values**	**Unit**
Drain-source voltage	V_{DS}	8	V
Gate-source voltage	$-V_{GS}$	5	
Drain current	I_D	80	mA
Gate-source peak current	$+I_{GSM}$	2	
Total power dissipation, $T_S \leq 48$ °C [2]	P_{tot}	300	mW
Channel temperature	T_{ch}	150	°C
Storage temperature range	T_{stg}	– 55 … + 125	

Thermal Resistance

Channel - soldering point [2]	$R_{th\,chS}$	≤ 340	K/W

[1] For detailed information see chapter Package Outlines.

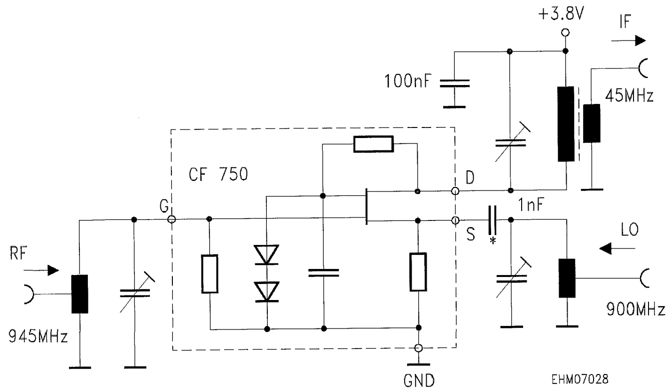
[2] T_S is measured on the GND lead at the soldering point to the pcb.

Electrical Characteristics

at T_A = 25 °C, unless otherwise specified, (for application circuit see next page).

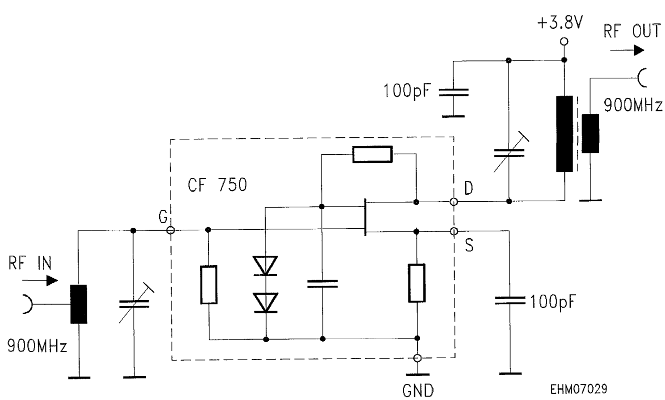
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Drain-source breakdown voltage I_D = 500 µA, – V_{GS} = 4 V	$V_{(BR)DS}$	8	–	–	V
Drain current V_{GGND} =0 V, V_{DS} = 3.8 V S-pin not connected	$I_{DSS,P}$	1.6	2	2.8	mA
Drain current V_{GS} =0 V, V_{DS} = 3.8 V S connected to GND	I_{DSS}	–	50	–	
Transconductance I_D =10 mA, V_{DS} = 3.8 V S connected to GND	g_m	–	25	–	ms
Power gain V_{DGND} = 3.8 V, I_D = 2 mA, f = 900 MHz V_{DGND} = 3.8 V, I_D = 2 mA, f = 1.8 GHz	G_{ps}	– –	11 9	– –	dB
Noise figure V_{DGND} = 3.8 V, I_D = 2 mA, f = 900 MHz V_{DGND} = 3.8 V, I_D = 2 mA, f = 1.8 GHz	F	– –	1.6 1.9	– –	

Mixer measurement and application circuit

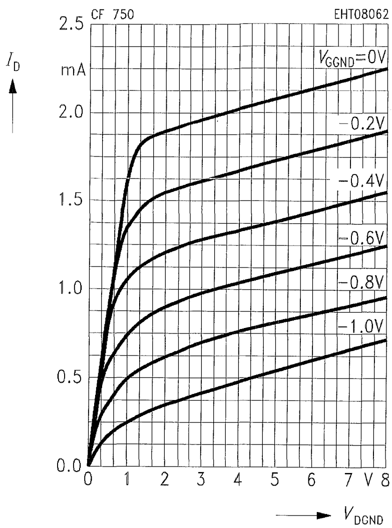


* Must be high capacitance to ensure good I_F grounding at source.

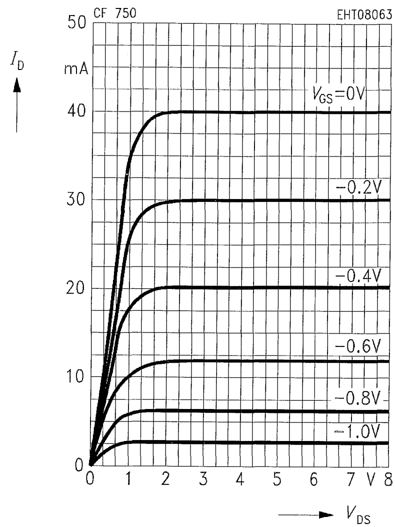
Amplifier measurement and application circuit



Output characteristics $I_D = f(V_{DGND})$
at nominal operating point, S not connected



Output characteristics $I_D = f(V_{DS})$
S connected to GND



S Parameters

Bias conditions: V_{DGND} = 3.8 V, I_D = 2 mA

Source-pad RF-grounded by capacitor with low inductance (< 0.5 nH)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**
0.01	0.97	– 1	1.78	179	0.002	89	0.98	– 1
0.10	0.97	– 3	1.78	175	0.008	84	0.98	– 2
0.25	0.96	– 8	1.76	169	0.015	78	0.97	– 6
0.50	0.94	– 16	1.73	155	0.027	75	0.95	– 11
0.75	0.91	– 26	1.70	141	0.039	71	0.93	– 16
1.00	0.87	– 34	1.68	127	0.046	64	0.91	– 22
1.25	0.83	– 42	1.65	118	0.054	62	0.89	– 26
1.50	0.78	– 49	1.62	108	0.061	57	0.88	– 30
1.75	0.72	– 57	1.59	95	0.066	55	0.87	– 34
2.00	0.66	– 65	1.54	82	0.069	52	0.86	– 38
2.25	0.61	– 73	1.51	71	0.071	54	0.85	– 43
2.50	0.56	– 81	1.47	60	0.073	60	0.84	– 48
2.75	0.52	– 87	1.45	52	0.074	63	0.83	– 52
3.00	0.49	– 93	1.42	45	0.075	66	0.82	– 56

Note:

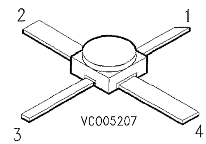
- Parameters are also valid for other V_{DGND} between 3.8 and 5.0 V.
- for I_D = 1.6 mA MAG [S_{21}] is about 10% lower than the above values.
- for I_D = 2.8 mA MAG [S_{21}] is about 20% higher than the above values.

SIEMENS

GaAs FET

CFY 10

- Low noise
- High gain
- Suitable up to 14 GHz
- Ion-implanted planar structure
- All gold metallization



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)]
CFY 10	A1	Q62703-F11	D	S	G	S	100 mil

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	5	V
Gate-source voltage	V_{GS}	– 5 … + 0.5	
Drain current	I_D	100	mA
Total power dissipation	P_{tot}	500	mW
Channel temperature	T_{ch}	125	˚C
Storage temperature range	T_{stg}	– 65 … + 125	

Thermal Resistance

Channel - case	R_{thchC}	200	K/W

1) For detailed information see chapter Package Outlines.

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

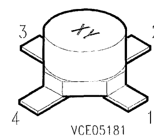
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Drain-source saturation current V_{DS} = 4 V, V_{GS} = 0	I_{DSS}	20	50	100	mA
Pinch-off voltage V_{DS} = 4 V, I_D = 1 mA	V_P	– 0.5	– 1.3	– 4.0	V
Transconductance V_{DS} = 4 V, I_D = 15 mA	g_m	20	45	–	mS
Gate leakage current V_{DS} = 4 V, I_D = 15 mA	I_G	–	0.1	2.0	µA
Maximum available gain I_{DS} = 30 mA, V_{DS} = 4 V, f = 4 GHz f = 6 GHz f = 12 GHz	MAG	 – – –	 16.5 13 8	 – – –	dB
Noise figure V_{DS} = 4 V, I_{DS} = 15 mA, f = 4 GHz f = 6 GHz f = 12 GHz	F_{min}	 – – –	 1.3 1.6 3.3	 – 1.8 –	
Associated gain V_{DS} = 4 V, I_{DS} = 15 mA, f = 4 GHz f = 6 GHz f = 12 GHz	G_a	 – 9.5 –	 12 10 6.5	 – – –	

SIEMENS

GaAs FET

CFY 19

- Low noise
- High gain
- Ion-implanted planar structure
- All gold metallization
- For front ends
- For oscillators
- For antenna amplifiers from UHF up to 12 GHz
- Hi rel/MIL tested upon request



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)]
CFY 19-18 CFY 19-22	A1 A2	Q62703-F14 Q62703-F3	D	S	G	S	Cerec-X

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	6	V
Drain-gate voltage	V_{DG}	8	
Gate-source voltage	V_{GS}	– 5 … + 0.5	
Drain current	I_D	80	mA
Total power dissipation, $T_S \leq 68$ ˚C[2)]	P_{tot}	300	mW
Channel temperature	T_{ch}	150	˚C
Storage temperature range	T_{stg}	– 65 … + 150	

Thermal Resistance

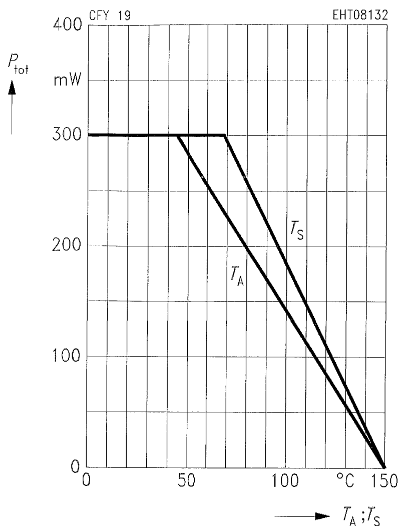
Channel - soldering point[2)]	$R_{th\,chS}$	≤ 275	K/W

1) For detailed information see chapter Package Outlines.
2) T_S is measured on the source lead at the soldering point to the pcb.

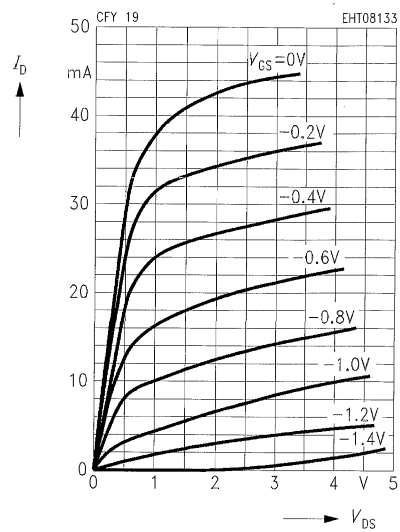
Electrical Characteristics
at T_A = 25 ˚C, unless otherwise specified.

Parameter		Symbol	Values			Unit
			min.	typ.	max.	
Drain current V_{DS} = 3.5 V, V_{GS} = 0		I_{DSS}	20	50	80	mA
Pinch-off voltage I_D = 1 mA, V_{DS} = 3.5 V		V_p	– 0.5	– 1.3	– 4	V
Transconductance I_D = 15 mA, V_{DS} = 3.5 V	 CFY 19-18 CFY 19-22	g_m	 20 20	 30 25	 – –	mS
Gate leakage current I_D = 15 mA, V_{DS} = 3.5 V		I_G	–	0.1	2	µA
Noise figure I_D = 15 mA, V_{DS} = 3.5 V f= 4 GHz f= 6 GHz	 CFY 19-18 CFY 19-22 CFY 19-18 CFY 19-22	F	 – – – –	 1.2 1.4 1.7 1.9	 – – 1.8 2.2	dB
Power gain at noise matching I_{DS} = 15 mA, V_{DS} = 3.5 V f= 4 GHz f= 6 GHz	 CFY 19-18 CFY 19-22 CFY 19-18 CFY 19-22	G_a	 – – 9.5 9.0	 13 12 10 10	 – – – –	

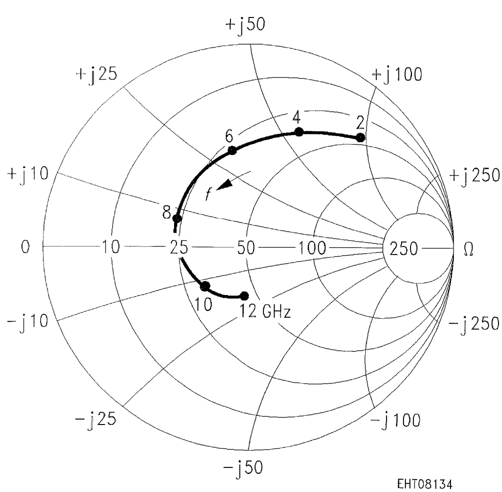
Total power dissipation $P_{tot} = f(T_S; T_A^*)$
* Package mounted on alumina



Output characteristics $I_D = f(V_{DS})$



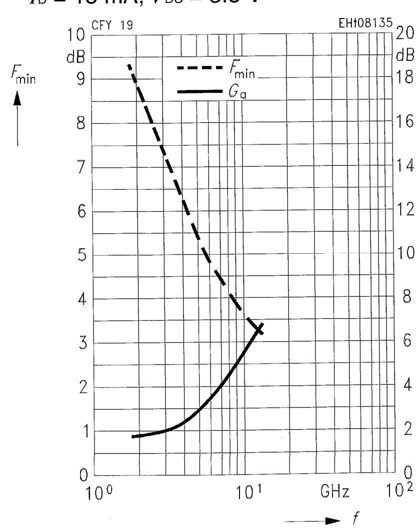
Source impedance for min. noise figure
I_D = 15 mA, V_{DS} = 3.5 V



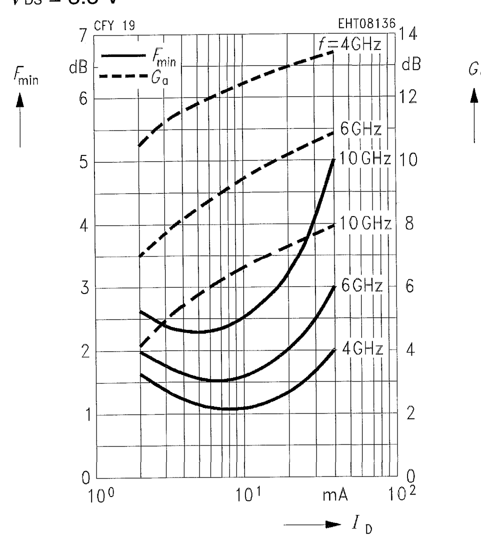
Noise Parameter CFY 19-18

f	F_{min}	G_a	Γ_{opt}		R_N	N	$F_{50\Omega}$
GHz	dB	dB	MAG	ANG	Ω	–	dB
I_D = 15 mA, V_{DS} = 3.5 V							
2	0.9	18	0.74	49	36	0.13	2.7
4	1.2	13	0.58	73	24	0.19	2.4
6	1.7	10	0.48	104	17	0.26	2.6
8	2.3	8	0.36	159	8	0.32	2.7
10	2.9	7	0.30	– 144	11	0.33	3.2
12	3.5	6	0.23	– 99	26	0.50	3.7

CFY 19-18
Minimum noise figure $F_{min} = f\ (f)$
Associated gain $G_a = f\ (f)$
I_D = 15 mA, V_{DS} = 3.5 V



CFY 19-18
Minimum noise figure $F_{min} = f\ (I_D)$
Associated gain $G_a = f\ (I_D)$
V_{DS} = 3.5 V



Common Source S Parameters

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_D = 10 mA, V_{DS} = 3.5 V, Z_0 = 50 Ω								
0.1	1.00	– 1.8	2.29	178.1	0.002	72.8	0.76	– 0.8
0.2	1.00	– 3.5	2.29	175.9	0.005	86.2	0.76	– 2.2
0.4	1.00	– 7.6	2.30	171.4	0.010	86.2	0.76	– 4.6
0.6	1.00	– 11.4	2.30	167.1	0.015	78.7	0.76	– 7.2
0.8	0.99	– 15.6	2.31	162.7	0.020	78.6	0.76	– 9.7
1.0	0.99	– 19.8	2.31	158.2	0.024	74.3	0.75	– 12.4
1.2	0.98	– 23.8	2.31	153.9	0.029	71.8	0.75	– 14.9
1.4	0.97	– 27.8	2.31	149.6	0.034	69.5	0.75	– 17.4
1.6	0.97	– 31.9	2.32	145.3	0.039	67.2	0.74	– 20.1
1.8	0.96	– 36.2	2.33	140.9	0.044	63.7	0.74	– 22.8
2.0	0.95	– 40.5	2.34	136.1	0.048	60.4	0.73	– 25.6
2.2	0.94	– 44.9	2.34	131.7	0.053	57.4	0.73	– 28.4
2.4	0.92	– 49.3	2.34	127.1	0.058	54.1	0.72	– 31.3
2.6	0.91	– 54.3	2.35	122.4	0.062	51.5	0.71	– 34.4
2.8	0.90	– 59.0	2.35	117.6	0.066	47.9	0.70	– 37.5
3.0	0.88	– 63.8	2.34	112.9	0.070	44.8	0.69	– 40.5
3.2	0.87	– 68.5	2.34	108.2	0.073	41.9	0.69	– 43.5
3.4	0.85	– 73.5	2.33	103.5	0.076	38.8	0.67	– 46.7
3.6	0.83	– 78.2	2.33	98.8	0.080	35.7	0.66	– 49.7
3.8	0.81	– 83.2	2.31	94.1	0.082	32.8	0.65	– 52.8
4.0	0.80	– 87.9	2.30	89.5	0.085	29.8	0.64	– 55.8
4.2	0.78	– 92.9	2.29	84.8	0.087	26.8	0.63	– 59.0
4.4	0.76	– 97.9	2.27	80.3	0.089	24.2	0.62	– 61.9
4.6	0.74	– 102.8	2.25	75.7	0.091	21.5	0.61	– 65.1
4.8	0.73	– 107.8	2.23	71.2	0.092	19.0	0.61	– 68.0
5.0	0.71	– 112.6	2.21	66.7	0.093	16.6	0.60	– 71.1
5.2	0.69	– 117.6	2.19	62.2	0.094	13.9	0.59	– 74.0
5.4	0.68	– 122.3	2.17	58.0	0.095	11.8	0.58	– 77.0
5.6	0.66	– 127.2	2.15	53.6	0.096	9.4	0.58	– 79.8
5.8	0.64	– 132.1	2.12	49.3	0.097	7.5	0.57	– 82.7
6.0	0.63	– 137.0	2.10	45.2	0.097	5.5	0.56	– 85.5
6.2	0.61	– 142.0	2.08	40.9	0.098	3.3	0.56	– 88.3
6.4	0.60	– 146.9	2.06	36.8	0.098	1.7	0.55	– 91.1
6.6	0.58	– 152.1	2.04	32.6	0.098	– 0.2	0.54	– 94.0
6.8	0.57	– 157.2	2.01	28.5	0.098	– 1.7	0.53	– 96.8
7.0	0.56	– 162.4	1.99	24.4	0.097	– 3.3	0.52	– 99.7
7.2	0.54	– 167.3	1.97	20.7	0.098	– 4.4	0.51	– 102.4
7.4	0.53	– 172.6	1.96	16.7	0.098	– 5.6	0.51	– 105.3
7.6	0.52	– 178.3	1.93	12.5	0.098	– 7.2	0.50	– 108.3
7.8	0.52	176.1	1.91	8.5	0.097	– 8.4	0.49	– 111.3
8.0	0.51	170.5	1.89	4.3	0.098	– 9.5	0.48	– 114.4
8.2	0.50	165.1	1.87	0.3	0.098	– 10.7	0.48	–117.6

Common Source S Parameters (continued)

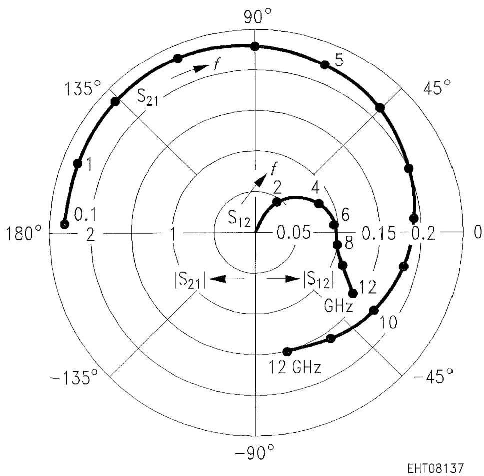
f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_D = 10 mA, V_{DS} = 3.5 V, Z_0 = 50 Ω								
8.4	0.50	159.9	1.85	– 3.6	0.099	– 11.4	0.47	– 120.8
8.6	0.49	154.6	1.82	– 7.6	0.099	– 12.0	0.46	– 124.2
8.8	0.49	149.5	1.81	– 11.5	0.100	– 12.8	0.46	– 127.6
I_D = 30 mA, V_{DS} = 3.5 V, Z_0 = 50 Ω								
0.1	1.00	– 2.2	3.26	177.8	0.001	98.5	0.74	– 1.0
0.2	1.00	– 4.2	3.27	175.4	0.003	75.4	0.73	– 2.0
0.4	1.00	– 9.1	3.28	170.3	0.008	79.8	0.73	– 4.6
0.6	0.99	– 13.7	3.27	165.5	0.013	82.0	0.73	– 7.1
0.8	0.99	– 18.6	3.27	160.6	0.017	77.1	0.73	– 9.7
1.0	0.98	– 23.6	3.26	155.5	0.021	74.5	0.72	– 12.3
1.2	0.97	– 28.4	3.25	150.7	0.024	72.4	0.72	– 14.7
1.4	0.96	– 33.1	3.24	145.9	0.029	69.2	0.71	– 17.2
1.6	0.94	– 38.0	3.24	141.1	0.032	65.9	0.71	– 19.7
1.8	0.93	– 43.0	3.24	136.1	0.036	63.5	0.70	– 22.4
2.0	0.91	– 48.1	3.22	131.0	0.040	60.2	0.70	– 25.1
2.2	0.90	– 53.3	3.21	126.1	0.043	57.3	0.69	– 27.7
2.4	0.88	– 58.3	3.19	121.2	0.046	54.6	0.68	– 30.5
2.6	0.86	– 63.9	3.17	116.1	0.049	51.7	0.67	– 33.4
2.8	0.84	– 69.3	3.14	111.0	0.052	48.4	0.66	– 36.3
3.0	0.81	– 74.8	3.10	106.1	0.055	45.6	0.65	– 39.0
3.2	0.79	– 80.1	3.08	101.1	0.057	43.4	0.65	– 41.8
3.4	0.77	– 85.7	3.04	96.2	0.059	40.4	0.63	– 44.7
3.6	0.75	– 91.0	3.00	91.4	0.061	38.3	0.63	– 47.5
3.8	0.73	– 96.5	2.96	86.5	0.063	36.1	0.61	– 50.4
4.0	0.70	– 101.8	2.92	81.9	0.064	33.9	0.60	– 53.1
4.2	0.68	– 107.3	2.87	77.1	0.065	31.7	0.60	– 55.9
4.4	0.66	– 112.7	2.83	72.6	0.066	29.9	0.59	– 58.7
4.6	0.64	– 118.2	2.78	68.0	0.068	28.2	0.58	– 61.5
4.8	0.62	– 123.6	2.73	63.5	0.068	26.6	0.57	– 64.2
5.0	0.61	– 128.9	2.69	59.2	0.070	25.1	0.57	– 67.0
5.2	0.59	– 134.2	2.64	54.7	0.070	23.6	0.56	– 69.7
5.4	0.57	– 139.4	2.60	50.6	0.071	22.6	0.56	– 72.4
5.6	0.56	– 144.8	2.56	46.2	0.072	21.5	0.55	– 75.0
5.8	0.54	– 150.1	2.51	42.1	0.073	20.5	0.55	– 77.7
6.0	0.53	– 155.3	2.47	38.1	0.074	19.3	0.54	– 80.4
6.2	0.52	– 160.8	2.43	33.9	0.075	18.6	0.54	– 83.0
6.4	0.50	– 166.1	2.40	30.0	0.076	17.8	0.53	– 85.6
6.6	0.49	– 171.7	2.36	25.9	0.077	16.9	0.53	– 88.4
6.8	0.48	– 177.1	2.32	21.9	0.078	16.2	0.52	– 91.1
7.0	0.47	177.3	2.28	17.9	0.080	15.8	0.52	– 93.8
7.2	0.47	172.2	2.25	14.5	0.081	15.1	0.51	– 96.4

Common Source S Parameters (continued)

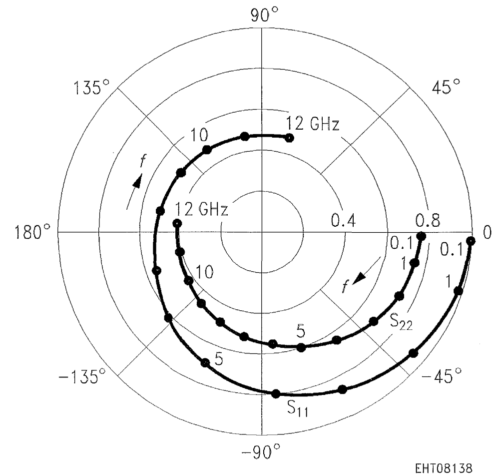
f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_D = 30 mA, V_{DS} = 3.5 V, Z_0 = 50 Ω								
7.4	0.46	166.4	2.22	10.5	0.083	14.2	0.50	– 99.2
7.6	0.46	160.6	2.19	6.6	0.085	13.7	0.50	– 102.1
7.8	0.45	155.1	2.16	2.7	0.087	12.7	0.49	– 104.9
8.0	0.45	149.4	2.13	– 1.3	0.089	12.0	0.49	– 108.0
8.2	0.45	144.1	2.09	– 5.0	0.091	11.4	0.48	– 111.1
8.4	0.45	139.0	2.06	– 8.8	0.094	10.9	0.48	– 114.3
8.6	0.45	133.8	2.03	– 12.6	0.096	9.7	0.47	– 117.6
8.8	0.45	128.9	2.01	– 16.4	0.099	8.8	0.47	– 120.8
9.0	0.45	123.7	1.98	– 20.2	0.102	7.6	0.47	– 124.5
9.2	0.45	119.1	1.95	– 24.0	0.105	6.3	0.46	– 127.9
9.4	0.46	114.5	1.92	– 27.7	0.109	4.7	0.46	– 131.6
9.6	0.46	109.9	1.90	– 31.4	0.112	3.4	0.46	– 135.3
9.8	0.46	105.6	1.88	– 35.1	0.115	1.8	0.46	– 139.0
10.0	0.47	101.2	1.85	– 38.8	0.119	0.1	0.45	– 142.8
10.2	0.47	96.8	1.83	– 42.5	0.122	– 1.6	0.45	– 146.5
10.4	0.47	92.5	1.81	– 46.3	0.126	– 3.5	0.45	– 150.3
10.6	0.47	88.3	1.78	– 49.9	0.130	– 5.3	0.45	– 154.0
10.8	0.47	84.2	1.76	– 53.5	0.133	– 7.0	0.45	– 157.8
11.0	0.48	80.1	1.75	– 57.1	0.138	– 8.9	0.44	– 161.5
11.2	0.48	76.1	1.73	– 60.8	0.141	– 11.0	0.44	– 165.3
11.4	0.48	71.7	1.72	– 64.6	0.146	– 13.2	0.44	– 168.8
11.6	0.48	67.6	1.70	– 68.3	0.150	– 15.3	0.44	– 172.2
11.8	0.48	62.9	1.69	– 72.2	0.155	– 17.6	0.44	– 175.6
12.0	0.48	58.5	1.68	– 75.9	0.161	– 20.0	0.45	– 179.0

S Parameters

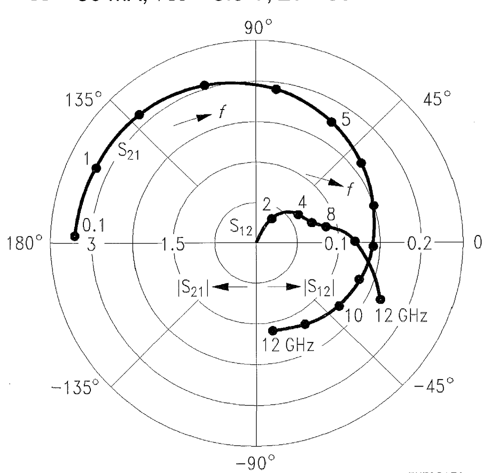
$S_{12}, S_{21} = f(f)$
I_D = 10 mA, V_{DS} = 3.5 V, Z_0 = 50 Ω



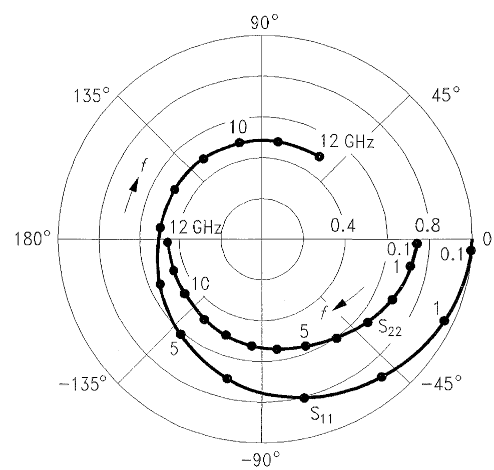
$S_{11}, S_{22} = f(f)$
I_D = 10 mA, V_{DS} = 3.5 V, Z_0 = 50 Ω



$S_{12}, S_{21} = f(f)$
I_D = 30 mA, V_{DS} = 3.5 V, Z_0 = 50 Ω



$S_{11}, S_{22} = f(f)$
I_D = 30 mA, V_{DS} = 3.5 V, Z_0 = 50 Ω

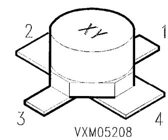


SIEMENS

GaAs FET

CFY 25

- Low noise
- High gain
- For front-end amplifiers
- Ion-implanted planar structure
- All gold metallization



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)]
CFY 25-17 CFY 25-20 CFY 25-23	C 5 C 6 C 7	Q62703-F106 Q62703-F107 Q62703-F108	D	S	G	S	Micro-X

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	5	V
Drain-gate voltage	V_{DG}	7	
Gate-source voltage	V_{GS}	– 5 … + 0	
Drain current	I_D	80	mA
Total power dissipation, $T_S \leq 56$ ˚C[2)]	P_{tot}	250	mW
Channel temperature	T_{ch}	150	˚C
Storage temperature range	T_{stg}	– 65 … + 150	

Thermal Resistance

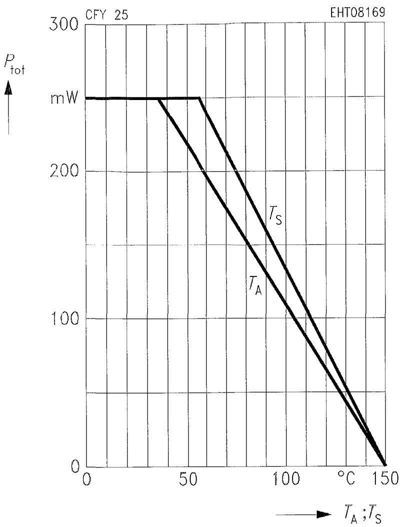
Channel - soldering point[2)]	$R_{th\,chS}$	375	K/W

1) For detailed information see chapter Package Outlines.
2) T_S is measured on the source lead at the soldering point to the pcb.

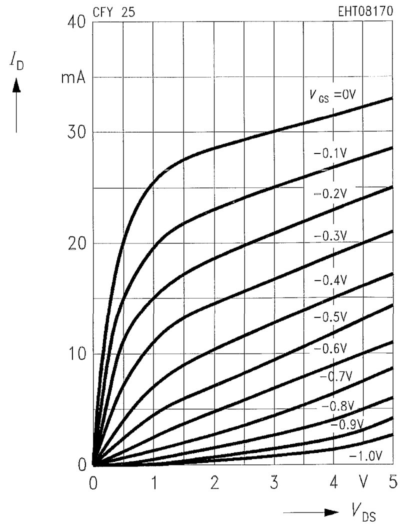
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Drain-source saturation current V_{DS} = 3 V, V_{GS} = 0	I_{DSS}	15	30	60	mA
Pinch-off voltage I_D = 1 mA, V_{DS} = 3 V	V_p	– 0.3	– 1.0	– 3.0	V
Gate leakage current I_D = 15 mA, V_{DS} = 3 V	I_G	–	0.1	2	µA
Transconductance I_D = 15 mA, V_{DS} = 3 V	g_m	30	40	–	mS
Noise figure I_{DS} = 15 mA, V_{DS} = 3 V, f=12 GHz CFY 25-17 CFY 25-20 CFY 25-23	F	 – – –	 1.6 1.9 2.2	 1.7 2.0 2.3	dB
Associated gain I_{DS} = 15 mA, V_{DS} = 3 V, f=12 GHz CFY 25-17 CFY 25-20 CFY 25-23	G_a	 9 8.5 8.5	 9.5 9 9	 – – –	

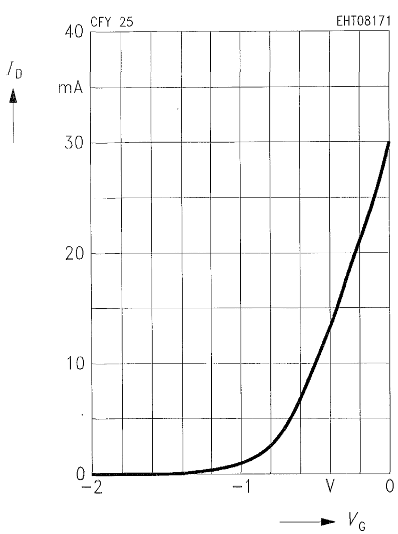
Total power dissipation $P_{tot} = f(T_S; T_A^*)$
* Package mounted on alumina



Output characteristics $I_D = f(V_{DS})$



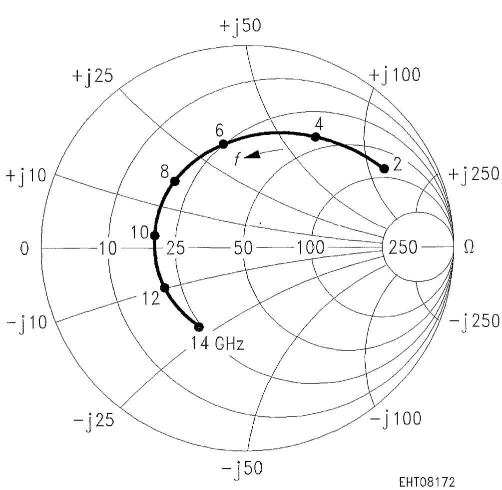
Transfer characteristics $I_D = f(V_G)$
V_{DS} = 3 V



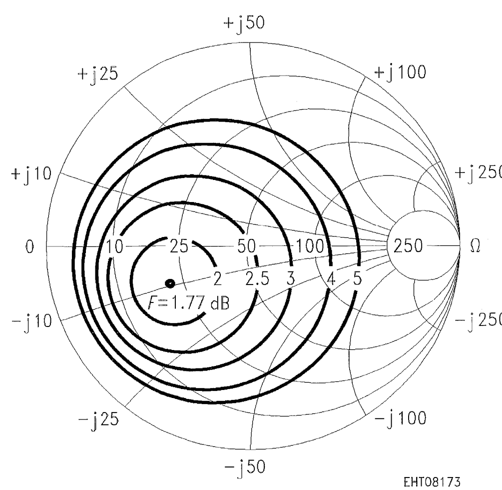
Common Source Noise Parameters

f	F_{min}	G_a	Γ_{opt}		R_N	r_N	N	$F_{50\Omega}$	$G(F_{50\Omega})$
GHz	dB	dB	MAG	ANG	Ω	–	–	dB	dB
I_D = 15 mA, V_{DS} = 3.0 V, Z_0 = 50 Ω									
2	0.60	18.5	0.70	31	29	0.580	0.10	2.0	11.4
4	0.77	14.6	0.59	63	21	0.420	0.14	1.8	10.5
6	1.00	12.4	0.50	103	13	0.260	0.19	1.8	9.3
8	1.25	11.0	0.47	140	7.3	0.146	0.23	2.0	8.2
10	1.55	9.8	0.45	174	5.6	0.112	0.28	2.4	7.3
12	1.77	9.0	0.43	– 156	7.1	0.142	0.29	2.5	6.4
14	2.15	8.1	0.41	– 130	18	0.360	0.46	3.0	5.8

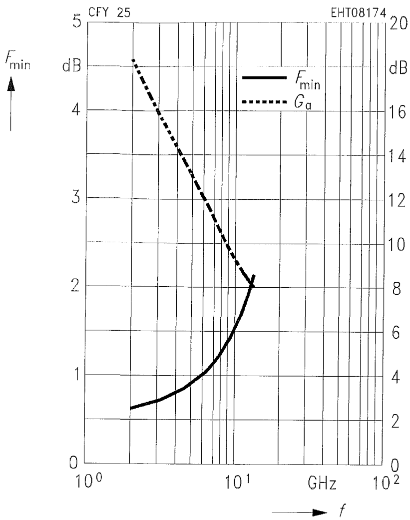
Source impedance for min. noise figure
I_D = 15 mA, V_{DS} = 3 V



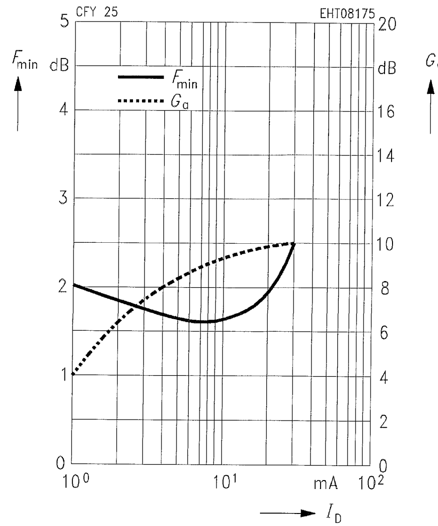
Circles of constant noise figure
I_D = 15 mA, V_{DS} = 3 V, f = 12 GHz



Minimum noise figure $F_{min} = f\,(f)$
Associated gain $G_a = f\,(f)$
I_D = 15 mA, V_{DS} = 3 V, Z_{Sopt}



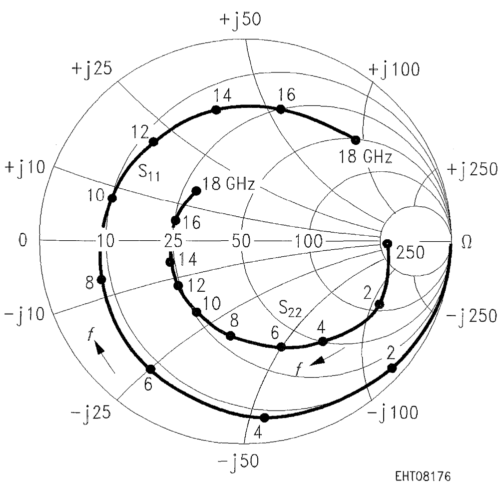
Minimum noise figure $F_{min} = f\,(I_D)$
Associated gain $G_a = f\,(I_D)$
V_{DS} = 3 V, f = 12 GHz, Z_{Sopt}



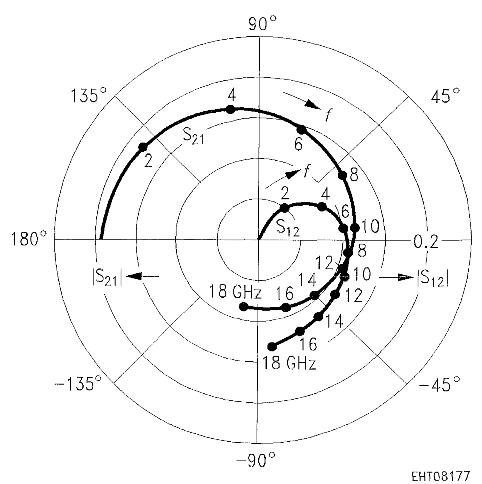
Common Source S Parameters

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_D = 15 mA, V_{DS} = 3 V, Z_0 = 50 Ω								
1.0	0.99	– 21	3.83	161	0.026	75	0.68	– 13
2.0	0.96	– 42	3.73	141	0.049	61	0.66	– 27
3.0	0.91	– 67	3.55	121	0.069	45	0.63	– 41
4.0	0.86	– 87	3.34	103	0.083	33	0.59	– 55
5.0	0.81	– 107	3.10	86	0.093	21	0.56	– 66
6.0	0.77	– 125	2.92	70	0.100	11	0.52	– 77
7.0	0.74	– 145	2.74	54	0.105	1	0.48	– 89
8.0	0.70	– 165	2.57	37	0.107	– 9	0.45	– 102
9.0	0.68	178	2.42	23	0.108	– 17	0.42	– 112
10.0	0.67	161	2.31	9	0.109	– 24	0.41	– 124
11.0	0.67	146	2.20	– 4	0.110	– 30	0.39	– 134
12.0	0.66	132	2.10	– 17	0.110	– 36	0.37	– 145
13.0	0.66	117	2.02	– 31	0.110	– 42	0.36	– 158
14.0	0.66	103	1.94	– 44	0.112	– 49	0.35	– 169
15.0	0.66	90	1.90	– 57	0.115	– 55	0.34	180
16.0	0.66	77	1.84	– 70	0.119	– 63	0.33	165
17.0	0.66	63	1.80	– 84	0.125	– 72	0.32	151
18.0	0.66	47	1.78	– 99	0.132	– 83	0.31	136

S_{11}, S_{22}
I_D = 15 mA, V_{DS} = 3 V, Z_0 = 50 Ω



S_{12}, S_{21}
I_D = 15 mA, V_{DS} = 3 V, Z_0 = 50 Ω



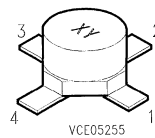
SIEMENS

GaAs FET

CFY 25-20 E7916

Preliminary Data

- Low noise
- High gain
- Low gate-leakage current
- All gold metallization
- For high-speed fibre optic receivers and PIN-FET modules up to 2.4 Gbit/sec



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)]
CFY 25-20 E7916	C6	Q62703-F113	D	S	G	S	Cerec-XF

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	5	V
Drain-gate voltage	V_{DG}	7	
Gate-source voltage	V_{GS}	– 5.0 … + 0	
Drain current	I_D	80	mA
Total power dissipation, $T_S \leq 56$ °C[2)]	P_{tot}	250	mW
Channel temperature	T_{ch}	150	°C
Storage temperature range	T_{stg}	– 65 … + 150	

Thermal Resistance

Channel - soldering point[2)]	$R_{th\,chS}$	375	K/W

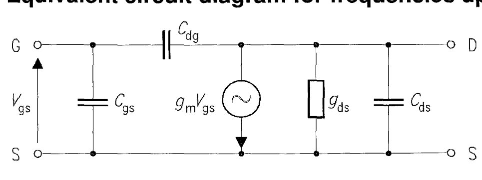
1) For detailed information see chapter Package Outlines.
2) T_S is measured on the source lead at the soldering point to the pcb.

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

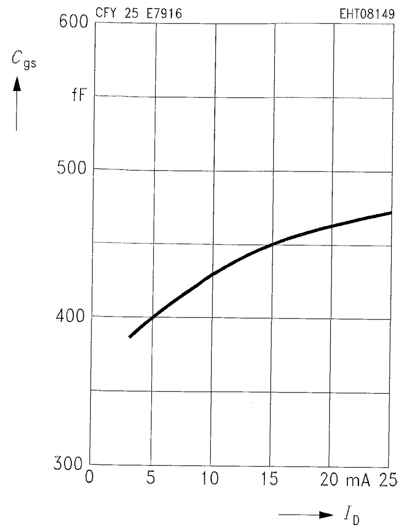
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Drain-source saturation current V_{DS} = 3 V, V_{GS} = 0	I_{DSS}	15	30	60	mA
Pinch-off voltage V_{DS} = 3 V, I_D = 1 mA	$V_{GS(P)}$	– 0.3	– 1.0	– 3.0	V
Gate leakage current V_{DS} = 3 V, I_D = 15 mA	I_G	–	5	20	nA
Transconductance V_{DS} = 3 V, I_D = 15 mA	g_m	35	45	–	mS
Gate-source capacitance * V_{DS} = 3 V, I_D = 15 mA	C_{gs}	–	450	–	fF
Drain-gate capacitance * V_{DS} = 3 V, I_D = 15 mA	C_{dg}	–	45	–	
Drain-source capacitance * V_{DS} = 3 V, I_D = 15 mA	C_{ds}	–	250	–	
Drain-source conductance * V_{DS} = 3 V, I_D = 15 mA	g_{ds}	–	4.5	–	mS

* Equivalent circuit elements as shown below

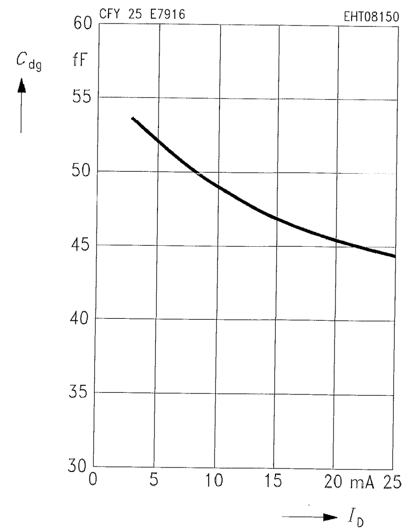
Equivalent circuit diagram for frequencies up to 3 GHz



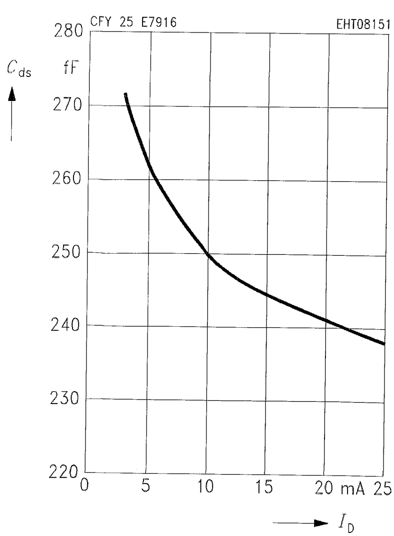
Gate-source capacitance $C_{gs} = f(I_D)$
V_{DS} = 3 V



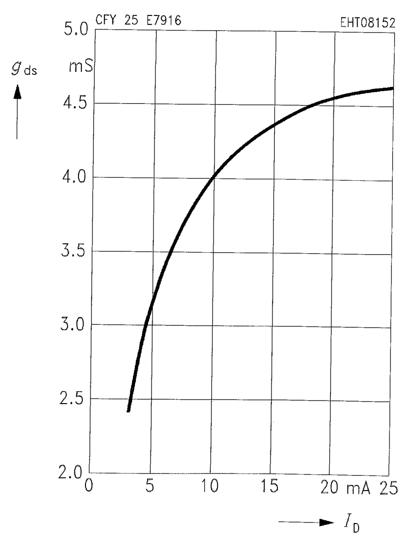
Drain-gate capacitance $C_{dg} = f(I_D)$
V_{DS} = 3 V



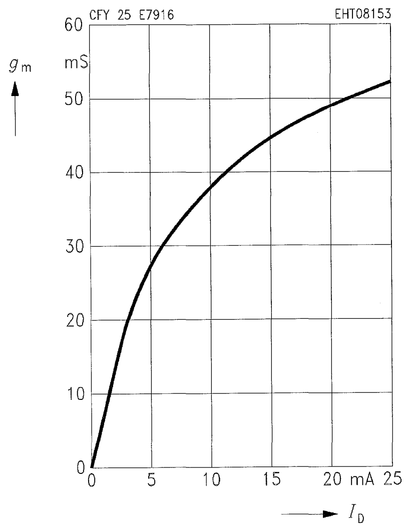
Drain-source capacitance $C_{ds} = f(I_D)$
V_{DS} = 3 V



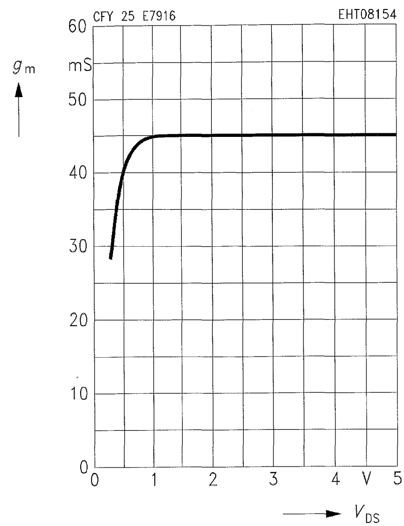
Drain-source conductance $g_{ds} = f(I_D)$
V_{DS} = 3 V



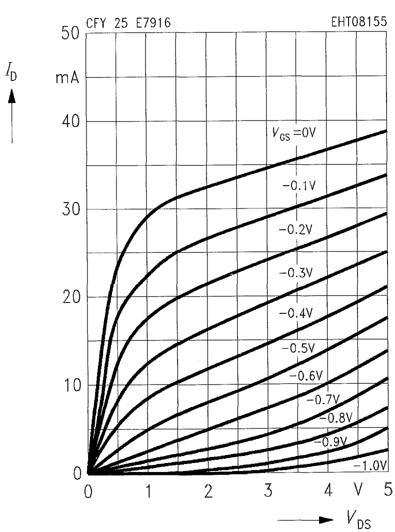
Transconductance $g_m = f(I_D)$
V_{DS} = 3 V



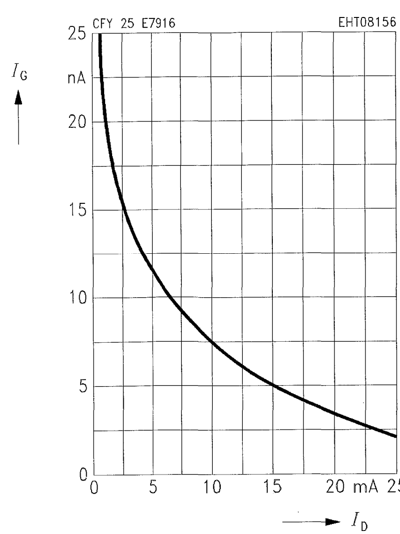
Transconductance $g_m = f(V_{DS})$
I_D = 15 mA



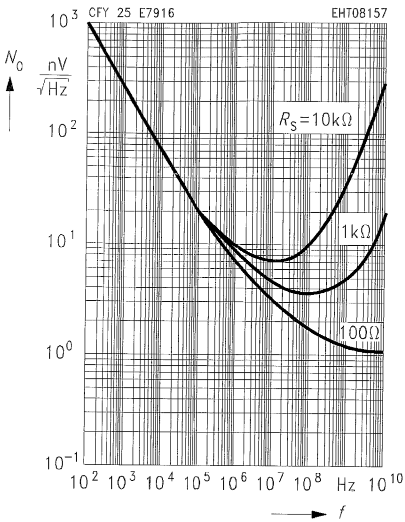
Output characteristics $I_D = f(V_{DS})$



Gate leakage current $I_G = f(I_D)$
V_{DS} = 3 V



Spectral noise density $N_O = f(f)$
V_{DS} = 3.0 V, I_D = 15 mA

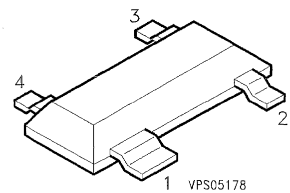


SIEMENS

GaAs FET

CFY 30

- Low noise (F_{min} = 1.4 dB at 4 GHz)
- High gain (11.5 dB typ. at 4 GHz)
- For oscillators up to 12 GHz
- For amplifiers up to 6 GHz
- Ion-implanted planar structure
- Chip all gold metallization
- Chip nitride passivation



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]
CFY 30	A2	Q62703-F97	S	D	S	G	SOT-143

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain voltage	V_{DS}	5	V
Drain-gate voltage	V_{DG}	7	
Gate-source voltage	V_{GS}	– 4 … + 0.5	
Drain current	I_D	80	mA
Total power dissipation, $T_S \leq 70$ °C[2]	P_{tot}	250	mW
Channel temperature	T_{ch}	150	°C
Storage temperature range	T_{stg}	– 40 … + 150	

Thermal Resistance

Channel - soldering point[2]	$R_{th\,chS}$	≤ 320	K/W

[1] For detailed information see chapter Package Outlines.
[2] T_S is measured on the source 1 lead at the soldering point to the pcb.

Electrical Characteristics

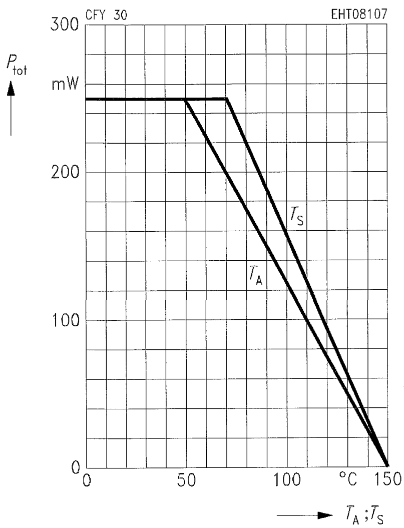
at T_A = 25 ˚C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Drain-source saturation current V_{DS} = 3.5 V, V_{GS} = 0	I_{DSS}	20	50	80	mA
Pinch-off voltage I_D = 1 mA, V_{DS} = 3.5 V	V_P	– 0.5	– 1.3	– 4.0	V
Transconductance I_D = 15 mA, V_{DS} = 3.5 V	g_m	20	30	–	mS
Gate leakage current I_D = 15 mA, V_{DS} = 3.5 V	I_G	–	0.1	2.0	µA
Noise figure I_D = 15 mA, V_{DS} = 3.5 V, f = 4 GHz f = 6 GHz	F	 – –	 1.4 2.0	 1.6 –	dB
Associated gain I_D = 15 mA, V_{DS} = 3.5 V, f = 4 GHz f = 6 GHz	G_a	 10 –	 11.5 8.9	 – –	
Maximum available gain I_D = 15 mA, V_{DS} = 3.5 V, f = 6 GHz	MAG	–	11.2	–	
Maximum stable gain I_D = 15 mA, V_{DS} = 3.5 V, f = 4 GHz	MSG	–	14.4	–	
Power output at 1 dB compression I_D = 30 mA, V_{DS} = 4 V, f = 6 GHz	P_{1dB}	–	16	–	dBm

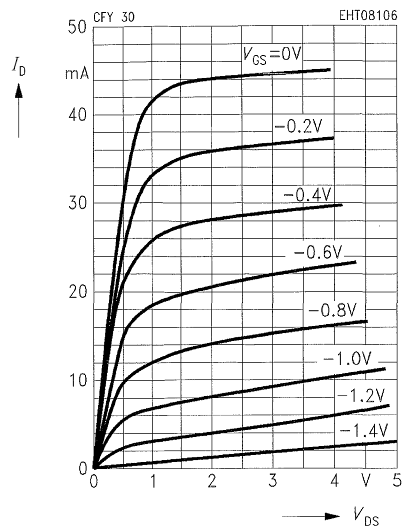
Common Source Noise Parameters

f	F_{min}	G_a	Γ_{opt}		R_N	N	$F_{50\Omega}$	$G(F_{50\Omega})$
GHz	dB	dB	MAG	ANG	Ω	–	dB	dB
I_D = 15 mA, V_{DS} = 3.5 V, Z_0 = 50 Ω								
2	1.0	15.5	0.72	27	49	0.17	2.9	10.0
4	1.4	11.5	0.64	61	29	0.17	2.7	9.3
6	2.0	8.9	0.46	101	19	0.30	2.8	7.5
8	2.5	7.1	0.31	153	9	0.31	2.8	6.4
10	3.0	5.8	0.34	–133	14	0.38	3.4	4.2
12	3.5	5.0	0.41	– 93	28	0.42	4.1	2.9

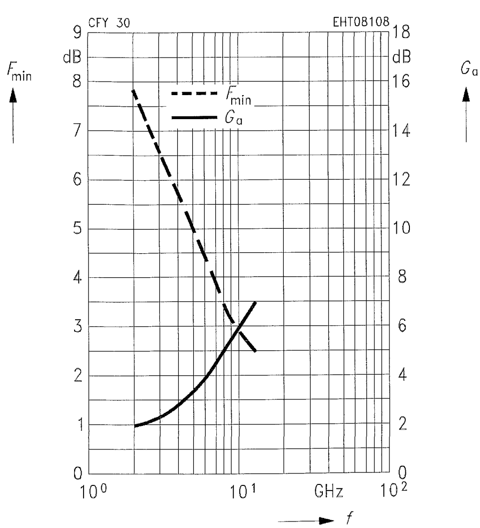
Total power dissipation $P_{tot} = f(T_S; T_A)$



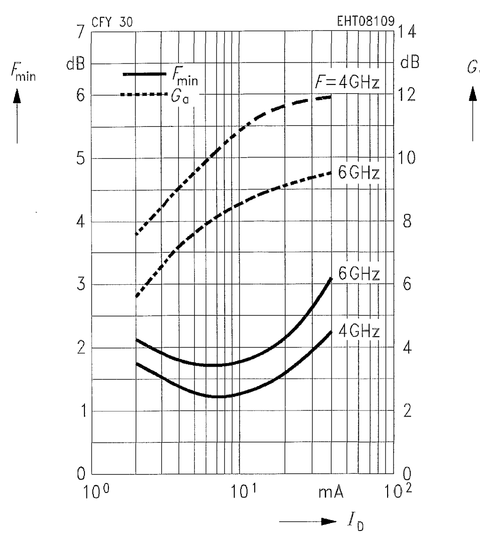
Output characteristics $I_D = f(V_{DS})$



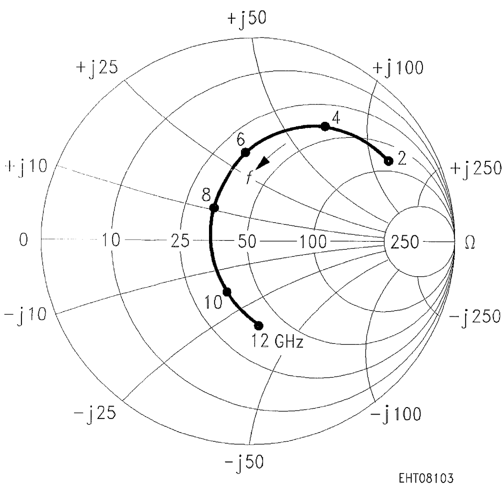
Minimum noise figure $F_{min} = f(f)$
Associated gain $G_a = f(f)$
I_D = 15 mA, V_{DS} = 3.5 V, Z_{Sopt}



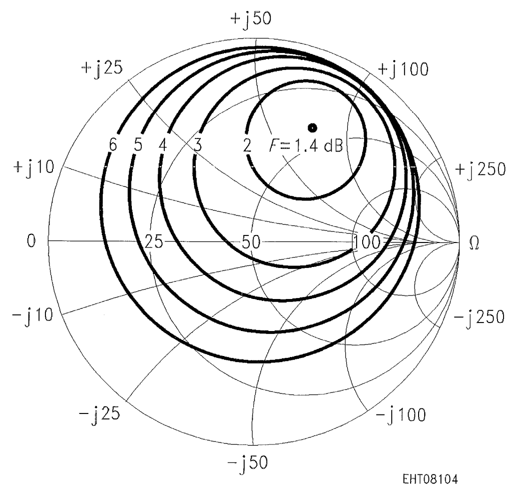
Minimum noise figure $F_{min} = f(I_D)$
Associated gain $G_a = f(I_D)$
V_{DS} = 3.5 V, Z_{Sopt}



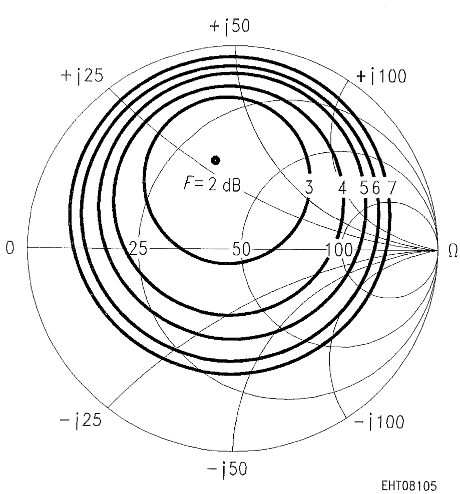
Source impedance for min. noise figure
I_D = 15 mA, V_{DS} = 3.5 V



Circles of constant noise figure
I_D = 15 mA, V_{DS} = 3.5 V, f = 4 GHz



Circles of constant noise figure
I_D = 15 mA, V_{DS} = 3.5 V, f = 6 GHz



Common Source S Parameters

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**
I_D = 15 mA, V_{DS} = 3.5 V, Z_0 = 50 Ω								
0.1	1.00	– 1	2.43	178	0.003	87	0.70	– 1
0.2	1.00	– 3	2.43	176	0.005	86	0.70	– 3
0.4	1.00	– 6	2.43	171	0.010	23	0.69	– 5
0.6	1.00	– 10	2.43	167	0.015	81	0.69	– 8
0.8	0.99	– 14	2.43	162	0.020	78	0.68	– 11
1.0	0.99	– 17	2.43	158	0.025	75	0.68	– 13
1.2	0.98	– 21	2.43	154	0.030	72	0.67	– 15
1.4	0.98	– 25	2.44	150	0.035	69	0.67	– 18
1.6	0.97	– 28	2.44	145	0.040	66	0.66	– 20
1.8	0.97	– 32	2.45	141	0.045	63	0.66	– 23
2.0	0.96	– 36	2.45	137	0.050	60	0.65	– 26
2.2	0.95	– 38	2.46	133	0.054	58	0.64	– 28
2.4	0.93	– 44	2.47	129	0.058	55	0.64	– 30
2.6	0.92	– 49	2.48	124	0.062	53	0.63	– 32
2.8	0.90	– 53	2.49	120	0.066	50	0.62	– 35
3.0	0.88	– 58	2.50	116	0.070	48	0.61	– 38
3.2	0.87	– 62	2.50	111	0.074	45	0.60	– 41
3.4	0.85	– 67	2.50	107	0.078	42	0.59	– 44
3.6	0.83	– 72	2.50	102	0.082	39	0.57	– 47
3.8	0.82	– 77	2.50	98	0.086	36	0.55	– 51
4.0	0.80	– 82	2.50	93	0.090	32	0.54	– 54
4.2	0.79	– 87	2.50	88	0.094	29	0.52	– 58
4.4	0.77	– 92	2.51	83	0.097	25	0.50	– 61
4.6	0.76	– 98	2.50	78	0.100	22	0.48	– 64
4.8	0.74	– 104	2.49	73	0.103	18	0.46	– 67
5.0	0.72	– 110	2.47	68	0.106	15	0.45	– 70
5.2	0.70	– 115	2.45	64	0.108	12	0.43	– 73
5.4	0.68	– 121	2.43	59	0.110	9	0.42	– 76
5.6	0.66	– 127	2.41	54	0.112	6	0.40	– 80
5.8	0.65	– 133	2.39	50	0.113	3	0.38	– 84
6.0	0.63	– 139	2.36	45	0.114	0	0.36	– 88
6.2	0.62	– 144	2.33	41	0.114	– 3	0.33	– 93
6.4	0.60	– 150	2.30	37	0.115	– 6	0.31	– 98
6.6	0.59	– 156	2.27	32	0.115	– 9	0.29	– 104
6.8	0.57	– 162	2.24	27	0.116	– 11	0.27	– 110
7.0	0.56	– 168	2.21	22	0.116	– 14	0.25	– 116
7.2	0.55	– 174	2.19	17	0.116	– 17	0.24	– 122
7.4	0.54	179	2.16	12	0.116	– 20	0.23	– 129
7.6	0.54	172	2.14	8	0.116	– 22	0.21	– 137
7.8	0.53	166	2.11	3	0.116	– 25	0.20	– 145

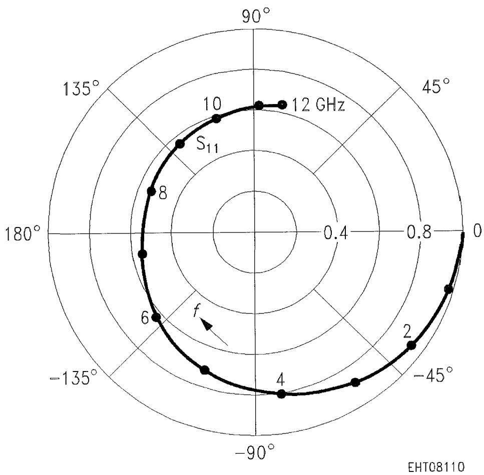
Common Source S Parameters (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_D = 15 mA, V_{DS} = 3.5 V, Z_0 = 50 Ω								
8.0	0.53	160	2.08	– 2	0.115	– 27	0.19	– 154
8.2	0.54	153	2.04	– 7	0.114	– 30	0.18	– 163
8.4	0.54	147	2.00	– 11	0.113	– 32	0.18	– 173
8.6	0.55	141	1.96	– 16	0.112	– 34	0.17	179
8.8	0.55	135	1.92	– 21	0.111	– 37	0.18	171
9.0	0.55	129	1.88	– 25	0.110	– 39	0.18	163
9.2	0.56	124	1.83	– 30	0.109	– 42	0.19	155
9.4	0.56	119	1.78	– 35	0.108	– 44	0.20	148
9.6	0.57	114	1.72	– 40	0.107	– 46	0.21	141
9.8	0.57	110	1.66	– 44	0.105	– 48	0.22	134
10.0	0.58	106	1.61	– 48	0.104	– 50	0.23	128
10.2	0.58	102	1.56	– 52	0.103	– 51	0.25	123
10.4	0.59	98	1.51	– 56	0.102	– 53	0.26	118
10.6	0.59	94	1.46	– 59	0.101	– 54	0.28	113
10.8	0.60	91	1.42	– 62	0.101	– 56	0.29	108
11.0	0.60	88	1.38	– 65	0.100	– 57	0.30	104
11.2	0.61	85	1.35	– 69	0.099	– 58	0.32	100
11.4	0.61	82	1.32	– 72	0.099	– 59	0.33	96
11.6	0.62	79	1.30	– 75	0.098	– 60	0.34	93
11.8	0.62	77	1.27	– 78	0.097	– 62	0.35	89
12.0	0.62	74	1.25	– 81	0.096	– 63	0.36	85

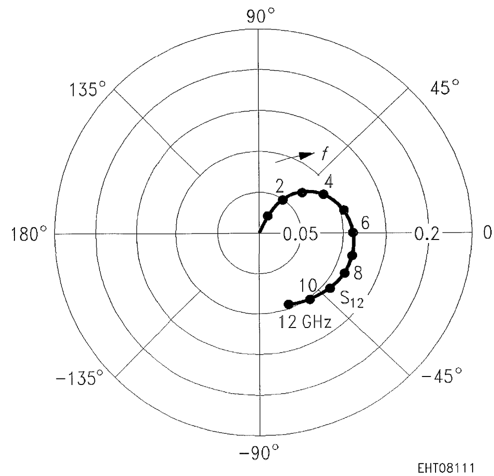
Common Source S Parameters (continued)

I_D = 15 mA, V_{DS} = 3.5 V, Z_0 = 50 Ω

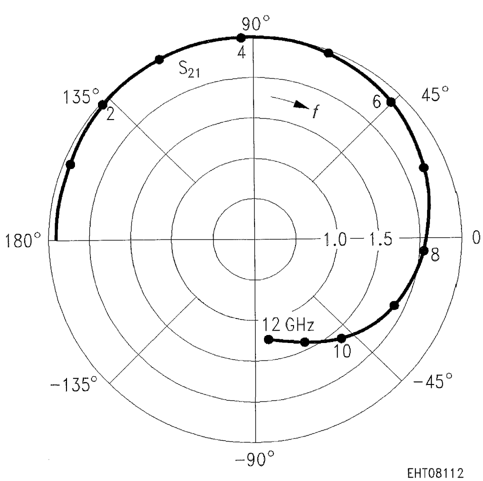
$S_{11} = f(f)$



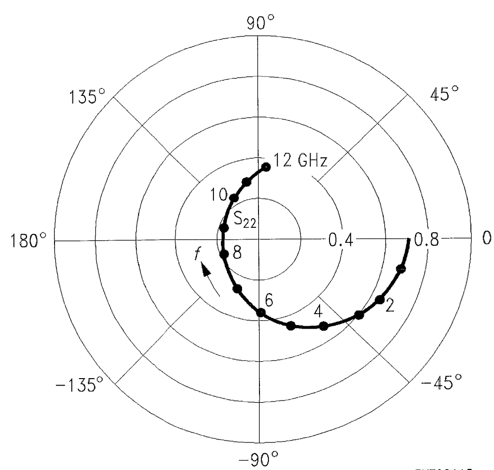
$S_{12} = f(f)$



$S_{21} = f(f)$



$S_{22} = f(f)$



Common Source S Parameters

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_D = 30 mA, V_{DS} = 3.5 V, Z_0 = 50 Ω								
0.1	1.00	– 2	3.23	178	0.002	85	0.71	– 1
0.2	1.00	– 4	3.22	176	0.004	82	0.71	– 3
0.4	1.00	– 8	3.21	171	0.009	79	0.70	– 6
0.6	0.99	– 12	3.20	167	0.013	76	0.69	– 9
0.8	0.99	– 16	3.19	162	0.017	73	0.69	– 11
1.0	0.98	– 20	3.18	157	0.021	73	0.68	– 14
1.2	0.97	– 24	3.18	153	0.025	70	0.67	– 16
1.4	0.96	– 28	3.18	148	0.030	67	0.67	– 19
1.6	0.95	– 32	3.17	143	0.034	65	0.66	– 21
1.8	0.94	– 38	3.17	139	0.038	63	0.66	– 24
2.0	0.92	– 40	3.17	135	0.042	61	0.65	– 26
2.2	0.91	– 44	3.17	131	0.046	58	0.64	– 28
2.4	0.90	– 48	3.17	127	0.051	56	0.63	– 31
2.6	0.89	– 53	3.17	123	0.055	53	0.62	– 33
2.8	0.87	– 58	3.17	119	0.059	50	0.61	– 36
3.0	0.85	– 63	3.17	114	0.063	48	0.60	– 39
3.2	0.83	– 68	3.16	109	0.067	45	0.58	– 42
3.4	0.81	– 73	3.14	104	0.070	42	0.56	– 45
3.6	0.79	– 79	3.12	99	0.073	40	0.55	– 48
3.8	0.77	– 85	3.10	94	0.076	37	0.54	– 51
4.0	0.75	– 91	3.08	88	0.079	34	0.52	– 54
4.2	0.73	– 96	3.06	83	0.082	31	0.51	– 57
4.4	0.71	– 102	3.04	78	0.084	28	0.50	– 60
4.6	0.69	– 108	3.02	73	0.087	24	0.48	– 63
4.8	0.67	– 114	3.00	68	0.089	21	0.47	– 66
5.0	0.65	– 120	2.98	63	0.091	18	0.45	– 70
5.2	0.63	– 126	2.95	58	0.092	15	0.43	– 73
5.4	0.62	– 132	2.91	54	0.093	12	0.41	– 77
5.6	0.60	– 138	2.87	49	0.094	10	0.38	– 81
5.8	0.59	– 144	2.82	44	0.095	7	0.36	– 85
6.0	0.57	– 150	2.77	40	0.096	4	0.34	– 89
6.2	0.56	– 156	2.73	35	0.097	2	0.32	– 94
6.4	0.54	– 162	2.68	31	0.097	– 1	0.30	– 99
6.6	0.53	– 168	2.63	27	0.098	– 4	0.29	– 104
6.8	0.52	– 174	2.58	22	0.098	– 6	0.27	– 109
7.0	0.51	179	2.54	18	0.099	– 9	0.26	– 115
7.2	0.51	173	2.50	14	0.099	– 11	0.24	– 121
7.4	0.51	166	2.46	9	0.099	– 13	0.22	– 127
7.6	0.50	160	2.43	5	0.099	– 16	0.21	– 134
7.8	0.50	153	2.40	0	0.099	– 18	0.19	– 141

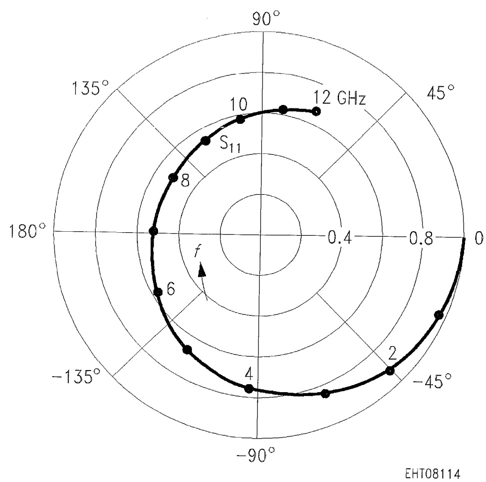
Common Source S Parameters (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**
I_D = 30 mA, V_{DS} = 3.5 V, Z_0 = 50 Ω								
8.0	0.50	147	2.36	– 4	0.099	– 20	0.18	– 148
8.2	0.51	141	2.31	– 8	0.099	– 22	0.17	– 156
8.4	0.51	135	2.26	– 13	0.099	– 24	0.16	– 164
8.6	0.52	130	2.21	– 17	0.099	– 27	0.16	– 174
8.8	0.52	125	2.15	– 22	0.099	– 29	0.16	176
9.0	0.53	120	2.09	– 26	0.099	– 31	0.16	167
9.2	0.54	115	2.04	– 30	0.099	– 33	0.17	158
9.4	0.55	111	1.98	– 35	0.099	– 35	0.18	150
9.6	0.55	107	1.93	– 39	0.099	– 37	0.19	142
9.8	0.56	103	1.87	– 43	0.099	– 39	0.21	135
10.0	0.57	99	1.82	– 47	0.099	– 41	0.22	128
10.2	0.58	95	1.76	– 51	0.100	– 42	0.23	123
10.4	0.59	91	1.71	– 54	0.100	– 44	0.25	118
10.6	0.60	88	1.65	– 58	0.100	– 45	0.26	114
10.8	0.60	85	1.60	– 62	0.101	– 47	0.27	109
11.0	0.61	82	1.55	– 65	0.101	– 48	0.29	104
11.2	0.61	79	1.51	– 69	0.102	– 49	0.30	100
11.4	0.61	76	1.47	– 72	0.102	– 51	0.31	96
11.6	0.62	73	1.44	– 75	0.103	– 52	0.32	92
11.8	0.62	71	1.41	– 78	0.103	– 53	0.33	89
12.0	0.62	68	1.38	– 82	0.104	– 55	0.34	85

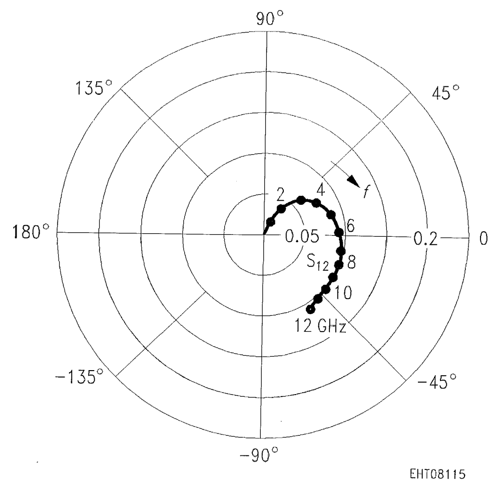
Common Source S Parameters (continued)

I_D = 30 mA, V_{DS} = 3.5 V, Z_0 = 50 Ω

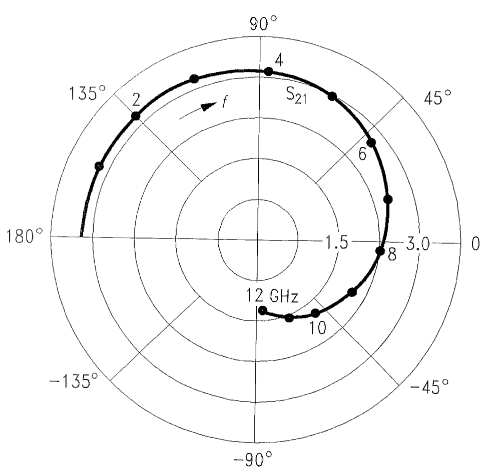
$S_{11} = f(f)$



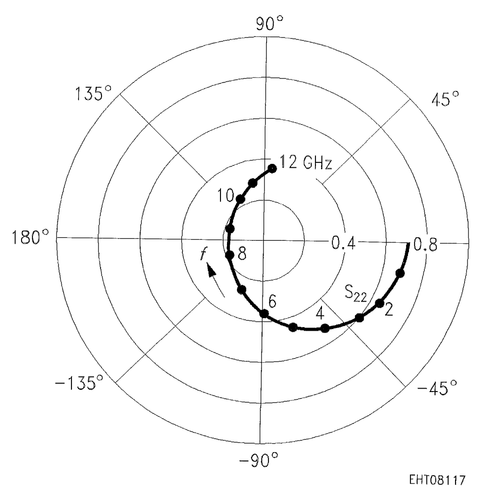
$S_{12} = f(f)$



$S_{21} = f(f)$



$S_{22} = f(f)$

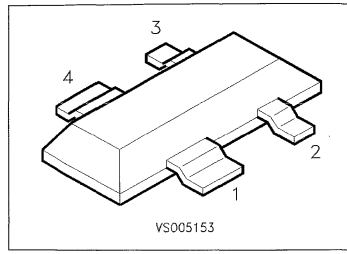


SIEMENS

GaAs FET

CFY 35

- Low noise
- High gain
- For low-noise front end amplifiers
- For DBS down converters



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]
CFY 35-20	NA	Q62702-F1393	S	D	S	G	MW-4
CFY 35-23	NB	Q62702-F1394					

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	5	V
Drain-gate voltage	V_{DG}	6	
Gate-source voltage	V_{GS}	– 4.0 ... 0	
Drain current	I_D	60	mA
Total power dissipation, $T_S \leq 53$ °C [2]	P_{tot}	180	mW
Channel temperature	T_{ch}	150	°C
Storage temperature range	T_{stg}	– 40 ... + 150	

Thermal Resistance

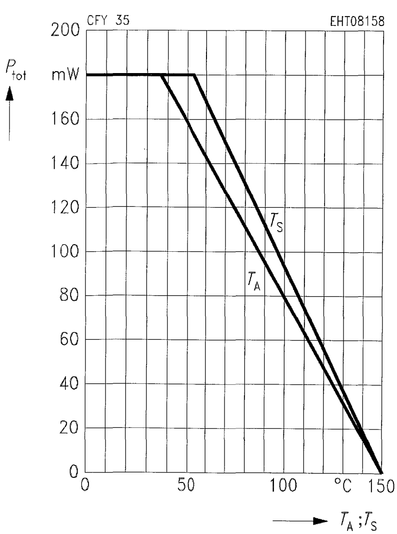
Channel - soldering point [2]	$R_{th\,chS}$	540	K/W

1) For detailed information see chapter Package Outlines.
2) T_S is measured on the source 1 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.	
Drain-source saturation current V_{DS} = 2.5 V, V_{GS} = 0	I_{DSS}	10	25	45	mA
Pinch-off voltage V_{DS} = 2.5 V, I_D = 1 mA	$V_{GS(P)}$	– 0.2	– 1.2	– 2.5	V
Gate leakage current V_{DS} = 2.5 V, I_D = 10 mA	I_G	–	0.1	2	µA
Transconductance V_{DS} = 2.5 V, I_D = 10 mA	g_m	20	30	–	mS
Noise figure V_{DS} = 2.5 V, I_D = 10 mA, f= 12 GHz CFY 35-20 CFY 35-23	F	 – –	 1.9 2.2	 2.0 2.3	dB
Associated gain V_{DS} = 2.5 V, I_D = 10 mA, f= 12 GHz	G_a	8	8.5	–	

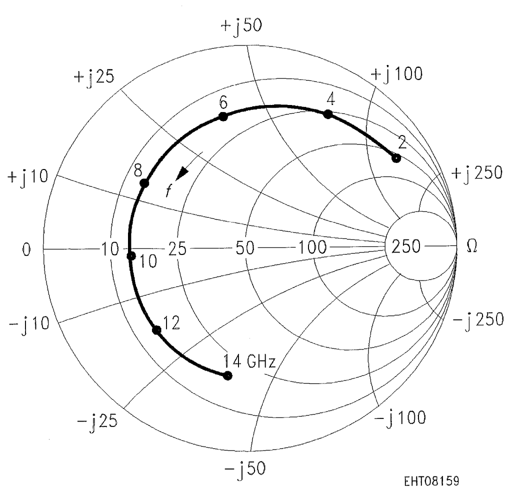
Total power dissipation $P_{tot} = f(T_S; T_A{}^*)$
* Package mounted on alumina



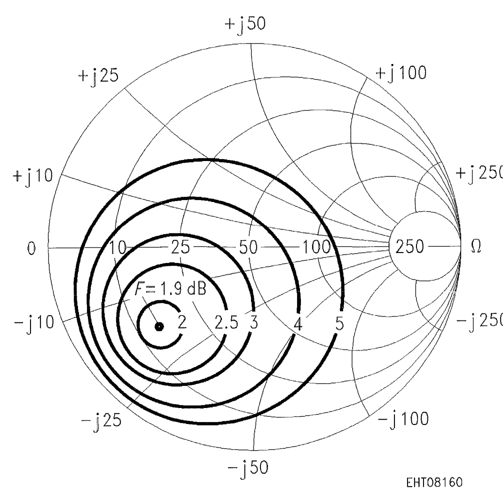
Common Source Noise Parameters

f	F_{min}	G_a	Γ_{opt}		R_N	r_N	N	$F_{50\Omega}$	$G(F_{50\Omega})$
GHz	dB	dB	MAG	ANG	Ω	–	–	dB	dB
I_D = 10 mA, V_{DS} = 2.5 V, Z_0 = 50 Ω									
2	0.60	17.6	0.82	32	35	0.7	0.08	2.35	12.9
4	0.83	14.2	0.73	65	25	0.5	0.11	2.3	11.2
6	1.10	11.8	0.65	105	14	0.28	0.14	2.35	9.5
8	1.38	10.5	0.60	146	5.5	0.11	0.19	2.55	7.8
10	1.64	9.4	0.58	– 177	3	0.06	0.22	2.80	6.5
12	1.90	8.5	0.61	– 139	10	0.2	0.28	3.5	4.9
14	2.15	7.9	0.62	– 110	26	0.52	0.33	3.95	3.8

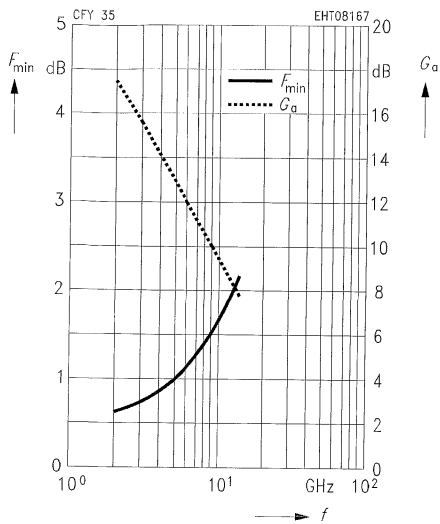
Source impedance for min. noise figure
I_D = 10 mA, V_{DS} = 2.5 V



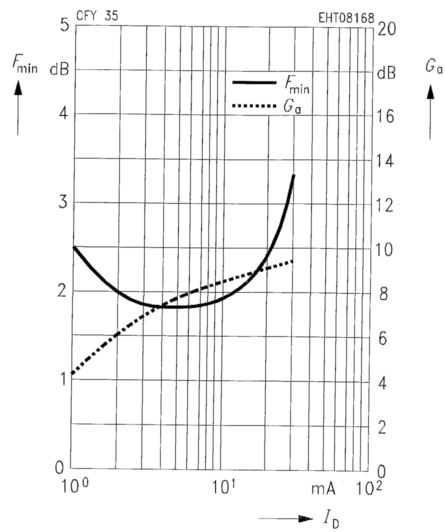
Circles of constant noise figure
I_D = 10 mA, V_{DS} = 2.5 V, f= 12 GHz



Minimum noise figure $F_{min} = f\,(f)$
Associated gain $G_a = f\,(f)$
I_D = 10 mA, V_{DS} = 2.5 V, Z_{Sopt}



Minimum noise figure $F_{min} = f\,(I_D)$
Associated gain $G_a = f\,(I_D)$
V_{DS} = 2.5 V, f= 12 GHz, Z_{Sopt}

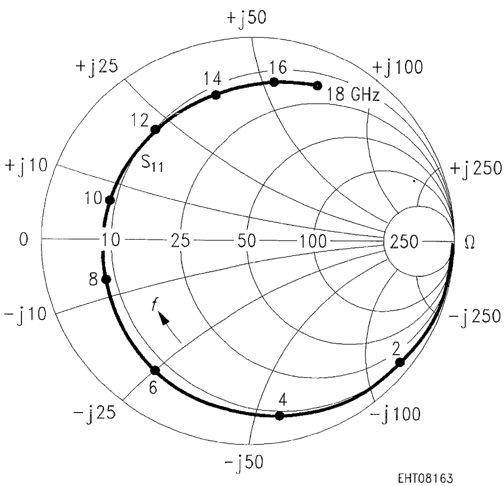


Common Source S Parameters

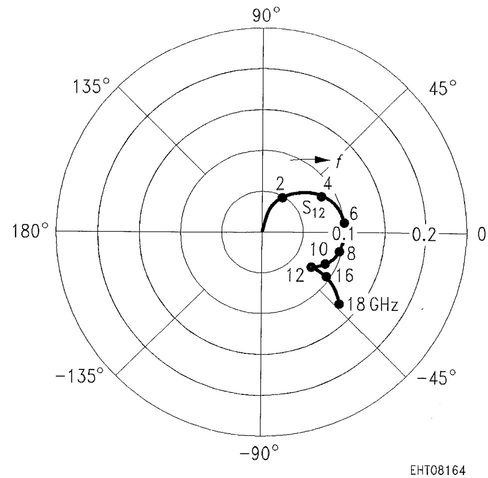
f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_D = 10 mA, V_{DS} = 2.5 V, Z_0 = 50 Ω								
0.5	0.99	– 9.3	2.930	170.9	0.014	82.6	0.76	– 6.1
1.0	0.98	– 19.1	2.938	161.8	0.026	75.9	0.76	– 12.6
1.5	0.97	– 29.2	2.948	152.4	0.039	67.8	0.75	– 19.4
2.0	0.95	– 39.8	2.936	142.7	0.051	60.3	0.73	– 26.5
2.5	0.93	– 50.5	2.904	133.0	0.062	52.7	0.71	– 33.5
3.0	0.91	– 60.8	2.859	123.7	0.072	45.7	0.69	– 40.0
3.5	0.89	– 70.9	2.818	114.8	0.082	39.0	0.67	– 46.2
4.0	0.87	– 81.2	2.791	105.9	0.090	32.6	0.64	– 52.5
4.5	0.85	– 91.9	2.770	96.7	0.098	26.1	0.61	– 59.1
5.0	0.82	– 103.2	2.736	87.1	0.104	18.9	0.58	– 66.5
5.5	0.79	– 114.9	2.672	77.4	0.108	11.8	0.54	– 74.6
6.0	0.77	– 126.2	2.586	68.0	0.111	5.3	0.51	– 83.0
6.5	0.75	– 136.8	2.489	59.0	0.111	– 0.9	0.48	– 91.6
7.0	0.74	– 146.7	2.392	50.4	0.110	– 6.5	0.46	– 100.0
7.5	0.73	– 155.7	2.299	42.1	0.108	– 11.3	0.45	– 107.8
8.0	0.72	– 164.1	2.211	34.2	0.106	– 15.5	0.44	– 114.9
8.5	0.71	– 172.1	2.133	26.7	0.104	– 19.1	0.42	– 121.7
9.0	0.70	180.0	2.065	19.3	0.101	– 22.4	0.41	– 128.8
9.5	0.70	172.1	2.007	12.1	0.099	– 25.2	0.39	– 136.7
10.0	0.70	163.8	1.960	4.5	0.096	– 27.3	0.37	– 146.1
10.5	0.70	155.0	1.907	– 3.6	0.094	– 29.5	0.36	– 157.2
11.0	0.70	146.3	1.837	– 11.9	0.092	– 31.7	0.36	– 169.1
11.5	0.70	138.1	1.751	– 19.8	0.088	– 33.2	0.36	179.0
12.0	0.70	130.9	1.664	– 26.9	0.085	– 33.2	0.37	168.0
12.5	0.72	124.9	1.589	– 33.5	0.084	– 32.3	0.39	158.6
13.0	0.73	118.8	1.526	– 40.2	0.085	– 31.1	0.41	150.2
13.5	0.74	112.3	1.462	– 47.1	0.086	– 30.5	0.43	142.3
14.0	0.75	106.0	1.399	– 54.0	0.089	– 31.3	0.44	134.1
14.5	0.76	100.0	1.339	– 60.7	0.093	– 32.0	0.46	125.7
15.0	0.77	94.3	1.275	– 67.1	0.096	– 32.6	0.47	116.8
15.5	0.78	89.3	1.209	– 73.2	0.099	– 33.2	0.49	108.3
16.0	0.80	85.3	1.156	– 78.7	0.103	– 34.1	0.52	101.3
16.5	0.82	81.4	1.113	– 84.3	0.107	– 35.6	0.55	95.5
17.0	0.82	77.4	1.073	– 90.1	0.114	– 37.9	0.57	90.1
17.5	0.82	72.5	1.036	– 96.0	0.120	– 40.6	0.58	84.1
18.0	0.82	69.9	1.010	– 99.4	0.129	– 41.2	0.58	80.3

Common Source S Parameters (continued)
I_D = 10 mA, V_D = 2.5 V, Z_0 = 50 Ω

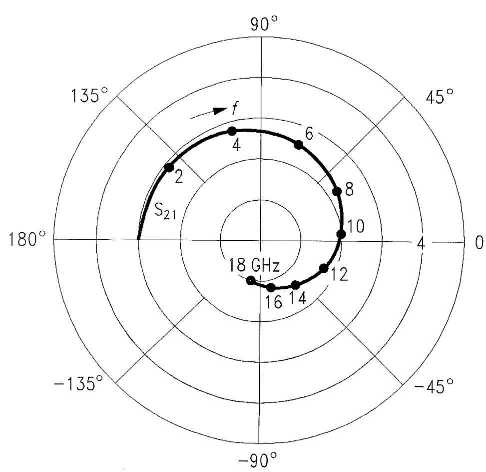
S_{11}



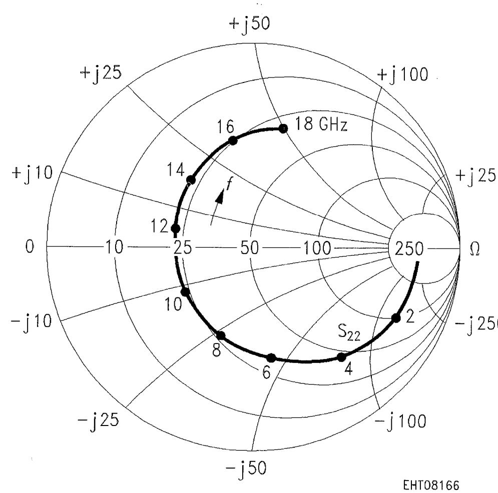
S_{12}



S_{21}



S_{22}

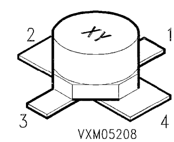


SIEMENS

AlGaAs/GaAs HEMT

CFY 65

- Very low noise (F = 1.2 dB max. at 12 GHz)
- Very high gain (G_a = 11.5 dB typ. at 12 GHz)
- For low-noise front-end amplifiers up to 20 GHz
- For DBS down converters



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]
CFY 65-12 CFY 65-14	HA HB	Q62703-F101 Q62703-F102	D	S	G	S	Micro-X

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	4	V
Drain-gate voltage	V_{DG}	5.5	
Gate-source voltage	V_{GS}	– 3.0 … 0	
Drain current	I_D	70	mA
Total power dissipation, $T_S \leq 65$ ˚C [2]	P_{tot}	200	mW
Channel temperature	T_{ch}	150	˚C
Storage temperature range	T_{stg}	– 65 … + 150	

Thermal Resistance

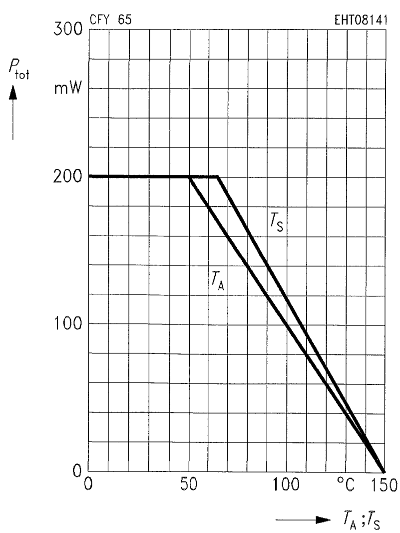
Channel - soldering point [2]	$R_{th\,chS}$	425	K/W

1) For detailed information see chapter Package Outlines.
2) T_S is measured on the source 2 lead at the soldering point to the pcb.

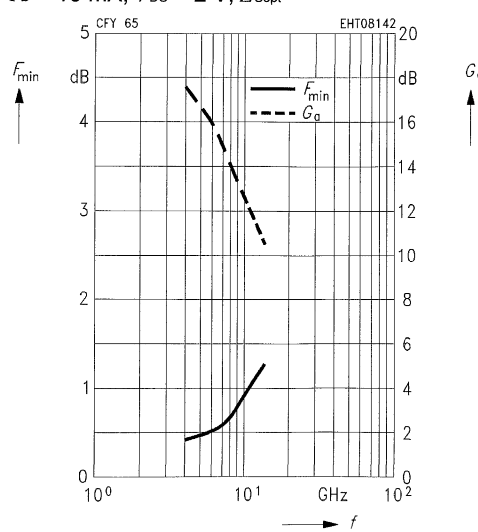
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Drain-source saturation current V_{DS} = 2 V, V_{GS} = 0	I_{DSS}	10	40	70	mA
Pinch-off voltage I_D = 1 mA, V_{DS} = 2 V	V_P	– 0.2	– 1.5	– 2.5	V
Gate leakage current I_D = 10 mA, V_{DS} = 2 V	I_G	–	0.1	5	µA
Transconductance I_D = 10 mA, V_{DS} = 2 V	g_m	25	40	–	mS
Noise figure I_D = 10 mA, V_{DS} = 2 V, f= 12 GHz CFY 65-12 CFY 65-14	F	– –	1.1 1.3	1.2 1.4	dB
Associated gain I_D = 10 mA, V_{DS} = 2 V, f= 12 GHz	G_a	10	11.5	–	

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



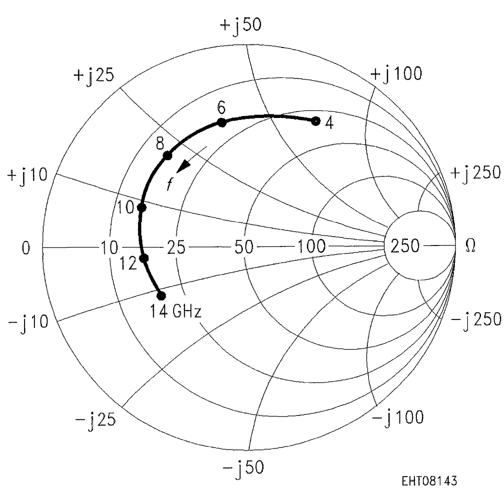
Minimum noise figure $F_{min} = f\,(f)$
Associated gain $G_a = f\,(f)$
I_D = 10 mA, V_{DS} = 2 V, Z_{Sopt}



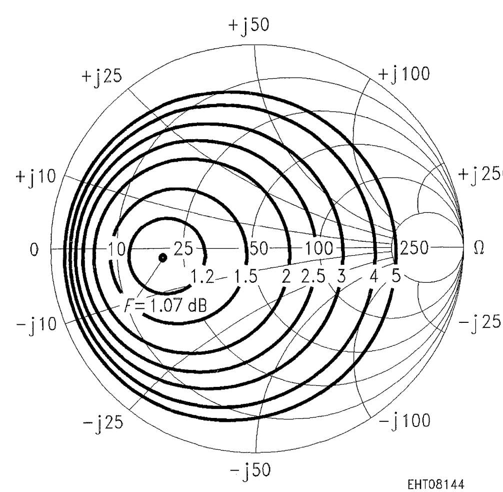
Common Source Noise Parameters

f	F_{min}	G_a	Γ_{opt}		R_N	r_N	N	$F_{50\Omega}$	$G(F_{50\Omega})$
GHz	dB	dB	MAG	ANG	Ω	–	–	dB	dB
I_D = 10 mA, V_{DS} = 2 V, Z_0 = 50 Ω									
4	0.40	17.5	0.66	65	13.6	0.272	0.08	1.25	13.2
6	0.51	16.0	0.60	100	9.0	0.180	0.10	1.3	12
8	0.66	14.0	0.56	130	5.1	0.102	0.12	1.4	10.8
10	0.86	12.5	0.53	160	3.3	0.066	0.17	1.7	10
12	1.07	11.5	0.46	– 175	2.9	0.058	0.16	1.6	9.2
14	1.25	10.5	0.44	– 150	2.7	0.054	0.10	1.55	8.7

Source impedance for min. noise figure
I_D = 10 mA, V_{DS} = 2 V



Circles of constant noise figure
I_D = 10 mA, V_{DS} = 2 V, f= 12 GHz

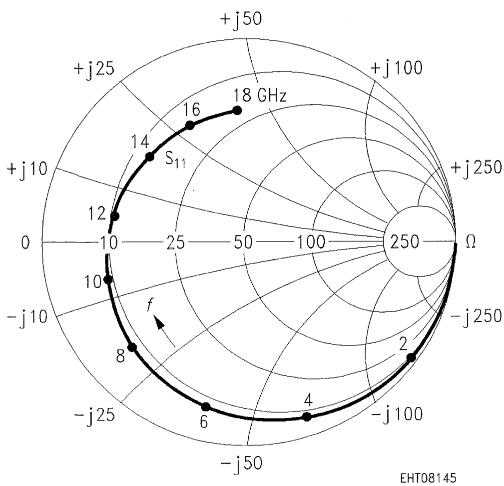


Common Source S Parameters

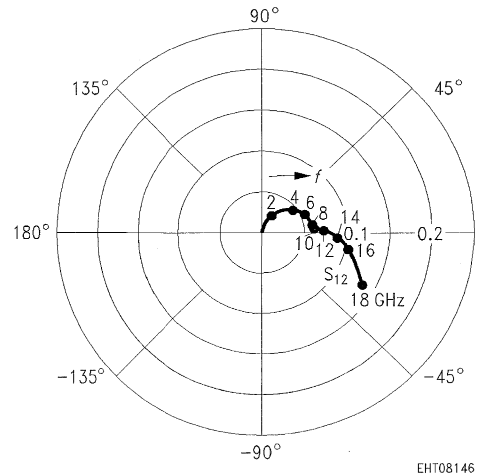
f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_D = 10 mA, V_{DS} = 2 V, Z_0 = 50 Ω								
0.50	1.00	– 9.7	3.69	169.5	0.01	84.3	0.74	– 6.6
1.00	0.99	– 19.0	3.67	160.0	0.01	76.0	0.74	– 13.0
1.50	0.99	– 29.0	3.65	152.3	0.02	68.7	0.73	– 18.0
2.00	0.97	– 38.0	3.63	143.0	0.03	63.0	0.72	– 24.0
2.50	0.96	– 45.7	3.59	134.3	0.04	56.7	0.72	– 31.6
3.00	0.94	– 55.0	3.53	126.0	0.04	51.0	0.71	– 39.0
3.50	0.93	– 63.7	3.43	117.3	0.04	45.9	0.70	– 45.2
4.00	0.90	– 72.0	3.36	109.0	0.05	40.0	0.68	– 51.0
4.50	0.87	– 79.6	3.27	101.4	0.05	34.9	0.68	– 57.2
5.00	0.85	– 88.0	3.20	93.0	0.05	30.0	0.66	– 63.0
5.50	0.84	– 95.5	3.14	85.5	0.06	27.4	0.65	– 68.1
6.00	0.82	– 103.5	3.07	78.0	0.06	23.6	0.64	– 74.0
6.50	0.79	– 111.6	3.00	70.6	0.06	19.1	0.63	– 80.2
7.00	0.77	– 120.0	2.92	63.0	0.06	15.0	0.62	– 86.0
7.50	0.76	– 129.7	2.85	54.3	0.06	11.4	0.61	– 92.4
8.00	0.74	– 137.0	2.79	46.0	0.06	9.0	0.60	– 99.0
8.50	0.73	– 144.6	2.73	38.6	0.06	6.6	0.60	– 104.2
9.00	0.71	– 152.0	2.66	32.0	0.06	6.0	0.59	– 111.0
9.50	0.70	– 158.3	2.61	25.7	0.06	5.9	0.59	– 115.9
10.00	0.69	– 165.0	2.57	19.0	0.06	5.0	0.59	– 121.0
10.50	0.68	– 171.4	2.53	11.5	0.06	5.0	0.58	– 127.1
11.00	0.67	– 179.0	2.48	5.0	0.06	5.0	0.58	– 132.0
11.50	0.66	174.7	2.44	– 0.1	0.07	5.0	0.58	– 138.3
12.00	0.65	168.0	2.39	– 7.0	0.07	5.0	0.57	– 144.0
12.50	0.65	161.7	2.34	– 14.4	0.07	4.9	0.57	– 149.0
13.00	0.65	155.0	2.30	– 21.0	0.07	4.0	0.57	– 155.0
13.50	0.64	148.7	2.25	– 27.1	0.08	2.7	0.58	– 162.2
14.00	0.64	142.0	2.23	– 33.0	0.08	1.0	0.58	– 167.0
14.50	0.64	135.8	2.19	– 40.3	0.09	– 0.4	0.58	– 172.0
15.00	0.64	130.0	2.16	– 46.0	0.09	– 3.0	0.58	– 178.0
15.50	0.63	124.9	2.13	– 52.4	0.10	– 5.6	0.59	174.6
16.00	0.63	119.0	2.10	– 59.0	0.10	– 9.0	0.59	168.0
16.50	0.63	113.9	2.09	– 64.1	0.11	– 12.8	0.60	161.9
17.00	0.62	108.0	2.08	– 71.0	0.11	– 17.0	0.60	156.0
17.50	0.62	101.7	2.08	– 78.5	0.12	– 22.0	0.60	148.4
18.00	0.62	95.0	2.07	– 86.0	0.13	– 27.0	0.61	141.0

Common Source S Parameters (continued)
I_D = 10 mA, V_D = 2 V, Z_0 = 50 Ω

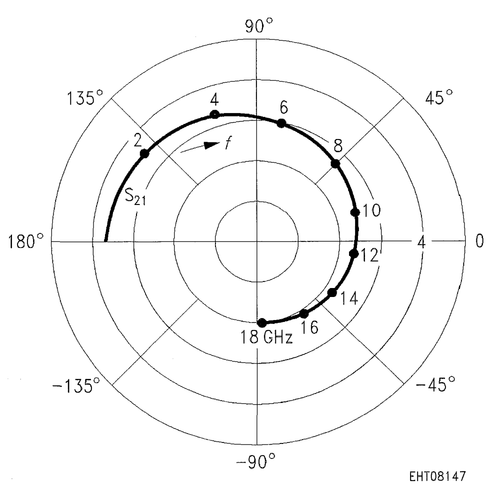
S_{11}



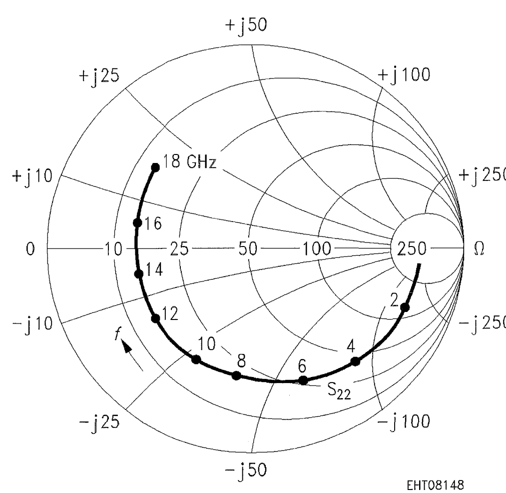
S_{12}



S_{21}



S_{22}

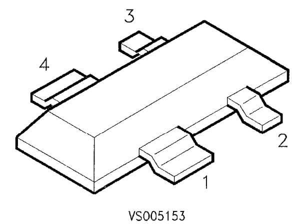


SIEMENS

AlGaAs/GaAs HEMT

CFY 75

- Very low noise
- Very high gain
- For low-noise front end amplifiers up to 20 GHz
- For DBS down converters



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)]
CFY 75-13 CFY 75-15	HB HC	Q62702-F1368 Q62702-F1369	S	D	S	G	MW-4

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	V_{DS}	4	V
Drain-gate voltage	V_{DG}	5	
Gate-source voltage	V_{GS}	– 3.0 ... 0	
Drain current	I_D	70	mA
Total power dissipation, $T_S \leq 51$ ˚C [2)]	P_{tot}	180	mW
Channel temperature	T_{ch}	150	˚C
Storage temperature range	T_{stg}	– 40 ... + 150	

Thermal Resistance

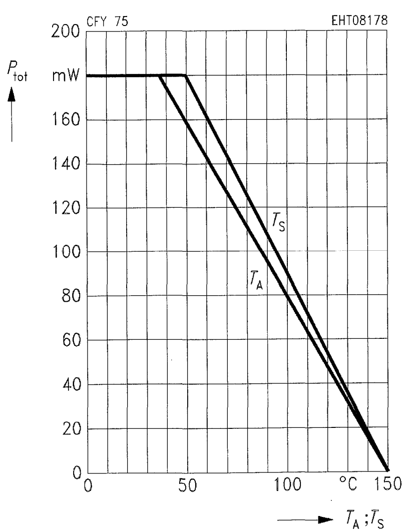
Channel - soldering point [2)]	$R_{th\,chS}$	550	K/W

1) For detailed information see chapter Package Outlines.
2) T_S is measured on the source 1 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					
Drain-source saturation current V_{DS} = 2 V, V_{GS} = 0	I_{DSS}	10	40	70	mA
Pinch-off voltage V_{DS} = 2 V, I_D = 1 mA	$V_{GS(P)}$	– 0.2	– 1.5	– 2.5	V
Gate leakage current V_{DS} = 2 V, I_D = 10 mA	I_G	–	0.1	5	µA
Transconductance V_{DS} = 2 V, I_D = 10 mA	g_m	25	40	–	mS
Noise figure V_{DS} = 2 V, I_D = 10 mA, f= 12 GHz CFY 75-13 CFY 75-15	F	– –	1.2 1.4	1.3 1.5	dB
Associated gain V_{DS} = 2 V, I_D = 10 mA, f= 12 GHz CFY 75-13 CFY 75-15	G_a	9.5 9.0	10.5 10.0	– –	

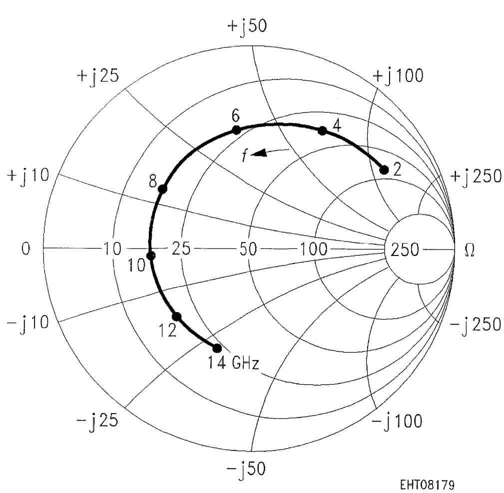
Total power dissipation $P_{tot} = f(T_A^*; T_S)$
* Package mounted on alumina



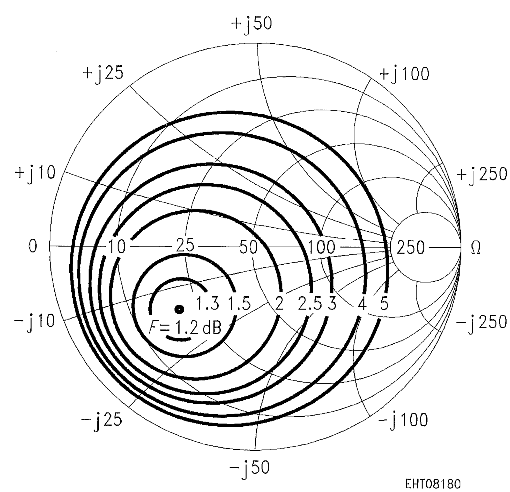
Common Source Noise Parameters

f	F_{min}	G_a	Γ_{opt}		R_N	r_N	N	$F_{50\Omega}$	$G(F_{50\Omega})$
GHz	dB	dB	MAG	ANG	Ω	–	–	dB	dB
I_D = 10 mA, V_{DS} = 2 V, Z_0 = 50 Ω									
2	0.41	19.9	0.70	33	19.3	0.386	0.07	1.35	16.1
4	0.55	15.8	0.62	61	14.6	0.293	0.09	1.3	14.2
6	0.73	14.0	0.55	100	7.7	0.154	0.10	1.3	12.3
8	0.88	12.6	0.51	146	3.3	0.066	0.12	1.4	10.6
10	1.05	11.5	0.46	– 175	2.9	0.058	0.16	1.6	9.3
12	1.20	10.6	0.48	– 138	6.3	0.126	0.19	1.95	7.9
14	1.39	10.2	0.50	– 112	13.7	0.274	0.23	2.3	6.9

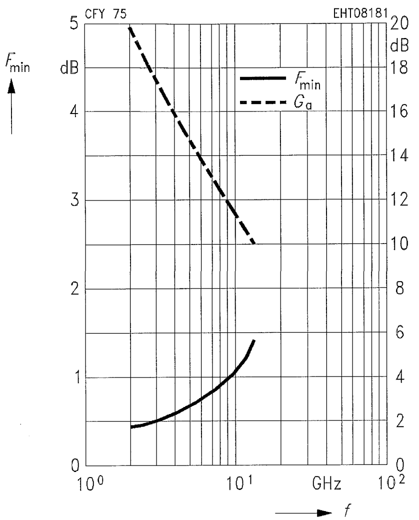
Source impedance for min. noise figure
I_D = 10 mA, V_{DS} = 2 V



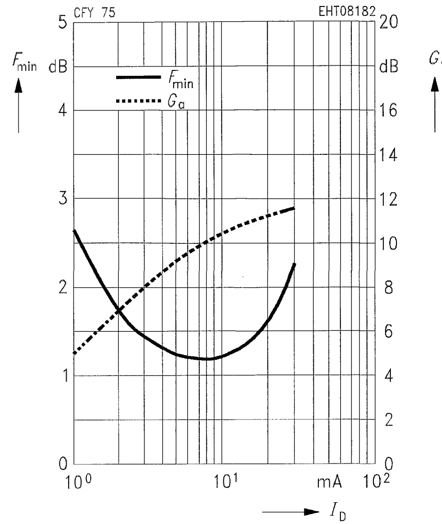
Circles of constant noise figure
I_D = 10 mA, V_{DS} = 2 V, f= 12 GHz



Minimum noise figure $F_{min} = f\ (f)$
Associated gain $G_a = f\ (f)$
I_D = 10 mA, V_{DS} = 2 V, Z_{Sopt}



Minimum noise figure $F_{min} = f\ (I_D)$
Associated gain $G_a = f\ (I_D)$
V_{DS} = 2 V, f= 12 GHz, Z_{Sopt}

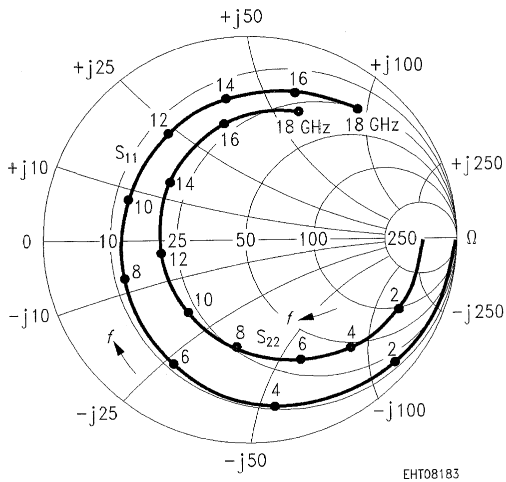


Common Source S Parameters

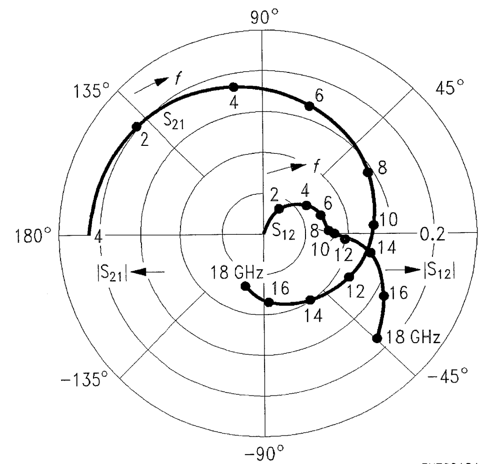
f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_D = 10 mA, V_{DS} = 2 V, Z_0 = 50 Ω								
0.5	0.98	– 9.9	4.195	170.6	0.009	64.7	0.80	– 5.8
1.0	0.97	– 22.3	4.152	159.5	0.020	71.9	0.80	– 12.9
1.5	0.95	– 31.9	4.104	150.6	0.028	66.6	0.79	– 18.6
2.0	0.93	– 44.0	4.028	139.6	0.037	59.1	0.77	– 25.7
2.5	0.91	– 53.7	3.953	130.8	0.044	53.0	0.76	– 31.5
3.0	0.88	– 63.7	3.867	121.6	0.050	47.0	0.74	– 37.4
3.5	0.85	– 74.8	3.760	111.5	0.056	40.8	0.71	– 43.8
4.0	0.83	– 83.8	3.666	103.3	0.061	35.8	0.69	– 48.9
4.5	0.80	– 94.7	3.549	93.6	0.065	30.1	0.67	– 55.1
5.0	0.77	– 103.0	3.460	86.0	0.068	26.1	0.65	– 60.0
5.5	0.74	– 113.4	3.361	76.7	0.070	21.3	0.63	– 66.3
6.0	0.71	– 122.3	3.284	69.0	0.072	17.7	0.60	– 71.7
6.5	0.68	– 131.7	3.207	61.1	0.073	14.1	0.58	– 77.5
7.0	0.66	– 143.7	3.113	51.4	0.075	9.5	0.55	– 85.1
7.5	0.64	– 153.3	3.038	43.7	0.075	6.3	0.53	– 91.4
8.0	0.63	– 164.5	2.942	34.3	0.075	3.4	0.51	– 99.1
8.5	0.62	– 172.9	2.866	27.1	0.076	1.9	0.50	– 105.3
9.0	0.61	178.2	2.788	19.4	0.077	0.9	0.48	– 112.4
9.5	0.60	168.2	2.704	10.9	0.078	0.3	0.45	– 121.0
10.0	0.60	160.0	2.635	3.8	0.080	0.2	0.44	– 128.5
10.5	0.60	149.9	2.550	– 5.1	0.083	– 0.3	0.42	– 139.0
11.0	0.60	141.9	2.481	– 12.4	0.087	– 1.0	0.41	– 148.3
11.5	0.62	132.4	2.387	– 21.4	0.092	– 2.3	0.40	– 161.2
12.0	0.63	125.0	2.302	– 28.7	0.096	– 3.3	0.39	– 173.0
12.5	0.64	118.4	2.217	– 35.8	0.102	– 4.5	0.40	175.0
13.0	0.66	111.4	2.119	– 43.9	0.109	– 6.4	0.42	162.3
13.5	0.67	106.2	2.048	– 50.0	0.116	– 8.3	0.44	153.6
14.0	0.68	99.5	1.967	– 57.5	0.126	– 11.4	0.46	143.2
14.5	0.69	93.3	1.910	– 64.3	0.134	– 14.7	0.48	134.2
15.0	0.70	86.1	1.846	– 71.9	0.143	– 18.8	0.49	123.9
15.5	0.72	77.7	1.754	– 80.7	0.152	– 23.6	0.52	111.5
16.0	0.74	71.3	1.666	– 87.6	0.158	– 27.7	0.56	102.1
16.5	0.76	64.3	1.556	– 95.6	0.165	– 32.9	0.60	92.2
17.0	0.78	59.4	1.478	– 101.7	0.171	– 37.1	0.62	84.9
17.5	0.80	54.0	1.391	– 108.9	0.176	– 42.2	0.65	76.0
18.0	0.81	52.4	1.368	– 111.5	0.180	– 44.0	0.65	72.6

Common Source S Parameters (continued)
I_D = 10 mA, V_D = 2 V, Z_0 = 50 Ω

S_{11}, S_{22}



S_{12}, S_{21}



GaAs MMIC

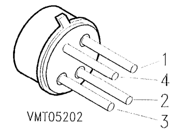
GaAs MMIC

SIEMENS

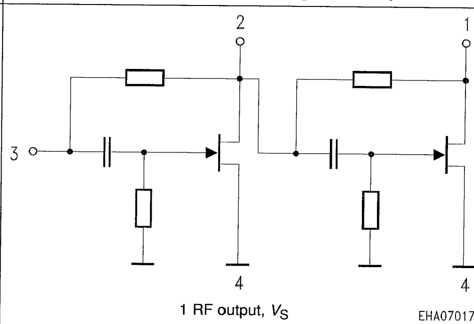
GaAs MMIC

CGY 21

- Two-stage monolithic microwave IC (MMIC amplifier)
- All gold metallization
- Chip fully passivated
- Operating voltage range: 3 to 6 V
- 50 Ω input/output; R_{LIN} R_{LOUT} > 10 dB
- Gain: 21 dB at 500 MHz
- Low noise figure: 3.9 dB at 500 MHz
- Bandwidth: 2 GHz
- Hermetically sealed package



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

Type	Ordering Code	Circuit Diagram (Pin Configuration)	Package[1)]
CGY 21	Q68000-A5953	 1 RF output, V_S 2 Interstage, V_S 3 RF input 4 RF and DC ground, case	TO-12

1) For detailed information see chapter Package Outlines.

Maximum Ratings

Parameter	Symbol	Values	Unit
Supply voltage, $T_C \leq 80$ °C	V_S	6	V
Total power dissipation, $T_C \leq 50$ °C	P_{tot}	2	W
Channel temperature	T_{ch}	150	°C
Storage temperature range	T_{stg}	– 55 ... + 150	

Thermal Resistance

Channel - case	R_{thchC}	50	K/W

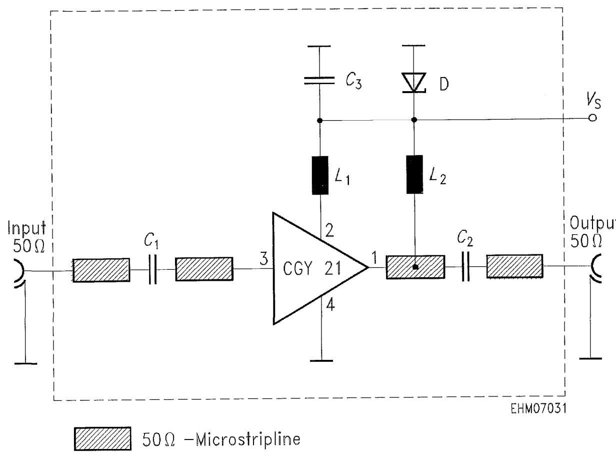
Note: Exceeding any of the maximum ratings may cause permanent damage to the device. Appropriate handling procedures are required to protect the electrostatic sensitive IC against degradation due to excess voltage or excess current spikes. Excellent ground connection of lead 4 and the package (e. g. soldered on microstripline laminate) is required to achieve guaranteed RF performance and stable operation conditions and provides adequate heat sink. Low parasitic capacitance of the bias network to port 2 gives optimum gain and flatness. Input and output connections must be DC isolated by coupling capacitors.

Electrical Characteristics
at T_A = 25 ˚C, V_S = 4.5 V, R_S = R_L = 50 Ω, unless otherwise specified,
(for application circuit see next page).

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Operating current	I_{op}	–	160	200	mA
Power gain f = 100 MHz to 900 MHz	G	19	21	–	dB
Gain flatness f = 100 MHz to 900 MHz	ΔG	–	1.5	2	
Noise figure f = 100 MHz to 900 MHz	F	–	3.9	5.5	
Input return loss f = 100 MHz to 900 MHz	RL_{IN}	–	12	9.5	
Output return loss f = 100 MHz to 900 MHz	RL_{OUT}	–	12	9.5	
Third order intercept point two-tone intermodulation test f_1 = 806 MHz, f_2 = 810 MHz, P_o = 10 dBm (both carriers)	IP_3	31	32.5	–	dBm
1 dB gain compression f = 100 MHz to 900 MHz	P_{1dB}	–	19	–	

Application Circuit

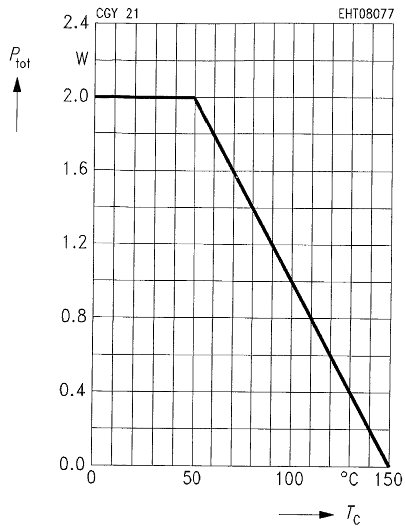
f = 100 MHz to 900 MHz



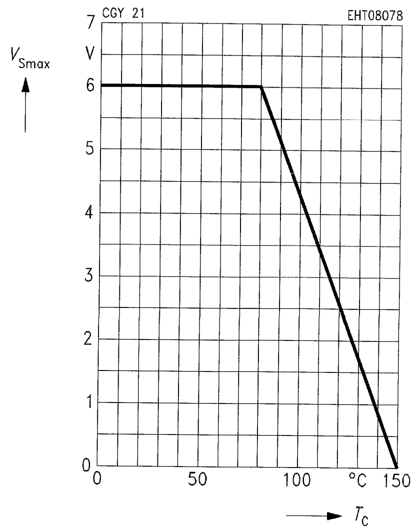
Legend of components

C_1, C_2, C_3	1 nF chip capacitors
L_1, L_2	1 µH inductance (B 78108 - T 1102K)
D	6 V2 Zener diode (BZW 22C6V2)

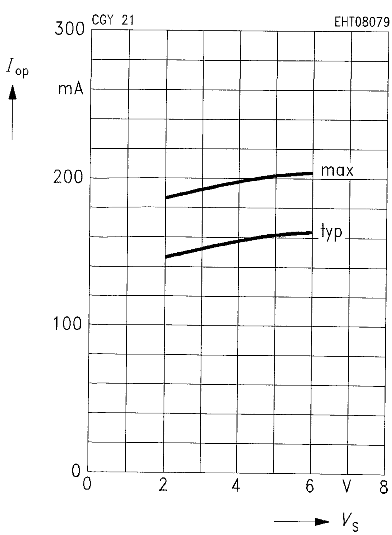
Total power dissipation $P_{tot} = f\,(T_C)$



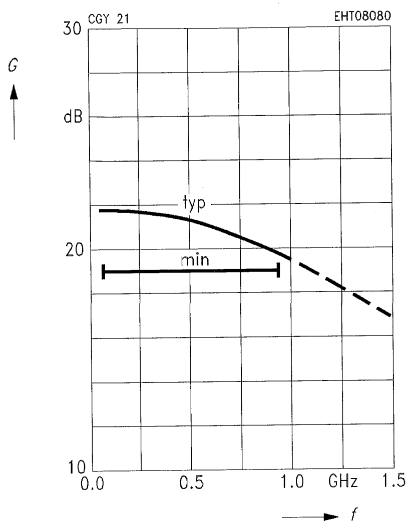
Max. supply voltage $V_{Smax} = f\,(T_C)$



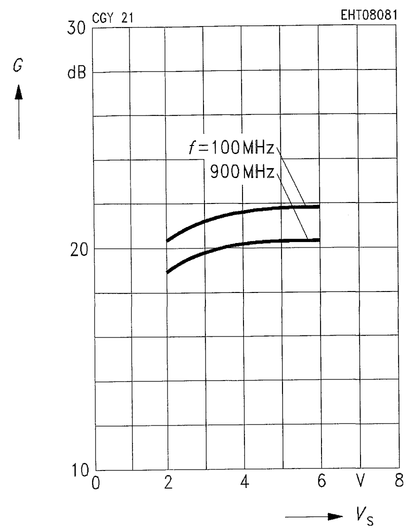
Operating current $I_{op} = f\,(V_S)$



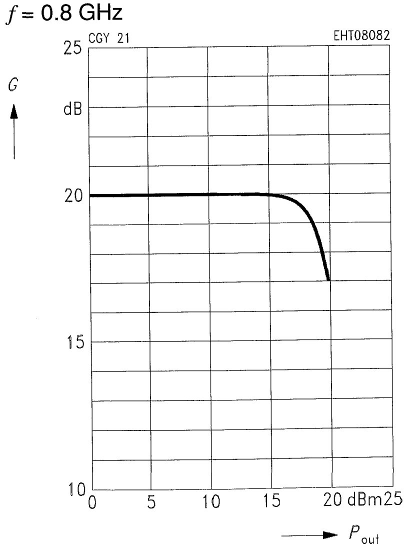
Power gain $G = f(f)$
$V_S = 4.5$ V, $R_S = R_L = 50\ \Omega$



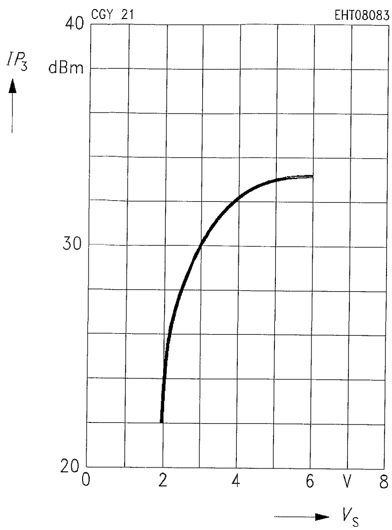
Power gain $G = f(V_S)$
$R_S = R_L = 50\ \Omega$



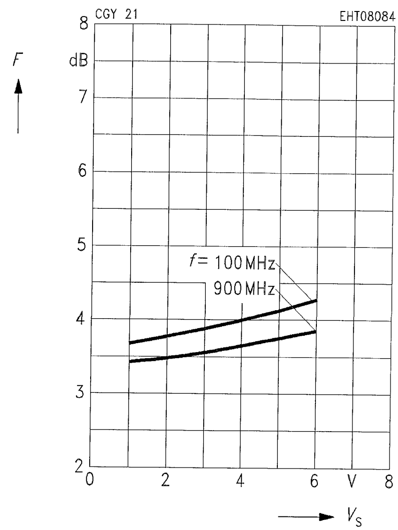
Power gain $G = f(P_{out})$
$V_S = 4.5$ V, $R_S = R_L = 50\ \Omega$
$f = 0.8$ GHz



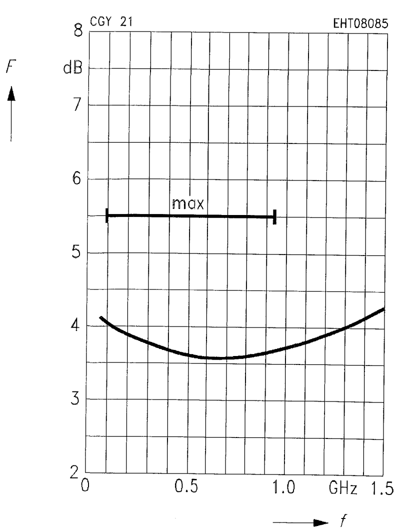
Third order intercept point $IP_3 = f\,(V_S)$
f = 800 MHz, $R_S = R_L$ = 50 Ω



Noise figure $F = f\,(V_S)$
$R_S = R_L$ = 50 Ω



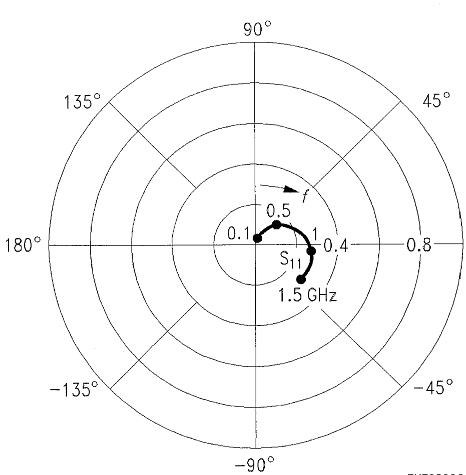
Noise figure $F = f\,(f)$
V_S = 4.5 V, $R_S = R_L$ = 50 Ω



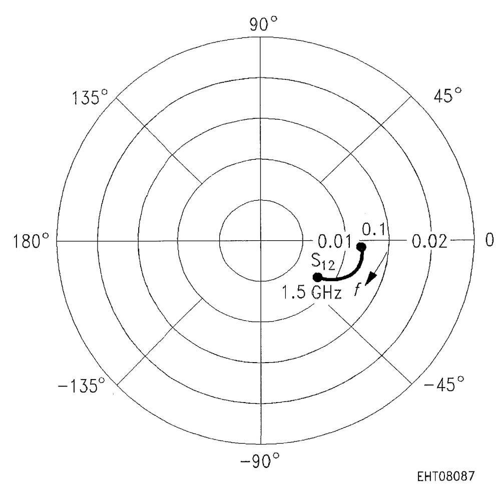
S Parameters

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**
V_S = 4.5 V, Z_0 = 50 Ω								
0.1	0.02	49	13.82	– 10	0.012	– 2	0.11	3
0.3	0.08	55	13.63	– 34	0.012	– 7	0.13	11
0.5	0.14	34	13.03	– 58	0.012	– 13	0.15	18
0.7	0.18	17	12.1	– 81	0.011	– 19	0.19	20
0.9	0.23	0	10.93	– 104	0.011	– 24	0.24	20
1.1	0.27	– 15	9.48	– 127	0.01	– 29	0.29	16
1.3	0.28	– 28	7.91	– 149	0.009	– 31	0.33	12
1.5	0.25	– 39	6.29	– 171	0.008	– 32	0.36	5

$S_{11} = f\,(f)$
V_S = 4.5 V, Z_0 = 50 Ω

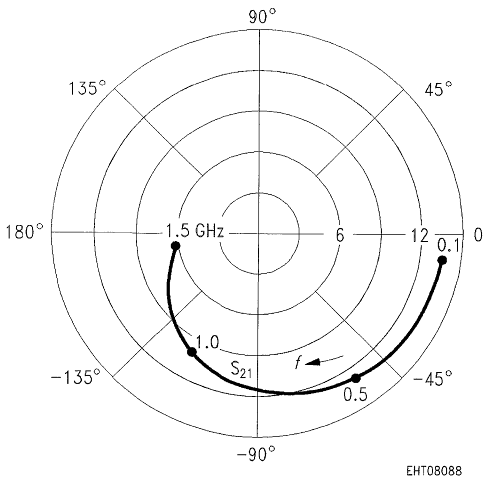


$S_{12} = f\,(f)$
V_S = 4.5 V, Z_0 = 50 Ω

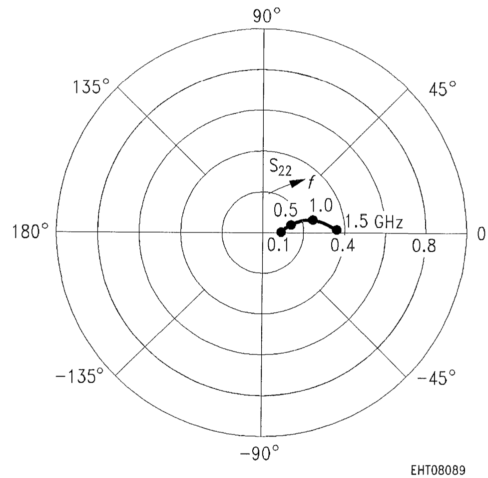


S Parameters (continued)

$S_{21} = f\ (f)$
V_S = 4.5 V, Z_0 = 50 Ω



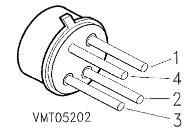
$S_{22} = f\ (f)$
V_S = 4.5 V, Z_0 = 50 Ω



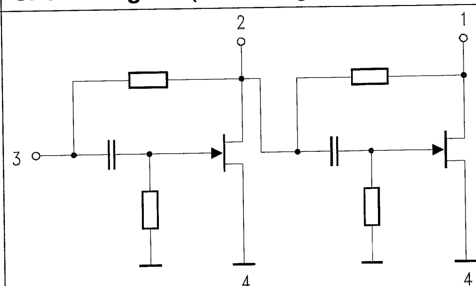
GaAs MMIC

CGY 31

- Two-stage monolithic microwave IC (MMIC amplifier)
- All-gold metallization
- Chip fully passivated
- Operating voltage range: 3 to 6 V
- 50 Ω input/output; R_{LIN} R_{LOUT} > 10 dB
- Gain: 18 dB at 1.6 GHz
- Low noise figure: 4 dB at 1.6 GHz
- 3 dB bandwidth: 2 GHz
- Hermetically sealed package



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

Type	Ordering Code	Circuit Diagram (Pin Configuration)	Package[1)]
CGY 31	Q68000-A6887	 1 RF output, V_S 2 Interstage, V_S 3 RF input 4 RF and DC ground, case	TO-12

1) For detailed information see chapter Package Outlines.

Maximum Ratings

Parameter	Symbol	Values	Unit
Supply voltage, $T_C \leq 80$ °C	V_S	6	V
Total power dissipation, $T_C \leq 50$ °C	P_{tot}	2	W
Channel temperature	T_{ch}	150	°C
Storage temperature range	T_{stg}	– 55 … + 150	

Thermal Resistance

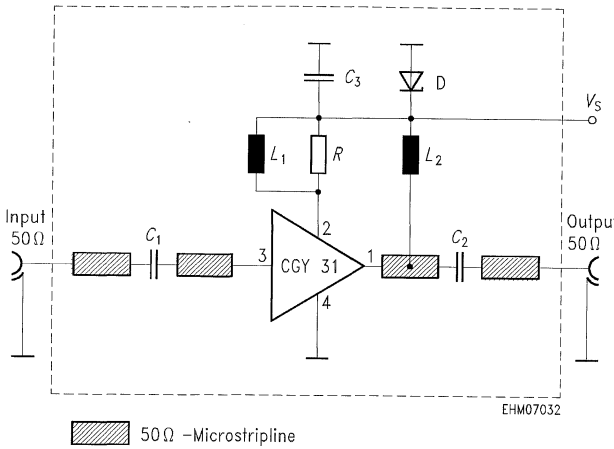
Channel - case	R_{thchC}	50	K/W

Note: Exceeding any of the maximum ratings may cause permanent damage to the device. Appropriate handling procedures are required to protect the electrostatic sensitive IC against degradation due to excess voltage or excess current spikes. Excellent ground connection of lead 4 and the package (e. g. soldered on microstripline laminate) is required to achieve guaranteed RF performance and stable operation conditions and provides adequate heat sink. Low parasitic capacitance of the bias network to port 2 gives optimum gain and flatness. Input and output connections must be DC isolated by coupling capacitors.

Electrical Characteristics
at T_A = 25 °C, V_S = 4.5 V, R_S = R_L = 50 Ω, unless otherwise specified,
(for application circuit see next page).

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Operating current	I_{op}	–	160	200	mA
Power gain f = 800 MHz to 1800 MHz	G	15	18	–	dB
Gain flatness f = 800 MHz to 1800 MHz	ΔG	–	2.0	2.5	
Noise figure f = 800 MHz to 1800 MHz	F	–	4.0	5.0	
Input return loss f = 800 MHz to 1800 MHz	RL_{IN}	–	13	9.5	
Output return loss f = 800 MHz to 1800 MHz	RL_{OUT}	–	12	9.5	
Third order intercept point two-tone intermodulation test f_1 = 806 MHz, f_2 = 810 MHz, P_o = 10 dBm (both carriers)	IP_3	31	32.5	–	dBm
1 dB gain compression f = 800 MHz to 1800 MHz	P_{1dB}	–	19	–	

Application Circuit
f = 800 MHz to 1800 MHz

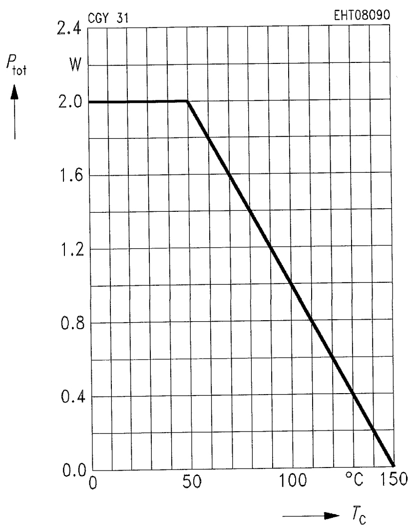


Legend of components

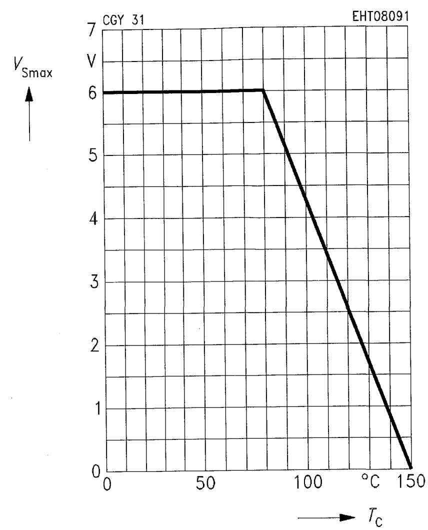
C_1, C_2, C_3	: 100 pF : 1 nF	Chip capacitors
R_1 L_1	39 Ω 70 nH	Resistor, e.g. l = 4 mm; ∅ 1.8 mm with axial leads Inductance, e.g. 8 turns, 0.25 mm enamelled copper wire wound on R. The geometrical combination of L_1 and R influences the frequency response.
L_2	40 nH	Inductance, e.g. 5 turns, 0.25 enamelled copper wire wound on M3-nylon rod.
D	6 V 2	Zener diode, 1.3 W (type BZW 22 C 6 V 2).

Note: For lower frequencies (f = 100 ... 900 MHz) the performance of CGY 31 is comparable to that of CGY 21, if an interstage circuit with L_1 = 1 μH is connected.

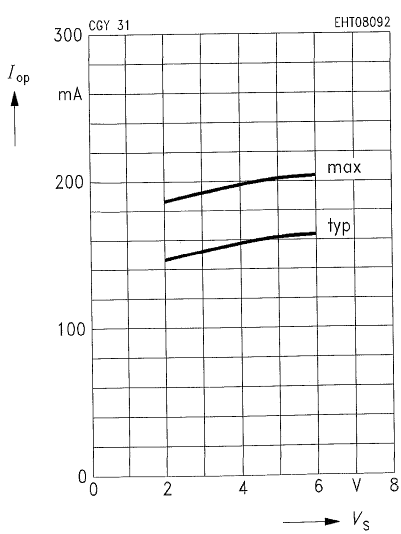
Total power dissipation $P_{tot} = f(T_C)$



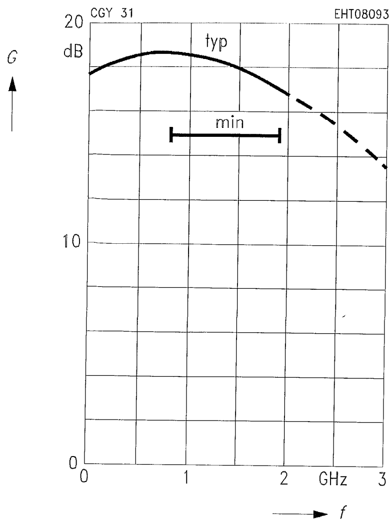
Max. supply voltage $V_{Smax} = f(T_C)$



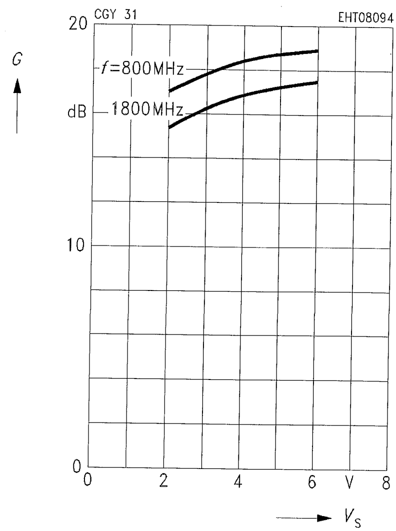
Operating current $I_{op} = f(V_S)$



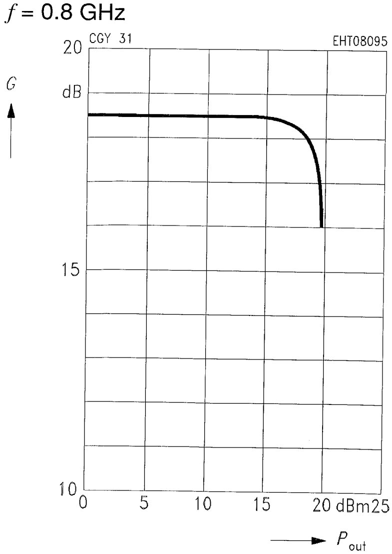
Power gain $G = f(f)$
V_S = 4.5 V, $R_S = R_L$ = 50 Ω



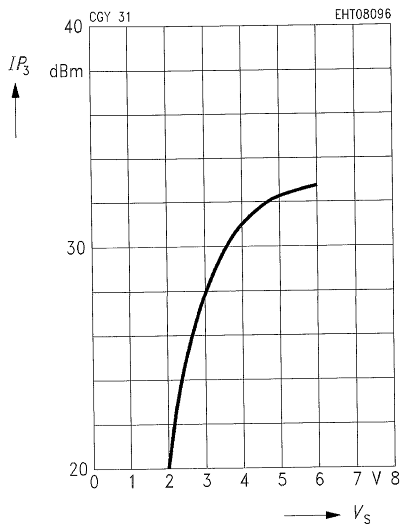
Power gain $G = f(V_S)$
$R_S = R_L$ = 50 Ω



Power output $G = f(P_{out})$
V_S = 4.5 V, $R_S = R_L$ = 50 Ω
f = 0.8 GHz



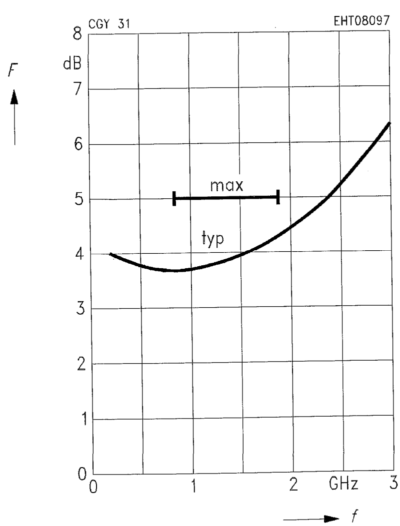
Third order intercept point $IP_3 = f\,(V_S)$
f = 0.8 GHz, $R_S = R_L$ = 50 Ω



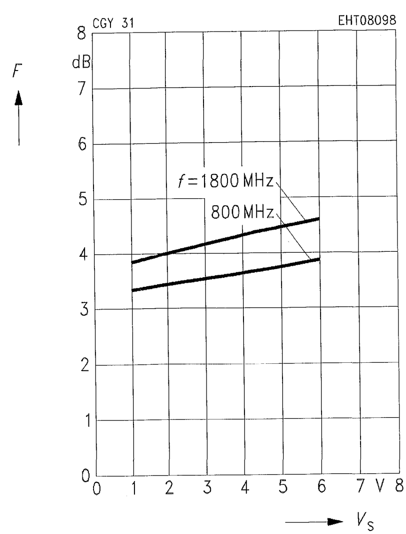
The intermodulation ratio d_{IM} can easily be determined.
$d_{IM} = 2\,(IP_3 - P_0)$

IP_3 = Intercept point
d_{IM} = Intermodulation ratio
P_0 = Power level of each carrier in dBm

Noise figure $F = f\,(f)$
V_S = 4.5 V, $R_S = R_L$ = 50 Ω



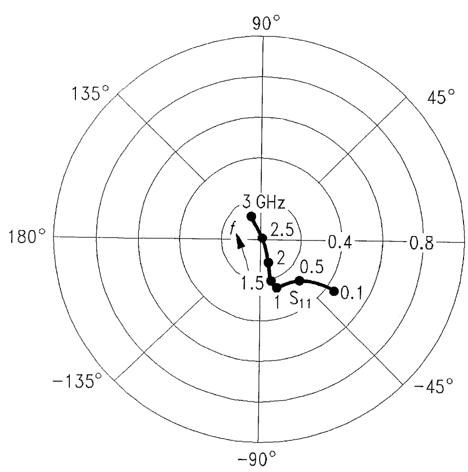
Noise figure $F = f\,(V_S)$
$R_S = R_L$ = 50 Ω



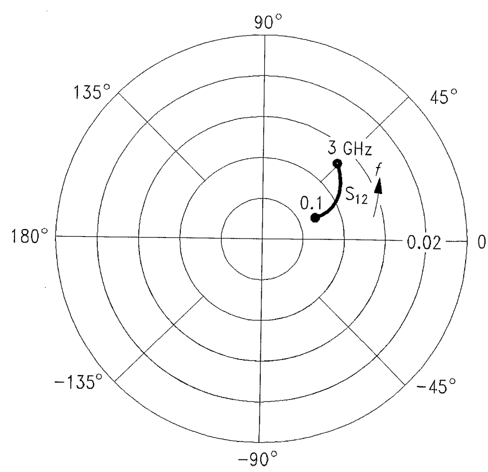
S Parameters

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
V_S = 4.5 V, Z_0 = 50 Ω								
0.1	0.42	– 35	7.77	23	0.007	31	0.25	– 19
0.3	0.28	– 42	8.93	– 12	0.008	21	0.21	– 20
0.5	0.26	– 51	9.04	– 34	0.008	21	0.21	– 23
0.7	0.25	– 64	9.16	– 52	0.009	22	0.22	– 30
0.9	0.24	– 72	9.15	– 71	0.009	28	0.23	– 34
1.1	0.24	– 76	8.99	– 90	0.010	27	0.24	– 36
1.3	0.23	– 78	8.62	– 109	0.010	29	0.25	– 35
1.5	0.22	– 77	8.15	– 127	0.011	30	0.27	– 31
1.7	0.19	– 73	7.52	– 145	0.011	29	0.30	– 26
1.9	0.16	– 71	6.80	– 162	0.011	32	0.33	– 22
2.1	0.12	– 66	6.06	– 179	0.012	33	0.35	– 17
2.3	0.06	– 56	5.45	165	0.011	35	0.36	– 13
2.5	0.02	– 8	4.81	150	0.012	36	0.36	– 11
2.7	0.06	107	4.15	135	0.012	36	0.35	– 10
2.9	0.11	108	3.43	121	0.012	41	0.34	– 13
3.1	0.15	111	2.68	110	0.014	40	0.33	– 20

$S_{11} = f(f)$
V_S = 4.5 V, Z_0 = 50 Ω

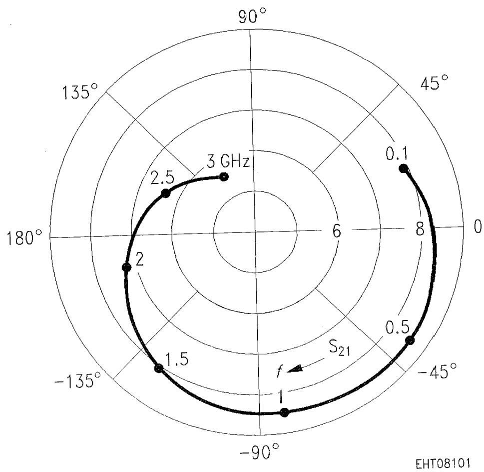


$S_{12} = f(f)$
V_S = 4.5 V, Z_0 = 50 Ω

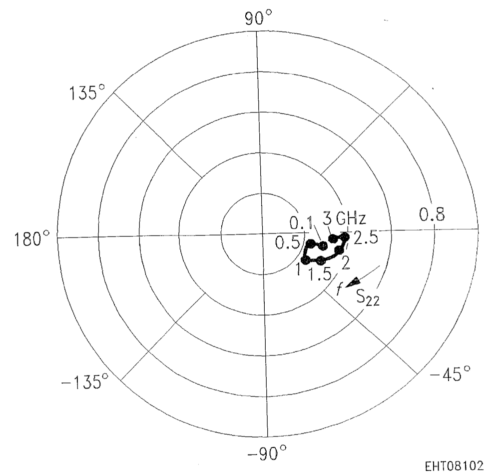


S Parameters (continued)

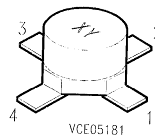
$S_{21} = f\,(f)$
V_S = 4.5 V, Z_0 = 50 Ω



$S_{22} = f\,(f)$
V_S = 4.5 V, Z_0 = 50 Ω



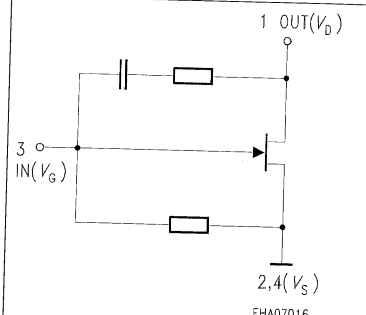
CGY 31



ɪnicrowave IC (MMIC amplifier)
MHz to 3 GHz
. 1.6 GHz
2.7 dB typical, at 1.6 GHz
Hz typical, at −3 dB, $VSWR \leq 2$:1
150 ɪage range: 3 to 5.5 V
urrent control with negative gate bias
ally sealed ceramic stripline package Cerec
ɪing unit: 1000 items per 18 cm tape reel

0

ɔ: Electrostatic discharge sensitive device, observe handling precautions!

ɪype	Marking	Ordering Code (tape and reel)	Circuit Diagram (Pin Configuration)	Package[1)]
CGY 40	40	Q68000-A4444		Cerec-X

1) For detailed information see chapter Package Outlines.

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain voltage	V_D	5.5	V
Current control gate voltage	V_G	– 3 … 0	
Drain-gate voltage	V_{DG}	8.5	
Input power	P_{IN}	16	dBm
Total power dissipation, $T_S \leq 82$ °C [1]	P_{tot}	440	mW
Channel temperature	T_{ch}	150	°C
Storage temperature range	T_{stg}	– 55 … + 150	

Thermal Resistance

Channel - soldering point [1]	$R_{th\,JS}$	155	K/W

Note: Exceeding any of the maximum ratings may cause permanent damage to the device. Appropriate handling is required to protect the electrostatic-sensitive MMIC against degradation due to excess voltage or excess current spikes. Proper ground connection of leads 2 and 4 (with minimum inductance) is required to achieve the guaranteed RF performance, stable operating conditions and adequate cooling.

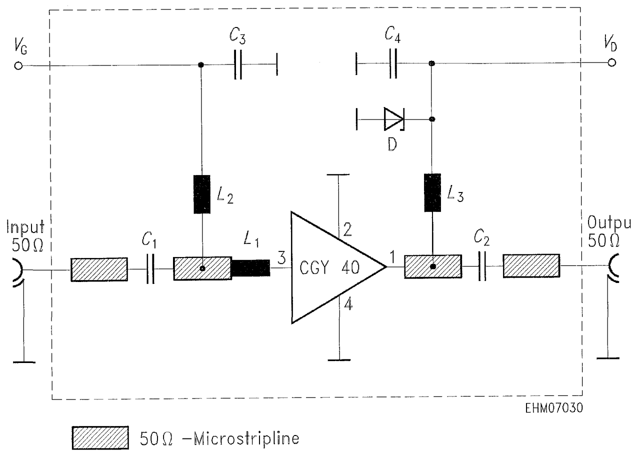
[1] T_S is measured on the source lead at the soldering point to the pcb.

Electrical Characteristics
at T_A = 25 °C, V_G = 0, V_D = 4.5 V, R_S = R_L = 50 Ω, unless otherwise specified,
(for application circuit see next page).

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC characteristics					
Drain current	I_D	–	60	80	mA
Power gain f = 200 MHz f = 1800 MHz	G	 – 8	 10.5 9	 – –	dB
Gain flatness f = 200 to 1000 MHz f = 800 to 1800 MHz	ΔG	 – –	 0.4 1.1	 – 2	
Noise figure f = 200 to 1000 MHz f = 800 to 1800 MHz	F	 – –	 2.5 2.8	 – 4.0	
Input return loss f = 200 to 1000 MHz f = 800 to 1800 MHz	RL_{IN}	 – –	 13 12	 – 9.5	
Output return loss f = 200 to 1000 MHz f = 800 to 1800 MHz	RL_{OUT}	 – –	 12 12	 – 9.5	
Third order intercept point two-tone intermodulation test f_1 = 806 MHz, f_2 = 810 MHz, P_0 = 10 dBm (both carriers)	IP_3	31	32	–	dBm
1 dB gain compression f = 200 to 1800 MHz	P_{1dB}	–	18	–	
Gain control dynamic range f = 200 to 1000 MHz f = 200 to 1800 MHz	ΔG	 – –	 30 20	 – –	dB

Application Circuit

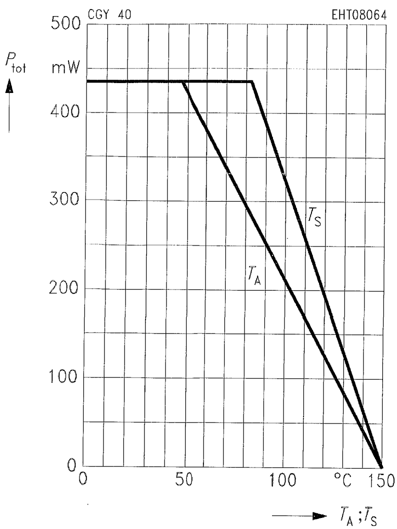
f = 800 to 1800 MHz



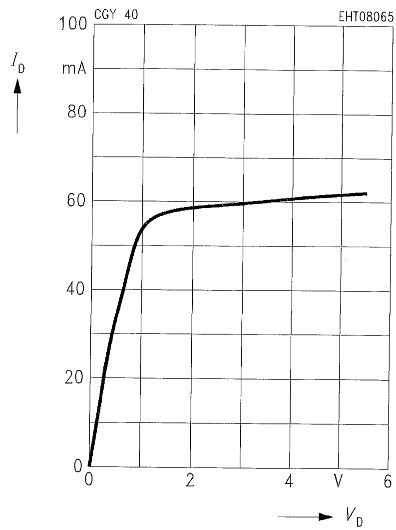
Legend of components

C_1, C_2, C_3, C_4	Chip capacitors 100 pF Chip capacitor 1 nF
L_1	For optimized input matching – discrete inductor: approx. 3 nH, or – printed microstripline inductor: Z approx. 100 Ω, l_e approx. 5 mm
L_2, L_3	– discrete inductor: approx. 40 nH, as e.g. 5 turns, 0.25 mm copper wire on nylon rod with M3-thread, or – printed microstripline inductor
D	Z diode 5.6 V (type BZW 22 C5 V 6)

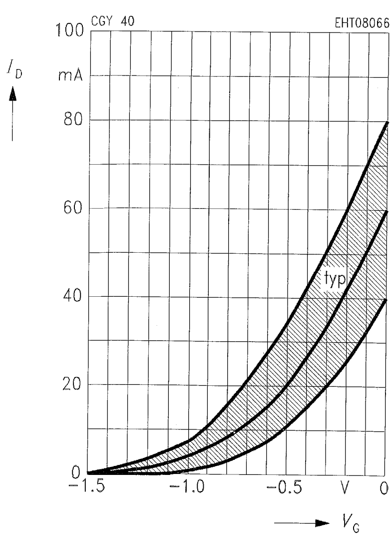
Total power dissipation $P_{tot} = f\,(T_A;\,T_S)$



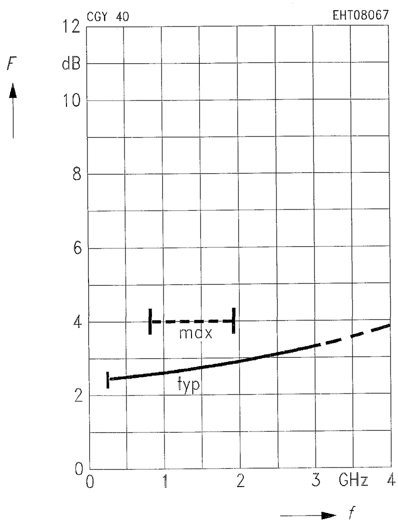
Drain current $I_D = f\,(V_D)$
$V_G = 0$



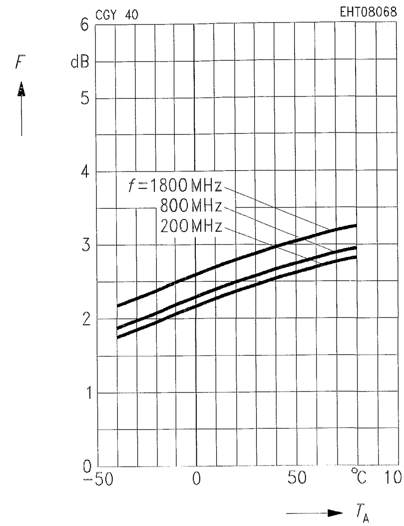
Drain current $I_D = f\,(V_G)$
$V_D = 4.5$ V



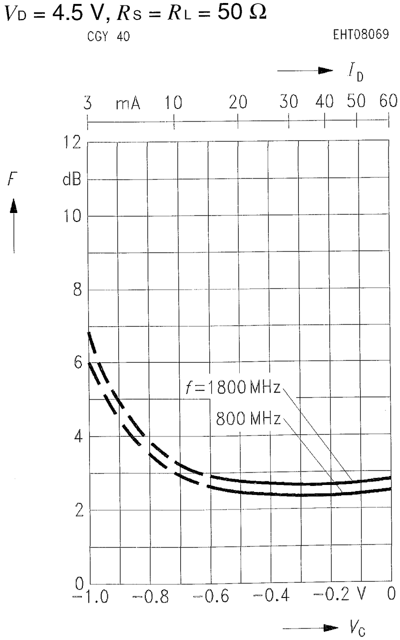
Noise figure $F = f(f)$
V_D = 4.5 V, V_G = 0, R_S = R_L = 50 Ω



Noise figure $F = f(T_A)$
V_D = 4.5 V, V_G = 0, R_S = R_L = 50 Ω

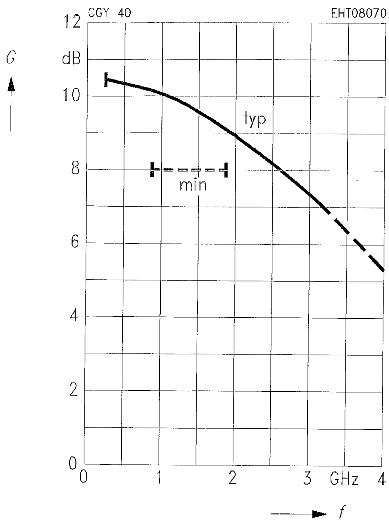


Noise figure $F = f(V_G)$
V_D = 4.5 V, R_S = R_L = 50 Ω

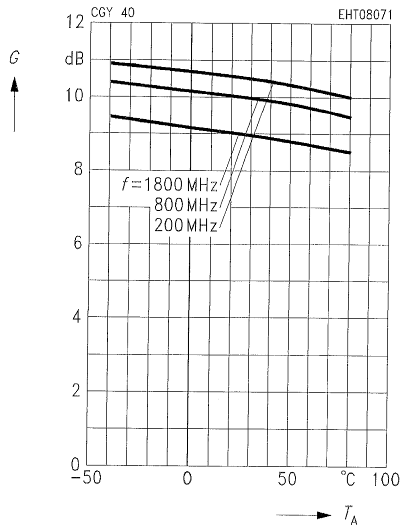


The gate voltage V_G refers to a typical drain current I_D of 60 mA with the supplementary information of the I_D values.

Power gain $G = f(f)$
V_D = 4.5 V, V_G = 0, $R_S = R_L$ = 50 Ω

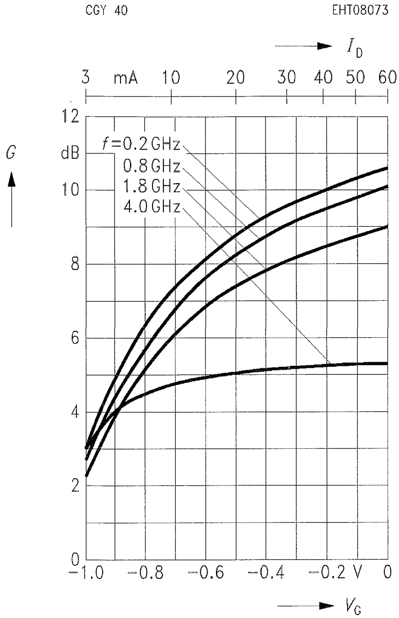


Power gain [1] $G = f(T_A)$
V_D = 4.5 V, V_G = 0, $R_S = R_L$ = 50 Ω

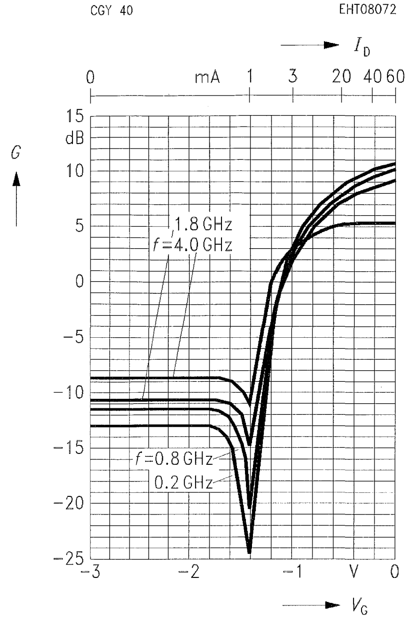


1) Mounted on pcb (application circuit)

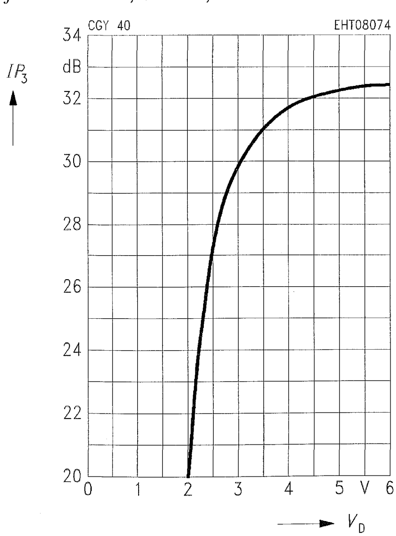
Power gain $G = f(V_G)$ *
V_D = 4.5 V, $R_S = R_L$ = 50 Ω



Power gain $G = f(V_G)$ *
V_D = 4.5 V, $R_S = R_L$ = 50 Ω



Third order intercept point $IP_3 = f(V_D)$
f = 800 MHz, V_G = 0, $R_S = R_L$ = 50 Ω



* The gate voltage V_G refers to a typical drain current I_D of 60 mA with the supplementary information of the I_D values.

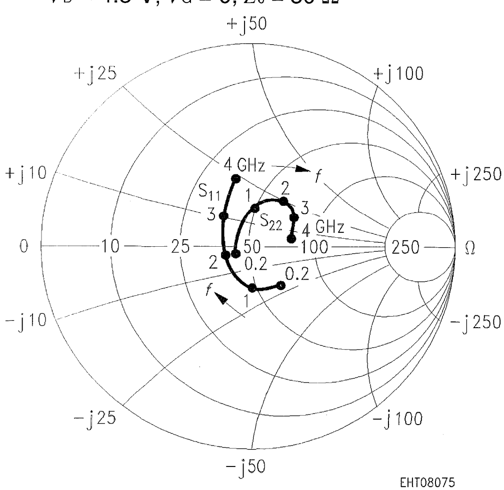
The intermodulation ratio d_{IM} can easily be determined.
$d_{IM} = 2\,(IP_3 - P_0)$

IP_3 = Intercept point
d_{IM} = Intermodulation ratio
P_0 = Power level of each carrier in dBm

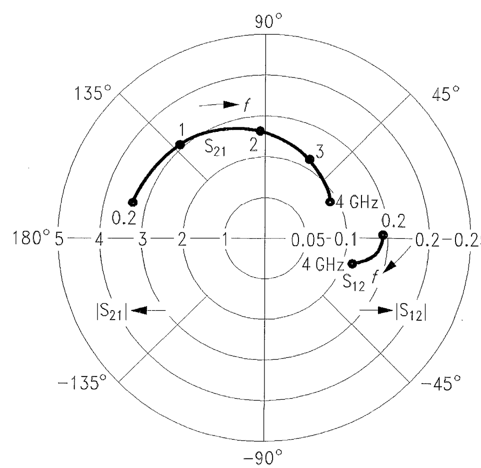
S Parameters

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
V_D = 4.5 V, V_G = 0, Z_0 = 50 Ω								
0.2	0.20	– 47	3.32	165	0.14	2	0.09	– 150
0.4	0.16	– 49	3.24	158	0.14	– 2	0.09	148
0.6	0.15	– 60	3.17	149	0.14	– 6	0.11	117
0.8	0.16	– 72	3.09	141	0.14	– 8	0.13	97
1.0	0.15	– 87	3.02	132	0.13	– 10	0.16	84
1.2	0.14	– 105	2.95	124	0.13	– 12	0.19	76
1.4	0.15	– 124	2.88	116	0.13	– 13	0.21	68
1.6	0.15	– 139	2.82	107	0.12	– 14	0.22	60
1.8	0.16	– 151	2.75	100	0.12	– 15	0.24	54
2.0	0.17	– 166	2.69	93	0.11	– 15	0.25	48
2.2	0.18	– 176	2.62	86	0.11	– 15	0.26	41
2.4	0.21	173	2.56	80	0.11	– 14	0.27	37
2.6	0.21	163	2.48	73	0.11	– 14	0.27	32
2.8	0.23	154	2.40	67	0.11	– 14	0.27	28
3.0	0.24	146	2.32	61	0.11	– 13	0.27	24
3.2	0.26	140	2.24	55	0.11	– 12	0.27	20
3.4	0.29	136	2.15	51	0.11	– 14	0.26	18
3.6	0.31	127	2.05	44	0.11	– 12	0.25	17
3.8	0.32	123	1.94	39	0.11	– 11	0.24	14
4.0	0.34	118	1.83	34	0.11	– 11	0.23	10
4.2	0.36	115	1.80	29	0.11	– 11	0.22	6

S_{11}, S_{22}
V_D = 4.5 V, V_G = 0, Z_0 = 50 Ω



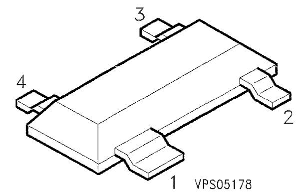
S_{12}, S_{21}
V_D = 4.5 V, V_G = 0, Z_0 = 50 Ω



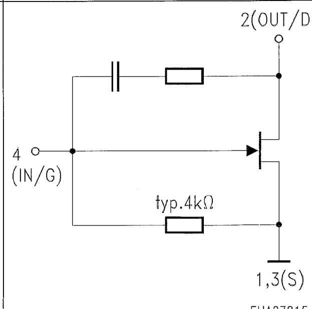
GaAs MMIC

CGY 50

- Single-stage, monolithic microwave IC (MMIC amplifier)
- Cascadable 50 Ω gain block
- Application range: 100 MHz to 3 GHz
- Third order intercept point 30 dBm typical at 1.8 GHz
- Gain: 8.5 dB typical at 1.8 GHz
- Low noise figure: 3.0 dB typical at 1.8 GHz
- Gain control dynamic range 20 dB
- Ion-implanted planar structure
- Chip all gold metallization
- Chip nitride passivation



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

Type	Marking	Ordering Code (tape and reel)	Circuit Diagram (Pin Configuration)	Package[1)]
CGY 50	G2	Q68000-A8370		SOT-143

1) For detailed information see chapter Package Outlines.

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain voltage (DC)	V_D	5.5	V
Peak drain voltage (DC + RF)	V_{Dp}	7.5	
Current control gate voltage	V_G	– 3 … 0	
Drain-gate voltage	V_{DG}	7.5	
Input power [1)]	P_{IN}	16	dBm
Total power dissipation, $T_S \leq 82$ ˚C [2)]	P_{tot}	400	mW
Channel temperature	T_{ch}	150	˚C
Storage temperature range	T_{stg}	– 40 … + 150	

Thermal Resistance

Channel - soldering point [2)]	$R_{th\ JS}$	≤ 170	K/W

Note: Exceeding any of the maximum ratings may cause permanent damage to the device. Appropriate handling is required to protect the electrostatic-sensitive MMIC against degradation due to excess voltage or excess current spikes. Proper ground connection of leads 1 and 3 (with minimum inductance) is required to achieve the guaranteed RF performance, stable operating conditions and adequate cooling.

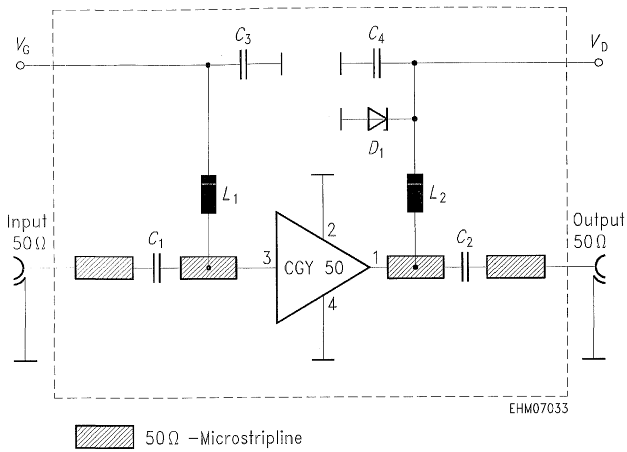
1) See application circuit.
2) T_S is measured on the source 1 lead at the soldering point to the pcb.

Electrical Characteristics
at T_A = 25 °C, V_G = 0 V, V_D = 4.5 V, R_S = R_L = 50 Ω, unless otherwise specified, (for application circuit see next page).

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Drain current	I_D	–	60	75	mA
Power gain f = 200 MHz f = 1800 MHz	G	 – 7.5	 10.0 8.5	 – –	dB
Gain flatness f = 200 to 1000 MHz f = 800 to 1800 MHz	ΔG	 – –	 0.4 1.1	 – 2	
Noise figure f = 200 to 1800 MHz	F	–	3.0	4.0	
Input return loss f = 200 to 1800 MHz	RL_{IN}	9.5	12	–	
Output return loss f = 200 to 1800 MHz	RL_{OUT}	9.5	12	–	
Third order intercept point, two-tone intermodulation test f_1 = 806 MHz, f_2 = 810 MHz, P_0 = 10 dBm (both carriers)	IP_3	29	31	–	dBm
1 dB gain compression f = 200 to 1800 MHz	P_{1dB}	–	16	–	
Gain control dynamic range f = 200 to 1800 MHz	ΔG	–	20	–	dB

Application Circuit

f = 800 to 1800 MHz

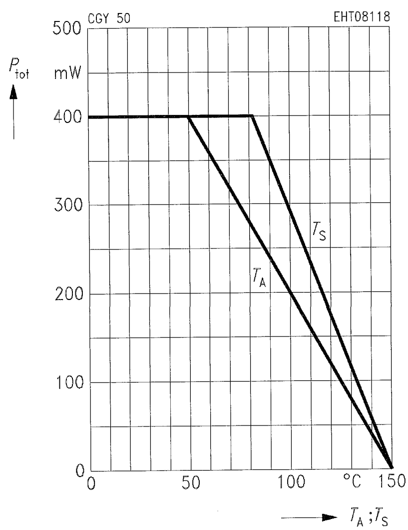


Legend of components

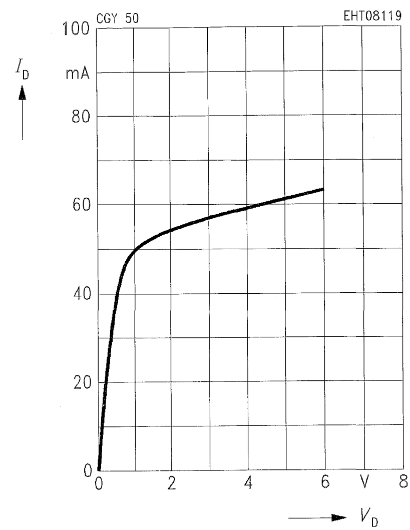
C_1, C_2, C_3, C_4	Chip capacitors 100 pF Chip capacitors 1 nF
L_1, L_2	Discrete inductor 1 µH or printed microstripline inductor
D_1	*Z* diode 5.6 V (type BZW 22 C5 V 6)

Note: Operating conditions for $P_{IN\ max}$: $R_G = R_L = 50\ \Omega$, $C_{1\ max} = 220$ pF, $V_D = 4.5$ V;
V_G current limited < 2 mA.

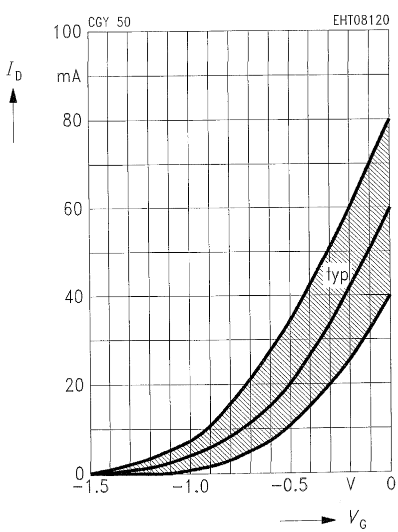
Total power dissipation $P_{tot} = f(T_A; T_S)$



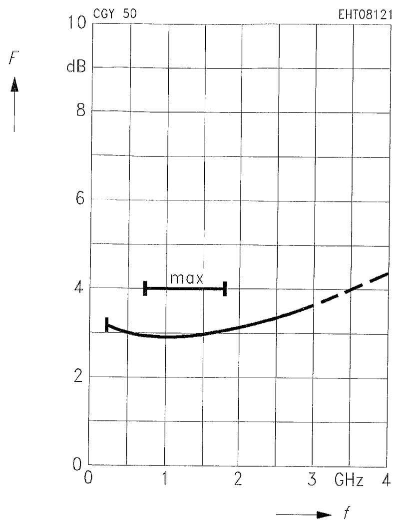
Drain current $I_D = f(V_D)$
$V_G = 0$



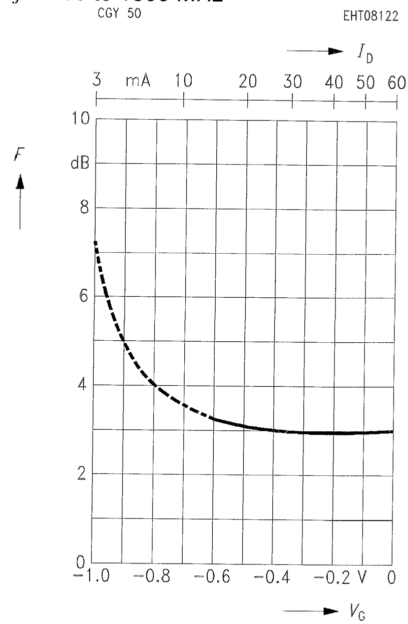
Drain current $I_D = f(V_G)$
$V_D = 4.5$ V



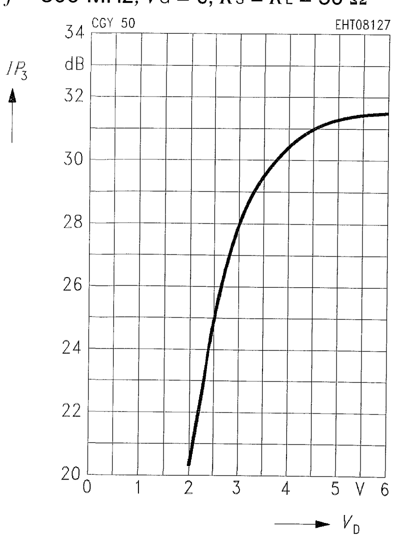
Noise figure $F = f(f)$
V_D = 4.5 V, V_G = 0, $R_S = R_L$ = 50 Ω



Noise figure $F = f(V_G)$*
V_D = 4.5 V, $R_S = R_L$ = 50 Ω
f = 200 to 1800 MHz



Third order intercept point $IP_3 = f(V_D)$
f = 800 MHz, V_G = 0, $R_S = R_L$ = 50 Ω



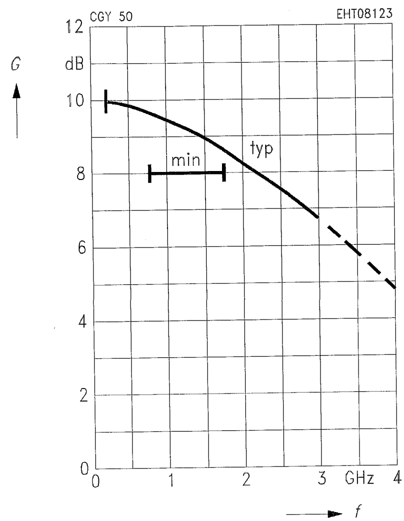
* The gate voltage V_G refers to a typical drain current I_{DSS} of 60 mA with the supplementary information of the I_D values.

The intermodulation ratio d_{IM} can easily be determined.

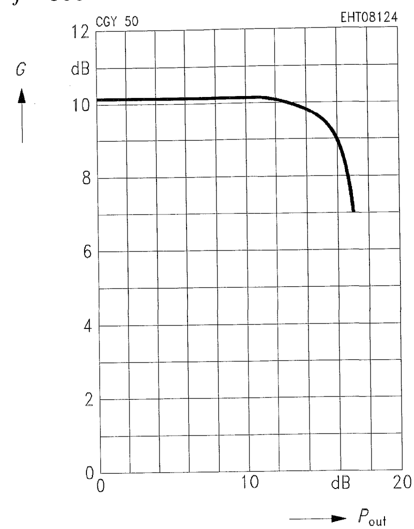
$d_{IM} = 2\,(IP_3 - P_0)$

IP_3 = Intercept point
d_{IM} = Intermodulation ratio
P_0 = Power level of each carrier in dBm

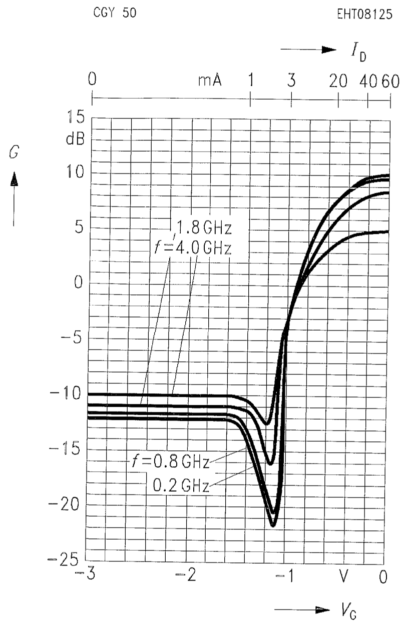
Power gain $G = f(f)$
$V_D = 4.5$ V, $V_G = 0$, $R_S = R_L = 50\ \Omega$



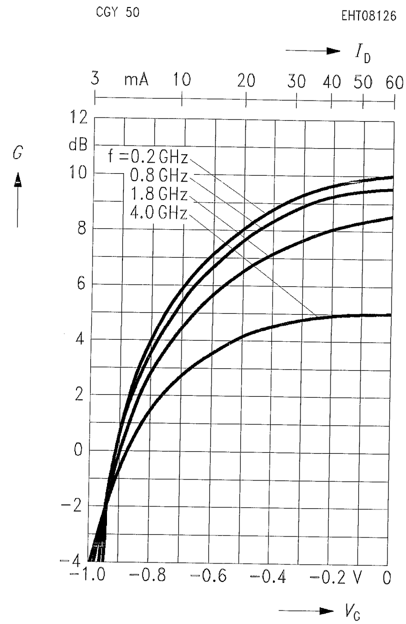
Power gain $G = f(P_{out})$
$V_D = 4.5$ V, $V_G = 0$, $R_S = R_L = 50\ \Omega$
$f = 800$ MHz



Power gain $G = f\,(V_G)$ [1)]
V_D = 4.5 V, $R_S = R_L$ = 50 Ω



Power gain $G = f\,(V_G)$ [1)]
V_D = 4.5 V, $R_S = R_L$ = 50 Ω

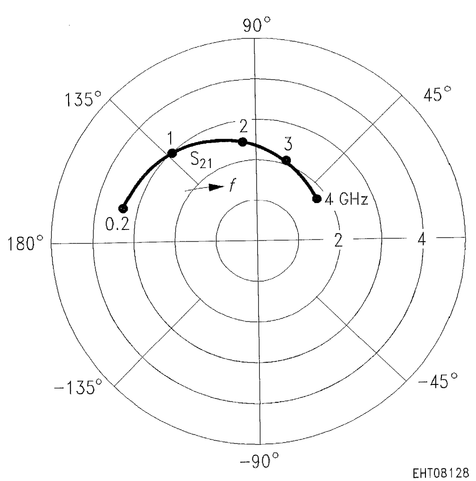


1) The gate voltage V_G refers to a typical drain current I_{DSS} of 60 mA with the supplementary information of the I_D values.

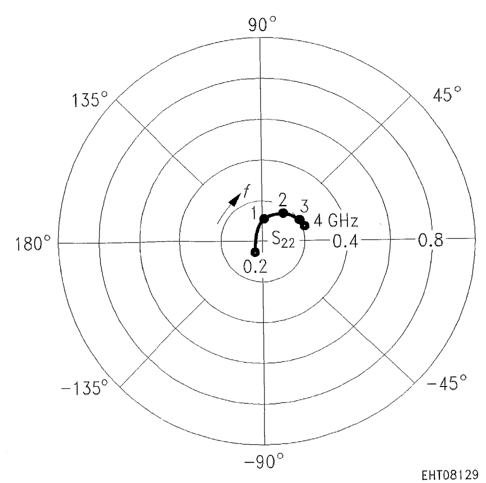
S Parameters

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
V_D = 4.5 V, V_G = 0, Z_0 = 50 Ω								
0.2	0.25	– 31	3.30	164	0.14	5.0	0.05	– 144
0.4	0.27	– 34	3.20	158	0.14	0.0	0.05	– 133
0.6	0.21	– 44	3.17	150	0.13	– 2.0	0.08	105
0.8	0.20	– 54	3.09	142	0.13	– 3.0	0.01	91
1.0	0.19	– 65	3.00	134	0.13	– 4.0	0.12	81
1.2	0.18	– 77	2.90	126	0.13	– 5.0	0.14	74
1.4	0.18	– 93	2.81	118	0.13	– 5.0	0.16	68
1.6	0.17	– 103	2.70	111	0.13	– 6.0	0.17	62
1.8	0.17	– 119	2.60	103	0.13	– 5.0	0.18	56
2.0	0.17	– 130	2.50	96	0.12	– 5.0	0.19	51
2.2	0.18	– 141	2.42	94	0.12	– 4.0	0.20	46
2.4	0.18	– 152	2.33	83	0.12	– 4.0	0.21	42
2.6	0.19	– 163	2.24	77	0.12	– 3.0	0.21	39
2.8	0.20	– 172	2.16	71	0.13	– 3.0	0.21	36
3.0	0.21	179	2.07	65	0.13	– 2.0	0.21	33
3.2	0.22	172	2.01	60	0.13	– 2.0	0.21	30
3.4	0.23	162	1.94	54	0.13	– 2.0	0.21	29
3.6	0.24	153	1.87	49	0.14	– 1.0	0.21	28
3.8	0.26	148	1.81	43	0.14	– 1.0	0.21	27
4.0	0.28	142	1.75	38	0.15	– 1.0	0.20	27

S_{21}

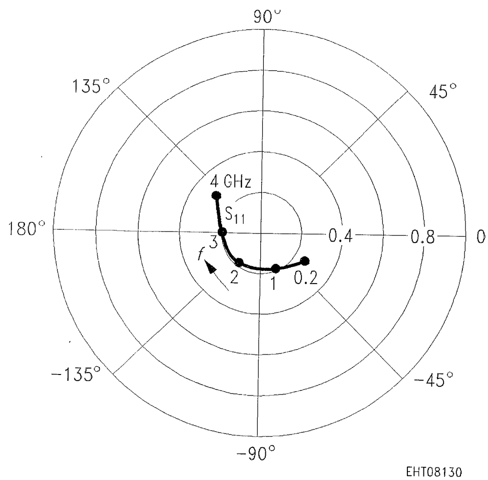


S_{22}

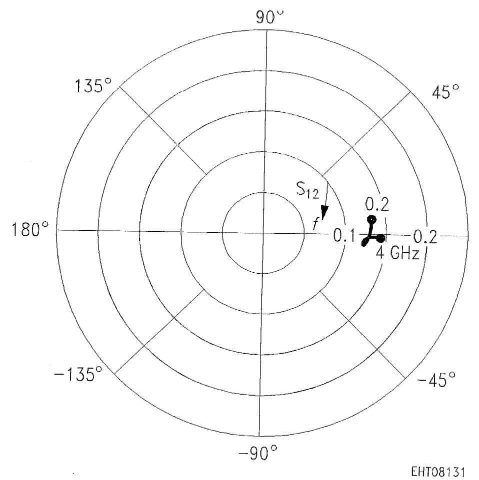


S Parameters (continued)
$V_D = 4.5\ V$, $V_G = 0$, $Z_0 = 50\ \Omega$

S_{11}



S_{12}



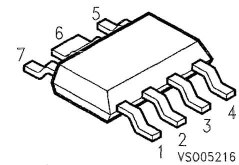
SIEMENS

GaAs MMIC

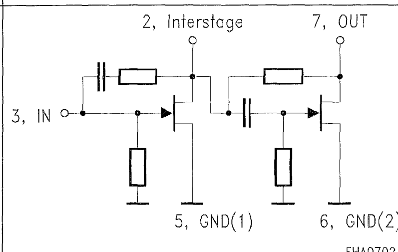
CGY 52

Preliminary Data

- Two stages monolithic microwave IC (MMIC amplifier)
- All gold metallization
- Chip fully passivated
- Operating voltage range: 3 to 6 V
- 50 Ω input / output



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

Type	Marking	Ordering Code (tape and reel)	Circuit Diagram (Pin Configuration)	Package[1)]
CGY 52	CGY 52	Q68000-A8615		MW-7

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain voltage	V_D	6	V
Total power dissipation, $T_A \leq$ *) °C [2)]	P_{tot}	*)	mW
Channel temperature	T_{ch}	150	°C
Storage temperature range	T_{stg}	– 55 ... + 150	

Thermal Resistance

Channel – soldering point (GND [(2)])	$R_{th\,chS}$	$\leq$*)	K/W

1) For detailed information see chapter Package Outlines.
2) Package mounted on alumina 15 mm × 16.7 mm × 0.7 mm.
*) On request.

Electrical Characteristics
at T_A = 25 ˚C, V_D = 4.5 V, RS = RL = 50 Ω, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Drain current	I_D	–	160	–	mA
Power gain f = 200 MHz f = 900 MHz f = 1800 MHz	G	 – – –	 14.0 17.0 15.0	 – – –	dB
Gain flatness f = 200 MHz to 1800 MHz	ΔG	–	4.0	–	
Noise figure f = 900 MHz to 1800 MHz	F	–	4.8	–	
Input return loss f = 200 MHz to 1800 MHz	RL_{in}	–	– 8.0	–	
Output return loss f = 200 MHz to 1800 MHz	RL_{out}	–	– 10.0	–	
Third order intercept point two-tone intermodulation test f_1 = 806 MHz, f_2 = 810 MHz, P_o = 10 dBm (both carriers)	IP_3	–	32	–	dBm
1 dB gain compression f = 200 MHz to 1800 MHz	P_{1dB}	–	19	–	

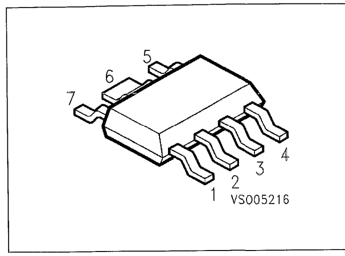
SIEMENS

GaAs MMIC

CMY 90

Preliminary Data

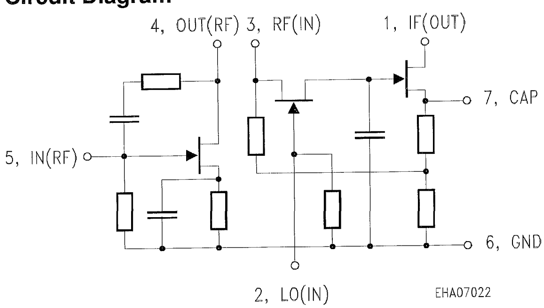
- GaAs mixer with integrated pre and IF amplifier
- For frequencies from 400 MHz to 2.5 GHz
- Mixer for mobile communication (applications in handheld equipment)
- Low power, 2.5 mA operating current
- Operating voltage range: 3 to 6 V
- All gold metallization
- Chip fully passivated



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

Type	Marking	Ordering Code (tape and reel)	Circuit Diagram (Pin Configuration)	Package[1]
CMY 90	CMY 90	Q62702-M1	see below	MW-7

Circuit Diagram



[1] For detailed information see chapter Package Outlines.

Maximum Ratings

Parameter	Symbol	Values	Unit
Drain-source voltage	$V_{OUT-GND}$, V_{IF-GND}	8	V
Gate-source voltage	V_{IN-GND}, V_{RF-GND}, V_{LO-GND}	– 5	
Drain current	I_{OUT}, I_{IF}	20	mA
Gate-source peak current	$+I_{IN}$, $+I_{RF}$, $+I_{LO}$	2	
Total power dissipation, $T_S \leq 90$°C [1]	P_{tot}	160	mW
Channel temperature	T_{ch}	150	°C
Storage temperature range	T_{stg}	– 55 … + 150	

Thermal Resistance

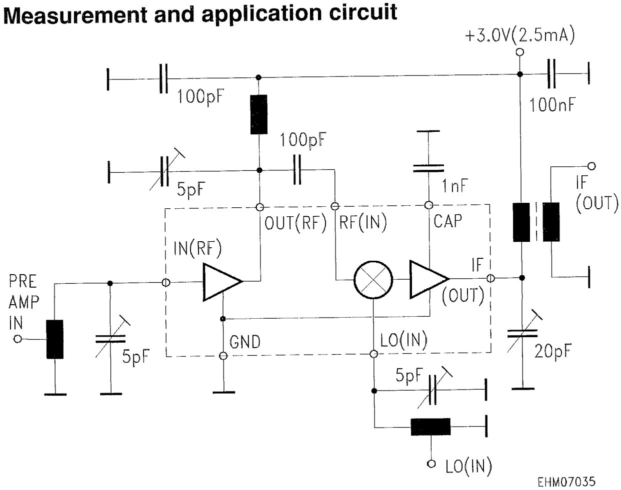
Channel – soldering point GND	$R_{th\,chS}$	350	K/W

[1] T_S is measured on the GND 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.	
Conversion gain f_{RF} = 945 MHz, f_{LO} = 900 MHz, f_{IF} = 45 MHz, P_{LO} = 0 dBm	G	–	17	–	dB
f_{RF} = 1845 MHz, f_{LO} = 1800 MHz, f_{IF} = 45 MHz, P_{LO} = 0 dBm		–	12	–	
Single sideband noise figure f_{RF} = 945 MHz, f_{LO} = 900 MHz, f_{IF} = 45 MHz, P_{LO} = 0 dBm	F_{SSB}	–	4.1	–	
f_{RF} = 1845 MHz, f_{LO} = 1800 MHz, f_{IF} = 45 MHz, P_{LO} = 0 dBm		–	5.4	–	

Measurement and application circuit



Anschriften
Literaturhinweise

Semiconductor Group-Addresses
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Literaturverzeichnis
Information on Literature

Einzelhalbleiter
Small-Signal Semiconductors

Titel Title	Ausgabe Edition	Seiten Pages	Bestell-Nr. Ordering No.	DM
Datenbücher / Data Books				
HF-Transistoren und Dioden, Datenbuch I RF Transistors and Diodes, Data Book I	12.91	1184	B132-H6406-X-X-7400	20,–
NF-Transistoren und Dioden, Datenbuch II AF Transistors and Diodes, Data Book II In Vorbereitung In preparation			B132-H6450-X-X-7400	
Transistoren für Verstärker- und Schalter-anwendungen	88/89	160	B3-B3789	10,–
Transistors for Amplifiers and Switching Applications	88/89	160	B3-B3789-X-X-7600	10,–
Discrete Semiconductors for Surface Mounting	05.90	952	B123-B6253-X-X-7600	20,–
Themenschriften / Special-Subject Brochures				
Qualitätssicherung, Qualität und Zuverlässigkeit Quality Assurance, Quality and Reliability	7.91	34	B132-B6483-X-X-7400	–,–
Poster/Posters				
GaAs Bauelemente für die Nachrichtentechnik	1987	1	B3-B3715	–,–
GaAs Components for the communications of the future	1981	1	B3-B3715-X-X-7600	–,–

Notizen
Notes

Typenübersicht	Selection Guide
Bestellnummern	Ordering Codes
Bestempelung	Marking Catalog
Technische Angaben	Technical Information
Qualitätsangaben	Quality Specification
Gehäuse	Package Outlines
Verarbeitungshinweise	Mounting Instructions
Verpackungshinweise	Packaging Instructions
HF-Dioden	RF Diodes
HF-Transistoren	RF Transistors
GaAs FET	GaAs FET
GaAs MMIC	GaAs MMIC
Anschriften Literaturhinweise	Semiconductor Group-Addresses Information on Literature

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