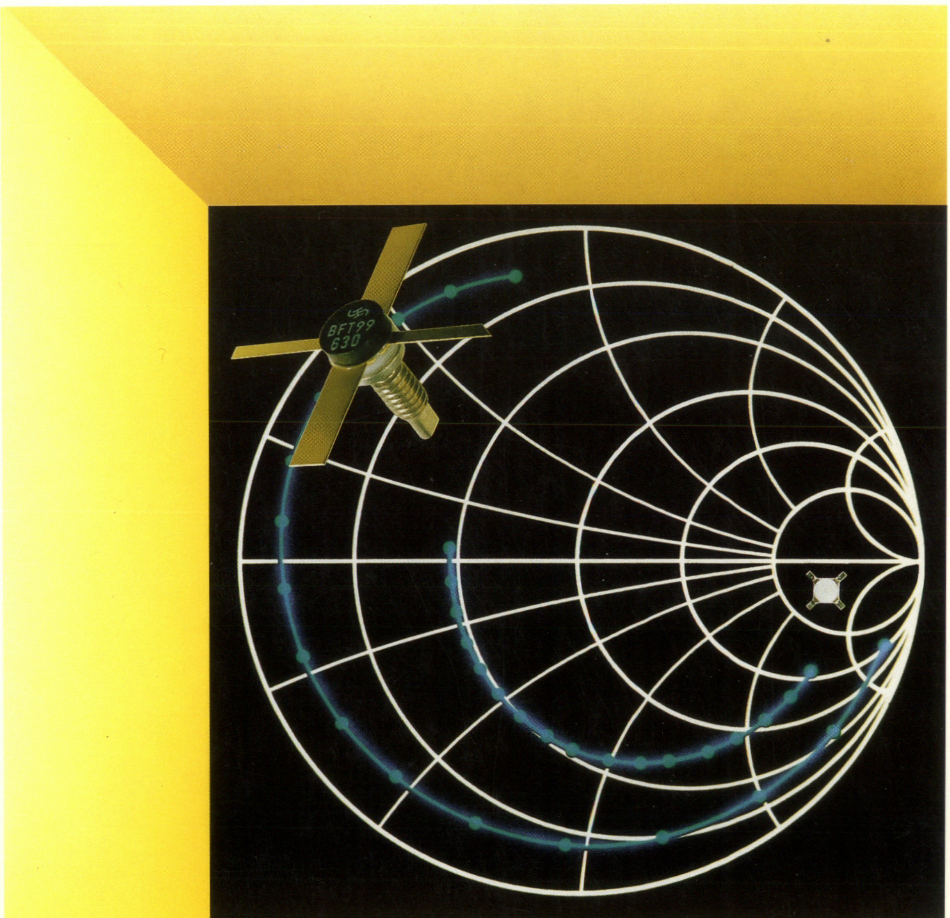
SIEMENS

Professionelle HF-Transistoren und Dioden
RF and Microwave Transistors and Diodes

Data Book



Professionelle HF-Transistoren und Dioden

RF and Microwave Transistors and Diodes

Data Book
Edition 1990/91

Siemens Aktiengesellschaft

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Every year, a revised edition of the SCS catalog on Preferred Products is published. This catalog comprises preferred products of the entire Siemens components program including their main technical specs.

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All components which are marked with the sign **S** are available for prompt delivery via the Siemens Components Service. The actually applicable range of preferred components is provided in the current edition of the above mentioned catalog.

Published by Siemens AG, Bereich Halbleiter, Marketing-Kommunikation
Balanstraße 73, D-8000 München 80.

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The information describes the type of component and shall not be considered as assured characteristics.

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Alle mit Kennzeichen **S** versehenen Bauelemente sind Schwerpunkttypen und können kurzfristig über unseren Siemens-Bauteile-Service bezogen werden. Das jeweils aktuelle Schwerpunktspektrum bitten wir der neuesten Ausgabe unserer SBS-Preis- und Lagerliste zu entnehmen.

Herausgegeben von Siemens AG, Bereich Halbleiter, Marketing-Kommunikation, Balanstraße 73, D-8000 München 80.

Gewähr für die Freiheit von Rechten Dritter leisten wir nur für Bauelemente selbst, nicht für Anwendungen, Verfahren und für die in Bauelementen oder Baugruppen realisierten Schaltungen.

Mit den Angaben werden die Bauelemente spezifiziert, nicht Eigenschaften zugesichert.

Liefermöglichkeiten und technische Änderungen vorbehalten.

Fragen über Technik, Preise und Liefermöglichkeiten richten Sie bitte an den Ihnen nächstgelegenen Siemens-Bauteile-Vertrieb in der Bundesrepublik Deutschland und Berlin (West) oder an unsere Landesgesellschaften im Ausland.

Bauelemente können aufgrund technischer Erfordernisse Gefahrstoffe enthalten. Auskünfte darüber bitten wir unter Angabe des betreffenden Typs ebenfalls über den Vertrieb Bauteile einzuholen.

RF and microwave semiconductors are key components for state-of-the art telecommunications and data transmission systems. Typical applications are radio links, cable amplifiers, CATV, MATV, satellite link and mobile radio.

This new data book describes our presently available product spectrum of RF and microwave semiconductors with regard to innovations and further developments.

The following components are included:

- Schottky Diodes
- PIN Diodes
- Varactors
- Silicon Transistors
- GaAs FETs
- GaAs MMICs

A selection guide with the most important main ratings and a scope of applications should help you select the right component types. The data sheets are arranged in chapters in alphabetical order to allow quick orientation. The detailed technical introduction gives you information on major parameters and comprises quality specifications as well as mounting and packaging instructions.

All components marked with the sign **S** are available for prompt delivery also in small quantities via the Siemens Components Service.

For questions on technology, prices and delivery please contact your nearest Siemens Office or Representative.

With this new data book previous editions are no longer applicable.

Literature Selector

Further literature concerning e.g. SMD technology is listed in the following survey and can be obtained from:
Siemens AG, Infoservice, P.O.B. 2348, D-8510 Fürth, West-Germany,
Tel. (0911) 3001-260, Telex 623313, FAX (0911) 3001-271

Title	Ordering code
Tuner Semiconductor Devices, Data Book	B3-B3587-X-X-7600
Transistors for Amplifier and Switching Applications, Data Book	B3-B3789-X-X-7600
Discrete Semiconductors for Surface Mounting SMD, Data Book	B3-B3497-X-X-7600
An Introduction to Surface Mounting, Product Information	B3-B3289-X-X-7600
SOT-23 Semiconductors, Off-Print	B3-B3342-X-X-7600
SMD Components, Short Form Catalog	B3-B3907-X-X-7400
Recommendation for PCB Layouts, Product Information	B3-B3580-X-X-7600
Components Library, Product Information	B9-B3695-X-X-7600
Soldering in SMD Technology, Product Information	B9-B3741-X-X-7600

Hochfrequenzhalbleiter sind Schlüsselbausteine für moderne Systeme zur Nachrichten- und Datenübertragung. Typische Anwendungen sind: Richtfunk, Kabelverstärker, CATV, MATV, Satellitendirektempfang und Mobilfunk.

Mit dem Datenbuch „Professionelle HF-Transistoren und Dioden" stellen wir Ihnen unser derzeit lieferbares Fertigungsspektrum vor. Das Buch beinhaltet alle bekannten Neuerungen und Verbesserungen bzw. Weiterentwicklungen auf diesem Gebiet.

Bauelementeorientiert finden Sie:

- Schottky-Dioden
- PIN Dioden
- Varaktoren
- Silizium Transistoren
- GaAs-FET
- GaAs-MMIC

Um die Bauelementeauswahl zu erleichtern, haben wir Typenübersichten mit den wichtigsten technischen Eckdaten und anwendungsorientierte Einsatzhinweise eingearbeitet. Die Datenblätter sind (kapitelweise) alphanumerisch sortiert und erleichtern so das Auffinden der gesuchten Bauform. Ein ausführlicher Vorspann gibt Auskunft über die wichtigsten Parameter, enthält Angaben zur Qualität und macht Angaben zur Verarbeitung bzw. Verpackung.

Alle mit einem **S** versehenen Bauelemente können auch in geringen Stückzahlen kurzfristig über unseren Siemens Bauteile-Service bezogen werden.

Fragen zur Technik, zu den Preisen und zu den Liefermöglichkeiten richten Sie bitte an den Ihnen nächstgelegenen Siemens-Bauteile-Vertrieb in der Bundesrepublik Deutschland und Berlin (West).

Mit der Herausgabe dieses neuen Datenbuchs werden alle vorhergehenden Ausgaben ungültig.

Literaturverzeichnis

Weitere Informationen – auch zur SMD-Technik – finden Sie in unten aufgeführter Schriftenreihe.
Die Druckschriften erhalten Sie bei:
Siemens AG, Infoservice, Postfach 2348, D-8510 Fürth, Tel. (0911) 3001-260, Telex 623313, FAX (0911) 3001-271

Titel	Bestellnummer
Tunerhalbleiter, Datenbuch	B3-B3587
Transistoren für Verstärker- und Schalteranwendungen, Datenbuch	B3-B3789
Diskrete Halbleiter für Oberflächenmontage, Datenbuch	B3-B3497
Einführung in die Oberflächenmontage, Produktschrift	B3-B3289
SOT-23 Halbleiter, Sonderdruck	B3-B3342
SMD Bauelemente, Lieferprogramm	B3-B3907-X-X-7400
Empfehlungen für das Layout von Leiterplatten, Produktschrift	B3-B3580
Bauelemente-Bibliothek, Produktschrift	B9-B3695
Löten in der SMD-Technik, Produktschrift	B9-B3741
Bauelemente-Bibliothek SMD (deutsch; 3½-Zoll-Disketten; CAD-System HP EGS, ab Version 2.21)	B91020-B1300-K
Prüfen in der SMD-Technik, Produktschrift	A19100-E610-A17-V1
SMD von Siemens: Produkte, Beratung, Produktschrift	B9-B3887

Table of Contents
Selection Guide
Ordering Codes

Inhaltsverzeichnis
Typenübersicht
Bestellnummern

Table of Contents / Inhaltsverzeichnis

Schottky Diodes for Professional Applications

Ceramic Packages

Medium 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
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	88
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	88
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	88
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	88
BAT 14-124	3	50	9.0 (16 GHz)	3	0.10	0.47	8.0	T1	88

Low Barrier

BAT 15-014	3	100	5.5 (3 GHz)	3	0.25	0.26	3.0	T1	105
BAT 15-044	3	100	5.5 (6 GHz)	3	0.20	0.28	3.5	T1	105
BAT 15-074	3	50	5.5 (9.7 GHz)	3	0.17	0.29	4.5	T1	105
BAT 15-104	3	50	6.0 (16 GHz)	3	0.13	0.30	5.5	T1	105
BAT 15-124	3	50	9.0 (16 GHz)	3	0.10	0.31	8.0	T1	105

Beam Lead

Medium Barrier

Type	Max. ratings		Characteristics at T_A = 25 °C					Pack-age	Page
	V_R V	I_F mA	F_{SSB} dB	V_{BR} V	C_T pF	V_F V	r_f Ω		
BAT 14-020 S BAT 14-020 D BAT 14-020 R	4	100	6.0 (3 GHz)	4	0.30	0.45	3.5	S D R	84 80 82
BAT 14-050 S BAT 14-050 D BAT 14-050 R	4	100	6.5 (6 GHz)	4	0.20	0.47	4.0	S D R	84 80 82
BAT 14-090 S BAT 14-090 D BAT 14-090 R	4	50	6.5 (9.3 GHz)	4	0.14	0.49	7.0	S D R	84 80 82
BAT 14-110 S BAT 14-110 D BAT 14-110 R	4	50	7.0 (16 GHz)	4	0.10	0.50	10.0	S D R	84 80 82

Low Barrier

BAT 15-020 S BAT 15-020 D BAT 15-020 R	4	100	6.0 (3 GHz)	4	0.30	0.26	3.5	S D R	101 97 99
BAT 15-050 S BAT 15-050 D BAT 15-050 R	4	100	6.5 (6 GHz)	4	0.20	0.28	4.0	S D R	101 97 99
BAT 15-090 S BAT 15-090 D BAT 15-090 R	4	50	6.5 (9.3 GHz)	4	0.14	0.30	7.0	S D R	101 97 99
BAT 15-110 S BAT 15-110 D BAT 15-110 R	4	50	7.0 (16 GHz)	4	0.10	0.31	10.0	S D R	101 97 99

Zero Bias

Type	Max. ratings		Characteristics at T_A = 25 °C				Pack-age	Page
	V_R V	I_F mA	V_{BR} V	C_T pF	V_F V	r_f kΩ		
BAT 30	6.5	50	6.5	0.14	0.20	15	S1	117

Beam Lead Technology, in Ceramic Packages

Medium 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
BAT 14-022 R	4	100	6.0	4	0.33	0.45	3.5	50 mil	86
[S] BAT 14-025 S			(3 GHz)		0.36			Cerec-X	95
[S] BAT 14-025 D					0.37			Cerec-X	91
[S] BAT 14-025 R					0.37			Cerec-X	93
BAT 14-052 R	4	100	6.5	4	0.23	0.47	4.0	50 mil	86
BAT 14-055 S			(6 GHz)		0.26			Cerec-X	95
[S] BAT 14-055 D					0.27			Cerec-X	91
BAT 14-055 R					0.27			Cerec-X	93
BAT 14-092 R	4	50	6.5	4	0.17	0.49	7.0	50 mil	86
BAT 14-095 S			(9.3 GHz)		0.20			Cerec-X	95
BAT 14-095 D					0.21			Cerec-X	91
BAT 14-095 R					0.21			Cerec-X	93
BAT 14-112 R	4	50	7.0	4	0.13	0.50	10.0	50 mil	86
BAT 14-115 S			(16 GHz)		0.16			Cerec-X	95
BAT 14-115 D					0.17			Cerec-X	91
BAT 14-115 R					0.17			Cerec-X	93

Low Barrier

Type	V_R V	I_F mA	F_{SSB} dB	V_{BR} V	C_T pF	V_F V	r_f Ω	Package	Page
BAT 15-022 R	4	100	6.0	4	0.33	0.26	3.5	50 mil	103
[S] BAT 15-025 S			(3 GHz)		0.36			Cerec-X	112
[S] BAT 15-025 D					0.37			Cerec-X	108
[S] BAT 15-025 R					0.37			Cerec-X	110
BAT 15-052 R	4	100	6.5	4	0.23	0.28	4.0	50 mil	103
[S] BAT 15-055 S			(6 GHz)		0.26			Cerec-X	112
[S] BAT 15-055 D					0.27			Cerec-X	108
[S] BAT 15-055 R					0.27			Cerec-X	110
BAT 15-092 R	4	50	6.5	4	0.17	0.30	7.0	50 mil	103
[S] BAT 15-095 S			(9.3 GHz)		0.20			Cerec-X	112
[S] BAT 15-095 D					0.21			Cerec-X	108
[S] BAT 15-095 R					0.21			Cerec-X	110
BAT 15-112 R	4	50	7.0	4	0.13	0.31	10.0	50 mil	103
[S] BAT 15-115 S			(16 GHz)		0.16			Cerec-X	112
[S] BAT 15-115 D					0.17			Cerec-X	108
[S] BAT 15-115 R					0.17			Cerec-X	110

Beam Lead Technology, in Ceramic Packages

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 V	r_f kΩ	Package	Page
S	BAT 32	6.5	50	6.5	0.20	0.20	15	Cerec-X	119

Schottky Diodes for General Purposes

SMD Plastic Packages

	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 µA	τ ps	Package	Page
S	BAS 40	40	80	40	380	5	1.0	100	SOT-23	74
S	BAS 40-04								SOT-23	
S	BAS 40-05								SOT-23	
S	BAS 40-06								SOT-23	
S	BAS 40-07								SOT-143	
S	BAS 70	70	40	70	410	2	0.1	100	SOT-23	77
S	BAS 70-04								SOT-23	
S	BAS 70-05								SOT-23	
S	BAS 70-06								SOT-23	
S	BAS 70-07								SOT-143	
S	BAT 17	4	30	4	350	1	0.25	–	SOT-23	114
S	BAT 17-04								SOT-23	
S	BAT 17-05								SOT-23	
S	BAT 17-06								SOT-23	
	BAT 64	30	200	–	1000	6	200	–	SOT-23	121

PIN Diodes for Professional Applications

Metal Ceramic Packages

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	132
BXY 42BA-3				350	0.2				T1	126
BXY 42BA-5				800	0.2				C1	128
BXY 42BA-6				800	0.3				D	130
BXY 43A	150	10000	150	500	0.09	1.2	250	15	T1	134
BXY 43B		20000		600	0.15	1.0	350	20	T1	
BXY 43C		20000		600	0.25	1.0	350	25	T1	
BXY 44K	200	20000	175	600	0.4	3.5	500	50	T1	136

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	123
BXY 42BB-S	30	175	0.15	1.3	20	2	S	123

PIN Diodes for General Purposes

SMD Plastic Packages

	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	100	140	150	0.25	7	1.0	1.05	SOT-23	64
S	BAR 15-1								SOT-23	
S	BAR 16-1								SOT-23	
S	BAR 17	100	140	150	0.32	3.5	4	0.91	SOT-23	67
S	BAR 60	100	140	150	0.25	7	1.0	1.25	SOT-143	70
S	BAR 61	100	140	150	0.25	7	1.0	1.25	SOT-143	70

Varactors

Hyperabrupt Varactors

Type	Max. ratings		Characteristics at T_A = 25 °C			Package	Page
	V_R V	T_j °C	C_T pF	C_{T4}/C_{T20} –	Q –		
BBY 34C	22	175	2.7 ... 3.3	4.3	400	D	146
BBY 34D	22	175	3.2 ... 3.8	2.7	400	D	146
BBY 35F	22	175	8.5 ... 10.0	3.5	250	T1	149

Abrupt Varactors

Type	Max. ratings		Characteristics at T_A = 25 °C					Package	Page
	V_R V	T_j °C	I_R nA	C_T pF	C_{T0}/C_{T25}	C_{T0}/C_{T120}	Q –		
BBY 24-S1	120	175	10	12 ... 16	–	8.5	200	P	140
BBY 25-S1	120	175	10	16 ... 20	–	9.0	200	P	
BBY 26-S1	120	175	10	20 ... 24	–	9.5	200	P	
BBY 27-S2	140	175	10	36 ... 40	–	9.5	200	P	
BBY 33BB-2	27	150	5	0.9 ... 1.5	3.0	–	4000	D	142
BBY 33DA-2	30	175	5	1.7 ... 2.1	3.0	–	3500	D	144

Charge Storage Varactors

Type	Characteristics at T_A = 25 °C						Package	Page
	f GHz	P_{in} mW	V_{BR} V	C_T pF	t_s ns	t_t ns		
BXY 18A2	2 ... 8	250	25	0.7 ... 1.3	10	0.2	T	151
BXY 18AB2	2 ... 12	250	25	1.1 ... 1.6	10	0.2	T	151
BXY 18AB6	1 ... 18	250	15	0.25 ... 0.5	10	0.2	T	151

Silicon Transistors

Metal Ceramic Packages

	Type	1)	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		
S	BFQ 70	N	15	35	300	5.0	1.5	18	0.8	Cerec-X	240
S	BFQ 71	N	15	30	300	5.2	1.5	15	0.8	Cerec-X	254
S	BFQ 72	N	15	50	350	5.1	2.5	18	0.8	Cerec-X	272
S	BFQ 73S	N	15	100	500	5.4	3.0	15	0.8	Cerec-X	286
S	BFQ 74	N	16	35	300	6.0	2.5	14	2.0	Cerec-X	297
	BFQ 75	P	12	50	350	5.0	3.0	14	0.8	Cerec-X	311
	BFQ 76	P	15	30	250	5.0	2.5	17	0.8	Cerec-X	315
S	BFQ 82	N	12	80	400	8.0	2.3	11	2.0	Cerec-X	339

Plastic Packages

	Type	1)	V_{CEO} V	I_C mA	P_{tot} mW	f_T GHz	F dB	G_{pe} dB	at f GHz	Package	Page
S	BFQ 69	N	15	30	300	5.8	1.4	16.5	0.8	T-plast	236
S	BFR 34A	N	12	30	200	5.0	2	14	0.8	T-plast	363
S	BFR 90	N	15	30	200	5.0	2	14	0.8	T-plast	386
S	BFR 91	N	15	50	250	5.0	1.9	17	0.5	T-plast	392
S	BFR 91A	N	12	35	300	6.2	1.6	14	0.8	T-plast	397
S	BFR 96S	N	15	100	700	5.5	3.2	11.5	0.8	T-plast	435
S	BFT 65	N	15	50	250	5.0	2.8	12	0.8	T-plast	481
S	BFT 97	N	15	30	200	5.0	1.2	–	0.2	T-plast	499
S	BFT 98T	N	20	150	800	3.2	–	12	0.8	T-plast	507
S	BFW 92	N	15	25	200	2.4	4.0	11	0.8	T-plast	514

1) N = NPN, P = PNP

Selection Guide

SMD Plastic Packages

	Type	1)	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
S	BFQ 29P	N	15	30	280	5.0	1.5	14	0.8	SOT-23	222
S	BFQ 81	N	16	30	280	5.8	1.4	15	0.8	SOT-23	319
S	BFR 35AP	N	12	30	280	4.9	1.5	14	0.8	SOT-23	369
S	BFR 92P	N	15	30	280	5.0	1.5	14	0.8	SOT-23	401
S	BFR 93A	N	12	50	280	5.5	1.7	13.5	0.8	SOT-23	418
S	BFR 93P	N	15	50	280	5.0	2.4	13	0.8	SOT-23	426
S	BFR 106	N	15	100	350	3.7	3.6	11.5	0.8	SOT-23	447
S	BFR 193	N	12	80	400	7.0	1.7	13.5	0.8	SOT-23	450
S	BFS 17P	N	15	25	280	2.5	3.5	10	0.8	SOT-23	467
S	BFT 92	P	15	25	200	5.0	2.4	18	0.5	SOT-23	491
S	BFT 93	P	12	35	200	5.0	2.4	16.5	0.5	SOT-23	495
	BFQ 17P	N	25	150	1000	1.4	–	11.5	0.5	SOT-89	208
	BFQ 19P	N	15	75	1000	5.1	3.8	11.5	0.8	SOT-89	212
S	BFQ 19S	N	15	75	1000	5.1	2.8	11.8	0.8	SOT-89	216
	BFQ 64	N	20	200	1000	3.0	–	10	0.8	SOT-89	232
S	BFP 81	N	16	30	280	5.8	1.2	16.5	0.8	SOT-143	154
S	BFP 93A	N	12	50	280	5.5	1.7	16.5	0.8	SOT-143	175
S	BFP 193	N	12	80	400	8.0	1.6	15	0.8	SOT-143	191

Metal Packages

	Type	1)	V_{CEO} V	I_C mA	P_{tot} mW	f_T GHz	F dB	G_{pe} dB	at f GHz	Package	Page
S	BFR 15A	N	12	30	200	4.5	3.0	12	0.8	TO-72	358
S	BFS 55A	N	15	50	250	4.5	2.9	10	0.8	TO-72	476
S	BFT 66	N	15	30	200	4.9	1.9	–	0.8	TO-72	487
S	BFX 59	N	20	100	370	0.9	3.4	–	0.2	TO-72	518
S	BFX 59F	N	20	100	370	1.0	3.4	–	0.2	TO-72	518
S	BFX 60	N	25	25	370	0.5	5.0	–	0.2	TO-72	522
S	BFY 90	N	15	25	200	1.5	6.0	23	0.2	TO-72	526

Metal Ceramic Packages

	Type	1)	V_{CEO} V	I_C mA	P_{tot} mW	f_T GHz	F dB	G_{pe} dB	at f GHz	Package	Page
S	BFT 98	N	20	200	2250	3.3	–	15	0.8	TO-117	503
	BFT 98B	N	20	200	2250	3.3	–	15	0.8	TO-117	
S	BFT 99	N	20	350	4000	3.3	–	12	0.8	TO-117	510
	BFT 99A	N	20	350	4000	3.3	–	12	0.8	TO-117	

1) N = NPN, P = PNP

GaAs FETs

Gallium Arsenide Field-Effect Transistors

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		
CF 739	10	6	6	80	10	1.8	17	1.75	SOT-143	532

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 30	5	−4 ... +0.5	80	30	1.4	11.5	4	SOT-143	566
Metal Ceramic Packages									
CFY 10	5	−5 ... +0.5	100	45	<1.8	>9.5	6	100 mil	538
CFY 11	5	−5 ... +0.5	100	40	<2.0	>10	6	100 mil	540
CFY 18-18	5	−5 ... +0.5	100	30	<1.8	>9.0	12	Cerec-XF	542
S CFY 18-20	5	−5 ... +0.5	100	30	<2.0	>8.5	12	Cerec-XF	
S CFY 18-23	5	−5 ... +0.5	100	30	<2.3	>8.5	12	Cerec-XF	
S CFY 19-18	6	−5 ... +0.5	80	30	<1.8	>9.5	6	Cerec-X	557
S CFY 19-22	6	−5 ... +0.5	80	25	<2.2	>9.0	6	Cerec-X	
S CFY 19-27	6	−5 ... +0.5	80	25	<2.7	>7.5	6	Cerec-X	
CFY 25-17	5	−5 ... +0	80	35	1.6	9.5	12	Cerec-XF	564
CFY 25-20	5	−5 ... +0	80	35	1.9	9	12	Cerec-XF	
CFY 25-23	5	−5 ... +0	80	35	2.2	9	12	Cerec-XF	
AlGaAs/GaAs HEMT									
CFY 65-12	4	−3 ... +0	70	40	1.1	11.5	12	Cerec-XF	576
CFY 65-14	4	−3 ... +0	70	40	1.3	11.5	12	Cerec-XF	

GaAs MMICs

Gallium Arsenide Monolithic Microwave ICs

Broadband Amplifiers in Metal 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		
CGY 21	3 ... 6	160	100 ... 900	21	3.9	32.5	TO-12	582
CGY 31	3 ... 6	160	800 ... 1800	18	4.0	32.5	TO-12	590
Broadband Amplifiers in Metal Ceramic Package								
S CGY 40	3 ... 5.5	60	200 ... 1800	10.5	2.8	32	Cerec-X	598
Broadband Amplifiers in SMD Plastic Package								
S CGY 50	5.5 ... 7.5	60	200 ... 1800	8.5	3.0	31	SOT-143	607

Ordering Codes

Type	Ordering code	Page
Schottky Diodes		
S BAS 40	Q 62702 – D339	74
S BAS 40-04	Q 62702 – D980	74
S BAS 40-05	Q 62702 – D979	74
S BAS 40-06	Q 62702 – D978	74
BAS 40-07	Q 62702 – A697	74
S BAS 70	Q 62702 – A118	77
S BAS 70-04	Q 62702 – A730	77
S BAS 70-05	Q 62702 – A711	77
S BAS 70-06	Q 62702 – A774	77
S BAS 70-07	Q 62702 – A846	77
BAT 14-014	Q 62702 – D1005	88
BAT 14-020D	Q 62702 – D1259	80
BAT 14-020R	Q 62702 – D1260	82
BAT 14-020S	Q 62702 – D1258	84
BAT 14-022R	Q 62702 – D411	86
S BAT 14-025D	Q 62702 – A790	91
S BAT 14-025R	Q 62702 – A791	93
S BAT 14-025S	Q 62702 – A789	95
BAT 14-034	Q 62702 – D1019	88
BAT 14-044	Q 62702 – D1026	88
BAT 14-050D	Q 62702 – D1268	80
BAT 14-050R	Q 62702 – D1269	82
BAT 14-050S	Q 62702 – D1267	84
BAT 14-052R	Q 62702 – D412	86
S BAT 14-055D	Q 62702 – A793	91
S BAT 14-055R	Q 62702 – A794	93
S BAT 14-055S	Q 62702 – A792	95
BAT 14-064	Q 62702 – D1036	88
BAT 14-074	Q 62702 – D1041	88
BAT 14-090D	Q 62702 – D1276	80
BAT 14-090R	Q 62702 – D1277	82
BAT 14-090S	Q 62702 – D1275	84
BAT 14-092R	Q 62702 – D413	86
BAT 14-094	Q 62702 – D1051	88
S BAT 14-095D	Q 62702 – A797	91
S BAT 14-095R	Q 62702 – A796	93
S BAT 14-095S	Q 62702 – A795	95
BAT 14-104	Q 62702 – D1056	88
BAT 14-110D	Q 62702 – D1285	80
BAT 14-110R	Q 62702 – D1286	82
BAT 14-110S	Q 62702 – D1284	84
BAT 14-112R	Q 62702 – D414	86
BAT 14-114	Q 62702 – D1061	88
S BAT 14-115D	Q 62702 – A800	91
S BAT 14-115R	Q 62702 – A801	93

Type	Ordering code	Page
S BAT 14-115S	Q 62702 – A799	95
BAT 14-124	Q 62702 – D1066	88
BAT 15-014	Q 62702 – D3429	105
BAT 15-020D	Q 62702 – D1263	97
BAT 15-020R	Q 62702 – D1264	99
BAT 15-020S	Q 62702 – D1262	101
BAT 15-022R	Q 62702 – D1265	103
S BAT 15-025D	Q 62702 – A803	108
S BAT 15-025R	Q 62702 – A804	110
S BAT 15-025S	Q 62702 – A802	112
BAT 15-044	Q 62702 – D3431	105
BAT 15-050D	Q 62702 – D3450	97
BAT 15-050R	Q 62702 – D1272	99
BAT 15-050S	Q 62702 – D1271	101
BAT 15-052R	Q 62702 – D1273	103
S BAT 15-055D	Q 62702 – A807	108
S BAT 15-055R	Q 62702 – A806	110
S BAT 15-055S	Q 62702 – A805	112
BAT 15-074	Q 62702 – D3433	105
BAT 15-090D	Q 62702 – D1280	97
BAT 15-090R	Q 62702 – D1281	99
BAT 15-090S	Q 62702 – D1279	101
BAT 15-092R	Q 62702 – D1282	103
S BAT 15-095D	Q 62702 – A798	108
S BAT 15-095R	Q 62702 – A809	110
S BAT 15-095S	Q 62702 – A808	112
BAT 15-104	Q 62702 – D3435	105
BAT 15-110D	Q 62702 – D1289	97
BAT 15-110R	Q 62702 – D1290	99
BAT 15-110S	Q 62702 – D1288	101
BAT 15-112R	Q 62702 – D1291	103
S BAT 15-115D	Q 62702 – A811	108
S BAT 15-115R	Q 62702 – A812	110
S BAT 15-115S	Q 62702 – A810	112
BAT 15-124	Q 62702 – D3437	105
S BAT 17	Q 62702 – A504	114
S BAT 17-04	Q 62702 – A775	114
S BAT 17-05	Q 62702 – A776	114
S BAT 17-06	Q 62702 – A777	114
BAT 30	Q 62702 – A764	117
S BAT 32	Q 62702 – A826	119
BAT 64	Q 62702 – A879	121
PIN Diodes		
S BAR 14-1	Q 62702 – A772	64
S BAR 15-1	Q 62702 – A731	64
S BAR 16-1	Q 62702 – A773	64

Ordering Codes

Type	Ordering code	Page
S BAR 17	Q 62702 – A785	67
S BAR 60	Q 62702 – A786	70
S BAR 61	Q 62702 – A120	70
BXY 42BA-S	Q 62702 – X151	123
BXY 42BA-3	Q 62702 – X143	126
BXY 42BA-5	Q 62702 – X145	128
BXY 42BA-6	Q 62702 – X146	130
BXY 42BA-7	Q 62702 – X160	132
BXY 42BB-S	Q 62702 – X159	123
BXY 43A	Q 62702 – X116	134
BXY 43B	Q 62702 – X104	134
BXY 43C	Q 62702 – X105	134
BXY 44K	Q 62702 – X148	136
Varactors		
BBY 24-S1	Q 62702 – B20-S1	140
BBY 25-S1	Q 62702 – B21-S1	140
BBY 26-S1	Q 62702 – B22-S1	140
BBY 27-S2	Q 62702 – B23-S2	140
BBY 33BB-2	Q 62702 – B70	142
BBY 33DA-2	Q 62702 – B127	144
BBY 34C	Q 62702 – B257	146
BBY 34D	Q 62702 – B194	146
BBY 35F	Q 62702 – B195	149
BXY 18A2	Q 62702 – X140	151
BXY 18AB2	Q 62702 – X133	151
BXY 18AB6	Q 62702 – X137	151
Silicon Transistors		
S BFP 81	Q 62702 – F1122	154
S BFP 93A	Q 62702 – F1144	175
S BFP 193	Q 62702 – F1217	191
S BFQ 17P	Q 62702 – F983	208
S BFQ 19P	Q 62702 – F1060	212
S BFQ 19S	Q 62702 – F1088	216
S BFQ 29P	Q 62702 – F659	222
S BFQ 64	Q 62702 – F1061	232
BFQ 69	Q 62702 – F780	236
S BFQ 70	Q 62702 – F774	240
S BFQ 71	Q 62702 – F775	254
S BFQ 72	Q 62702 – F776	272
S BFQ 73S	Q 62702 – F1104	286
S BFQ 74	Q 62702 – F778	297
S BFQ 75	Q 62702 – F803	311

Type	Ordering code	Page
S BFQ 76	Q 62702 – F804	315
S BFQ 81	Q 62702 – F1049	319
S BFQ 82	Q 62702 – F1189	339
BFR 15A	Q 62702 – F460	358
BFR 34A	Q 62702 – F346-S1	363
S BFR 35AP	Q 62702 – F938	369
BFR 90	Q 62702 – F560	386
BFR 91	Q 62702 – F559	392
BFR 91A	Q 62702 – F735	397
S BFR 92P	Q 62702 – F1050	401
S BFR 93A	Q 62702 – F1086	418
S BFR 93P	Q 62702 – F1051	426
BFR 96S	Q 68000 – A5689	435
S BFR 106	Q 62702 – F1219	447
S BFR 193	Q 62702 – F1218	450
BFS 17P	Q 62702 – F940	467
BFS 55A	Q 62702 – F454	476
BFT 65	Q 62702 – F451	481
BFT 66	Q 62702 – F456	487
S BFT 92	Q 62702 – F1062	491
S BFT 93	Q 62702 – F1063	495
BFT 97	Q 62702 – F514	499
S BFT 98	Q 62702 – F523	503
BFT 98B	Q 62702 – F1084	503
BFT 98T	Q 62702 – F877	507
S BFT 99	Q 62702 – F524	510
BFT 99A	Q 62702 – F901	510
BFW 92	Q 62702 – F321	514
BFX 59	Q 60206 – X59	518
BFX 59F	Q 60206 – X59-S5	518
BFX 60	Q 60206 – X60	522
BFY 90	Q 62702 – F297	526

GaAs FETs

Type	Ordering code	Page
CF 739	Q 62702 – F1215	532
CFY 10	Q 62703 – F11	538
CFY 11	Q 62703 – F0001	540
S CFY 18-18	Q 62703 – F33	542
S CFY 18-20	Q 62703 – F23	542
S CFY 18-23	Q 62703 – F24	542

Ordering Codes

Type	Ordering code	Page
S CFY 19-18	Q 62703 – F14	557
S CFY 19-22	Q 62703 – F3	557
S CFY 19-27	Q 62703 – F5	557
S CFY 25-17	Q 62703 – F106	564
S CFY 25-20	Q 62703 – F107	564
S CFY 25-23	Q 62703 – F108	564
S CFY 30	Q 62703 – F97	566
S CFY 65-12	Q 62703 – F101	576
S CFY 65-14	Q 62703 – F102	576
GaAs MMICs		
CGY 21	Q 68000 – A5953	582
CGY 31	Q 68000 – A6887	590
S CGY 40	Q 68000 – A4444	598
S CGY 50	Q 68000 – A8370	607

Scope of Applications
Technical Information
Quality Specifications

Einsatzhinweise
Technische Angaben
Qualitätsangaben

Scope of Applications

Diodes

- Protective diodes
- Switches
- Mixers
- Detectors
- Limiters
- Tuners

- Switches
- RF resistors
- Modulators

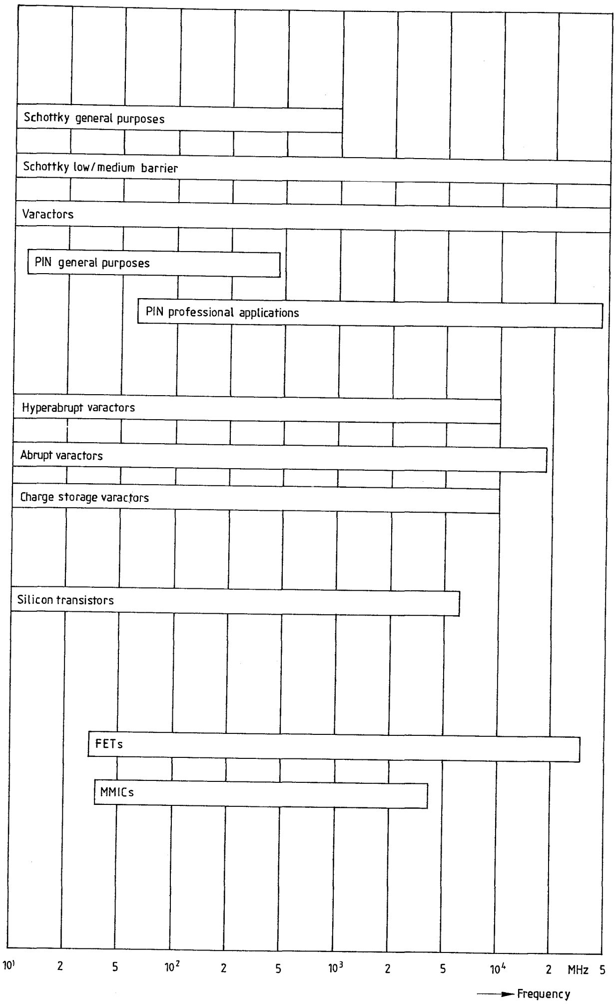
- Oscillator tuning

Silicon Transistors

- Amplifiers
- Oscillators
- Mixers

GaAs FETs/MMICs

- Broadband amplifiers
- Microwave amplifiers
- Low-noise amplifiers
- Oscillators
- Mixers



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.

Notation of the Symbols and Terms Used (DIN 41785)

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 "Λ" over the letter.

Examples: $\hat{I}_C$, $\hat{I}_c$

Technical Information

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.

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.

Thermal Resistance

The heat dissipation of components depends on material and thickness of the PC board and of the conductor paths (inherent heating), as well as on the packing density (external heating). Hence, inherent and external heating determine the junction temperature, and thus the permissible thermal stress of the components.

The values for thermal resistance given in the data sheets should only be used for rough estimations of the junction temperature T_j, since they were measured under certain laboratory conditions, where no regard was paid to specific applications.

ESD, Electro**s**tatic **D**ischarge 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.

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

Quality Specifications

Quality Assurance

Siemens microwave transistors and diodes are manufactured applying the most advanced technologies and manufacturing processes. Years of technical experience and a proven system of quality assurance ensure a continuously high level of quality and reliability. The high degree of operational safety of our components is achieved by the following measures:

Sophisticated technologies

- ion implantation
- self-adjusting photo technology
- multilayer precious metal contacts resistant to corrosion and electromigration
- hermetic chip nitride passivation
- ion etching

On-receipt and final inspections

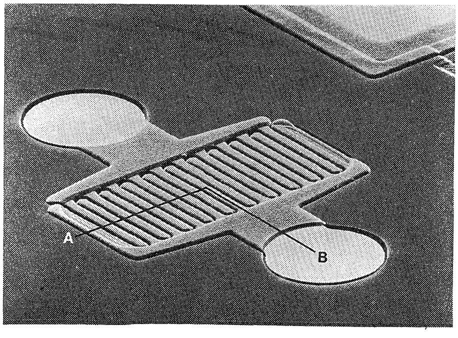
On-receipt inspections of material and parts, as well as final inspections of the finished semiconductor by quality assurance departments which are independent of the production process.

Process control

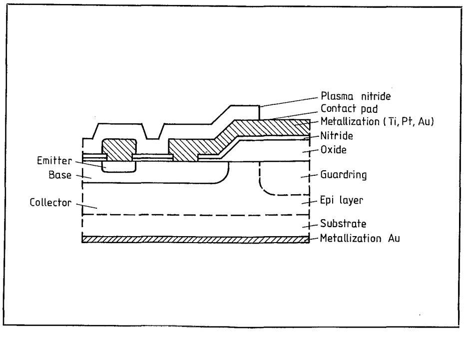
Sampling inspections

- Equipment and process monitoring by checks during the individual production steps and electrical and visual final evaluation of the wafers by scanning electron microscopes. These methods ensure that only flawless chips are assembled.
- Control of assembly processes by light and electron microscopes.

Hermetic chip system
(Silicon transistor)



Chip cross section A/B



Reliability

Microwave semiconductors, characterized by extremely small structures (typically 0.5 µm strip width), are operated with high current densities. The failure mechanisms depend to a very high degree on the operating temperature and the stress on the semiconductor system (chip). The following diagrams show the interrelation between junction temperature and failure rate for the components described here. The increase in the failure rate with rising temperature depends on the activation energies (component-specific) of the failure mechanisms, which again are decisively influenced by the technology used.

Reliability is also influenced by operational and environmental factors, i.e. also by the user. The user can therefore provide a derating by suitable electrical and mechanical dimensioning of his devices, thus directly influencing the reliability.

The expected failure rate depending on junction or channel temperature includes:

- The statistical spread of the components with a confidence coefficient of 90%.
- Deviations of stress due to electrical operational and environmental factors of low to high intensity. A sufficient safety margin from the absolute maximum ratings has to be observed.

The expected failure rate does not include:

- Time deviations
  The initial course of the operating life curve varies and, although influenced by type and technology, depends directly on the stress. According to the stress, early failures may occur within some hundred hours; under a small load, they may occur in a time range of some thousand hours.
- Extraordinary unrecognized stress during the manufacturing process, testing and maintenance owing to unexpected operational conditions and general risks on the part of the customer, etc.
- Extreme demands on the functional criteria which considerably deviate from the characteristics specified; e.g. exceptionally low reverse current level, very low operating points with stringent drift requirements, very closely tolerated parameters.

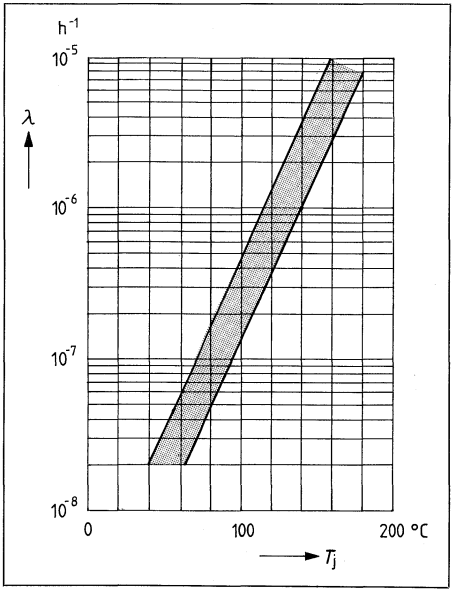
Considering the above factors, the specified reliability is obtained.

Failures, by definition, are only total failures i.e. components with considerably impaired functions to the effect that they cannot be used for assembly.

"Industry" Quality Level

All components in "industry" quality level feature very high reliability and are supplied in low-cost packages. Owing to their favorably priced packages these components ensure high reliability combined with the cost efficiency necessary for mass production. The production of these chips utilizes the same technology as was developed for "Hi-rel" components.

The diagram below shows the expected failure rate.



Time range: 1000 h ... 10000 h
Environmental conditions: T_A = 40 °C

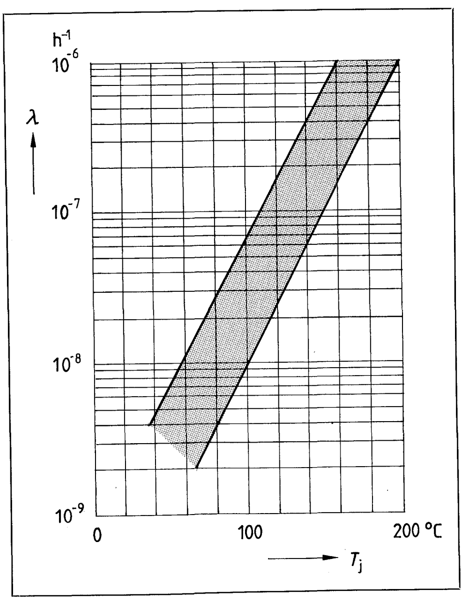
100% inspection
– electrical inspection of the chips prior to assembly
– inspection of the alloys and contacts by means of error-specific testing
– electrical final inspection of the finished small-signal semiconductors.

"Hi-rel" Quality Level

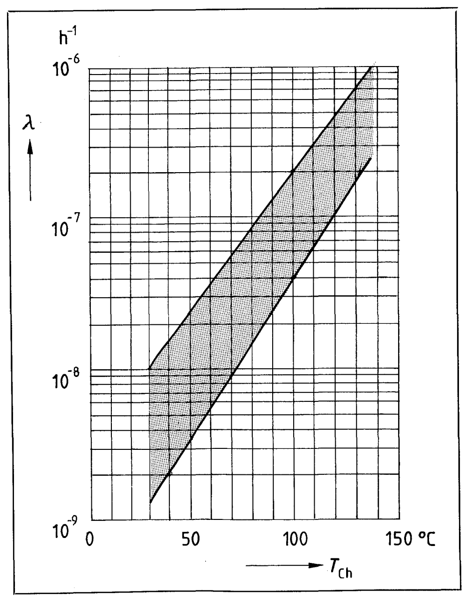
All Siemens "Hi-rel" microwave transistors and diodes are manufactured under clean room conditions.

The exclusive use of hermetically sealed ceramic packages ensures the high quality of these products.
The reliability of components manufactured this way was impressively proven during the last ten years in applications such as in analog (60 MHz) and digital (565 Mbit/s) underfloor amplifiers as well as in satellite projects (Symphony, Meteo Sat).

Expected failure rate λ versus junction temperature for "Hi-rel" microwave transistors and diodes.



Expected failure rate λ versus channel temperature for "Hi-rel" GaAs microwave transistors.



Siemens microwave semiconductors are available in two quality levels:

- Level 1 professional
- Level 2 "Hi-rel" (level 1 + burn-in)

Quality Specifications

Quality levels	Failure rate (1 fit = 10^{-9} failures in time) Silicon diodes and transistors	GaAs FETs
Professional	50 ... 200 fit	50 ... 200 fit
"Hi-rel"	10 ... 70 fit	10 ... 70 fit
Junction or channel temperature	100 °C	75 °C

100% inspection

- electrical inspection of chips prior to assembly
- visual inspection of metalized and contacted chips prior to sealing
- electrical inspection of the alloys and contacts
- electrical final inspection of the finished small-signal semiconductors according to the data sheets.

Quality Specifications

AQL Values and Definitions of Defectives

Delivery quality

In this data book the delivery quality is described by technical data, such as maximum ratings and minimum and maximum characteristics.

Acceptable quality level (AQL)

In order to determine the acceptable quality level of delivery lots, the sample tests of attributes are based on AQL values. The testing of attributes is performed in accordance with the single sampling plan for normal inspection, inspection level II, DIN 40080, IEC 410, MIL-STD-105D respectively.

Classification of defects

A defect exists if a component characteristic does not fulfil the value given in the data sheet. Defects are classified according to type and degree of seriousness.

Types of defects

- Damage to package and connections
- Electrical defects

Degree of defects

- A defect exists if a data sheet value exceeds the specified range.
- Inoperatives are components whose functional use as per data sheet is impossible.

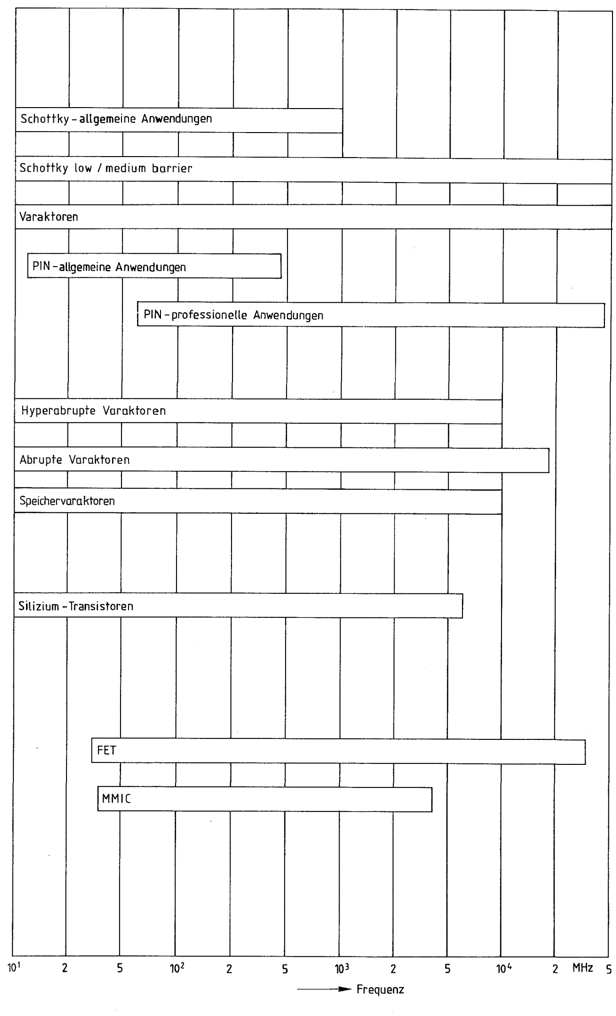
AQL table

Type of defect	AQL value
Inoperatives (mechanical and electrical)	0.1
Σ defects in DC parameters	0.4
Defects in AC parameters	1.5
Σ damage to package and connections	0.4

AQL values do not describe the actual quality of individual delivery lots, but rather serve to determine – on the basis of the sampling plans – their acceptance or rejection.

As a rule, the average percentage of defectives in shipments is lower than the AQL values.

Einsatzhinweise



Dioden

- Schutzdioden
- Schalter
- Mischer
- Detektoren
- Begrenzer
- Tuner

- Schalter
- HF-Widerstände
- Modulatoren

- Oszillatorabstimmung

Silizium-Transistoren

- Verstärker
- Oszillatoren
- Mischer

GaAs-FET/MMIC

- Breitbandverstärker
- Mikrowellenverstärker
- Rauscharme Verstärker
- Oszillatoren
- Mischer

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.

Schreibweise der Symbole und Begriffe (DIN 41785)

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_C, I_C, v_{BE}, V_{BE}, p_C, P_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_c, I_c, v_{be}, V_{be}, p_c, P_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_{CM}, I_{CAV}, I_{cm}, I_{cav}

Bei Scheitelwerten kann auch ein "∧" über dem Buchstaben verwendet werden.

Beispiele: $\hat{I}_C$, $\hat{I}_c$

Technische Angaben

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 Durchbruchspannungen, wie auch in der Anwendung, muß deswegen mit entsprechenden Sicherungen das Überschreiten der Grenzwerte zuverlässig verhindert werden.

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.

Wärmewiderstände

Die Wärmeableitung der Bauelemente resultiert aus Materialart und -dicke der Platine und der Leiterbahnen (Eigenerwärmung), sowie der Packungsdichte (Fremderwärmung). Eigen- und Fremderwärmung bestimmen also die Sperrschichttemperatur und damit die zulässige Belastbarkeit der Bauelemente.

Die Datenblattwerte der Wärmewiderstände dienen somit nur zum groben Abschätzen der Sperrschichttemperatur T_j, da sie unter bestimmten Randbedingungen im Labor gemessen werden und der jeweilige Anwendungsfall nicht berücksichtigt ist.

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.

Normen

Spezielle Einzelheiten entnehmen Sie bitte folgenden Unterlagen:

DIN 41782: Dioden
DIN 41785: Grenzwerte
DIN 41791: Allgemeine Vorschriften
DIN 41852: Halbleiter-Technologie
DIN 41853: Begriffe für Dioden
DIN 41854: Begriffe für Bipolartransistoren

Qualitätsangaben

Qualitätssicherung

Siemens Mikrowellentransistoren und -dioden werden nach modernsten Technologie- und Fertigungsverfahren hergestellt. Langjährige technische Erfahrung und ein bewährtes Qualitätssicherungssystem garantieren ein stets gleichhohes Maß an Qualität und Zuverlässigkeit. Die hohe Betriebssicherheit unserer Bauelemente wird erreicht durch:

Modernste Technologien

- Ionenimplantation
- Selbstjustierende Fototechnik
- Korrosions- und elektromigrationssichere Mehrschicht-Edelmetallkontakte
- Hermetische Chip-Nitrid-Passivierung
- Ionenätzung

Eingangs- und Ausgangskontrollen

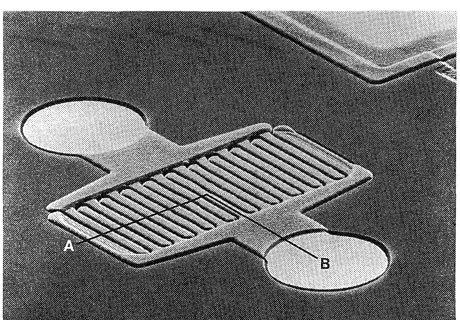
Eingangskontrollen von Material und Teilen sowie Ausgangskontrollen der fertigen Einzelhalbleiter durch fertigungsunabhängige Qualitätsdienststellen.

Fertigungskontrollen

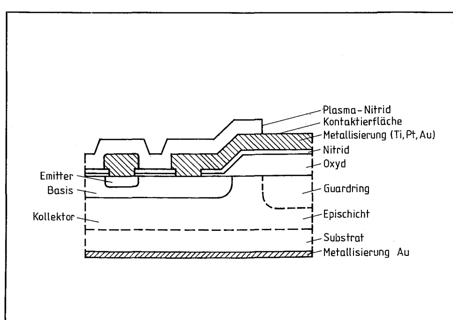
Stichproben

- Anlagen- und Prozeßüberwachung durch Kontrollen innerhalb der einzelnen Fertigungsschritte bei der elektrischen und optischen Endbeurteilung der Scheiben unter Einsatz von Rasterelektronenmikroskopen, so daß nur einwandfreie Chips zur Montage gelangen.
- Licht- und elektronenmikroskopische Kontrolle der Montageprozesse.

Hermetisches Chip-System
(Silizium-Transistor)



Chip-Querschnitt A–B



Qualitätsangaben

Zuverlässigkeit

Mikrowellenhalbleiter, im Aufbau durch kleinste Strukturen gekennzeichnet (typisch 0,5 µm Streifenbreite), werden bei hohen Stromdichten betrieben. Die Fehlermechanismen hängen sehr stark von der Betriebstemperatur und der Beanspruchung des jeweiligen Halbleitersystems (Chip) ab. Die nachfolgenden Diagramme zeigen in etwa den Zusammenhang zwischen Sperrschichttemperatur und Ausfallrate für die hier beschriebenen Bauelemente. Die Zunahme der Ausfallrate mit der Temperatur ist abhängig von den Aktivierungsenergien (bauelementespezifische Größe) der Ausfallmechanismen, welche wiederum entscheidend durch die jeweils verwendete Technologie beeinflußt werden.

Die Zuverlässigkeit wird von Umwelt- und Betriebsgrößen, d.h. auch vom Anwender, mit beeinflußt. Der Anwender kann z.B. durch geeignete Dimensionierung seiner Geräte in elektrischer und mechanischer Hinsicht eine Unterlastung (Derating) vornehmen, mit dem Ziel die Ausfallrate herabzusetzen.

Der in den folgenden Diagrammen gezeigte "Erwartungsbereich" der Ausfallrate in Abhängigkeit der Sperrschicht- oder der Kanaltemperatur beinhaltet:

- Die statistische Streuung der Bauelemente für die Aussagewahrscheinlichkeit von 90%.
- Die Streubreite der Beanspruchungen durch die elektrischen Betriebs- und Umweltgrößen kleiner bis großer Intensität. Dabei ist ein ausreichender Sicherheitsabstand zu den Grenzdaten zu berücksichtigen.

Nicht enthalten im "Erwartungsbereich" sind:

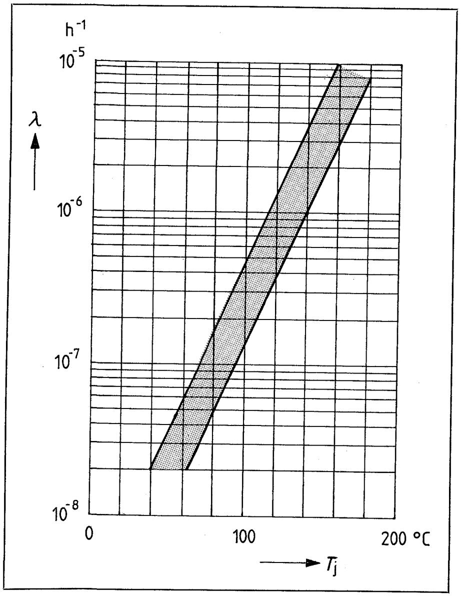
- Die Streubreite der Zeit.
  Der Anfangsverlauf der Lebensdauerkurve ist unterschiedlich und hängt je nach Typ und Technologie unmittelbar von der Beanspruchung ab. Je nach Beanspruchung treten Frühausfälle in einigen hundert Stunden oder, bei geringer Beanspruchung, in einem Zeitraum von einigen tausend Stunden auf.
- Nicht programmgemäße Beanspruchung durch nicht erkannten Streß bei der Geräteherstellung, Prüfung und Wartung durch unvorhergesehene Betriebszustände, durch allgemeine Risiken beim Gerätekunden usw.
- Extreme Ansprüche an die Funktionskriterien, die gegenüber den beschriebenen Kenndaten stark abweichen. Zum Beispiel besonders niedrige Sperrstrompegel, sehr kleine Arbeitspunkte mit scharfen Drift-Anforderungen, sehr enge Parameter-Gruppierungen usw.

Bei Berücksichtigung der beschriebenen Zusammenhänge wird die angegebene Zuverlässigkeitserwartung erreicht.
Als Ausfall werden nur Totalausfälle angesprochen bzw. diejenigen Bauelemente, bei denen die Funktion ganz wesentlich beeinträchtigt wird, so daß sie für eine Weiterverwendung unbrauchbar sind.

Qualitätsstufe "Industrie"

Die hier angebotenen Bauelemente bieten höchste Zuverlässigkeit bei gleichzeitiger Verwendung von kostengünstigen Gehäusen. Die Chipherstellung bedient sich hierbei der gleichen Technologie, wie sie für "Hi-rel" Bauelemente entwickelt wurde.

Den "Erwartungsbereich" der Ausfallrate als Funktion der Sperrschichttemperatur T_j zeigt folgendes Diagramm:



Zeitbereich: 1000 h ... 10000 h
Umgebungsbedingungen: T_A = 40 °C

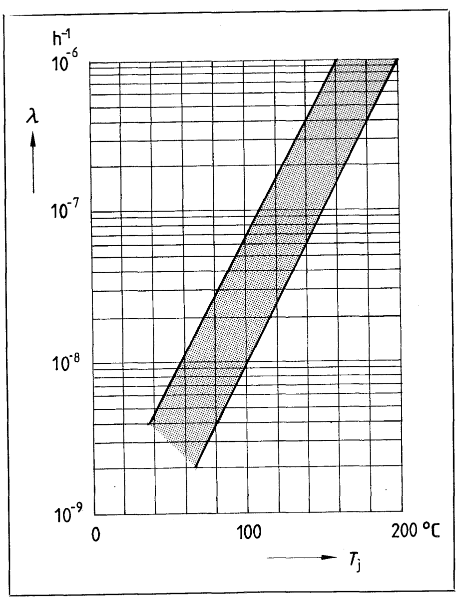
100-%-Prüfung
- Elektrische Beurteilung der Chips vor der Montage.
- Prüfung der Legierung und Kontaktierung durch fehlerspezifische Prüfungen.
- Elektrische Endprüfung der fertigen Einzelhalbleiter.

Qualitätsstufe "Hi-rel" (High reliability)

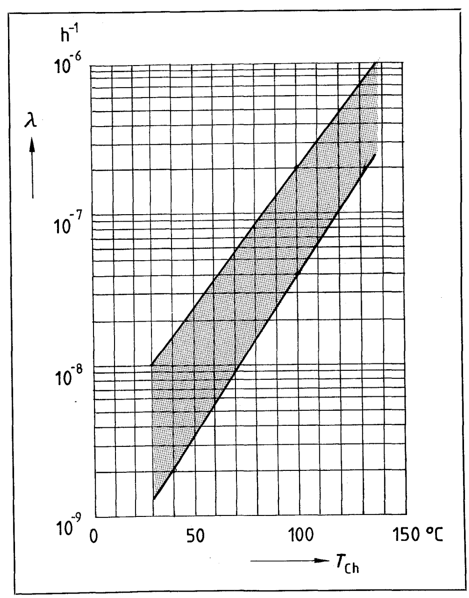
"Hi-rel"-Mikrowellentransistoren und -dioden werden bei Siemens ausschließlich unter Weißraumbedingungen (clean room) hergestellt.

Die ausschließliche Verwendung von hermetisch dichten Keramikgehäusen liefert Produkte hoher Qualität.
Die Zuverlässigkeit der auf diese Weise hergestellten Bauelemente wurde auch durch den Feldeinsatz in Unterflurverstärkern der Analog- (60 MHz) und Digitaltechnik (565 Mbit/s), sowie in Satellitenprojekten (Symphonie, Meteo Sat) während der letzten 10 Jahre eindrucksvoll bestätigt.

Zu erwartende Ausfallrate λ als Funktion der Sperrschichttemperatur T_j für "Hi-rel"-Mikrowellentransistoren und "Hi-rel"-Mikrowellendioden.



Zu erwartende Ausfallrate λ als Funktion der Kanaltemperatur T_{ch} für "Hi-rel" GaAs-Mikrowellentransistoren.



Die Mikrowellenhalbleiter von Siemens lassen sich zu zwei Qualitätsgruppen einteilen:

- Stufe 1 professionell
- Stufe 2 "Hi-rel" (Stufe 1 + burn-in)

Qualitätsangaben

Qualitätsstufen	Ausfallrate (1 fit = 10^{-9} Ausfälle pro Stunde) Silizium- Dioden und Transistoren	GaAs FET
professionell	50 ... 200 fit	50 ... 200 fit
"Hi-rel"	10 ... 70 fit	10 ... 70 fit
Sperrschicht- bzw. Kanaltemperatur	100 °C	75 °C

100-%-Prüfung

- Elektrische Beurteilung der Chips vor der Montage.
- Optische Kontrolle der legierten und kontaktierten Chips vor dem Verschließen.
- Elektrische Prüfung der Legierung und Kontaktierung.
- Elektrische Endprüfung der fertigen Einzelhalbleiter gemäß Datenblatt.

Qualitätsangaben

AQL-Werte und Fehlerkriterien

Lieferqualität

Die Lieferqualität wird in diesem Datenbuch durch technische Merkmale wie Grenzdaten und Streugrenzen der Kenndaten beschrieben.

Annehmbare Qualitätslage (AQL)

Zur Beurteilung der annehmbaren Qualitätslage von Lieferlosen werden bei stichprobenweisen Überprüfungen der qualitativen Merkmale (Attribute) AQL-Werte zugrunde gelegt. Als Grundlage für die Attributprüfung dienen die Einfach-Stichprobenpläne für normale Prüfung, Hauptprüfniveau II nach DIN 40080 (oder IEC 410, MIL-STD-105D).

Fehlerarten, Fehlerklassen

Ein Fehler liegt vor, wenn ein Bauelementmerkmal nicht den Datenblattangaben entspricht. Die Fehler werden nach Art und Ausmaß klassifiziert.

Fehler-Art

- Fehler an Gehäusen und Zuleitungen
- Fehler in elektrischen Eigenschaften

Fehler-Ausmaß

- Ein Fehler liegt vor, wenn ein Merkmalswert den spezifizierten Bereich überschreitet.
- Ein Totalfehler beschreibt den Zustand eines Bauelements, der jede funktionsgemäße Verwendung ausschließt.

AQL-Tabelle

Fehler-Art	AQL
Totalfehler (mechanisch und elektrisch)	0,1
Summe Fehler statischer (Gleichstrom)-Daten	0,4
Fehler dynamischer (Wechselstrom-)Daten	1,5
Summe Fehler in Gehäusen und Zuleitungen	0,4

AQL-Werte beschreiben nicht die tatsächliche Qualität der einzelnen Lieferlose, sondern bestimmen bei Anwendung der Stichprobenpläne die Annahme oder Rückweisung.

Der prozentuale durchschnittliche Fehleranteil von Auslieferungen liegt im allgemeinen unter den AQL-Werten.

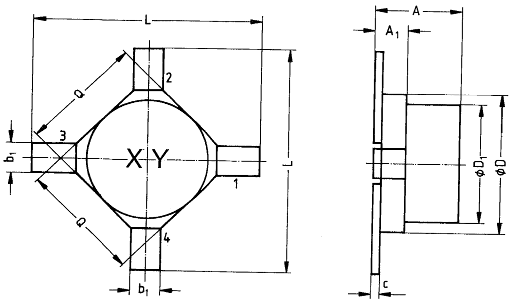
Package Outlines
Mounting Instructions
Packaging Instructions

Gehäusebauformen
Verarbeitungshinweise
Verpackungshinweise

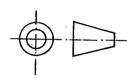
Package Outlines

All dimensions in mm, unless otherwise specified.

Cerec-X

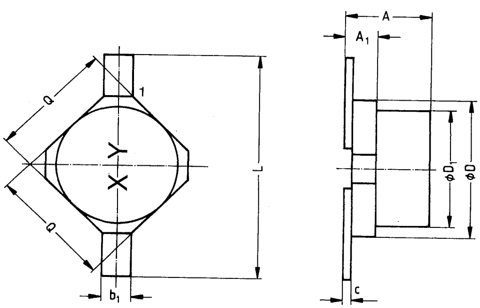


Dim.	min.	typ.	max.
A	–	–	1.6
A_1	–	0.6	–
b_1	0.45	0.5	0.55
c	0.1	0.15	0.2
D	2.35	2.55	2.75
D_1	–	2.1	–
L	4.0	4.2	–
Q	2.0	2.2	2.4



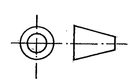
Approx. weight: 0.02 g

Cerec-X



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

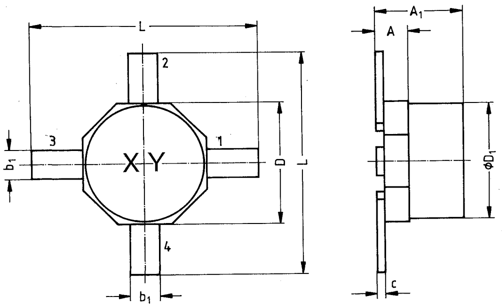
Approx. weight: 0.02 g



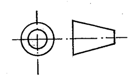
Package Outlines

All dimensions in mm, unless otherwise specified.

Cerec-XF

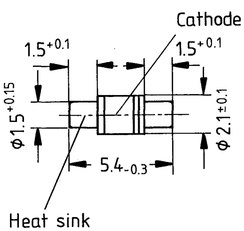


Dim.	min.	typ.	max.
A	0.45	0.48	0.50
A_1	1.0	1.5	–
b_1	0.40	0.5	0.60
c	0.08	0.1	0.16
D	–	1.78	–
D_1	–	1.75	–
L	–	4.2	–



Approx. weight: 0.02 g

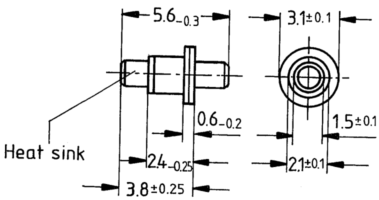
C1

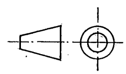


Approx. weight: 0.1 g

All dimensions in mm, unless otherwise specified.

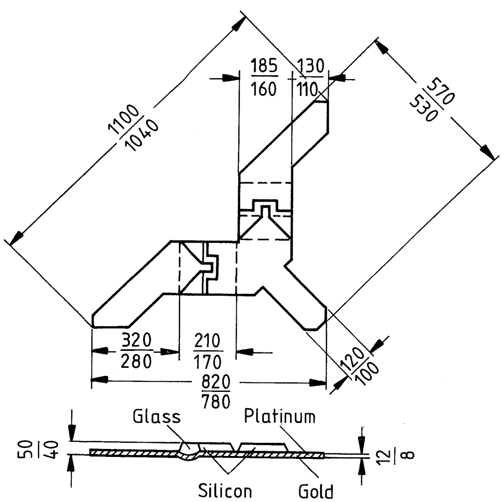
D

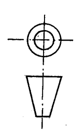




Approx. weight: 0.12 g

D

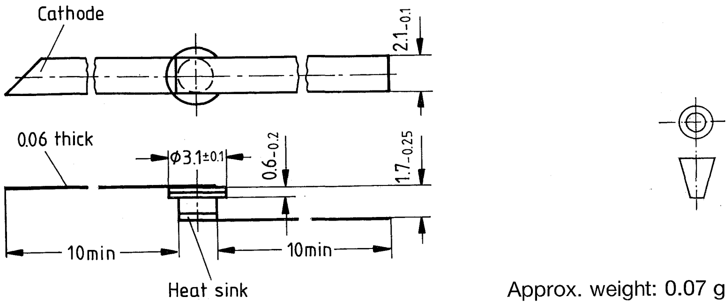




Dimensions in µm

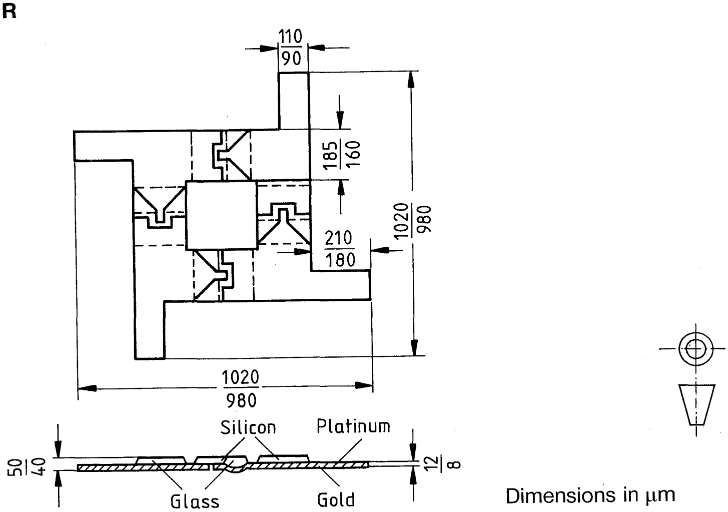
All dimensions in mm, unless otherwise specified.

P



Approx. weight: 0.07 g

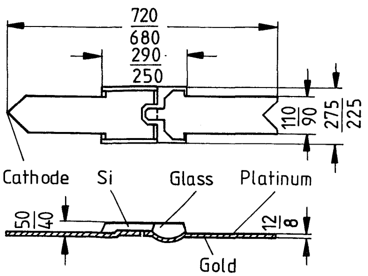
R

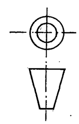


Dimensions in µm

All dimensions in mm, unless otherwise specified.

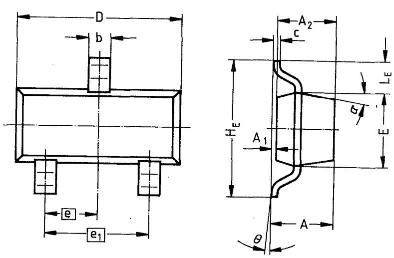
S





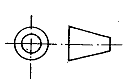
Dimensions in µm

SOT-23



Approx. weight: 0.02 g

Note 1
Applicable on all sides

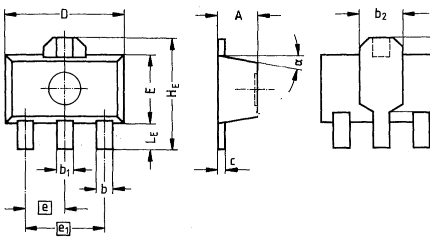


Dim.	min.	typ.	max.	Gradient	Note
A	–	–	1.1	–	–
A_1	–	–	0.1	–	–
A_2	–	–	1.0	–	–
b	0.35	–	0.50	–	–
c	0.08	–	0.15	–	–
D	2.8	–	3.0	–	–
E	1.2	–	1.4	–	–
$\|e\|$	–	1.95	–	–	–
$\|e_1\|$	–	1.7	–	–	–
H_E	–	–	2.6	–	–
L_E	–	–	0.6	–	–
α	–	–	–	max. 10°	1
θ	–	–	–	2° ... 30°	–

Package Outlines

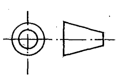
All dimensions in mm, unless otherwise specified.

SOT-89



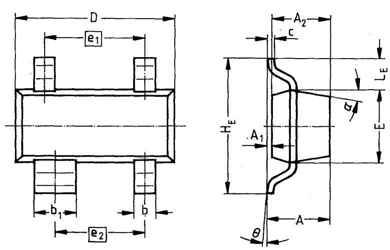
Approx. weight: 0.1 g

Note 1
Applicable on all sides



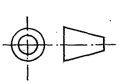
Dim.	min.	typ.	max.	Gradient	Note
A	–	1.5	–	–	–
b	–	–	0.65	–	–
b_1	–	–	0.65	–	–
b_2	–	1.6	–	–	–
c	0.25	–	–	–	–
D	–	–	4.5	–	–
E	–	–	2.6	–	–
|e|	–	1.5	–	–	–
$\|e_1\|$	–	3	–	–	–
H_E	–	–	4.25	–	–
L	2.6	–	2.85	–	–
L_E	0.8	–	1.2	–	–
α	–	–	–	max. 10°	1

SOT-143



Approx. weight: 0.02 g

Note 1
Applicable on all sides

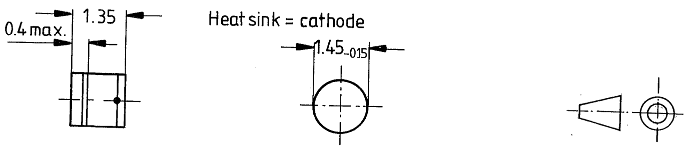


Dim.	min.	typ.	max.	Gradient	Note
A	–	–	1.1	–	–
A_1	–	–	0.1	–	–
A_2	–	–	1.0	–	–
b	0.35	–	0.50	–	–
b_1	0.75	–	0.90	–	–
c	0.08	–	0.15	–	–
D	2.8	–	3.0	–	–
E	1.2	–	1.4	–	–
$\|e_1\|$	–	1.9	–	–	–
$\|e_2\|$	–	1.7	–	–	–
H_E	–	–	2.6	–	–
L_E	–	–	0.6	–	–
α	–	–	–	max. 10°	1
θ	–	–	–	2° ... 30°	–

Package Outlines

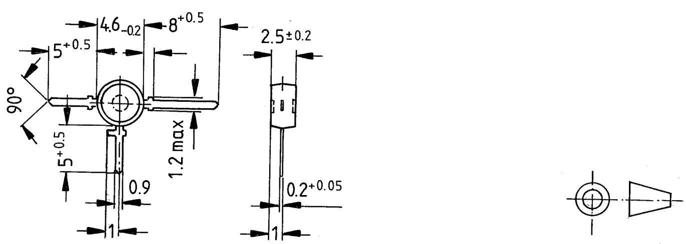
All dimensions in mm, unless otherwise specified.

T



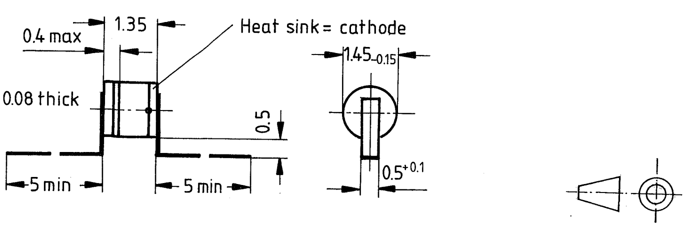
Approx. weight: 0.02 g

T-plast



Approx. weight: 0.25 g

T1

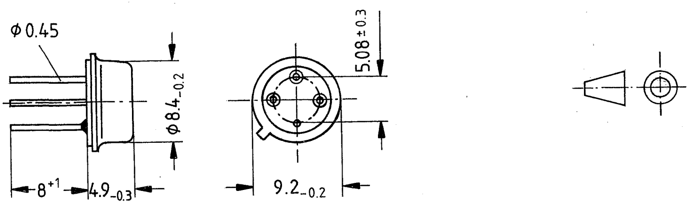


Approx. weight: 0.02 g

Package Outlines

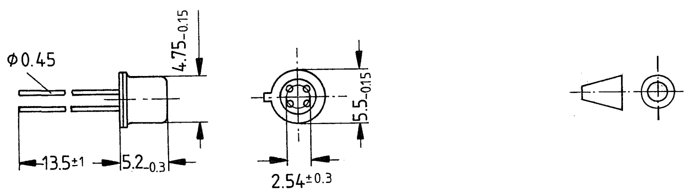
All dimensions in mm, unless otherwise specified.

TO-12



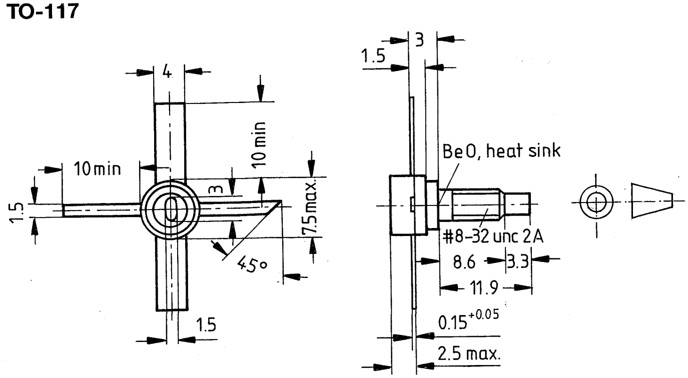
Approx. weight: 1 g

TO-72



Approx. weight: 0.4 g

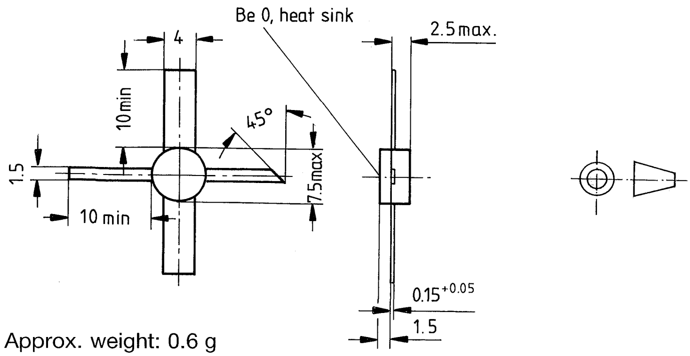
TO-117



Approx. weight: 1.9 g

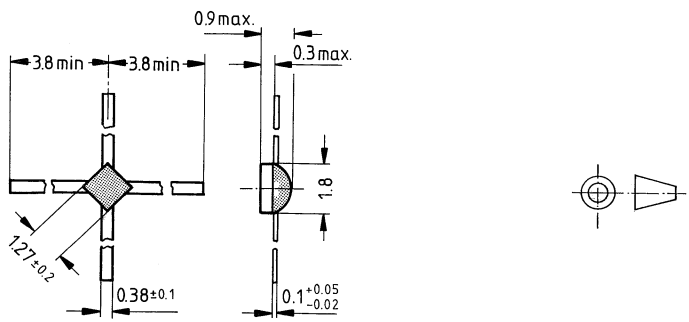
All dimensions in mm, unless otherwise specified.

TO-117 (similar)



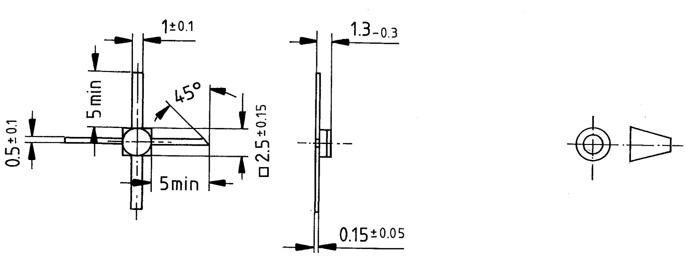
Approx. weight: 0.6 g

50 mil



Approx. weight: 0.1 g

100 mil



Approx. weight: 0.5 g

Mounting Instructions

Mechanical Stress

When preparing and mounting the components, take care that the parts are free from mechanical tensions; especially endangered is the fixing of the pins in the package, the loosening of which may lead to a failure of the components.

- For the bending process, the pins should be relieved between bending point and package in order to avoid mechanical stress between package and connecting point.
- Terminal strips (e.g. of T-plast) should not be bent in the mounting plane.
- Avoid repeated bendings at the same point.

Thermal Stress

Each semiconductor component is extraordinarily sensitive to an exceeding of the maximum permissible junction temperature. When designing the devices, care must be taken that the distance between heat generators and semiconductors is large enough. If a preheating up to 75 °C is applied, the soldering times have to be shortened by 30%.

Soldering Specifications

- for plastic encapsulated components

Lead length L = 1)	0.5 mm	1.5 mm	5 mm
Soldering temperature 245 °C	4 s	5 s	10 s
Soldering temperature 260 °C	3 s	5 s	5 s
Soldering temperature 300 °C2)	2.5 s	3 s	5 s

- for hermetically sealed components

Lead length L = 1)	1.5 mm	2.5 mm	5 mm
Soldering temperature 245 °C	5 s	6 s	13 s
Soldering temperature 260 °C	3.5 s	4 s	10 s
Soldering temperature 300 °C2)	3 s	3.5 s	8 s

- for SMD components

Before starting the soldering, make sure the component is attached to the PC board in a way that does not exert undue mechanical stress on the leads. The adhesives that are used for wave soldering of SMDs must be neutral in their chemical and electrical reaction.

Package	SOT-23	SOT-89	SOT-143	Cerec-X/XF
Wave soldering	x	○	x	□
Reflow soldering	x	x	x	x

x = suitable, ○ = restricted, □ = unsuitable

1) The lead length is measured from the soldering point on, i.e. with normally clad plates from plate bottom on, and with through-plated holes from the plate top on.
If the case won't be touched by the solder iron, a lead length of L = 0 is permissible for transistors. A special soldering instruction additionally applies to this case.
2) Only valid for iron soldering.

Packaging Instructions

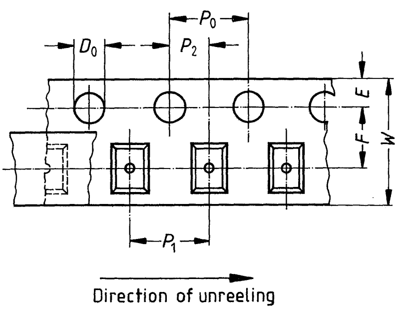
Each packaging unit of regular deliveries is marked with information about the manufacturer, type, quantity, date and place of manufacture, lot, ESD sensitivity, matching, etc. These details on the content are mandatory and characterize in uncoded form particularly those types whose size does not permit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

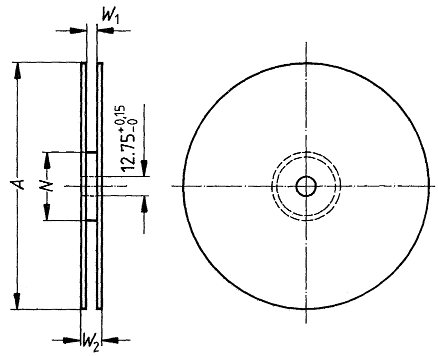
Bulk is the general loose form of packaging that enables components to be removed singly, but appropriate stations are needed to direct their supply for automatic placement. This is the normal form of packaging, especially for T-plast and X-plast devices. Taping is available in standardized versions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

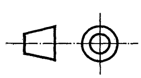
Below, the current forms of taping are summarized. Please inquire for details of dimensional tolerances or variations in how the components are oriented.

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

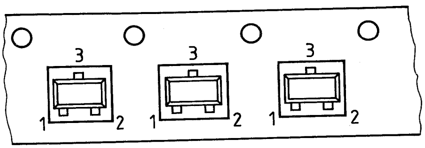
Reel dimensions (mm)

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

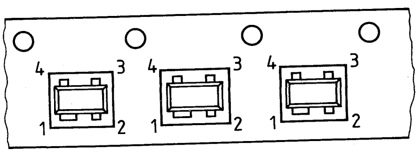
Polarity and Orientation of Taped Components

View top

8-mm tape

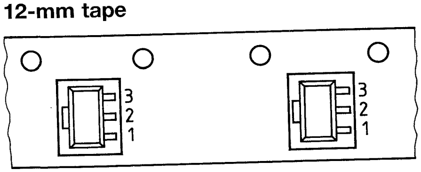


SOT-23

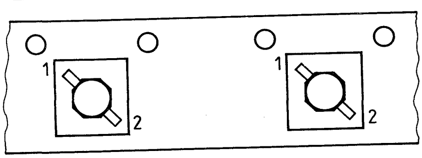


SOT-143

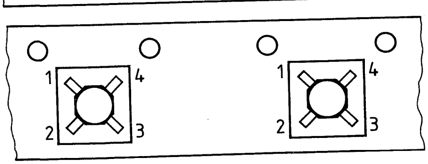
12-mm tape



SOT-89



Cerec-X (S)



Cerec-X / XF

Verarbeitungshinweise

Mechanische Beanspruchung

Bei Zurichtung und Einbau ist auf Freiheit der Teile von mechanischen Spannungen zu achten; gefährdet ist vor allem die Verankerung der Anschlüsse im Gehäuse, deren Lockerung Bauelementeausfall erwarten läßt.

- Abbiegen der Anschlüsse erfordert mechanische Entlastung zwischen Biegestelle und Gehäuse.
- Bandförmige Anschlüsse (z. B. bei T-plast) sollen nicht in Bandebene gebogen werden.
- Wiederholtes Biegen ist unzulässig.

Thermische Beanspruchung

Jedes Halbleiter-Bauelement ist äußerst empfindlich gegen Überschreiten der höchstzulässigen Sperrschichttemperatur. Man soll bei der Konstruktion der Geräte beachten, daß der Abstand zwischen Wärmeerzeugern und Halbleiter-Bauelementen ausreichend groß ist. Bei Vorwärmung auf 75 °C müssen die Lötzeiten um 30% vermindert werden.

Lötangaben

- für kunststoffumhüllte Bauelemente

Drahtlänge L = [1])	0,5 mm	1,5 mm	5 mm
Löttemperatur 245 °C	4 s	5 s	10 s
Löttemperatur 260 °C	3 s	5 s	5 s
Löttemperatur 300 °C[2])	2,5 s	3 s	5 s

- für hermetisch dichte Bauelemente

Drahtlänge L = [1])	1,5 mm	2,5 mm	5 mm
Löttemperatur 245 °C	5 s	6 s	13 s
Löttemperatur 260 °C	3,5 s	4 s	10 s
Löttemperatur 300 °C[2])	3 s	3,5 s	8 s

- für SMD-Bauelemente

Bei der Lötung ist auf verspannungsfreie Fixierung des Bauelementes vor dem Lötvorgang zu achten. Die für Schwall-Lötung von SMD-Bauteilen verwendeten Kleber müssen sich chemisch und elektrisch neutral verhalten.

Gehäuse	SOT-23	SOT-89	SOT-143	Cerec-X/XF
Wellen-Löten	x	○	x	□
Reflow-Löten	x	x	x	x

x = lötbar, ○ = bedingt lötbar, □ = nicht geeignet

1) Die Drahtlänge wird von der Lötstelle an gemessen, d. h. bei normalen kaschierten Platten von der Plattenunterseite, bei durchmetallisierten Bohrungen von der Plattenoberseite.
Drahtlänge L = 0 ist für Transistoren zulässig, sofern das Gehäuse nicht mit dem Lötkolben berührt wird. Hier gilt zusätzlich eine spezielle Lötvorschrift.
2) Gilt nur für Kolbenlötung.

Verpackungshinweise

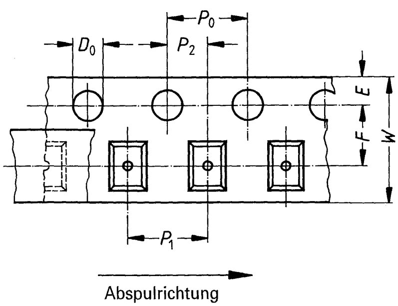
Jede Verpackungseinheit regulärer Lieferungen trägt Aufdrucke mit Informationen über Hersteller, Typ, Anzahl, Herstelldatum und -ort, Loszugehörigkeit, ESD-Empfindlichkeit, Paarung usw. Diese für den Inhalt verbindlichen Angaben kennzeichnen im Klartext insbesondere Typen, deren Bauformen keine ausführliche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

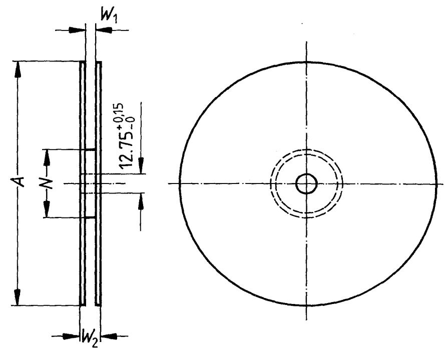
Schüttgut ist die allgemeine ungerichtete Verpackungsform ("bulk packaging"), die eine ungehinderte Einzelentnahme ermöglicht, bei automatischer Gerätebestückung aber richtungsorientierende Zufuhrstationen erfordert. Sie gilt, insbesondere bei T-plast- und X-plast-Bauelementen, als normale Verpackungsform.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

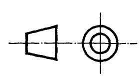
Die folgende Zusammenstellung gibt einen Überblick über die derzeitigen Gurtformen. Zu Einzelheiten über Maßtoleranzen oder Variationen der Orientierung erbitten wir Ihre Anfrage.

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

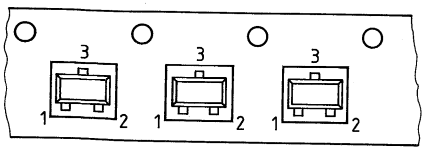
Gurtrollenmaße (mm)

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

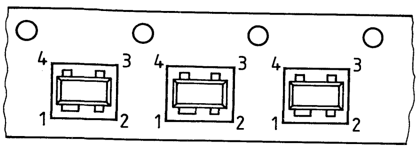
Polarität und Lage der Bauelemente im Gurt

Ansicht Oberseite

8-mm-Gurt

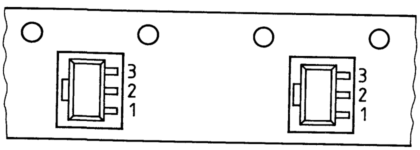


SOT-23

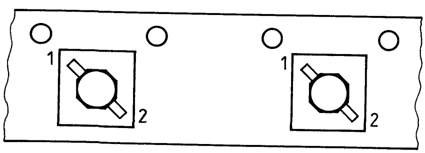


SOT-143

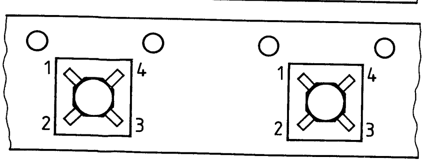
12-mm-Gurt



SOT-89



Cerec-X (S)

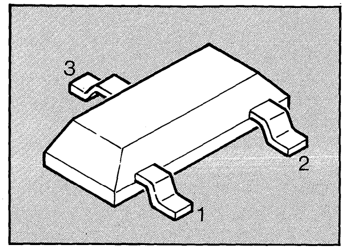


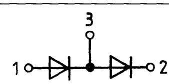
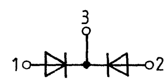
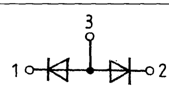
Cerec-X/XF

Schottky Diodes
PIN Diodes

Schottky-Dioden
PIN Dioden

- RF switch, RF attenuator
- Low-distortion factor
- Long-term stability of electrical characteristics



Type	Marking	Ordering code (tape and reel)	Pin configuration	Package[1])
BAR 14-1	L7	Q 62702 – A772		SOT-23
BAR 15-1	L8	Q 62702 – A731		
BAR 16-1	L9	Q 62702 – A773		

Maximum Ratings per Diode

Parameter	Symbol	Values	Unit
Reverse voltage	V_R	100	V
Forward current	I_F	100	mA
Total power dissipation, $T_A = 25$ °C[2])	P_{tot}	140	mW
Junction temperature	T_j	150	°C
Operating temperature range	T_{op}	–55 ... +150	°C
Storage temperature range	T_{stg}	–55 ... +150	°C

Thermal Resistance

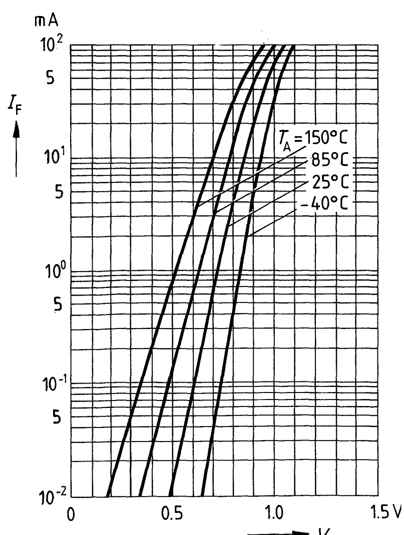
Junction – ambient[2])	R_{thJA}	≤450	K/W

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

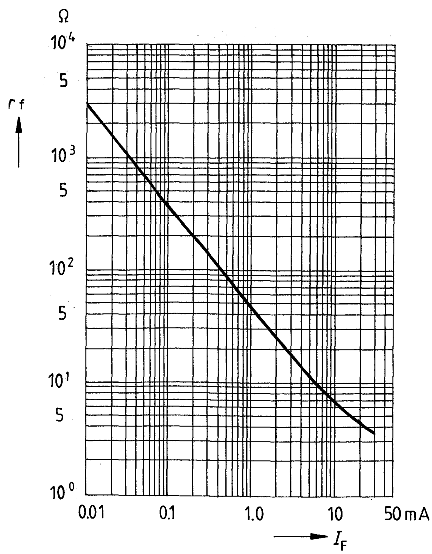
Electrical Characteristics per Diode
at T_A = 25 °C, unless otherwise specified.

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	1.25	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

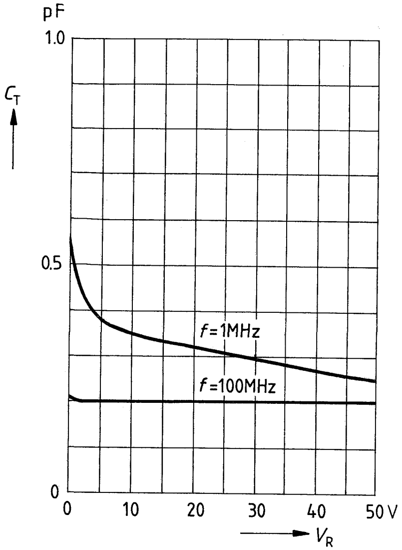
Forward current I_F = f (V_F)



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

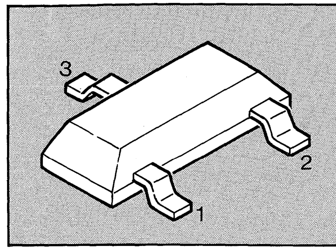


Diode capacitance C_T = f (V_R)



Silicon PIN Diodes — BAR 17

- Current-controlled RF resistor for RF attenuation
- Switching applications above 1 MHz



Type	Marking	Ordering code (tape and reel)	Pin configuration	Package[1])
BAR 17	L6	Q 62702 – A785	1 ○—▷|—○ 3	SOT-23

Maximum Ratings

Parameter	Symbol	Values	Unit
Reverse voltage	V_R	100	V
Forward current	I_F	100	mA
Total power dissipation, $T_A = 25$ °C[2])	P_{tot}	140	mW
Junction temperature	T_j	150	°C
Operating temperature range	T_{op}	–55 ... +150	°C
Storage temperature range	T_{stg}	–55 ... +150	°C

Thermal Resistance

Junction – ambient[2])	R_{thJA}	≤450	K/W

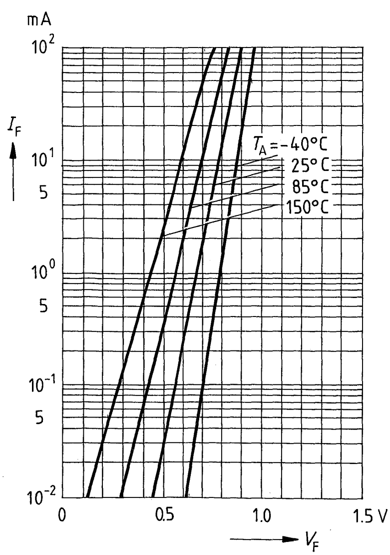
1) For detailed dimensions see chapter Package Outlines.
2) Package mounted on alumina 15 mm × 16.7 mm × 0.7 mm.

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

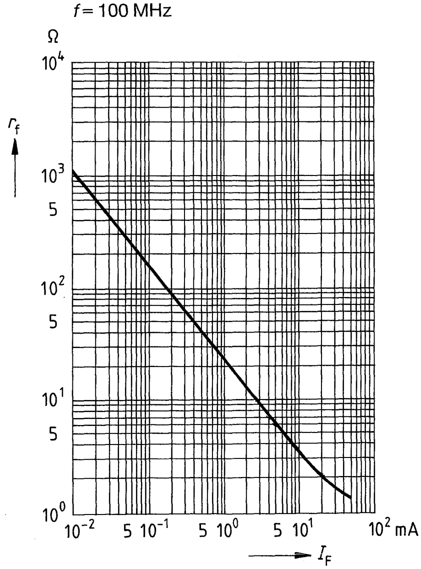
DC/AC Characteristics

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	–	

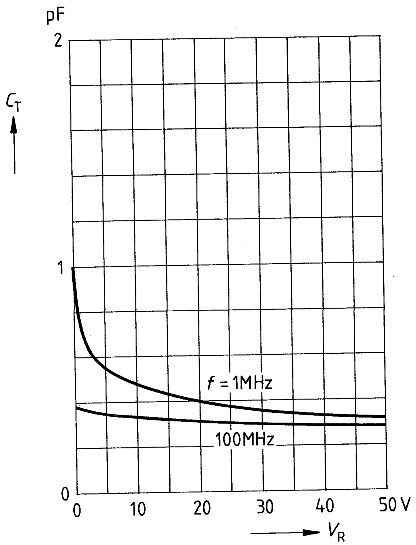
Forward current I_F = f (V_F)



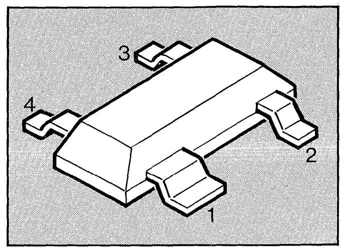
Forward resistance r_f = f (I_F)
f = 100 MHz

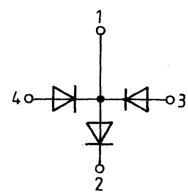
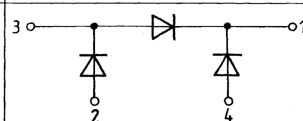


Diode capacitance $C_T = f(V_R)$



- For RF attenuation
- Switching applications for frequencies above 10 MHz



Type	Marking	Ordering code (tape and reel)	Pin configuration	Package[1])
BAR 60	60	Q 62702 – A786		SOT-143
BAR 61	61	Q 62702 – A120		

Maximum Ratings per Diode

Parameter	Symbol	Values	Unit
Reverse voltage	V_R	100	V
Forward current	I_F	100	mA
Total power dissipation, T_A = 25 °C[2])	P_{tot}	140	mW
Junction temperature	T_j	150	°C
Operating temperature range	T_{op}	–55 ... +150	°C
Storage temperature range	T_{stg}	–55 ... +150	°C

Thermal Resistance

Junction – ambient[2])	R_{thJA}	$\leq$450	K/W

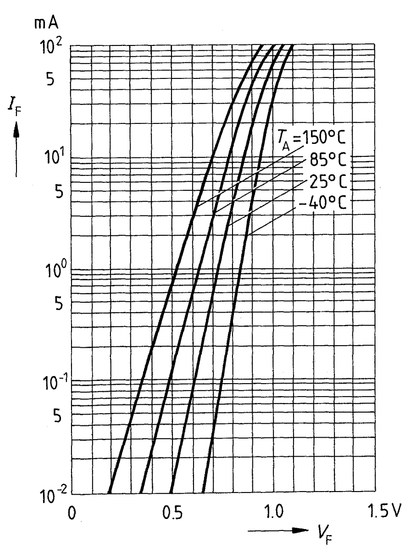
1) For detailed dimensions see chapter Package Outlines.
2) Package mounted on alumina 15 mm × 16.7 mm × 0.7 mm.

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

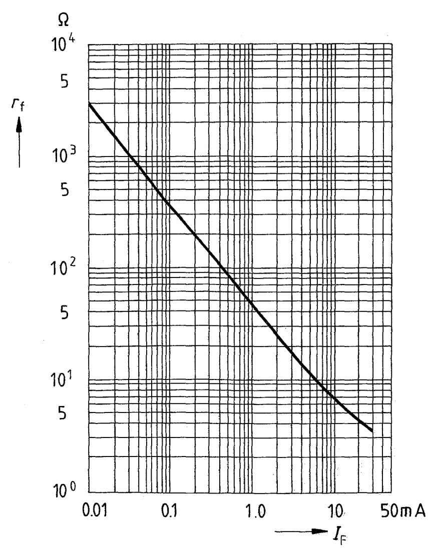
DC/AC Characteristics

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	–	–	1.25	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	–	
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	–	
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

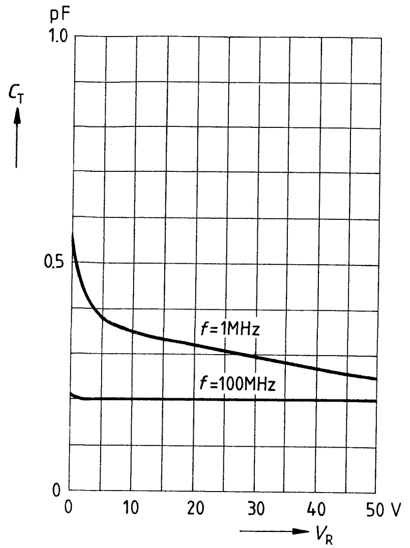
Forward current I_F = f (V_F)



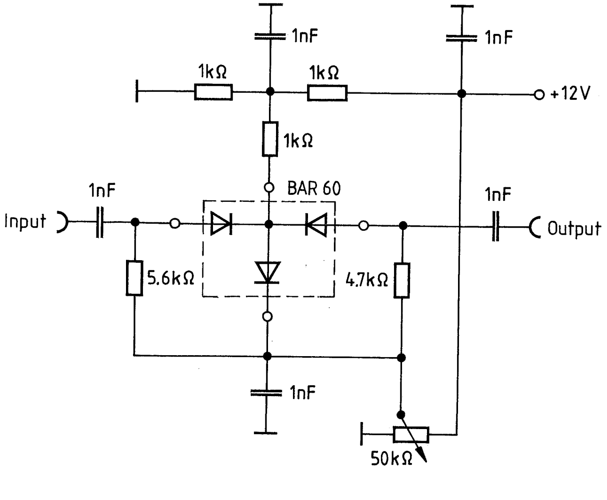
Forward resistance r_f = f (I_F)
f = 100 MHz



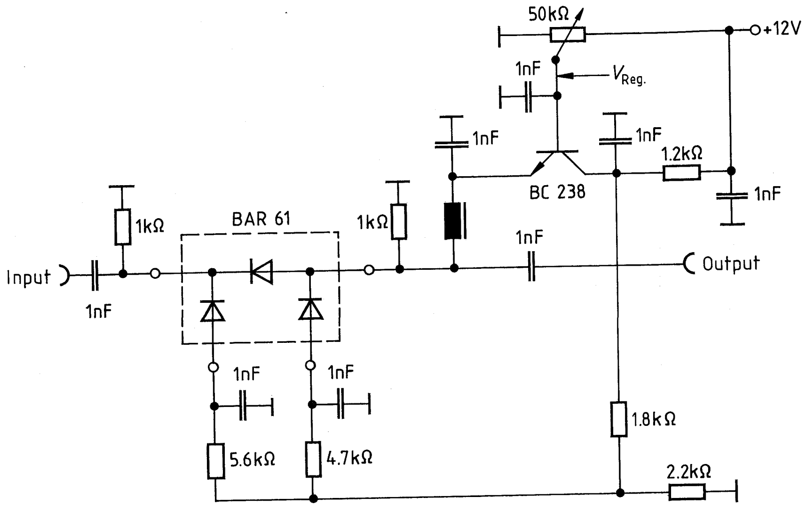
Diode capacitance C_T = f (V_R)



Circuit example for attenuation networks with diode BAR 60

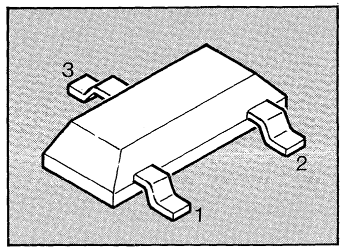


Circuit example for attenuation networks with diode BAR 61

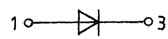
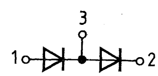
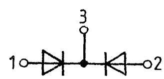
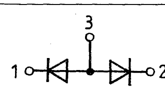


- General-purpose diodes for high-speed switching
- Circuit protection
- Voltage clamping
- High-level detecting and mixing

Ⓒ – available with CECC quality assessment

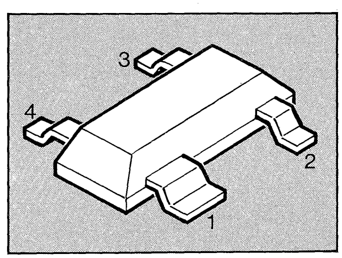


ESD: Electro**s**tatic **d**ischarge sensitive device, observe handling precautions!

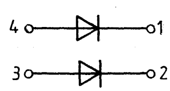
Type	Marking	Ordering code (tape and reel)	Pin configuration	Package[1])
Ⓒ BAS 40	43	Q 62702 – D339		SOT-23
Ⓒ BAS 40-04	44	Q 62702 – D980		
Ⓒ BAS 40-05	45	Q 62702 – D979		
Ⓒ BAS 40-06	46	Q 62702 – D978		

- General-purpose diodes for high-speed switching
- Circuit protection
- Voltage clamping
- High-level detecting and mixing

Ⓒ – available with CECC quality assessment



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

Type	Marking	Ordering code (tape and reel)	Pin configuration	Package[1])
Ⓒ BAS 40-07	47	Q 62702 – A697		SOT-143

1) For detailed dimensions see chapter Package Outlines.

Maximum Ratings per Diode

Parameter	Symbol	Value	Unit
Reverse voltage	V_R	40	V
Forward current	I_F	40	mA
Peak forward current	I_{FRM}	80	mA
Surge forward current, $t \leq 10$ ms	I_{FSM}	200	mA
Junction temperature	T_j	150	°C
Operating temperature range	T_{op}	–55 ... +150	°C
Storage temperature range	T_{stg}	–55 ... +150	°C

Thermal Resistance

Junction – ambient[1])	R_{thJA}	≤450	K/W

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

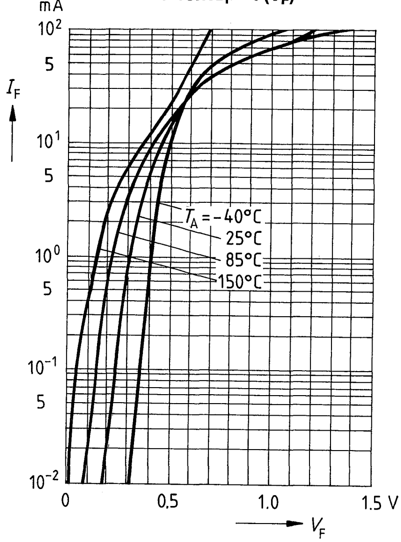
Parameter	Symbol	Values			Unit
		min	typ	max	
DC characteristics					
Breakdown voltage I_R = 10 µA	$V_{(BR)}$	40	–	–	V
Reverse current V_R = 30 V V_R = 40 V	I_R	 – –	 – –	 1 10	µA
Forward voltage I_F = 1 mA I_F = 10 mA I_F = 40 mA	V_F	 – – –	 310 450 720	 380 500 1000	mV
Diode capacitance V_R = 0, f = 1 MHz	C_T	 –	 4	 5	pF
Charge carrier life time I_F = 25 mA	τ	–	–	100	ps
Differential forward resistance I_F = 10 mA, f = 10 kHz	r_f	–	10	–	Ω

1) Package mounted on alumina 15 mm × 16.7 mm × 0.7 mm.

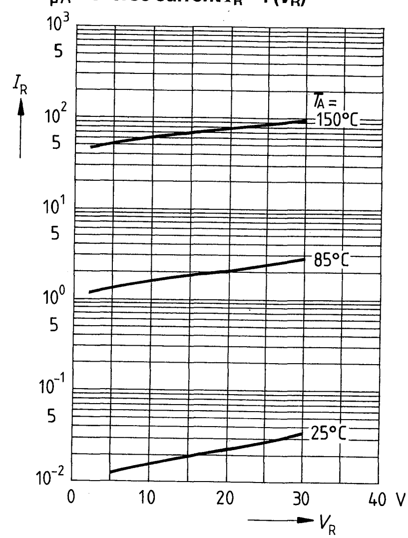
Characteristics per Diode

at T_A = 25 °C, unless otherwise specified.

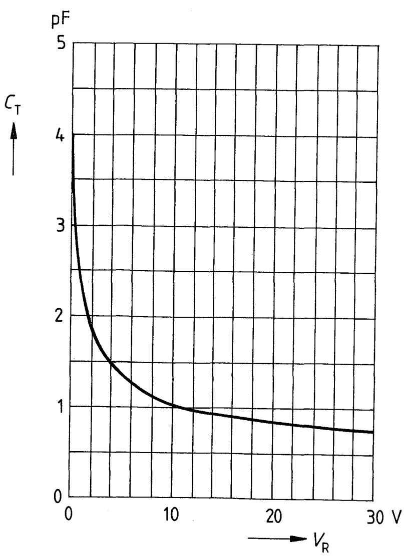
Forward current $I_F = f(V_F)$



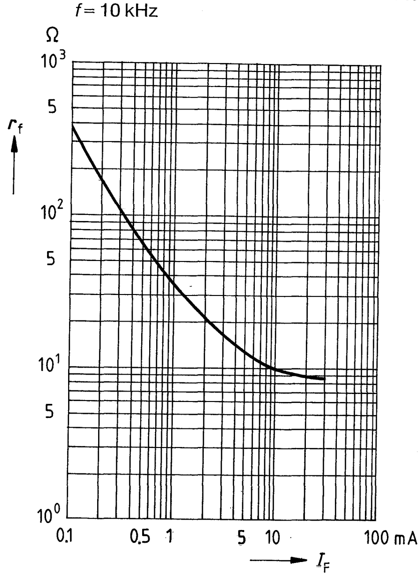
Reverse current $I_R = f(V_R)$



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

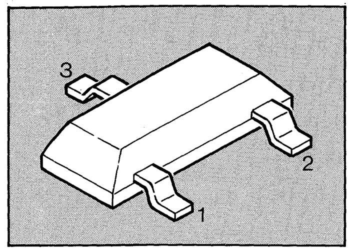


Differential forward resistance $r_f = f(I_F)$
f = 10 kHz

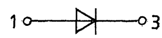
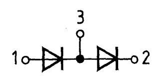
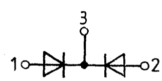
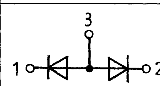


- General-purpose diodes for high-speed switching
- Circuit protection
- Voltage clamping
- High-level detecting and mixing

Ⓔ – available with CECC quality assessment

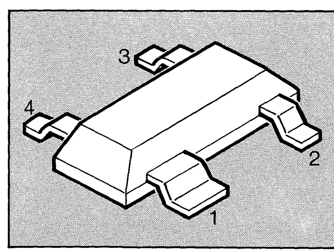


ESD: Electro**s**tatic **d**ischarge sensitive device, observe handling precautions!

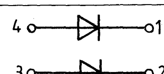
Type	Marking	Ordering code (tape and reel)	Pin configuration	Package[1])
Ⓔ BAS 70	73	Q 62702 – A118		SOT-23
Ⓔ BAS 70-04	74	Q 62702 – A730		
Ⓔ BAS 70-05	75	Q 62702 – A711		
Ⓔ BAS 70-06	76	Q 62702 – A774		

- General-purpose diodes for high-speed switching
- Circuit protection
- Voltage clamping
- High-level detecting and mixing

Ⓔ – available with CECC quality assessment



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

Type	Marking	Ordering code (tape and reel)	Pin configuration	Package[1])
Ⓔ BAS 70-07	77	Q 62702 – A846		SOT-143

1) For detailed dimensions see chapter Package Outlines.

Maximum Ratings per Diode

Parameter	Symbol	Value	Unit
Reverse voltage	V_R	70	V
Forward current	I_F	15	mA
Peak forward current	I_{FRM}	40	mA
Surge forward current, $t \leq 10$ ms	I_{FSM}	100	mA
Junction temperature	T_j	150	°C
Operating temperature range	T_{op}	–55 ... +150	°C
Storage temperature range	T_{stg}	–55 ... +150	°C

Thermal Resistance

Junction – ambient[1])	R_{thJA}	≤450	K/W

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

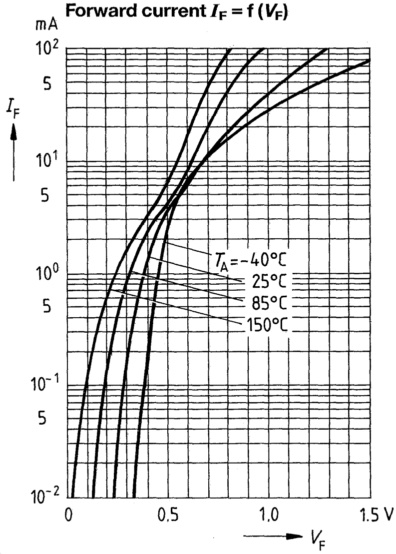
Parameter	Symbol	Values			Unit
		min	typ	max	
DC characteristics					
Breakdown voltage I_R = 10 µA	$V_{(BR)}$	70	–	–	V
Reverse current V_R = 50 V V_R = 70 V	I_R	 – –	 – –	 0.1 10	µA
Forward voltage I_F = 1 mA I_F = 10 mA I_F = 15 mA	V_F	 – – –	 380 690 780	 410 750 1000	mV
Diode capacitance V_R = 0, f = 1 MHz	C_T	–	1.6	2	pF
Charge carrier life time I_F = 25 mA	τ	–	–	100	ps
Differential forward resistance I_F = 10 mA, f = 10 kHz	r_f	–	30	–	Ω

1) Package mounted on alumina 15 mm × 16.7 mm × 0.7 mm.

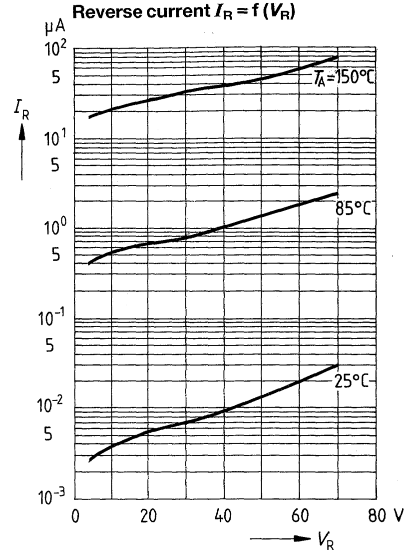
Characteristics per Diode

at T_A = 25 °C, unless otherwise specified.

Forward current $I_F = f(V_F)$

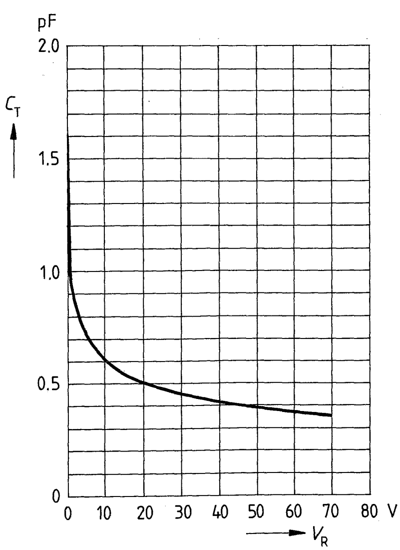


Reverse current $I_R = f(V_R)$



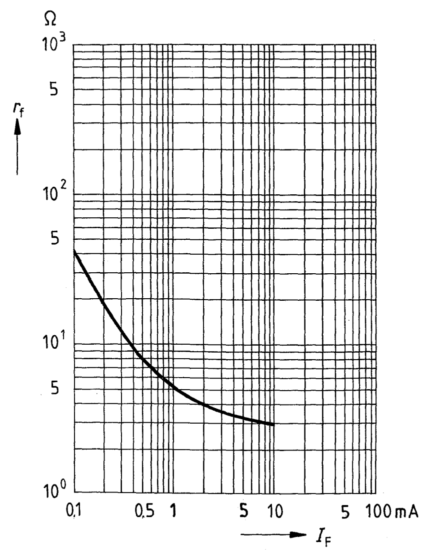
Diode capacitance $C_T = f(V_R)$

f = 1 MHz

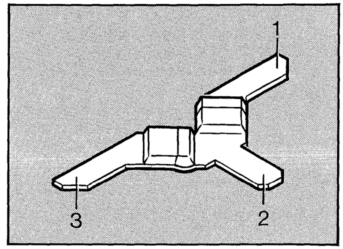


Differential forward resistance $r_f = f(I_F)$

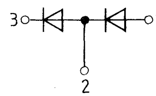
f = 10 kHz



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



ESD: Electrostatic discharge sensitive device, observe handling precautions!

Type	Ordering code	Pin configuration	Package[1])
BAT 14-020 D	Q 62702 – D1259		D
BAT 14-050 D	Q 62702 – D1268		
BAT 14-090 D	Q 62702 – D1276		
BAT 14-110 D	Q 62702 – D1285		

Maximum Ratings

Parameter	Symbol	Value		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}	–55 ... +175		°C
Ambient temperature range	T_A	–55 ... +175		°C

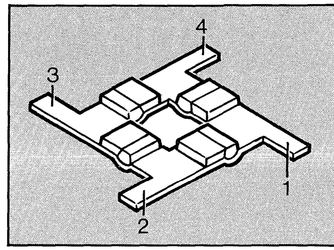
1) For detailed dimensions see chapter Package Outlines.

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

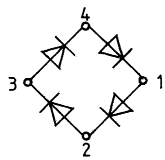
DC characteristics

Parameter		Symbol	Values			Unit
			min	typ	max	
Breakdown voltage		$V_{(BR)}$				V
I_R = 10 µA			4	–	–	
Diode capacitance		C_T				pF
V_R = 0, f = 1 MHz	BAT 14-020 D		–	0.30	0.35	
	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		V_F				V
I_F = 1 mA	BAT 14-020 D		–	0.45	–	
	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_{SSB}				dB
F_{IF} = 1.5 dB, P_{LO} = 0 dBm, f_{IF} = 10.7 MHz						
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		r_f				Ω
I_F = 10 mA	BAT 14-020 D		–	3.5	–	
	BAT 14-050 D		–	4.0	–	
I_F = 50 mA	BAT 14-090 D		–	7.0	–	
	BAT 14-110 D		–	10.0	–	

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



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

Type	Ordering code	Pin configuration	Package[1])
BAT 14-020 R	Q 62702 – D1260		R
BAT 14-050 R	Q 62702 – D1269		
BAT 14-090 R	Q 62702 – D1277		
BAT 14-110 R	Q 62702 – D1286		

Maximum Ratings

Parameter	Symbol	Value		Unit
		BAT 14-020 R BAT 14-050 R	BAT 14-090 R BAT 14-110 R	
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 ... +175		°C
Ambient temperature range	T_A	–55 ... +175		°C

1) For detailed dimensions see chapter Package Outlines.

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

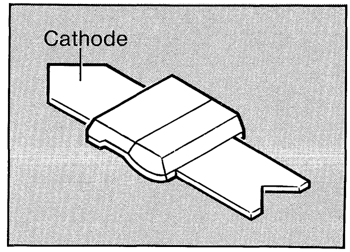
DC characteristics

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 14-020 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_{IF} = 1.5 dB, P_{LO} = 0 dBm, f_{IF} = 10.7 MHz		F_{SSB}				dB
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	–	

Silicon Schottky Diodes

BAT 14- ... S

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



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

Type	Ordering code	Type	Ordering code	Package[1])
BAT 14-020 S	Q 62702 – D1258	BAT 14-090 S	Q 62702 – D1275	S
BAT 14-050 S	Q 62702 – D1267	BAT 14-110 S	Q 62702 – D1284	

Maximum Ratings

Parameter	Symbol	Value		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}	–55 ... +175		°C
Ambient temperature range	T_A	–55 ... +175		°C

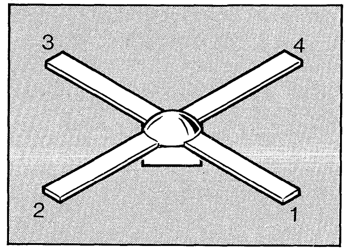
1) For detailed dimensions see chapter Package Outlines.

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

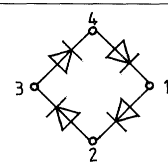
DC characteristics

Parameter		Symbol	Values min	Values typ	Values max	Unit
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	–	

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



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

Type	Ordering code	Circuit diagram	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

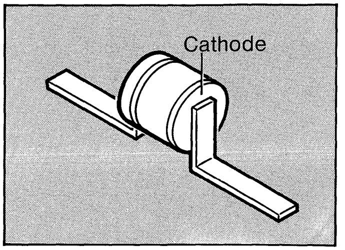
Parameter	Symbol	Value		Unit
		BAT 14-022 R BAT 14-052 R	BAT 14-092 R BAT 14-112 R	
Reverse voltage	V_R	4	4	V
Forward current	I_F	100	50	mA
Junction temperature	T_j	175		°C
Storage temperature range	T_{stg}	–55 ... +175		°C
Ambient temperature range	T_A	–55 ... +175		°C

1) For detailed dimensions see chapter Package Outlines.

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

Parameter		Symbol	Values min	typ	max	Unit
Breakdown voltage I_R = 10 μA		$V_{(BR)}$	4	–	–	V
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_{IF} = 1.5 dB, P_{LO} = 0 dBm, f_{IF} = 10.7 MHz		F_{SSB}				dB
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 I_F = 10/50 mA		r_f				Ω
	BAT 14-022 R		–	3.5	–	
	BAT 14-052 R		–	4.0	–	
	BAT 14-092 R		–	7.0	–	
	BAT 14-112 R		–	10.0	–	

- Medium barrier diodes for detector and mixer applications
- Hermetical ceramic package
- 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 14-014 BAT 14-034	... 4 (S)	Q 62702 – D1005 Q 62702 – D1019	Cathode: black dot, heat sink	T1
BAT 14-044 BAT 14-064	... 8 (C)	Q 62702 – D1026 Q 62702 – D1036		
BAT 14-074 BAT 14-094	... 12 (X)	Q 62702 – D1041 Q 62702 – D1051		
BAT 14-104 BAT 14-114	... 18 (Ku)	Q 62702 – D1056 Q 62702 – D1061		
BAT 14-124	... 40 (Ka)	Q 62702 – D1066		

Maximum Ratings

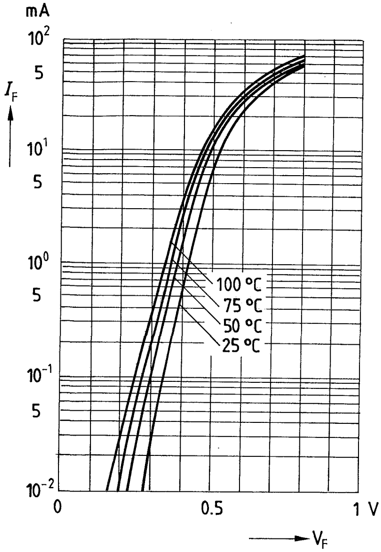
Parameter		Symbol	Value	Unit
Reverse voltage		V_R	3	V
Forward current	BAT 14-014 ... BAT 14-064 BAT 14-074 ... BAT 14-124	I_F	100 50	mA
Junction temperature		T_j	150	°C
Storage temperature range		T_{stg}	–55 ... +150	°C

1) For detailed dimensions see chapter Package Outlines.

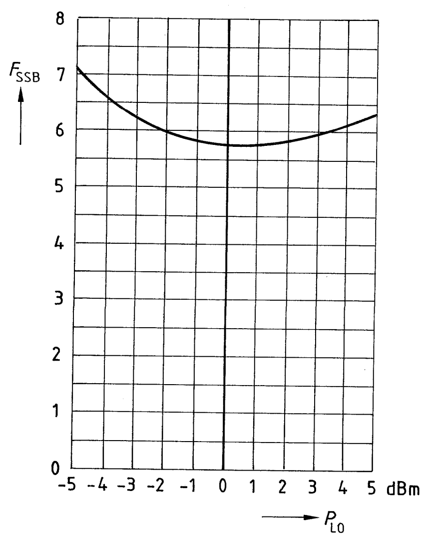
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter		Symbol	Values min	typ	max	Unit
Breakdown voltage I_R = 10 µA		$V_{(BR)}$	3	–	–	V
Forward voltage		V_F				V
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	–	pF
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	–	

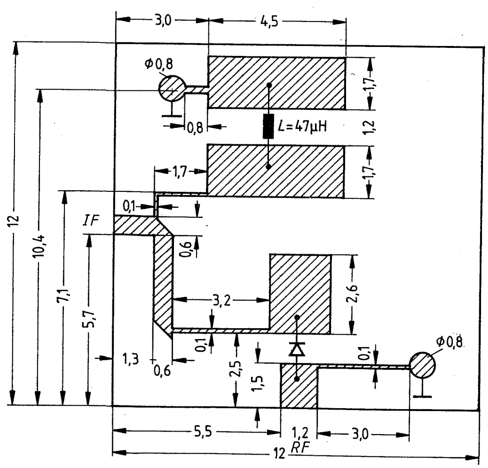
Forward current $I_F = f(V_F)$
of BAT 14-094



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

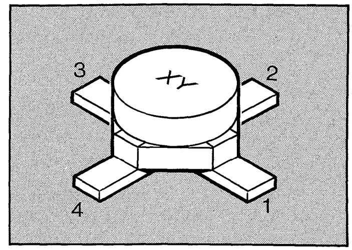


Measuring circuit for IF amplifier noise

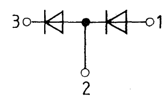


Ceramic p. c. board for noise measurement at 9.375 GHz
(material = alumina; E_R = 9.94; thickness = 0.635 mm)
Dimensions in mm

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



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

Type	Marking	Ordering code	Circuit diagram	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

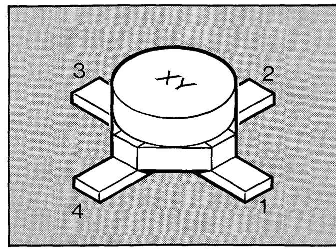
Parameter	Symbol	Value		Unit
		BAT 14-025 D BAT 14-055 D	BAT 14-095 D BAT 14-115 D	
Reverse voltage	V_R	4	4	V
Forward current	I_F	100	50	mA
Junction temperature	T_j	175		°C
Storage temperature range	T_{stg}	–55 ... +175		°C
Ambient temperature range	T_A	–55 ... +175		°C

1) For detailed dimensions see chapter Package Outlines.

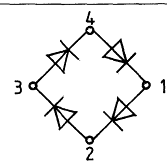
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

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 D		–	0.37	0.42	
	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		V_F				V
I_F = 1 mA	BAT 14-025 D		–	0.45	–	
	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_{SSB}				dB
f = 3 GHz	BAT 14-025 D		–	6.0	–	
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		r_f				Ω
	BAT 14-025 D		–	3.5	–	
	BAT 14-055 D		–	4.0	–	
	BAT 14-095 D		–	7.0	–	
	BAT 14-115 D		–	10.0	–	

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



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

Type	Marking	Ordering code	Circuit diagram	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

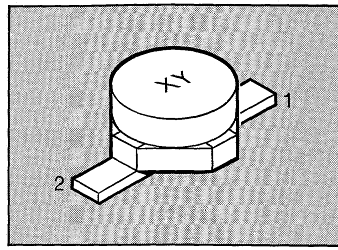
Parameter	Symbol	Value		Unit
		BAT 14-025 R BAT 14-055 R	BAT 14-095 R BAT 14-115 R	
Reverse voltage	V_R	4	4	V
Forward current	I_F	100	50	mA
Junction temperature	T_j	175		°C
Storage temperature range	T_{stg}	–55 ... +175		°C
Ambient temperature range	T_A	–55 ... +175		°C

1) For detailed dimensions see chapter Package Outlines.

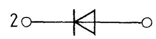
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

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		C_T				pF
	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_{IF} = 1.5 dB, P_{LO} = 0 dBm, f_{IF} = 10.7 MHz		F_{SSB}				dB
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 I_F = 10/50 mA		r_f				Ω
	BAT 14-025 R		–	3.5	–	
	BAT 14-055 R		–	4.0	–	
	BAT 14-095 R		–	7.0	–	
	BAT 14-115 R		–	10.0	–	

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



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

Type	Marking	Ordering code	Circuit diagram	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

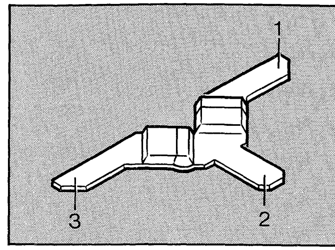
Parameter	Symbol	Value		Unit
		BAT 14-025 S BAT 14-055 S	BAT 14-095 S BAT 14-115 S	
Reverse voltage	V_R	4	4	V
Forward current	I_F	100	50	mA
Junction temperature	T_j	175		°C
Storage temperature range	T_{stg}	–55 ... +175		°C
Ambient temperature range	T_A	–55 ... +175		°C

1) For detailed dimensions see chapter Package Outlines.

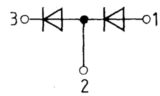
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

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 S	C_T	–	0.36	0.41	pF
	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 I_F = 1 mA	BAT 14-025 S	V_F	–	0.45	–	V
	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_{IF} = 1.5 dB, P_{LO} = 0 dBm, f_{IF} = 10.7 MHz		F_{SSB}				dB
f = 3 GHz	BAT 14-025 S		–	6.0	–	
f = 6 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 I_F = 10/50 mA		r_f				Ω
	BAT 14-025 S		–	3.5	–	
	BAT 14-055 S		–	4.0	–	
	BAT 14-095 S		–	7.0	–	
	BAT 14-115 S		–	10.0	–	

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



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

Type	Ordering code	Pin configuration	Package[1])
BAT 15-020 D	Q 62702 – D1263		D
BAT 15-050 D	Q 62702 – D3450		
BAT 15-090 D	Q 62702 – D1280		
BAT 15-110 D	Q 62702 – D1289		

Maximum Ratings

Parameter	Symbol	Value		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}	–55 ... +175		°C
Ambient temperature range	T_A	–55 ... +175		°C

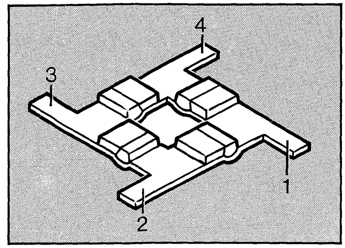
1) For detailed dimensions see chapter Package Outlines.

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

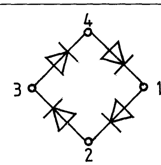
DC characteristics

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 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	–	

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



ESD: Electrostatic discharge sensitive device, observe handling precautions!

Type	Ordering code	Pin configuration	Package[1])
BAT 15-020 R	Q 62702 – D1264		R
BAT 15-050 R	Q 62702 – D1272		
BAT 15-090 R	Q 62702 – D1281		
BAT 15-110 R	Q 62702 – D1290		

Maximum Ratings

Parameter	Symbol	Value		Unit
		BAT 15-020 R BAT 15-050 R	BAT 15-090 R BAT 15-110 R	
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 ... +175		°C
Ambient temperature range	T_A	–55 ... +175		°C

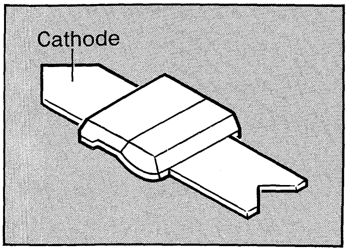
1) For detailed dimensions see chapter Package Outlines.

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

DC characteristics

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 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_{IF} = 1.5 dB, P_{LO} = 0 dBm, f_{IF} = 10.7 MHz		F_{SSB}				dB
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	–	

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



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

Type	Ordering code	Type	Ordering code	Package[1])
BAT 15-020 S	Q 62702 – D1262	BAT 15-090 S	Q 62702 – D1279	S
BAT 15-050 S	Q 62702 – D1271	BAT 15-110 S	Q 62702 – D1288	

Maximum Ratings

Parameter	Symbol	Value		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}	–55 ... +175		°C
Ambient temperature range	T_A	–55 ... +175		°C

1) For detailed dimensions see chapter Package Outlines.

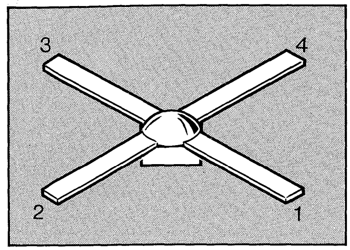
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

DC characteristics

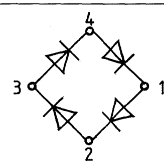
Parameter		Symbol	Values min	typ	max	Unit
Breakdown voltage I_R = 10 µA		$V_{(BR)}$	4	–	–	V
Diode capacitance V_R = 0, f = 1 MHz	BAT 15-020 S	C_T	–	0.30	0.35	pF
	BAT 15-050 S		–	0.20	0.25	
	BAT 15-090 S		–	0.14	0.15	
	BAT 15-110 S		–	0.10	0.12	
Forward voltage I_F = 1 mA	BAT 15-020 S	V_F	–	0.26	–	V
	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_{IF} = 1.5 dB, P_{LO} = 0 dBm, f_{IF} = 10.7 MHz f = 3.0 GHz	BAT 15-020 S	F_{SSB}	–	6.0	–	dB
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 I_F = 10 mA	BAT 15-020 S	r_f	–	3.5	–	Ω
	BAT 15-050 S		–	4.0	–	
I_F = 50 mA	BAT 15-090 S		–	7.0	–	
	BAT 15-110 S		–	10.0	–	

Silicon Schottky Diodes — BAT 15- ... 2 R

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



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

Type	Ordering code	Circuit diagram	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

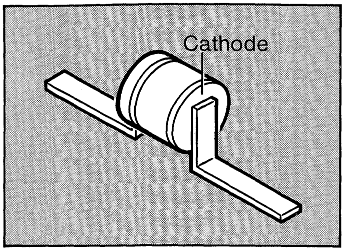
Parameter	Symbol	Value		Unit
		BAT 15-022 R BAT 15-052 R	BAT 15-092 R BAT 15-112 R	
Reverse voltage	V_R	4	4	V
Forward current	I_F	100	50	mA
Junction temperature	T_j	175		°C
Storage temperature range	T_{stg}	–55 ... +175		°C
Ambient temperature range	T_A	–55 ... +175		°C

1) For detailed dimensions 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 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_{IF} = 1.5 dB, P_{LO} = 0 dBm, f_{IF} = 10.7 MHz		F_{SSB}				dB
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 I_F = 10/50 mA		r_f				Ω
	BAT 15-022 R		–	3.5	–	
	BAT 15-052 R		–	4.0	–	
	BAT 15-092 R		–	7.0	–	
	BAT 15-112 R		–	10.0	–	

- 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)	Q 62702 – D3429	Cathode: black dot, heat sink	T1
BAT 15-044	... 8 (C)	Q 62702 – D3431		
BAT 15-074	... 12.4 (X)	Q 62702 – D3433		
BAT 15-104	... 18 (Ku)	Q 62702 – D3435		
BAT 15-124	... 40 (Ka)	Q 62702 – D3437		

Maximum Ratings

Parameter		Symbol	Value	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	150	°C
Storage temperature range		T_{stg}	–55 ... +150	°C

1) For detailed dimensions see chapter Package Outlines.

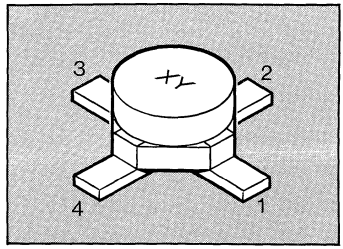
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

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	–	pF

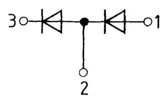
DC Characteristics (continued)

Parameter		Symbol	Values min	typ	max	Unit
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	–	

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



ESD: Electrostatic discharge sensitive device, observe handling precautions!

Type	Marking	Ordering code	Circuit diagram	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

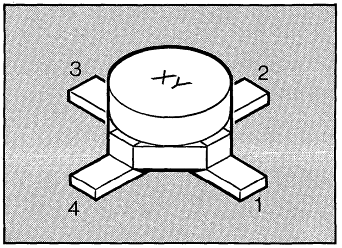
Parameter	Symbol	Value BAT 15-025 D BAT 15-055 D	Value BAT 15-095 D BAT 15-115 D	Unit
Reverse voltage	V_R	4	4	V
Forward current	I_F	100	50	mA
Junction temperature	T_j	175		°C
Storage temperature range	T_{stg}	–55 ... +175		°C
Ambient temperature range	T_A	–55 ... +175		°C

1) For detailed dimensions see chapter Package Outlines.

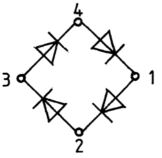
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

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		r_f				Ω
	BAT 15-025 D		–	3.5	–	
	BAT 15-055 D		–	4.0	–	
	BAT 15-095 D		–	7.0	–	
	BAT 15-115 D		–	10.0	–	

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



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

Type	Marking	Ordering code	Circuit diagram	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		

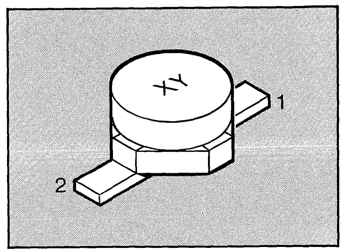
Maximum Ratings

Parameter	Symbol	Value BAT 15-025 R BAT 15-055 R	Value BAT 15-095 R BAT 15-115 R	Unit
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 ... +175		°C
Ambient temperature range	T_A	–55 ... +175		°C

1) For detailed dimensions 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 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_{IF} = 1.5 dB, P_{LO} = 0 dBm, f_{IF} = 10.7 MHz		F_{SSB}				dB
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 I_F = 10/50 mA		r_f				Ω
	BAT 15-025 R		–	3.5	–	
	BAT 15-055 R		–	4.0	–	
	BAT 15-095 R		–	7.0	–	
	BAT 15-115 R		–	10.0	–	



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

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

Type	Marking	Ordering code	Circuit diagram	Package¹)
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

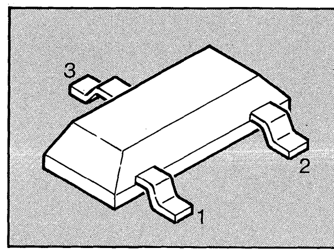
Parameter	Symbol	Value		Unit
		BAT 15-025 S BAT 15-055 S	BAT 15-095 S BAT 15-115 S	
Reverse voltage	V_R	4	4	V
Forward current	I_F	100	50	mA
Junction temperature	T_j	175		°C
Storage temperature range	T_{stg}	–55 ... +175		°C
Ambient temperature range	T_A	–55 ... +175		°C

1) For detailed dimensions see chapter Package Outlines.

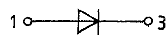
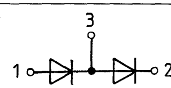
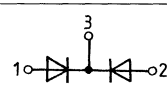
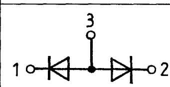
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

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 15-025 S		–	0.36	0.41	
	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		V_F				V
I_F = 1 mA	BAT 15-025 S		–	0.26	–	
	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 GHz	BAT 15-025 S		–	6.0	–	
f = 6 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		r_f				Ω
	BAT 15-025 S		–	3.5	–	
	BAT 15-055 S		–	4.0	–	
	BAT 15-095 S		–	7.0	–	
	BAT 15-115 S		–	10.0	–	

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



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

Type	Marking	Ordering code (tape and reel)	Pin configuration	Package[1])
BAT 17	53	Q 62702 – A504		SOT-23
BAT 17-04	54	Q 62702 – A775		
BAT 17-05	55	Q 62702 – A776		
BAT 17-06	56	Q 62702 – A777		

Maximum Ratings per Diode

Parameter	Symbol	Value	Unit
Reverse voltage	V_R	4	V
Forward current	I_F	30	mA
Junction temperature	T_j	150	°C
Operating temperature range	T_{op}	–55 ... +150	°C
Storage temperature range	T_{stg}	–55 ... +150	°C

Thermal Resistance

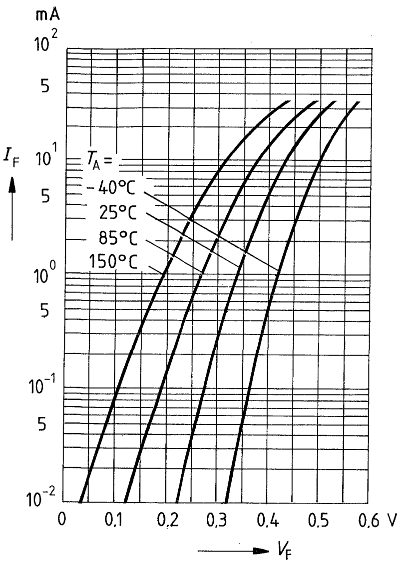
Junction – ambient[2])	R_{thJA}	≤450	K/W

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

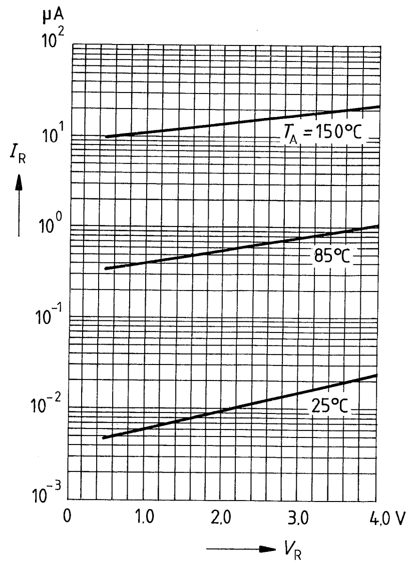
Electrical Characteristics per Diode
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min	typ	max	
DC characteristics					
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

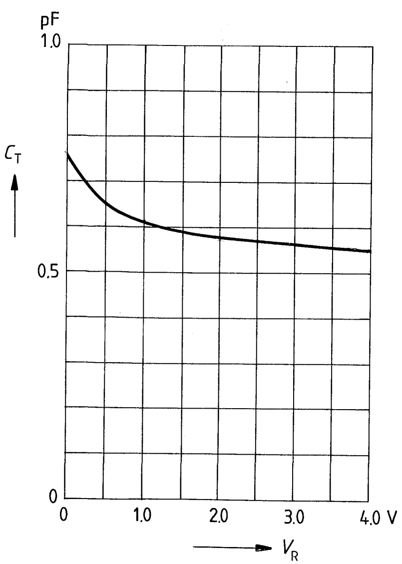
Forward current $I_F = f(V_F)$



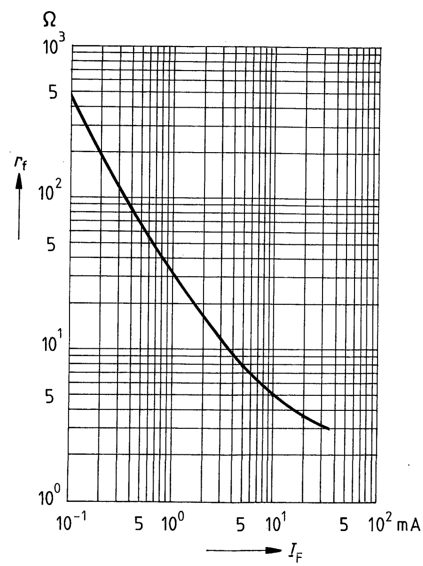
Reverse current $I_R = f(V_R)$



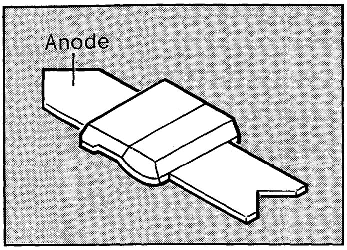
Diode capacitance $C_T = f(V_R)$
f = 1 MHz



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



- 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)	Q 62702 – A764	Pointed anode	S1

Maximum Ratings

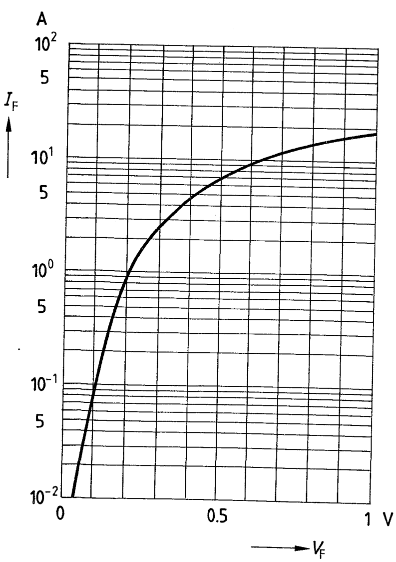
Parameter	Symbol	Value	Unit
Reverse voltage	V_R	6.5	V
Forward current	I_F	50	mA
Junction temperature	T_j	150	°C
Storage temperature range	T_{stg}	–55 ... +175	°C

1) For detailed dimensions see chapter Package Outlines.

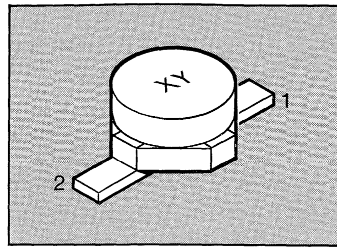
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

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 $I_F = f(V_F)$



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



ESD: Electro**s**tatic **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	Q 62702 – A826		Cerec-X

Maximum Ratings

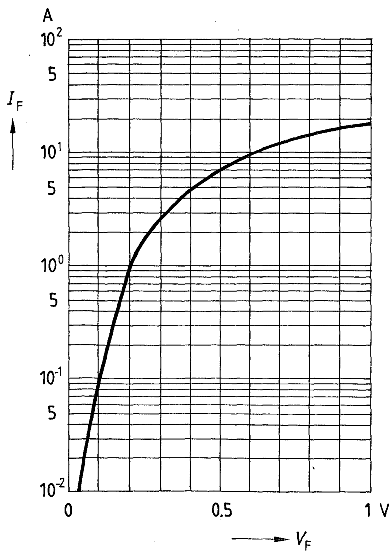
Parameter	Symbol	Value	Unit
Reverse voltage	V_R	6.5	V
Forward current	I_F	50	mA
Junction temperature	T_j	150	°C
Storage temperature range	T_{stg}	–55 ... +175	°C

1) For detailed dimensions see chapter Package Outlines.

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

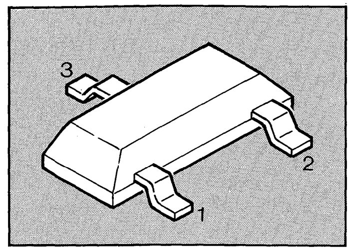
Parameter	Symbol	Values			Unit
		min	typ	max	
Breakdown voltage I_R = 1 mA	$V_{(BR)}$	6.5	–	–	V
Forward voltage I_F = 1 mA I_F = 10 mA	V_F	 – –	 0.2 0.6	 – –	mV
Diode capacitance V_R = 0.15, f = 1 MHz	C_T	–	0.20	0.24	pF
Differential resistance V_F = 0, f = 10 kHz	r_f	–	15	–	kΩ

Forward current I_F = f (V_F)



Silicon Schottky Diode **BAT 64**

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



Type	Marking	Ordering code (tape and reel)	Pin configuration	Package[1])
BAT 64	64	Q 62702 – A879	1 o—▷|—o 3	SOT-23

Maximum Ratings

Parameter	Symbol	Value	Unit
Reverse voltage	V_R	30	V
Forward current	I_F	200	mA
Average forward current (50/60 Hz, sinus)	I_{FAV}	100	mA
Surge forward current (t ≤10 ms)	I_{FSM}	800	mA
Total power dissipation ($T_A \leq 25$ °C[2]))	P_{tot}	230	mW
Junction temperature	T_j	125	°C
Storage temperature range	T_{stg}	–55 ... +150	°C

Thermal Resistance

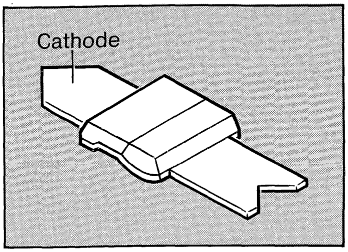
Junction – ambient[2])	R_{thJA}	≤430	K/W

1) For detailed dimensions 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					
Reverse current V_R = 25 V V_R = 25 V, T_A = 125 °C	I_R	 – –	 – –	 2 200	µA
Forward voltage I_F = 1 mA I_F = 10 mA I_F = 30 mA I_F = 100 mA	V_F	 – – – –	 320 375 420 550	 – – – 1000	mV
Diode capacitance V_R = 1 V, f = 1 MHz	C_T	 –	 4	 6	pF
Reverse recovery time $I_F : I_{R1} : I_{R2}$ = 10 : 10 : 1 mA	t_{rr}	 –	 –	 5	ns

- Beam lead version
- Fast switching



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

Type	Ordering code	Pin configuration	Package[1])
BXY 42BA-S BXY 42BB-S	Q 62702 – X151 Q 62702 – X159	Pointed cathode	S

Maximum Ratings

Parameter	Symbol	Value		Unit
		BXY 42BA-S	BXY 42BB-S	
Reverse voltage	V_R	50	30	V
Junction temperature	T_j	175		°C
Ambient temperature range	T_A	–55 ... +175		°C
Storage temperature range	T_{stg}	–55 ... +175		°C

1) For detailed dimensions see chapter Package Outlines.

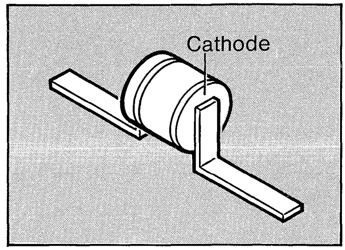
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

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	–	V
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	V_F	–	1.1	–	V
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

- Fast switching
- Stripline package other lead configurations available



Type	Ordering code	Package[1])
BXY 42BA-3	Q 62702 – X143	T1

Maximum Ratings

Parameter	Symbol	Value	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
Ambient temperature range	T_A	–55 ... +175	°C
Storage temperature range	T_{stg}	–55 ... +175	°C

Thermal Resistance

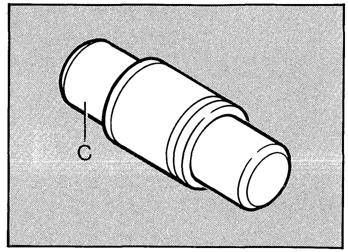
Junction – ambient	R_{thJA}	≤450	K/W

1) For detailed dimensions 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

- Fast switching
- Coax package



Type	Ordering code	Package[1])
BXY 42BA-5	Q 62702 – X145	C1

Maximum Ratings

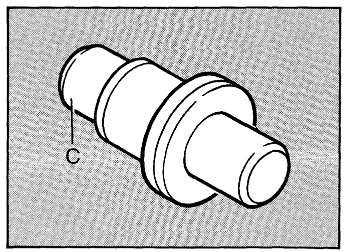
Parameter	Symbol	Value	Unit
Reverse voltage	V_R	50	V
Peak Forward current, t_p = 1 µs	I_{FRM}	5	A
Total power dissipation	P_{tot}	800	mW
Junction temperature	T_j	175	°C
Ambient temperature range	T_A	–55 ... +175	°C
Storage temperature range	T_{stg}	–55 ... +175	°C

1) For detailed dimensions 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

- Fast switching
- Coax package



Type	Ordering code	Package[1])
BXY 42BA-6	Q 62702 – X146	D

Maximum Ratings

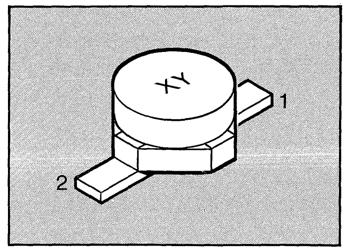
Parameter	Symbol	Value	Unit
Reverse voltage	V_R	50	V
Peak forward current, t_p = 1 µs	I_{FRM}	5	A
Total power dissipation	P_{tot}	800	mW
Junction temperature	T_j	175	°C
Ambient temperature range	T_A	–55 ... +175	°C
Storage temperature range	T_{stg}	–55 ... +175	°C

1) For detailed dimensions 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

- Fast switching
- SMD version



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

Type	Ordering code	Package[1])
BXY 42BA-7	Q 62702 – X160	Cerec-X

Maximum Ratings

Parameter	Symbol	Value	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
Ambient temperature range	T_A	–55 ... +175	°C
Storage temperature range	T_{stg}	–55 ... +175	°C

Thermal Resistance

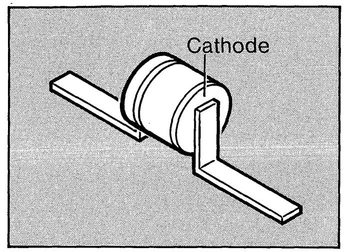
Junction – ambient[2])	R_{thJA}	≤450	K/W

1) For detailed dimensions 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

- High-speed switching
- Phase shifting up to 10 GHz
- Power splitter



Type	Marking	Ordering code	Package[1])
BXY 43A	cathode = black dot	Q 62702 – X116	T1
BXY 43B		Q62702 – X104	
BXY 43C		Q62702 – X105	

Maximum Ratings (T_A = 25 °C)

Parameter	Symbol	Values BXY 43A	BXY 43B	BXY 43C	Unit
Breakdown voltage	$V_{(BR)}$	150	150	150	V
Forward current	I_F	400	500	500	mA
Peak forward current, t_p = 1 µs	I_{FRM}	10	20	20	A
Total power dissipation	P_{tot}	500	600	600	mW
Junction temperature	T_j	150			°C
Storage temperature range	T_{stg}	–55 ... +175			°C

Thermal Resistance

Junction – case	R_{thJC}	80	70	70	K/W

1) For detailed dimensions see chapter Package Outlines.

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

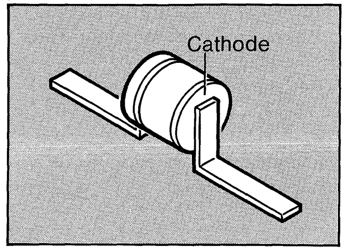
DC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
Reverse current V_R = 100 V	I_R	–	5	–	nA
Forward voltage I_F = 100 mA	V_F	–	1	–	V

AC characteristics

Parameter		Symbol	min	typ	max	Unit
Junction capacitance V_R = 50 V, f = 1 MHz		C_j				pF
	BXY 43A		–	0.09	0.10	
	BXY 43B		–	0.15	0.18	
	BXY 43C		–	0.25	0.30	
Series resistance I_F = 10 mA, f = 100 MHz		r_s				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				ns
	BXY 43A		–	15	–	
	BXY 43B		–	20	–	
	BXY 43C		–	25	–	
Case capacitance		C_c	–	0.1	–	pF
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}	–	torr. 1 / –s

- Microwave attenuator diode
- Linear RF characteristic



Type	Ordering code	Package[1])
BXY 44K	Q 62702 – X148	T1

Maximum Ratings

Parameter	Symbol	Value	Unit
Reverse voltage	V_R	200	V
Forward current	I_F	0.5	A
Peak forward current, $t_p = 1$ µs	I_{FRM}	20	A
Total power dissipation	P_{tot}	600	mW
Junction temperature	T_j	175	°C
Ambient temperature range	T_A	–65 ... +175	°C
Storage temperature range	T_{stg}	–65 ... +175	°C

1) For detailed dimensions see chapter Package Outlines.

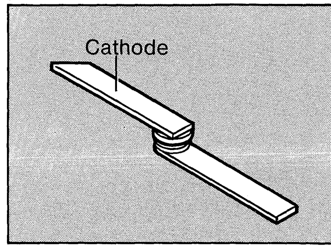
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values min	Values typ	Values max	Unit
Breakdown voltage I_R = 10 µA	$V_{(BR)}$	200	–	–	V
Forward voltage I_F = 100 mA	V_F	–	–	1	V
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
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

Varactors

Varaktoren

- Abrupt junction tuning diode
- Tuning range 120 V



Type	Ordering code	Package[1])
BBY 24-S1	Q 62702 – B20-S1	P
BBY 25-S1	Q 62702 – B21-S1	
BBY 26-S1	Q 62702 – B22-S1	
BBY 27-S2	Q 62702 – B23-S2	

Maximum Ratings

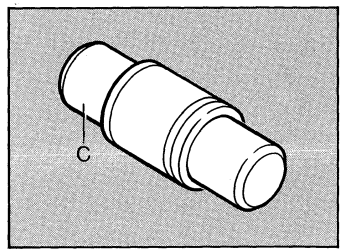
Parameter	Symbol	Value		Unit
		BBY 24 ... 26	BBY 27	
Reverse voltage	V_R	120	140	V
Junction temperature	T_j	175		°C
Ambient temperature range	T_A	–55 ... +175		°C
Storage temperature range	T_{stg}	–55 ... +175		°C

1) For detailed dimensions 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	–	–	–

● Tuning varactor in passivated Mesa technology (epitaxial design)



Type	Marking	Ordering code	Package
BBY 33 BB-2	–	Q 62702 – B70	D

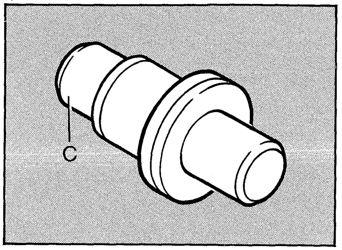
Maximum Ratings

Parameter	Symbol	Value	Unit
Reverse voltage	V_R	27	V
Forward current	I_F	200	mA
Junction temperature	T_j	150	°C
Storage temperature range	T_{stg}	–55 ... +175	°C

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	–	–	–

- Abrupt junction tuning diode
- Tuning range 25 V
- High figure of merit



Type	Ordering code	Package[1])
BBY 33DA-2	Q 62702 – B127	D

Maximum Ratings

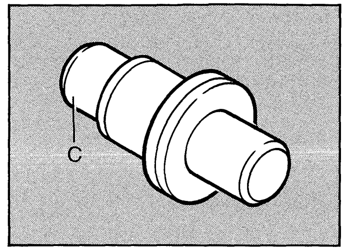
Parameter	Symbol	Value	Unit
Reverse voltage	V_R	30	V
Junction temperature	T_j	175	°C
Ambient temperature range	T_A	–55 ... +175	°C
Storage temperature range	T_{stg}	–55 ... +175	°C

1) For detailed dimensions 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, V_{R2} = 25 V	$\frac{C_{T0}}{C_{T25}}$	3.0	–	–	–
Figure of merit V_R = 4 V, f = 50 MHz	Q	3500	–	–	–

- Hyperabrupt junction tuning diode
- Frequency linear tuning range 4 ... 12 V
- High figure of merit



Type	Ordering code	Package[1])
BBY 34C BBY 34D	Q 62702 – B257 Q 62702 – B194	D

Maximum Ratings

Parameter	Symbol	Value	Unit
Reverse voltage	V_R	22	V
Forward current	I_F	20	mA
Junction temperature	T_j	175	°C
Ambient temperature range	T_A	–55 ... +175	°C
Storage temperature range	T_{stg}	–55 ... +175	°C

1) For detailed dimensions see chapter Package Outlines.

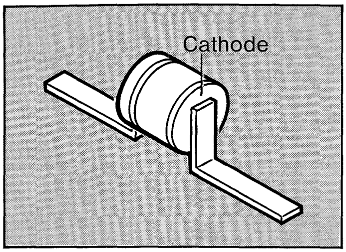
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min	typ	max	
Reverse current $V_R = 20$ V	I_R	–	–	10	nA
Diode capacitance $V_R = 4$ V, $f = 1$ MHz	C_T	2.7	–	3.3	pF
Capacitance ratio $V_{R1} = 4$ V, $V_{R2} = 20$ V	$\frac{C_{T4}}{C_{T20}}$	4.3	–	–	–
Figure of merit $V_R = 4$ V, $f = 50$ MHz	Q	400	–	–	–

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	–	–	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	–	–	–

- Hyperabrupt junction tuning diode
- Frequency linear tuning range 4 ... 12 V
- High figure of merit



Type	Ordering code	Package[1])
BBY 35F	Q 62702 – B195	T1

Maximum Ratings

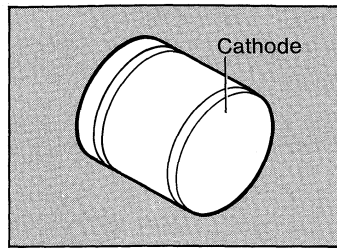
Parameter	Symbol	Value	Unit
Reverse voltage	V_R	22	V
Forward current	I_F	400	mA
Junction temperature	T_j	175	°C
Ambient temperature range	T_A	–55 ... +175	°C
Storage temperature range	T_{stg}	–55 ... +175	°C

1) For detailed dimensions see chapter Package Outlines.

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

Parameter	Symbol	Values			Unit
		min	typ	max	
Breakdown voltage $I_R = 10\ \mu A$	$V_{(BR)}$	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	–	–

● Multiplier diode for high frequencies up to 18 GHz



Type	Ordering code	Package[1])
BBY 18A2 BBY 18AB2 BBY 18AB6	Q 62702 – X140 Q 62702 – X133 Q 62702 – X137	T

Maximum Ratings

Parameter	Symbol	Value		Unit
		BXY 18A2 BXY 18AB2	BXY 18AB6	
Reverse voltage	V_R	25	15	V
Junction temperature	T_j	175		°C
Ambient temperature range	T_A	–55 ... +175		°C
Storage temperature range	T_{stg}	–55 ... +175		°C

Thermal Resistance

Junction – case	R_{thJC}	110	K/W

1) For detailed dimensions see chapter Package Outlines.

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

Parameter		Symbol	Values			Unit
			min	typ	max	
Breakdown voltage		$V_{(BR)}$				V
I_R = 10 µA	BXY 18A2		25	–	–	
	BXY 18AB2		25	–	–	
	BXY 18AB6		15	–	–	
Diode capacitance		C_T				pF
V_R = 0, f = 1 MHz	BXY 18A2		0.7	–	1.3	
	BXY 18AB2		1.1	–	1.6	
V_R = 6 V, f = 1 MHz	BXY 18AB6		0.25	–	0.5	
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	ns
Input power		P_{IN}	–	250	–	mW

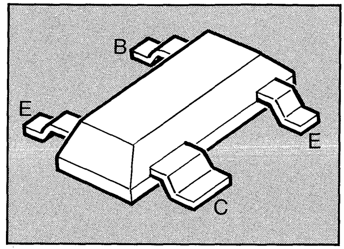
Silicon Transistors

Silizium-Transistoren

NPN Silicon RF Transistor BFP 81

- For low-noise amplifiers up to 2 GHz at collector currents from 0.5 to 25 mA.

- CECC-type in preparation: CECC 50002/...



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

Type	Marking	Ordering code (tape and reel)	Package[1])
BFP 81	FA	Q 62702 – F1122	SOT-143

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CEO}	16	V
Collector-base voltage	V_{CBO}	25	V
Emitter-base voltage	V_{EBO}	2	V
Collector current	I_C	30	mA
Base current	I_B	4	mA
Total power dissipation, $T_A \leq 25$ °C[2])	P_{tot}	280	mW
Junction temperature	T_j	150	°C
Ambient temperature range	T_A	–65 ... +150	°C
Storage temperature range	T_{stg}	–65 ... +150	°C

Thermal Resistance

Junction – ambient[2])	R_{thJA}	≤450	K/W

1) For detailed dimensions 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.

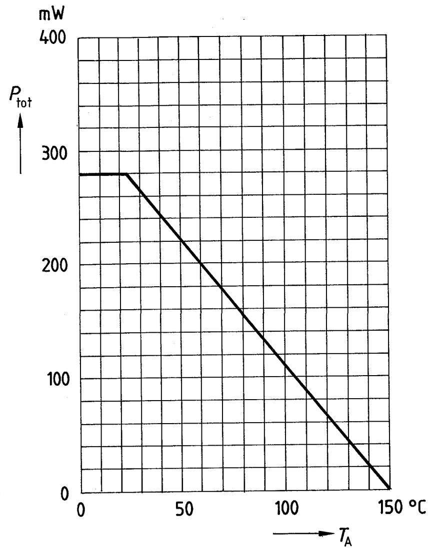
DC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CEO}$	16	–	–	V
Collector-base cutoff current V_{CB} = 15 V, I_E = 0	I_{CBO}	–	–	100	nA
Emitter-base cutoff current V_{EB} = 2 V, I_C = 0	I_{EBO}	–	–	10	µA
DC current gain I_C = 5 mA, V_{CE} = 10 V I_C = 15 mA, V_{CE} = 10 V	h_{FE}	 50 50	 – –	 250 –	–
Collector-emitter saturation voltage I_C = 30 mA, I_B = 3 mA	V_{CEsat}	–	0.2	0.4	V

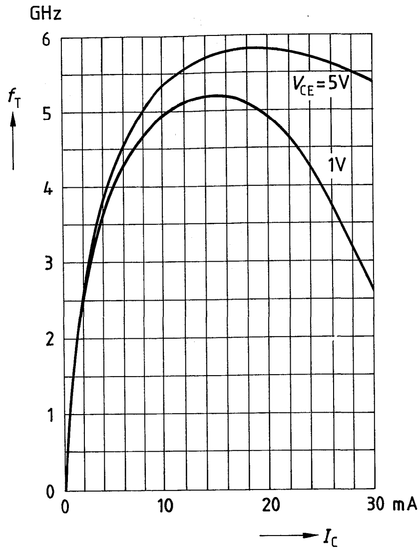
AC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
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}	–	0.34	–	pF
Collector-emitter capacitance V_{CE} = 10 V, $V_{BE} = v_{be}$ = 0, f = 1 MHz	C_{ce}	–	0.32	–	pF
Input capacitance V_{EB} = 0.5 V, $I_C = i_c$ = 0, f = 1 MHz	C_{ibo}	–	1.2	–	pF
Output capacitance V_{CE} = 10 V, $V_{BE} = v_{be}$ = 0, f = 1 MHz	C_{obs}	–	0.65	–	pF
Noise figure I_C = 3 mA, V_{CE} = 10 V, f = 10 MHz, Z_S = 75 Ω I_C = 5 mA, V_{CE} = 10 V, f = 800 MHz, $Z_S = Z_{Sopt}$ I_C = 5 mA, V_{CE} = 10 V, f = 2 GHz, $Z_S = Z_{Sopt}$	F	 – – –	 0.9 1.25 2.25	 – – –	dB
Power gain I_C = 5 mA, V_{CE} = 10 V, f = 800 MHz, Z_S = 50 Ω, $Z_L = Z_{Lopt}$ I_C = 10 mA, V_{CE} = 10 V, f = 800 MHz, Z_S = 50 Ω, $Z_L = Z_{Lopt}$	G_{pe}	 – –	 15.5 16.5	 – –	dB
Transducer gain I_C = 20 mA, V_{CE} = 10 V, f = 1 GHz, Z_0 = 50 Ω	$\|S_{21e}\|^2$	–	15	–	dB
Linear output voltage two-tone intermodulation test I_C = 25 mA, V_{CE} = 10 V, d_{IM} = 60 dB f_1 = 806 MHz, f_2 = 810 MHz, $Z_S = Z_L$ = 50 Ω	$V_{o1} = V_{o2}$	–	160	–	mV
Third order intercept point I_C = 25 mA, V_{CE} = 10 V, f = 800 MHz	IP_3	–	27	–	dBm

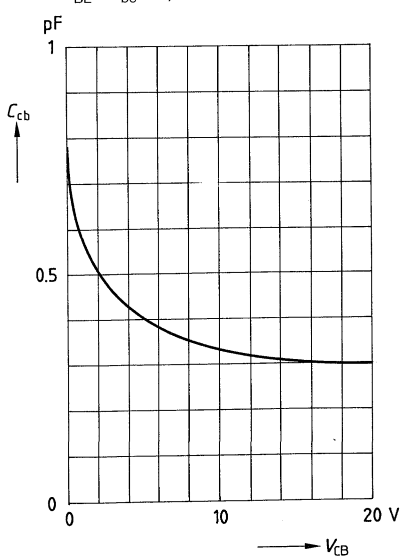
Total power dissipation $P_{tot} = f(T_A)$
Package mounted on alumina



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

I_C = 5 mA, V_{CE} = 10 V, Z_0 = 50 Ω

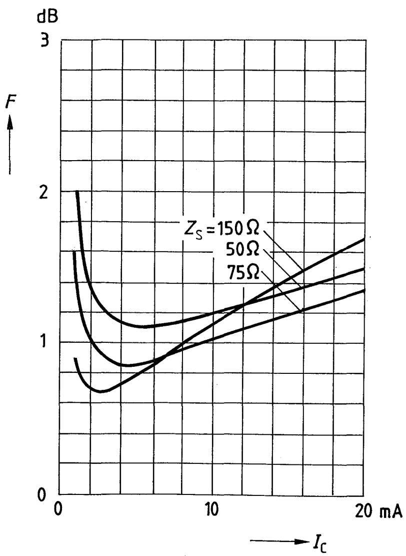
f	F_{min}	G_p (F_{min})	Γ_{opt}		R_N	N	$F_{50\,\Omega}$	G_p ($F_{50\,\Omega}$)
GHz	dB	dB	MAG	ANG	Ω	–	dB	dB
0.01	0.8	–	(Z_S = 120 Ω)		–	–	1.1	–
0.8	1.25	16	0.26	77	9.6	0.151	1.4	15.5
2.0	2.25	10	0.32	178	8.6	0.334	2.7	8.5

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

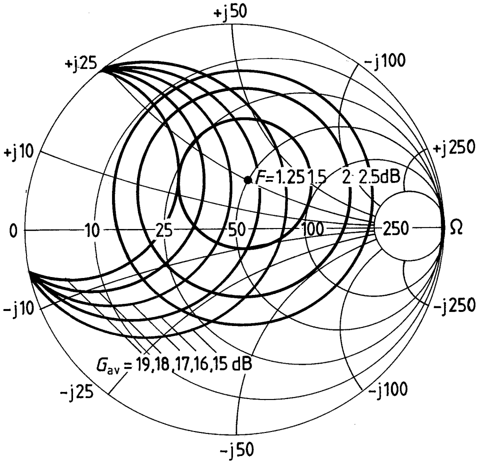
f	F_{min}	G_p (F_{min})	Γ_{opt}		R_N	N	$F_{50\,\Omega}$	G_p ($F_{50\,\Omega}$)
GHz	dB	dB	MAG	ANG	Ω	–	dB	dB
0.01	1.05	–	(Z_S = 75 Ω)		–	–	1.2	–
0.8	1.4	17	0.21	93	8.3	0.155	1.5	16.5
2.0	2.5	11	0.33	–167	10.8	0.413	2.9	9.5

Noise figure F = f (I_C)

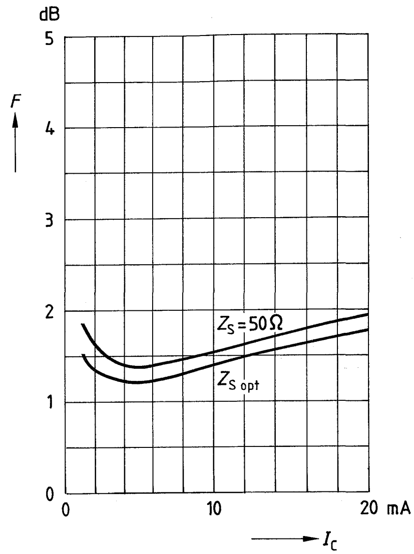
V_{CE} = 10V, f = 10 MHz



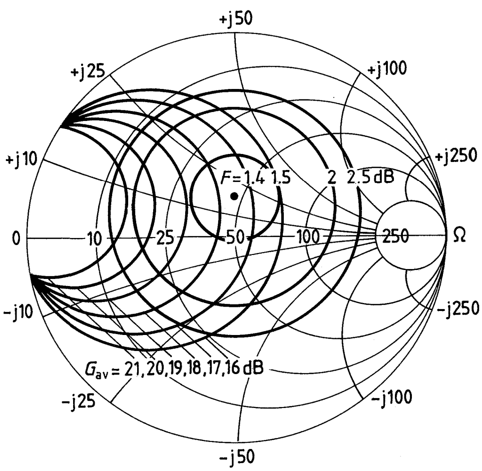
Circles of constant noise figure $F = f(Z_S)$ and available power gain $G_{av} = f(Z_S)$
I_C = 5 mA, V_{CE} = 10 V, f = 800 MHz



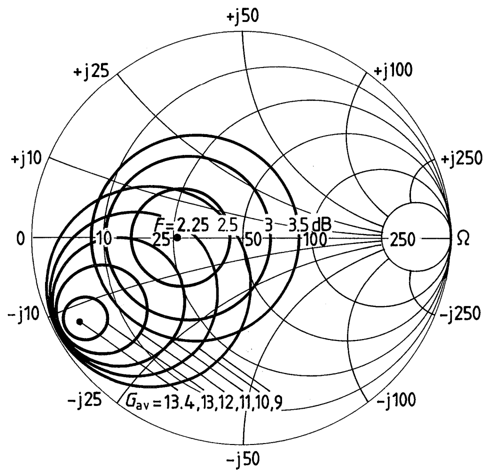
Noise figure $F = f(I_C)$
V_{CE} = 10 V, f = 800 MHz, Z_{Lopt} (G)



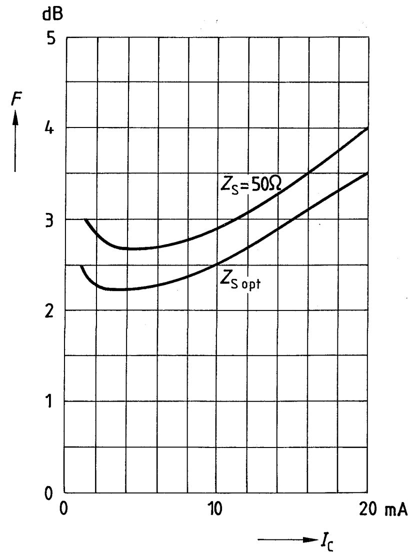
Circles of constant noise figure $F = f(Z_S)$ and available power gain $G_{av} = f(Z_S)$
I_C = 10 mA, V_{CE} = 10 V, f = 800 MHz



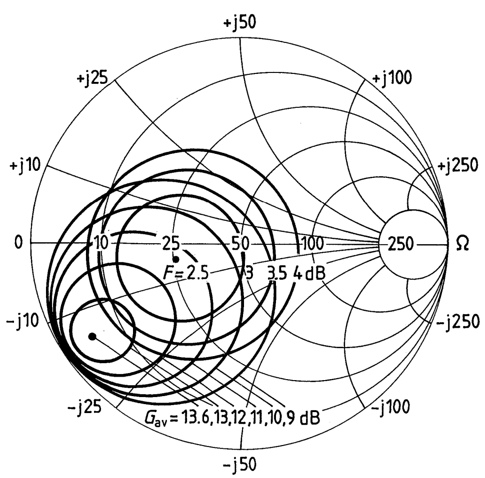
Circles of constant noise figure $F = f(Z_S)$ and available power gain $G_{av} = f(Z_S)$
$I_C = 5$ mA, $V_{CE} = 10$ V, $f = 2$ GHz



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

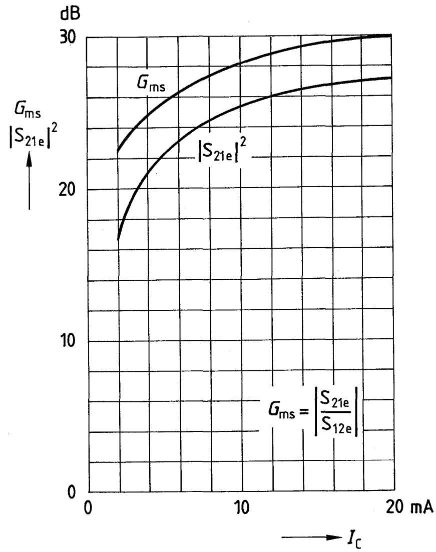


Circles of constant noise figure $F = f(Z_S)$ and available power gain $G_{av} = f(Z_S)$
$I_C = 10$ mA, $V_{CE} = 10$ V, $f = 2$ GHz

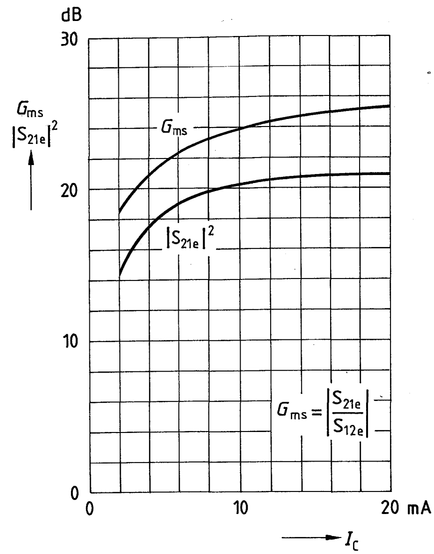


Common Emitter Power Gain

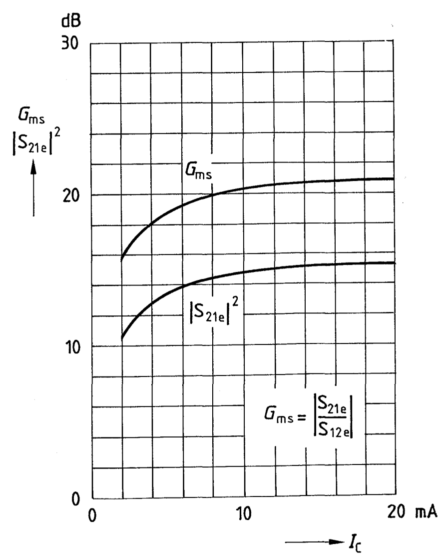
Power gain G_{ms}, $|S_{21e}|^2 = f(I_C)$
$V_{CE} = 10$ V, $f = 200$ MHz, $Z_0 = 50\ \Omega$



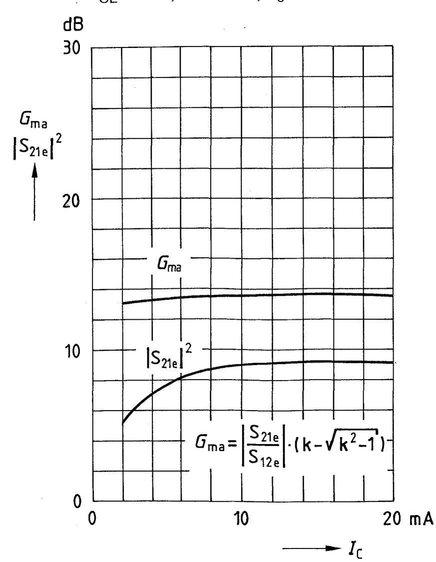
Power gain G_{ms}, $|S_{21e}|^2 = f(I_C)$
$V_{CE} = 10$ V, $f = 500$ MHz, $Z_0 = 50\ \Omega$



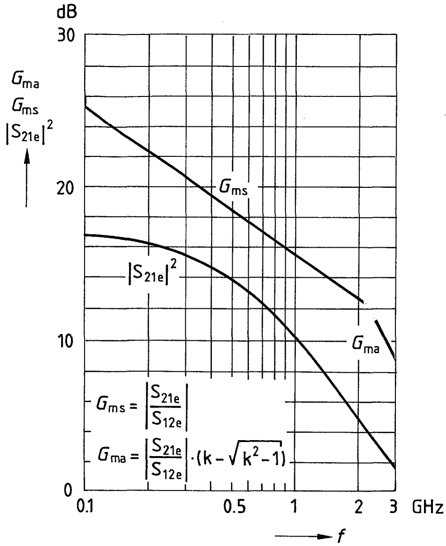
Power gain G_{ms}, $|S_{21e}|^2 = f(I_C)$
$V_{CE} = 10$ V, $f = 1$ GHz, $Z_0 = 50\ \Omega$



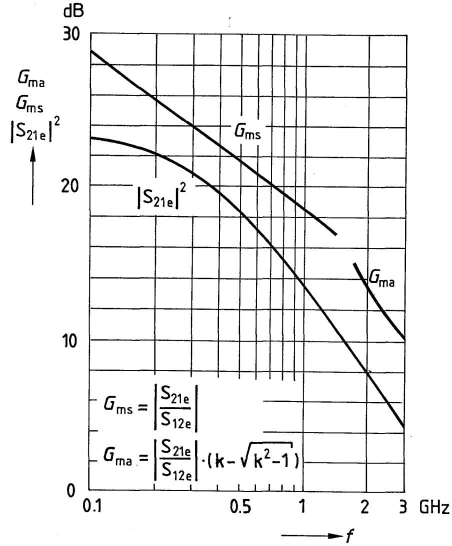
Power gain G_{ma}, $|S_{21e}|^2 = f(I_C)$
$V_{CE} = 10$ V, $f = 2$ GHz, $Z_0 = 50\ \Omega$



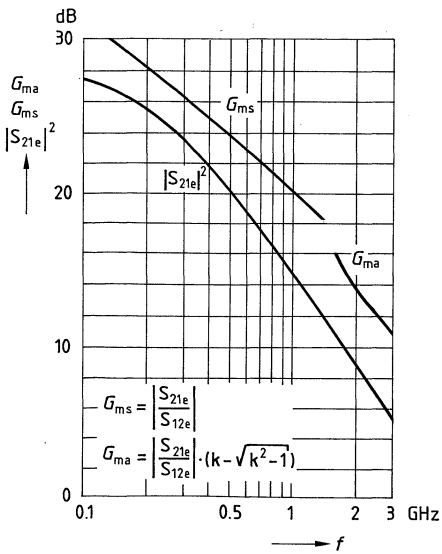
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
I_C = 2mA, V_{CE} = 10 V, Z_0 = 50 Ω



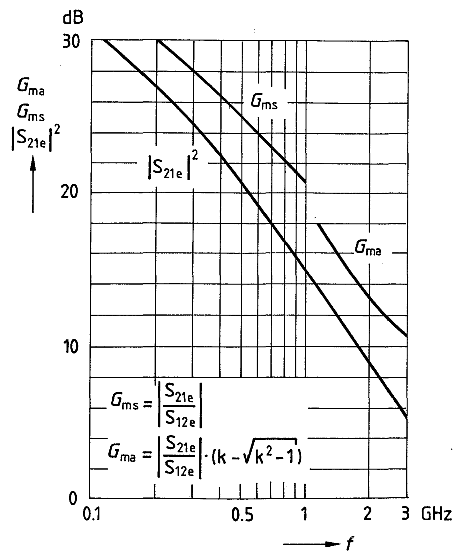
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
I_C = 5 mA, V_{CE} = 10 V, Z_0 = 50 Ω



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
I_C = 1 mA, V_{CE} = 1 V, Z_0 = 50 Ω

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

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

I_C = 2 mA, V_{CE} = 3 V, Z_0 = 50 Ω

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

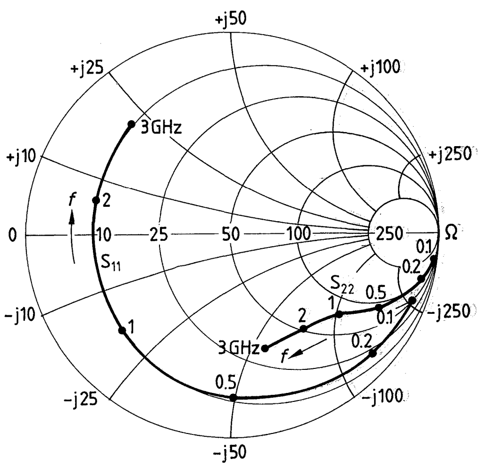
I_C = 5 mA, V_{CE} = 3 V, Z_0 = 50 Ω

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

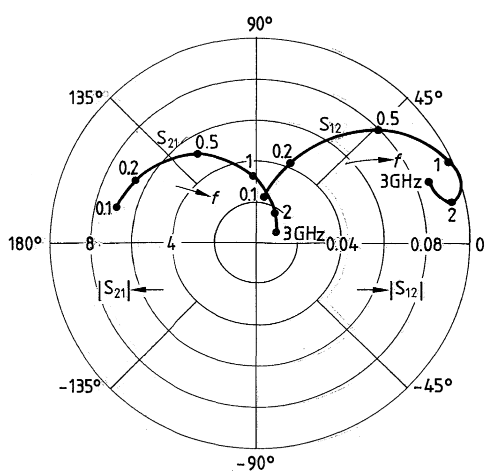
I_C = 2 mA, V_{CE} = 6 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	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



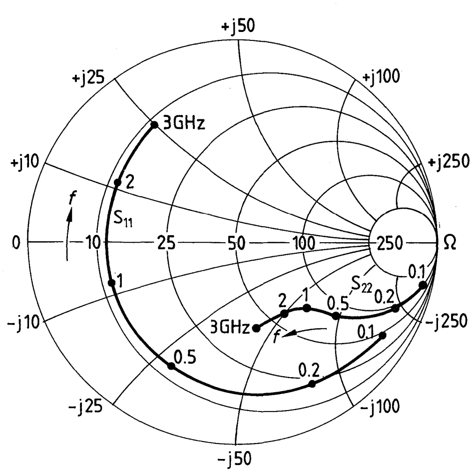
S_{12}, S_{21} = f (f)
I_C = 2 mA, V_{CE} = 6 V, Z_0 = 50 Ω



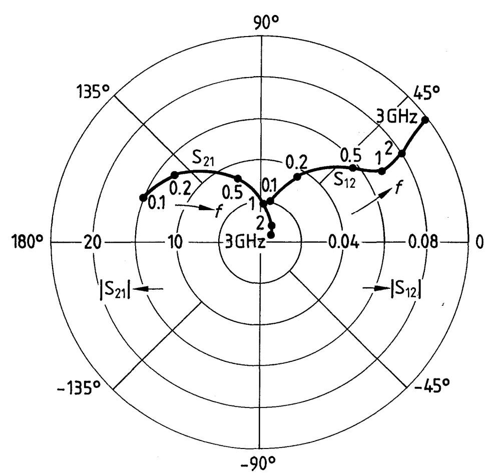
I_C = 5 mA, V_{CE} = 6 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	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



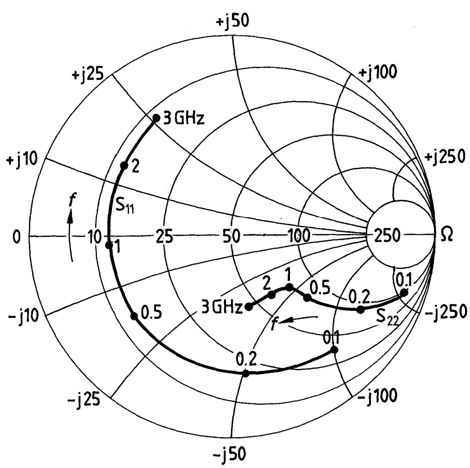
S_{12}, S_{21} = f (*f*)
I_C = 5 mA, V_{CE} = 6 V, Z_0 = 50 Ω



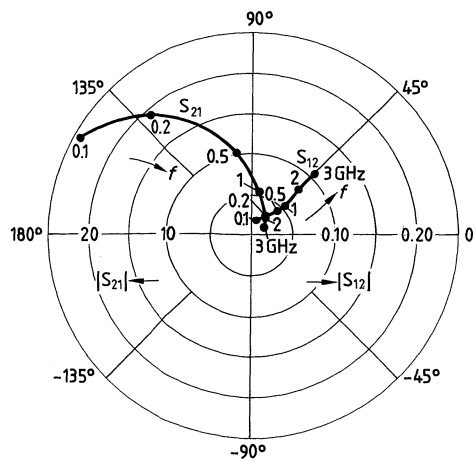
I_C = 10 mA, V_{CE} = 6 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	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



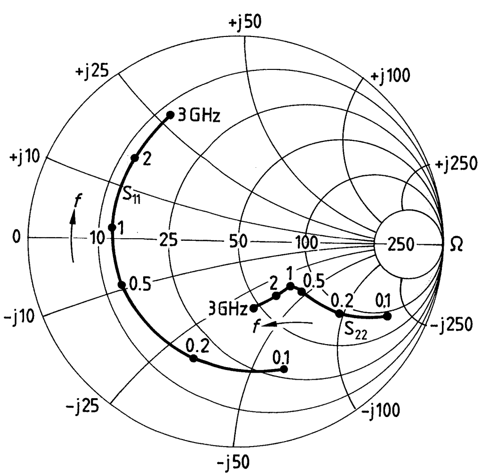
S_{12}, S_{21} = f (*f*)
I_C = 10 mA, V_{CE} = 6 V, Z_0 = 50 Ω



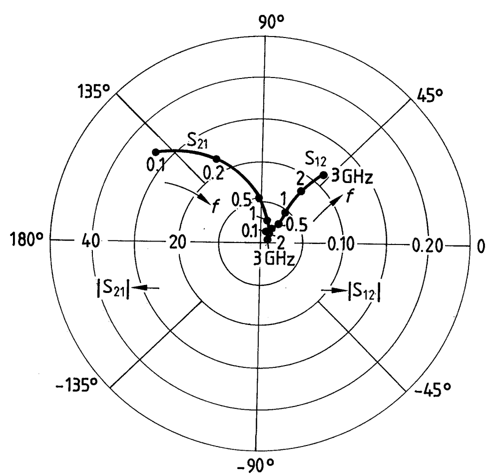
I_C = 20 mA, V_{CE} = 6 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	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



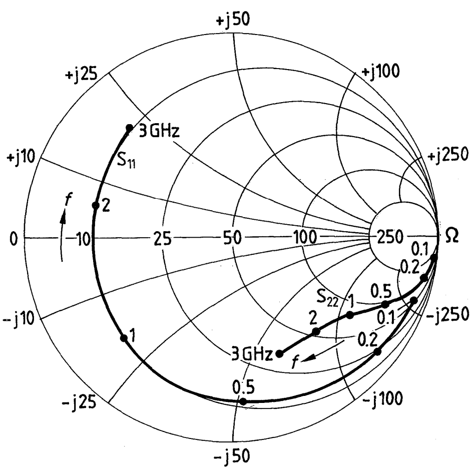
S_{12}, S_{21} = f (*f*)
I_C = 20 mA, V_{CE} = 6 V, Z_0 = 50 Ω



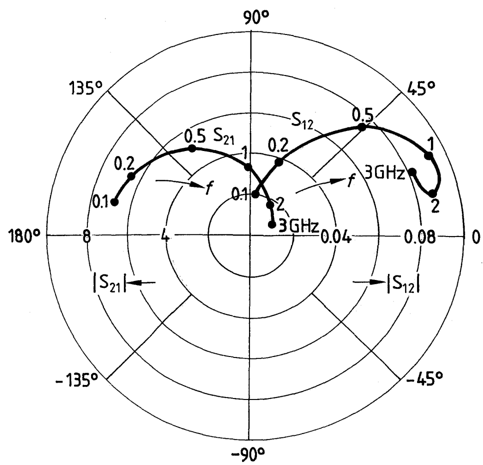
I_C = 2 mA, V_{CE} = 10 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	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



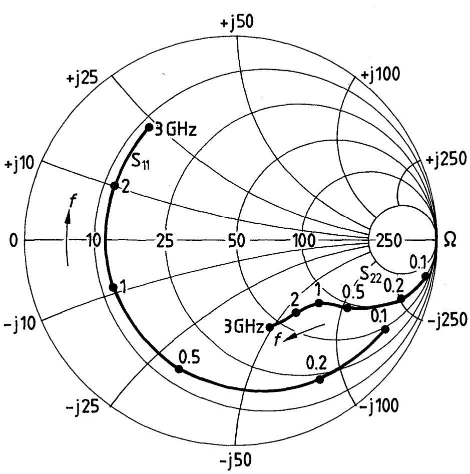
S_{12}, S_{21} = f (*f*)
I_C = 2 mA, V_{CE} = 10 V, Z_0 = 50 Ω



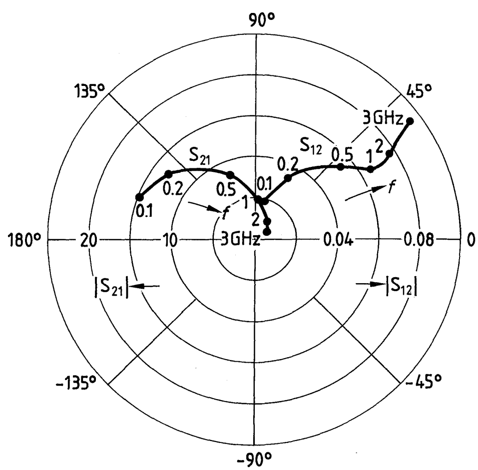
I_C = 5 mA, V_{CE} = 10 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	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



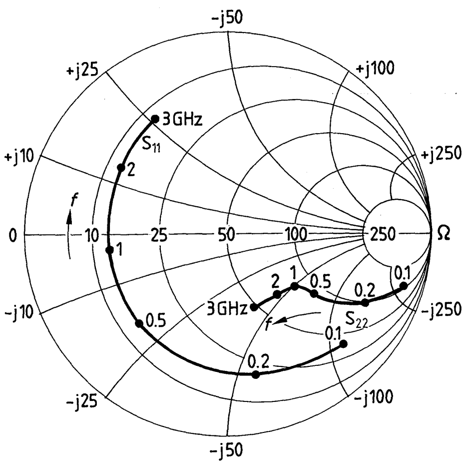
S_{12}, S_{21} = f (*f*)
I_C = 5 mA, V_{CE} = 10 V, Z_0 = 50 Ω



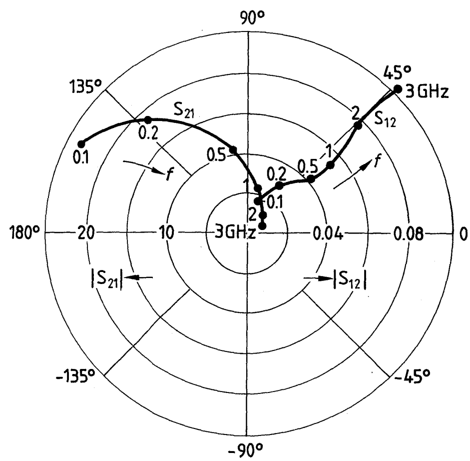
I_C = 10 mA, V_{CE} = 10 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	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



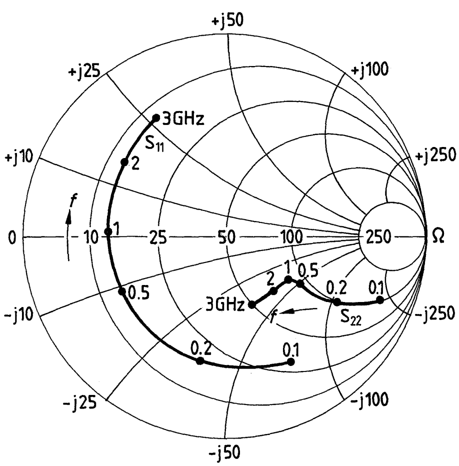
S_{12}, S_{21} = f (*f*)
I_C = 10 mA, V_{CE} = 10 V, Z_0 = 50 Ω



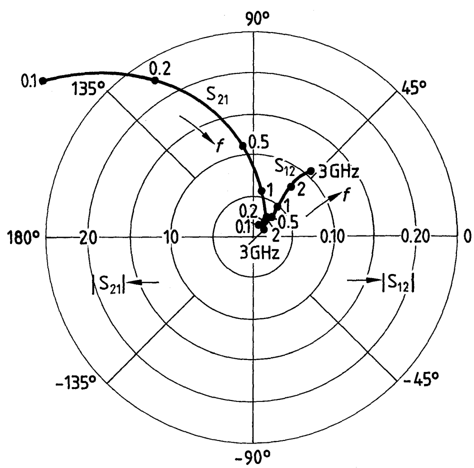
I_C = 20 mA, V_{CE} = 10 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	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



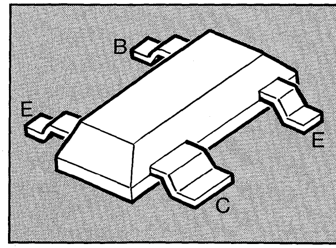
S_{12}, S_{21} = f (f)
I_C = 20 mA, V_{CE} = 10 V, Z_0 = 50 Ω



NPN Silicon RF Transistor

BFP 93A

- For broadband amplifiers and oscillators up to 2 GHz at collector currents from 5 to 30 mA.
- CECC-type in preparation: CECC 50002/...



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

Type	Marking	Ordering code (tape and reel)	Package[1])
BFP 93A	FE	Q 62702 – F1144	SOT-143

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CEO}	12	V
Collector-base voltage	V_{CBO}	15	V
Emitter-base voltage	V_{EBO}	2	V
Collector current	I_C	50	mA
Base current	I_B	6	mA
Total power dissipation, $T_A \leq 25$ °C[2])	P_{tot}	280	mW
Junction temperature	T_j	150	°C
Ambient temperature range	T_A	–65 ... +150	°C
Storage temperature range	T_{stg}	–65 ... +150	°C

Thermal Resistance

Junction – ambient[2])	R_{thJA}	≤450	K/W

1) For detailed dimensions 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.

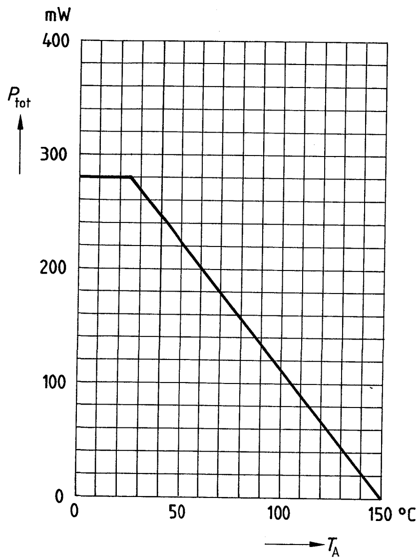
DC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
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

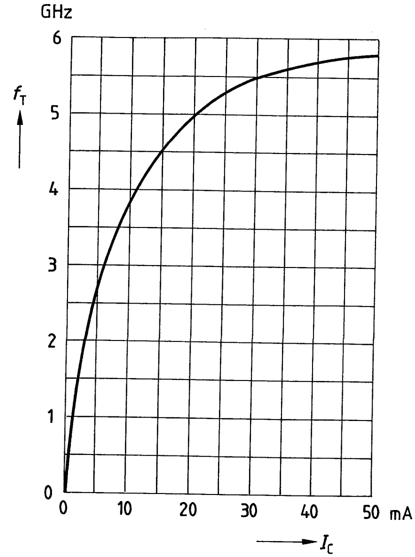
AC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
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	–	pF
Input capacitance $V_{EB} = 0.5$ V, $I_C = i_c = 0$, $f = 1$ MHz	C_{ibo}	–	2.2	–	pF
Output capacitance $V_{CE} = 10$ V, $V_{BE} = v_{be} = 0$, $f = 1$ MHz	C_{obs}	–	0.8	–	pF
Noise figure $I_C = 5$ mA, $V_{CE} = 8$ V, $f = 10$ MHz, $Z_S = 50\ \Omega$ $I_C = 5$ 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	–	dB
Transducer gain $I_C = 30$ mA, $V_{CE} = 8$ V, $f = 1$ GHz, $Z_0 = 50\ \Omega$	$\|S_{21e}\|^2$	–	13.4	–	dB
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, $Z_S = Z_L = 50\ \Omega$	$V_{o1} = V_{o2}$	–	280	–	mV
Third order intercept point $I_C = 30$ mA, $V_{CE} = 8$ V, $f = 800$ MHz	IP_3	–	32	–	dBm

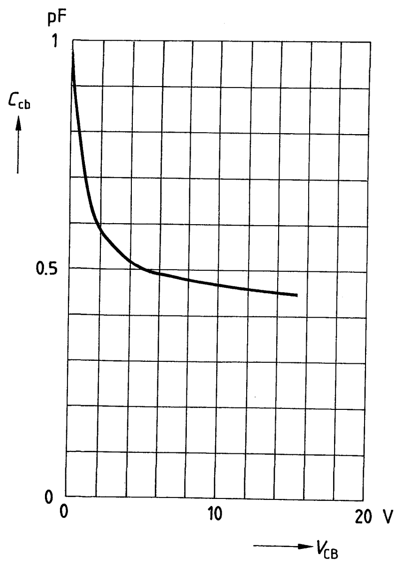
Total power dissipation $P_{tot} = f(T_A)$
Package mounted on alumina



Transition frequency $f_T = f(I_C)$
$V_{CE} = 5$ V, $f = 200$ MHz



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



Common Emitter Noise Parameters

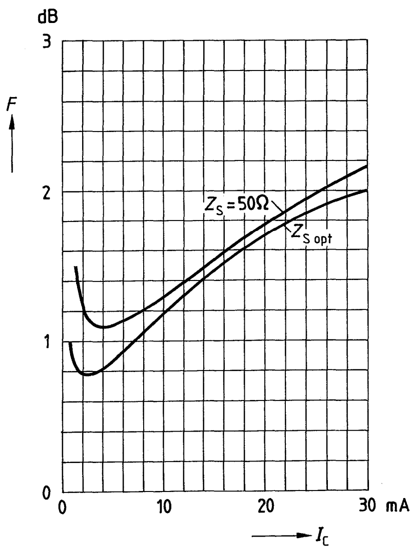
I_C = 5 mA, V_{CE} = 8 V, Z_0 = 50 Ω

f	F_{min}	G_p (F_{min})	Γ_{opt}		R_N	N	$F_{50\,\Omega}$	G_p ($F_{50\,\Omega}$)
GHz	dB	dB	MAG	ANG	Ω	–	dB	dB
0.01	0.8	–	(Z_S = 150 Ω)		–	–	1.1	–
0.8	1.7	13.5	0.26	124	8.3	0.199	1.8	13

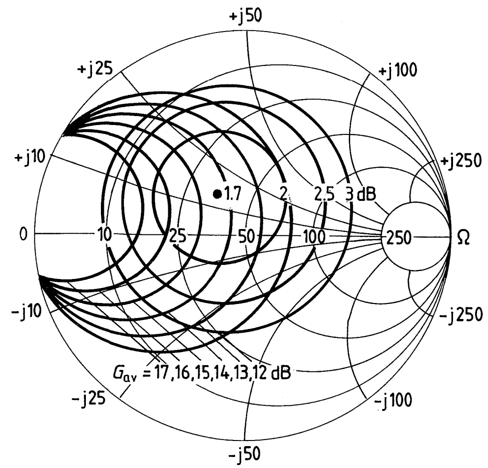
I_C = 30 mA, V_{CE} = 8 V, Z_0 = 50 Ω

f	F_{min}	G_p (F_{min})	Γ_{opt}		R_N	N	$F_{50\,\Omega}$	G_p ($F_{50\,\Omega}$)
GHz	dB	dB	MAG	ANG	Ω	–	dB	dB
0.01	2.0	–	(Z_S = 100 Ω)		–	–	2.15	–
0.8	2.6	15.5	0.2	156	10.9	0.31	2.85	15

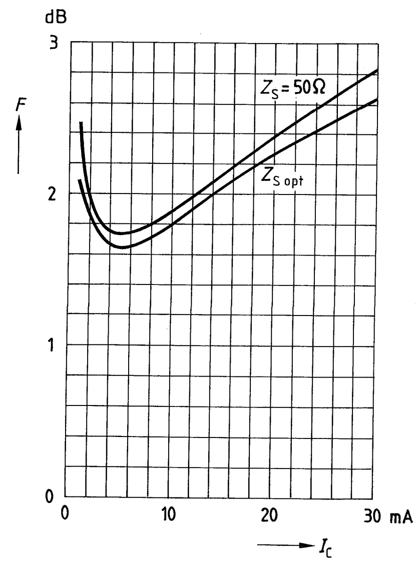
Noise figure F = f (I_C)
V_{CE} = 8 V, f = 10 MHz



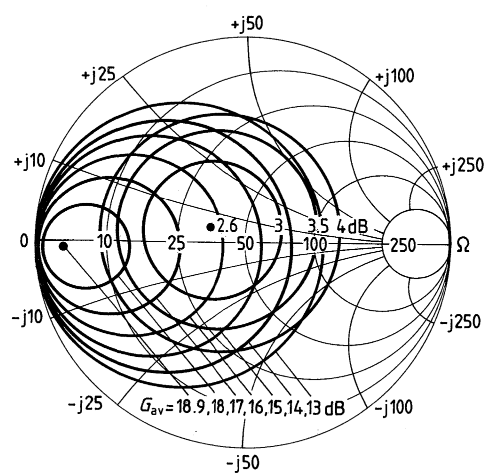
Circles of constant noise figure $F = f(Z_S)$ and available power gain $G_{av} = f(Z_S)$
I_C = 5 mA, V_{CE} = 8 V, f = 800 MHz



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

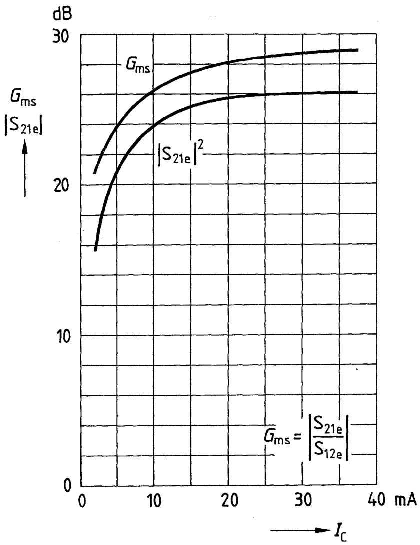


Circles of constant noise figure $F = f(Z_S)$ and available power gain $G_{av} = f(Z_S)$
I_C = 30 mA, V_{CE} = 8 V, f = 800 MHz

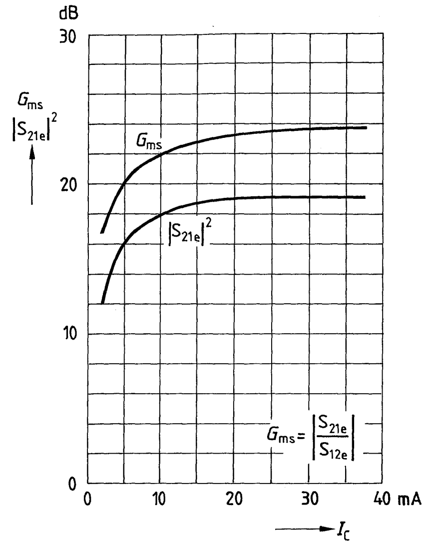


Common Emitter Power Gain

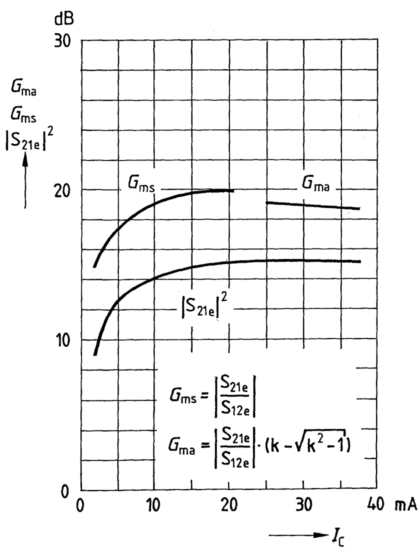
Power gain G_{ms}, $|S_{21e}|^2 = f(I_C)$
V_{CE} = 8 V, f = 200 MHz, Z_0 = 50 Ω



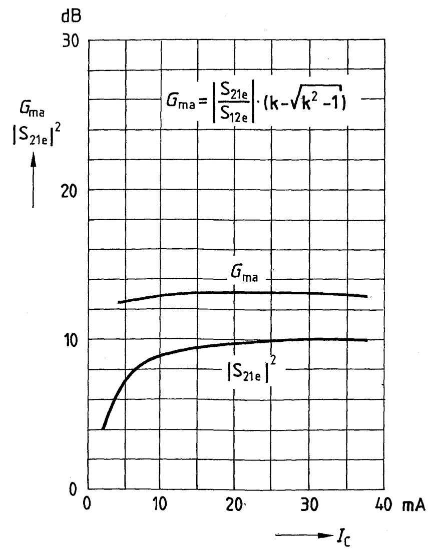
Power gain G_{ms}, $|S_{21e}|^2 = f(I_C)$
V_{CE} = 8 V, f = 500 MHz, Z_0 = 50 Ω



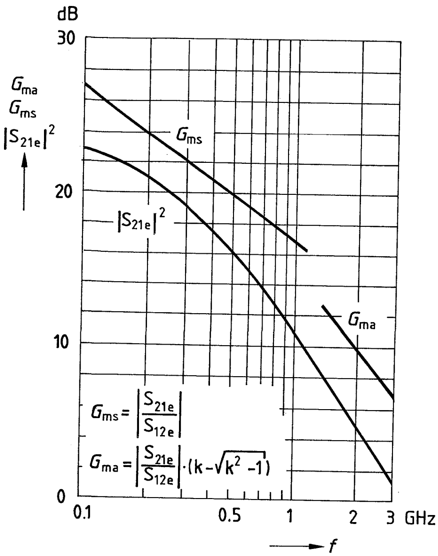
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(I_C)$
V_{CE} = 8 V, f = 800 MHz, Z_0 = 50 Ω



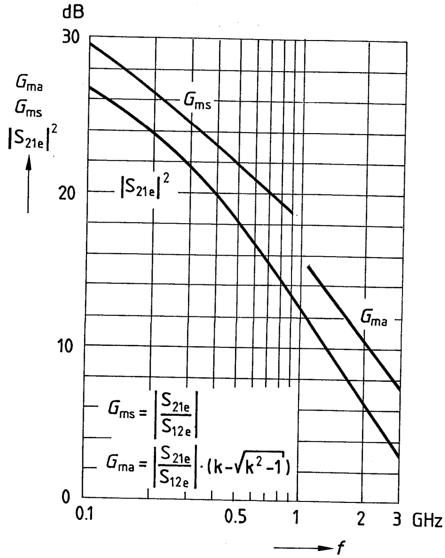
Power gain G_{ma}, $|S_{21e}|^2 = f(I_C)$
V_{CE} = 8 V, f = 1.5 GHz, Z_0 = 50 Ω



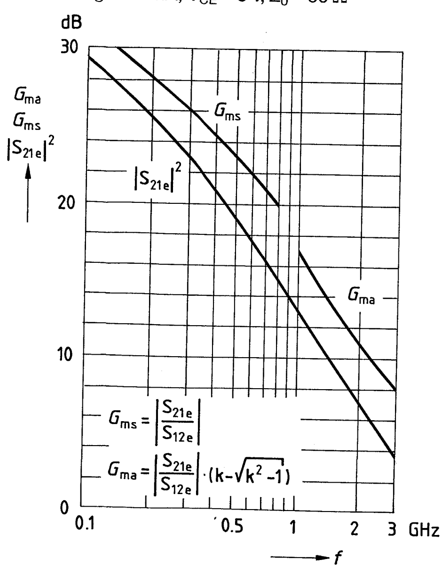
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
$I_C = 5$ mA, $V_{CE} = 8$ V, $Z_0 = 50\ \Omega$



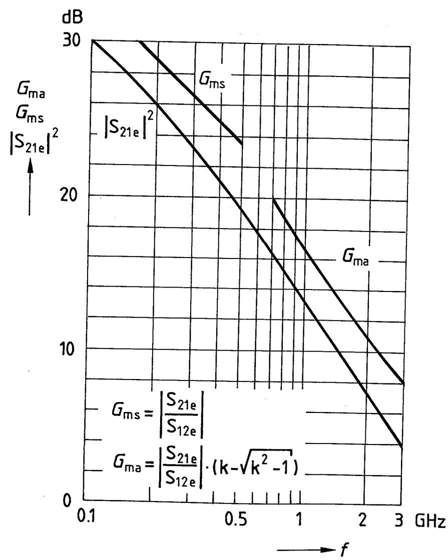
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
$I_C = 10$ mA, $V_{CE} = 8$ V, $Z_0 = 50\ \Omega$



Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
$I_C = 20$ mA, $V_{CE} = 8$ V, $Z_0 = 50\ \Omega$



Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
$I_C = 30$ mA, $V_{CE} = 8$ V, $Z_0 = 50\ \Omega$



Common Emitter S Parameters

I_C = 10 mA, V_{CE} = 3 V, Z_0 = 50 Ω

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

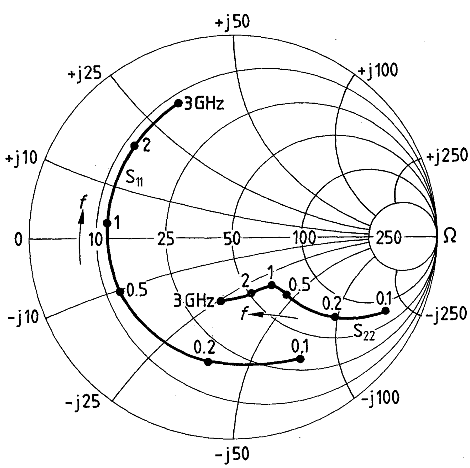
I_C = 30 mA, V_{CE} = 3 V, Z_0 = 50 Ω

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

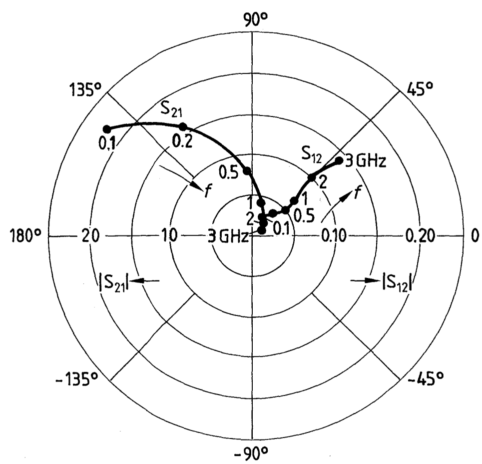
I_C = 10 mA, V_{CE} = 5 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	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



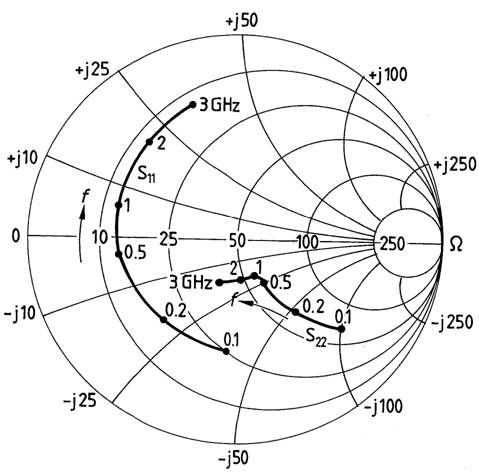
S_{12}, S_{21} = f (*f*)
I_C = 10 mA, V_{CE} = 5 V, Z_0 = 50 Ω



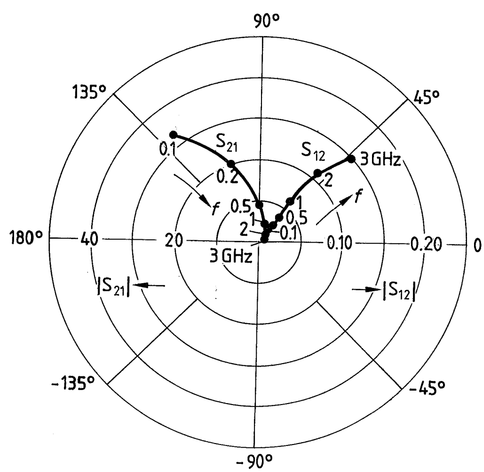
I_C = 30 mA, V_{CE} = 5 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	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



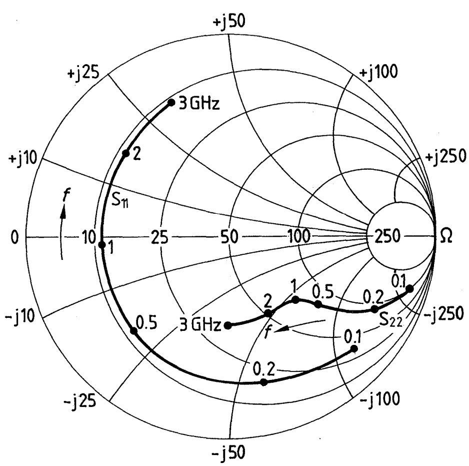
S_{12}, S_{21} = f (f)
I_C = 30 mA, V_{CE} = 5 V, Z_0 = 50 Ω



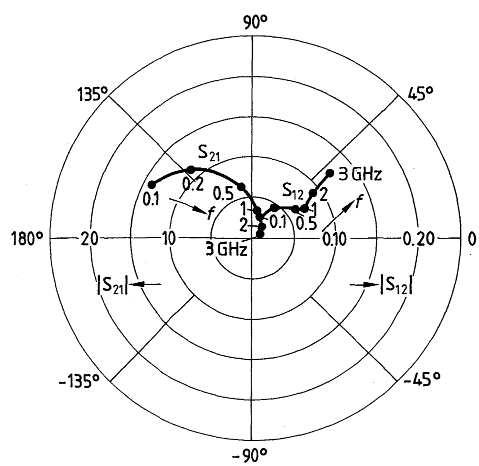
I_C = 5 mA, V_{CE} = 8 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	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



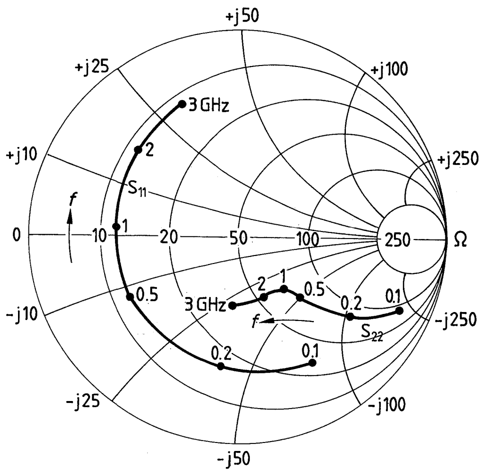
S_{12}, S_{21} = f (*f*)
I_C = 5 mA, V_{CE} = 8 V, Z_0 = 50 Ω



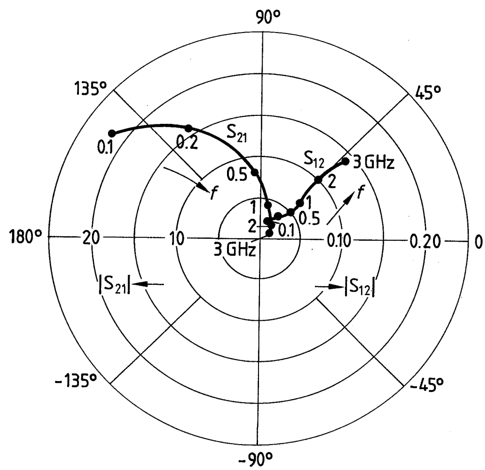
I_C = 10 mA, V_{CE} = 8 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	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



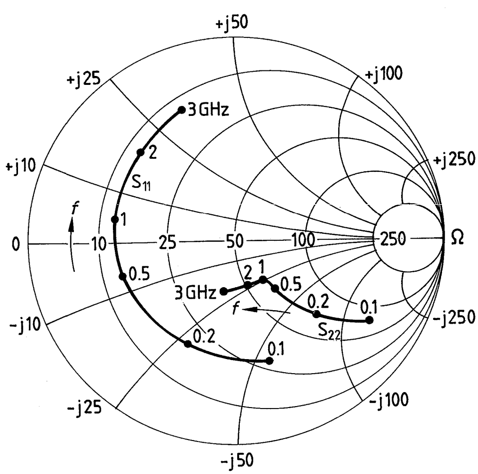
S_{12}, S_{21} = f (*f*)
I_C = 10 mA, V_{CE} = 8 V, Z_0 = 50 Ω



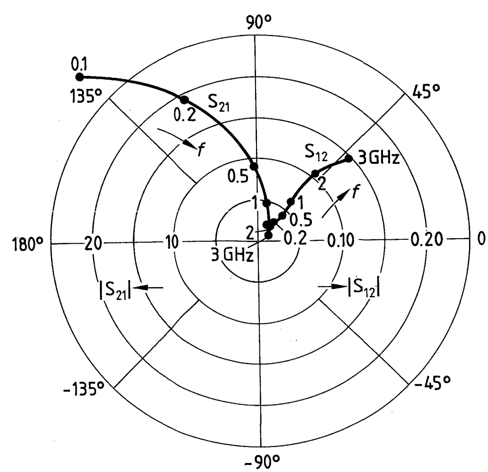
I_C = 20 mA, V_{CE} = 8 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	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



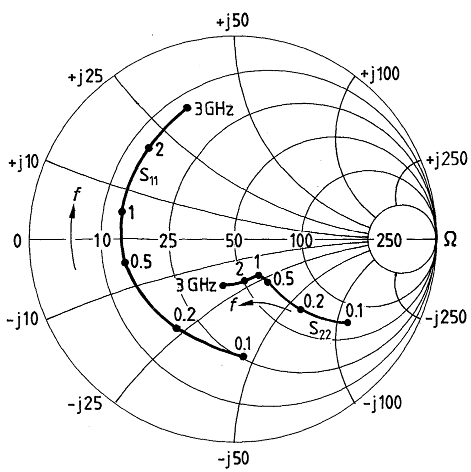
S_{12}, S_{21} = f (*f*)
I_C = 20 mA, V_{CE} = 8 V, Z_0 = 50 Ω



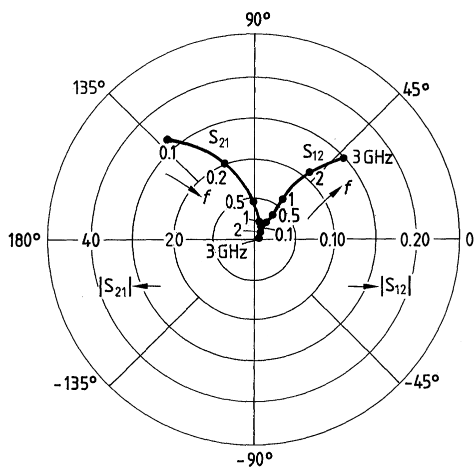
I_C = 30 mA, V_{CE} = 8 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	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

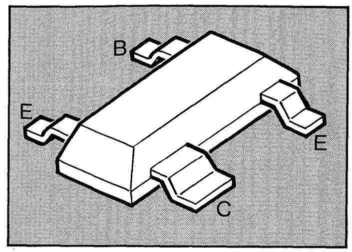
S_{11}, S_{22} = f (f)
I_C = 30 mA, V_{CE} = 8 V, Z_0 = 50 Ω



S_{12}, S_{21} = f (f)
I_C = 30 mA, V_{CE} = 8 V, Z_0 = 50 Ω



- 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)	Package[1])
BFP 193	RC	Q 62702 – F1217	SOT-143

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CEO}	12	V
Collector-emitter voltage, $V_{BE} = 0$	V_{CES}	20	V
Collector-base voltage	V_{CBO}	20	V
Emitter-base voltage	V_{EBO}	2	V
Collector current	I_C	80	mA
Base current	I_B	10	mA
Total power dissipation, $T_A \leq 50$ °C[2])	P_{tot}	400	mW
Junction temperature	T_j	150	°C
Ambient temperature range	T_A	–65 ... +150	°C
Storage temperature range	T_{stg}	–65 ... +150	°C

Thermal Resistance

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

1) For detailed dimensions 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.

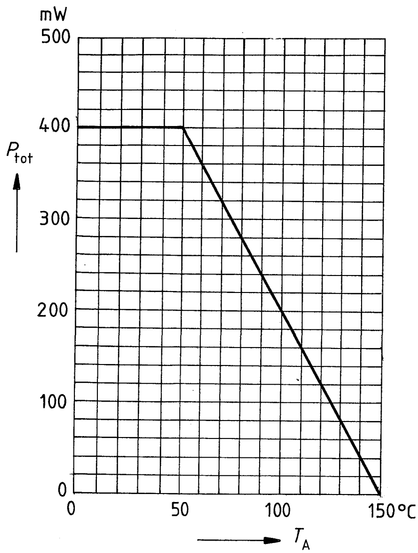
DC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
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

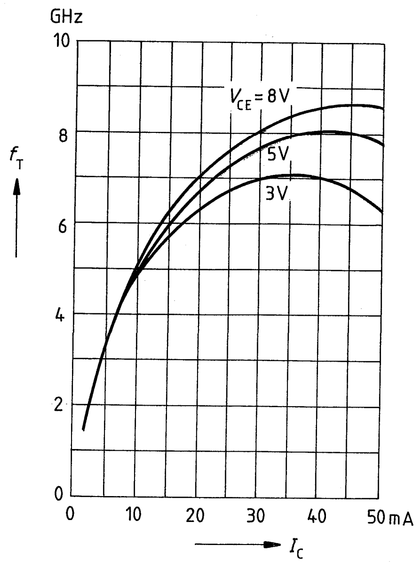
AC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
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}	–	0.6	–	pF
Collector-emitter capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{ce}	–	0.33	–	pF
Input capacitance V_{EB} = 0.5 V, I_C = i_c = 0, f = 1 MHz	C_{ibo}	–	2.3	–	pF
Output capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{obs}	–	0.95	–	pF
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}		–	1.6	–	
I_C = 30 mA, V_{CE} = 8 V, f = 1 GHz, Z_S = 50 Ω		–	1.9	–	
Power gain I_C = 30 mA, V_{CE} = 8 V, f = 800 MHz, Z_S = 50 Ω, Z_L = Z_{Lopt}	G_{pe}	–	15	–	dB
Transducer gain I_C = 30 mA, V_{CE} = 8 V, f = 1 GHz, Z_0 = 50 Ω	$\|S_{21e}\|^2$	–	13.5	–	dB
Linear output voltage two-tone intermodulation test I_C = 40 mA, V_{CE} = 5 V, d_{IM} = 60 dB f_1 = 806 MHz, f_2 = 810 MHz, Z_S = Z_L = 50 Ω	$V_{o1} = V_{o2}$	–	250	–	mV
Third order intercept point I_C = 40 mA, V_{CE} = 5 V, f = 800 MHz	IP_3	–	31	–	dBm

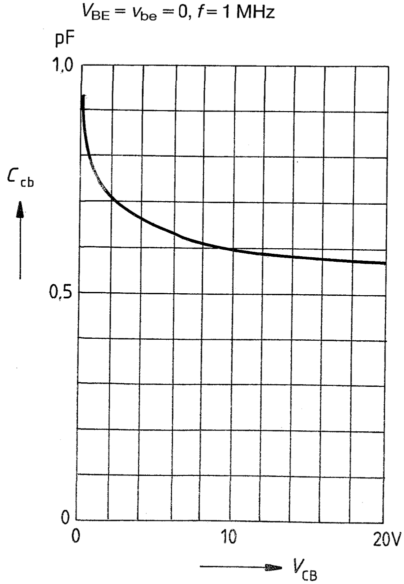
Total power dissipation $P_{tot} = f(T_A)$
Package mounted on alumina



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 Noise Parameters

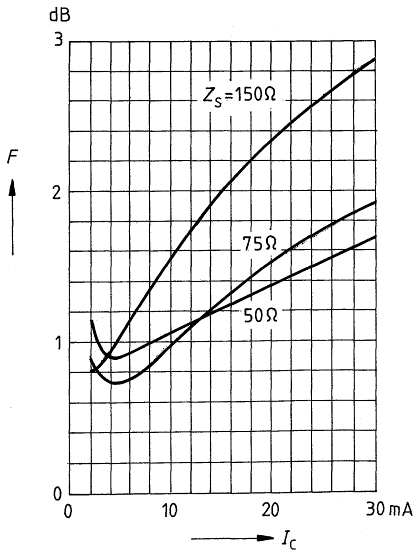
I_C = 10 mA, V_{CE} = 8 V, Z_0 = 50 Ω

f	F_{min}	G_p (F_{min})	Γ_{opt}		R_N	N	$F_{50\,\Omega}$	G_p ($F_{50\,\Omega}$)
GHz	dB	dB	MAG	ANG	Ω	–	dB	dB
0.01	1	–	(Z_S = 75 Ω)		–	–	1.05	–
0.8	1.2	15.4	–	–	–	–	1.35	14.4
2.0	2.3	9	–	–	–	–	2.8	7

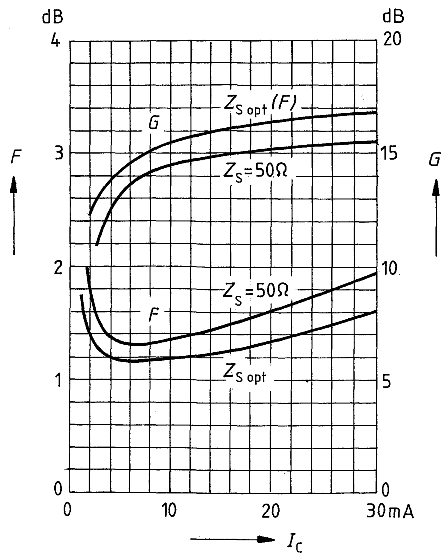
I_C = 30 mA, V_{CE} = 8 V, Z_0 = 50 Ω

f	F_{min}	G_p (F_{min})	Γ_{opt}		R_N	N	$F_{50\,\Omega}$	G_p ($F_{50\,\Omega}$)
GHz	dB	dB	MAG	ANG	Ω	–	dB	dB
0.01	1.65	–	(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

Noise figure F = f (I_C)
V_{CE} = 8 V, f = 10 MHz

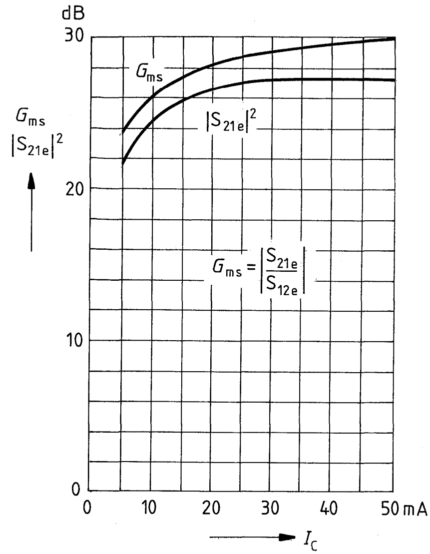


Noise figure F = f (I_C)
Power gain G = f (I_C)
V_{CE} = 8 V, f = 800 MHz, Z_{Lopt} (G)

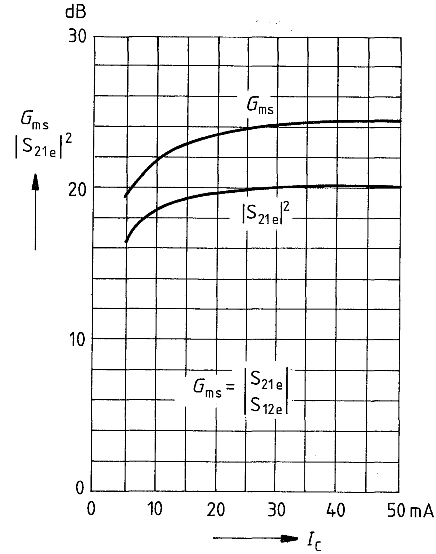


Common Emitter Power Gain

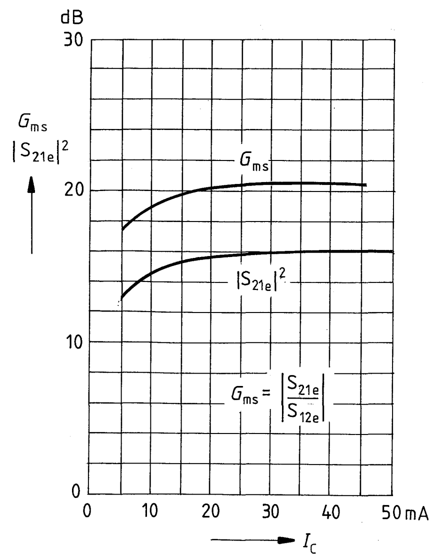
Power gain G_{ms}, $|S_{21e}|^2 = f(I_C)$
V_{CE} = 8 V, f = 200 MHz, Z_0 = 50 Ω



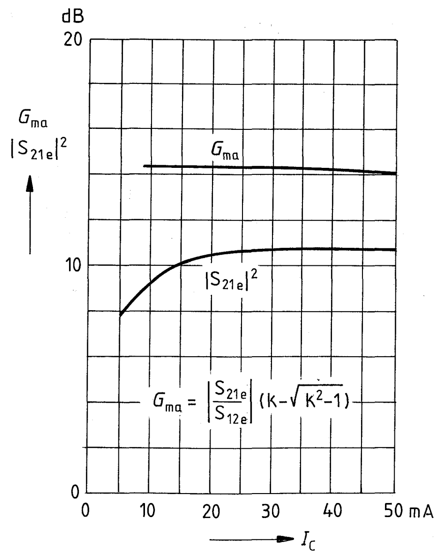
Power gain G_{ms}, $|S_{21e}|^2 = f(I_C)$
V_{CE} = 8 V, f = 500 MHz, Z_0 = 50 Ω



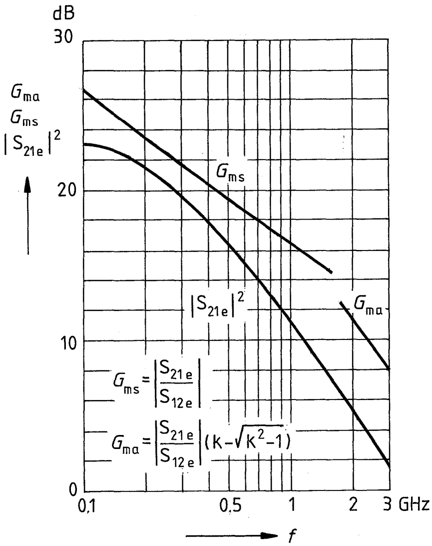
Power gain G_{ms}, $|S_{21e}|^2 = f(I_C)$
V_{CE} = 8 V, f = 800 MHz, Z_0 = 50 Ω



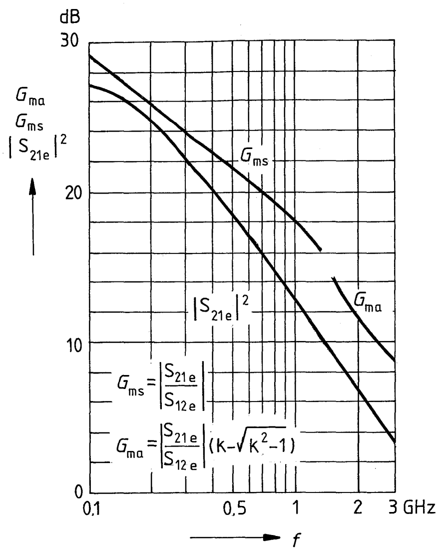
Power gain G_{ma}, $|S_{21e}|^2 = f(I_C)$
V_{CE} = 8 V, f = 1.5 GHz, Z_0 = 50 Ω



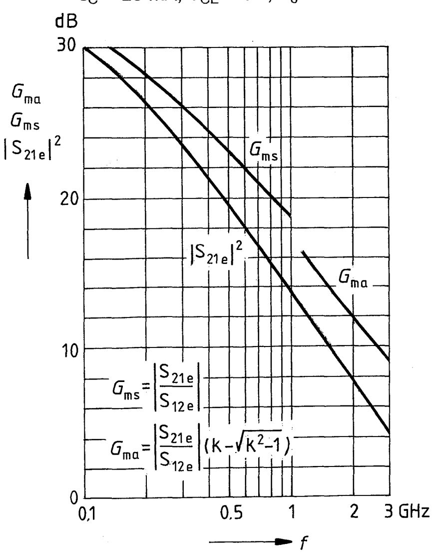
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
$I_C = 5$ mA, $V_{CE} = 8$ V, $Z_0 = 50\ \Omega$



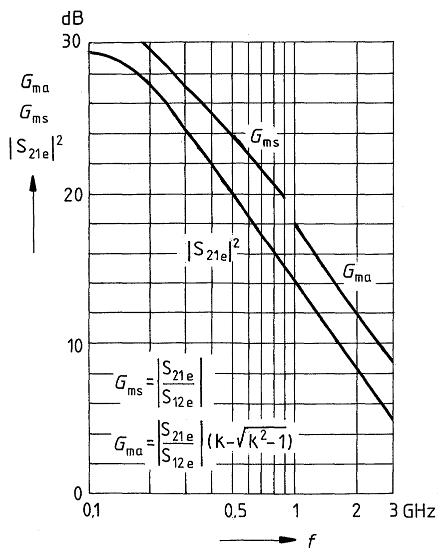
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
$I_C = 10$ mA, $V_{CE} = 8$ V, $Z_0 = 50\ \Omega$



Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
$I_C = 20$ mA, $V_{CE} = 8$ V, $Z_0 = 50\ \Omega$



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



Common Emitter S Parameters
I_C = 10 mA, V_{CE} = 3 V, Z_0 = 50 Ω

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

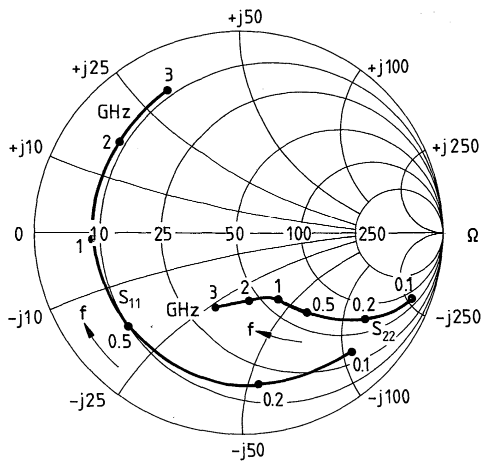
I_C = 30 mA, V_{CE} = 3 V, Z_0 = 50 Ω

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

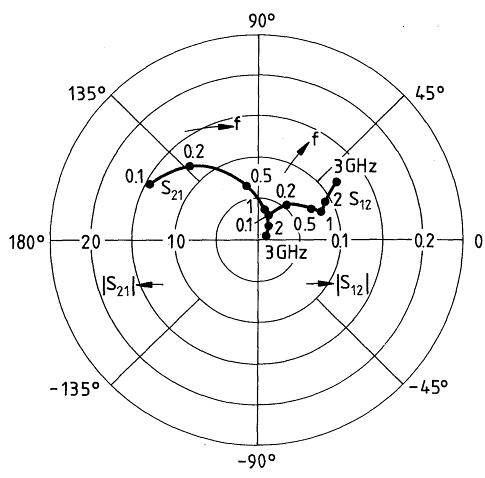
I_C = 5 mA, V_{CE} = 5 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	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



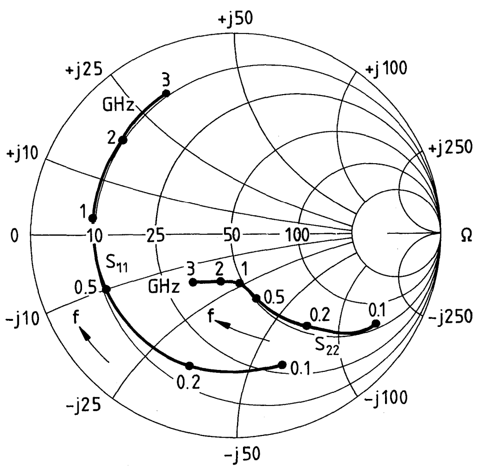
S_{12}, S_{21} = f (*f*)
I_C = 5 mA, V_{CE} = 5 V, Z_0 = 50 Ω



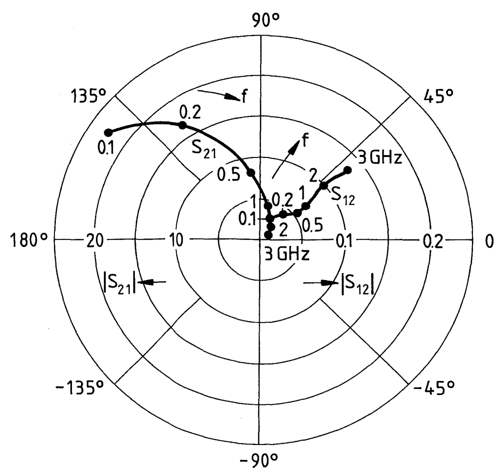
I_C = 10 mA, V_{CE} = 5 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	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



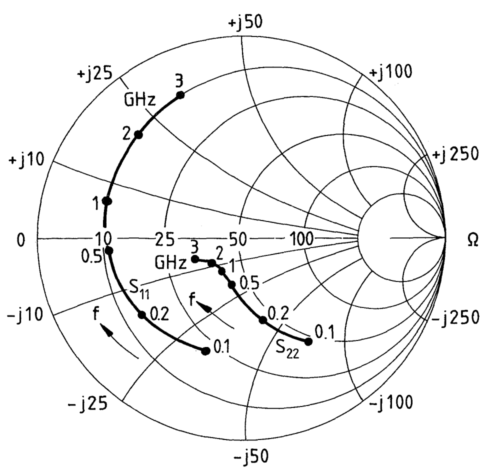
S_{12}, S_{21} = f (*f*)
I_C = 10 mA, V_{CE} = 5 V, Z_0 = 50 Ω



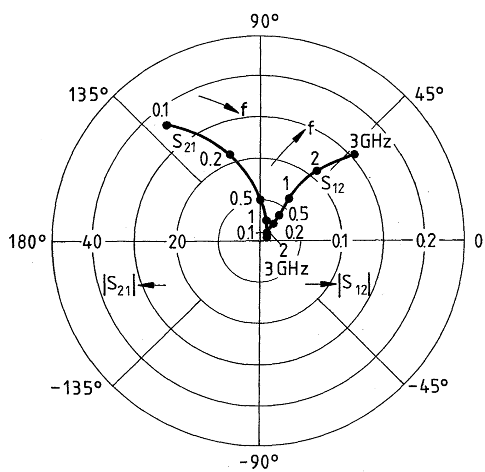
I_C = 30 mA, V_{CE} = 5 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	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



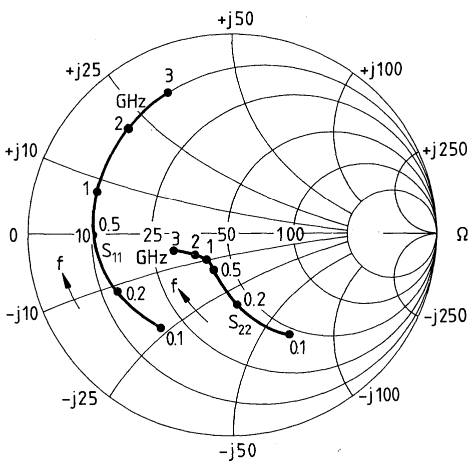
S_{12}, S_{21} = f (*f*)
I_C = 30 mA, V_{CE} = 5 V, Z_0 = 50 Ω



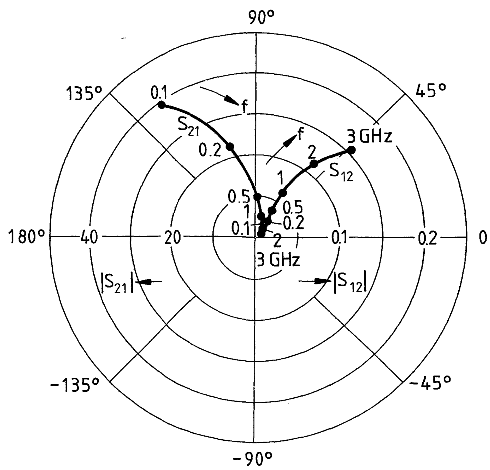
I_C = 50 mA, V_{CE} = 5 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	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



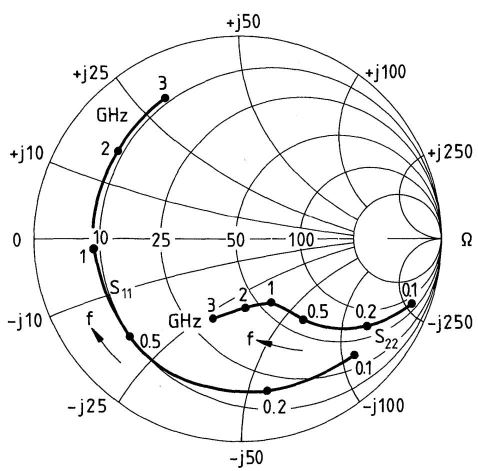
S_{12}, S_{21} = f (f)
I_C = 50 mA, V_{CE} = 5 V, Z_0 = 50 Ω



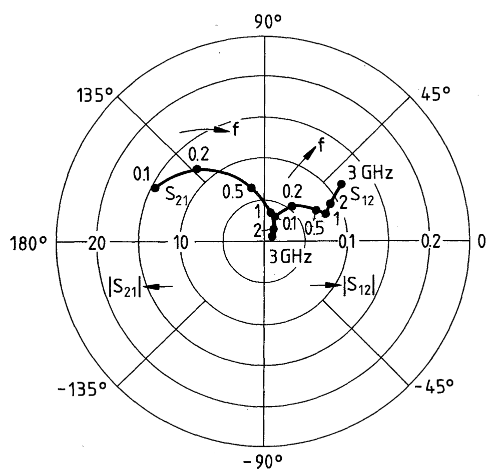
I_C = 5 mA, V_{CE} = 8 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	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



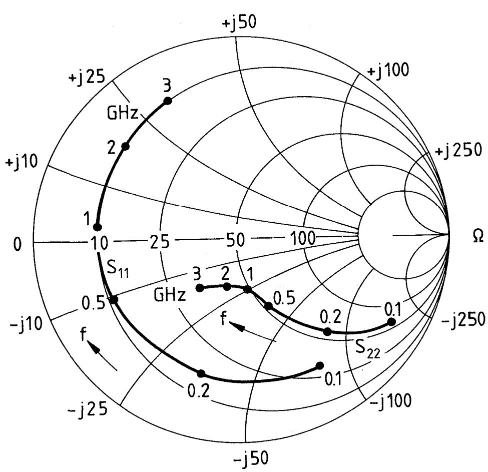
S_{12}, S_{21} = f (*f*)
I_C = 5 mA, V_{CE} = 8 V, Z_0 = 50 Ω



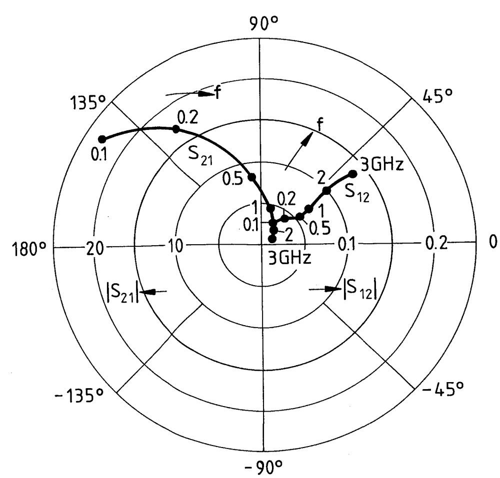
I_C = 10 mA, V_{CE} = 8 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	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



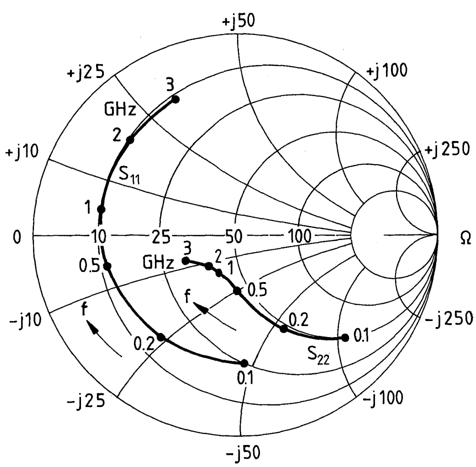
S_{12}, S_{21} = f (*f*)
I_C = 10 mA, V_{CE} = 8 V, Z_0 = 50 Ω



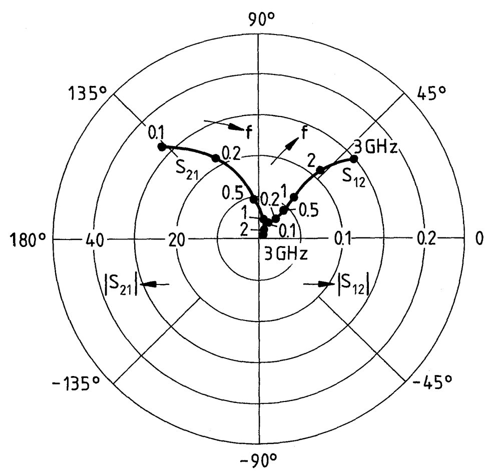
I_C = 20 mA, V_{CE} = 8 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	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



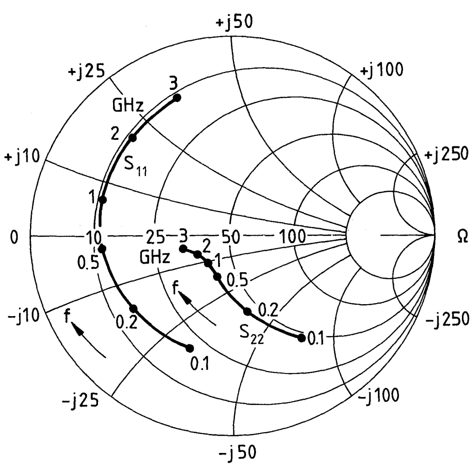
S_{12}, S_{21} = f (f)
I_C = 20 mA, V_{CE} = 8 V, Z_0 = 50 Ω



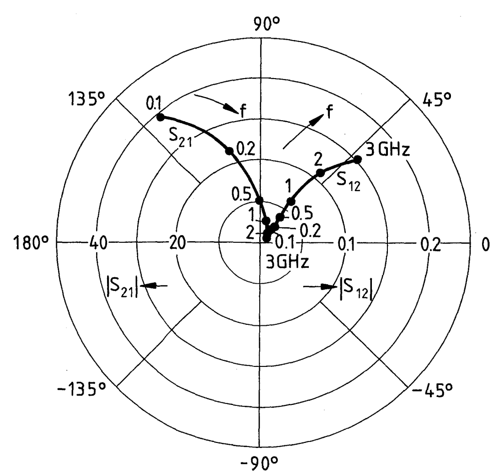
I_C = 40 mA, V_{CE} = 8 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	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

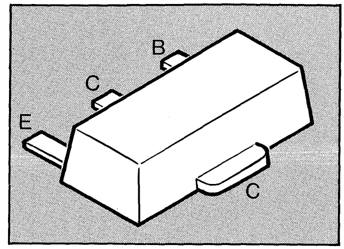


S_{12}, S_{21} = f (f)
I_C = 40 mA, V_{CE} = 8 V, Z_0 = 50 Ω



NPN Silicon RF Transistor BFQ 17P

- For low-distortion broadband amplifiers up to 900 MHz at collector currents from 20 to 150 mA.



Type	Marking	Ordering code (tape and reel)	Package[1])
BFQ 17P	FD	Q 62702 – F983	SOT-89

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CEO}	25	V
Collector-base voltage	V_{CBO}	40	V
Emitter-base voltage	V_{EBO}	2	V
Collector current	I_C	150	mA
Peak collector current, $f \geq 1$ MHz	I_{CM}	300	mA
Total power dissipation, $T_A \leq 25$ °C[2])	P_{tot}	1	W
Junction temperature	T_j	150	°C
Ambient temperature range	T_A	–65 ... +150	°C
Storage temperature range	T_{stg}	–65 ... +150	°C

Thermal Resistance

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

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

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

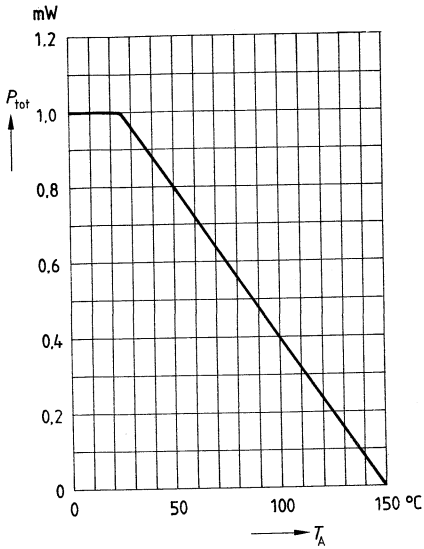
DC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
Collector-emitter breakdown voltage I_C = 10 mA, I_B = 0	$V_{(BR)CEO}$	25	–	–	V
Collector-base cutoff current	I_{CBO}				µA
V_{CB} = 20 V, I_E = 0		–	–	0.1	
V_{CB} = 20 V, I_E = 0, T_A = 125 °C		–	–	20	
Emitter-base cutoff current V_{EB} = 1 V, I_C = 0	I_{EBO}	–	–	100	nA
DC current gain	h_{FE}				–
I_C = 50 mA, V_{CE} = 5 V		25	–	–	
I_C = 150 mA, V_{CE} = 5 V		25	–	–	
Collector-emitter saturation voltage I_C = 100 mA, I_B = 10 mA	V_{CEsat}	–	0.2	0.5	V

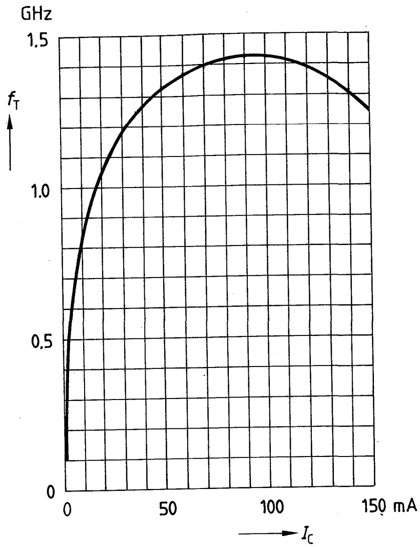
AC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
Transition frequency I_C = 70 mA, V_{CE} = 5 V, f = 200 MHz I_C = 150 mA, V_{CE} = 5 V, f = 200 MHz	f_T	 – –	 1.4 1.2	 – –	GHz
Collector-base capacitance V_{CB} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{cb}	–	1.9	–	pF
Input capacitance V_{EB} = 0.5 V, I_C = i_c = 0, f = 1 MHz	C_{ibo}	–	13	–	pF
Output capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{obs}	–	2.5	4	pF
Power gain I_C = 60 mA, V_{CE} = 15 V, f = 500 MHz, $Z_S = Z_{Sopt}$, $Z_L = Z_{Lopt}$	G_{pe}	–	11.5	–	dB
Linear output voltage two-tone intermodulation test I_C = 60 mA, V_{CE} = 15 V, d_{IM} = 60 dB f_1 = 206 MHz, f_2 = 210 MHz, $Z_S = Z_L$ = 50 Ω	$V_{o1} = V_{o2}$	–	480	–	mV
Third order intercept point I_C = 60 mA, V_{CE} = 15 V, f = 200 MHz	IP_3	–	36.5	–	dBm

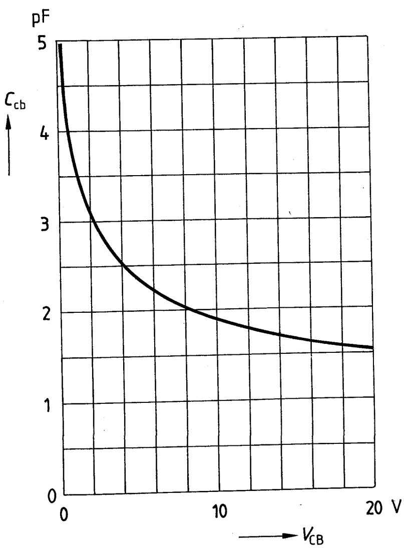
Total power dissipation $P_{tot} = f(T_A)$
Package mounted on alumina



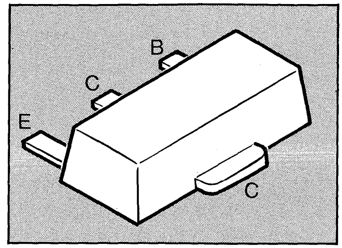
Transition frequency $f_T = f(I_C)$
$V_{CE} = 5$ V, $f = 200$ MHz



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



- For low-distortion broadband amplifiers in antenna and telecommunications systems at collector currents from 10 to 70 mA.



For new design refer to BFQ 19S

Type	Marking	Ordering code (tape and reel)	Package[1])
BFQ 19P	FE	Q 62702 – F1060	SOT-89

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CEO}	15	V
Collector-base voltage	V_{CBO}	20	V
Emitter-base voltage	V_{EBO}	3	V
Collector current	I_C	75	mA
Peak collector current, $f \geq 1$ MHz	I_{CM}	150	mA
Total power dissipation, $T_A \leq 25$ °C[2])	P_{tot}	1	W
Junction temperature	T_j	150	°C
Ambient temperature range	T_A	–65 ... +150	°C
Storage temperature range	T_{stg}	–65 ... +150	°C

Thermal Resistance

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

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

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

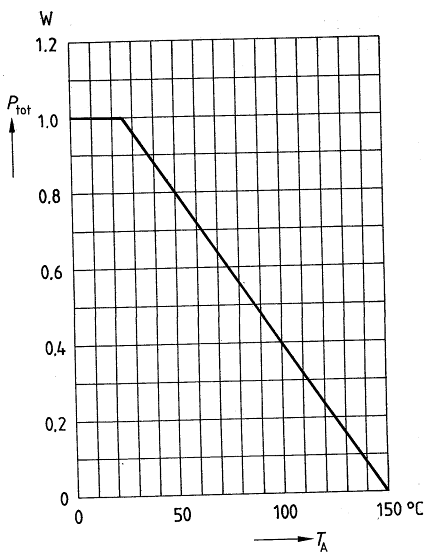
DC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CEO}$	15	–	–	V
Collector-base cutoff current V_{CB} = 10 V, I_E = 0	I_{CBO}	–	–	100	nA
Emitter-base cutoff current V_{EB} = 2 V, I_C = 0	I_{EBO}	–	–	10	µA
DC current gain I_C = 50 mA, V_{CE} = 10 V	h_{FE}	25	70	–	–
Collector-emitter saturation voltage I_C = 75 mA, I_B = 7.5 mA	V_{CEsat}	–	0.2	0.5	V

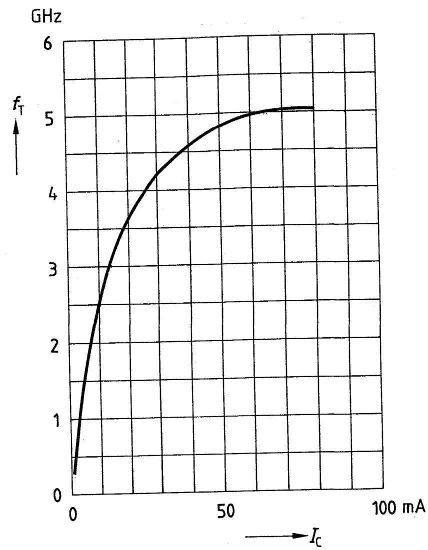
AC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
Transition frequency $I_C = 50$ mA, $V_{CE} = 10$ V, $f = 200$ MHz $I_C = 75$ mA, $V_{CE} = 10$ V, $f = 200$ MHz	f_T	 4 4.4	 4.8 5.1	 – –	GHz
Collector-base capacitance $V_{CB} = 10$ V, $V_{BE} = v_{be} = 0$, $f = 1$ MHz	C_{cb}	–	1.1	1.5	pF
Collector-emitter capacitance $V_{CE} = 10$ V, $V_{BE} = v_{be} = 0$, $f = 1$ MHz	C_{ce}	–	0.4	–	pF
Output capacitance $V_{CE} = 10$ V, $V_{BE} = v_{be} = 0$, $f = 1$ MHz	C_{obs}	–	1.5	–	pF
Noise figure $I_C = 50$ mA, $V_{CE} = 10$ V, $f = 800$ MHz, $Z_S = Z_{Sopt}$	F	–	3.8	–	dB
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	–	dB
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, $Z_S = Z_L = 50\ \Omega$	$V_{o1} = V_{o2}$	–	500	–	mV
Third order intercept point $I_C = 70$ mA, $V_{CE} = 10$ V, $f = 800$ MHz	IP_3	–	37	–	dBm

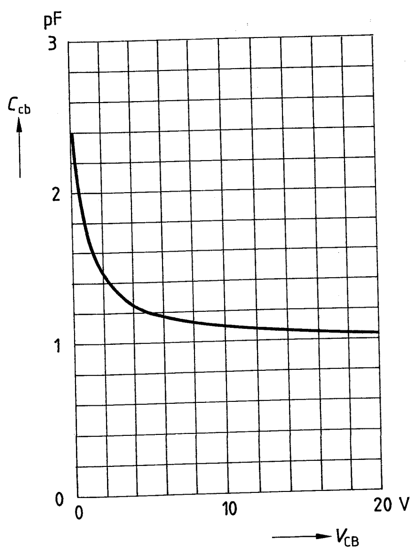
Total power dissipation $P_{tot} = f(T_A)$
Package mounted on alumina



Transition frequency $f_T = f(I_C)$
$V_{CE} = 10$ V, $f = 200$ MHz

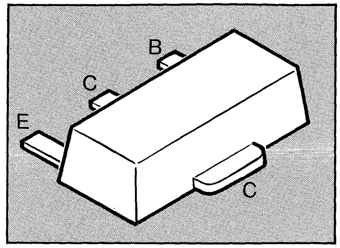


Collector-base capacitance $C_{cb} = f(V_{CB})$
$V_{BE} = v_{be} = 0$, $f = 1$ MHz



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 to 70 mA.
- CECC-type available: CECC 50002/259.



Type	Marking	Ordering code (tape and reel)	Package[1])
BFQ 19S	FG	Q 62702 – F1088	SOT-89

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CEO}	15	V
Collector-base voltage	V_{CBO}	20	V
Emitter-base voltage	V_{EBO}	3	V
Collector current	I_C	75	mA
Peak collector current, $f \geq 1$ MHz	I_{CM}	150	mA
Base current	I_B	10	mA
Total power dissipation, $T_A \leq 25$ °C[2])	P_{tot}	1	W
Junction temperature	T_j	150	°C
Ambient temperature range	T_A	–65 ... +150	°C
Storage temperature range	T_{stg}	–65 ... +150	°C

Thermal Resistance

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

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

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

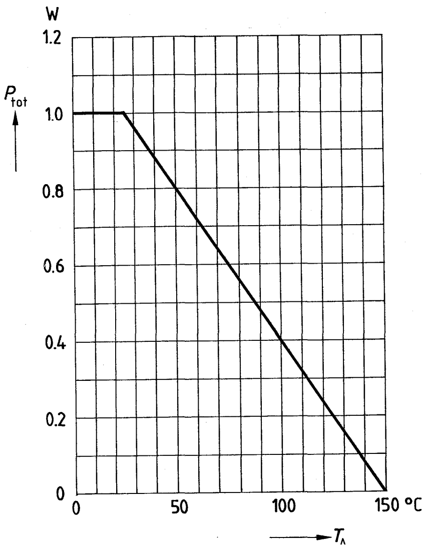
DC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CEO}$	15	–	–	V
Collector-base cutoff current V_{CB} = 10 V, I_E = 0	I_{CBO}	–	–	100	nA
Emitter-base cutoff current V_{EB} = 2 V, I_C = 0	I_{EBO}	–	–	10	µA
DC current gain I_C = 50 mA, V_{CE} = 10 V	h_{FE}	25	70	–	–
Collector-emitter saturation voltage I_C = 75 mA, I_B = 7.5 mA	V_{CEsat}	–	0.2	0.5	V

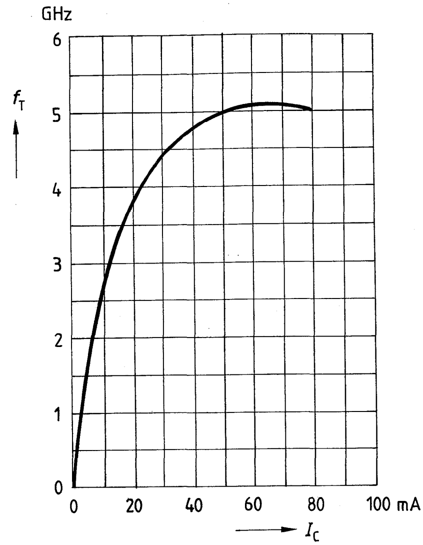
AC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
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 5.1	 – –	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}	–	0.4	–	pF
Input capacitance $V_{EB} = 0.5$ V, $I_C = i_c = 0$, $f = 1$ MHz	C_{ibo}	–	4.5	–	pF
Output capacitance $V_{CE} = 10$ V, $V_{BE} = v_{be} = 0$, $f = 1$ MHz	C_{obs}	–	1.45	–	pF
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 2.8	 – –	dB
Power gain $I_C = 70$ mA, $V_{CE} = 10$ V, $f = 800$ MHz, $Z_S = 50\ \Omega$, $Z_L = Z_{Lopt}$	G_{pe}	–	11.8	–	dB
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, $Z_S = Z_L = 50\ \Omega$	$V_{o1} = V_{o2}$	–	520	–	mV
Third order intercept point $I_C = 70$ mA, $V_{CE} = 10$ V, $f = 800$ MHz	IP_3	–	37.5	–	dBm

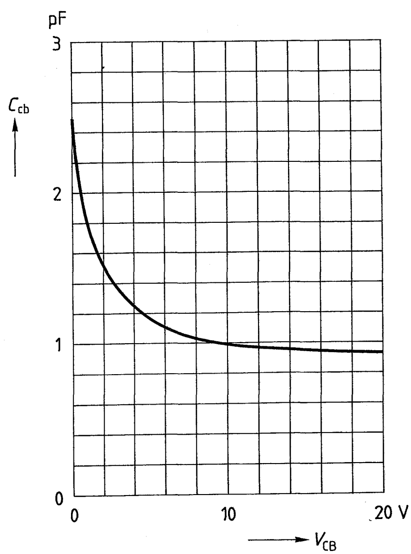
Total power dissipation $P_{tot} = f\,(T_A)$
Package mounted on alumina



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

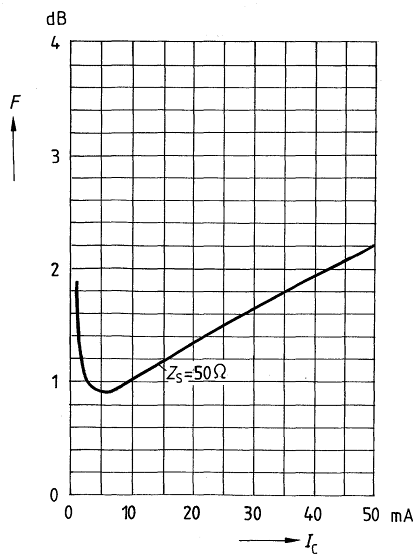
I_C = 5 mA, V_{CE} = 10 V, Z_0 = 50 Ω

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

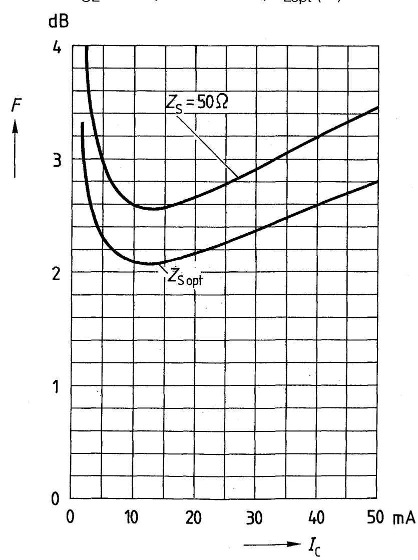
I_C = 50 mA, V_{CE} = 10 V, Z_0 = 50 Ω

f	F_{min}	G_p (F_{min})	Γ_{opt}		R_N	N	$F_{50\,\Omega}$	G_p ($F_{50\,\Omega}$)
GHz	dB	dB	MAG	ANG	Ω	–	dB	dB
0.01	2.2	–	–	–	–	–	2.2	–
0.8	2.8	–	–	–	–	–	3.5	–

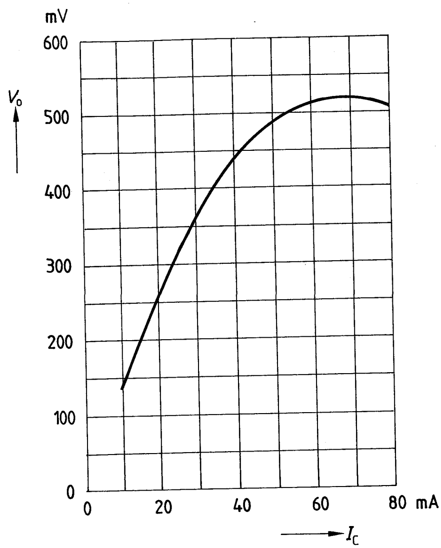
Noise figure F = f (I_C)
V_{CE} = 10 V, f = 10 MHz



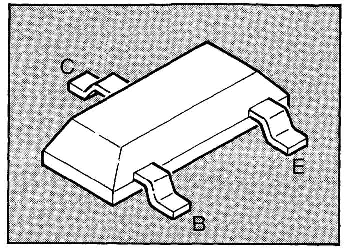
Noise figure F = f (I_C)
V_{CE} = 10 V, f = 800 MHz, Z_{Lopt} (G)



Linear output voltage $V_O = f(I_C)$
$V_{CE} = 10$ V, $d_{IM} = 60$ dB, $f_1 = 806$ MHz
$f_2 = 810$ MHz, $Z_S = Z_L = 50\ \Omega$



- For low-noise IF and broadband amplifiers up to 1 GHz at collector currents from 1 to 20 mA.
- CECC-type available: CECC 50002/258.



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

Type	Marking	Ordering code (tape and reel)	Package[1])
BFQ 29P	KC	Q 62702 – F659	SOT-23

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CEO}	15	V
Collector-base voltage	V_{CBO}	20	V
Emitter-base voltage	V_{EBO}	3	V
Collector current	I_C	30	mA
Base current	I_B	4	mA
Total power dissipation, $T_A \leq 25$ °C[2])	P_{tot}	280	mW
Junction temperature	T_j	150	°C
Ambient temperature range	T_A	–65 ... +150	°C
Storage temperature range	T_{stg}	–65 ... +150	°C

Thermal Resistance

Junction – ambient[2])	R_{thJA}	≤450	K/W

1) For detailed dimensions 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.

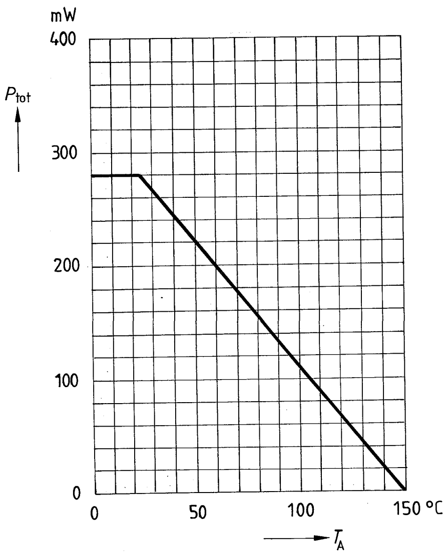
DC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CEO}$	15	–	–	V
Collector-base cutoff current V_{CB} = 10 V, I_E = 0 V_{CB} = 20 V, I_E = 0	I_{CBO}	 – –	 – –	 0.05 10	µA
Emitter-base cutoff current V_{EB} = 3 V, I_C = 0	I_{EBO}	–	–	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

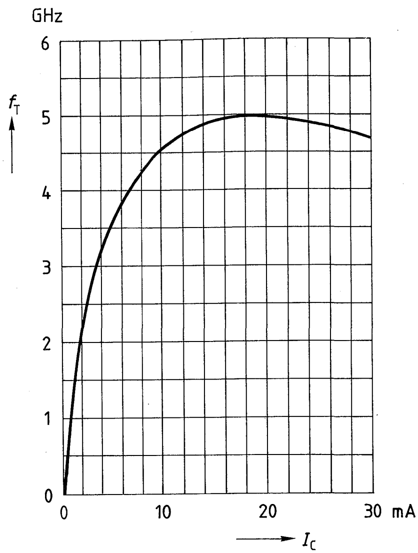
AC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
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	–	pF
Input capacitance $V_{EB} = 0.5$ V, $I_C = i_c = 0$, $f = 1$ MHz	C_{ibo}	–	1.35	–	pF
Output capacitance $V_{CE} = 10$ V, $V_{BE} = v_{be} = 0$, $f = 1$ MHz	C_{obs}	–	0.8	–	pF
Noise figure $I_C = 3$ mA, $V_{CE} = 6$ V, $f = 10$ MHz, $Z_S = 75\ \Omega$ $I_C = 4$ mA, $V_{CE} = 6$ V, $f = 800$ MHz, $Z_S = 50\ \Omega$	F	 – –	 0.9 1.5	 1.2 –	dB
Power gain $I_C = 20$ mA, $V_{CE} = 6$ V, $f = 800$ MHz, $Z_S = 50\ \Omega$, $Z_L = Z_{Lopt}$	G_{pe}	–	14	–	dB
Transducer gain $I_C = 20$ mA, $V_{CE} = 6$ V, $f = 1$ GHz, $Z_0 = 50\ \Omega$	$\|S_{21e}\|^2$	–	11	–	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, $Z_S = Z_L = 50\ \Omega$	$V_{o1} = V_{o2}$	–	180	–	mV
Third order intercept point $I_C = 20$ mA, $V_{CE} = 6$ V, $f = 800$ MHz	IP_3	–	28	–	dBm

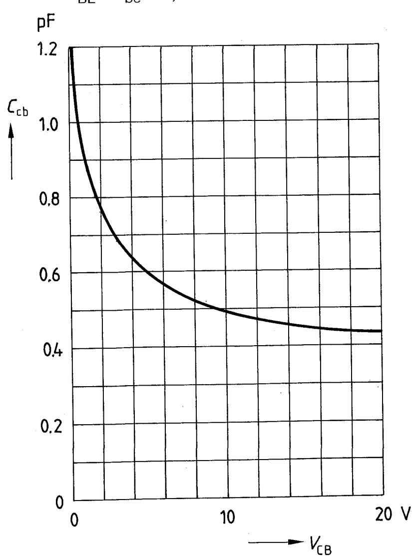
Total power dissipation $P_{tot} = f(T_A)$
Package mounted on alumina



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



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



Common Emitter Noise Parameters

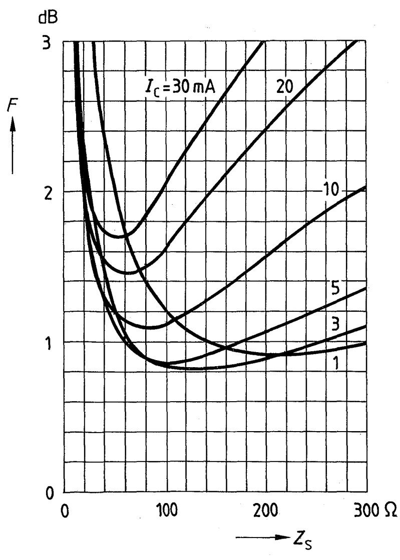
I_C = 3 mA, V_{CE} = 6 V, Z_0 = 50 Ω

f	F_{min}	G_p (F_{min})	Γ_{opt}		R_N	N	$F_{50\,\Omega}$	G_p ($F_{50\,\Omega}$)
GHz	dB	dB	MAG	ANG	Ω	–	dB	dB
0.01	0.85	–	(Z_S = 130 Ω)		–	–	1.2	–

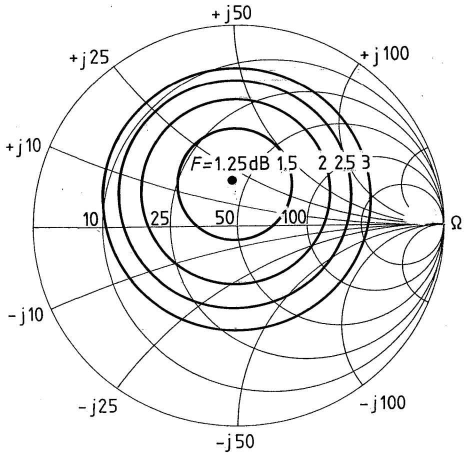
I_C = 5 mA, V_{CE} = 6 V, Z_0 = 50 Ω

f	F_{min}	G_p (F_{min})	Γ_{opt}		R_N	N	$F_{50\,\Omega}$	G_p ($F_{50\,\Omega}$)
GHz	dB	dB	MAG	ANG	Ω	–	dB	dB
0.01	0.85	–	(Z_S = 100 Ω)		–	–	1.1	–
0.8	1.25	13	0.25	93.5	11.1	0.20	1.45	14

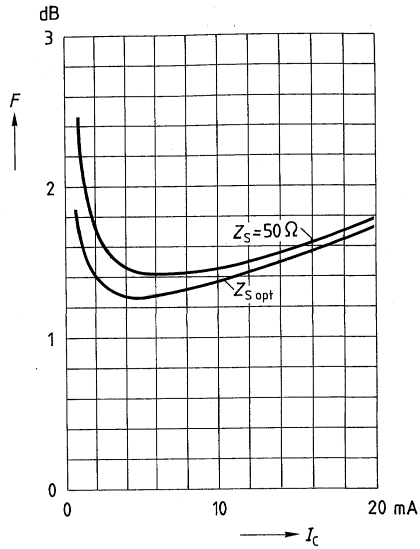
Noise figure F = f (Z_S)
V_{CE} = 6 V, f = 10 MHz



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



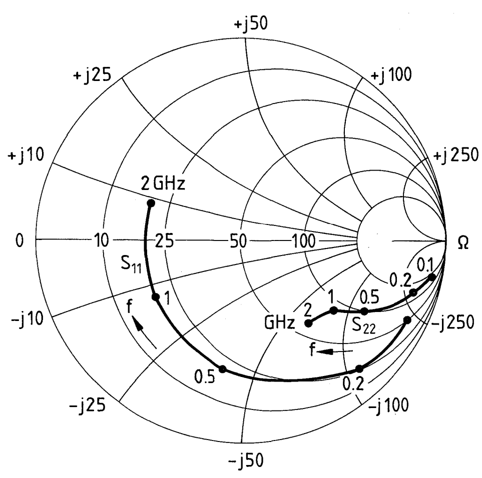
Noise figure $F = f(I_C)$
$V_{CE} = 6$ V, $f = 800$ MHz, Z_{Lopt} (G)



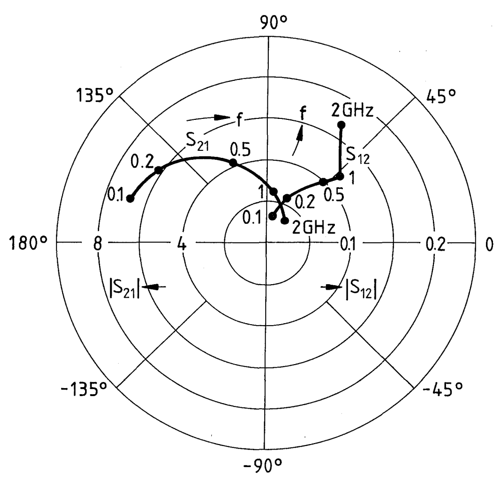
Common Emitter S Parameters
I_C = 2 mA, V_{CE} = 6 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.93	– 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



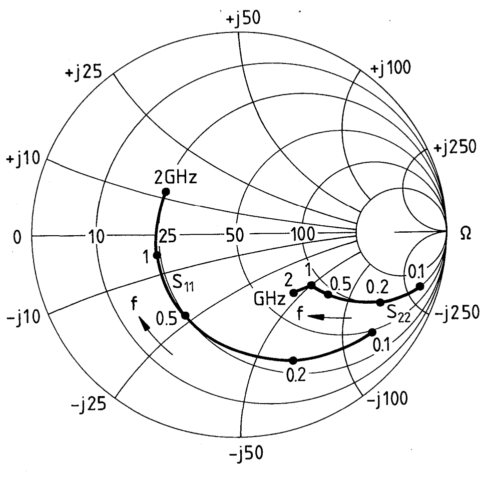
S_{12}, S_{21} = f (*f*)
I_C = 2 mA, V_{CE} = 6 V, Z_0 = 50 Ω



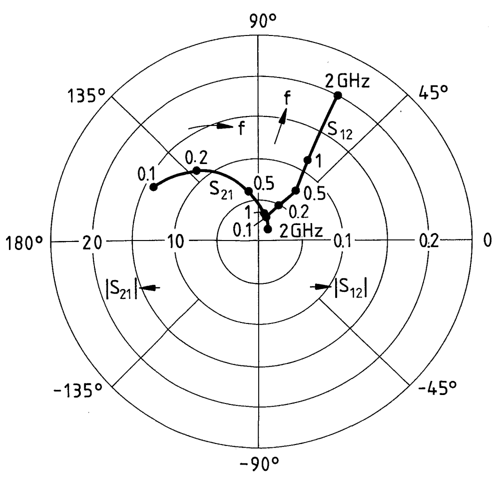
I_C = 5 mA, V_{CE} = 6 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.80	– 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



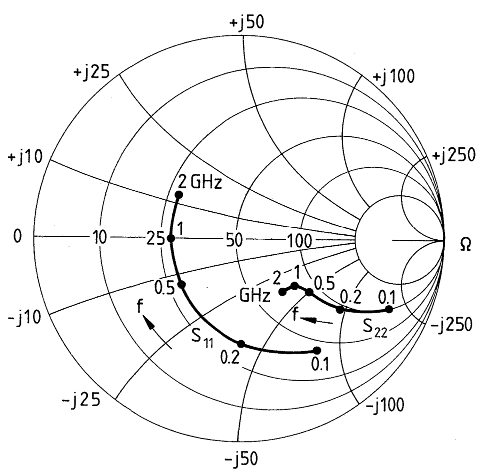
S_{12}, S_{21} = f (f)
I_C = 5 mA, V_{CE} = 6 V, Z_0 = 50 Ω



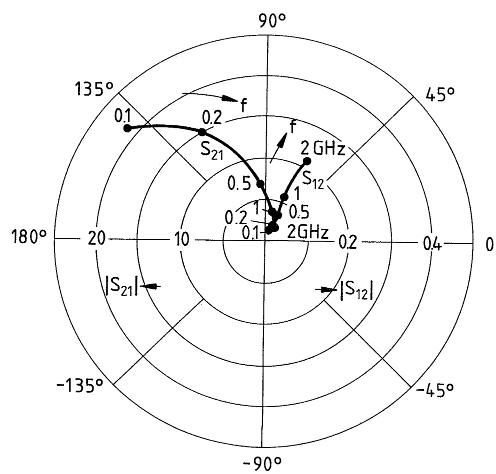
I_C = 10 mA, V_{CE} = 6 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.65	– 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



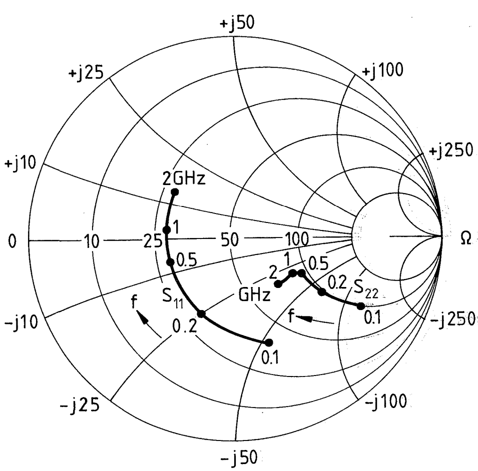
S_{12}, S_{21} = f (*f*)
I_C = 10 mA, V_{CE} = 6 V, Z_0 = 50 Ω



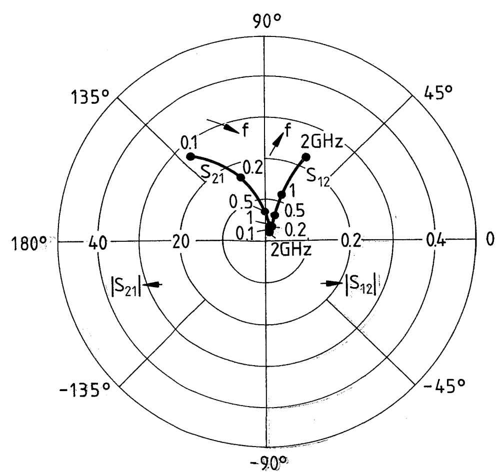
I_C = 20 mA, V_{CE} = 6 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.47	– 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

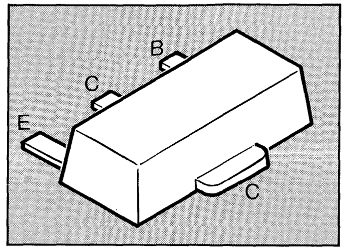
S_{11}, S_{22} = f (*f*)
I_C = 20 mA, V_{CE} = 6 V, Z_0 = 50 Ω



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



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



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

Maximum Ratings

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

Thermal Resistance

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

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

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

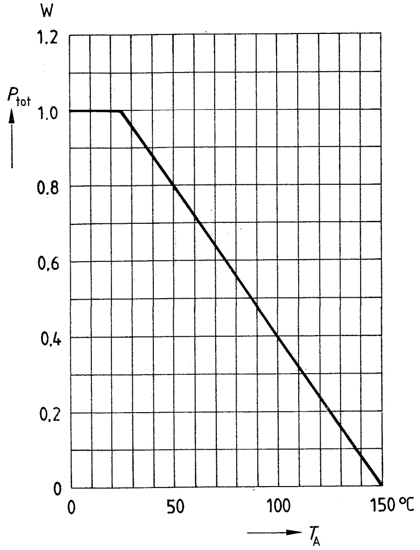
DC characteristics

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

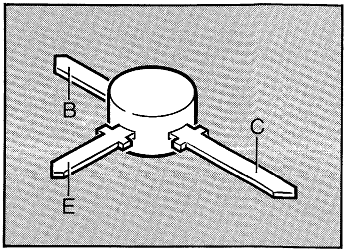
AC characteristics

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

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



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



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

Type	Marking	Ordering code	Package¹)
BFQ 69	BFQ 69	Q 62702 – F780	T-plast

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CEO}	15	V
Collector-base voltage	V_{CBO}	25	V
Emitter-base voltage	V_{EBO}	2	V
Collector current	I_C	30	mA
Base current	I_B	4	mA
Total power dissipation, $T_A \leq 30$ °C²)	P_{tot}	300	mW
Junction temperature	T_j	150	°C
Ambient temperature range	T_A	–65 ... +150	°C
Storage temperature range	T_{stg}	–65 ... +150	°C

Thermal Resistance

Junction – ambient²)	R_{thJA}	≤400	K/W

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

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

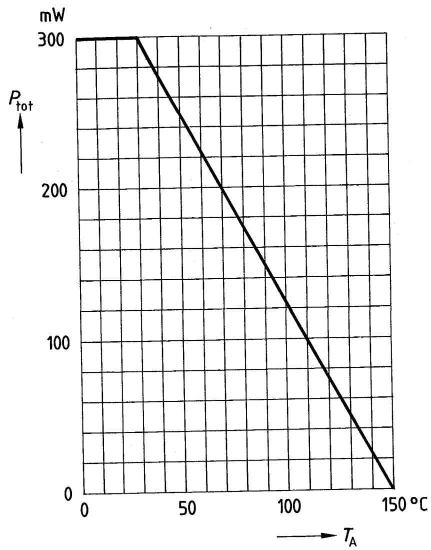
DC characteristics

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

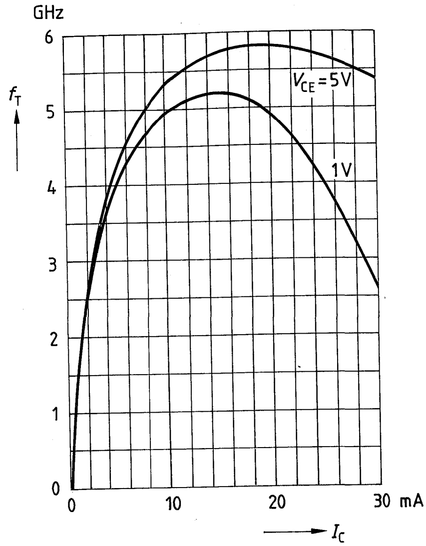
AC characteristics

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

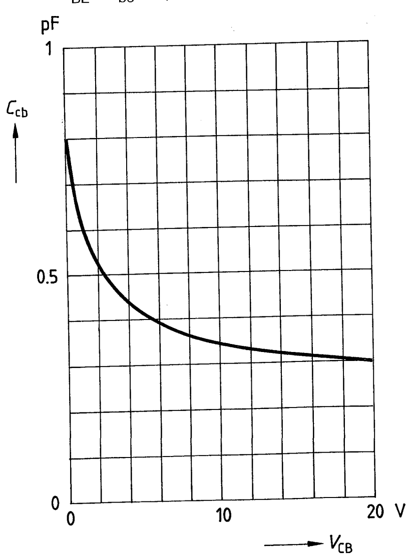
Total power dissipation $P_{tot} = f(T_A)$
Package mounted on glass epoxy



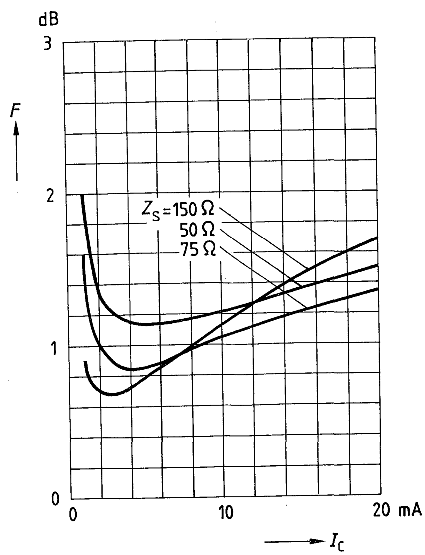
Transition frequency $f_T = f(I_C)$
$f = 200$ MHz



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



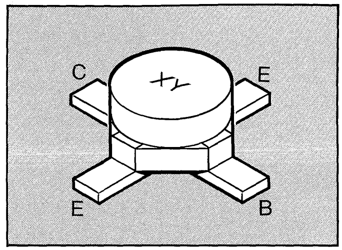
Noise figure $F = f(I_C)$
$V_{CE} = 10$ V, $f = 10$ MHz



NPN Silicon RF Transistor

BFQ 70

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



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

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

Maximum Ratings

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

Thermal Resistance

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

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

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

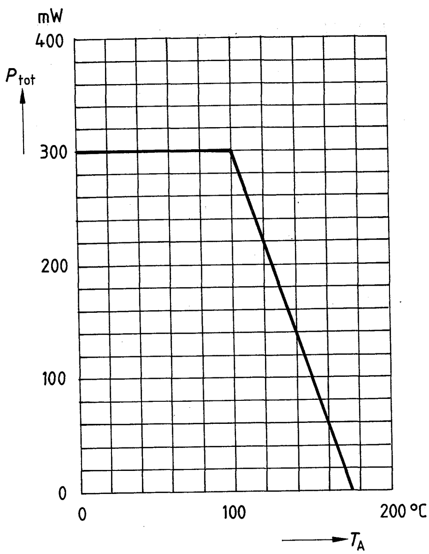
DC characteristics

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

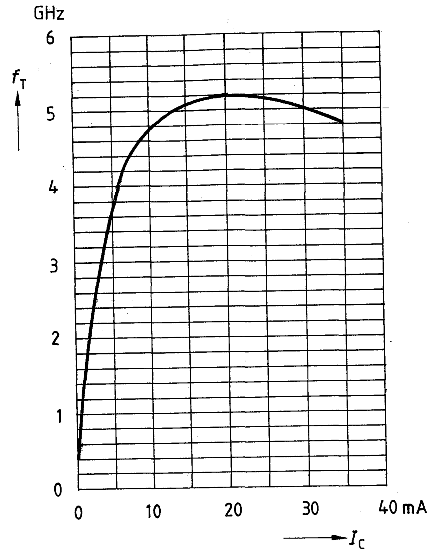
AC characteristics

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

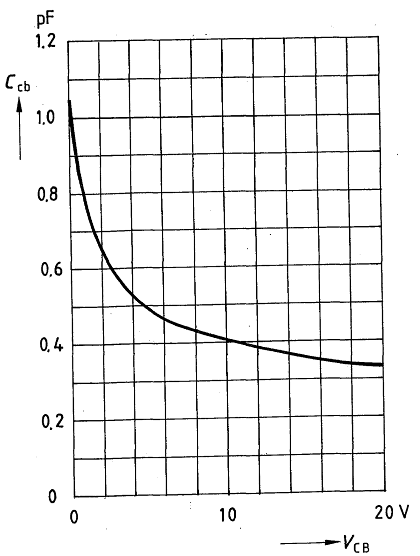
Total power dissipation $P_{tot} = f(T_A)$
Package mounted on alumina



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



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



Common Emitter Noise Parameters

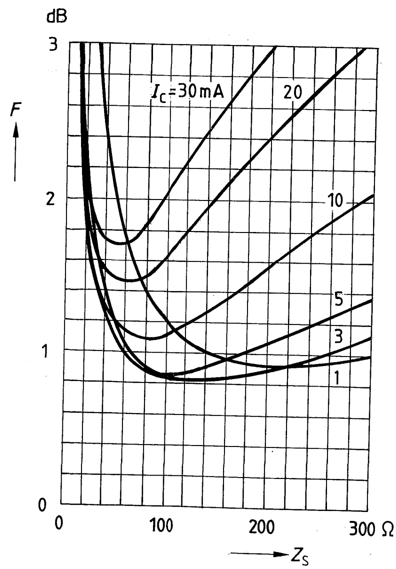
I_C = 3 mA, V_{CE} = 6 V, Z_0 = 50 Ω

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

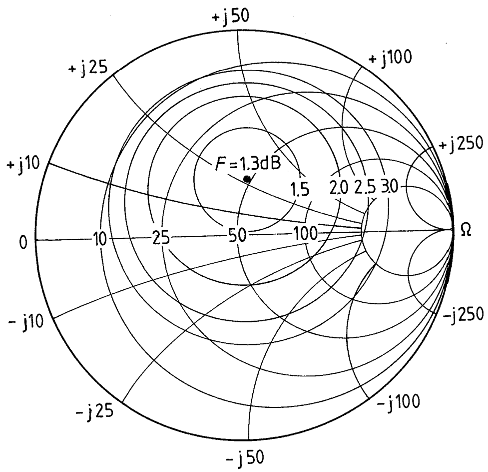
I_C = 5 mA, V_{CE} = 6 V, Z_0 = 50 Ω

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

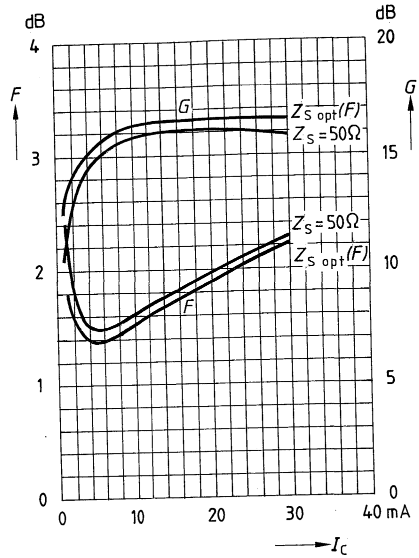
Noise figure F = f (Z_S)
V_{CE} = 6 V, f = 10 MHz



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

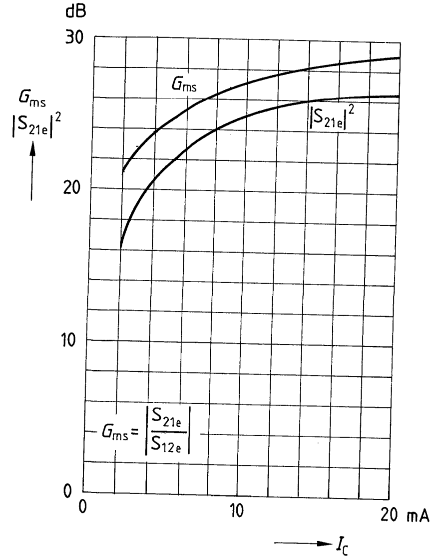


Noise figure $F = f(I_C)$
Power gain $G = f(I_C)$
$V_{CE} = 6$ V, $f = 800$ MHz, $Z_{Lopt}(G)$

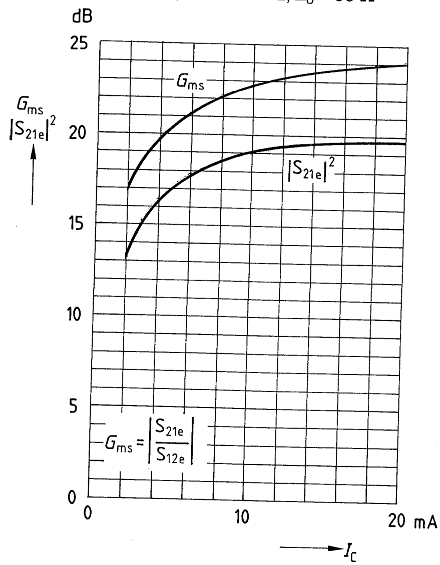


Common Emitter Power Gain

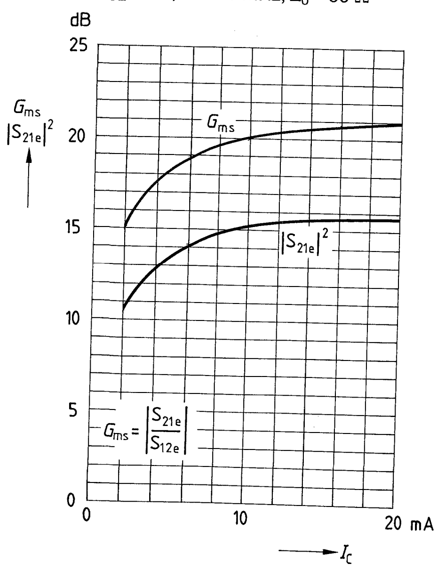
Power gain G_{ms}, $|S_{21e}|^2 = f(I_C)$
$V_{CE} = 6$ V, $f = 200$ MHz, $Z_0 = 50\ \Omega$



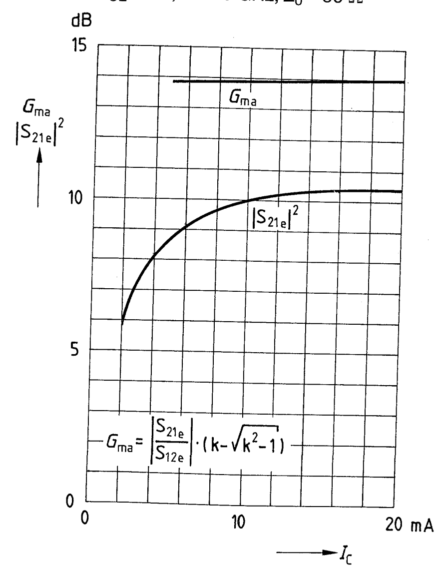
Power gain G_{ms}, $|S_{21e}|^2 = f(I_C)$
$V_{CE} = 6$ V, $f = 500$ MHz, $Z_0 = 50\ \Omega$



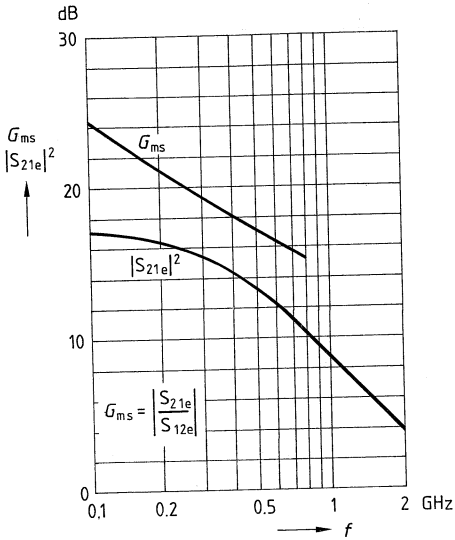
Power gain G_{ms}, $|S_{21e}|^2 = f(I_C)$
$V_{CE} = 6$ V, $f = 800$ MHz, $Z_0 = 50\ \Omega$



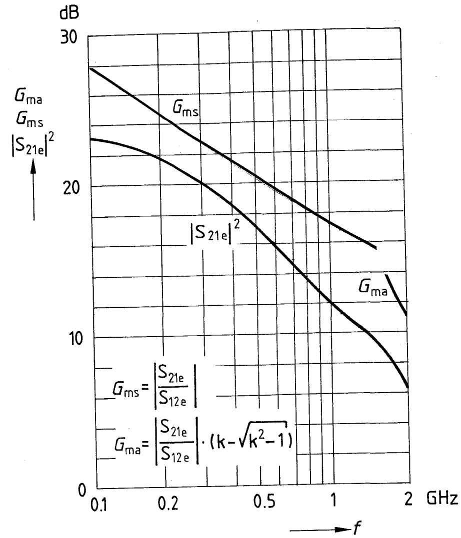
Power gain G_{ma}, $|S_{21e}|^2 = f(I_C)$
$V_{CE} = 6$ V, $f = 1.5$ GHz, $Z_0 = 50\ \Omega$



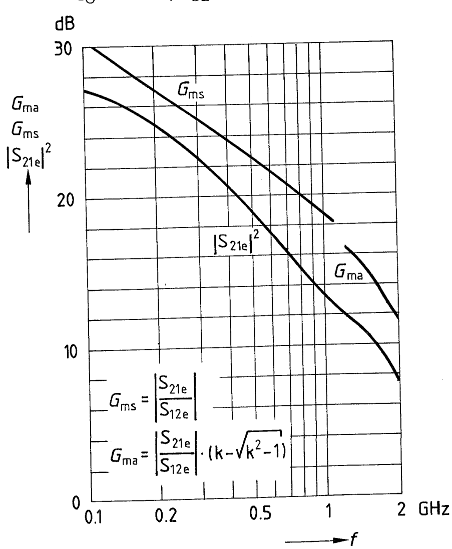
Power gain G_{ms}, $|S_{21e}|^2 = f(f)$
$I_C = 2$ mA, $V_{CE} = 6$ V, $Z_0 = 50\ \Omega$



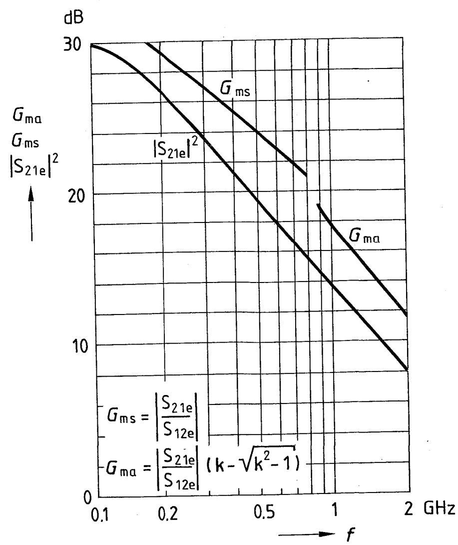
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
$I_C = 5$ mA, $V_{CE} = 6$ V, $Z_0 = 50\ \Omega$



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



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

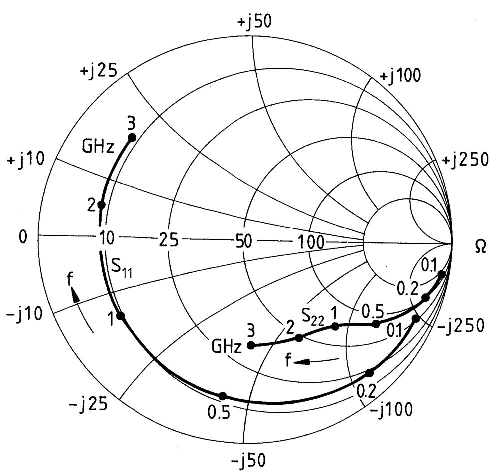


Common Emitter S Parameters

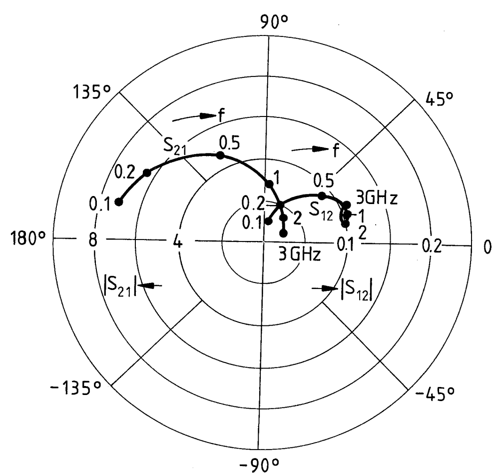
I_C = 2 mA, V_{CE} = 6 V, Z_0 = 50 Ω

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

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



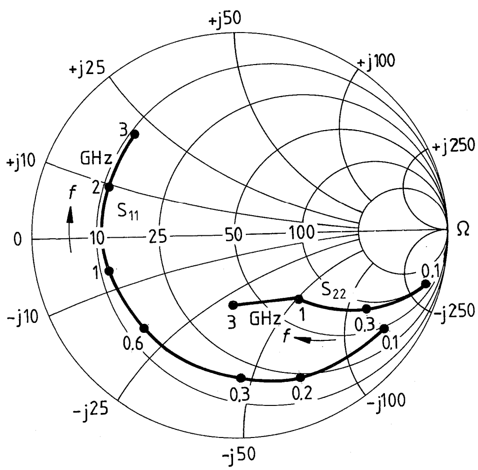
S_{12}, S_{21} = f (f)
I_C = 2 mA, V_{CE} = 6 V, Z_0 = 50 Ω



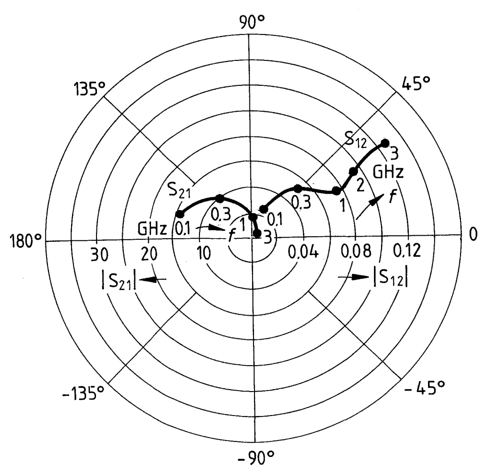
I_C = 5 mA, V_{CE} = 6 V, Z_0 = 50 Ω

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

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



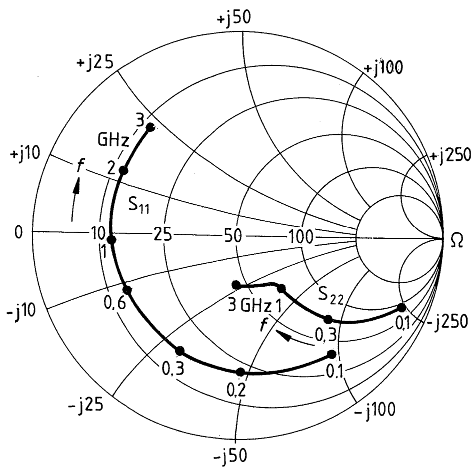
S_{12}, S_{21} = f (*f*)
I_C = 5 mA, V_{CE} = 6 V, Z_0 = 50 Ω



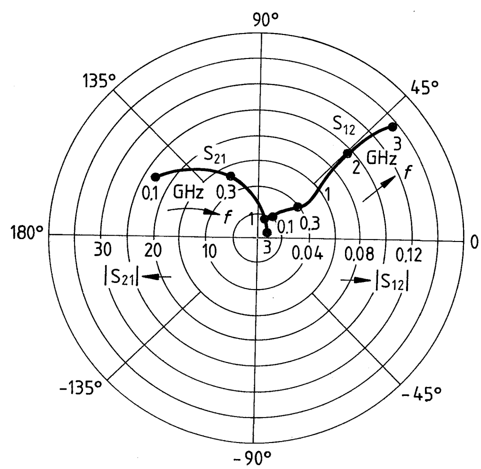
I_C = 10 mA, V_{CE} = 6 V, Z_0 = 50 Ω

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

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



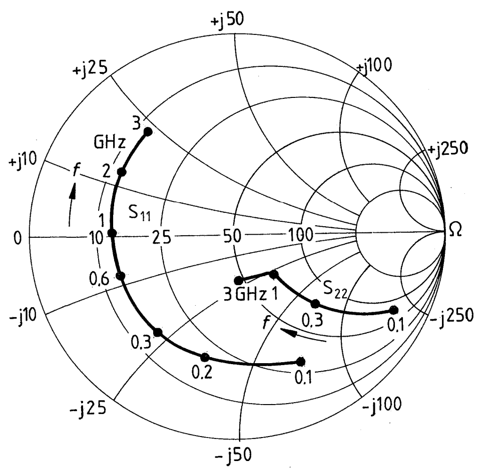
S_{12}, S_{21} = f (*f*)
I_C = 10 mA, V_{CE} = 6 V, Z_0 = 50 Ω



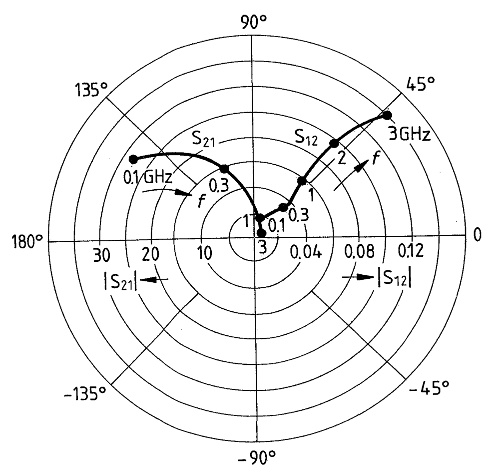
I_C = 15 mA, V_{CE} = 6 V, Z_0 = 50 Ω

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

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



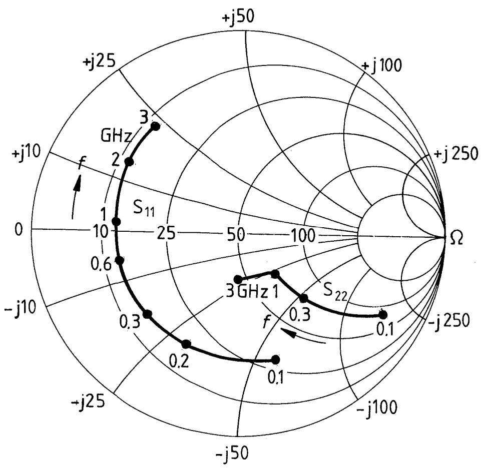
S_{12}, S_{21} = f (f)
I_C = 15 mA, V_{CE} = 6 V, Z_0 = 50 Ω



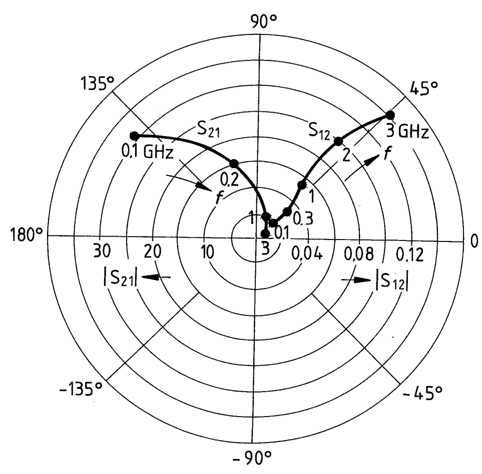
I_C = 20 mA, V_{CE} = 6 V, Z_0 = 50 Ω

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

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



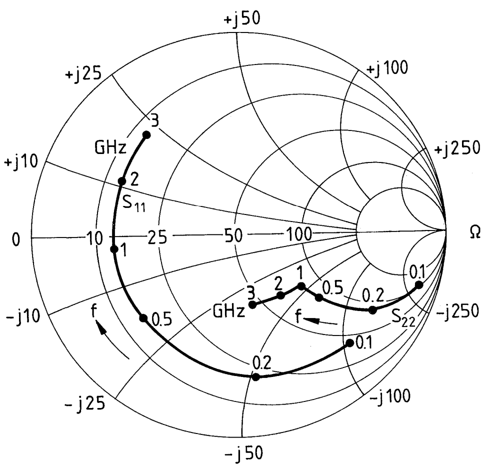
S_{12}, S_{21} = f (*f*)
I_C = 20 mA, V_{CE} = 6 V, Z_0 = 50 Ω



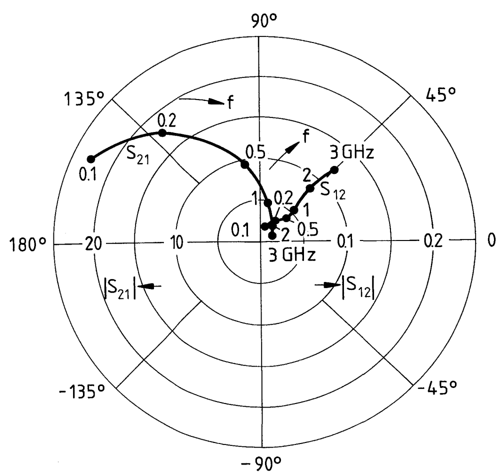
I_C = 10 mA, V_{CE} = 10 V, Z_0 = 50 Ω

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

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

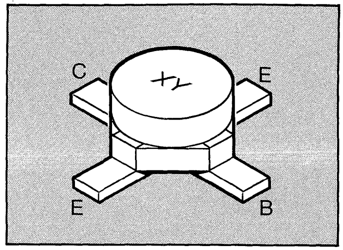


S_{12}, S_{21} = f (*f*)
I_C = 10 mA, V_{CE} = 10 V, Z_0 = 50 Ω



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

CECC-type available: CECC 50002/260.



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

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

Maximum Ratings

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

Thermal Resistance

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

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

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

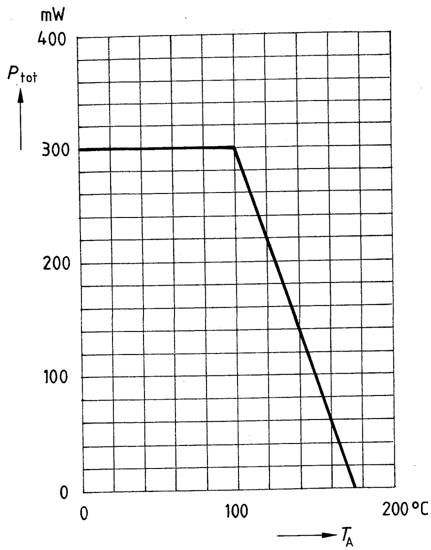
DC characteristics

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

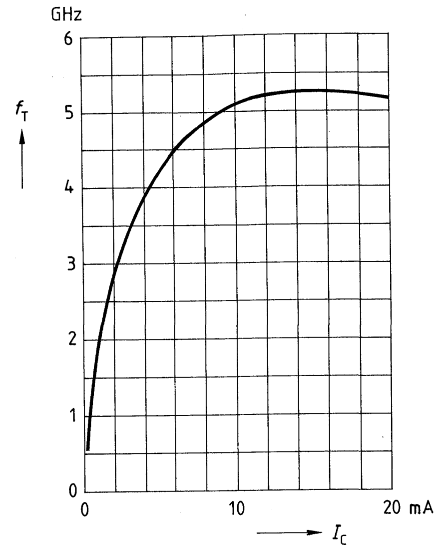
AC characteristics

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

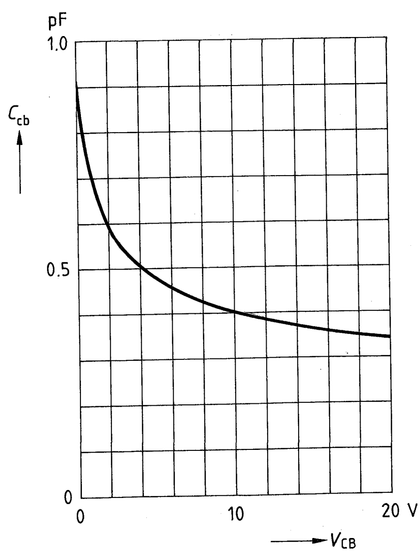
Total power dissipation $P_{tot} = f(T_A)$
Package mounted on alumina



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



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



Common Emitter Noise Parameters

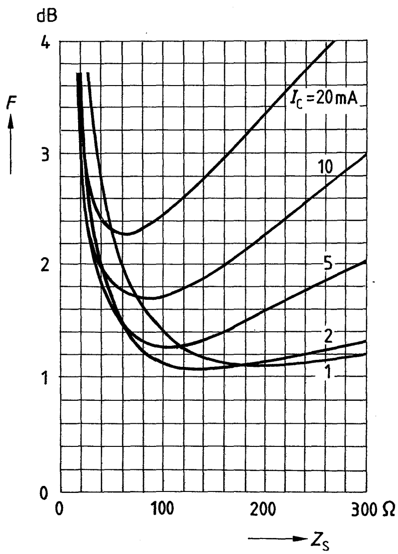
I_C = 2 mA, V_{CE} = 6 V, Z_0 = 50 Ω

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

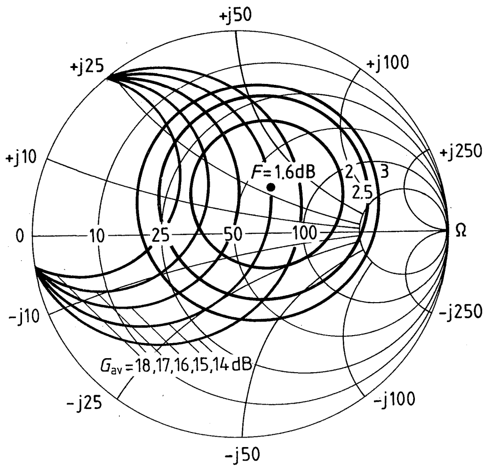
I_C = 5 mA, V_{CE} = 10 V, Z_0 = 50 Ω

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

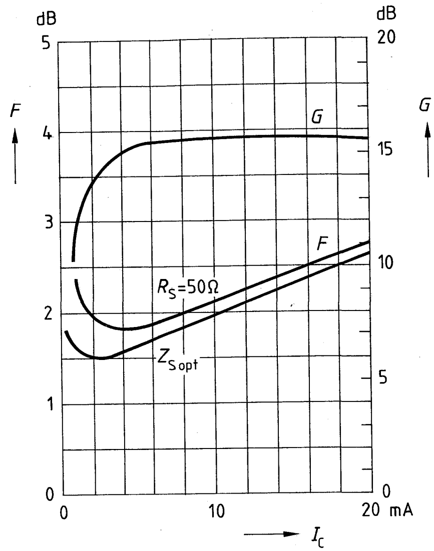
Noise figure F = f (Z_S)
V_{CE} = 6 V, f = 10 MHz



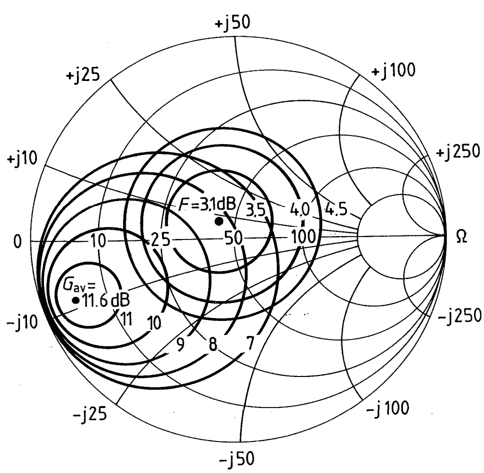
Circles of constant noise figure $F = f(Z_S)$ and available power gain $G_{av} = f(Z_S)$
$I_C = 5$ mA, $V_{CE} = 10$ V, $f = 800$ MHz



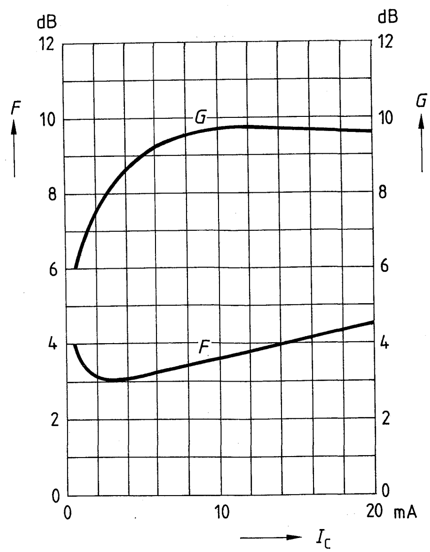
Noise figure $F = f(I_C)$
Power gain $G = f(I_C)$
$V_{CE} = 10$ V, $f = 800$ MHz, Z_{Lopt} (G)



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

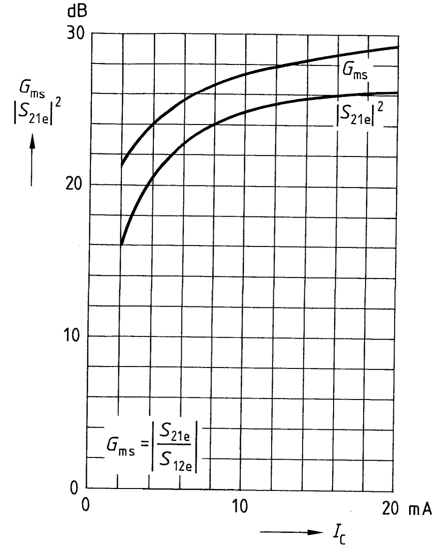


Noise figure $F = f(I_C)$
Power gain $G = f(I_C)$
$V_{CE} = 10$ V, $f = 2$ GHz, Z_{Lopt} (G)

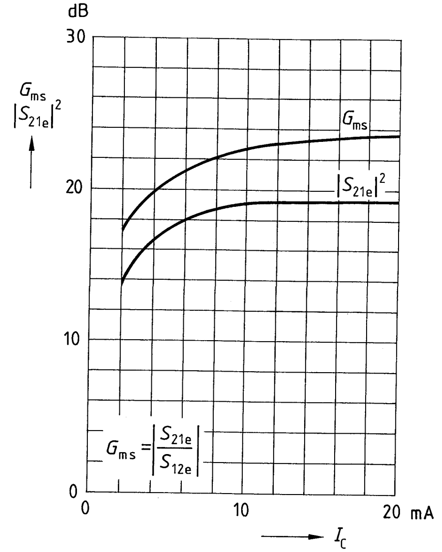


Common Emitter Power Gain

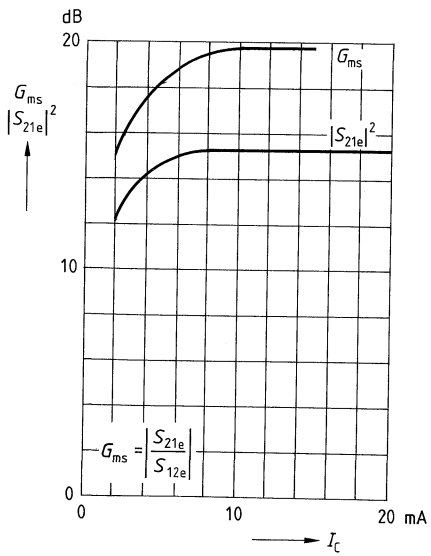
Power gain G_{ms}, $|S_{21e}|^2 = f(I_C)$
$V_{CE} = 6$ V, $f = 200$ MHz, $Z_0 = 50\ \Omega$



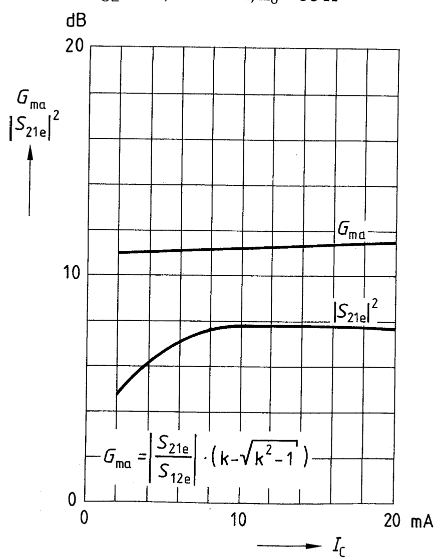
Power gain G_{ms}, $|S_{21e}|^2 = f(I_C)$
$V_{CE} = 6$ V, $f = 500$ MHz, $Z_0 = 50\ \Omega$



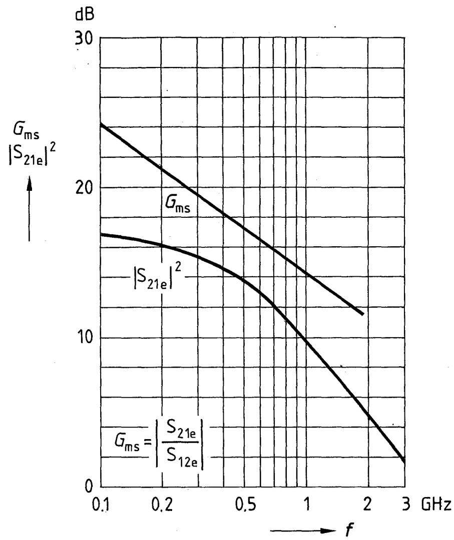
Power gain G_{ms}, $|S_{21e}|^2 = f(I_C)$
$V_{CE} = 6$ V, $f = 800$ MHz, $Z_0 = 50\ \Omega$



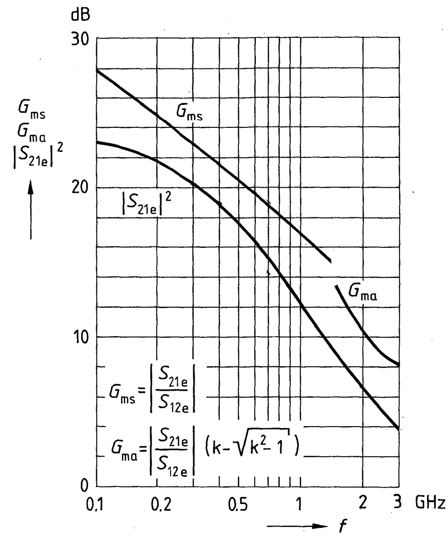
Power gain G_{ma}, $|S_{21e}|^2 = f(I_C)$
$V_{CE} = 6$ V, $f = 2$ GHz, $Z_0 = 50\ \Omega$



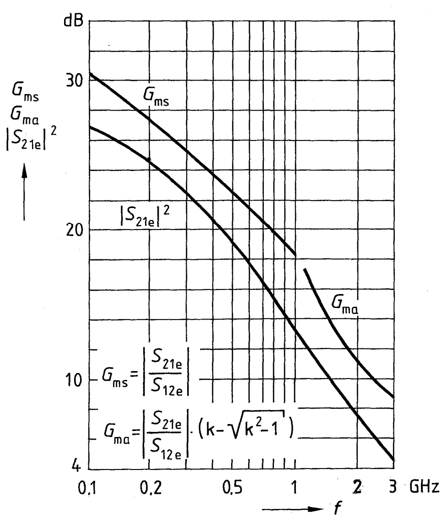
Power gain G_{ms}, $|S_{21e}|^2 = f(f)$
$I_C = 2$ mA, $V_{CE} = 6$ V, $Z_0 = 50\ \Omega$



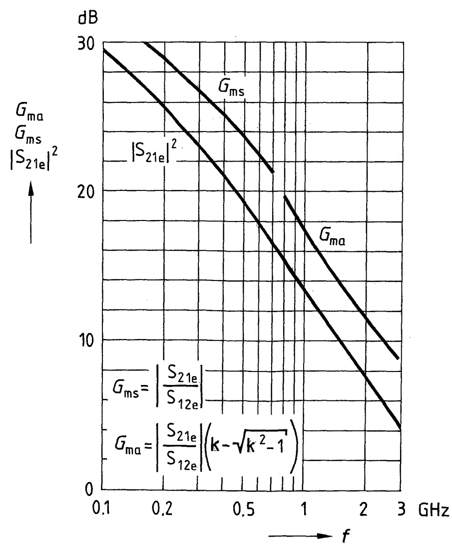
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
$I_C = 5$ mA, $V_{CE} = 6$ V, $Z_0 = 50\ \Omega$



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



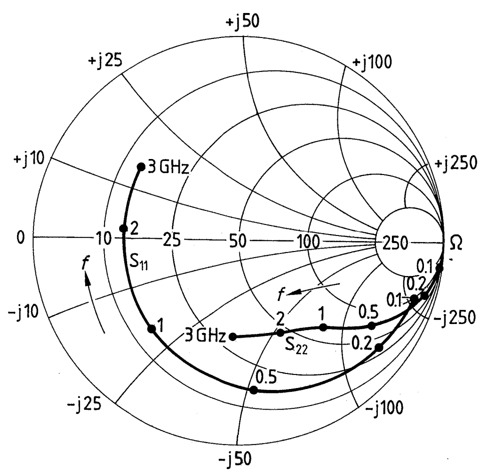
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
$I_C = 20$ mA, $V_{CE} = 6$ V, $Z_0 = 50\ \Omega$



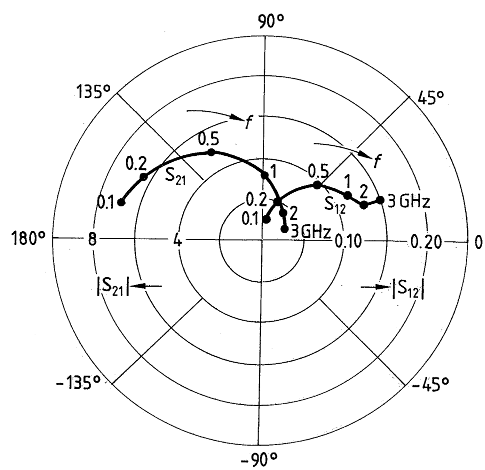
Common Emitter S Parameters
I_C = 2 mA, V_{CE} = 6 V, Z_0 = 50 Ω

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

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



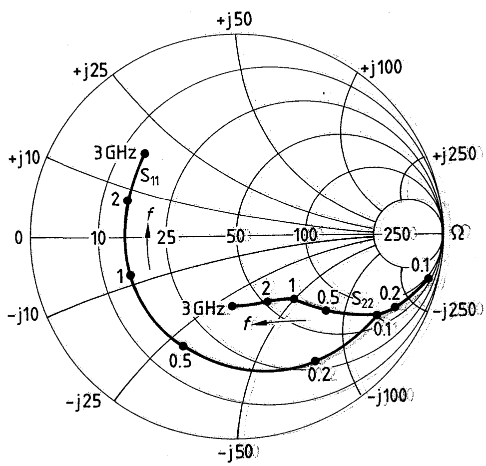
S_{12}, S_{21} = f (*f*)
I_C = 2 mA, V_{CE} = 6 V, Z_0 = 50 Ω



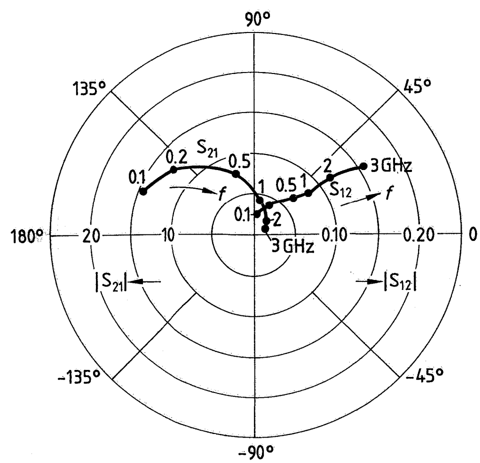
I_C = 5 mA, V_{CE} = 6 V, Z_0 = 50 Ω

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

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



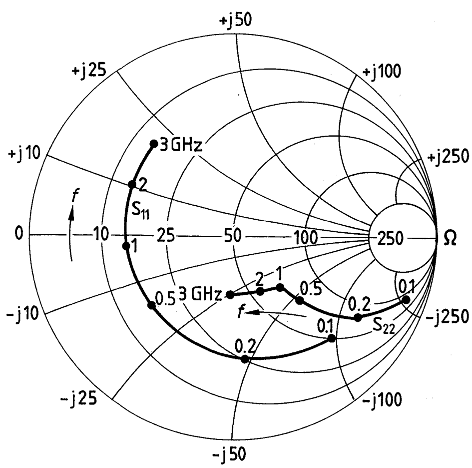
S_{12}, S_{21} = f (*f*)
I_C = 5 mA, V_{CE} = 6 V, Z_0 = 50 Ω



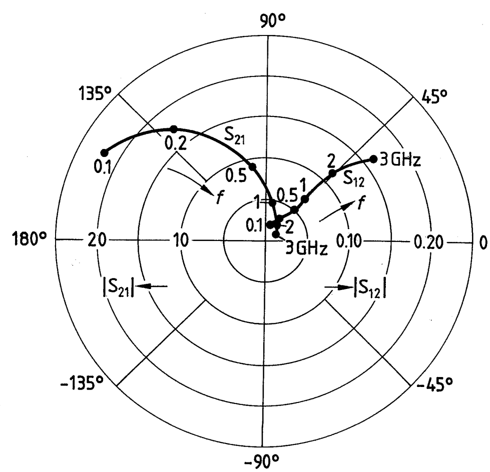
I_C = 10 mA, V_{CE} = 6 V, Z_0 = 50 Ω

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

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



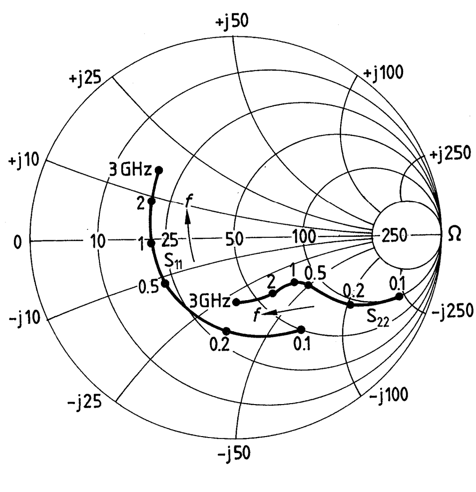
S_{12}, S_{21} = f (f)
I_C = 10 mA, V_{CE} = 6 V, Z_0 = 50 Ω



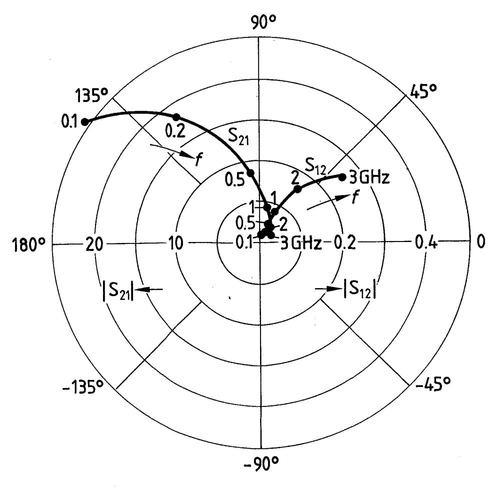
I_C = 15 mA, V_{CE} = 6 V, Z_0 = 50 Ω

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

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



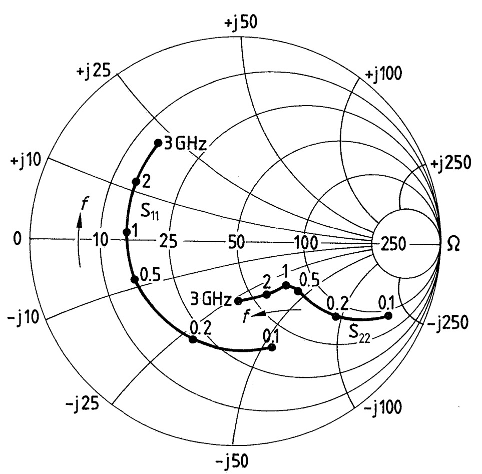
S_{12}, S_{21} = f (f)
I_C = 15 mA, V_{CE} = 6 V, Z_0 = 50 Ω



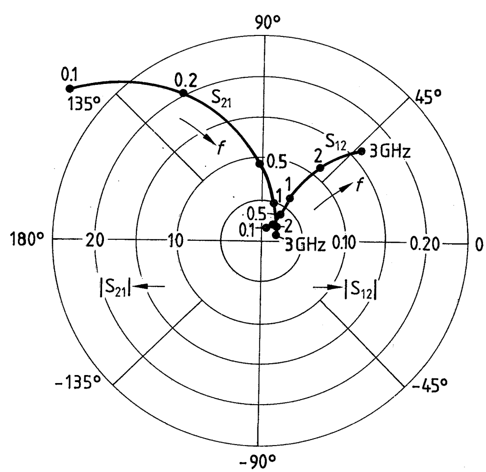
I_C = 20 mA, V_{CE} = 6 V, Z_0 = 50 Ω

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

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



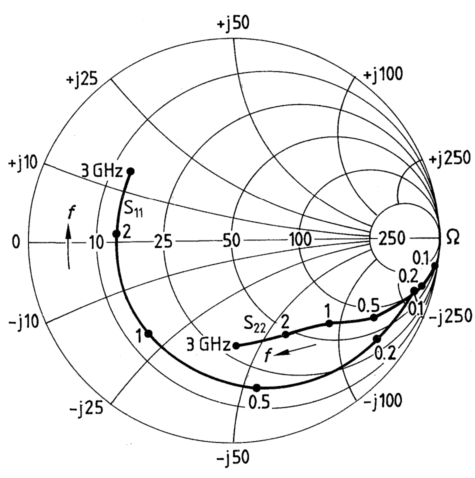
S_{12}, S_{21} = f (*f*)
I_C = 20 mA, V_{CE} = 6 V, Z_0 = 50 Ω



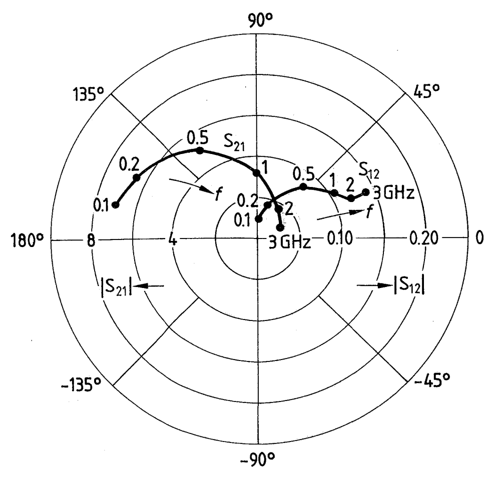
I_C = 2 mA, V_{CE} = 10 V, Z_0 = 50 Ω

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

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



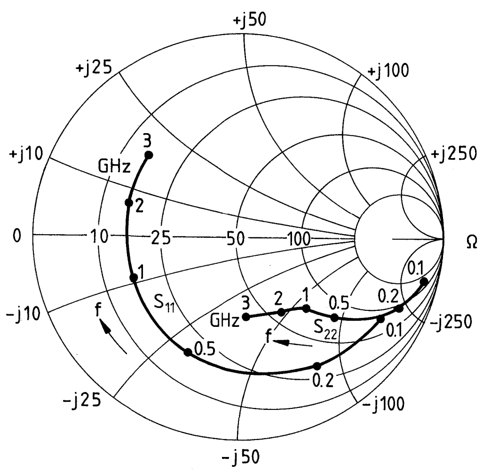
S_{12}, S_{21} = f (*f*)
I_C = 2 mA, V_{CE} = 10 V, Z_0 = 50 Ω



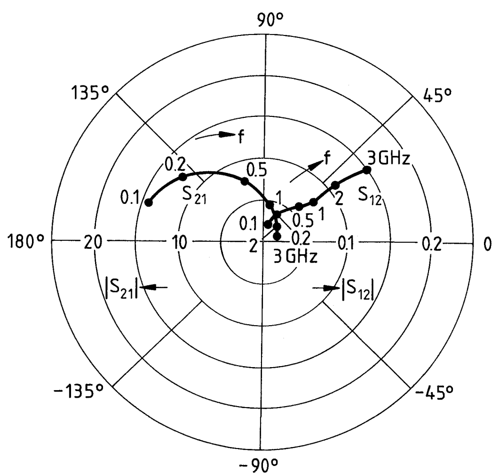
I_C = 5 mA, V_{CE} = 10 V, Z_0 = 50 Ω

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

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



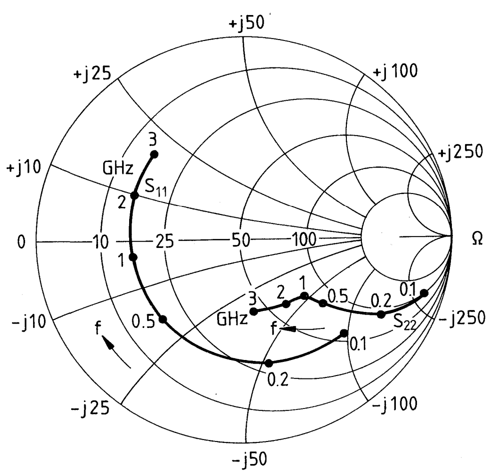
S_{12}, S_{21} = f (*f*)
I_C = 5 mA, V_{CE} = 10 V, Z_0 = 50 Ω



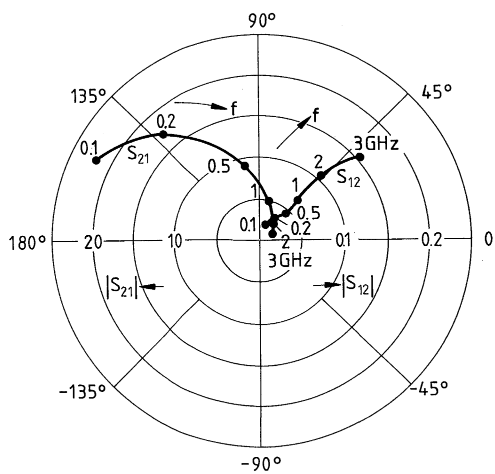
I_C = 10 mA, V_{CE} = 10 V, Z_0 = 50 Ω

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

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



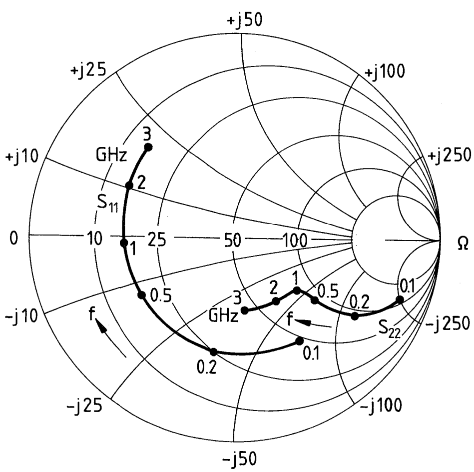
S_{12}, S_{21} = f (*f*)
I_C = 10 mA, V_{CE} = 10 V, Z_0 = 50 Ω



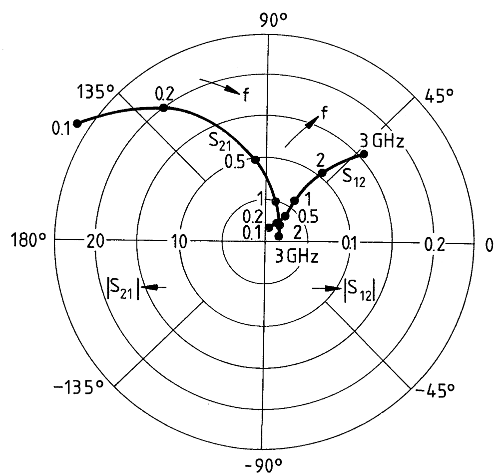
I_C = 15 mA, V_{CE} = 10 V, Z_0 = 50 Ω

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

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



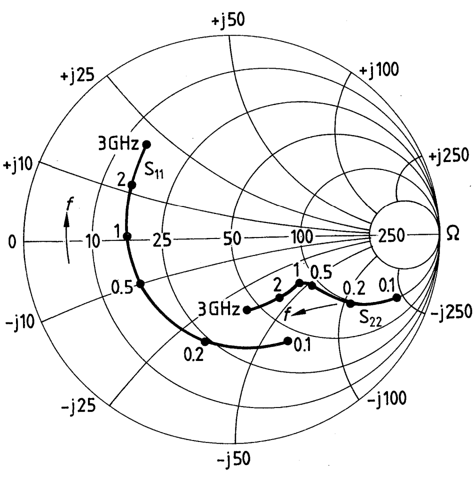
S_{12}, S_{21} = f (*f*)
I_C = 15 mA, V_{CE} = 10 V, Z_0 = 50 Ω



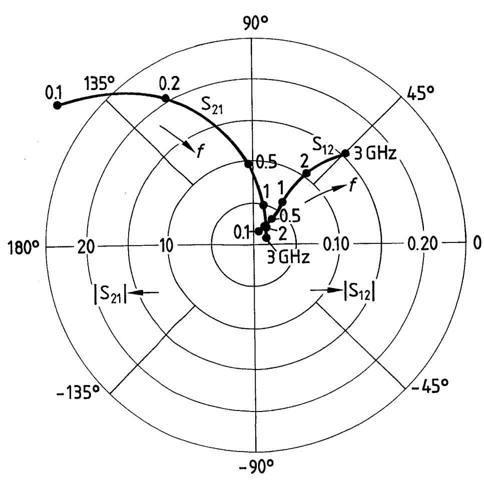
I_C = 20 mA, V_{CE} = 10 V, Z_0 = 50 Ω

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

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



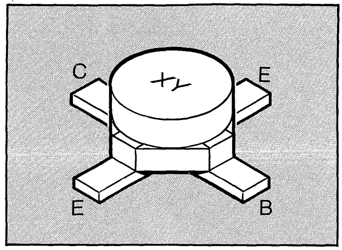
S_{12}, S_{21} = f (f)
I_C = 20 mA, V_{CE} = 10 V, Z_0 = 50 Ω



NPN Silicon RF Transistor BFQ 72

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

CECC-type available: CECC 50002/263.



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

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

Maximum Ratings

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

Thermal Resistance

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

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

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

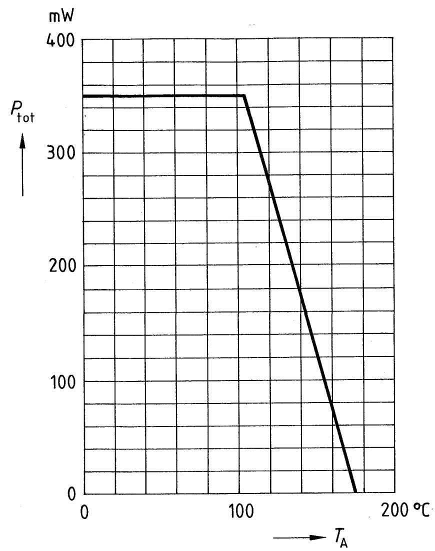
DC characteristics

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

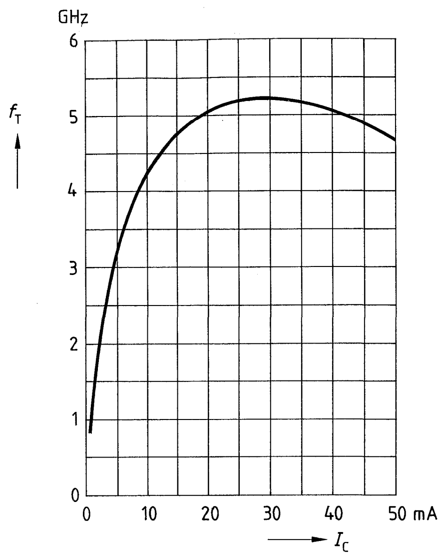
AC characteristics

Parameter	Symbol	Values min	typ	max	Unit
Transition frequency $I_C = 25$ mA, $V_{CE} = 5$ V, $f = 200$ MHz $I_C = 50$ mA, $V_{CE} = 5$ V, $f = 200$ MHz	f_T	 – –	 5.1 4.7	 – –	GHz
Collector-base capacitance $V_{CB} = 10$ V, $V_{BE} = v_{be} = 0$, $f = 1$ MHz	C_{cb}	–	0.55	0.7	pF
Collector-emitter capacitance $V_{CE} = 10$ V, $V_{BE} = v_{be} = 0$, $f = 1$ MHz	C_{ce}	–	0.4	–	pF
Input capacitance $V_{EB} = 0.5$ V, $I_C = i_c = 0$, $f = 1$ MHz	C_{ibo}	–	2.1	–	pF
Output capacitance $V_{CE} = 10$ V, $V_{BE} = v_{be} = 0$, $f = 1$ MHz	C_{obs}	–	0.95	1.5	pF
Noise figure $I_C = 10$ mA, $V_{CE} = 8$ V, $f = 10$ MHz, $Z_S = 75\ \Omega$ $I_C = 10$ mA, $V_{CE} = 8$ V, $f = 800$ MHz, $Z_S = 50\ \Omega$	F	 – –	 1.7 2.5	 – –	dB
Power gain $I_C = 25$ mA, $V_{CE} = 8$ V, $f = 800$ MHz, $Z_S = Z_{Sopt}$, $Z_L = Z_{Lopt}$	G_{pe}	–	18	–	dB
Transducer gain $I_C = 25$ mA, $V_{CE} = 8$ V, $f = 1$ GHz, $Z_0 = 50\ \Omega$	$\|S_{21e}\|^2$	–	12.5	–	dB
Linear output voltage two-tone intermodulation test $I_C = 25$ mA, $V_{CE} = 8$ V, $d_{IM} = 60$ dB $f_1 = 806$ MHz, $f_2 = 810$ MHz, $Z_S = Z_L = 50\ \Omega$	$V_{o1} = V_{o2}$	–	240	–	mV
Third order intercept point $I_C = 25$ mA, $V_{CE} = 8$ V, $f = 800$ MHz	IP_3	–	30.5	–	dBm

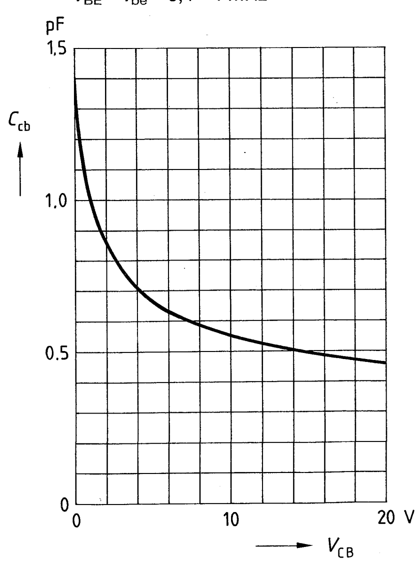
Total power dissipation $P_{tot} = f(T_A)$
Package mounted on alumina



Transition frequency $f_T = f(I_C)$
$V_{CE} = 5$ V, $f = 200$ MHz



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



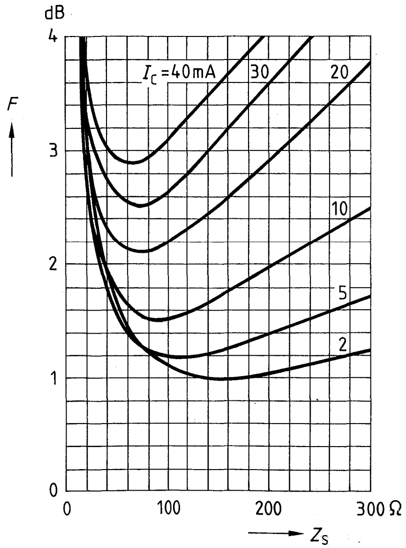
Common Emitter Noise Parameters
I_C = 2 mA, V_{CE} = 8 V, Z_0 = 50 Ω

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

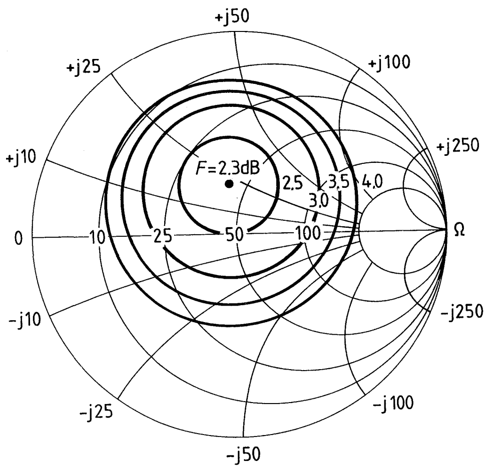
I_C = 10 mA, V_{CE} = 8 V, Z_0 = 50 Ω

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

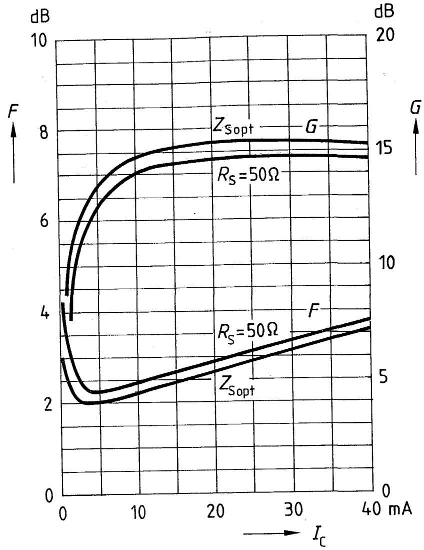
Noise figure F = f (Z_S)
V_{CE} = 8 V, f = 10 MHz



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

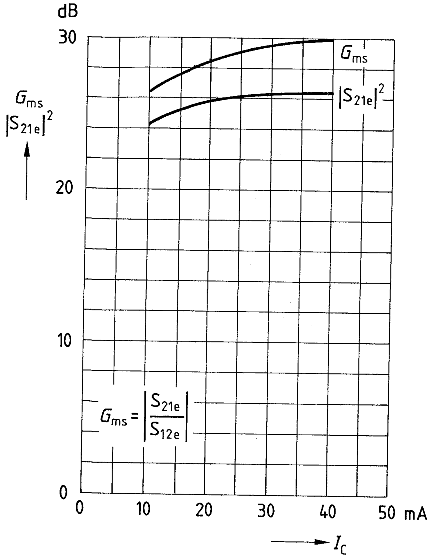


Noise figure $F = f(I_C)$
Power gain $G = f(I_C)$
$V_{CE} = 8$ V, $f = 800$ MHz, Z_{Lopt} (G)

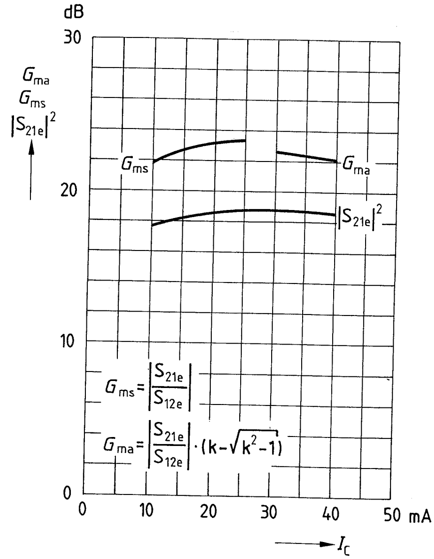


Common Emitter Power Gain

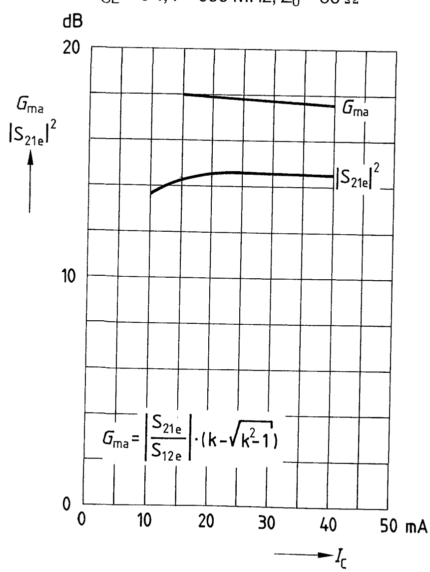
Power gain G_{ms}, $|S_{21e}|^2 = f(I_C)$
$V_{CE} = 8$ V, $f = 200$ MHz, $Z_0 = 50\ \Omega$



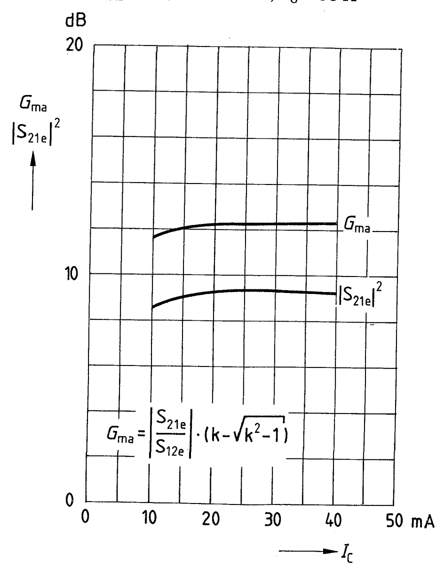
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(I_C)$
$V_{CE} = 8$ V, $f = 500$ MHz, $Z_0 = 50\ \Omega$



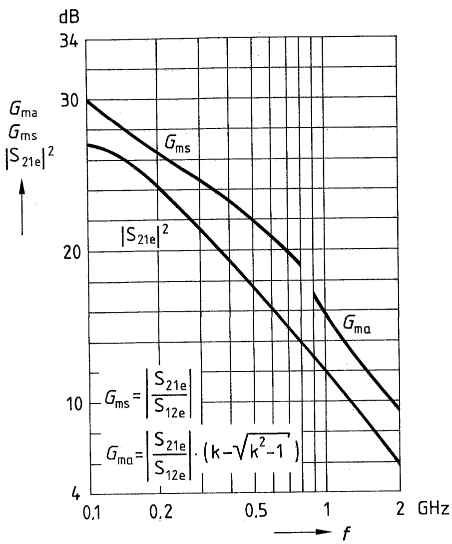
Power gain G_{ma}, $|S_{21e}|^2 = f(I_C)$
$V_{CE} = 8$ V, $f = 800$ MHz, $Z_0 = 50\ \Omega$



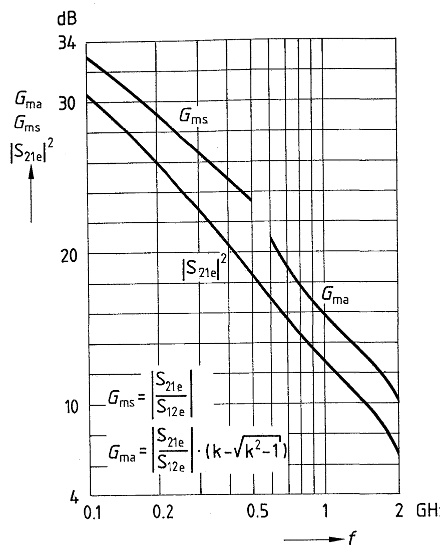
Power gain G_{ma}, $|S_{21e}|^2 = f(I_C)$
$V_{CE} = 8$ V, $f = 1.5$ GHz, $Z_0 = 50\ \Omega$



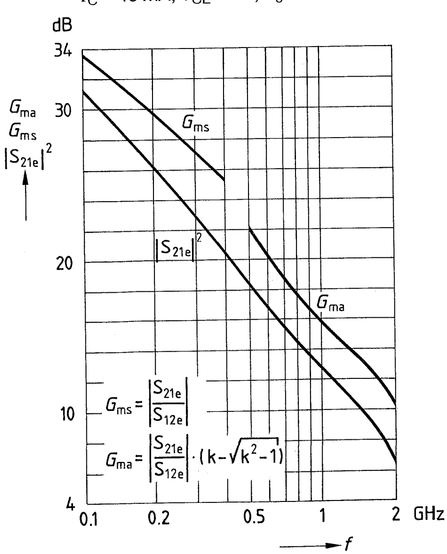
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
$I_C = 10$ mA, $V_{CE} = 8$ V, $Z_0 = 50\ \Omega$



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



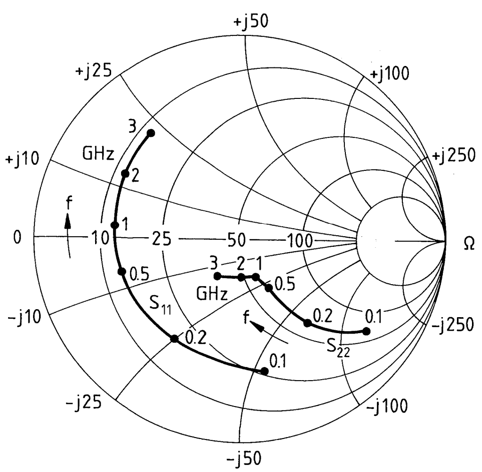
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
$I_C = 40$ mA, $V_{CE} = 8$ V, $Z_0 = 50\ \Omega$



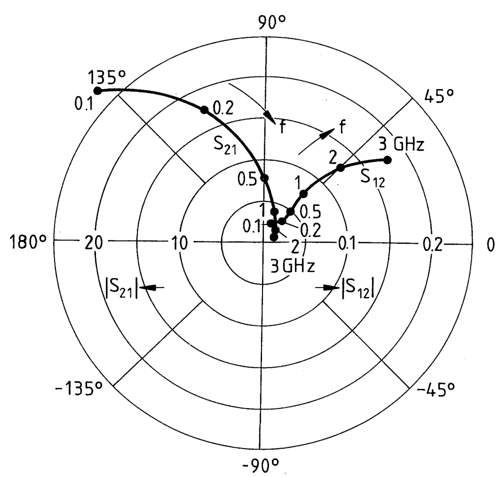
Common Emitter S Parameters
I_C = 15 mA, V_{CE} = 5 V, Z_0 = 50 Ω

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

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



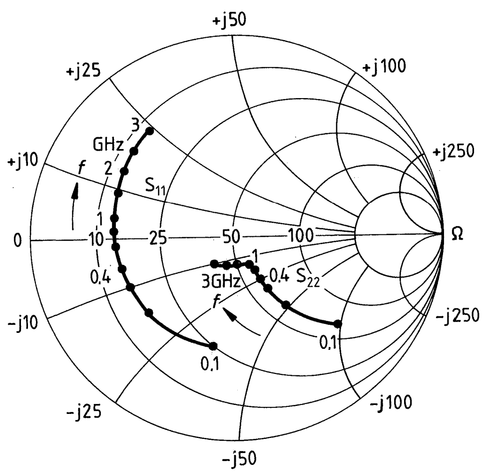
S_{12}, S_{21} = f (*f*)
I_C = 15 mA, V_{CE} = 5 V, Z_0 = 50 Ω



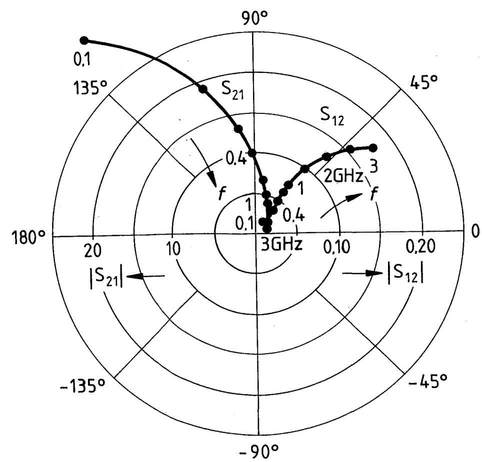
I_C = 25 mA, V_{CE} = 5 V, Z_0 = 50 Ω

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

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



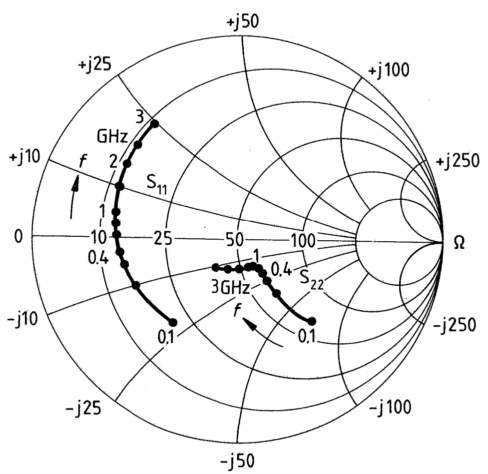
S_{12}, S_{21} = f (*f*)
I_C = 25 mA, V_{CE} = 5 V, Z_0 = 50 Ω



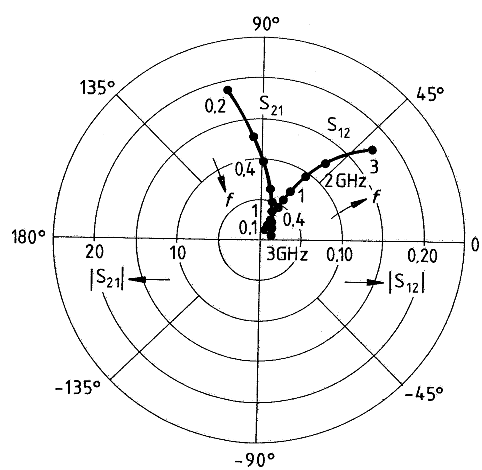
I_C = 50 mA, V_{CE} = 5 V, Z_0 = 50 Ω

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

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



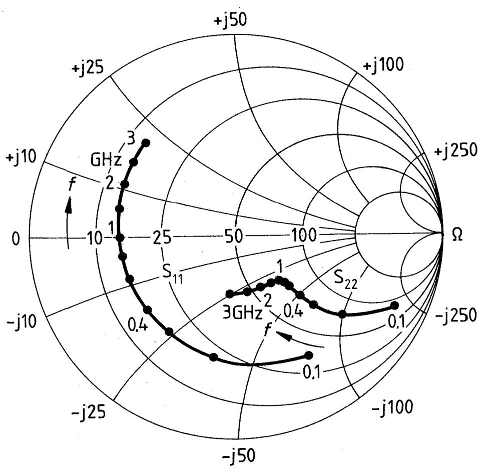
S_{12}, S_{21} = f (*f*)
I_C = 50 mA, V_{CE} = 5 V, Z_0 = 50 Ω



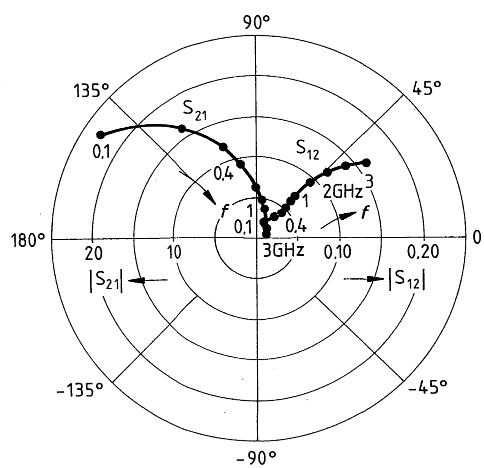
I_C = 10 mA, V_{CE} = 8 V, Z_0 = 50 Ω

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

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



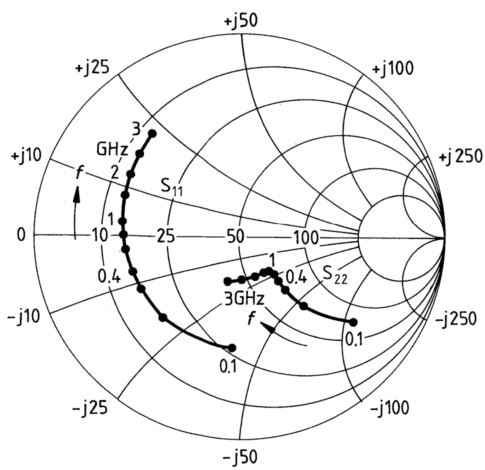
S_{12}, S_{21} = f (*f*)
I_C = 10 mA, V_{CE} = 8 V, Z_0 = 50 Ω



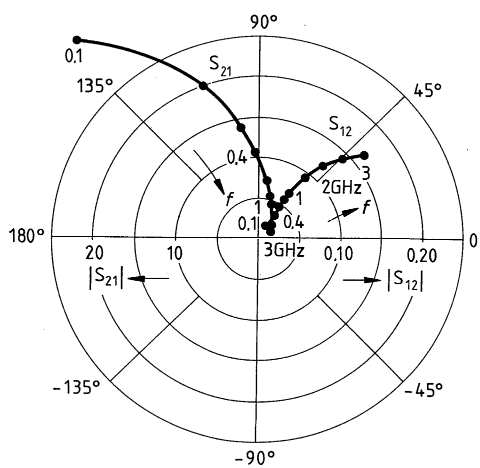
I_C = 25 mA, V_{CE} = 8 V, Z_0 = 50 Ω

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

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



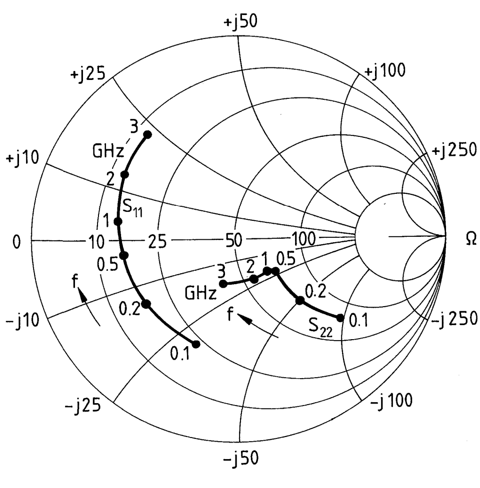
S_{12}, S_{21} = f (*f*)
I_C = 25 mA, V_{CE} = 8 V, Z_0 = 50 Ω



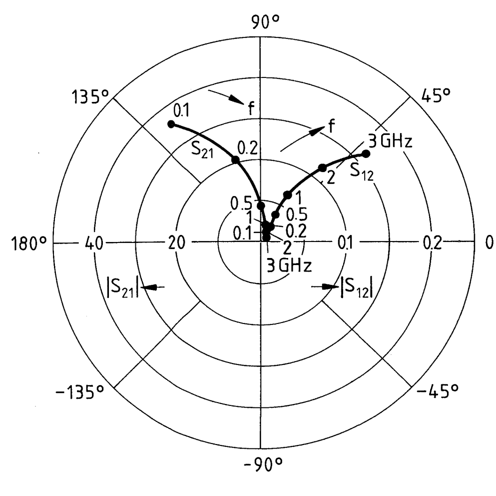
I_C = 40 mA, V_{CE} = 8 V, Z_0 = 50 Ω

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

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



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

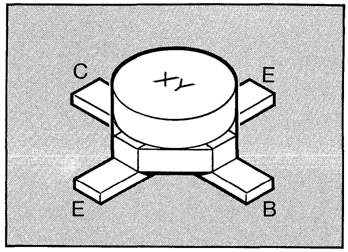


NPN Silicon RF Transistor

BFQ 73S

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

CECC-type available: CECC 50002/261.



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

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

Maximum Ratings

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

Thermal Resistance

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

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

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

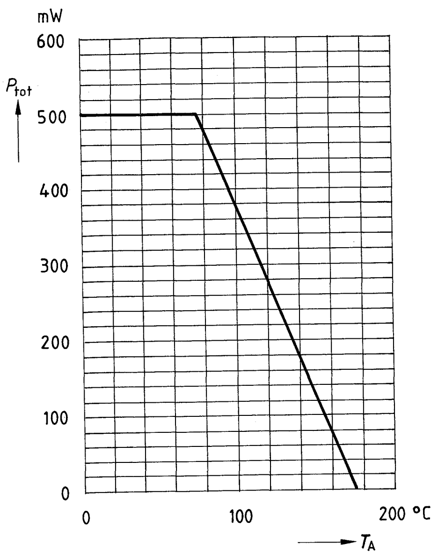
DC characteristics

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

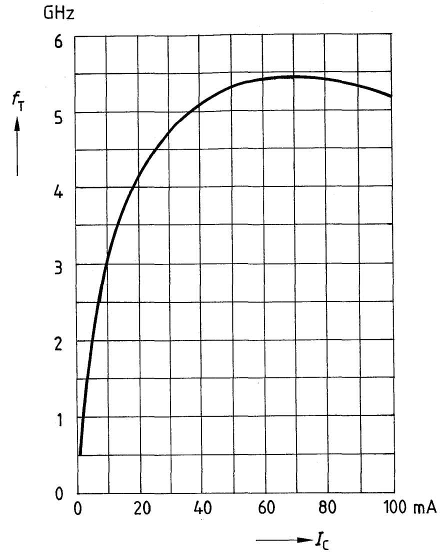
AC characteristics

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

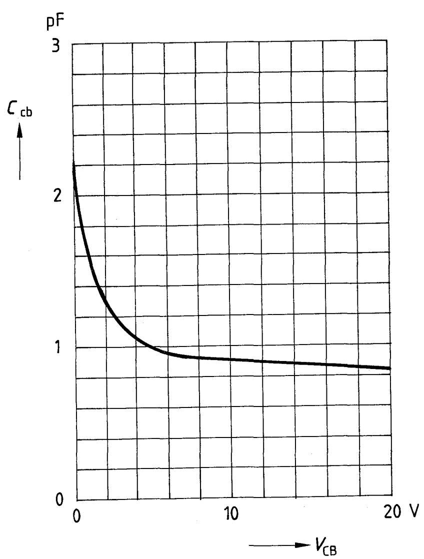
Total power dissipation $P_{tot} = f(T_A)$
Package mounted on alumina



Transition frequency $f_T = f(I_C)$
$V_{CE} = 5$ V, $f = 200$ MHz



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



Common Emitter Noise Parameters

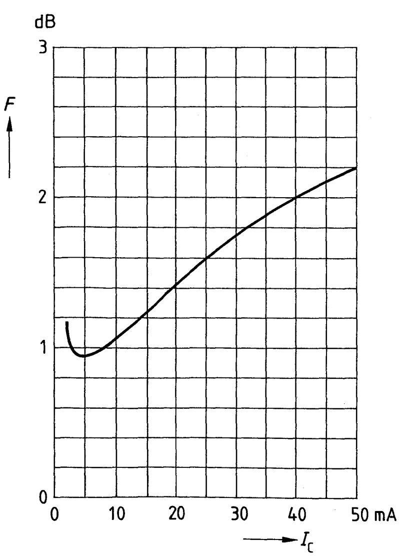
I_C = 5 mA, V_{CE} = 5 V, Z_0 = 50 Ω

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

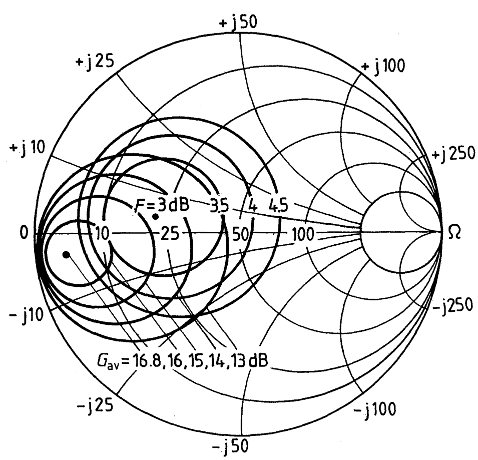
I_C = 50 mA, V_{CE} = 5 V, Z_0 = 50 Ω

f	F_{min}	G_p (F_{min})	Γ_{opt}		R_N	N	$F_{50\,\Omega}$	G_p ($F_{50\,\Omega}$)
GHz	dB	dB	MAG	ANG	Ω	–	dB	dB
0.01	2.0	–	(Z_S = 50 Ω)		–	–	–	–
0.8	3	14	0.41	168	9.5	0.43	3.8	–

Noise figure $F = f(I_C)$
V_{CE} = 5 V, f = 10 MHz, Z_S = 50 Ω

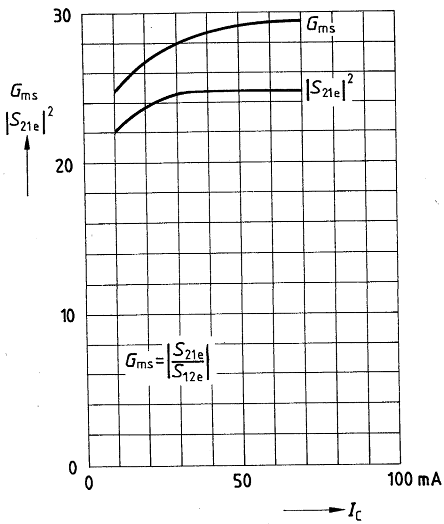


Circles of constant noise figure $F = f(Z_S)$ and available power gain $G_{av} = f(Z_S)$
I_C = 50 mA, V_{CE} = 5 V, f = 800 MHz, Z_0 = 50 Ω

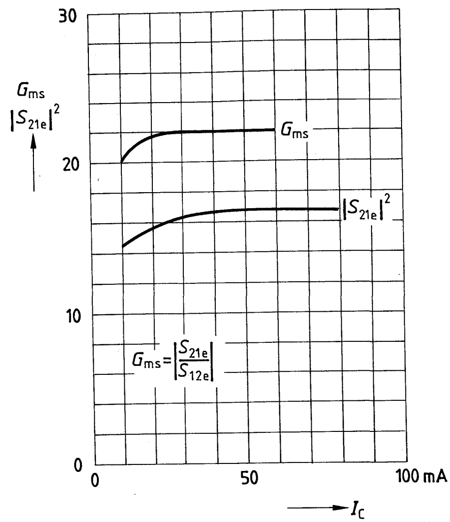


Common Emitter Power Gain

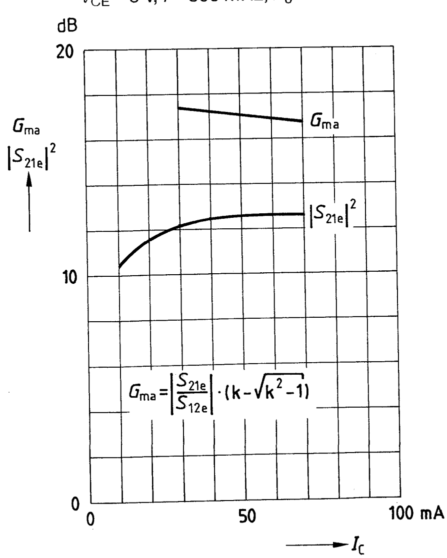
Power gain G_{ms}, $|S_{21e}|^2 = f(I_C)$
$V_{CE} = 5$ V, $f = 200$ MHz, $Z_0 = 50\ \Omega$



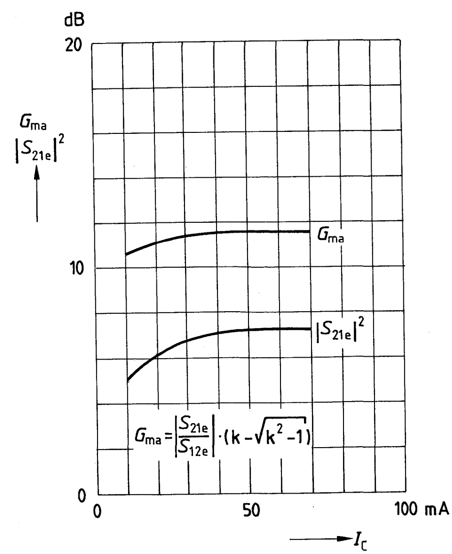
Power gain G_{ms}, $|S_{21e}|^2 = f(I_C)$
$V_{CE} = 5$ V, $f = 500$ MHz, $Z_0 = 50\ \Omega$



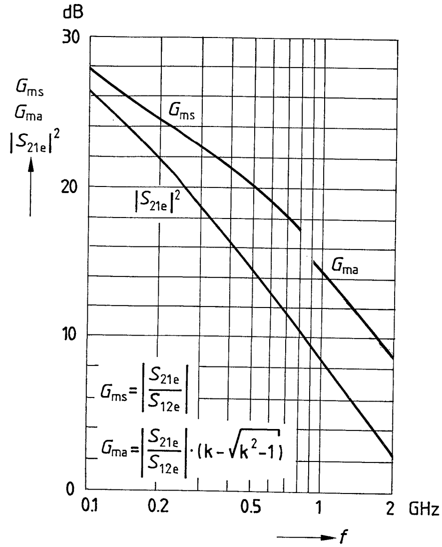
Power gain G_{ma}, $|S_{21e}|^2 = f(I_C)$
$V_{CE} = 5$ V, $f = 800$ MHz, $Z_0 = 50\ \Omega$



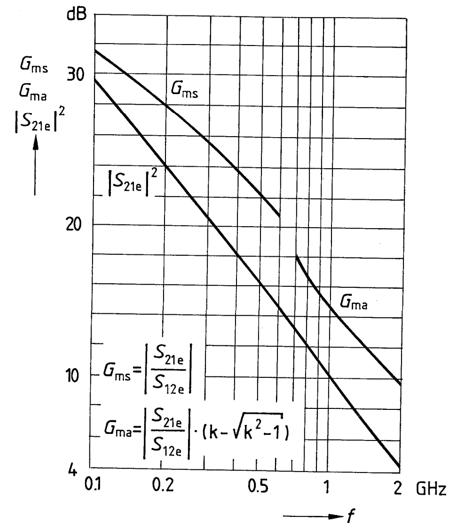
Power gain G_{ma}, $|S_{21e}|^2 = f(I_C)$
$V_{CE} = 5$ V, $f = 1.5$ GHz, $Z_0 = 50\ \Omega$



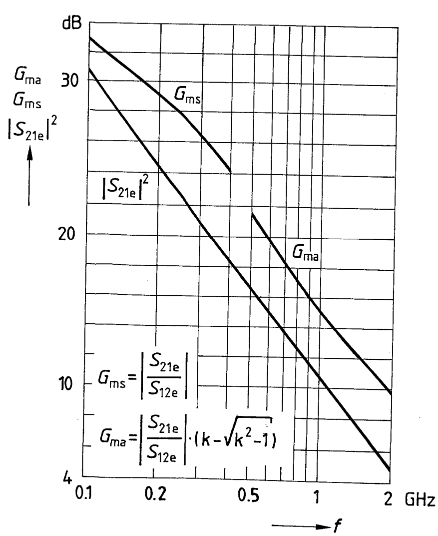
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
$I_C = 10$ mA, $V_{CE} = 5$ V, $Z_0 = 50\ \Omega$



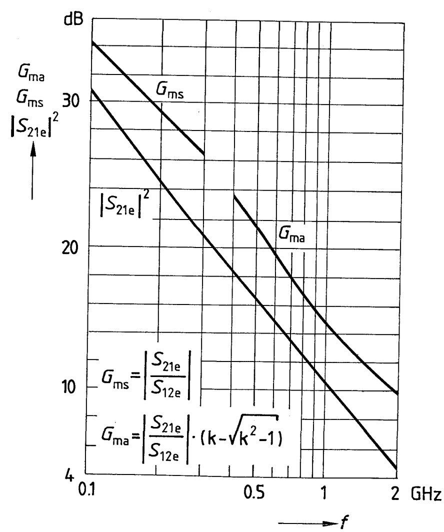
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
$I_C = 30$ mA, $V_{CE} = 5$ V, $Z_0 = 50\ \Omega$



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



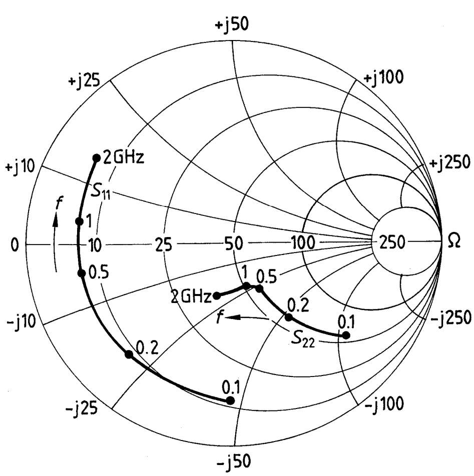
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
$I_C = 70$ mA, $V_{CE} = 5$ V, $Z_0 = 50\ \Omega$



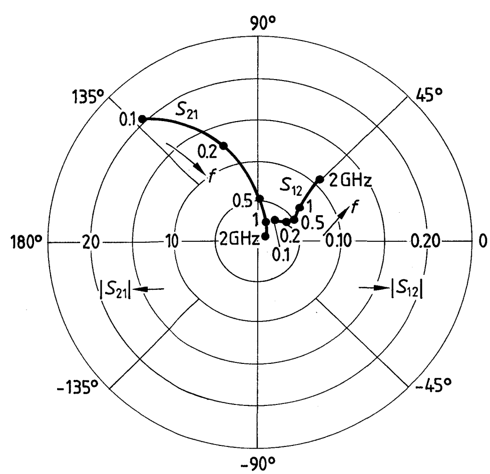
Common Emitter S Parameters
I_C = 10 mA, V_{CE} = 5 V, Z_0 = 50 Ω

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

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



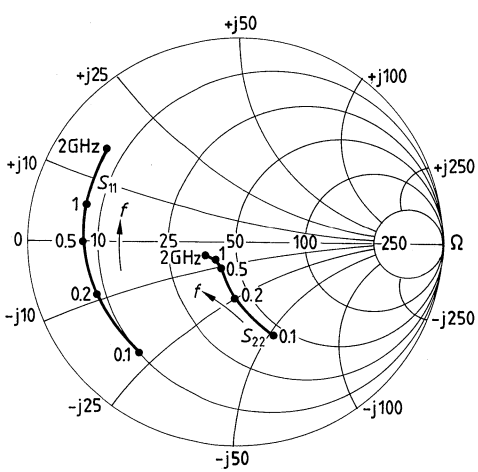
S_{12}, S_{21} = f (*f*)
I_C = 10 mA, V_{CE} = 5 V, Z_0 = 50 Ω



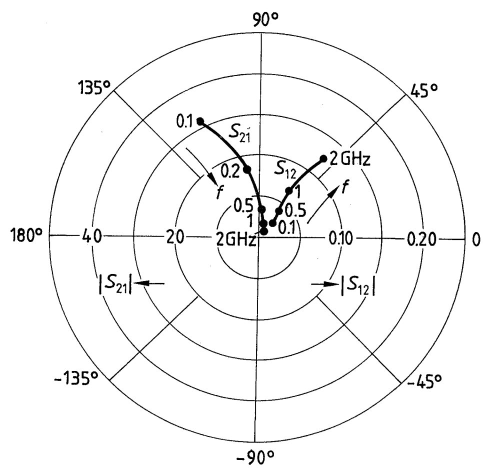
I_C = 30 mA, V_{CE} = 5 V, Z_0 = 50 Ω

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

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



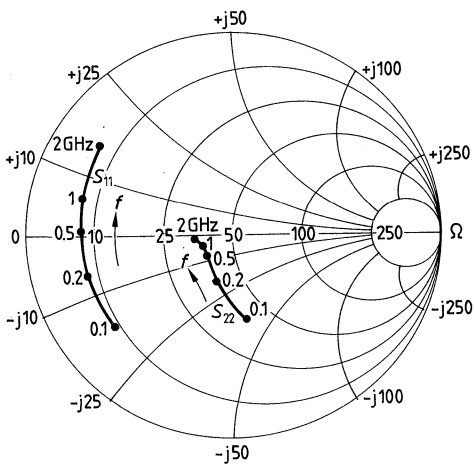
S_{12}, S_{21} = f (*f*)
I_C = 30 mA, V_{CE} = 5 V, Z_0 = 50 Ω



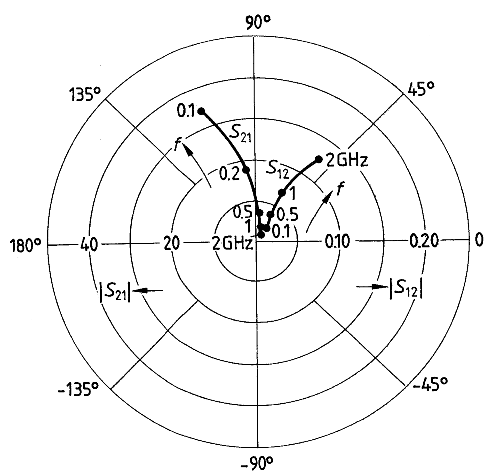
I_C = 50 mA, V_{CE} = 5 V, Z_0 = 50 Ω

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

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



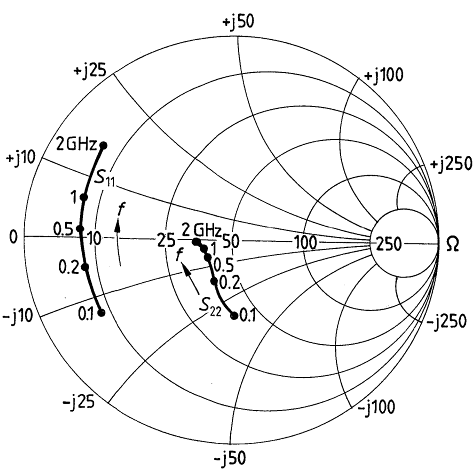
S_{12}, S_{21} = f (f)
I_C = 50 mA, V_{CE} = 5 V, Z_0 = 50 Ω



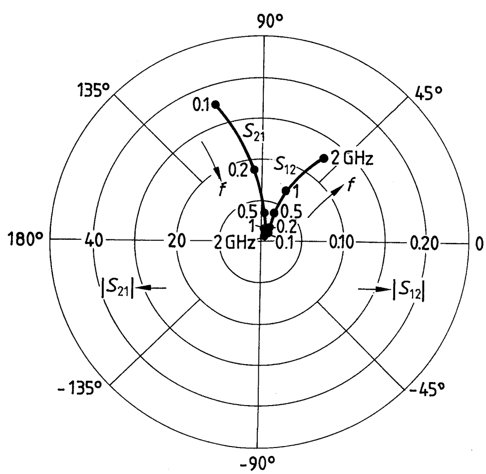
I_C = 70 mA, V_{CE} = 5 V, Z_0 = 50 Ω

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

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

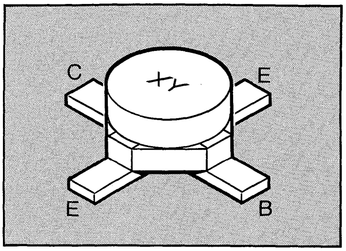


S_{12}, S_{21} = f (*f*)
I_C = 70 mA, V_{CE} = 5 V, Z_0 = 50 Ω



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 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)	Package[1])
BFQ 74	74	Q 62702 – F778	Cerec-X

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CEO}	16	V
Collector-emitter voltage, $V_{BE} = 0$	V_{CES}	25	V
Collector-base voltage	V_{CBO}	25	V
Emitter-base voltage	V_{EBO}	2	V
Collector current	I_C	35	mA
Peak collector current, $f \geq 10$ MHz	I_{CM}	45	mA
Base current	I_B	5	mA
Total power dissipation, $T_A \leq 100$ °C[2])	P_{tot}	300	mW
Junction temperature	T_j	175	°C
Ambient temperature range	T_A	–65 ... +175	°C
Storage temperature range	T_{stg}	–65 ... +175	°C

Thermal Resistance

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

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

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

DC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CEO}$	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_{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} = 10 V I_C = 15 mA, V_{CE} = 10 V	h_{FE}	 50 50	 – –	 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	–	V

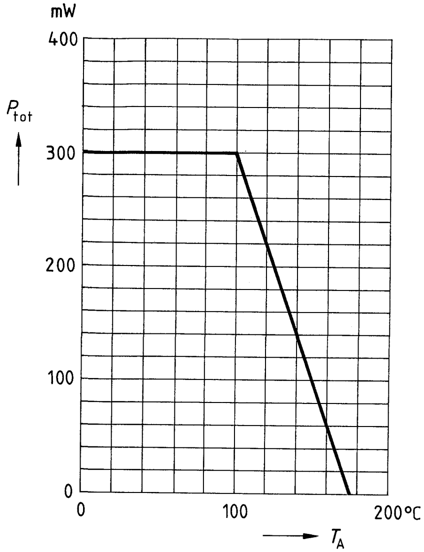
AC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
Transition frequency	f_T				GHz
I_C = 5 mA, V_{CE} = 10 V, f = 200 MHz		–	4.4	–	
I_C = 15 mA, V_{CE} = 10 V, f = 200 MHz		–	6	–	
Collector-base capacitance V_{CB} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{cb}	–	0.3	0.4	pF
Collector-emitter capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{ce}	–	0.4	–	pF
Input capacitance V_{EB} = 0.5 V, I_C = i_c = 0, f = 1 MHz	C_{ibo}	–	1.35	–	pF
Output capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{obs}	–	0.7	–	pF
Noise figure	F				dB
I_C = 3 mA, V_{CE} = 10 V, f = 10 MHz, Z_S = 75 Ω		–	0.9	–	
I_C = 5 mA, V_{CE} = 10 V, f = 800 MHz, Z_S = 50 Ω		–	1.4	–	
I_C = 10 mA, V_{CE} = 10 V, f = 2 GHz, Z_S = Z_{Sopt}		–	2.5	2.9	
Power gain					dB
I_C = 15 mA, V_{CE} = 10 V, f = 2 GHz, Z_0 = 50 Ω	G_{ma} [1])	–	14	–	
I_C = 15 mA, V_{CE} = 10 V, f = 4 GHz, Z_0 = 50 Ω	G_{ms} [2])	–	9.8	–	
Transducer gain I_C = 15 mA, V_{CE} = 10 V, f = 2 GHz, Z_0 = 50 Ω	$\|S_{21e}\|^2$	–	9.8	–	dB
Linear output voltage two-tone intermodulation test I_C = 25 mA, V_{CE} = 10 V, d_{IM} = 60 dB f_1 = 806 MHz, f_2 = 810 MHz, Z_S = Z_L = 50 Ω	$V_{o1} = V_{o2}$	–	160	–	mV
Third order intercept point I_C = 25 mA, V_{CE} = 10 V, f = 800 MHz	IP_3	–	27	–	dBm

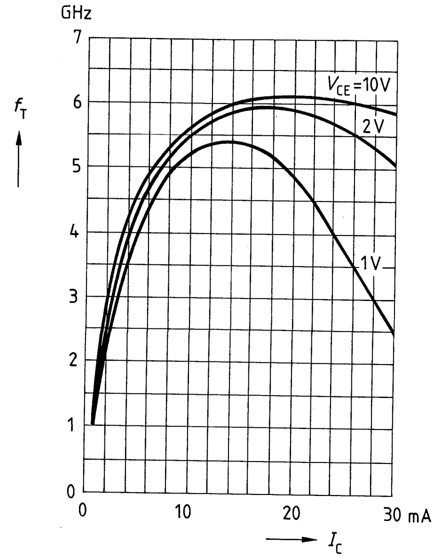
1) $G_{ma} = \frac{|S_{21e}|}{|S_{12e}|} (k - \sqrt{k^2-1})$

2) $G_{ms} = \frac{|S_{21e}|}{|S_{12e}|}$

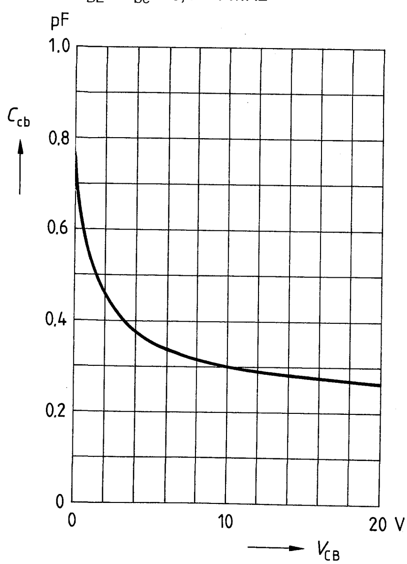
Total power dissipation $P_{tot} = f(T_A)$
Package mounted on alumina



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

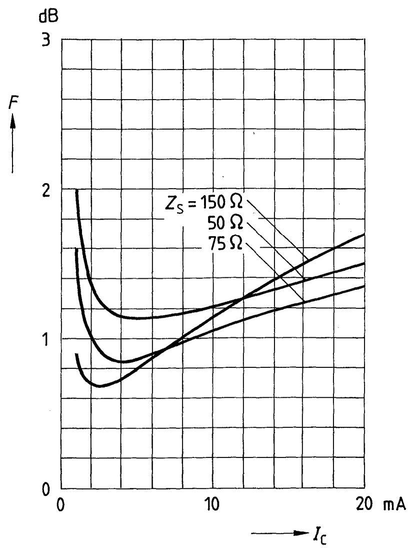
I_C = 3 mA, V_{CE} = 10 V, Z_0 = 50 Ω

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

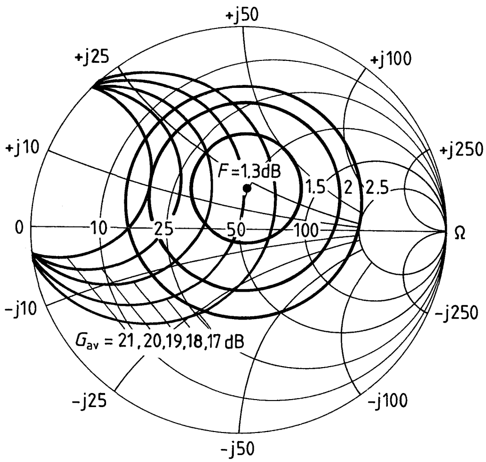
I_C = 10 mA, V_{CE} = 10 V, Z_0 = 50 Ω

f	F_{min}	G_p (F_{min})	Γ_{opt}		R_N	N	$F_{50\,\Omega}$	G_p ($F_{50\,\Omega}$)
GHz	dB	dB	MAG	ANG	Ω	–	dB	dB
0.01	1.05	–	(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

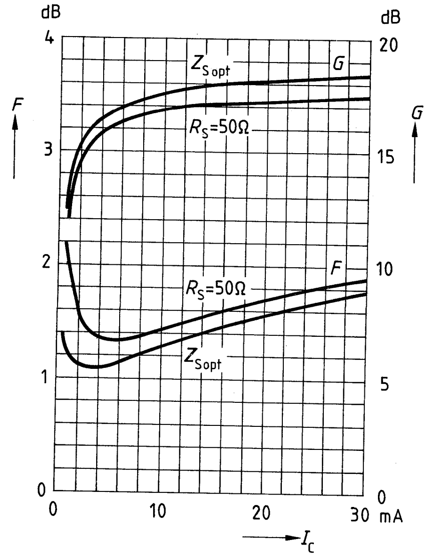
Noise figure F = f (I_C)
V_{CE} = 10 V, f = 10 MHz



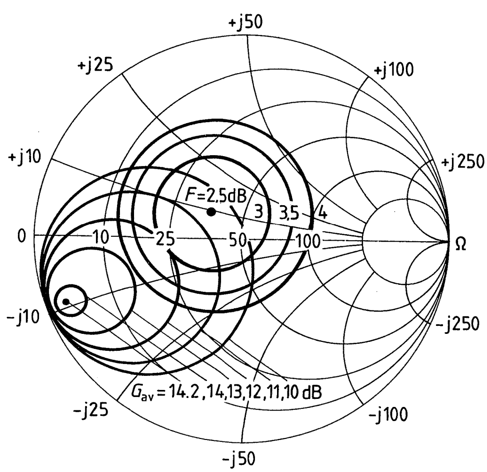
Circles of constant noise figure $F = f(Z_S)$ and available power gain $G_{av} = f(Z_S)$
I_C = 10 mA, V_{CE} = 10 V, f = 800 MHz



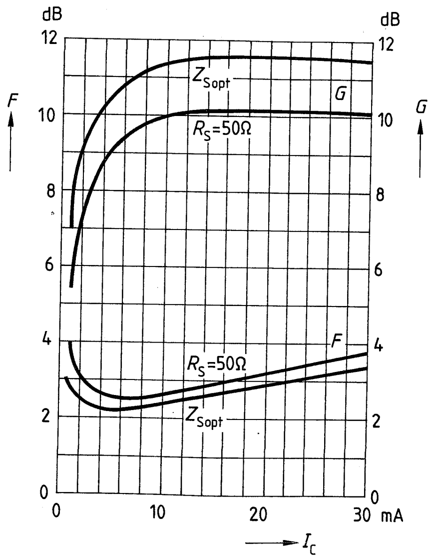
Noise figure $F = f(I_C)$
Power gain $G = f(I_C)$
V_{CE} = 10 V, f = 800 MHz, Z_{Lopt} (G)



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

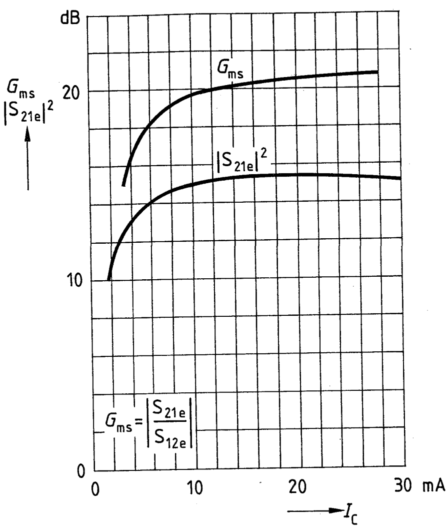


Noise figure $F = f(I_C)$
Power gain $G = f(I_C)$
V_{CE} = 10 V, f = 2 GHz, Z_{Lopt} (G)

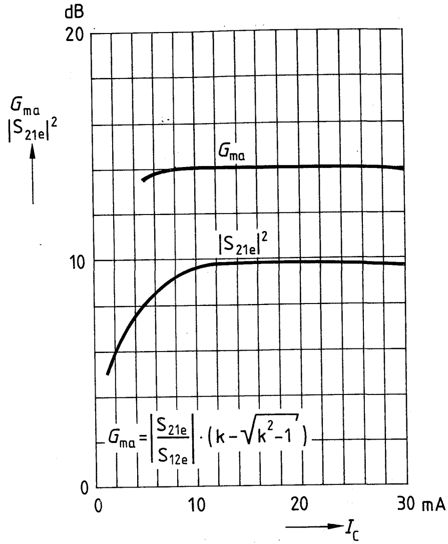


Common Emitter Power Gain

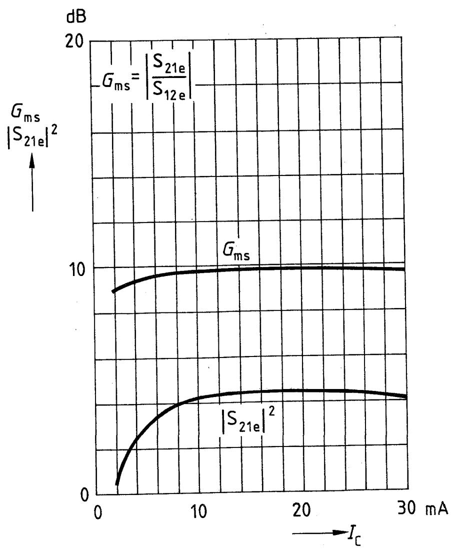
Power gain G_{ms}, $|S_{21e}|^2 = f(I_C)$
$V_{CE} = 10$ V, $f = 1$ GHz, $Z_0 = 50\ \Omega$



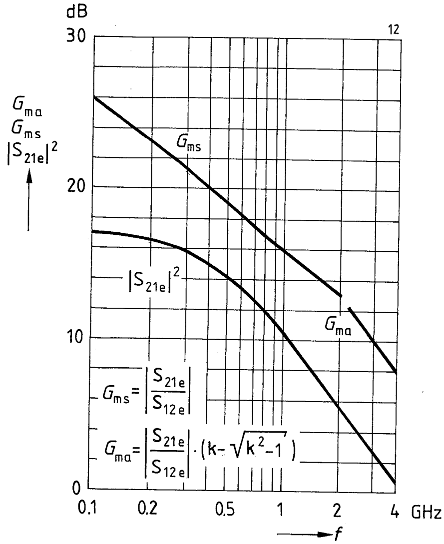
Power gain G_{ma}, $|S_{21e}|^2 = f(I_C)$
$V_{CE} = 10$ V, $f = 2$ GHz, $Z_0 = 50\ \Omega$



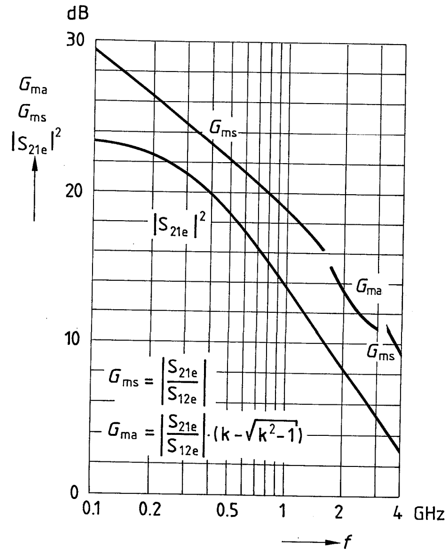
Power gain G_{ms}, $|S_{21e}|^2 = f(I_C)$
$V_{CE} = 10$ V, $f = 4$ GHz, $Z_0 = 50\ \Omega$



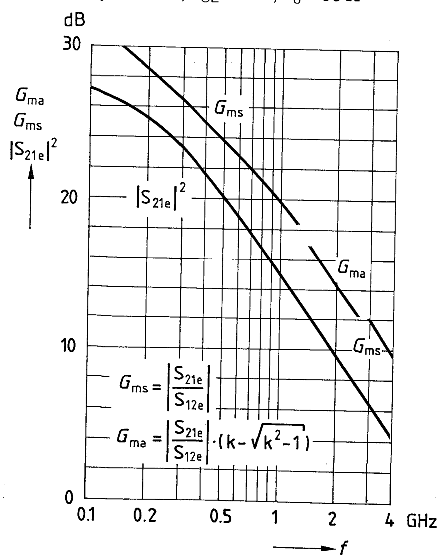
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
$I_C = 2$ mA, $V_{CE} = 10$ V, $Z_0 = 50\ \Omega$



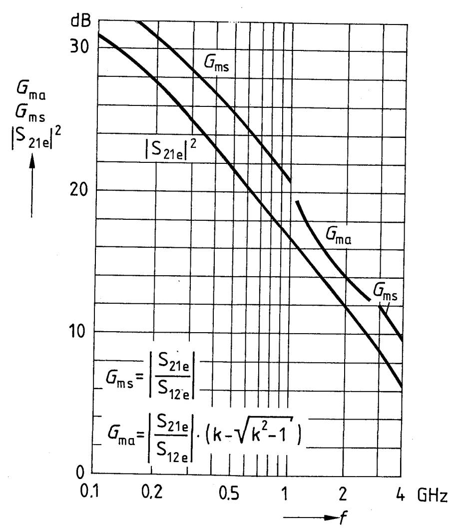
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
$I_C = 5$ mA, $V_{CE} = 10$ V, $Z_0 = 50\ \Omega$



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



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

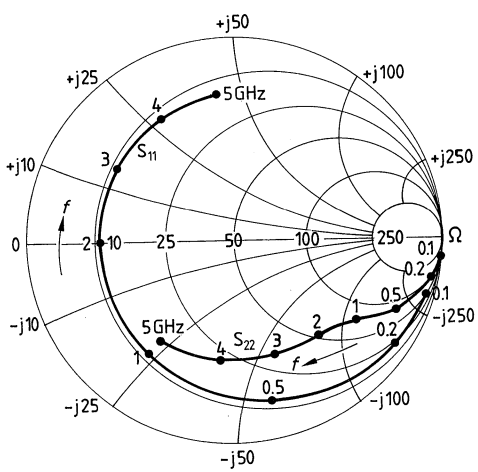


Common Emitter S Parameters

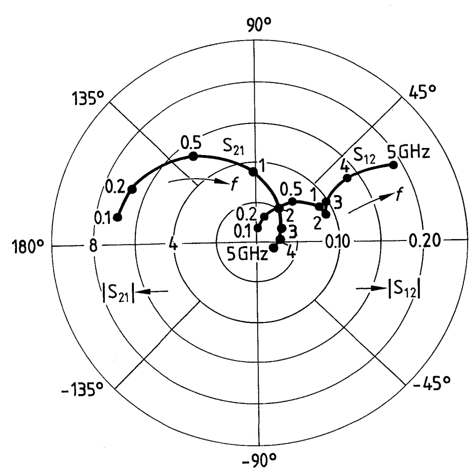
I_C = 2 mA, V_{CE} = 10 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.96	– 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



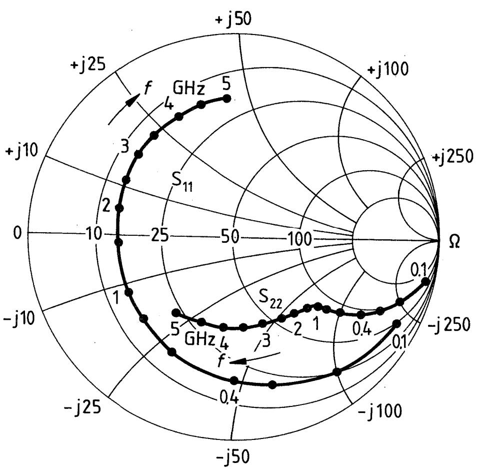
S_{12}, S_{21} = f (*f*)
I_C = 2 mA, V_{CE} = 10 V, Z_0 = 50 Ω



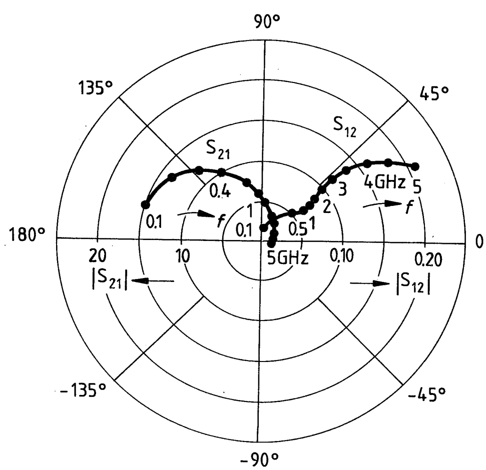
I_C = 5 mA, V_{CE} = 10 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.91	– 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



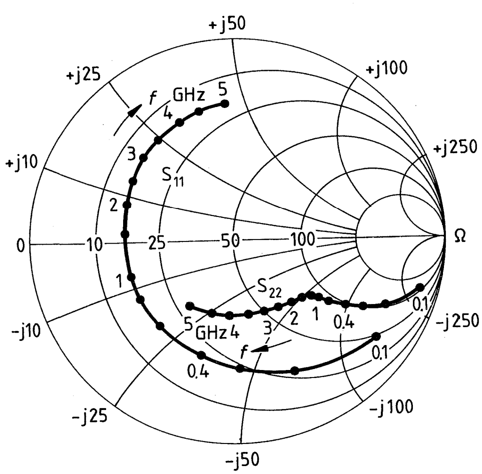
S_{12}, S_{21} = f (*f*)
I_C = 5 mA, V_{CE} = 10 V, Z_0 = 50 Ω



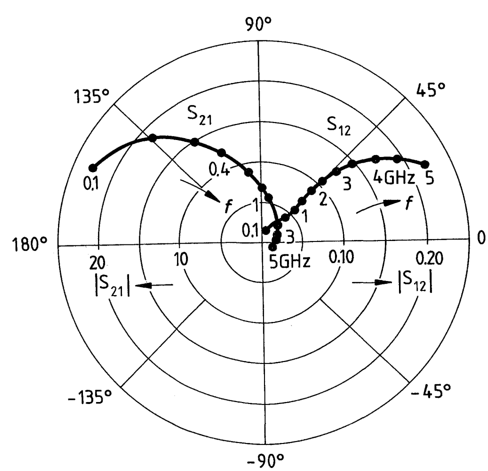
I_C = 10 mA, V_{CE} = 10 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.83	– 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



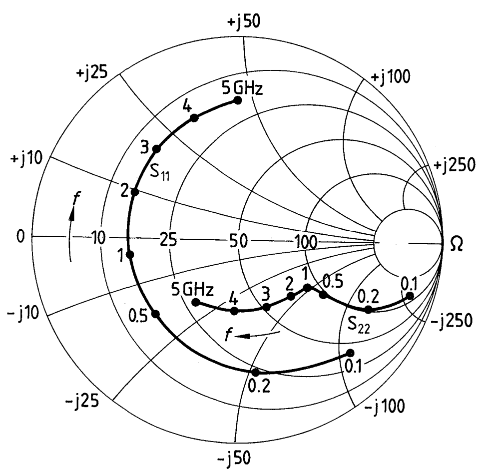
S_{12}, S_{21} = f (f)
I_C = 10 mA, V_{CE} = 10 V, Z_0 = 50 Ω



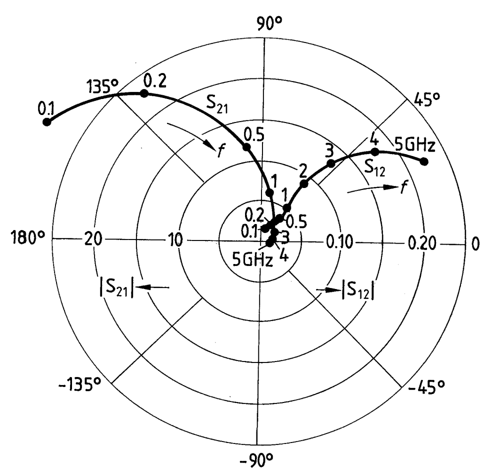
I_C = 15 mA, V_{CE} = 10 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.79	– 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



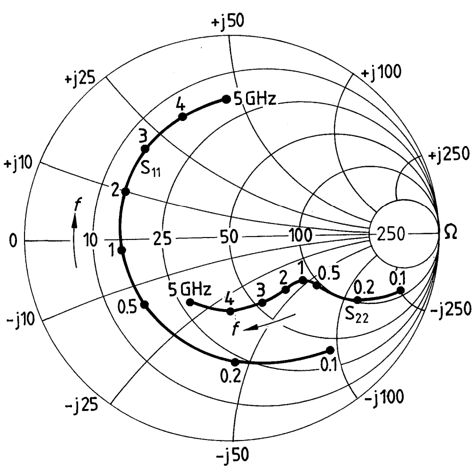
S_{12}, S_{21} = f (*f*)
I_C = 15 mA, V_{CE} = 10 V, Z_0 = 50 Ω



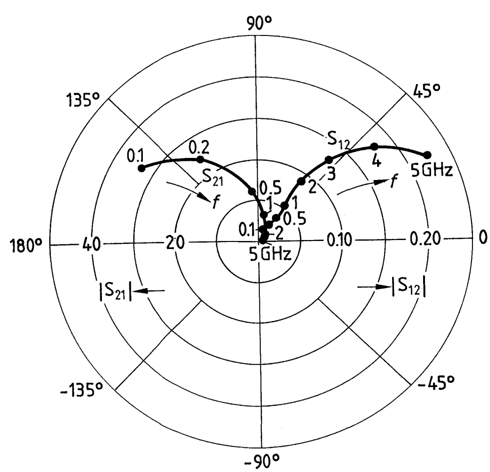
I_C = 20 mA, V_{CE} = 10 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.73	– 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



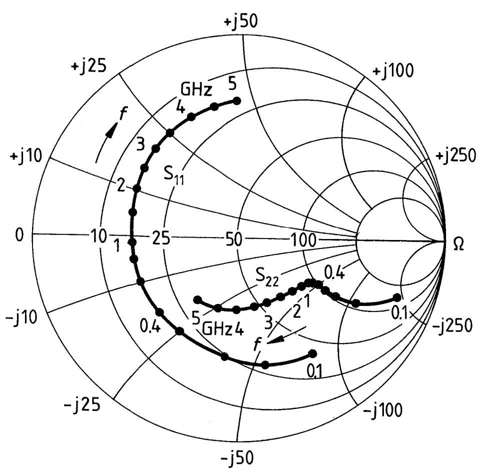
S_{12}, S_{21} = f (*f*)
I_C = 20 mA, V_{CE} = 10 V, Z_0 = 50 Ω



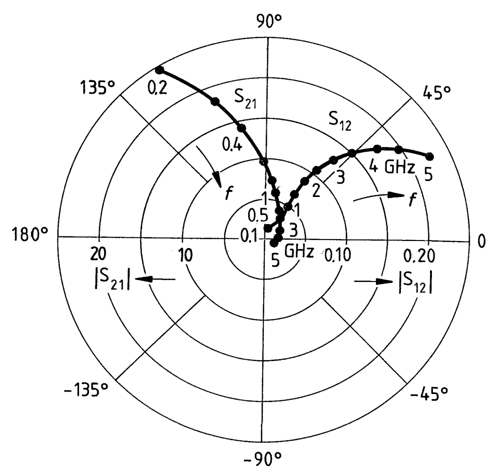
I_C = 25 mA, V_{CE} = 10 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.69	– 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



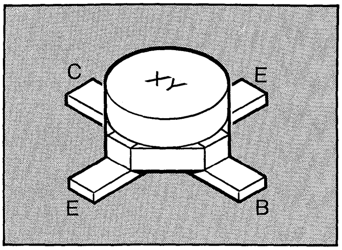
S_{12}, S_{21} = f (*f*)
I_C = 25 mA, V_{CE} = 10 V, Z_0 = 50 Ω



PNP Silicon RF Transistor

BFQ 75

- For broadband amplifiers up to 2 GHz at collector currents from 5 to 30 mA.
- Complementary type: BFQ 72 (NPN).



ESD: Electrostatic discharge sensitive device, observe handling precautions!

Type	Marking	Ordering code (tape and reel)	Package[1])
BFQ 75	75	Q 62702 – F803	Cerec-X

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CEO}	12	V
Collector-emitter voltage, $V_{BE} = 0$	V_{CES}	1	V
Collector-base voltage	V_{CBO}	15	V
Emitter-base voltage	V_{EBO}	2	V
Collector current	I_C	50	mA
Total power dissipation, $T_A \leq 105$ °C[2])	P_{tot}	350	mW
Junction temperature	T_j	175	°C
Ambient temperature range	T_A	–65 ... +175	°C
Storage temperature range	T_{stg}	–65 ... +175	°C

Thermal Resistance

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

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

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

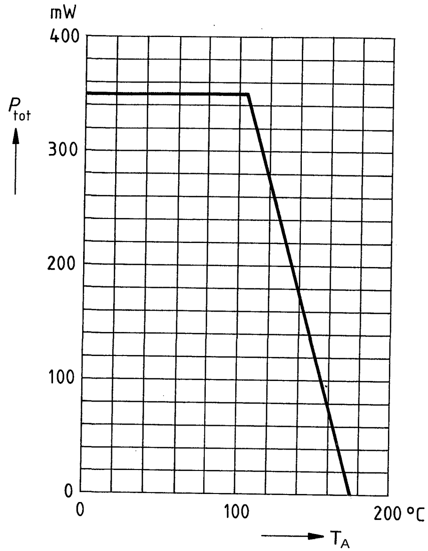
DC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CEO}$	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	–	–

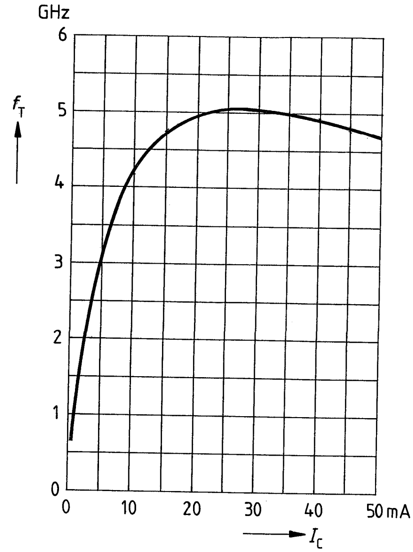
AC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
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	–	pF
Output capacitance $V_{CE} = 10$ V, $V_{BE} = v_{be} = 0$, $f = 1$ MHz	C_{obs}	–	1.1	–	pF
Noise figure $I_C = 10$ mA, $V_{CE} = 8$ V, $f = 10$ MHz, $Z_S = 50\ \Omega$ $I_C = 10$ mA, $V_{CE} = 8$ V, $f = 800$ MHz, $Z_S = 50\ \Omega$	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	–	dB

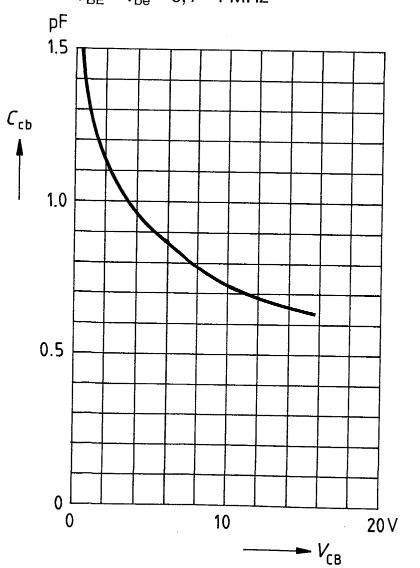
Total power dissipation $P_{tot} = f(T_A)$
Package mounted on alumina



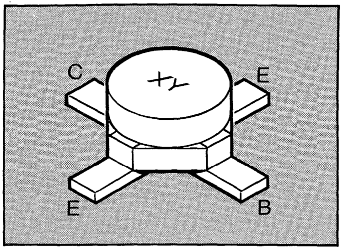
Transition frequency $f_T = f(I_C)$
$V_{CE} = 5$ V, $f = 500$ MHz



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



- 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)	Package[1])
BFQ 76	76	Q 62702 – F804	Cerec-X

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CEO}	15	V
Collector-base voltage	V_{CBO}	20	V
Emitter-base voltage	V_{EBO}	2	V
Collector current	I_C	30	mA
Total power dissipation, $T_A \leq 110$ °C[2])	P_{tot}	250	mW
Junction temperature	T_j	175	°C
Ambient temperature range	T_A	–65 ... +175	°C
Storage temperature range	T_{stg}	–65 ... +175	°C

Thermal Resistance

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

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

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

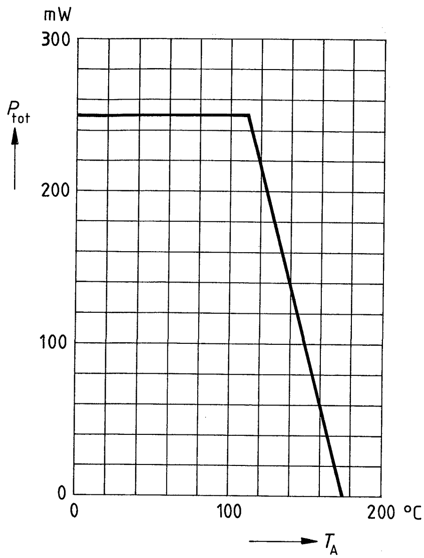
DC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CEO}$	15	–	–	V
Collector-base cutoff current V_{CB} = 10 V, I_E = 0	I_{CBO}	–	–	50	nA
Emitter-base cutoff current V_{EB} = 2 V, I_C = 0	I_{EBO}	–	–	10	µA
DC current gain I_C = 14 mA, V_{CE} = 10 V	h_{FE}	20	50	–	–

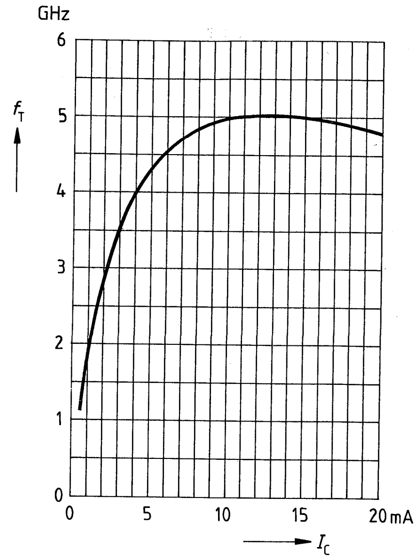
AC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
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	–	pF
Output capacitance $V_{CE} = 10$ V, $V_{BE} = v_{be} = 0$, $f = 1$ MHz	C_{obs}	–	0.9	–	pF
Noise figure $I_C = 5$ mA, $V_{CE} = 6$ V, $f = 10$ MHz, $Z_S = 75\ \Omega$ $I_C = 4$ 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	–	dB

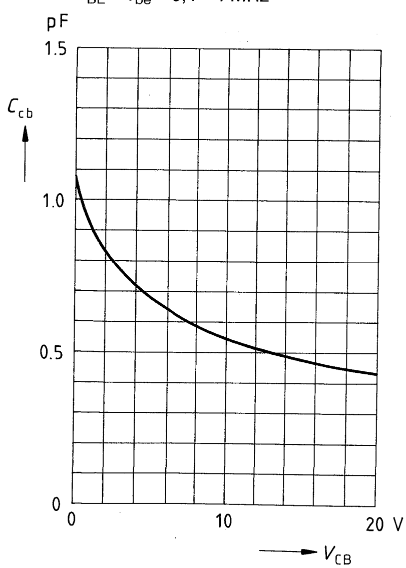
Total power dissipation $P_{tot} = f(T_A)$
Package mounted on alumina



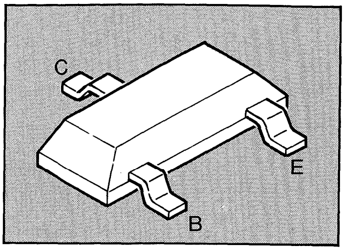
Transition frequency $f_T = f(I_C)$
$V_{CE} = 10$ V, $f = 200$ MHz



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



- For low-noise amplifiers up to 2 GHz and broadband analog and digital applications in telecommunications systems at collector currents from 0.5 to 20 mA.
- CECC-type available: CECC 50002/257.



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

Type	Marking	Ordering code (tape and reel)	Package[1])
BFQ 81	RA	Q 62702 – F1049	SOT-23

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CEO}	16	V
Collector-base voltage	V_{CBO}	25	V
Emitter-base voltage	V_{EBO}	2	V
Collector current	I_C	30	mA
Total power dissipation, $T_A \leq 25$ °C[2])	P_{tot}	280	mW
Junction temperature	T_j	150	°C
Ambient temperature range	T_A	−65 ... +150	°C
Storage temperature range	T_{stg}	−65 ... +150	°C

Thermal Resistance

Junction – ambient[2])	R_{thJA}	≤450	K/W

1) For detailed dimensions 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.

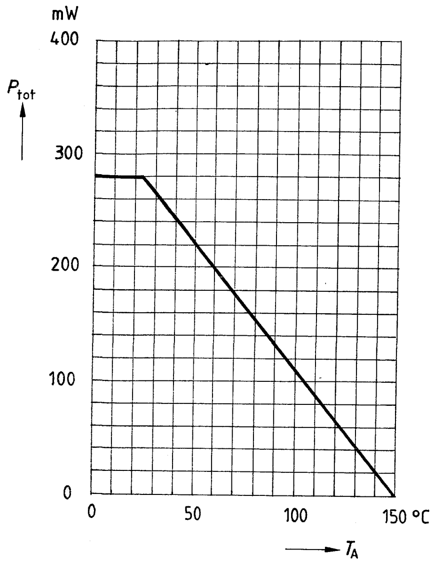
DC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CEO}$	16	–	–	V
Collector-base cutoff current V_{CB} = 15 V, I_E = 0	I_{CBO}	–	–	100	nA
Emitter-base cutoff current V_{EB} = 2 V, I_C = 0	I_{EBO}	–	–	10	µA
DC current gain I_C = 5 mA, V_{CE} = 10 V I_C = 15 mA, V_{CE} = 10 V	h_{FE}	 50 50	 – –	 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	–	V

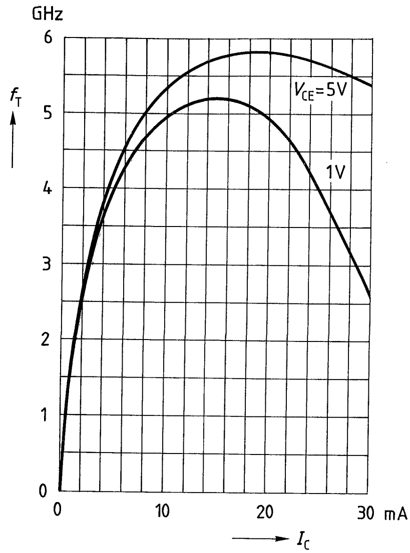
AC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
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	–	pF
Input capacitance V_{EB} = 0.5 V, I_C = i_c = 0, f = 1 MHz	C_{ibo}	–	1.27	–	pF
Output capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{obs}	–	0.6	–	pF
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	–	dB
Transducer gain I_C = 20 mA, V_{CE} = 10 V, f = 1 GHz, Z_0 = 50 Ω	$\|S_{21e}\|^2$	–	12.4	–	dB
Linear output voltage two-tone intermodulation test I_C = 25 mA, V_{CE} = 10 V, d_{IM} = 60 dB f_1 = 806 MHz, f_2 = 810 MHz, Z_S = Z_L = 50 Ω	$V_{o1} = V_{o2}$	–	160	–	mV
Third order intercept point I_C = 25 mA, V_{CE} = 10 V, f = 800 MHz	IP_3	–	27	–	dBm

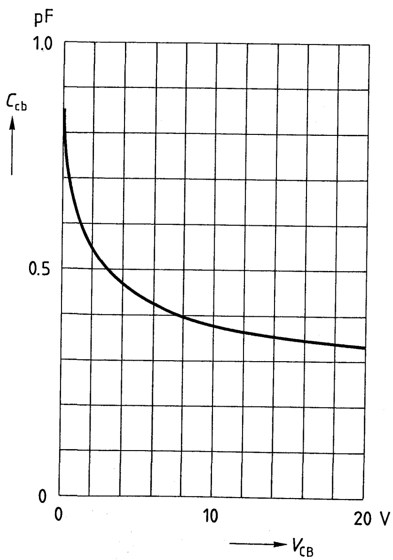
Total power dissipation $P_{tot} = f(T_A)$
Package mounted on alumina



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

I_C = 3 mA, V_{CE} = 10 V, Z_0 = 50 Ω

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

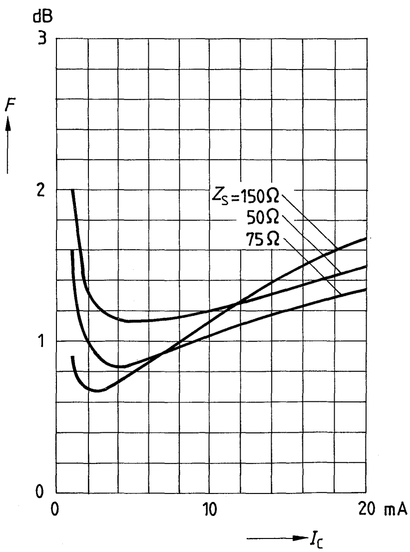
I_C = 5 mA, V_{CE} = 10 V, Z_0 = 50 Ω

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

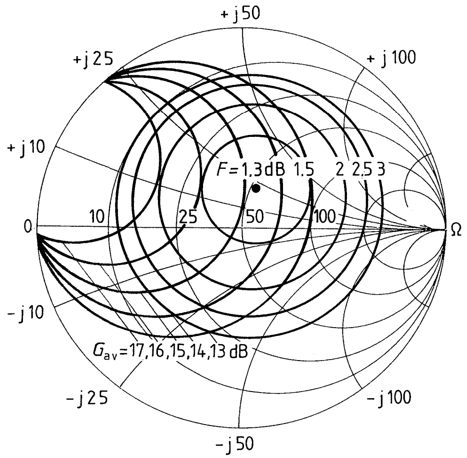
I_C = 10 mA, V_{CE} = 10 V, Z_0 = 50 Ω

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
2.0	2.5	8.5	0.27	–139	14.2	0.39	2.8	–

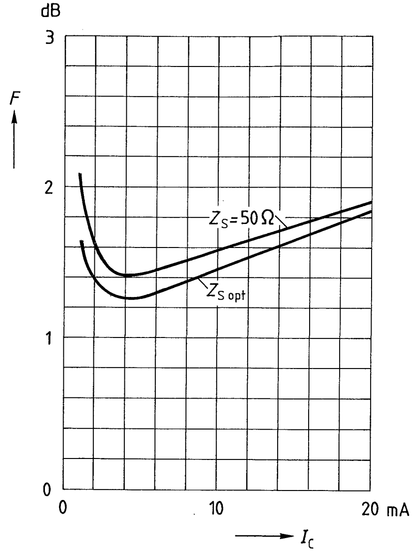
Noise figure F = f (I_C)
V_{CE} = 10 V, f = 10 MHz



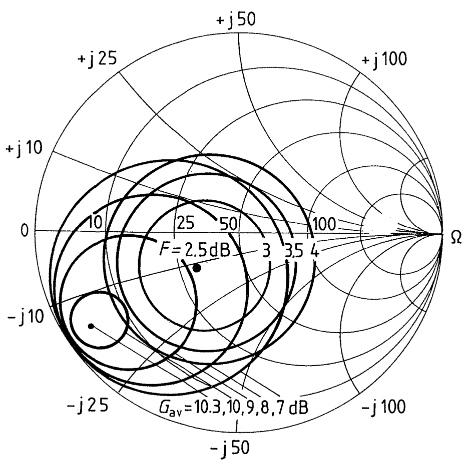
Circles of constant noise figure $F = f(Z_S)$ and available power gain $G_{av} = f(Z_S)$
$I_C = 5$ mA, $V_{CE} = 10$ V, $f = 800$ MHz



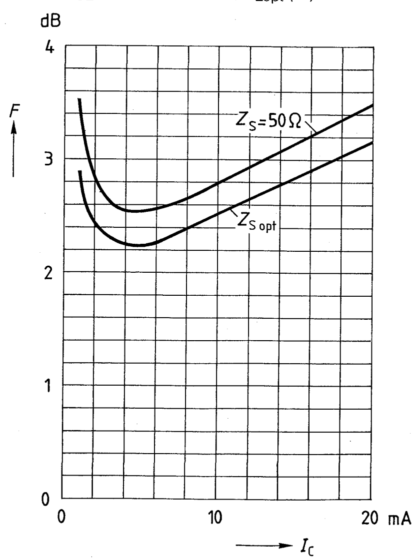
Noise figure $F = f(I_C)$
$V_{CE} = 10$ V, $f = 800$ MHz, Z_{Lopt} (G)



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

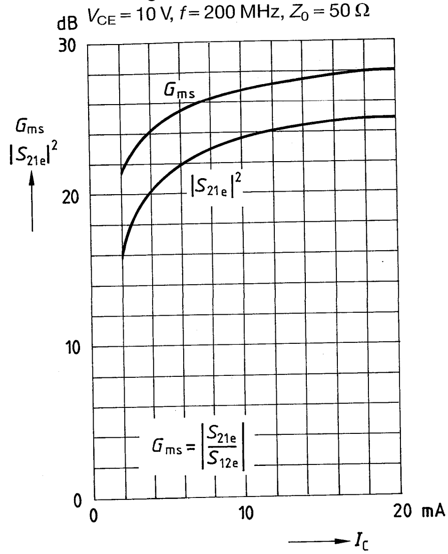


Noise figure $F = f(I_C)$
$V_{CE} = 10$ V, $f = 2$ GHz, Z_{Lopt} (G)

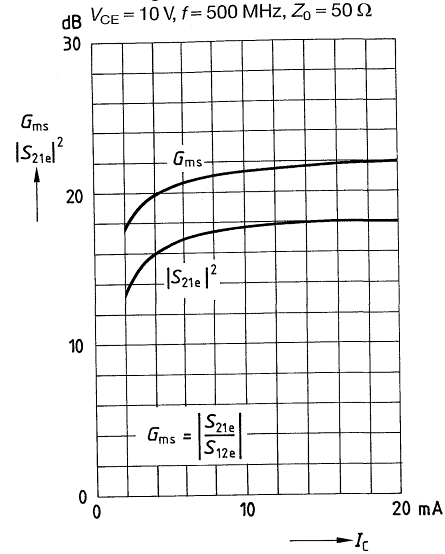


Common Emitter Power Gain

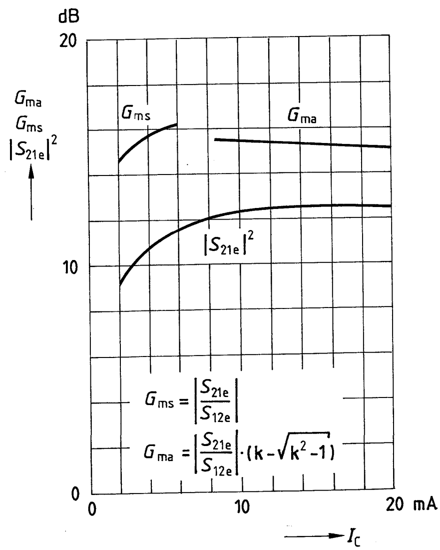
Power gain G_{ms}, $|S_{21e}|^2 = f(I_C)$
$V_{CE} = 10$ V, $f = 200$ MHz, $Z_0 = 50\ \Omega$



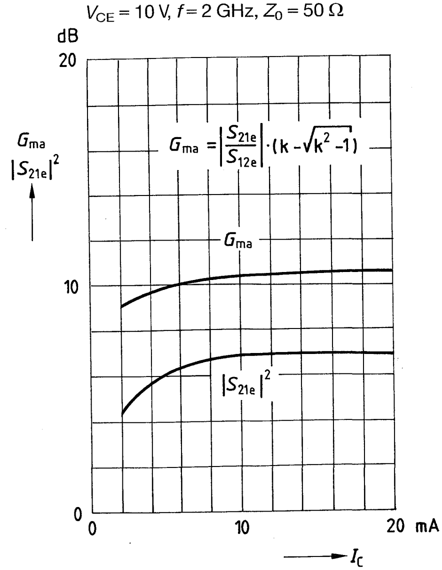
Power gain G_{ms}, $|S_{21e}|^2 = f(I_C)$
$V_{CE} = 10$ V, $f = 500$ MHz, $Z_0 = 50\ \Omega$



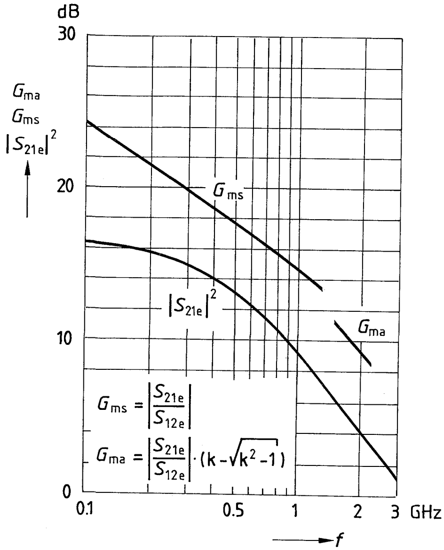
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(I_C)$
$V_{CE} = 10$ V, $f = 1$ GHz, $Z_0 = 50\ \Omega$



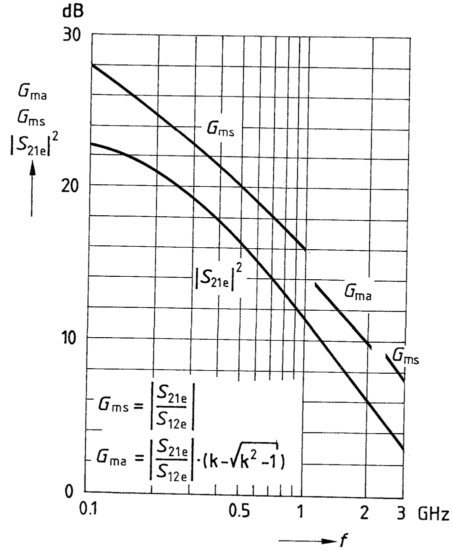
Power gain G_{ma}, $|S_{21e}|^2 = f(I_C)$
$V_{CE} = 10$ V, $f = 2$ GHz, $Z_0 = 50\ \Omega$



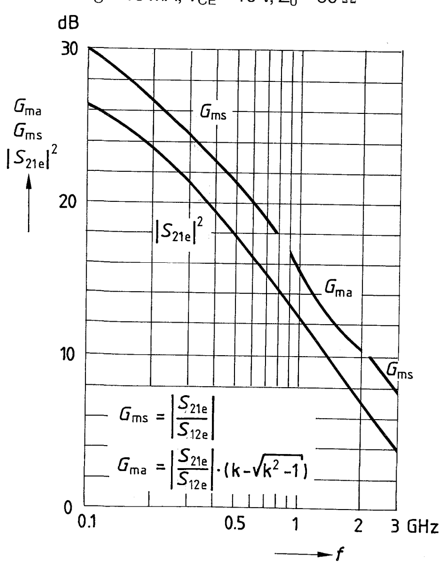
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
$I_C = 2$ mA, $V_{CE} = 10$ V, $Z_0 = 50\ \Omega$



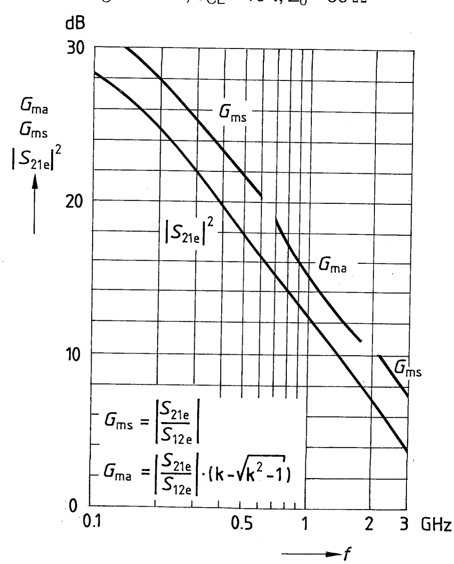
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
$I_C = 5$ mA, $V_{CE} = 10$ V, $Z_0 = 50\ \Omega$



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



Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
$I_C = 20$ mA, $V_{CE} = 10$ V, $Z_0 = 50\ \Omega$



Common Emitter S Parameters

I_C = 1 mA, V_{CE} = 1 V, Z_0 = 50 Ω

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

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

I_C = 2 mA, V_{CE} = 3 V, Z_0 = 50 Ω

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

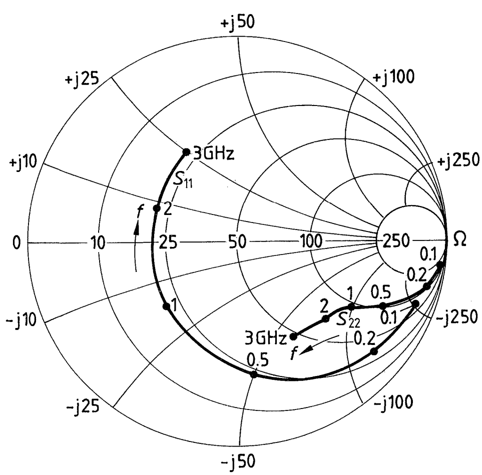
I_C = 5 mA, V_{CE} = 3 V, Z_0 = 50 Ω

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

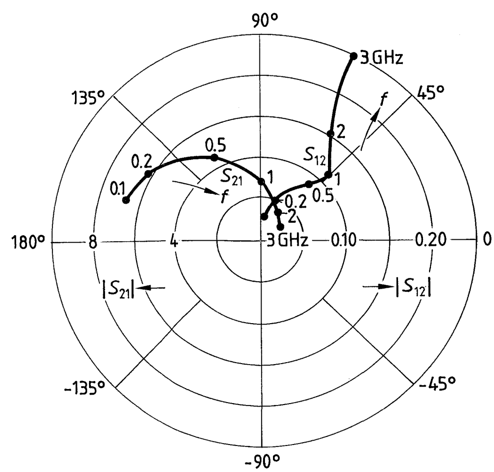
I_C = 2 mA, V_{CE} = 6 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	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



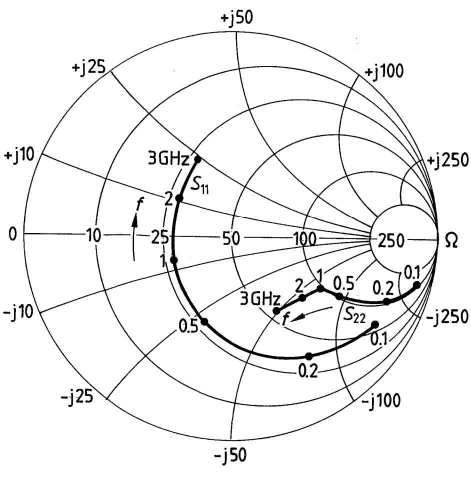
S_{12}, S_{21} = f (f)
I_C = 2 mA, V_{CE} = 6 V, Z_0 = 50 Ω



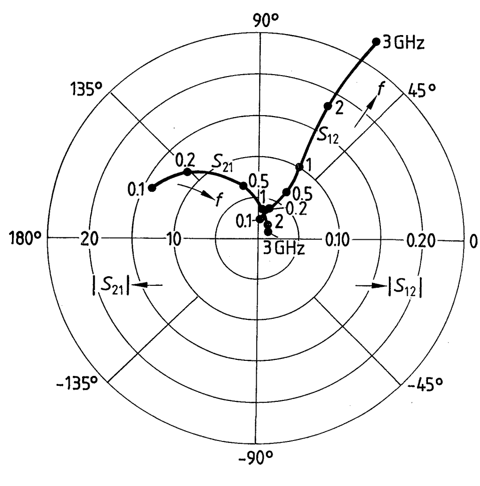
I_C = 5 mA, V_{CE} = 6 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	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



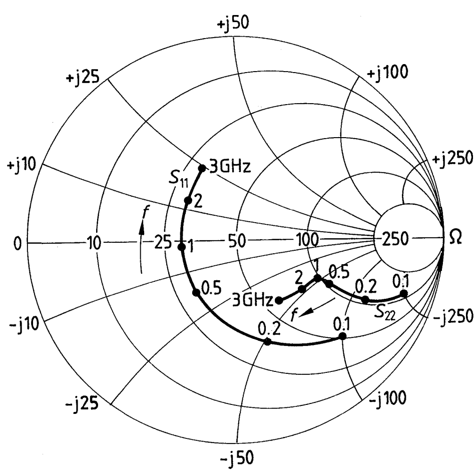
S_{12}, S_{21} = f (*f*)
I_C = 5 mA, V_{CE} = 6 V, Z_0 = 50 Ω



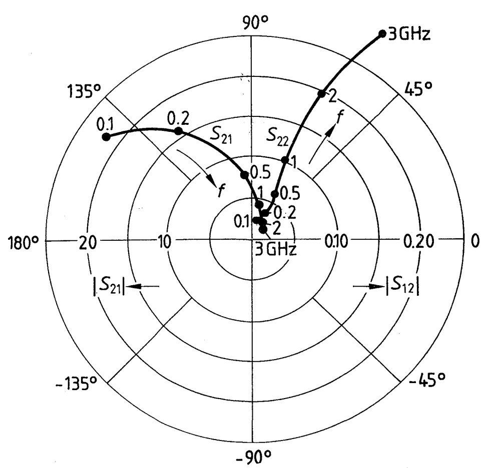
I_C = 10 mA, V_{CE} = 6 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	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



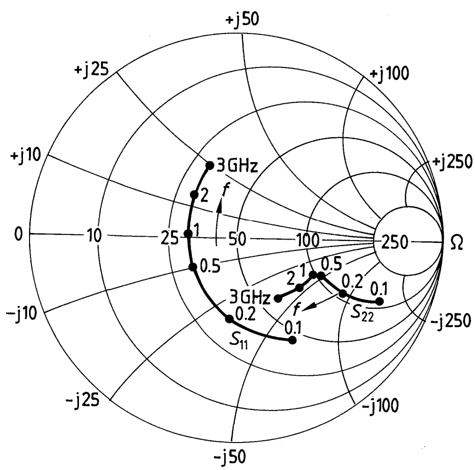
S_{12}, S_{21} = f (*f*)
I_C = 10 mA, V_{CE} = 6 V, Z_0 = 50 Ω



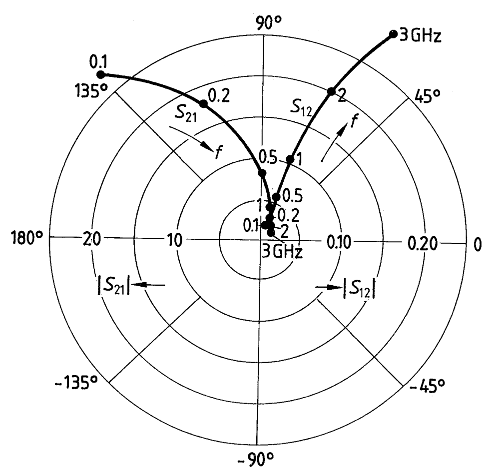
I_C = 20 mA, V_{CE} = 6 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	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



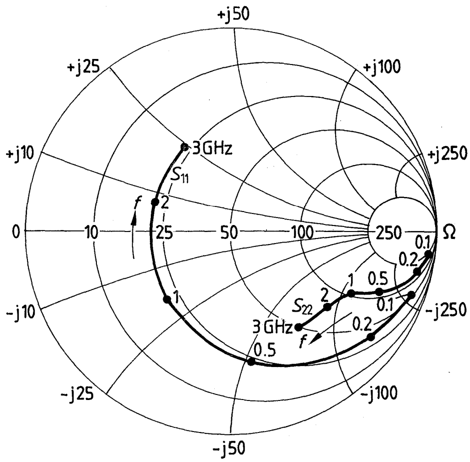
S_{12}, S_{21} = f (*f*)
I_C = 20 mA, V_{CE} = 6 V, Z_0 = 50 Ω



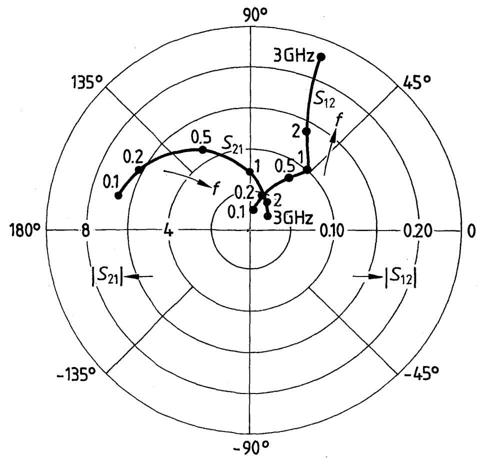
I_C = 2 mA, V_{CE} = 10 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	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



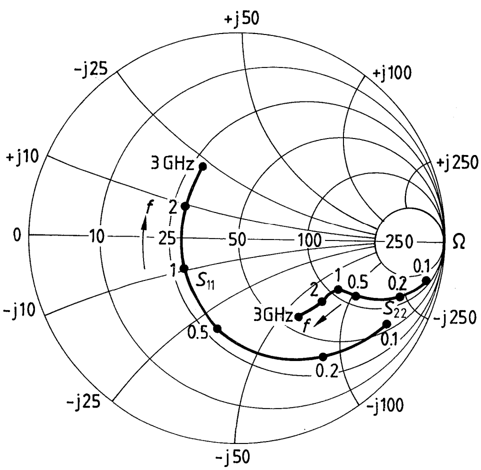
S_{12}, S_{21} = f (f)
I_C = 2 mA, V_{CE} = 10 V, Z_0 = 50 Ω



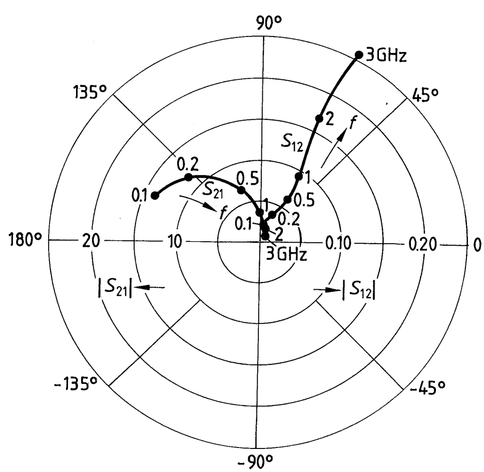
I_C = 5 mA, V_{CE} = 10 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	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



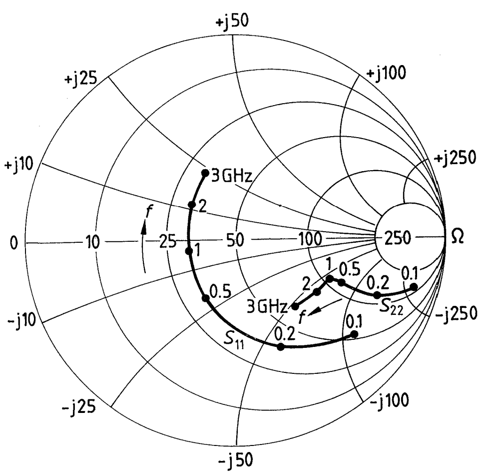
S_{12}, S_{21} = f (f)
I_C = 5 mA, V_{CE} = 10 V, Z_0 = 50 Ω



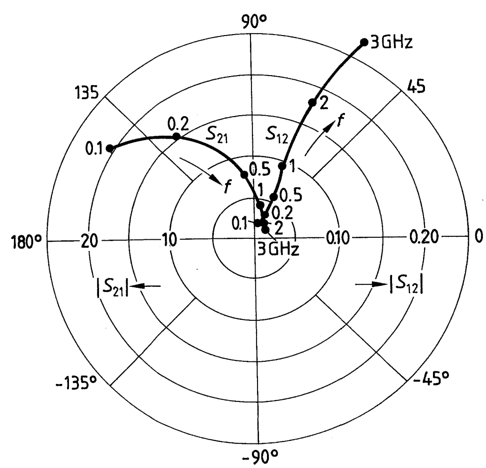
I_C = 10 mA, V_{CE} = 10 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	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



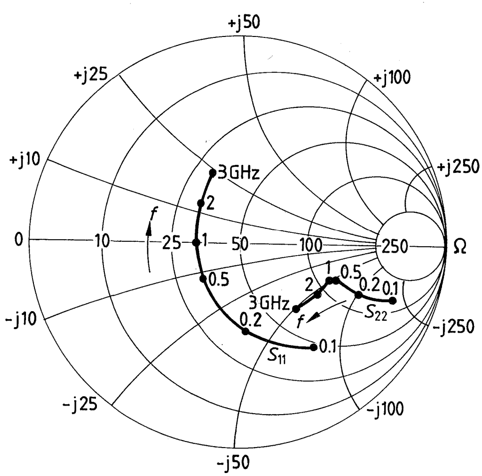
S_{12}, S_{21} = f (f)
I_C = 10 mA, V_{CE} = 10 V, Z_0 = 50 Ω



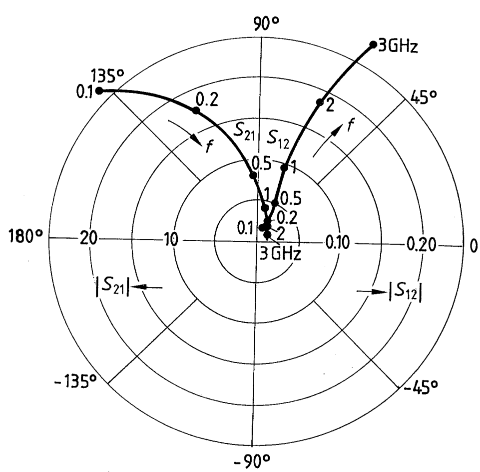
I_C = 20 mA, V_{CE} = 10 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	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

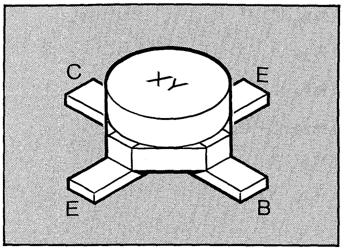
S_{11}, S_{22} = f (*f*)
I_C = 20 mA, V_{CE} = 10 V, Z_0 = 50 Ω



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



- 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: Electrostatic discharge sensitive device, observe handling precautions!

Type	Marking	Ordering code (tape and reel)	Package[1])
BFQ 82	82	Q 62702 – F1189	Cerec-X

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CEO}	12	V
Collector-emitter voltage, $V_{BE} = 0$	V_{CES}	20	V
Collector-base voltage	V_{CBO}	20	V
Emitter-base voltage	V_{EBO}	2	V
Collector current	I_C	80	mA
Base current	I_B	10	mA
Total power dissipation, $T_A \leq 95$ °C[2])	P_{tot}	400	mW
Junction temperature	T_j	175	°C
Ambient temperature range	T_A	–65 ... +175	°C
Storage temperature range	T_{stg}	–65 ... +175	°C

Thermal Resistance

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

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

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

DC characteristics

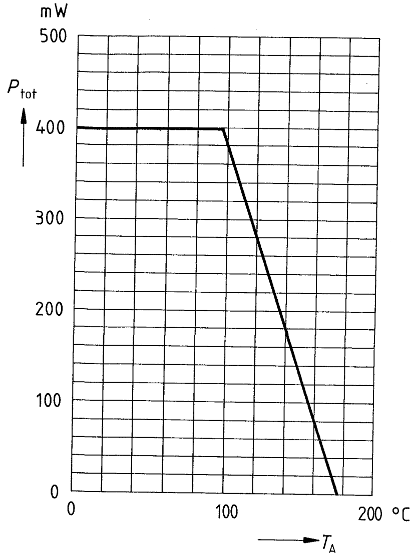
Parameter	Symbol	Values			Unit
		min	typ	max	
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CEO}$	12	–	–	V
Collector-emitter cutoff current V_{CE} = 20 V, V_{BE} = 0	I_{CES}	–	–	100	µA
Collector-base cutoff current V_{CB} = 10 V, I_E = 0 V_{CB} = 10 V, I_E = 0, T_A = 125° C	I_{CBO}	 – –	 – –	 0.05 5	µA
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}	 – –	 110 120	 – –	–

AC characteristics

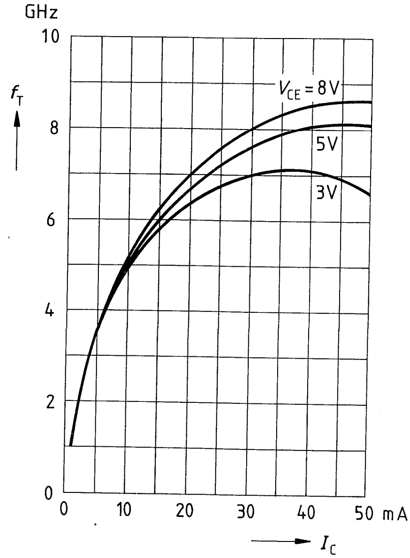
Parameter	Symbol	Values			Unit
		min	typ	max	
Transition frequency	f_T				GHz
I_C = 5 mA, V_{CE} = 8 V, f = 500 MHz		–	3.6	–	
I_C = 30 mA, V_{CE} = 8 V, f = 500 MHz		–	8	–	
Collector-base capacitance V_{CB} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{cb}	–	0.62	–	pF
Collector-emitter capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{ce}	–	0.4	–	pF
Input capacitance V_{EB} = 0.5 V, I_C = i_c = 0, f = 1 MHz	C_{ibo}	–	2.5	–	pF
Output capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{obs}	–	1.0	–	pF
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)				dB
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	–	dB
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) $G_{ma} = \frac{|S_{21e}|}{|S_{12e}|} (k - \sqrt{k^2-1})$

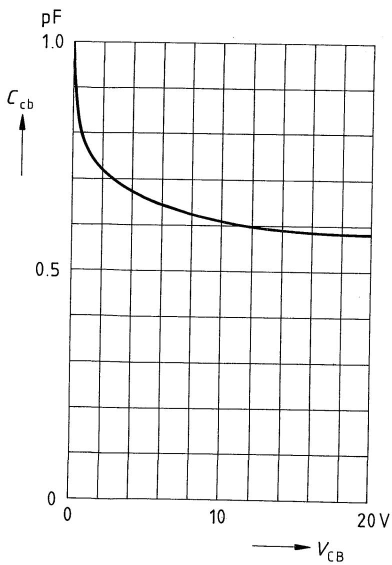
Total power dissipation $P_{tot} = f(T_A)$
Package mounted on alumina



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

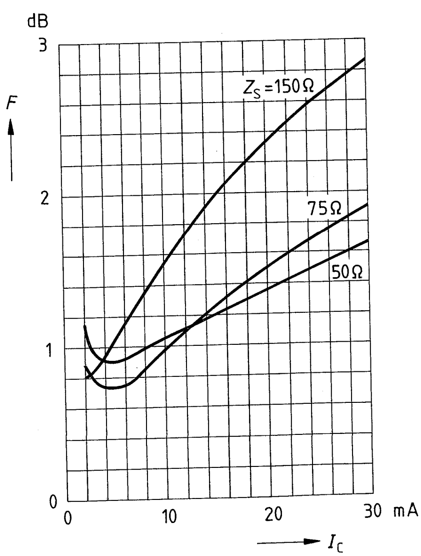
I_C = 10 mA, V_{CE} = 8 V, Z_0 = 50 Ω

f	F_{min}	G_p (F_{min})	Γ_{opt}		R_N	N	$F_{50\,\Omega}$	G_p ($F_{50\,\Omega}$)
GHz	dB	dB	MAG	ANG	Ω	–	dB	dB
0.01	1	–	(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

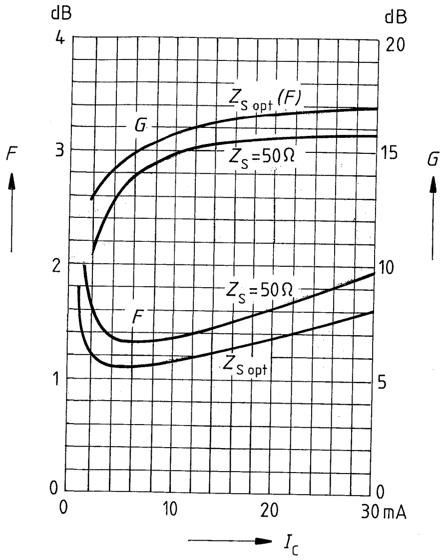
I_C = 30 mA, V_{CE} = 8 V, Z_0 = 50 Ω

f	F_{min}	G_p (F_{min})	Γ_{opt}		R_N	N	$F_{50\,\Omega}$	G_p ($F_{50\,\Omega}$)
GHz	dB	dB	MAG	ANG	Ω	–	dB	dB
0.01	1.65	–	(Z_S = 50 Ω)		–	–	1.65	–
0.8	1.6	17	–	–	–	–	1.95	15.8
2.0	2.6	10	–	–	–	–	3.3	8

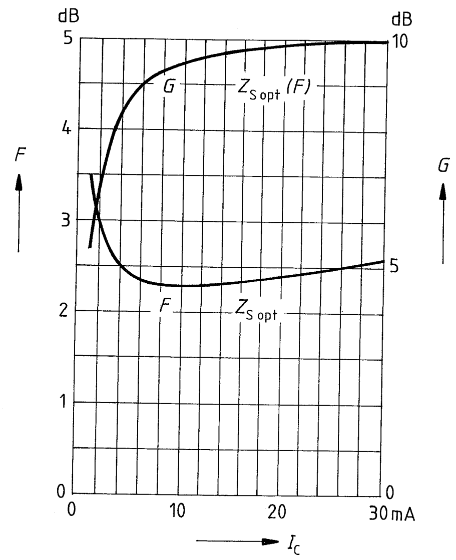
Noise figure F = f (I_C)
V_{CE} = 8 V, f = 10 MHz



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

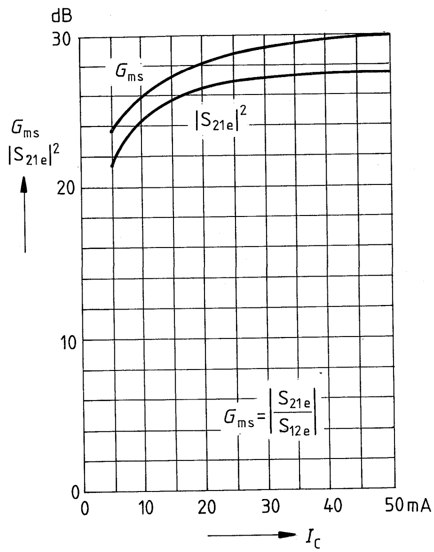


Noise figure $F = f(I_C)$
Power gain $G = f(I_C)$
$V_{CE} = 8$ V, $f = 2$ GHz, Z_{Lopt} (G)

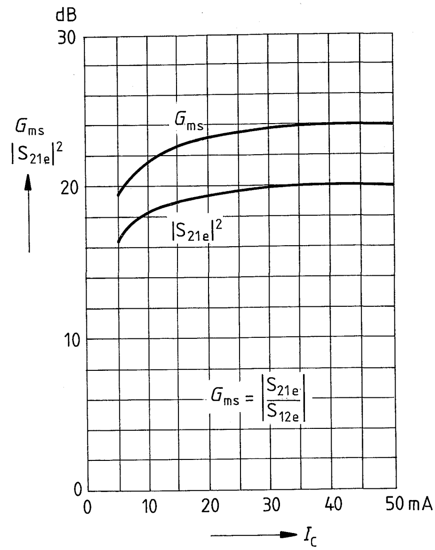


Common Emitter Power Gain

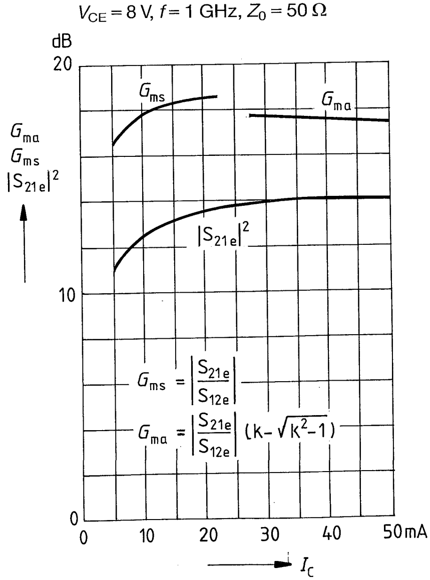
Power gain G_{ms}, $|S_{21e}|^2 = f(I_C)$
$V_{CE} = 8$ V, $f = 200$ MHz, $Z_0 = 50\ \Omega$



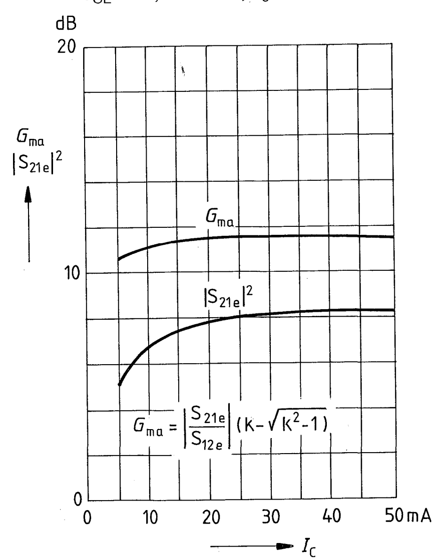
Power gain G_{ms}, $|S_{21e}|^2 = f(I_C)$
$V_{CE} = 8$ V, $f = 500$ MHz, $Z_0 = 50\ \Omega$



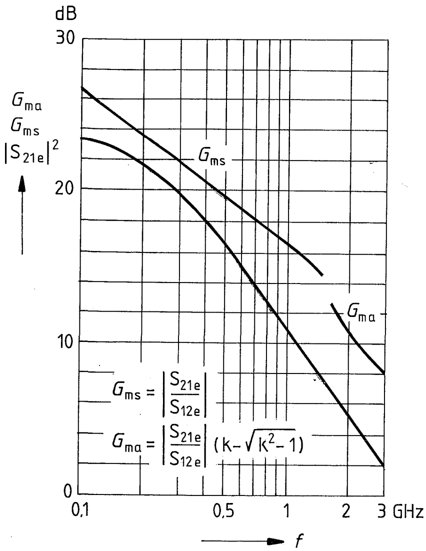
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(I_C)$
$V_{CE} = 8$ V, $f = 1$ GHz, $Z_0 = 50\ \Omega$



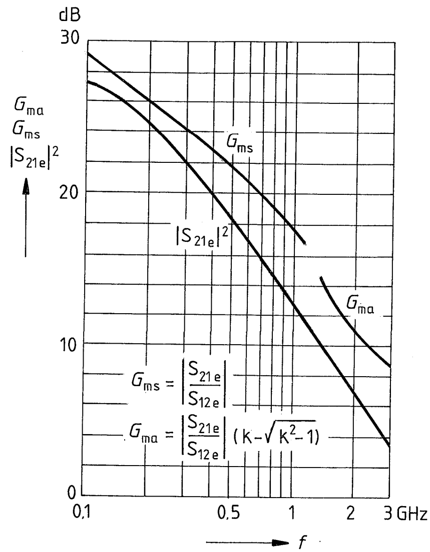
Power gain G_{ma}, $|S_{21e}|^2 = f(I_C)$
$V_{CE} = 8$ V, $f = 2$ GHz, $Z_0 = 50\ \Omega$



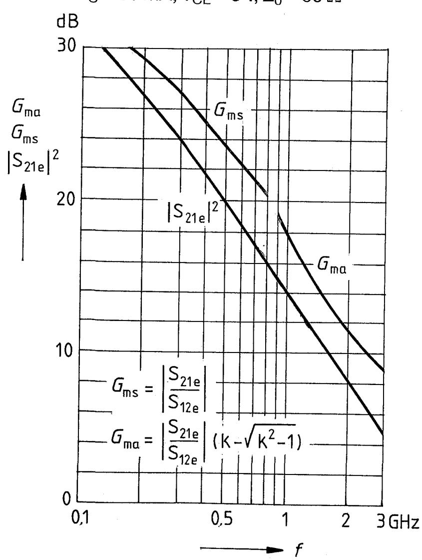
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
$I_C = 5$ mA, $V_{CE} = 8$ V, $Z_0 = 50\ \Omega$



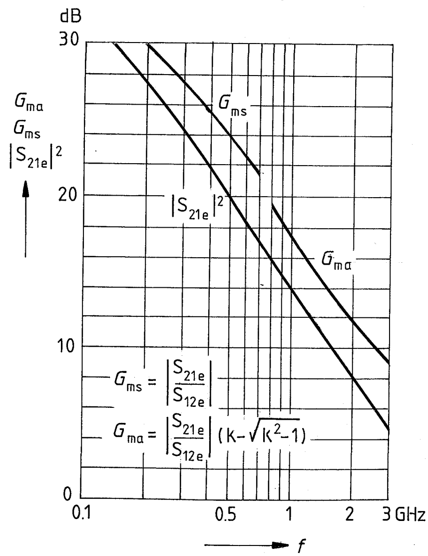
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
$I_C = 10$ mA, $V_{CE} = 8$ V, $Z_0 = 50\ \Omega$



Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
$I_C = 30$ mA, $V_{CE} = 8$ V, $Z_0 = 50\ \Omega$



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



Common Emitter S Parameters

I_C = 10 mA, V_{CE} = 3 V, Z_0 = 50 Ω

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

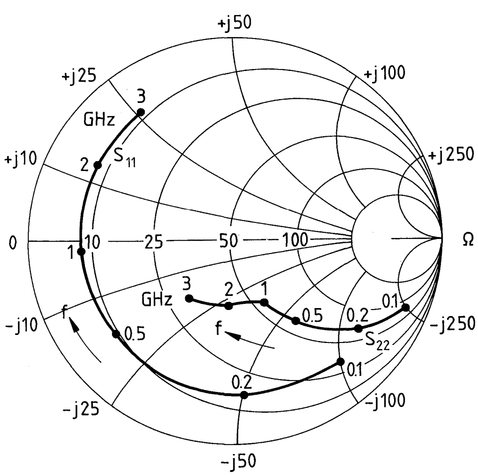
I_C = 30 mA, V_{CE} = 3 V, Z_0 = 50 Ω

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

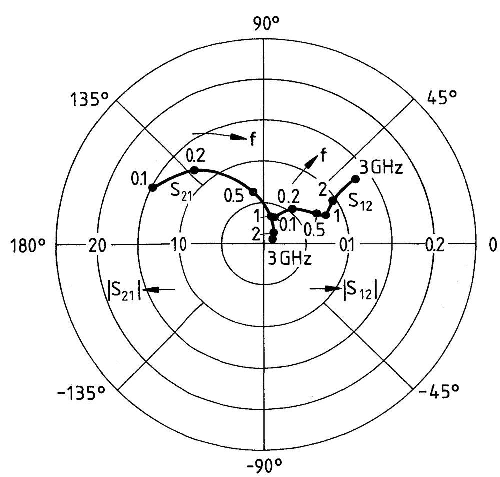
I_C = 5 mA, V_{CE} = 5 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	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



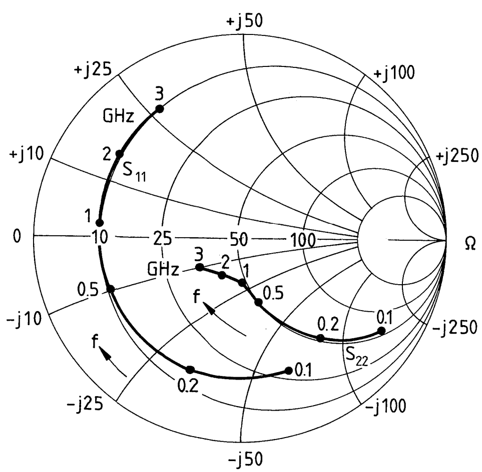
S_{12}, S_{21} = f (*f*)
I_C = 5 mA, V_{CE} = 5 V, Z_0 = 50 Ω



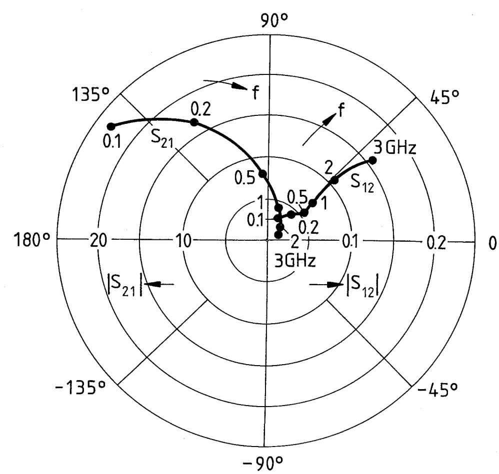
I_C = 10 mA, V_{CE} = 5 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	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



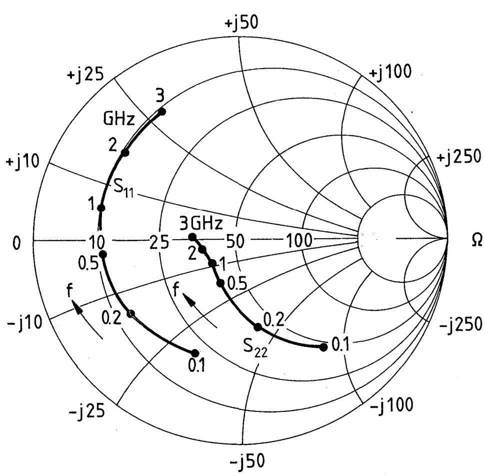
S_{12}, S_{21} = f (*f*)
I_C = 10 mA, V_{CE} = 5 V, Z_0 = 50 Ω



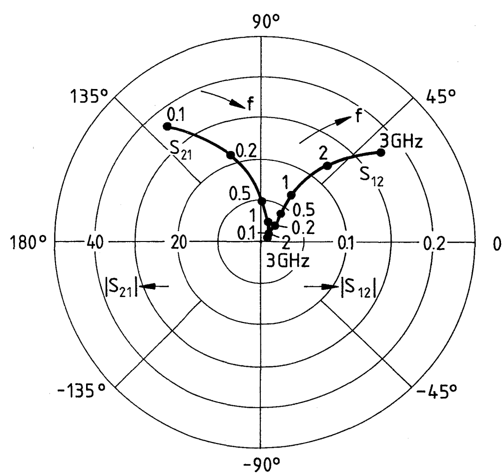
I_C = 30 mA, V_{CE} = 5 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	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



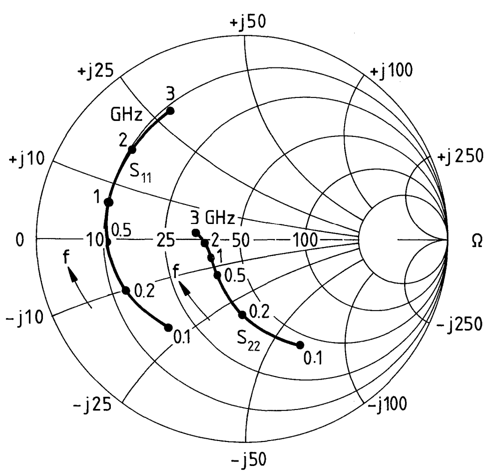
S_{12}, S_{21} = f (*f*)
I_C = 30 mA, V_{CE} = 5 V, Z_0 = 50 Ω



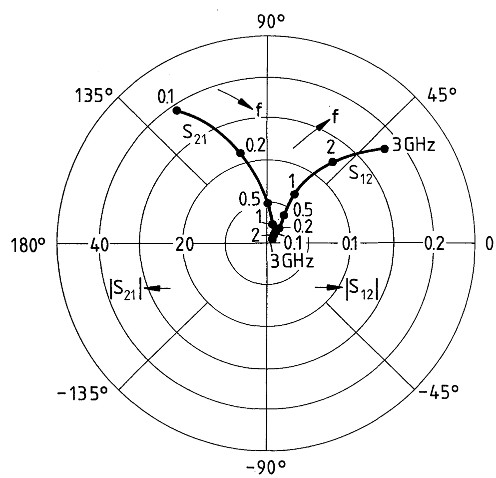
I_C = 50 mA, V_{CE} = 5 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	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



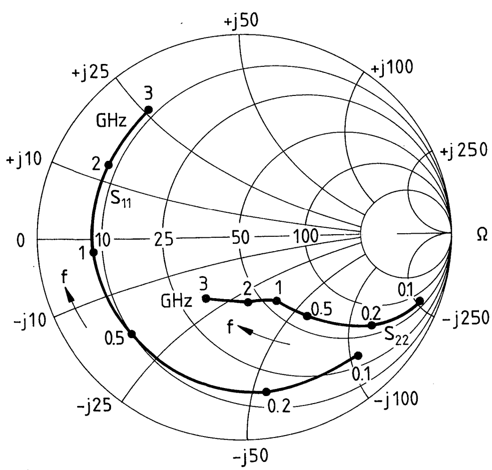
S_{12}, S_{21} = f (*f*)
I_C = 50 mA, V_{CE} = 5 V, Z_0 = 50 Ω



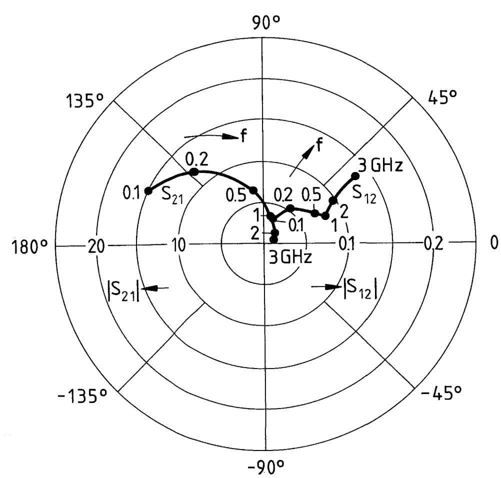
I_C = 5 mA, V_{CE} = 8 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	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



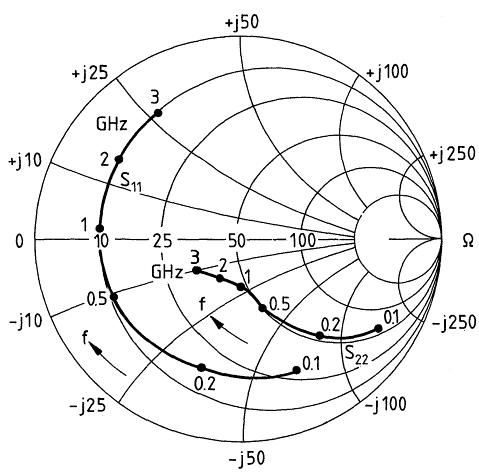
S_{12}, S_{21} = f (f)
I_C = 5 mA, V_{CE} = 8 V, Z_0 = 50 Ω



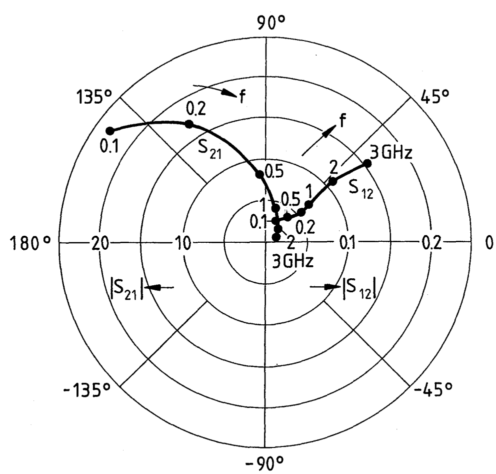
I_C = 10 mA, V_{CE} = 8 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	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



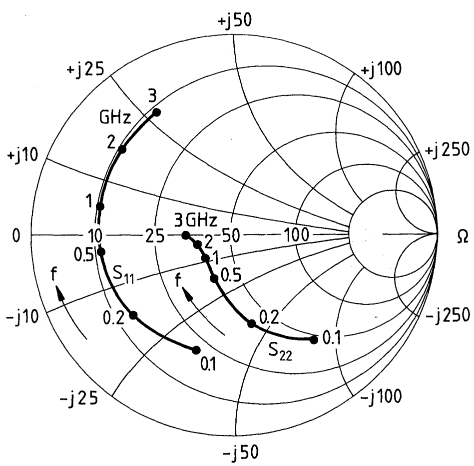
S_{12}, S_{21} = f (*f*)
I_C = 10 mA, V_{CE} = 8 V, Z_0 = 50 Ω



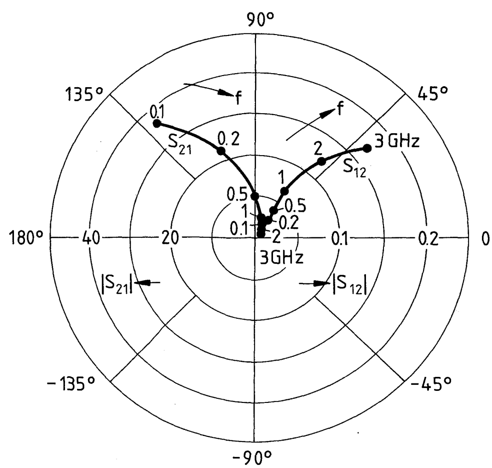
I_C = 30 mA, V_{CE} = 8 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	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



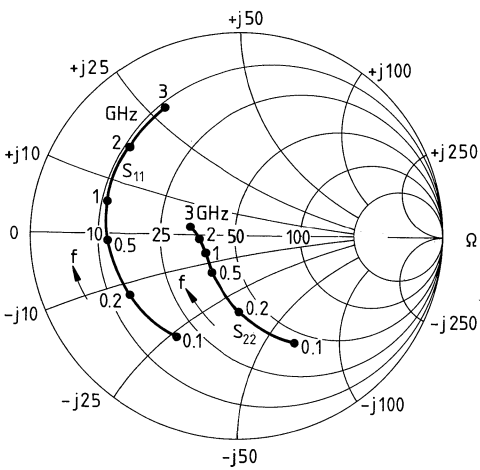
S_{12}, S_{21} = f (f)
I_C = 30 mA, V_{CE} = 8 V, Z_0 = 50 Ω



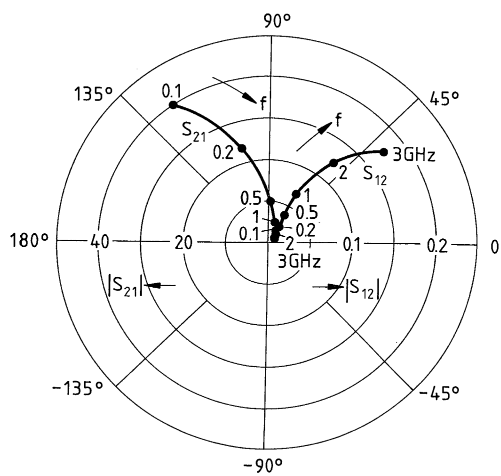
$I_C = 50$ mA, $V_{CE} = 8$ V, $Z_0 = 50\ \Omega$

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

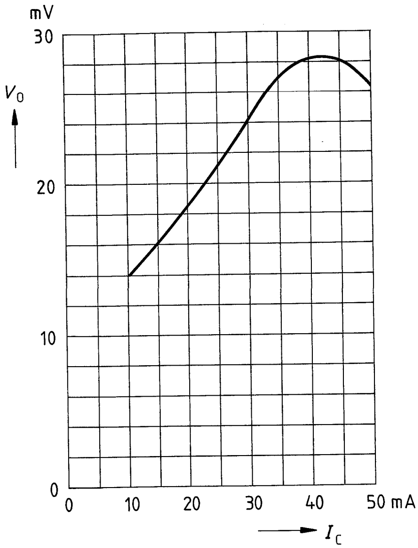
S_{11}, S_{22} = f (*f*)
$I_C = 50$ mA, $V_{CE} = 8$ V, $Z_0 = 50\ \Omega$



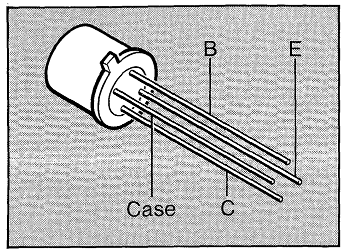
S_{12}, S_{21} = f (*f*)
$I_C = 50$ mA, $V_{CE} = 8$ V, $Z_0 = 50\ \Omega$



Linear output voltage $V_O = f(I_C)$
$V_{CE} = 8$ V, $d_{IM} = 60$ dB, $f_1 = 806$ MHz,
$f_2 = 810$ MHz, $Z_S = Z_L = 50\ \Omega$



- For broadband amplifiers up to 1 GHz at collector currents up to 20 mA.



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

Type	Marking	Ordering code	Package[1])
BFR 15A	BFR 15A	Q 62702 – F460	TO-72

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CEO}	12	V
Collector-emitter voltage, $V_{BE} = 0$	V_{CES}	20	V
Collector-base voltage	V_{CBO}	20	V
Emitter-base voltage	V_{EBO}	2.5	V
Collector current	I_C	30	mA
Base current	I_B	4	mA
Total power dissipation, $T_A \leq 60$ °C	P_{tot}	200	mW
Junction temperature	T_j	200	°C
Ambient temperature range	T_A	–65 ... +175	°C
Storage temperature range	T_{stg}	–65 ... +175	°C

Thermal Resistance

Junction – ambient	R_{thJA}	≤700	K/W
Junction – case	R_{thJC}	≤400	K/W

1) For detailed dimensions see chapter Package Outlines.

Electrical Characteristics

at T_A = 25 °C, unless otherwise specified.

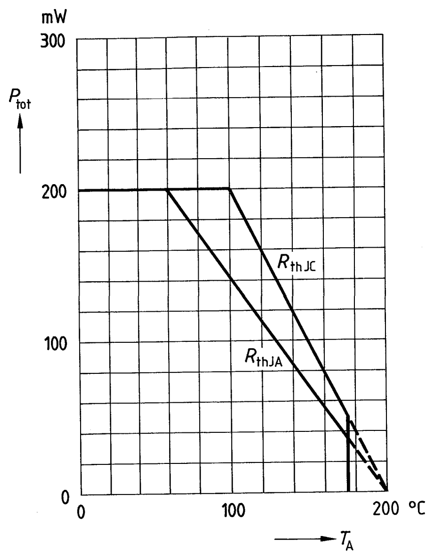
DC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CEO}$	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}	 25 25	 – –	 – –	–

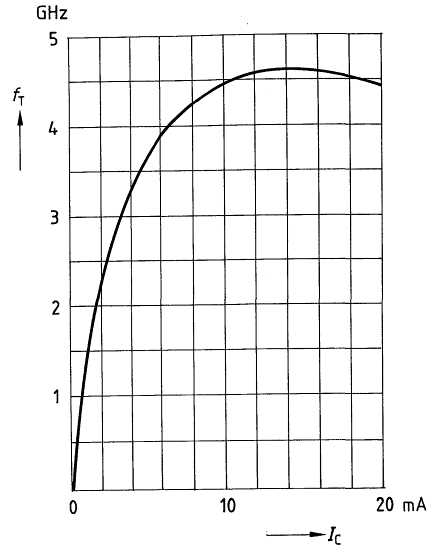
AC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
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	pF
Noise figure $I_C = 2$ mA, $V_{CE} = 6$ V, $f = 10$ MHz, $Z_S = 75\ \Omega$ $I_C = 2$ mA, $V_{CE} = 6$ V, $f = 200$ MHz, $Z_S = 75\ \Omega$ $I_C = 2$ mA, $V_{CE} = 6$ V, $f = 800$ MHz, $Z_S = 60\ \Omega$	F	 – – –	 1.8 2 3	 – – –	dB
Power gain $I_C = 10$ mA, $V_{CE} = 6$ V, $f = 800$ MHz, $Z_S = 60\ \Omega$, $Z_L = Z_{Lopt}$	G_{pe}	–	12	–	dB
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, $Z_S = Z_L = 50\ \Omega$	$V_{o1} = V_{o2}$	–	140	–	mV
Third order intercept point $I_C = 15$ mA, $V_{CE} = 5$ V, $f = 800$ MHz	IP_3	–	26	–	dBm

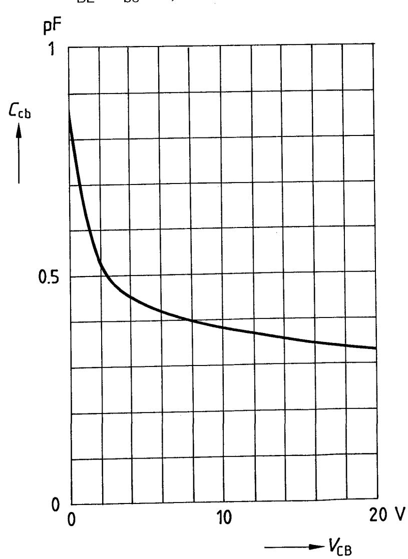
Total power dissipation $P_{tot} = f(T_A)$



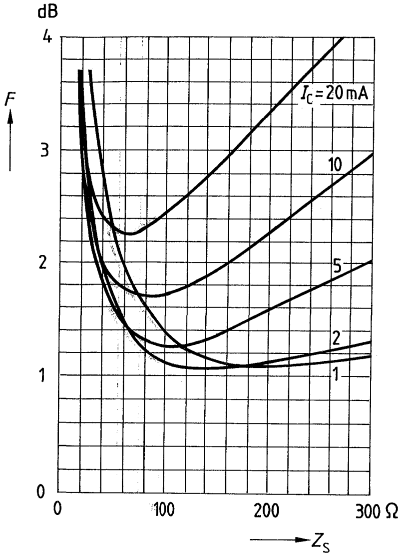
Transition frequency $f_T = f(I_C)$
$V_{CE} = 6$ V, $f = 200$ MHz



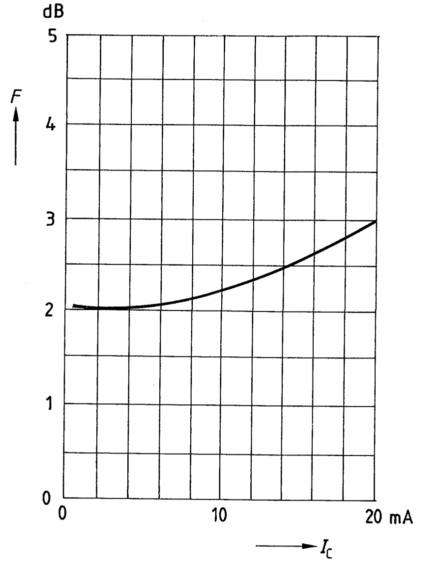
Collector-base capacitance $C_{cb} = f(V_{CB})$
$V_{BE} = v_{be} = 0$, $f = 1$ MHz



Noise figure $F = f(Z_S)$
$V_{CE} = 6$ V, $f = 10$ MHz

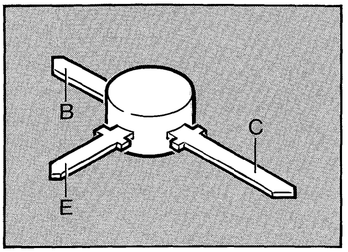


Noise figure $F = f(I_C)$
$V_{CE} = 6$ V, $f = 800$ MHz, Z_{Lopt} (G)



NPN Silicon RF Transistor — BFR 34A

- For broadband amplifiers up to 2 GHz at collector currents from 1 to 20 mA.



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

Type	Marking	Ordering code	Package1)
BFR 34A	BFR 34A	Q 62702 – F346 – S1	T-plast

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CEO}	12	V
Collector-emitter voltage, $V_{BE} = 0$	V_{CES}	20	V
Emitter-base voltage	V_{EBO}	2.5	V
Collector current	I_C	30	mA
Base current	I_B	4	mA
Total power dissipation, $T_A \leq 50$ °C2)	P_{tot}	200	mW
Junction temperature	T_j	150	°C
Ambient temperature range	T_A	–65 ... +150	°C
Storage temperature range	T_{stg}	–65 ... +150	°C

Thermal Resistance

Junction – ambient2)	R_{thJA}	≤500	K/W

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

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

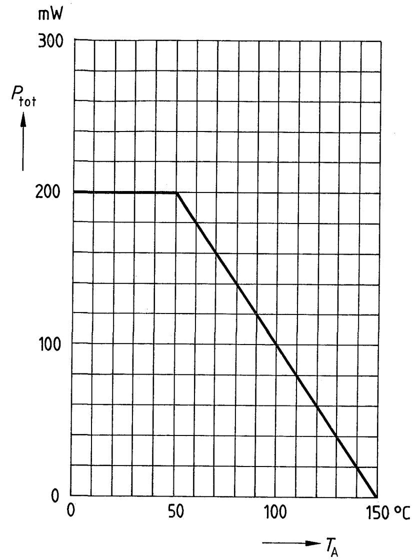
DC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CEO}$	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	 – –	 – –	–

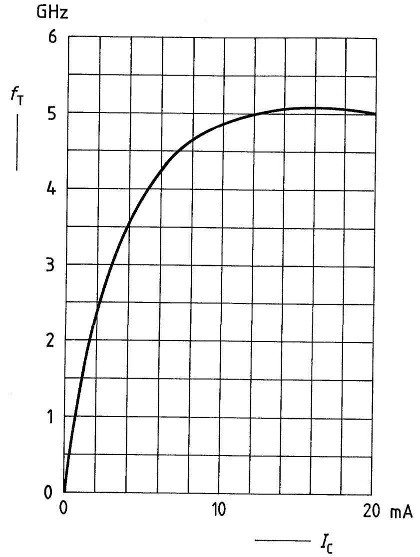
AC characteristics

Parameter	Symbol	Values min	Values typ	Values max	Unit
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	–	pF
Output capacitance $V_{CE} = 10$ V, $V_{BE} = v_{be} = 0$, $f = 1$ MHz	C_{obs}	–	0.75	–	pF
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	–	dB
Transducer gain $I_C = 5$ mA, $V_{CE} = 6$ V, $f = 500$ MHz, $Z_0 = 50\ \Omega$	$\|S_{21e}\|^2$	–	16.2	–	dB
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

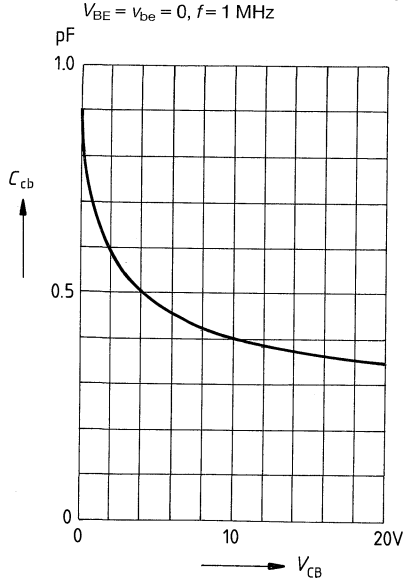
Total power dissipation $P_{tot} = f\,(T_A)$
Package mounted on glass epoxy



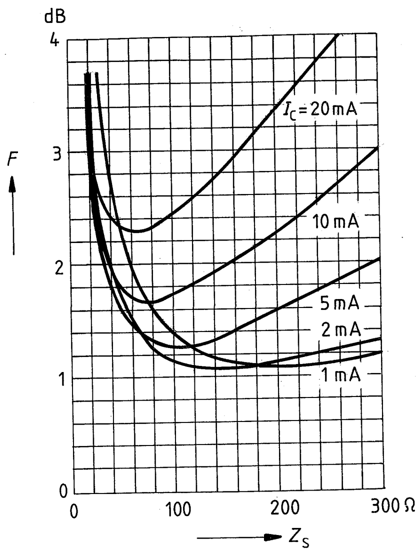
Transition frequency $f_T = f\,(I_C)$
$V_{CE} = 10$ V, $f = 200$ MHz



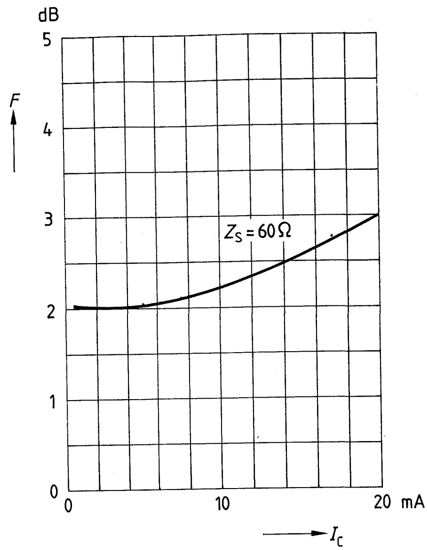
Collector-base capacitance $C_{cb} = f\,(V_{CB})$
$V_{BE} = v_{be} = 0$, $f = 1$ MHz



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)

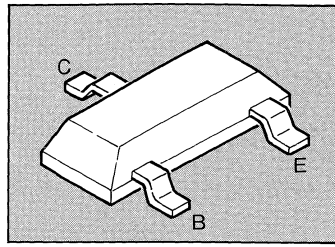


Common Emitter S Parameters
I_C = 5 mA, V_{CE} = 6 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.794	– 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

NPN Silicon RF Transistor **BFR 35AP**

- For broadband amplifiers up to 2 GHz and fast non-saturated switches at collector currents from 0.5 to 20 mA.



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

Type	Marking	Ordering code (tape and reel)	Package[1])
BFR 35AP	GE	Q 62702 – F 938	SOT-23

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CEO}	12	V
Collector-emitter voltage, $V_{BE} = 0$	V_{CES}	20	V
Emitter-base voltage	V_{EBO}	2.5	V
Collector current	I_C	30	mA
Base current	I_B	4	mA
Total power dissipation, $T_A \leq 25$ °C[2])	P_{tot}	280	mW
Junction temperature	T_j	150	°C
Ambient temperature range	T_A	–65 ... +150	°C
Storage temperature range	T_{stg}	–65 ... +150	°C

Thermal Resistance

Junction – ambient[2])	R_{thJA}	≤450	K/W

1) For detailed dimensions 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.

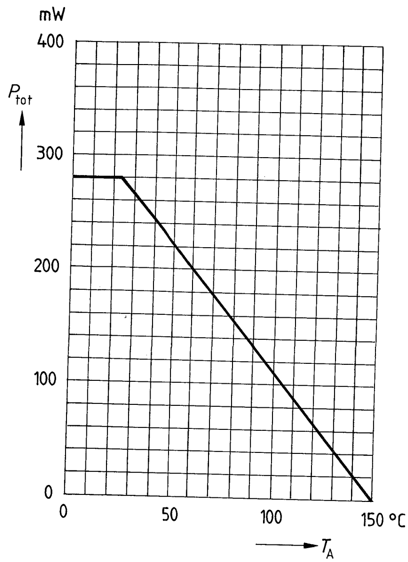
DC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
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

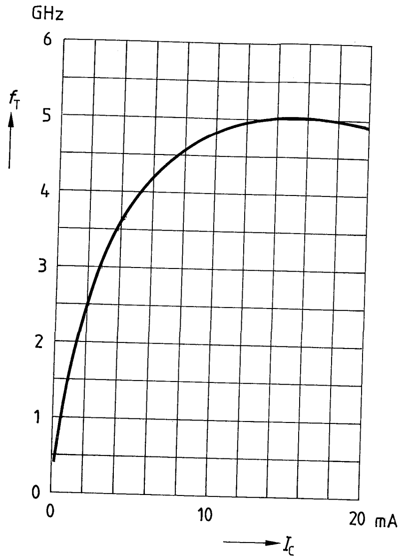
AC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
Transition frequency I_C = 5 mA, V_{CE} = 6 V, f = 200 MHz I_C = 20 mA, V_{CE} = 6 V, f = 200 MHz	f_T	 – 3.6	 3.8 4.9	 – –	GHz
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	–	pF
Input capacitance V_{EB} = 0.5 V, I_C = i_c = 0, f = 1 MHz	C_{ibo}	–	0.9	–	pF
Output capacitance V_{CE} = 6 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{obs}	–	0.85	–	pF
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	–	dB
Transducer gain I_C = 15 mA, V_{CE} = 6 V, f = 1 GHz, Z_0 = 50 Ω	$\|S_{21e}\|^2$	–	11	–	dB
Linear output voltage two-tone intermodulation test I_C = 15 mA, V_{CE} = 10 V, d_{IM} = 60 dB f_1 = 806 MHz, f_2 = 810 MHz, Z_S = Z_L = 50 Ω	V_{o1} = V_{o2}	–	110	–	mV
Third order intercept point I_C = 15 mA, V_{CE} = 10 V, f = 800 MHz	IP_3	–	23.5	–	dBm

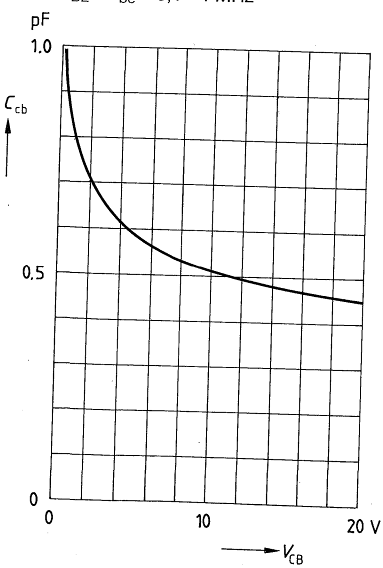
Total power dissipation $P_{tot} = f(T_A)$
Package mounted on alumina



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



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



Common Emitter Noise Parameters

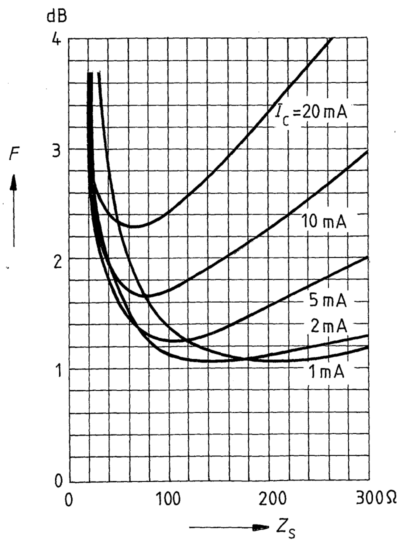
I_C = 2 mA, V_{CE} = 6 V, Z_0 = 50 Ω

f	F_{min}	G_p (F_{min})	Γ_{opt}		R_N	N	$F_{50\,\Omega}$	G_p ($F_{50\,\Omega}$)
GHz	dB	dB	MAG	ANG	Ω	–	dB	dB
0.01	1.05	–	(Z_S = 150 Ω)		–	–	3	–

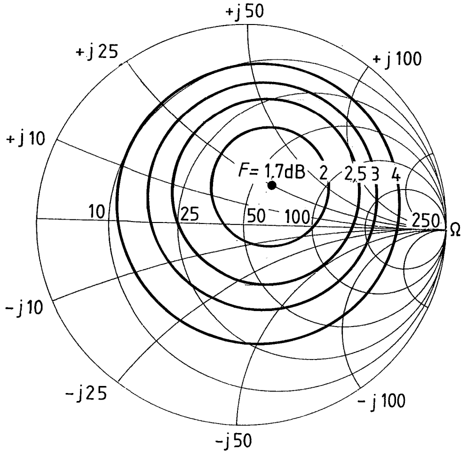
I_C = 5 mA, V_{CE} = 6 V, Z_0 = 50 Ω

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

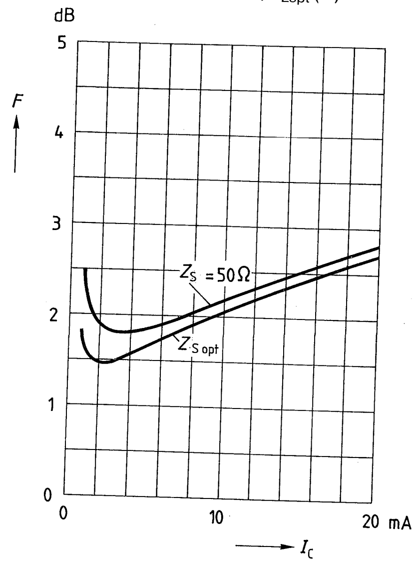
Noise figure F = f (Z_S)
V_{CE} = 6 V, f = 10 MHz



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

I_C = 0.5 mA, V_{CE} = 1 V, Z_0 = 50 Ω

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

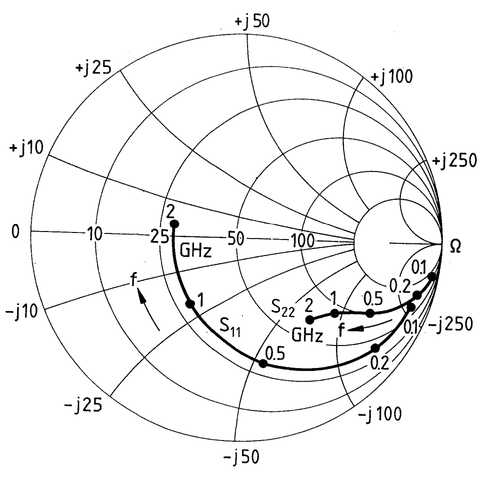
I_C = 1 mA, V_{CE} = 1 V, Z_0 = 50 Ω

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

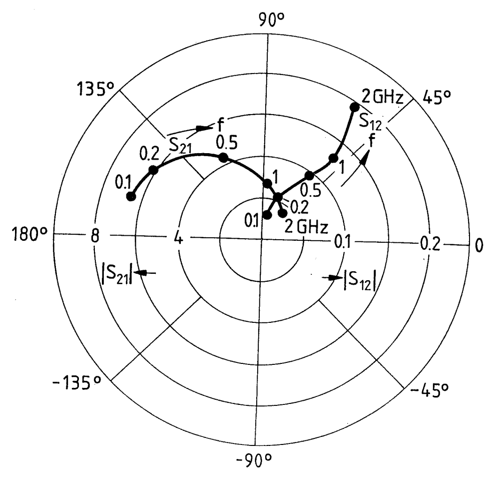
I_C = 2 mA, V_{CE} = 6 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.91	– 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



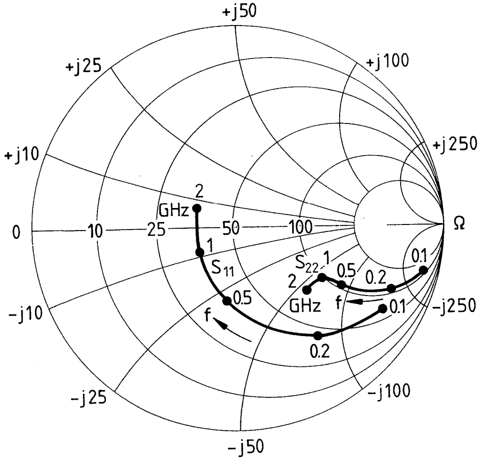
S_{12}, S_{21} = f (*f*)
I_C = 2 mA, V_{CE} = 6 V, Z_0 = 50 Ω



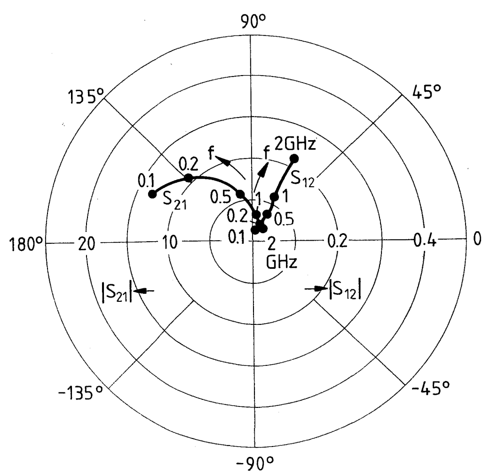
I_C = 5 mA, V_{CE} = 6 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.80	– 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



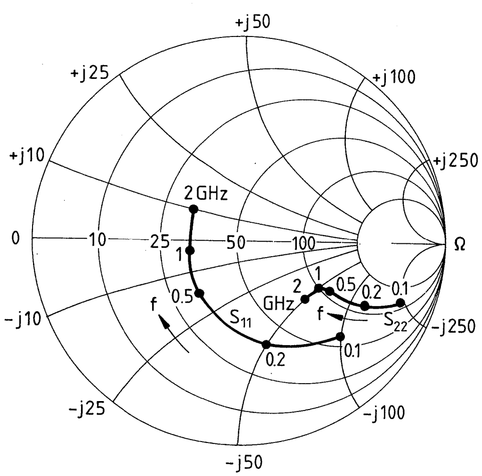
S_{12}, S_{21} = f (f)
I_C = 5 mA, V_{CE} = 6 V, Z_0 = 50 Ω



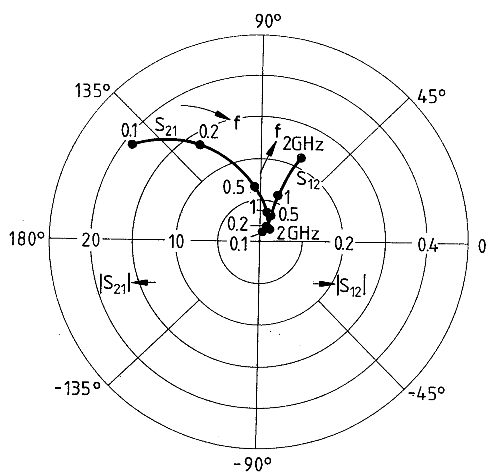
I_C = 10 mA, V_{CE} = 6 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.66	– 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	–31
1.2	0.21	–178	3.09	71	0.14	64	0.41	–32
1.5	0.21	164	2.54	63	0.17	63	0.41	–34
1.8	0.22	147	2.18	55	0.21	62	0.40	–36
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



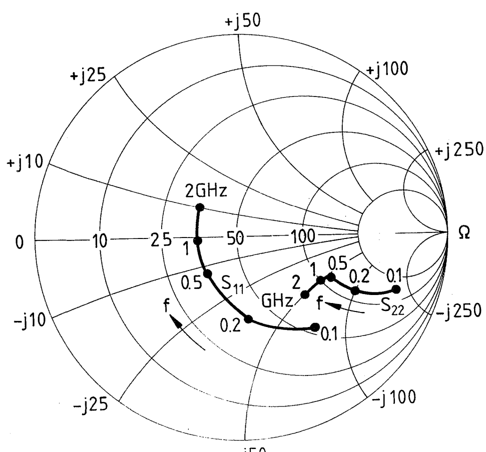
S_{12}, S_{21} = f (*f*)
I_C = 10 mA, V_{CE} = 6 V, Z_0 = 50 Ω



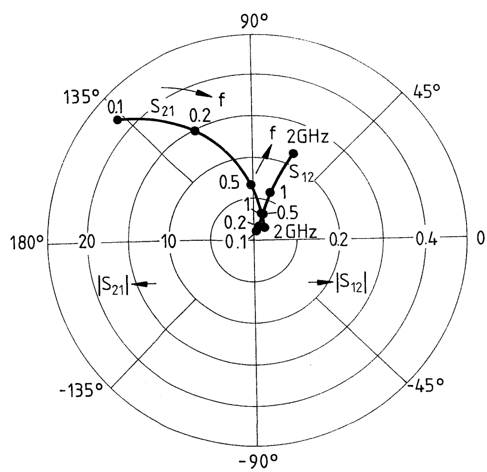
I_C = 15 mA, V_{CE} = 6 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.57	– 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



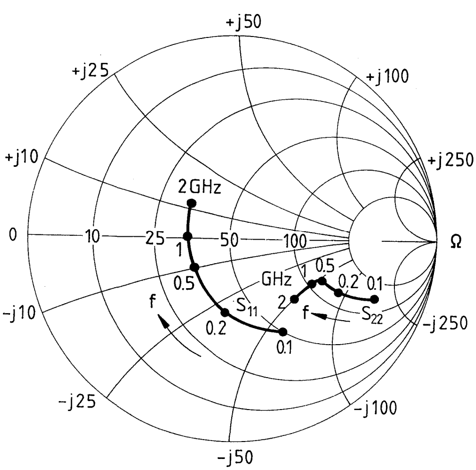
S_{12}, S_{21} = f (f)
I_C = 15 mA, V_{CE} = 6 V, Z_0 = 50 Ω



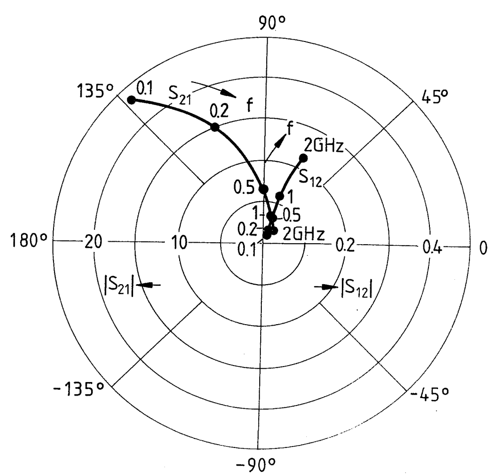
I_C = 20 mA, V_{CE} = 6 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.51	– 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



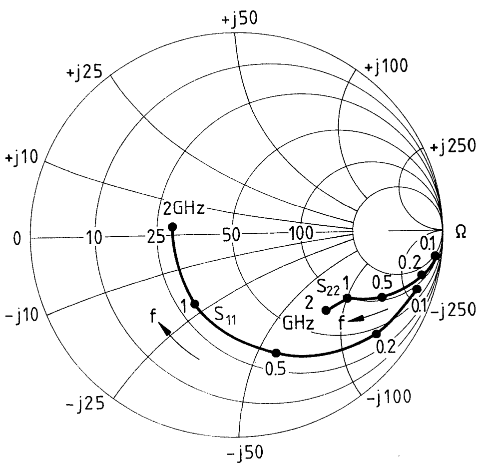
S_{12}, S_{21} = f (*f*)
I_C = 20 mA, V_{CE} = 6 V, Z_0 = 50 Ω



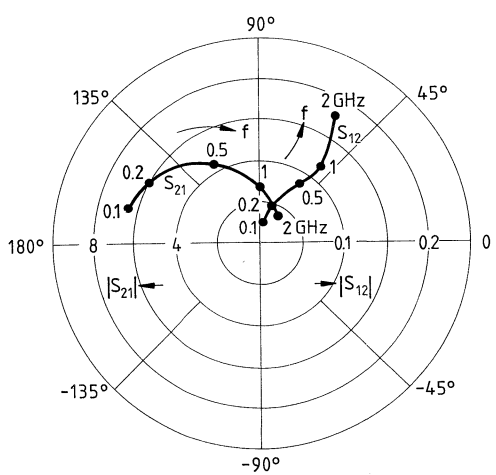
I_C = 2 mA, V_{CE} = 10 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.92	– 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



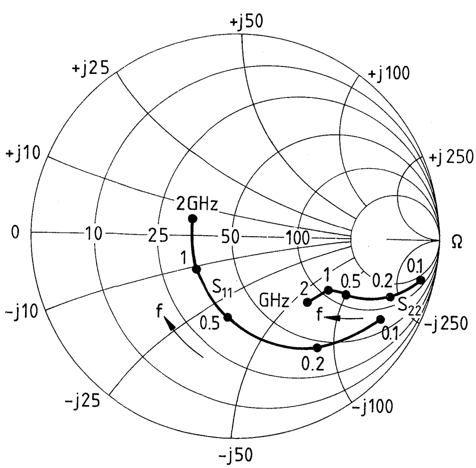
S_{12}, S_{21} = f (*f*)
I_C = 2 mA, V_{CE} = 10 V, Z_0 = 50 Ω



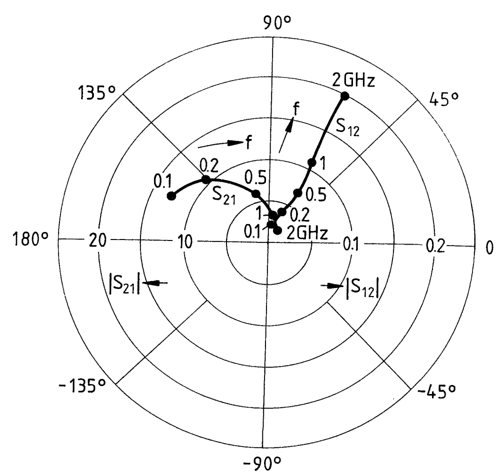
I_C = 5 mA, V_{CE} = 10 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.83	− 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



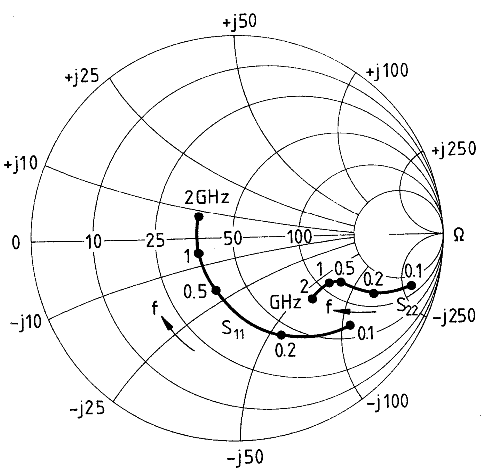
S_{12}, S_{21} = f (*f*)
I_C = 5 mA, V_{CE} = 10 V, Z_0 = 50 Ω



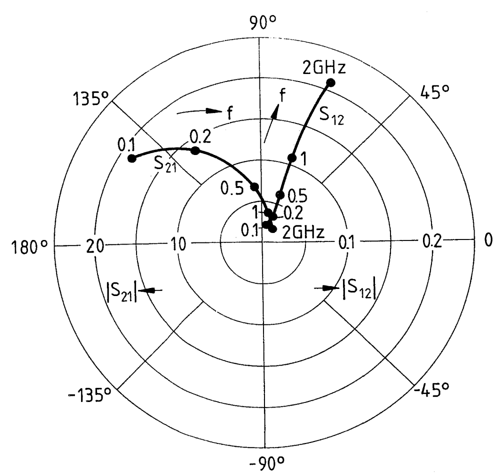
I_C = 10 mA, V_{CE} = 10 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.75	– 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



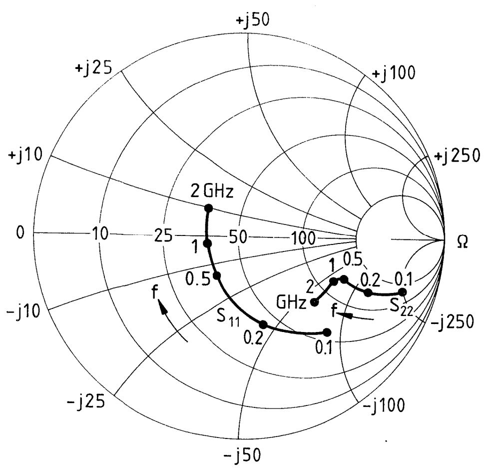
S_{12}, S_{21} = f (f)
I_C = 10 mA, V_{CE} = 10 V, Z_0 = 50 Ω



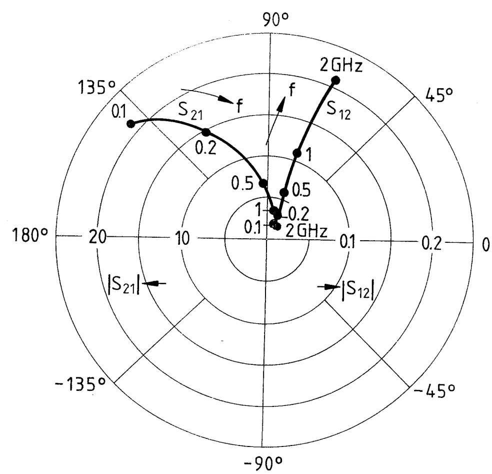
I_C = 15 mA, V_{CE} = 10 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.64	– 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



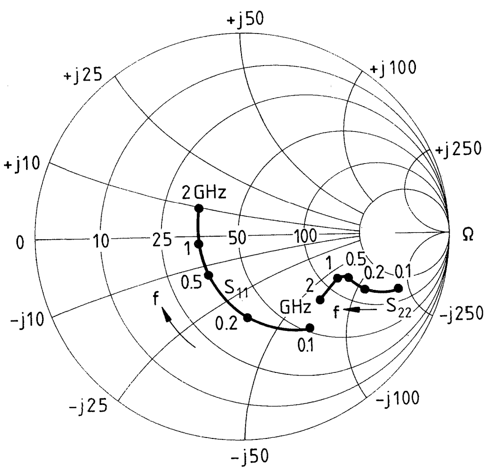
S_{12}, S_{21} = f (*f*)
I_C = 15 mA, V_{CE} = 10 V, Z_0 = 50 Ω



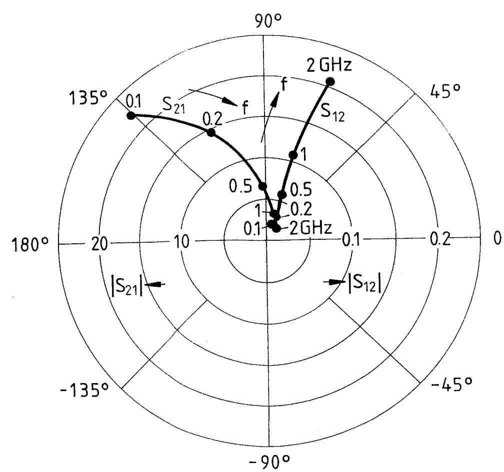
I_C = 20 mA, V_{CE} = 10 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.58	– 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



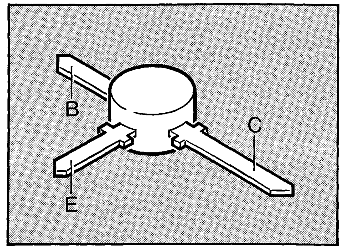
S_{12}, S_{21} = f (*f*)
I_C = 20 mA, V_{CE} = 10 V, Z_0 = 50 Ω



NPN Silicon RF Transistor

BFR 90

- For broadband amplifiers up to 2 GHz at collector currents from 1 to 20 mA.



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

Type	Marking	Ordering code	Package[1])
BFR 90	BFR 90	Q 62702 – F560	T-plast

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CEO}	15	V
Collector-emitter voltage, $V_{BE} = 0$	V_{CES}	20	V
Emitter-base voltage	V_{EBO}	2.5	V
Collector current	I_C	30	mA
Base current	I_B	4	mA
Total power dissipation, $T_A \leq 50$ °C[2])	P_{tot}	200	mW
Junction temperature	T_j	150	°C
Ambient temperature range	T_A	–65 ... +150	°C
Storage temperature range	T_{stg}	–65 ... +150	°C

Thermal Resistance

Junction – ambient[2])	R_{thJA}	≤500	K/W

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

Electrical Characteristics

at T_A = 25 °C, unless otherwise specified.

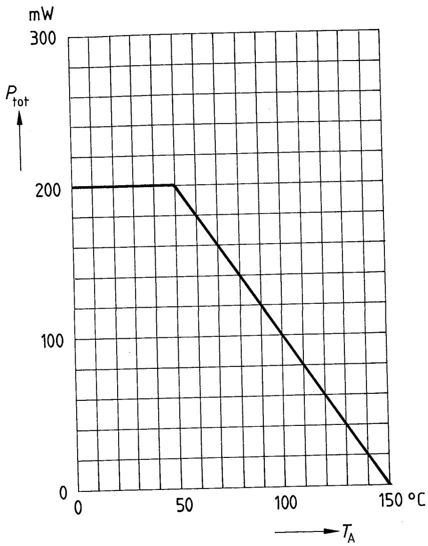
DC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CEO}$	15	–	–	V
Collector-emitter cutoff current V_{CE} = 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	 – –	 – –	–

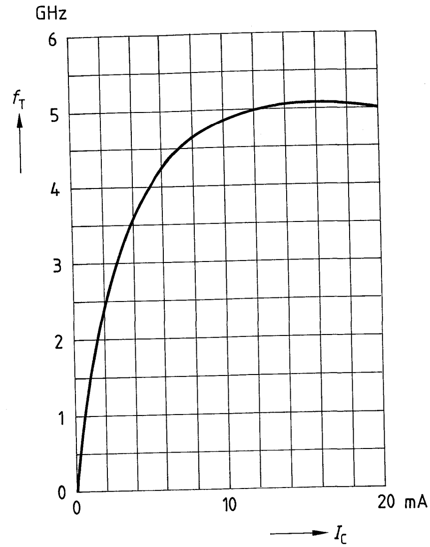
AC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
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	–	pF
Output capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{obs}	–	0.75	–	pF
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	–	dB
Transducer gain I_C = 15 mA, V_{CE} = 6 V, f = 500 MHz, Z_0 = 50 Ω	$\|S_{21e}\|^2$	–	17	–	dB
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

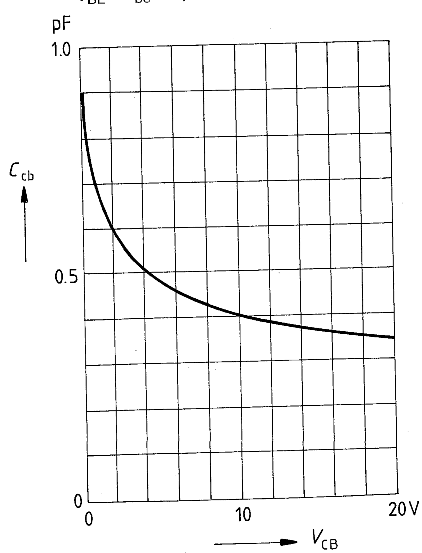
Total power dissipation $P_{tot} = f(T_A)$
Package mounted on glass epoxy



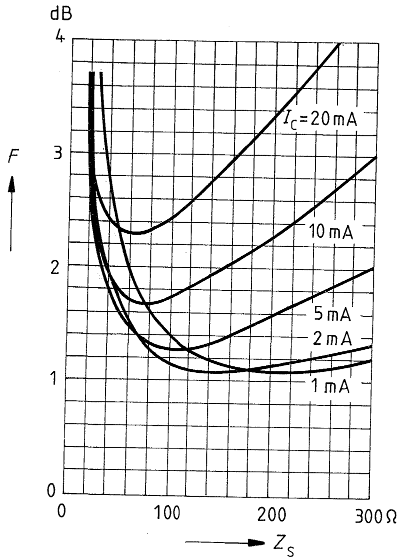
Transition frequency $f_T = f(I_C)$
$V_{CE} = 10$ V, $f = 200$ MHz



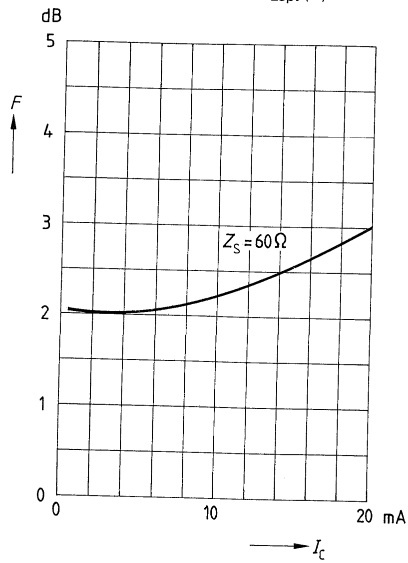
Collector-base capacitance $C_{cb} = f(V_{CB})$
$V_{BE} = v_{be} = 0$, $f = 1$ MHz



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

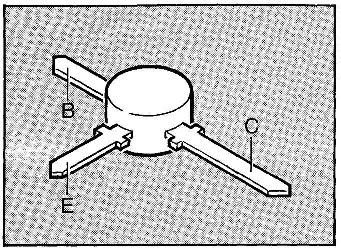
I_C = 15 mA, V_{CE} = 6 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.300	– 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

NPN Silicon RF Transistor

BFR 91

- For low-distortion broadband amplifiers up to 1 GHz at collector currents from 10 to 30 mA.



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

Type	Marking	Ordering code	Package[1])
BFR 91	BFR 91	Q 62702 – F559	T-plast

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CEO}	15	V
Collector-emitter voltage, $V_{BE} = 0$	V_{CES}	20	V
Emitter-base voltage	V_{EBO}	2.5	V
Collector current	I_C	50	mA
Base current	I_B	10	mA
Total power dissipation, $T_A \leq 50$ °C[2])	P_{tot}	250	mW
Junction temperature	T_j	150	°C
Ambient temperature range	T_A	–65 ... +150	°C
Storage temperature range	T_{stg}	–65 ... +150	°C

Thermal Resistance

Junction – ambient[2])	R_{thJA}	≤400	K/W
Junction – ambient	R_{thJA}	≤700	K/W

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

Electrical Characteristics

at T_A = 25 °C, unless otherwise specified.

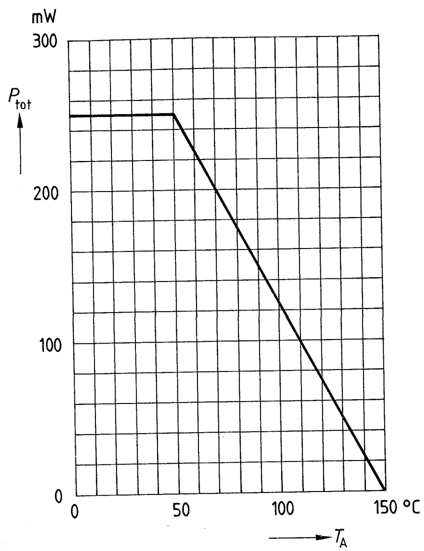
DC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CEO}$	15	–	–	V
Collector-emitter cutoff current V_{CE} = 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 = 25 mA, V_{CE} = 8 V I_C = 50 mA, V_{CE} = 5 V	h_{FE}	 30 30	 – –	 – –	–

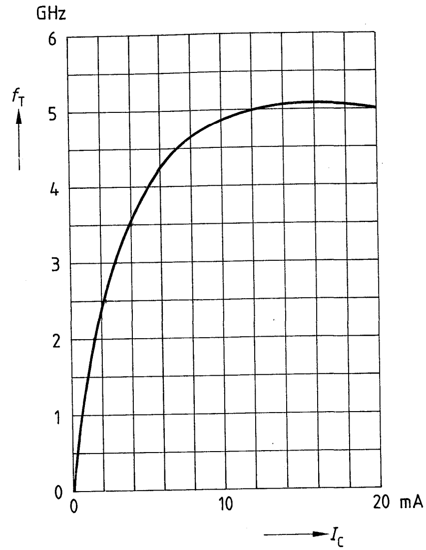
AC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
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	–	pF
Output capacitance $V_{CE} = 10$ V, $V_{BE} = v_{be} = 0$, $f = 1$ MHz	C_{obs}	–	0.85	–	pF
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, $Z_S = 60\ \Omega$, $Z_L = Z_{Lopt}$	G_{pe}	–	17	–	dB
Transducer gain $I_C = 30$ mA, $V_{CE} = 5$ V, $f = 800$ MHz, $Z_0 = 50\ \Omega$	$\|S_{21e}\|^2$	–	12.4	–	dB
Linear output voltage two-tone intermodulation test $I_C = 25$ mA, $V_{CE} = 8$ V, $d_{IM} = 60$ dB $f_1 = 806$ MHz, $f_2 = 810$ MHz, $Z_S = Z_L = 50\ \Omega$	$V_{o1} = V_{o2}$	–	240	–	mV
Third order intercept point $I_C = 25$ mA, $V_{CE} = 8$ V, $f = 800$ MHz	IP_3	–	30.5	–	dBm

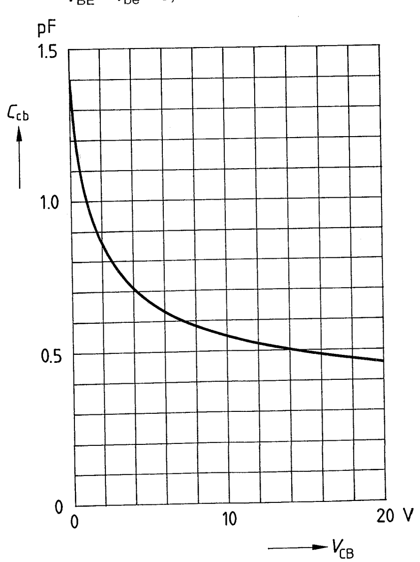
Total power dissipation $P_{tot} = f(T_A)$
Package mounted on glass epoxy



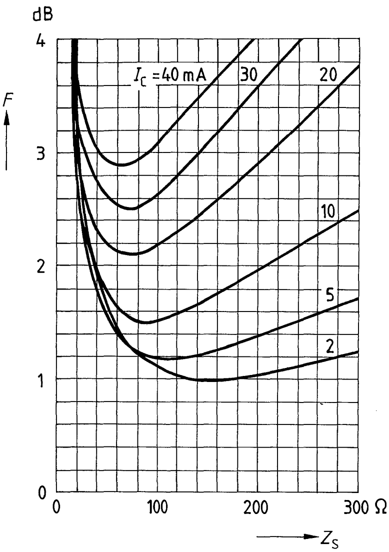
Transition frequency $f_T = f(I_C)$
$V_{CE} = 8$ V, $f = 200$ MHz



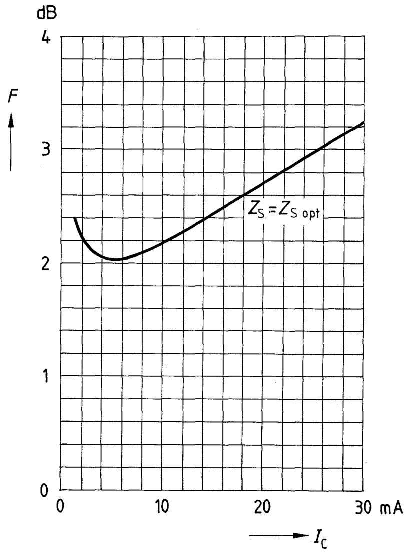
Collector-base capacitance $C_{cb} = f(V_{CB})$
$V_{BE} = v_{be} = 0$, $f = 1$ MHz



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)

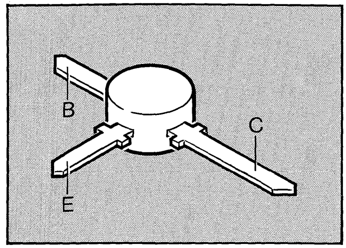


Common Emitter S Parameters
$I_C = 30$ mA, $V_{CE} = 5$ V, $Z_0 = 50$ Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.353	–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

NPN Silicon RF Transistor **BFR 91A**

- For low-distortion broadband amplifiers and oscillators up to 2 GHz at collector currents from 5 to 30 mA.



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

Type	Marking	Ordering code	Package[1])
BFR 91A	BFR 91A	Q 62702 – F735	T-plast

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CEO}	12	V
Collector-base voltage	V_{CBO}	15	V
Emitter-base voltage	V_{EBO}	2	V
Collector current	I_C	35	mA
Peak collector current, $f \geq$ 10 MHz	I_{CM}	50	mA
Peak base current, $f \geq$ 10 MHz	I_{BM}	10	mA
Total power dissipation, $T_A \leq 50$ °C[2])	P_{tot}	300	mW
Junction temperature	T_j	150	°C
Ambient temperature range	T_A	–65 ... +150	°C
Storage temperature range	T_{stg}	–65 ... +150	°C

Thermal Resistance

Junction – ambient[2])	R_{thJA}	≤300	K/W

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

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

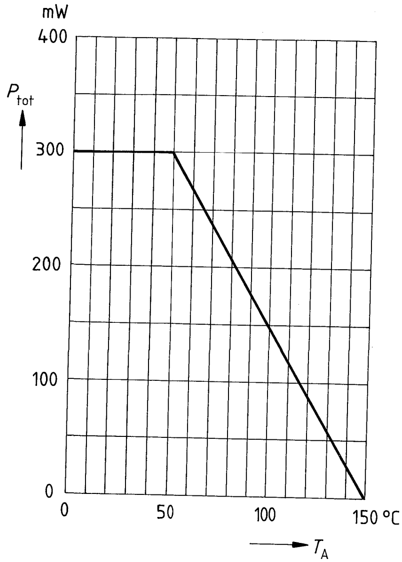
DC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CEO}$	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

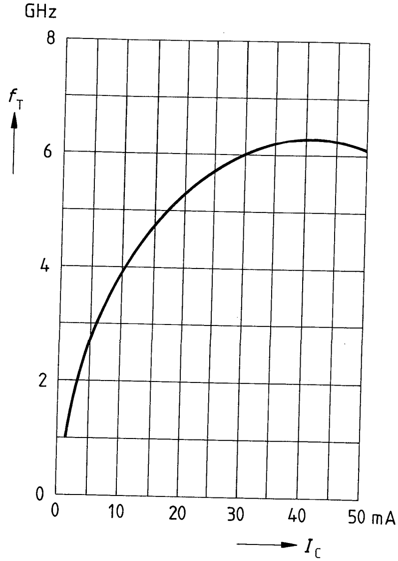
AC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
Transition frequency	f_T				GHz
I_C = 30 mA, V_{CE} = 5 V, f = 500 MHz		–	6	–	
I_C = 50 mA, V_{CE} = 5 V, f = 500 MHz		–	6.2	–	
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	–	pF
Input capacitance V_{EB} = 0.5 V, I_C = i_c = 0, f = 1 MHz	C_{ibo}	–	2.3	–	pF
Output capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{obs}	–	0.8	–	pF
Noise figure	F				dB
I_C = 5 mA, V_{CE} = 8 V, f = 10 MHz, Z_S = 50 Ω		–	1.1	–	
I_C = 5 mA, V_{CE} = 8 V, f = 800 MHz, Z_S = Z_{Sopt}		–	1.6	–	
Power gain I_C = 30 mA, V_{CE} = 8 V, f = 800 MHz, Z_S = 50 Ω, Z_L = Z_{Lopt}	G_{pe}	–	14	–	dB
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

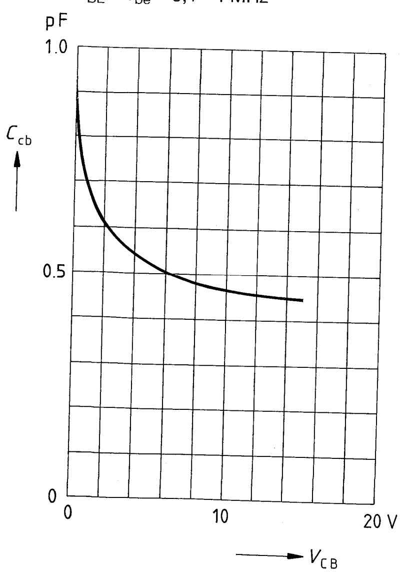
Total power dissipation $P_{tot} = f(T_A)$
Package mounted on glass epoxy



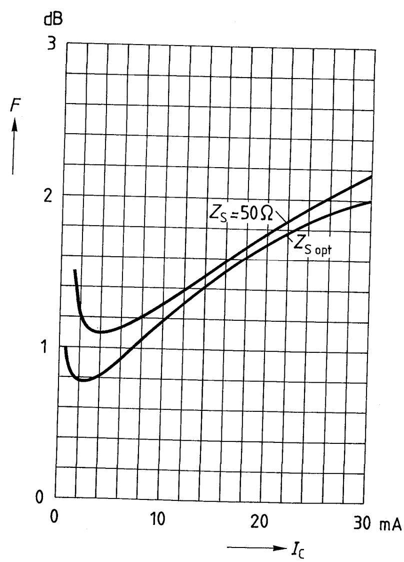
Transition frequency $f_T = f(I_C)$
$V_{CE} = 5$ V, $f = 500$ MHz



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



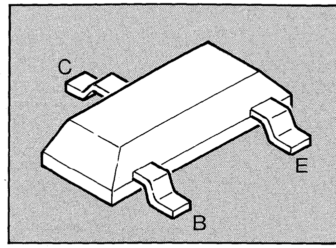
Noise figure $F = f(I_C)$
$V_{CE} = 8$ V, $f = 10$ MHz



NPN Silicon RF Transistor

BFR 92P

- For broadband amplifiers up to 2 GHz and fast non-saturated switches at collector currents from 0.5 to 20 mA.
- CECC-type available: CECC 50002/254.



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

Type	Marking	Ordering code (tape and reel)	Package[1])
BFR 92P	GF	Q 62702 – F1050	SOT-23

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CEO}	15	V
Collector-base voltage	V_{CBO}	20	V
Emitter-base voltage	V_{EBO}	2.5	V
Collector current	I_C	30	mA
Base current	I_B	4	mA
Total power dissipation, $T_A \leq 25$ °C[2])	P_{tot}	280	mW
Junction temperature	T_j	150	°C
Ambient temperature range	T_A	–65 ... +150	°C
Storage temperature range	T_{stg}	–65 ... +150	°C

Thermal Resistance

Junction – ambient[2])	R_{thJA}	≤450	K/W

1) For detailed dimensions 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.

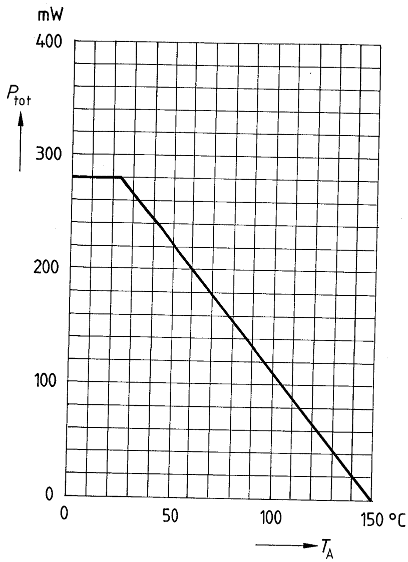
DC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CEO}$	15	–	–	V
Collector-base cutoff current V_{CB} = 10 V, I_E = 0 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	µA
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

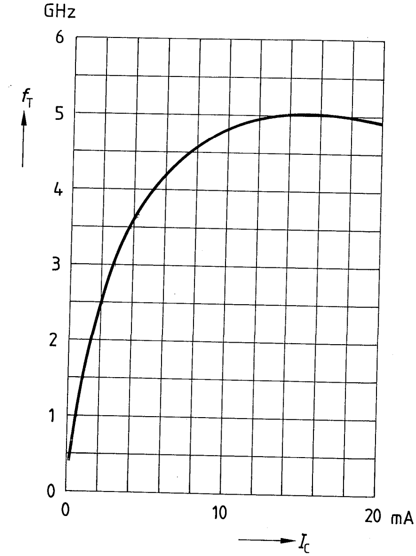
AC characteristics

Parameter	Symbol	Values min	Values typ	Values max	Unit
Transition frequency	f_T				GHz
I_C = 5 mA, V_{CE} = 10 V, f = 200 MHz		–	3.8	–	
I_C = 14 mA, V_{CE} = 10 V, f = 200 MHz		–	5	–	
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	–	pF
Input capacitance V_{EB} = 0.5 V, I_C = i_c = 0, f = 1 MHz	C_{ibo}	–	0.9	–	pF
Output capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{obs}	–	0.77	–	pF
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	–	dB
Transducer gain I_C = 15 mA, V_{CE} = 6 V, f = 1 GHz, Z_0 = 50 Ω	$\|S_{21e}\|^2$	–	11	–	dB
Linear output voltage two-tone intermodulation test I_C = 15 mA, V_{CE} = 10 V, d_{IM} = 60 dB f_1 = 806 MHz, f_2 = 810 MHz, Z_S = Z_L = 50 Ω	$V_{o1} = V_{o2}$	–	110	–	mV
Third order intercept point I_C = 15 mA, V_{CE} = 10 V, f = 800 MHz	IP_3	–	23.5	–	dBm

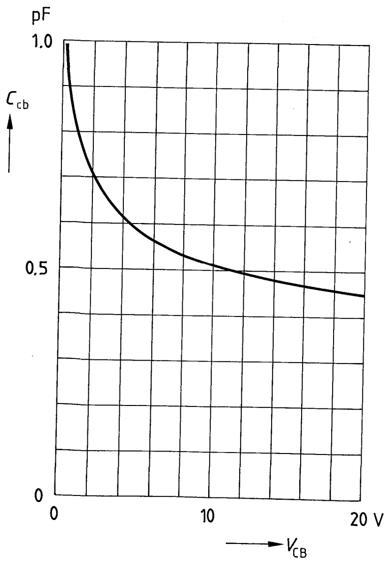
Total power dissipation $P_{tot} = f(T_A)$
Package mounted on alumina



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



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



Common Emitter Noise Parameters

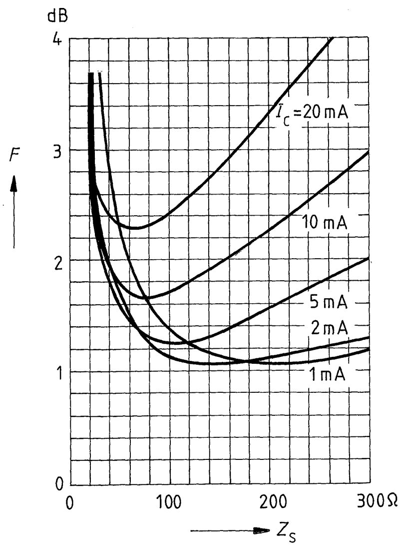
I_C = 2 mA, V_{CE} = 6 V, Z_0 = 50 Ω

f	F_{min}	G_p (F_{min})	Γ_{opt}		R_N	N	$F_{50\,\Omega}$	G_p ($F_{50\,\Omega}$)
GHz	dB	dB	MAG	ANG	Ω	–	dB	dB
0.01	1.05	–	(Z_S = 150 Ω)		–	–	3	–

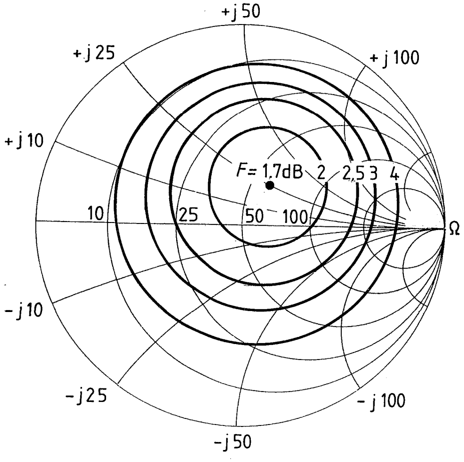
I_C = 5 mA, V_{CE} = 6 V, Z_0 = 50 Ω

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

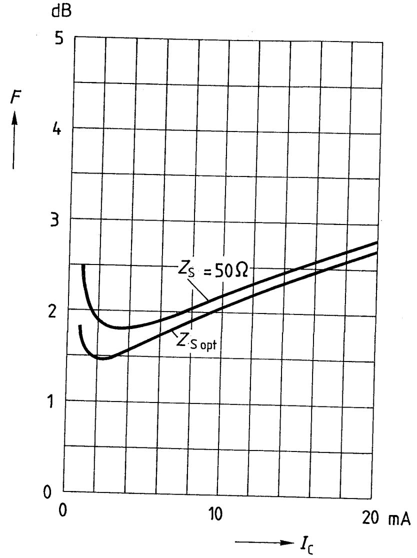
Noise figure F = f (Z_S)
V_{CE} = 6 V, f = 10 MHz



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

I_C = 0.5 mA, V_{CE} = 1 V, Z_0 = 50 Ω

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

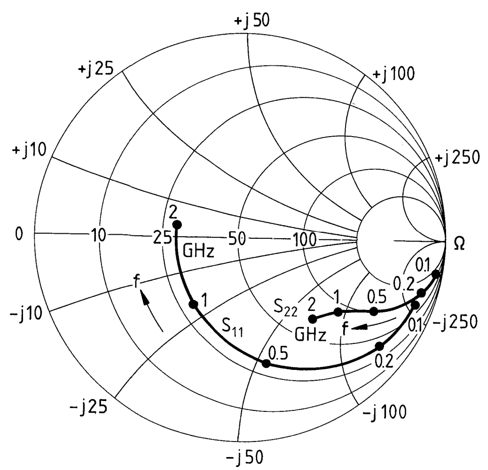
I_C = 1 mA, V_{CE} = 1 V, Z_0 = 50 Ω

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

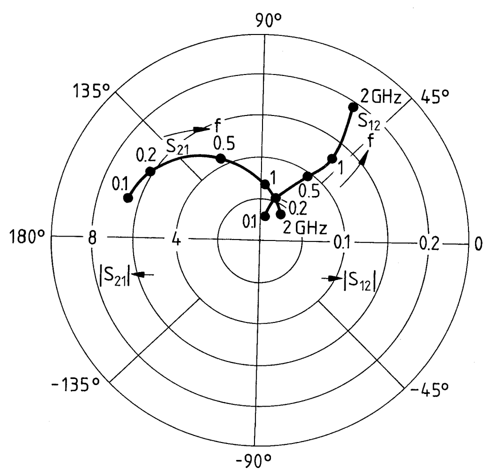
I_C = 2 mA, V_{CE} = 6 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.91	− 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



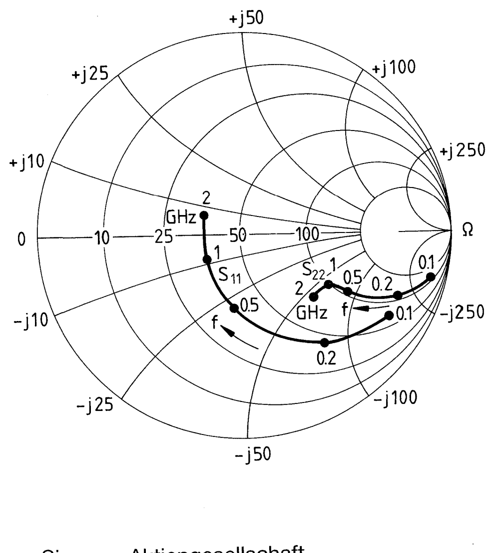
S_{12}, S_{21} = f (f)
I_C = 2 mA, V_{CE} = 6 V, Z_0 = 50 Ω



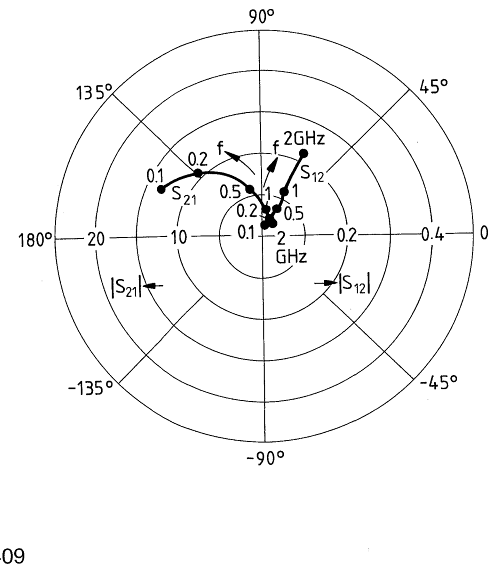
I_C = 5 mA, V_{CE} = 6 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.80	– 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



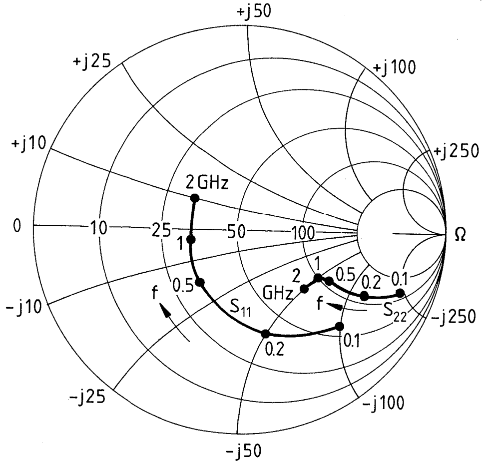
S_{12}, S_{21} = f (*f*)
I_C = 5 mA, V_{CE} = 6 V, Z_0 = 50 Ω



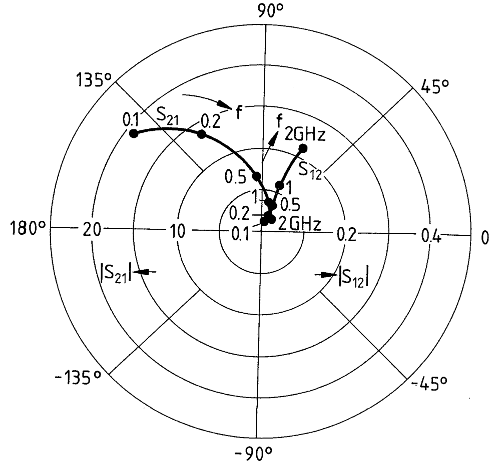
I_C = 10 mA, V_{CE} = 6 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.66	– 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



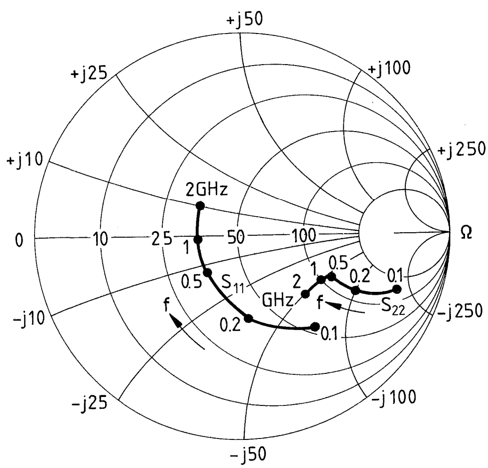
S_{12}, S_{21} = f (f)
I_C = 10 mA, V_{CE} = 6 V, Z_0 = 50 Ω



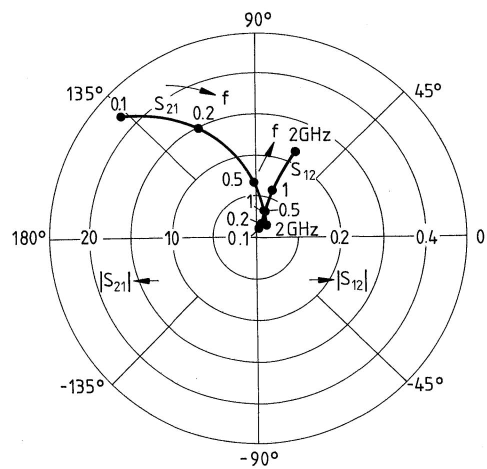
I_C = 15 mA, V_{CE} = 6 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.57	– 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



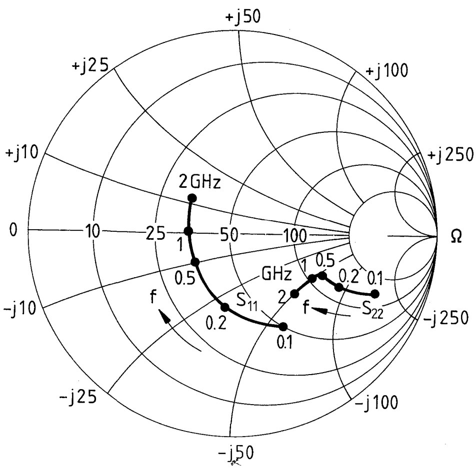
S_{12}, S_{21} = f (*f*)
I_C = 15 mA, V_{CE} = 6 V, Z_0 = 50 Ω



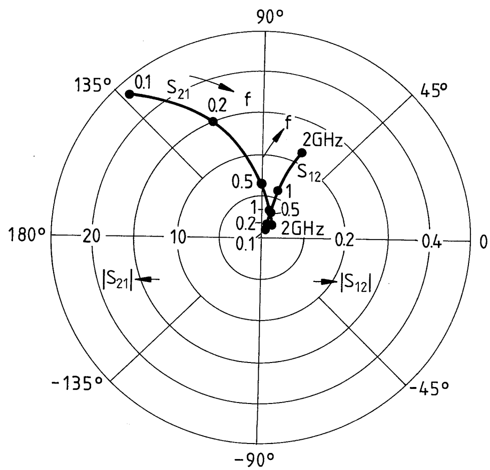
I_C = 20 mA, V_{CE} = 6 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.51	– 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



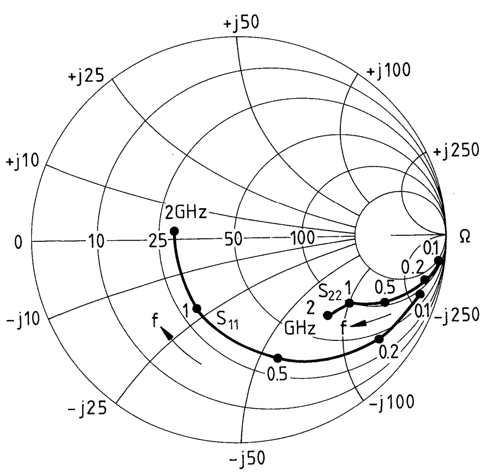
S_{12}, S_{21} = f (*f*)
I_C = 20 mA, V_{CE} = 6 V, Z_0 = 50 Ω



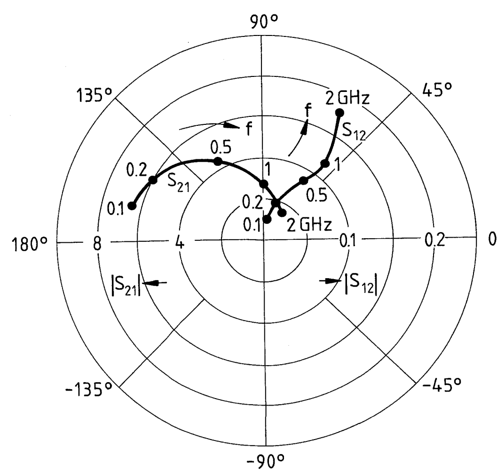
I_C = 2 mA, V_{CE} = 10 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.92	– 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



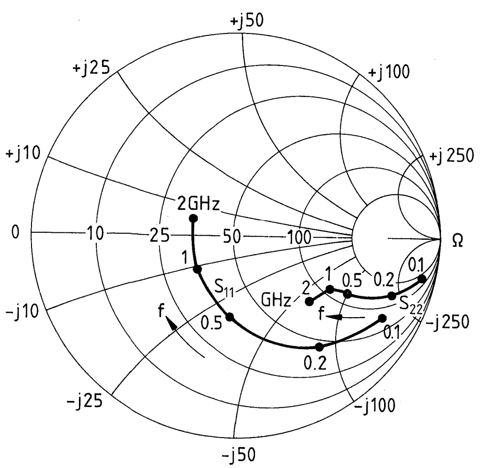
S_{12}, S_{21} = f (*f*)
I_C = 2 mA, V_{CE} = 10 V, Z_0 = 50 Ω



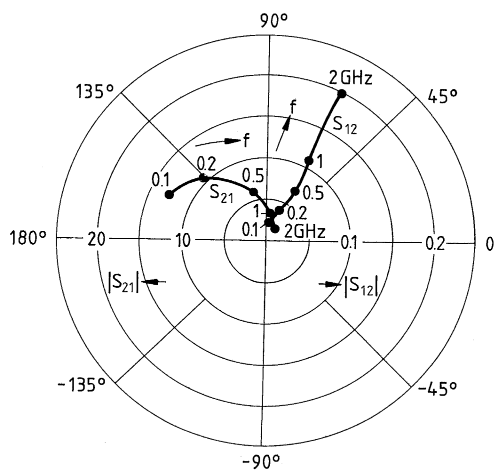
I_C = 5 mA, V_{CE} = 10 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.83	– 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



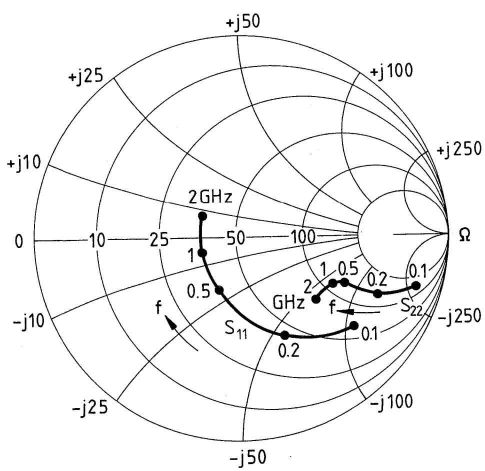
S_{12}, S_{21} = f (*f*)
I_C = 5 mA, V_{CE} = 10 V, Z_0 = 50 Ω



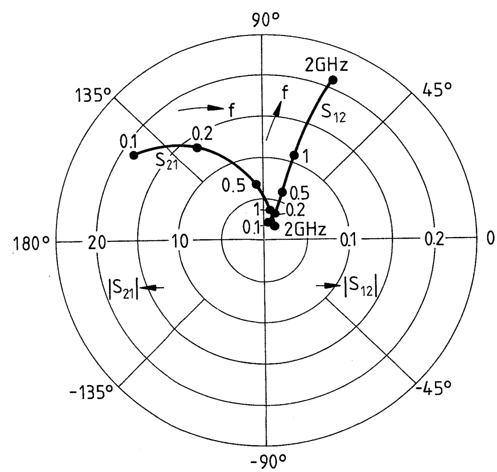
I_C = 10 mA, V_{CE} = 10 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.75	– 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



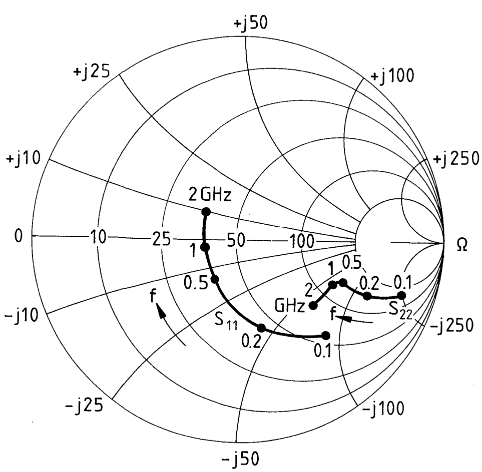
S_{12}, S_{21} = f (*f*)
I_C = 10 mA, V_{CE} = 10 V, Z_0 = 50 Ω



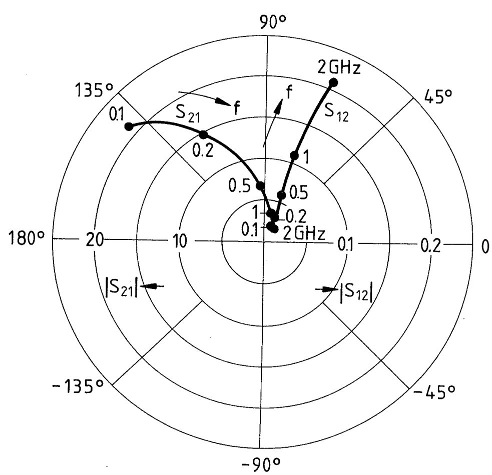
I_C = 15 mA, V_{CE} = 10 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.64	− 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



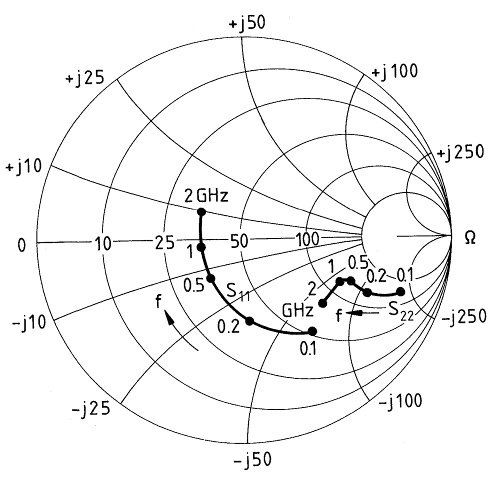
S_{12}, S_{21} = f (*f*)
I_C = 15 mA, V_{CE} = 10 V, Z_0 = 50 Ω



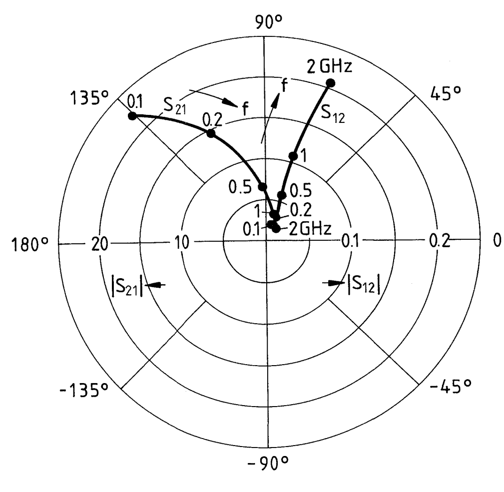
I_C = 20 mA, V_{CE} = 10 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.58	– 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



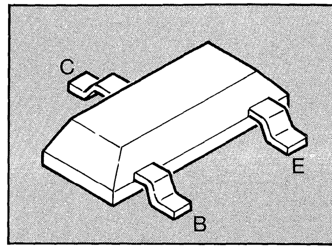
S_{12}, S_{21} = f (*f*)
I_C = 20 mA, V_{CE} = 10 V, Z_0 = 50 Ω



NPN Silicon RF Transistor

BFR 93A

- For low-distortion broadband amplifiers and oscillators up to 2 GHz at operating currents from 5 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)**	**Package**[1])
BFR 93A	R2	Q 62702 – F1086	SOT-23

Maximum Ratings

Parameter	**Symbol**	**Value**	**Unit**
Collector-emitter voltage	V_{CEO}	12	V
Collector-base voltage	V_{CBO}	15	V
Emitter-base voltage	V_{EBO}	2	V
Collector current	I_C	50	mA
Total power dissipation, $T_A \leq 25$ °C[2])	P_{tot}	280	mW
Junction temperature	T_j	150	°C
Ambient temperature range	T_A	–65 ... +150	°C
Storage temperature range	T_{stg}	–65 ... +150	°C

Thermal Resistance

Junction – ambient[2])	R_{thJA}	≤450	K/W

1) For detailed dimensions 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.

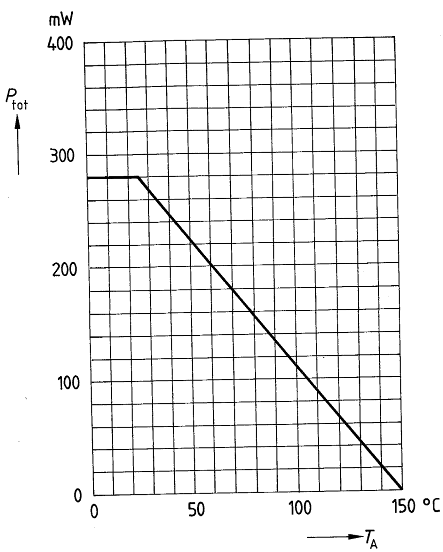
DC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
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

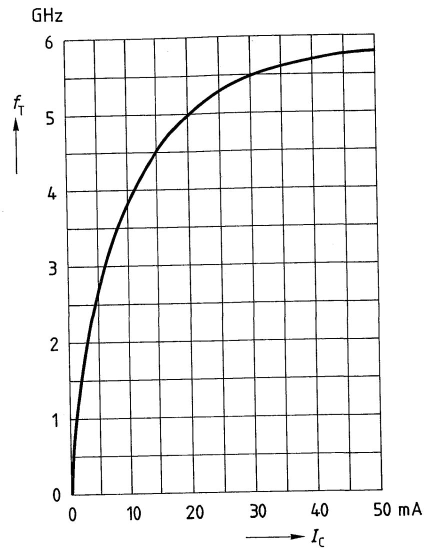
AC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
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	–	pF
Input capacitance $V_{EB} = 0.5$ V, $I_C = i_c = 0$, $f = 1$ MHz	C_{ibo}	–	2.1	–	pF
Output capacitance $V_{CE} = 10$ V, $V_{BE} = v_{be} = 0$, $f = 1$ MHz	C_{obs}	–	0.8	–	pF
Noise figure $I_C = 5$ mA, $V_{CE} = 8$ V, $f = 10$ MHz, $Z_S = 50\ \Omega$ $I_C = 5$ 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	–	dB
Transducer gain $I_C = 30$ mA, $V_{CE} = 8$ V, $f = 1$ GHz, $Z_0 = 50\ \Omega$	$\|S_{21e}\|^2$	–	11.5	–	dB
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, $Z_S = Z_L = 50\ \Omega$	$V_{o1} = V_{o2}$	–	280	–	mV
Third order intercept point $I_C = 30$ mA, $V_{CE} = 8$ V, $f = 800$ MHz	IP_3	–	32	–	dBm

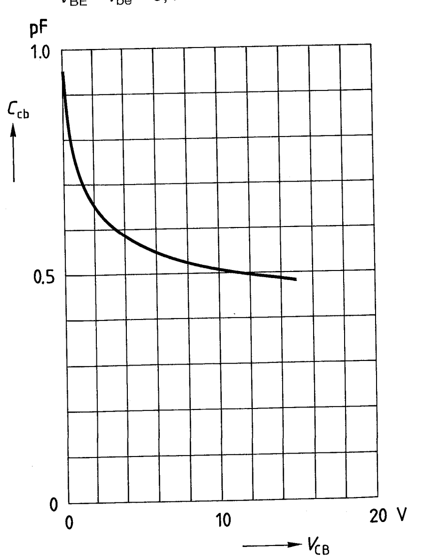
Total power dissipation $P_{tot} = f(T_A)$
Package mounted on alumina



Transition frequency $f_T = f(I_C)$
$V_{CE} = 5$ V, $f = 200$ MHz



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



Common Emitter Noise Parameters

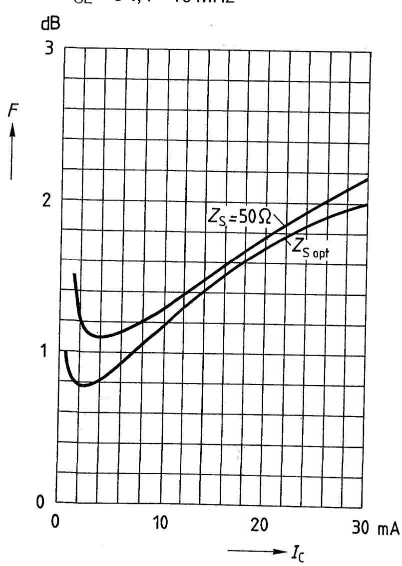
I_C = 4 mA, V_{CE} = 8 V, Z_0 = 50 Ω

f	F_{min}	G_p (F_{min})	Γ_{opt}		R_N	N	$F_{50\,\Omega}$	G_p ($F_{50\,\Omega}$)
GHz	dB	dB	MAG	ANG	Ω	–	dB	dB
0.01	0.8	–	(Z_S = 150 Ω)		–	–	1.1	–

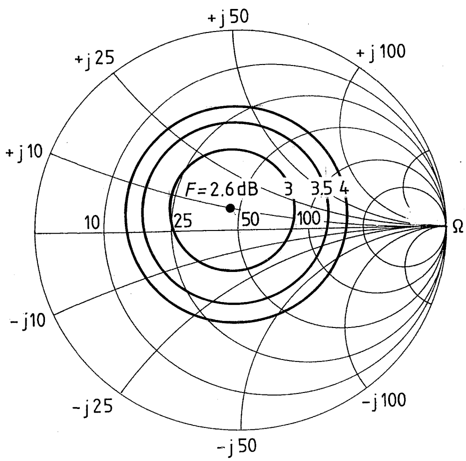
I_C = 30 mA, V_{CE} = 8 V, Z_0 = 50 Ω

f	F_{min}	G_p (F_{min})	Γ_{opt}		R_N	N	$F_{50\,\Omega}$	G_p ($F_{50\,\Omega}$)
GHz	dB	dB	MAG	ANG	Ω	–	dB	dB
0.01	2.0	–	(Z_S = 100 Ω)		–	–	2.15	–
0.8	2.6	13.5	0.13	108	19.3	0.41	2.85	13

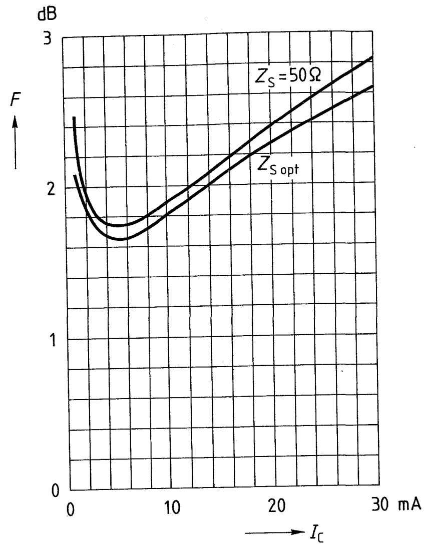
Noise figure $F = f(I_C)$
V_{CE} = 8 V, f = 10 MHz



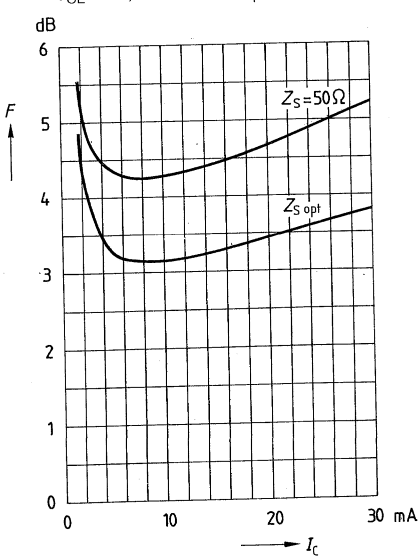
Circles of constant noise figure $F = f(Z_S)$
in Z_S-plane, $I_C = 30$ mA, $V_{CE} = 8$ V, $f = 800$ MHz



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



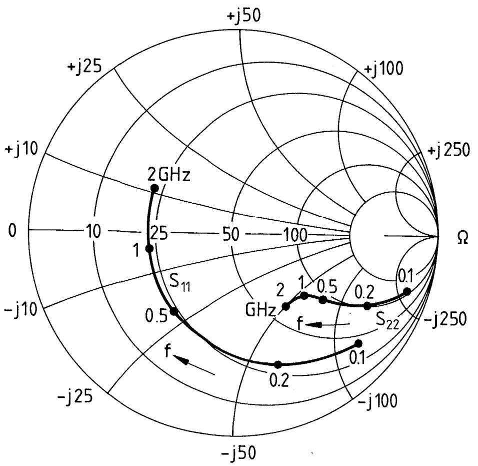
Noise figure $F = f(I_C)$
$V_{CE} = 8$ V, $f = 2$ GHz, Z_{Lopt} (G)



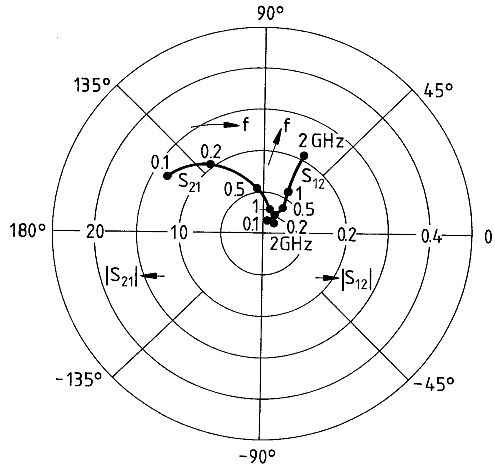
Common Emitter S Parameters
I_C = 5 mA, V_{CE} = 8 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.74	– 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



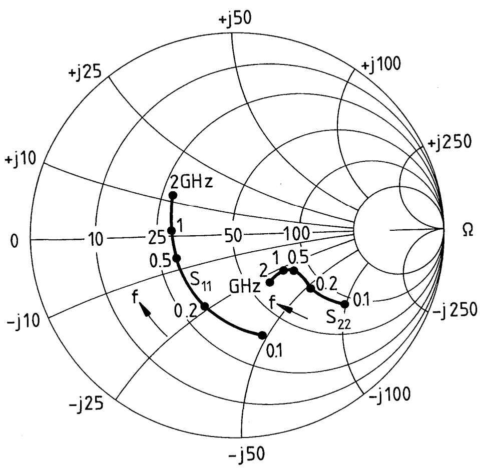
S_{12}, S_{21} = f (*f*)
I_C = 5 mA, V_{CE} = 8 V, Z_0 = 50 Ω



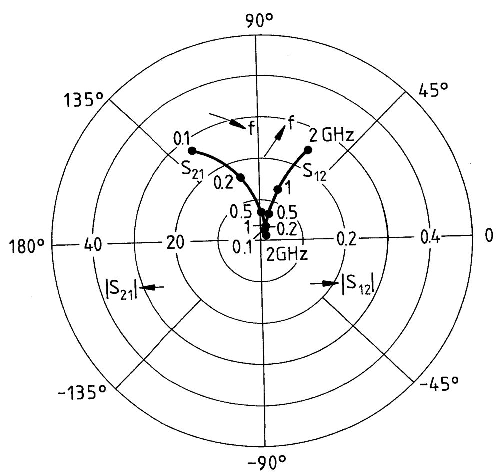
I_C = 30 mA, V_{CE} = 8 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.38	–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

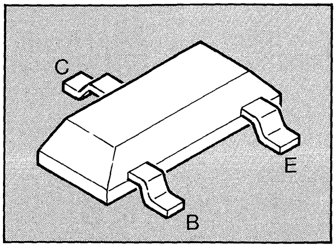
S_{11}, S_{22} = f (*f*), *Z*-plane
I_C = 30 mA, V_{CE} = 8 V, Z_0 = 50 Ω



S_{12}, S_{21} = f (*f*)
I_C = 30 mA, V_{CE} = 8 V, Z_0 = 50 Ω



● For low-distortion broadband amplifiers up to 1 GHz at collector currents from 2 to 30 mA.



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

Type	Marking	Ordering code (tape and reel)	Package[1])
BFR 93P	GG	Q 62702 – F1051	SOT-23

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CEO}	15	V
Collector-base voltage	V_{CBO}	20	V
Emitter-base voltage	V_{EBO}	2.5	V
Collector current	I_C	50	mA
Base current	I_B	10	mA
Total power dissipation, $T_A \leq 25$ °C[2])	P_{tot}	280	mW
Junction temperature	T_j	150	°C
Ambient temperature range	T_A	–65 ... +150	°C
Storage temperature range	T_{stg}	–65 ... +150	°C

Thermal Resistance

Junction – ambient[2])	R_{thJA}	≤450	K/W

1) For detailed dimensions 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.

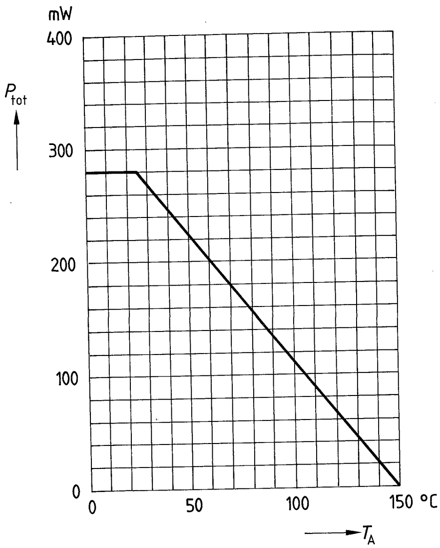
DC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CEO}$	15	–	–	V
Collector-base cutoff current V_{CB} = 10 V, I_E = 0 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	µA
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

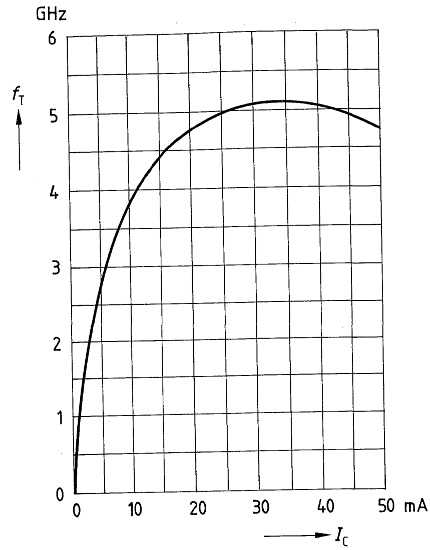
AC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
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	–	pF
Input capacitance V_{EB} = 0.5 V, I_C = i_c = 0, f = 1 MHz	C_{ibo}	–	2.1	–	pF
Output capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{obs}	–	0.9	–	pF
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	–	dB
Transducer gain I_C = 25 mA, V_{CE} = 8 V, f = 500 MHz, Z_0 = 50 Ω	$\|S_{21e}\|^2$	–	15.8	–	dB
Linear output voltage two-tone intermodulation test I_C = 25 mA, V_{CE} = 8 V, d_{IM} = 60 dB f_1 = 806 MHz, f_2 = 810 MHz, Z_S = Z_L = 50 Ω	$V_{o1} = V_{o2}$	–	240	–	mV
Third order intercept point I_C = 25 mA, V_{CE} = 8 V, f = 800 MHz	IP_3	–	30.5	–	dBm

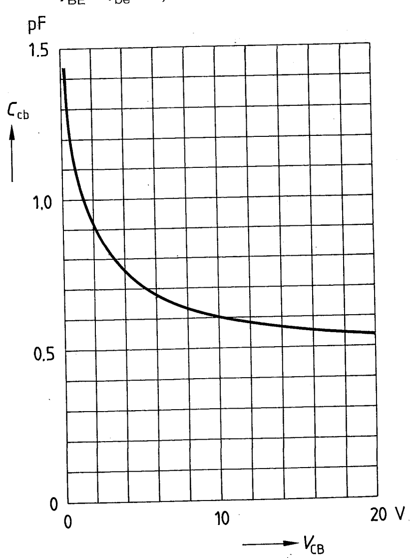
Total power dissipation $P_{tot} = f(T_A)$
Package mounted on alumina



Transition frequency $f_T = f(I_C)$
$V_{CE} = 5$ V, $f = 200$ MHz



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



Common Emitter Noise Parameters

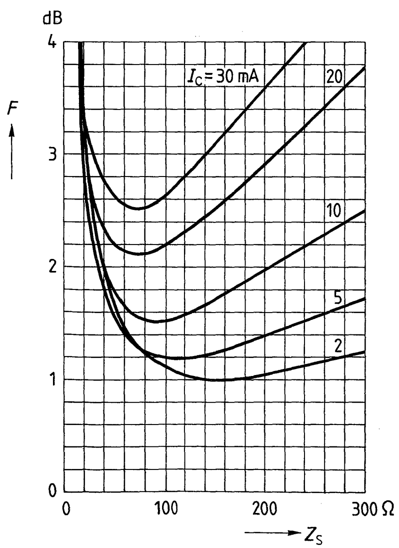
I_C = 2 mA, V_{CE} = 8 V, Z_0 = 50 Ω

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

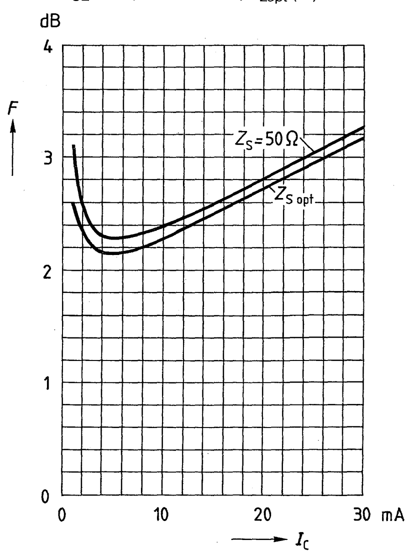
I_C = 10 mA, V_{CE} = 8 V, Z_0 = 50 Ω

f	F_{min}	G_p (F_{min})	Γ_{opt}		R_N	N	$F_{50\,\Omega}$	G_p ($F_{50\,\Omega}$)
GHz	dB	dB	MAG	ANG	Ω	–	dB	dB
0.01	1.5	–	(Z_S = 90 Ω)		–	–	1.7	–
0.8	2.3	–	(Z_S = Z_{Sopt})		–	–	2.4	–

Noise figure F = f (Z_S)
V_{CE} = 8 V, f = 10 MHz



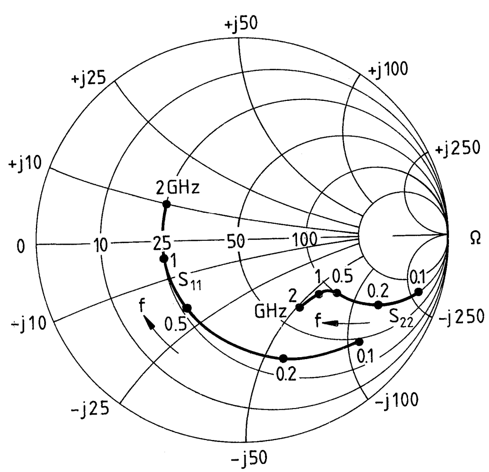
Noise figure F = f (I_C)
V_{CE} = 8 V, f = 800 MHz, Z_{Lopt} (G)



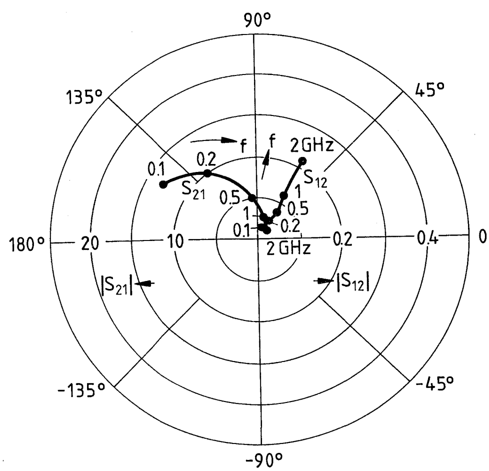
Common Emitter S Parameters
$I_C = 5$ mA, $V_{CE} = 8$ V, $Z_0 = 50\ \Omega$

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
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, $Z_0 = 50\ \Omega$



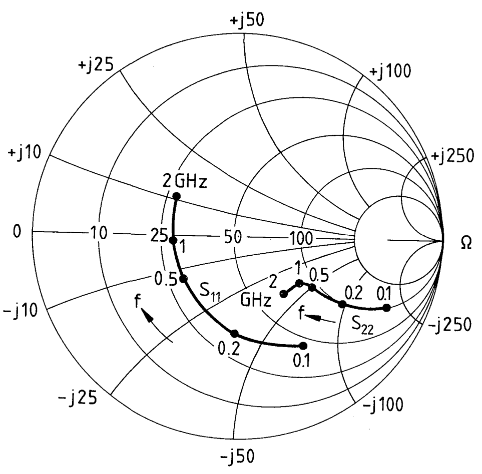
S_{12}, S_{21} = f (f)
$I_C = 5$ mA, $V_{CE} = 8$ V, $Z_0 = 50\ \Omega$



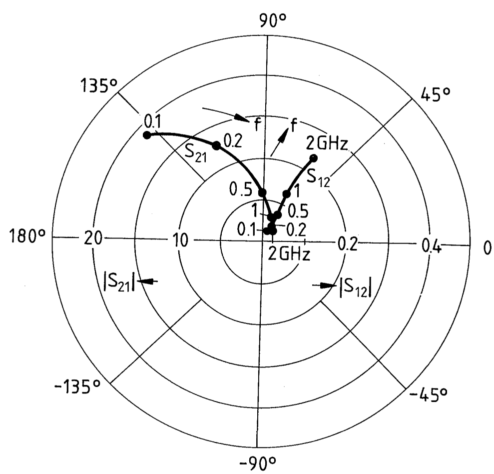
I_C = 10 mA, V_{CE} = 8 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.58	– 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



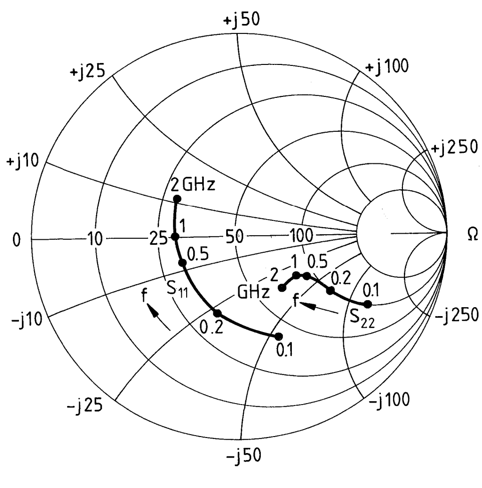
S_{12}, S_{21} = f (*f*)
I_C = 10 mA, V_{CE} = 8 V, Z_0 = 50 Ω



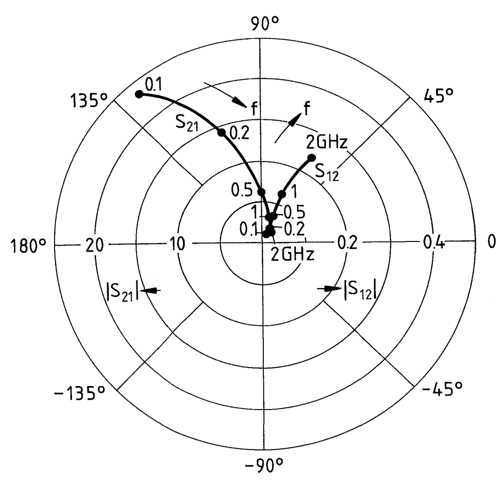
I_C = 20 mA, V_{CE} = 8 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.41	– 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



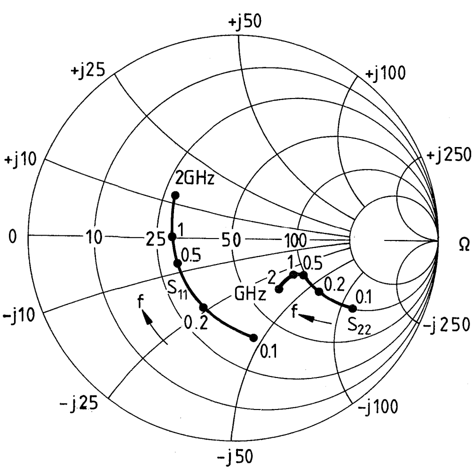
S_{12}, S_{21} = f (*f*)
I_C = 20 mA, V_{CE} = 8 V, Z_0 = 50 Ω



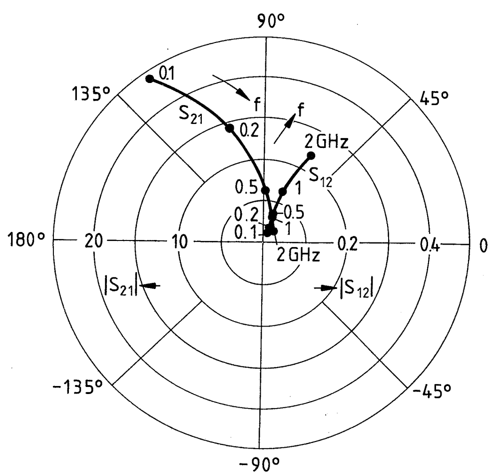
I_C = 25 mA, V_{CE} = 8 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.37	– 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

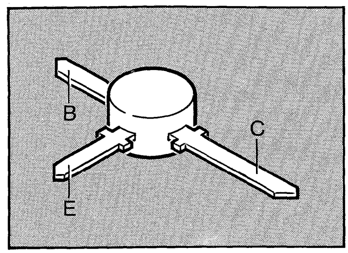


S_{12}, S_{21} = f (*f*)
I_C = 25 mA, V_{CE} = 8 V, Z_0 = 50 Ω



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 to 70 mA.



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

Type	Marking	Ordering code	Package[1])
BFR 96S	BFR 96S	Q 68000 – A5689	T-plast

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CEO}	15	V
Collector-base voltage	V_{CBO}	20	V
Emitter-base voltage	V_{EBO}	3	V
Collector current	I_C	100	mA
Total power dissipation, $T_A \leq 45$ °C[2])	P_{tot}	700	mW
Junction temperature	T_j	150	°C
Ambient temperature range	T_A	–65 ... +150	°C
Storage temperature range	T_{stg}	–65 ... +150	°C

Thermal Resistance

Junction – ambient[2])	R_{thJA}	≤150	K/W

1) For detailed dimensions see chapter Package Outlines.
2) Package mounted on glass epoxy 40 mm × 25 mm × 15 mm.

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

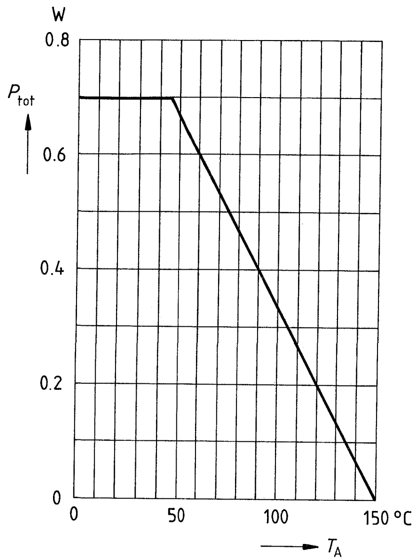
DC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CEO}$	15	–	–	V
Collector-base cutoff current V_{CB} = 10 V, I_E = 0	I_{CBO}	–	–	100	nA
Emitter-base cutoff current V_{EB} = 3 V, I_C = 0	I_{EBO}	–	–	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

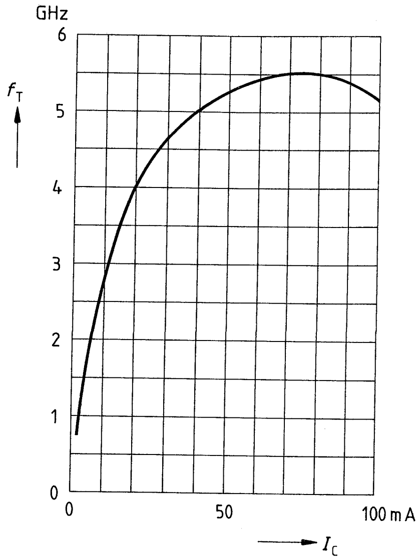
AC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
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	 – –	 5.3 5.5	 – –	GHz
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	–	pF
Input capacitance $V_{EB} = 0.5$ V, $I_C = i_c = 0$, $f = 1$ MHz	C_{ibo}	–	5	–	pF
Output capacitance $V_{CE} = 10$ V, $V_{BE} = v_{be} = 0$, $f = 1$ MHz	C_{obs}	–	1.25	–	pF
Noise figure $I_C = 5$ mA, $V_{CE} = 10$ V, $f = 10$ MHz, $Z_S = 50\ \Omega$ $I_C = 70$ mA, $V_{CE} = 10$ V, $f = 800$ MHz, $Z_S = Z_{Sopt}$	F	 – –	 0.9 3.2	 – –	dB
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	–	dB
Transducer gain $I_C = 70$ mA, $V_{CE} = 10$ V, $f = 500$ MHz, $Z_0 = 50\ \Omega$	$\|S_{21e}\|^2$	–	14.8	–	dB
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, $Z_S = Z_L = 50\ \Omega$	$V_{o1} = V_{o2}$	–	500	–	mV
Third order intercept point $I_C = 70$ mA, $V_{CE} = 10$ V, $f = 800$ MHz	IP_3	–	37	–	dBm

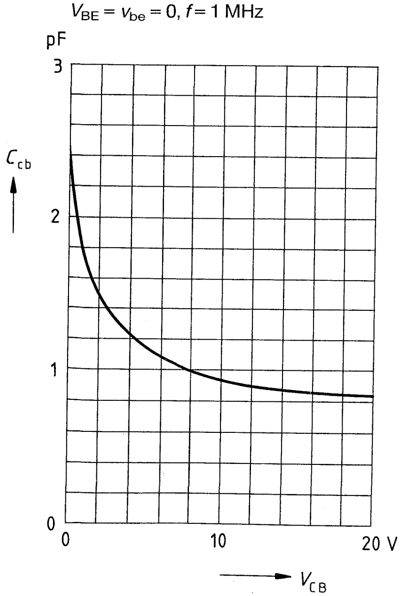
Total power dissipation $P_{tot} = f(T_A)$
Package mounted on glass epoxy



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

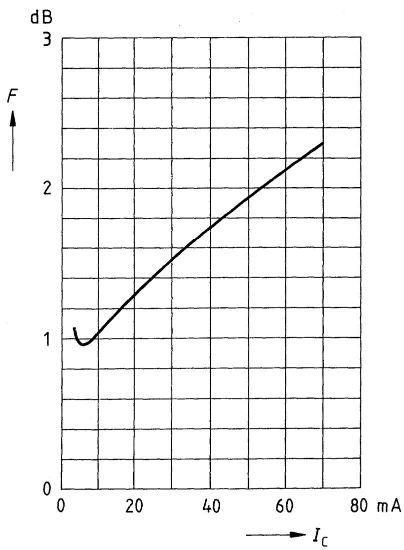
I_C = 10 mA, V_{CE} = 10 V, Z_0 = 50 Ω

f	F_{min}	G_p (F_{min})	Γ_{opt}		R_N	N	$F_{50\,\Omega}$	G_p ($F_{50\,\Omega}$)
GHz	dB	dB	MAG	ANG	Ω	–	dB	dB
0.01	–	–	–	–	–	–	1.05	–
0.8	2.2	–	0.41	–170.3	6.6	0.31	2.8	–

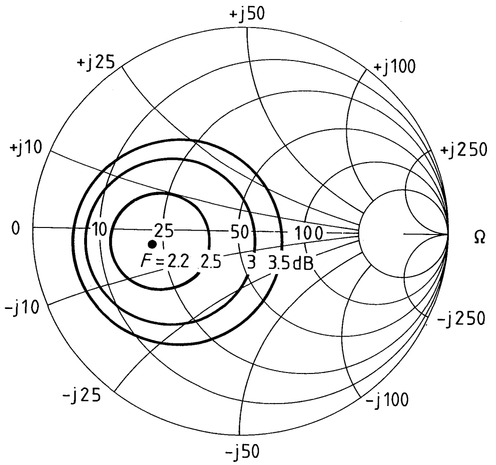
I_C = 70 mA, V_{CE} = 10 V, Z_0 = 50 Ω

f	F_{min}	G_p (F_{min})	Γ_{opt}		R_N	N	$F_{50\,\Omega}$	G_p ($F_{50\,\Omega}$)
GHz	dB	dB	MAG	ANG	Ω	–	dB	dB
0.01	–	–	–	–	–	–	2.3	–
0.8	3.2	–	0.43	–162.6	9.7	0.43	3.9	–

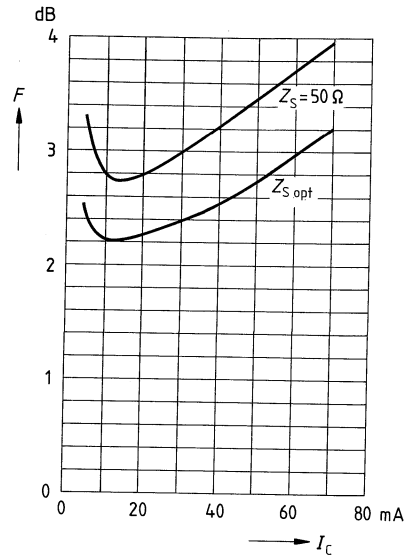
Noise figure $F = f(I_C)$
V_{CE} = 10 V, f = 10 MHz



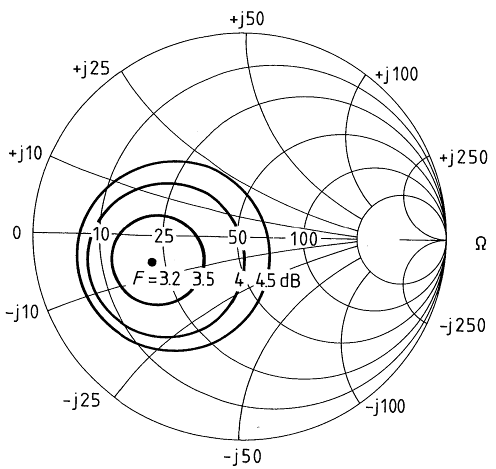
Circles of constant noise figure $F = f\ (Z_S)$
I_C = 10 mA, V_{CE} = 10 V, f = 800 MHz



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



Circles of constant noise figure $F = f\ (Z_S)$
I_C = 70 mA, V_{CE} = 10 V, f = 800 MHz



Common Emitter S Parameters

I_C = 50 mA, V_{CE} = 5 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.42	–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

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

I_C = 30 mA, V_{CE} = 10 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.44	–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

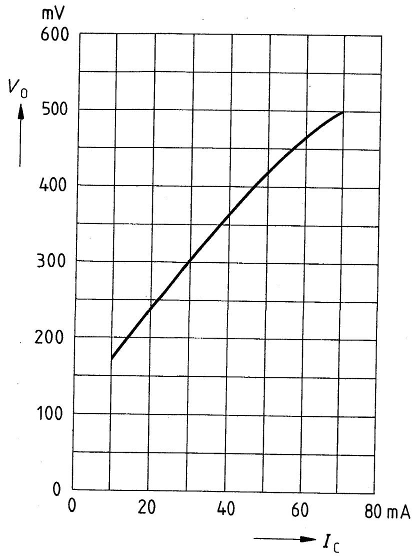
I_C = 50 mA, V_{CE} = 10 V, Z_0 = 50 Ω

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

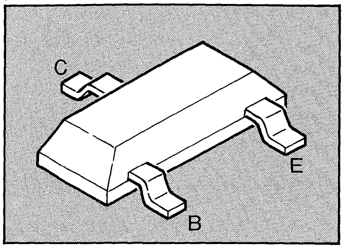
I_C = 70 mA, V_{CE} = 10 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.40	–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

Linear output voltage $V_O = f(I_C)$
$V_{CE} = 10$ V, $d_{IM} = 60$ dB, $f_1 = 806$ MHz,
$f_2 = 810$ MHz, $Z_S = Z_L = 50\ \Omega$



- For low-noise, high-gain amplifiers
- For linear broadband amplifiers
- Special application: antenna amplifiers



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

Type	Marking	Ordering code (tape and reel)	Package[1])
BFR 106	R7	Q 62702 – F1219	SOT-23

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CEO}	15	V
Collector-base voltage	V_{CBO}	20	V
Emitter-base voltage	V_{EBO}	3	V
Collector current	I_C	100	mA
Total power dissipation, $T_A \leq 45$ °C[2])	P_{tot}	350	mW
Junction temperature	T_j	150	°C
Ambient temperature range	T_A	–65 ... +150	°C
Storage temperature range	T_{stg}	–65 ... +150	°C

Thermal Resistance

Junction – ambient[2])	R_{thJA}	≤300	K/W

1) For detailed dimensions 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.

DC characteristics

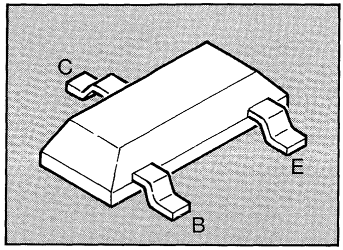
Parameter	Symbol	Values			Unit
		min	typ	max	
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CEO}$	15	–	–	V
Collector-base cutoff current V_{CB} = 10 V, I_E = 0	I_{CBO}	–	–	100	nA
Emitter-base cutoff current V_{EB} = 2 V, I_C = 0	I_{EBO}	–	–	10	µA
DC current gain I_C = 5 mA, V_{CE} = 6 V I_C = 30 mA, V_{CE} = 6 V	h_{FE}	 25 25	 – 90	 – –	–
Collector-emitter saturation voltage I_C = 50 mA, I_B = 5 mA	V_{CEsat}	–	–	0.4	V

AC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
Transition frequency I_C = 30 mA, V_{CE} = 6 V, f = 200 MHz	f_T	–	3.7	–	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}	–	0.3	–	pF
Input capacitance V_{EB} = 0.5 V, I_C = i_c = 0, f = 1 MHz	C_{ibo}	–	4.5	–	pF
Output capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{obs}	–	1.3	–	pF
Noise figure I_C = 30 mA, V_{CE} = 6 V, f = 800 MHz, $Z_S = Z_{Sopt}$	F	–	3.6	–	dB
Power gain I_C = 30 mA, V_{CE} = 6 V, f = 800 MHz, Z_S = 50 Ω, $Z_L = Z_{Lopt}$	G_{pe}	–	11.5	–	dB
Linear output voltage two-tone intermodulation test I_C = 30 mA, V_{CE} = 6 V, d_{IM} = 60 dB f_1 = 806 MHz, f_2 = 810 MHz, $Z_S = Z_L$ = 50 Ω	$V_{o1} = V_{o2}$	–	250	–	mV

NPN Silicon RF Transistor BFR 193

- 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)	Package[1])
BFR 193	RC	Q 62702 – F1218	SOT-23

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CEO}	12	V
Collector-emitter voltage, $V_{BE} = 0$	V_{CES}	20	V
Collector-base voltage	V_{CBO}	20	V
Emitter-base voltage	V_{EBO}	2	V
Collector current	I_C	80	mA
Base current	I_B	10	mA
Total power dissipation, $T_A \leq 50$ °C[2])	P_{tot}	400	mW
Junction temperature	T_j	150	°C
Ambient temperature range	T_A	–65 ... +150	°C
Storage temperature range	T_{stg}	–65 ... +150	°C

Thermal Resistance

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

1) For detailed dimensions 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.

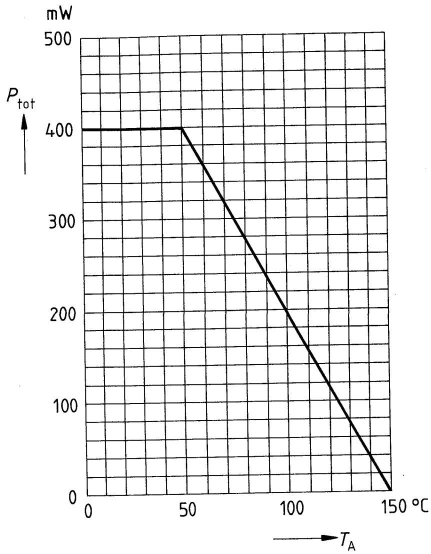
DC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
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

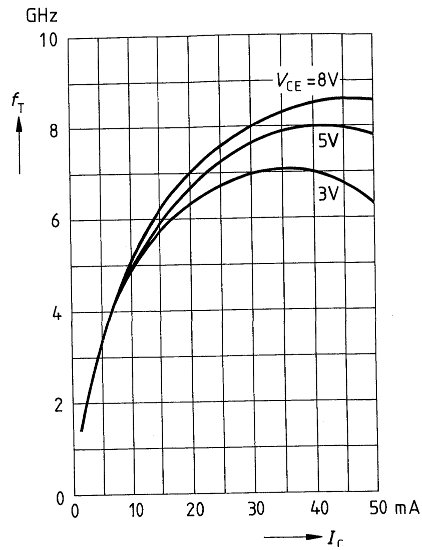
AC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
Transition frequency	f_T				GHz
I_C = 5 mA, V_{CE} = 8 V, f = 200 MHz		–	3.5	–	
I_C = 30 mA, V_{CE} = 8 V, f = 200 MHz		–	7	–	
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	–	pF
Input capacitance V_{EB} = 0.5 V, I_C = i_c = 0, f = 1 MHz	C_{ibo}	–	2.2	–	pF
Output capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{obs}	–	0.9	–	pF
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	–	dB
Transducer gain I_C = 30 mA, V_{CE} = 8 V, f = 1 GHz, Z_0 = 50 Ω	$\|S_{21e}\|^2$	–	11.5	–	dB
Linear output voltage two-tone intermodulation test I_C = 40 mA, V_{CE} = 5 V, d_{IM} = 60 dB f_1 = 806 MHz, f_2 = 810 MHz, Z_S = Z_L = 50 Ω	$V_{o1} = V_{o2}$	–	250	–	mV
Third order intercept point I_C = 40 mA, V_{CE} = 5 V, f = 800 MHz	IP_3	–	31	–	dBm

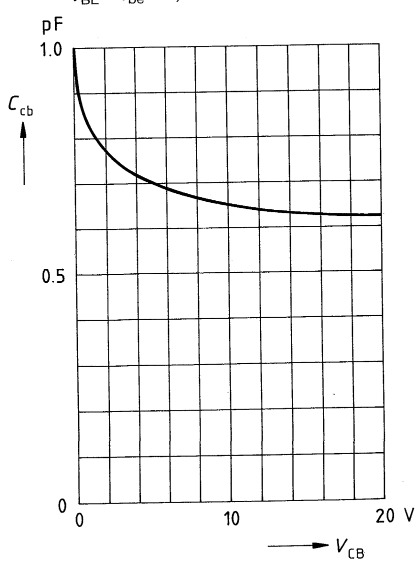
Total power dissipation P_{tot} = f (T_A)
Package mounted on alumina



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



Common Emitter Noise Parameters

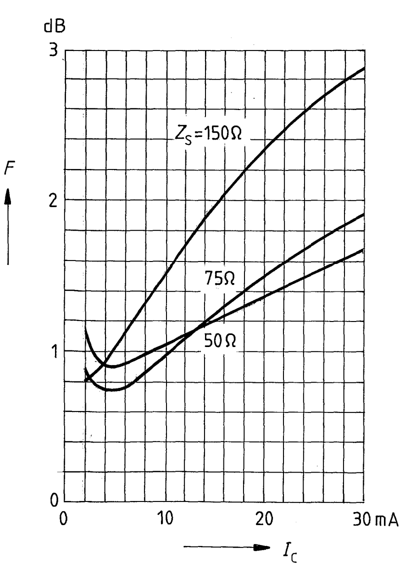
I_C = 10 mA, V_{CE} = 8 V, Z_0 = 50 Ω

f	F_{min}	G_p (F_{min})	Γ_{opt}		R_N	N	$F_{50\,\Omega}$	G_p ($F_{50\,\Omega}$)
GHz	dB	dB	MAG	ANG	Ω	–	dB	dB
0.01	1	–	(Z_S = 75 Ω)		–	–	1.05	–
0.8	1.25	13.5	–	–	–	–	1.35	12.4
2.0	2.4	7	–	–	–	–	–	–

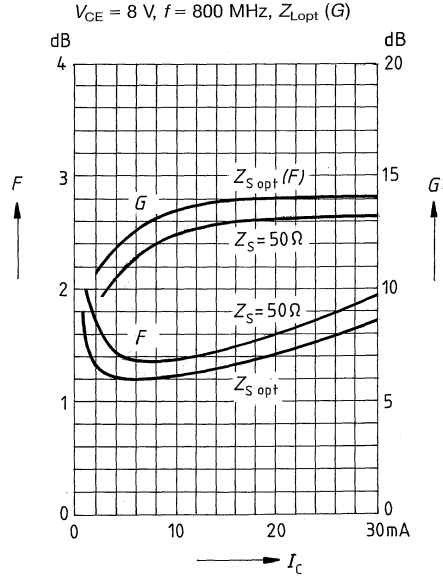
I_C = 30 mA, V_{CE} = 8 V, Z_0 = 50 Ω

f	F_{min}	G_p (F_{min})	Γ_{opt}		R_N	N	$F_{50\,\Omega}$	G_p ($F_{50\,\Omega}$)
GHz	dB	dB	MAG	ANG	Ω	–	dB	dB
0.01	1.65	–	(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

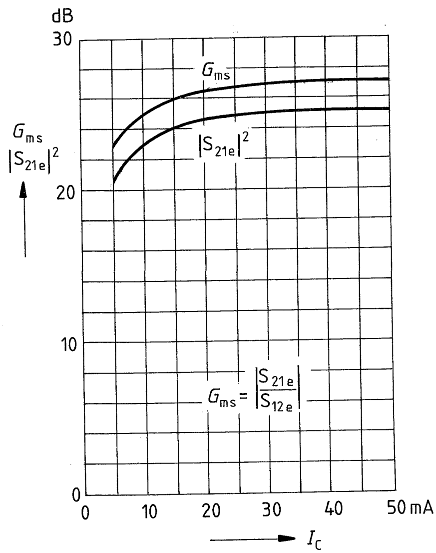


Noise figure F = f (I_C)
Power gain G = f (I_C)
V_{CE} = 8 V, f = 800 MHz, Z_{Lopt} (G)

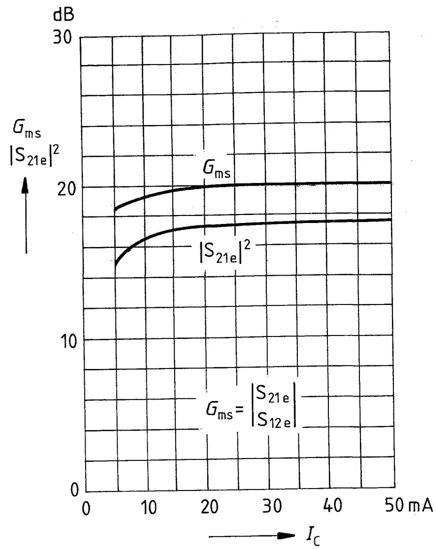


Common Emitter Power Gain

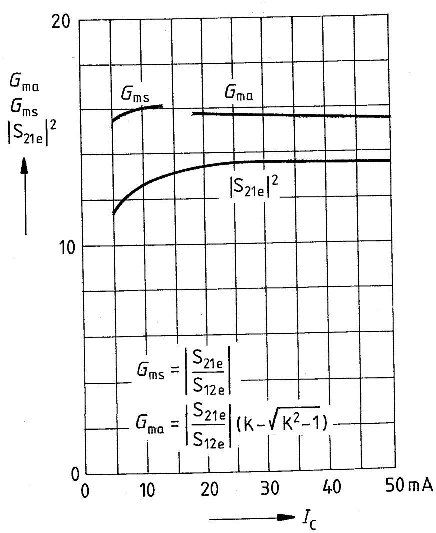
Power gain G_{ms}, $|S_{21e}|^2 = f(I_C)$
$V_{CE} = 8$ V, $f = 200$ MHz, $Z_0 = 50\ \Omega$



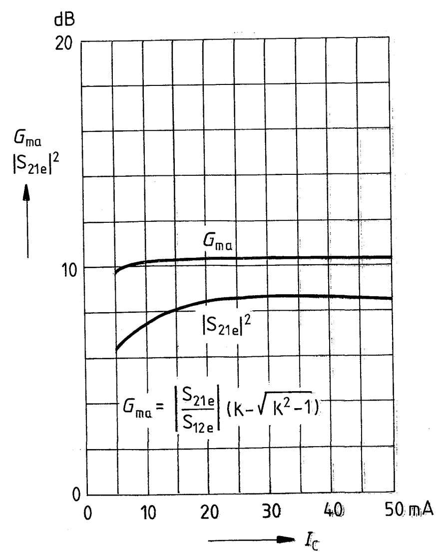
Power gain G_{ms}, $|S_{21e}|^2 = f(I_C)$
$V_{CE} = 8$ V, $f = 500$ MHz, $Z_0 = 50\ \Omega$



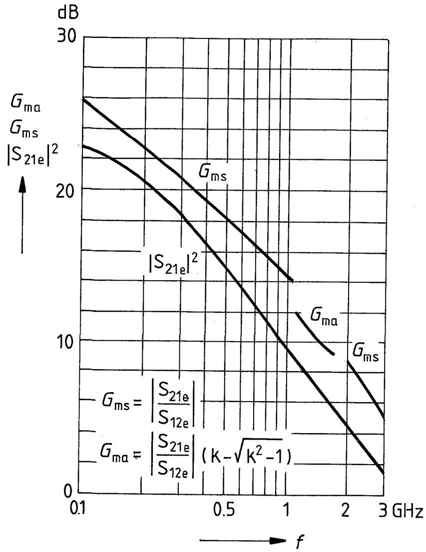
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(I_C)$
$V_{CE} = 8$ V, $f = 800$ MHz, $Z_0 = 50\ \Omega$



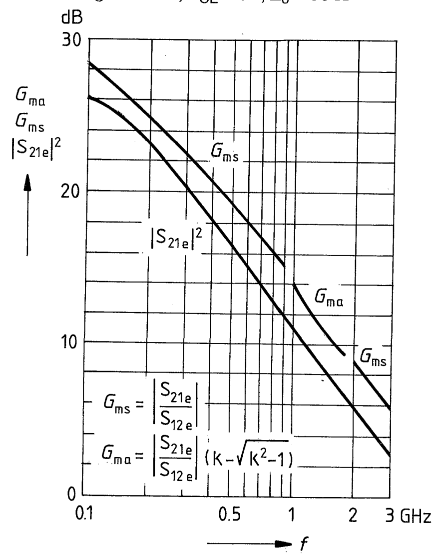
Power gain G_{ma}, $|S_{21e}|^2 = f(I_C)$
$V_{CE} = 8$ V, $f = 1.5$ GHz, $Z_0 = 50\ \Omega$



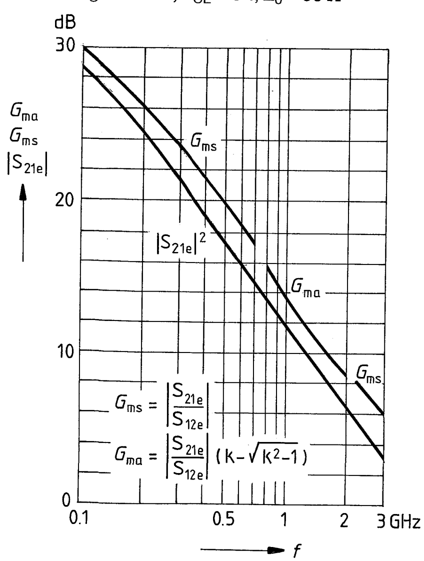
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
$I_C = 5$ mA, $V_{CE} = 8$ V, $Z_0 = 50\ \Omega$



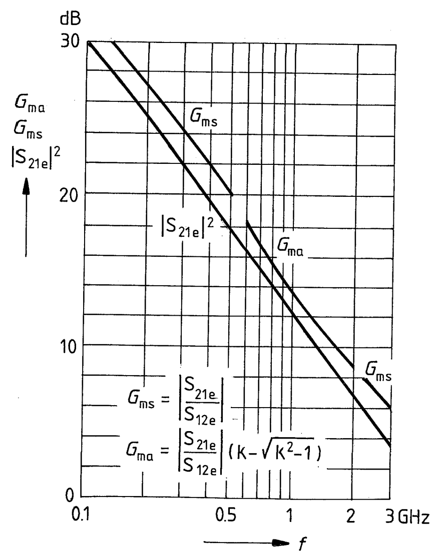
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
$I_C = 10$ mA, $V_{CE} = 8$ V, $Z_0 = 50\ \Omega$



Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
$I_C = 20$ mA, $V_{CE} = 8$ V, $Z_0 = 50\ \Omega$



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



Common Emitter S Parameters

I_C = 10 mA, V_{CE} = 3 V, Z_0 = 50 Ω

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

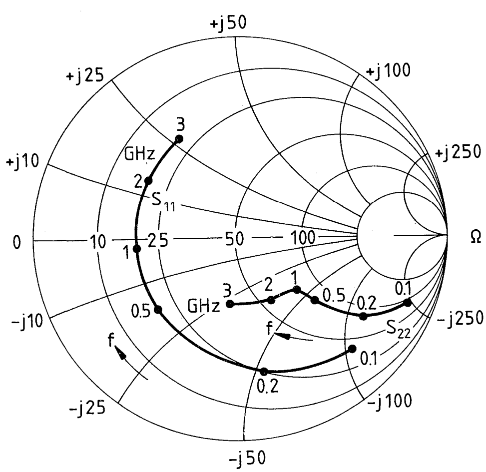
I_C = 30 mA, V_{CE} = 3 V, Z_0 = 50 Ω

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

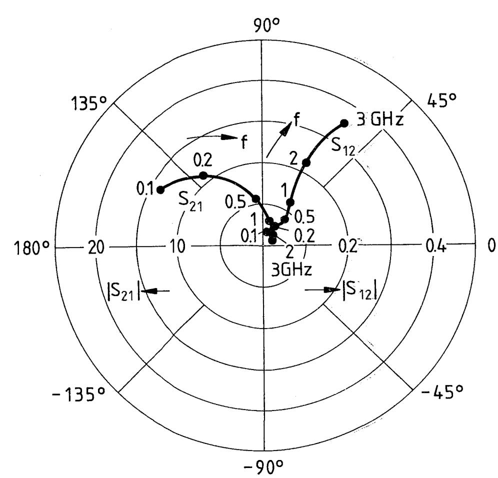
I_C = 5 mA, V_{CE} = 5 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	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



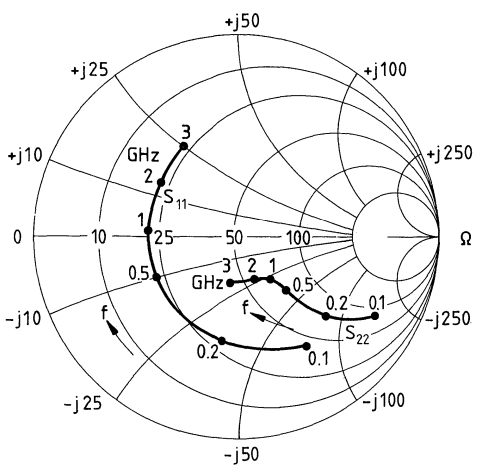
S_{12}, S_{21} = f (f)
I_C = 5 mA, V_{CE} = 5 V, Z_0 = 50 Ω



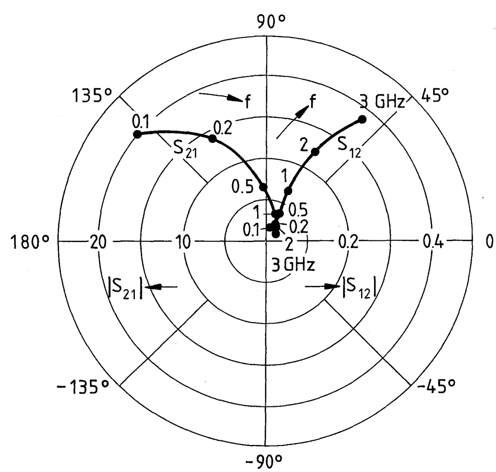
I_C = 10 mA, V_{CE} = 5 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	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



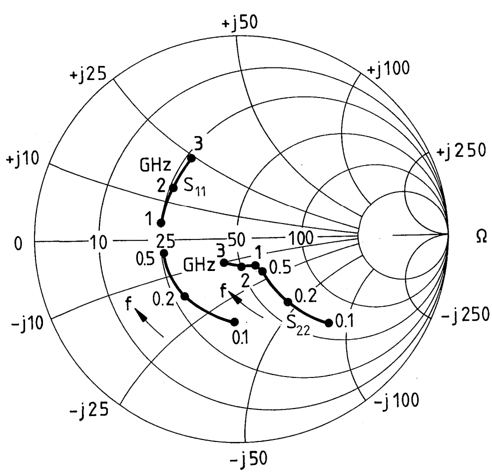
S_{12}, S_{21} = f (f)
I_C = 10 mA, V_{CE} = 5 V, Z_0 = 50 Ω



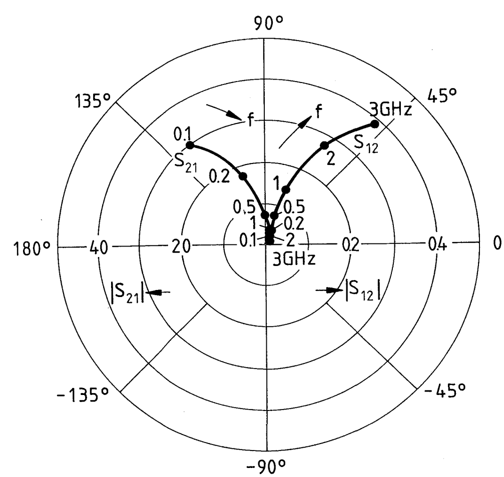
I_C = 30 mA, V_{CE} = 5 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	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



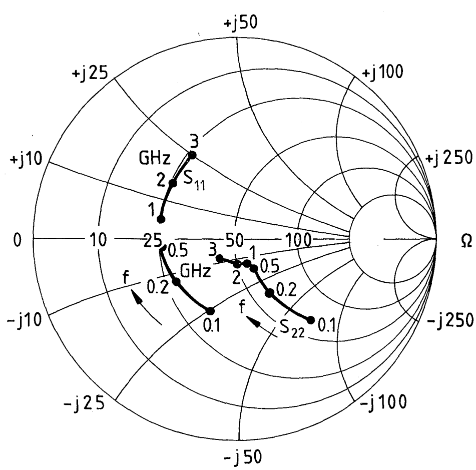
S_{12}, S_{21} = f (*f*)
I_C = 30 mA, V_{CE} = 5 V, Z_0 = 50 Ω



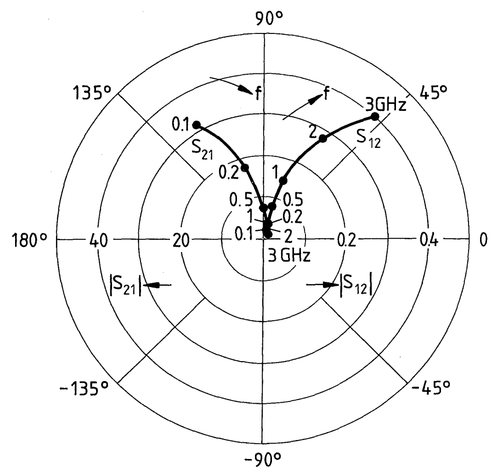
I_C = 50 mA, V_{CE} = 5 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	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



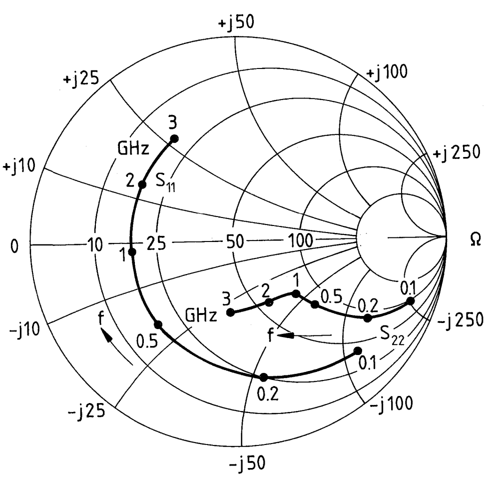
S_{12}, S_{21} = f (*f*)
I_C = 50 mA, V_{CE} = 5 V, Z_0 = 50 Ω



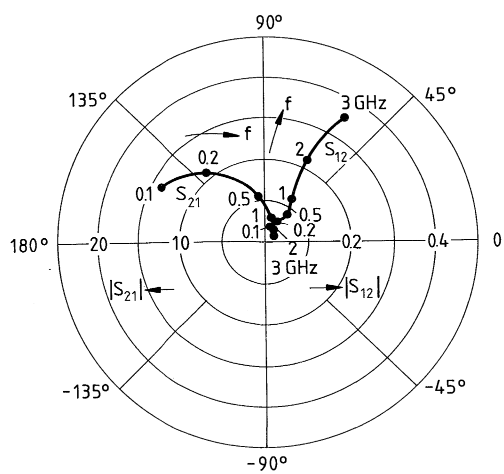
I_C = 5 mA, V_{CE} = 8 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	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



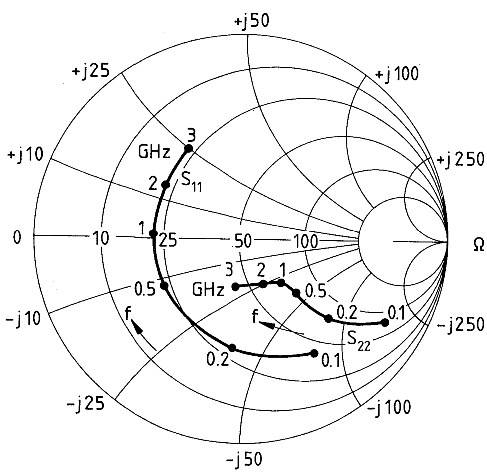
S_{12}, S_{21} = f (f)
I_C = 5 mA, V_{CE} = 8 V, Z_0 = 50 Ω



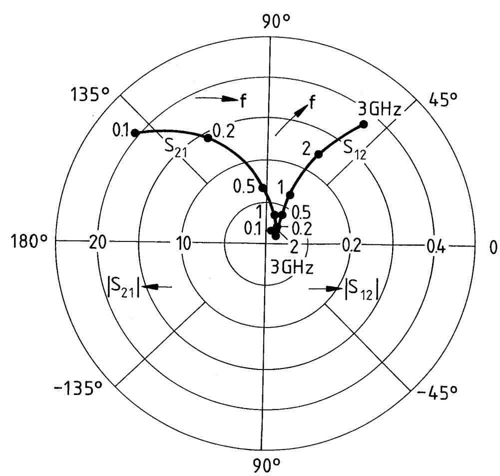
I_C = 10 mA, V_{CE} = 8 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	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	39.1	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



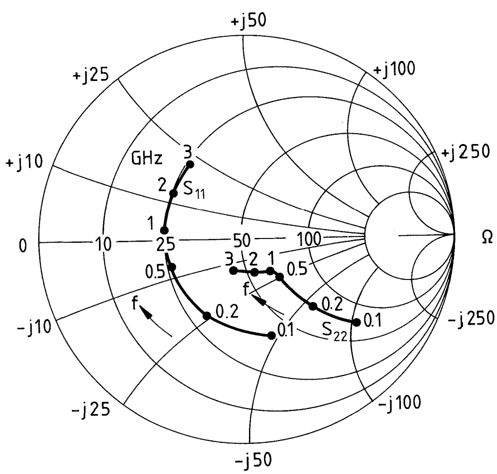
S_{12}, S_{21} = f (*f*)
I_C = 10 mA, V_{CE} = 8 V, Z_0 = 50 Ω



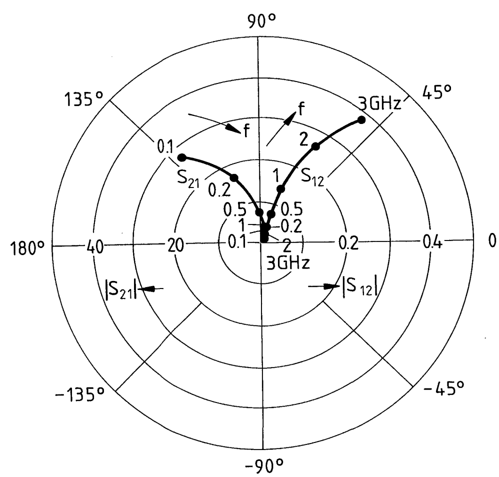
I_C = 20 mA, V_{CE} = 8 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	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



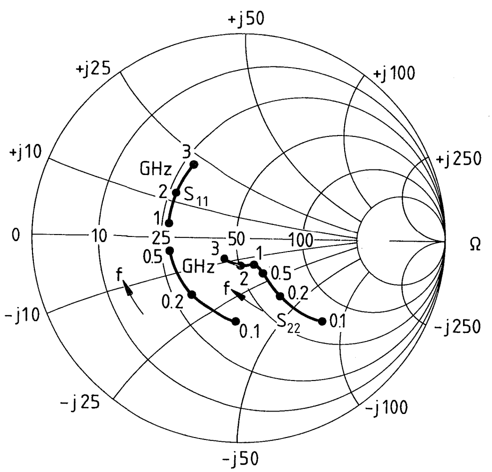
S_{12}, S_{21} = f (*f*)
I_C = 20 mA, V_{CE} = 8 V, Z_0 = 50 Ω



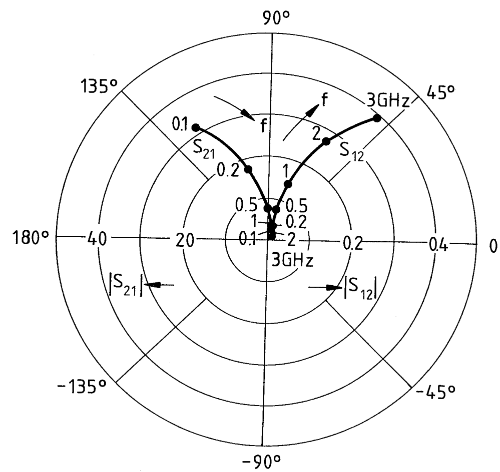
I_C = 40 mA, V_{CE} = 8 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	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	0.422	– 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

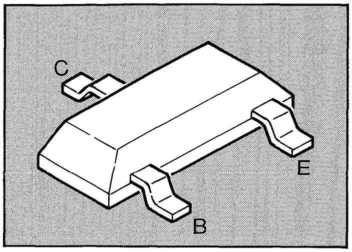
S_{11}, S_{22} = f (*f*)
I_C = 40 mA, V_{CE} = 8 V, Z_0 = 50 Ω



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



- For broadband amplifiers up to 1 GHz at collector currents from 1 to 20 mA.
- CECC-type available: CECC 50002/262.



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

Type	Marking	Ordering code (tape and reel)	Package[1])
BFS 17P	MC	Q 62702 – F940	SOT-23

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CEO}	15	V
Collector-base voltage	V_{CBO}	25	V
Emitter-base voltage	V_{EBO}	2.5	V
Collector current	I_C	25	mA
Peak collector current, $f \geq 10$ MHz	I_{CM}	50	mA
Total power dissipation, $T_A \leq 25$ °C[2])	P_{tot}	280	mW
Junction temperature	T_j	150	°C
Ambient temperature range	T_A	–65 ... +150	°C
Storage temperature range	T_{stg}	–65 ... +150	°C

Thermal Resistance

Junction – ambient[2])	R_{thJA}	≤450	K/W

1) For detailed dimensions 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.

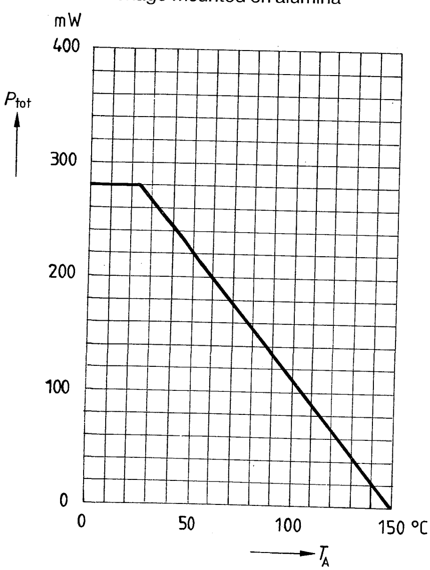
DC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CEO}$	15	–	–	V
Collector-base cutoff current V_{CB} = 15 V, I_E = 0 V_{CB} = 25 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	µA
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

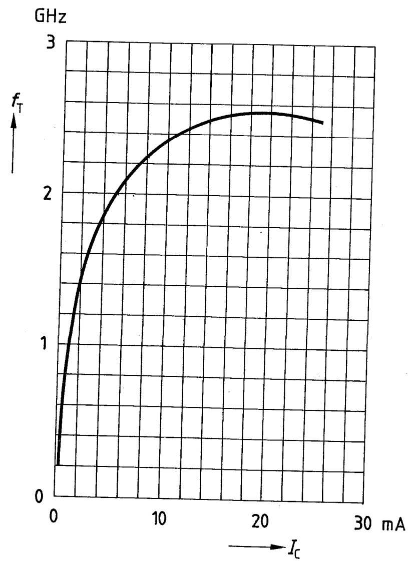
AC characteristics

Parameter	Symbol	Values min	Values typ	Values max	Unit
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	–	pF
Input capacitance V_{EB} = 0.5 V, I_C = i_c = 0, f = 1 MHz	C_{ibo}	–	1.2	–	pF
Output capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{obs}	–	–	1.5	pF
Noise figure I_C = 2 mA, V_{CE} = 5 V, f = 800 MHz, Z_S = 50 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	–	dB
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

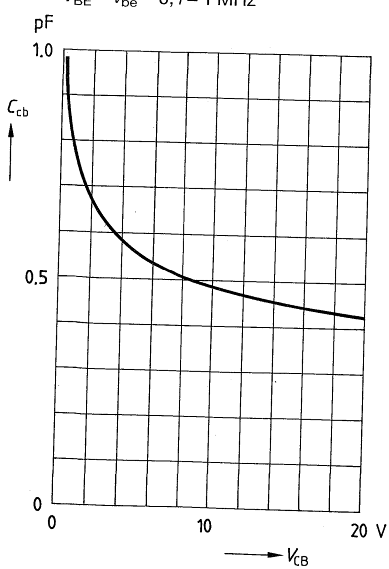
Total power dissipation $P_{tot} = f(T_A)$
Package mounted on alumina



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

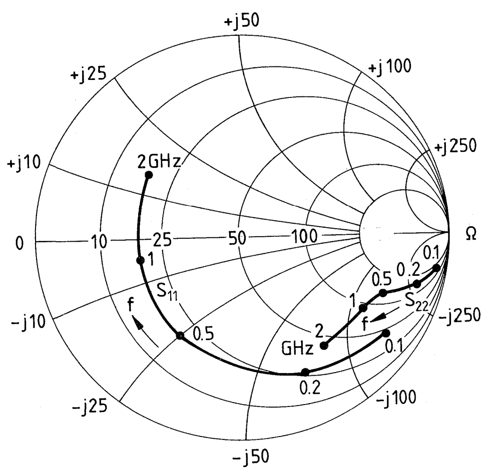


Common Emitter S Parameters

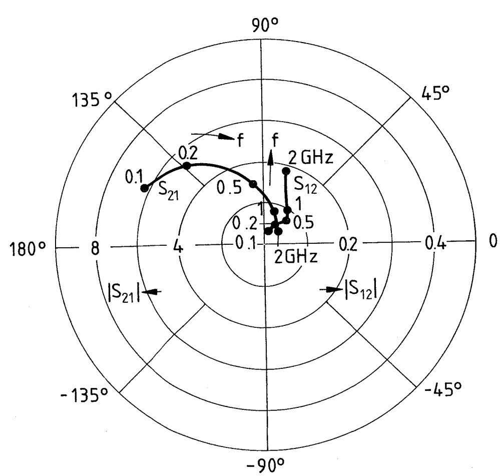
I_C = 2 mA, V_{CE} = 5 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.83	– 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 Ω



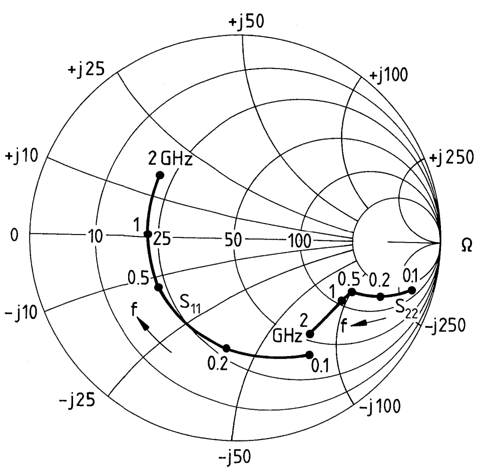
S_{12}, S_{21} = f (*f*)
I_C = 2 mA, V_{CE} = 5 V, Z_0 = 50 Ω



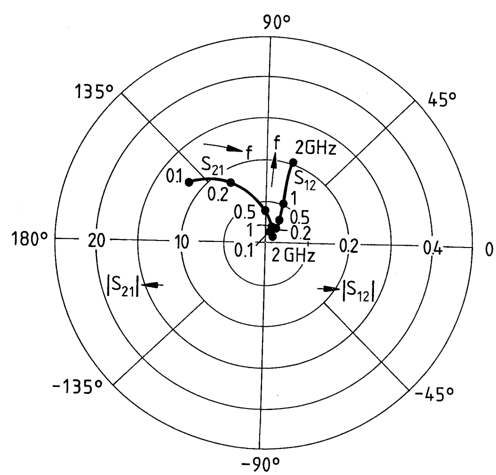
I_C = 5 mA, V_{CE} = 5 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.63	– 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



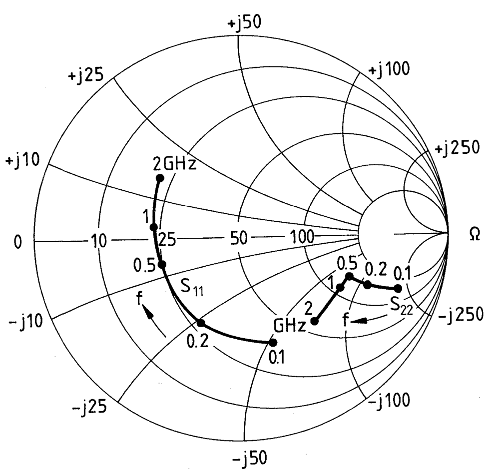
S_{12}, S_{21} = f (*f*)
I_C = 5 mA, V_{CE} = 5 V, Z_0 = 50 Ω



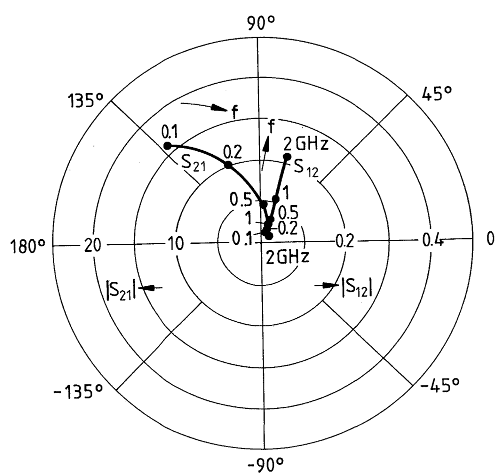
I_C = 10 mA, V_{CE} = 5 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.44	– 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



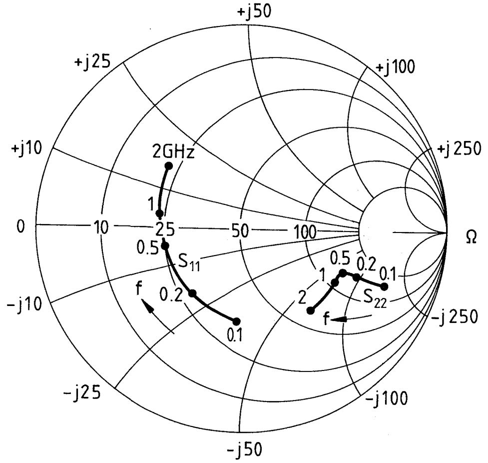
S_{12}, S_{21} = f (*f*)
I_C = 10 mA, V_{CE} = 5 V, Z_0 = 50 Ω



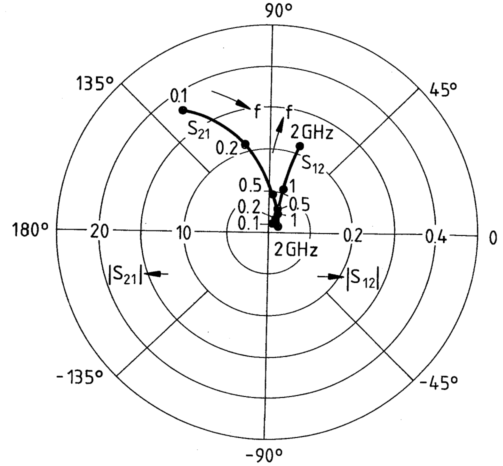
I_C = 15 mA, V_{CE} = 5 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.34	– 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



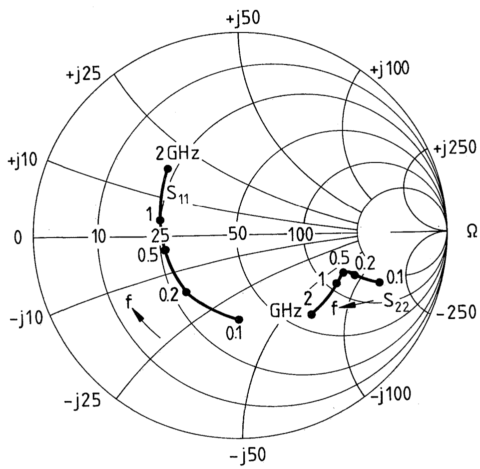
S_{12}, S_{21} = f (f)
I_C = 15 mA, V_{CE} = 5 V, Z_0 = 50 Ω



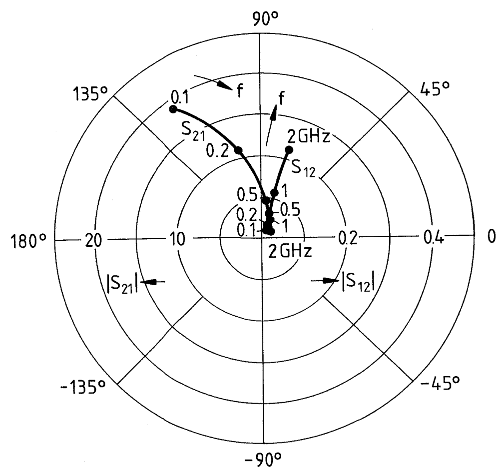
I_C = 20 mA, V_{CE} = 5 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.27	– 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

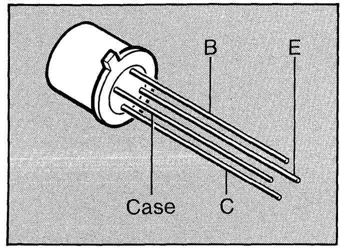
S_{11}, S_{22} = f (*f*)
I_C = 20 mA, V_{CE} = 5 V, Z_0 = 50 Ω



S_{12}, S_{21} = f (*f*)
I_C = 20 mA, V_{CE} = 5 V, Z_0 = 50 Ω



- For low-distortion broadband amplifiers up to 1 GHz at collector currents from 10 to 30 mA.



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

Type	Marking	Ordering code	Package[1])
BFS 55A	BFS 55A	Q 62702 – F454	TO-72

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CEO}	15	V
Collector-emitter voltage, $V_{BE} = 0$	V_{CES}	20	V
Collector-base voltage	V_{CBO}	20	V
Emitter-base voltage	V_{EBO}	2.5	V
Collector current	I_C	50	mA
Base current	I_B	10	mA
Total power dissipation, $T_A \leq 25$ °C	P_{tot}	250	mW
Junction temperature	T_j	200	°C
Ambient temperature range	T_A	–65 ... +175	°C
Storage temperature range	T_{stg}	–65 ... +175	°C

Thermal Resistance

Junction – ambient	R_{thJA}	≤700	K/W
Junction – case	R_{thJC}	≤400	K/W

1) For detailed dimensions see chapter Package Outlines.

Electrical Characteristics

at T_A = 25 °C, unless otherwise specified.

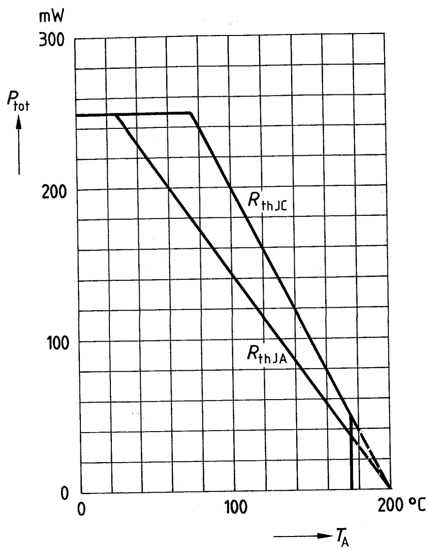
DC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CEO}$	15	–	–	V
Collector-emitter cutoff current V_{CE} = 20 V, V_{BE} = 0	I_{CES}	–	–	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	 – –	 – –	–

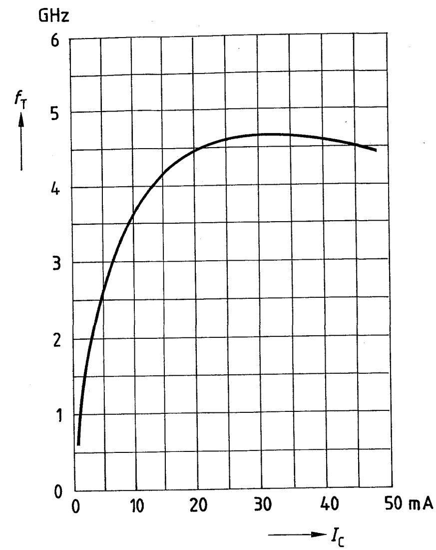
AC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
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	–	pF
Noise figure $I_C = 10$ mA, $V_{CE} = 8$ V, $f = 10$ MHz, $Z_S = 75\ \Omega$ $I_C = 10$ mA, $V_{CE} = 8$ V, $f = 800$ MHz, $Z_S = 60\ \Omega$	F	 – –	 1.7 2.9	 – –	dB
Power gain $I_C = 25$ mA, $V_{CE} = 8$ V, $f = 800$ MHz, $Z_S = 60\ \Omega$	G_{pe}	–	10	–	dB
Linear output voltage two-tone intermodulation test $I_C = 25$ mA, $V_{CE} = 8$ V, $d_{IM} = 60$ dB $f_1 = 806$ MHz, $f_2 = 810$ MHz, $Z_S = Z_L = 50\ \Omega$	$V_{o1} = V_{o2}$	–	350	–	mV
Third order intercept point $I_C = 25$ mA, $V_{CE} = 8$ V, $f = 800$ MHz	IP_3	–	33.5	–	dBm

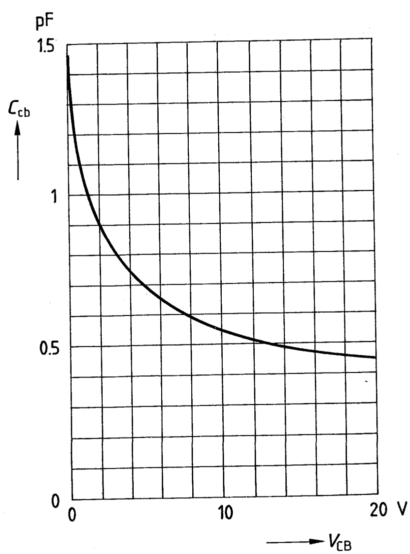
Total power dissipation $P_{tot} = f(T_A)$



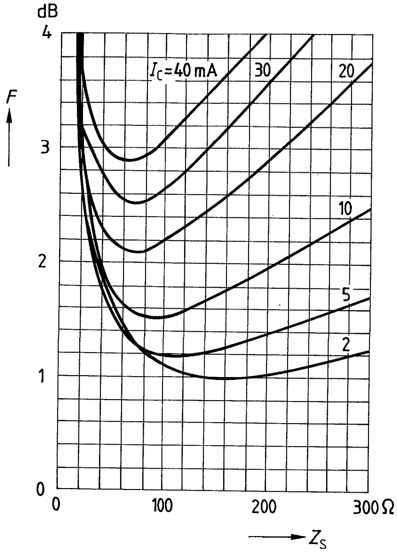
Transition frequency $f_T = f(I_C)$
$V_{CE} = 8$ V, $f = 200$ MHz



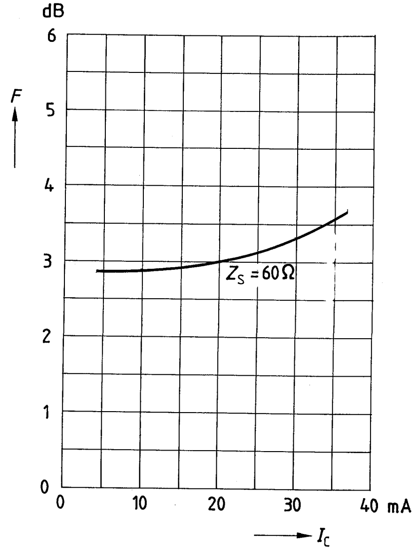
Collector-base capacitance $C_{cb} = f(V_{CB})$
$V_{BE} = v_{be} = 0$, $f = 1$ MHz



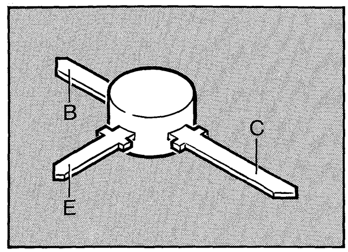
Noise figure $F = f(Z_S)$
$V_{CE} = 8$ V, $f = 10$ MHz



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



- For low-distortion broadband amplifiers up to 1 GHz at collector currents from 10 to 30 mA.



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

Type	Marking	Ordering code	Package[1])
BFT 65	BFT 65	Q 62702 – F451	T-plast

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CEO}	15	V
Collector-emitter voltage, $V_{BE} = 0$	V_{CES}	20	V
Emitter-base voltage	V_{EBO}	2.5	V
Collector current	I_C	50	mA
Base current	I_B	10	mA
Total power dissipation, $T_A \leq 50$ °C[2])	P_{tot}	250	mW
Junction temperature	T_j	150	°C
Ambient temperature range	T_A	–65 ... +150	°C
Storage temperature range	T_{stg}	–65 ... +150	°C

Thermal Resistance

Junction – ambient[2])	R_{thJA}	≤400	K/W
Junction – ambient	R_{thJA}	≤700	K/W

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

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

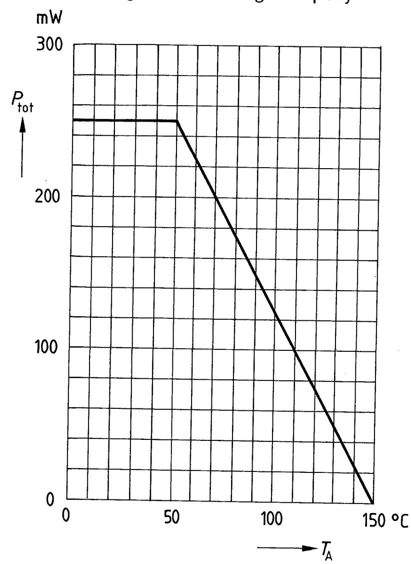
DC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
Collector-emitter breakdown voltage $I_C = 1$ mA, $I_B = 0$	$V_{(BR)CEO}$	15	–	–	V
Collector-emitter cutoff current $V_{CE} = 20$ 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}				–
$I_C = 25$ mA, $V_{CE} = 8$ V		30	–	–	
$I_C = 50$ mA, $V_{CE} = 5$ V		30	–	–	

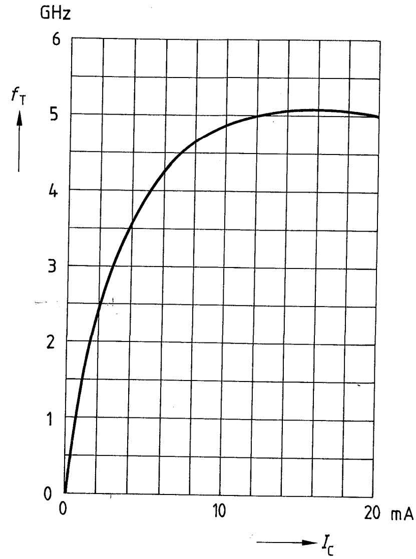
AC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
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	–	pF
Output capacitance $V_{CE} = 10$ V, $V_{BE} = v_{be} = 0$, $f = 1$ MHz	C_{obs}	–	0.85	–	pF
Noise figure $I_C = 10$ mA, $V_{CE} = 8$ V, $f = 800$ MHz, $Z_S = 60\ \Omega$	F	–	2.8	–	dB
Power gain $I_C = 25$ mA, $V_{CE} = 8$ V, $f = 800$ MHz, $Z_S = 60\ \Omega$, $Z_L = Z_{Lopt}$	G_{pe}	–	12	–	dB
Transducer gain $I_C = 25$ mA, $V_{CE} = 8$ V, $f = 500$ MHz, $Z_0 = 50\ \Omega$	$\|S_{21e}\|^2$	–	16	–	dB
Linear output voltage two-tone intermodulation test $I_C = 25$ mA, $V_{CE} = 8$ V, $d_{IM} = 60$ dB $f_1 = 806$ MHz, $f_2 = 810$ MHz, $Z_S = Z_L = 50\ \Omega$	$V_{o1} = V_{o2}$	–	240	–	mV
Third order intercept point $I_C = 25$ mA, $V_{CE} = 8$ V, $f = 800$ MHz	IP_3	–	30.5	–	dBm

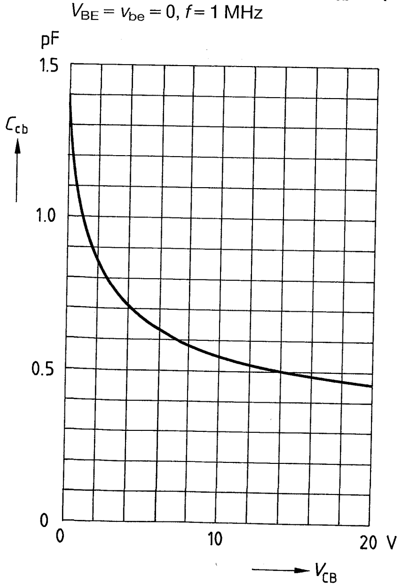
Total power dissipation $P_{tot} = f(T_A)$
Package mounted on glass epoxy



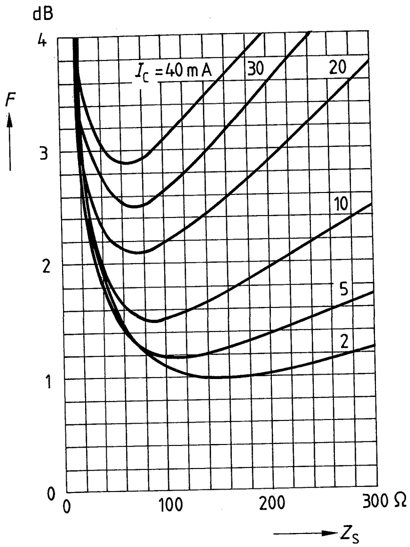
Transition frequency $f_T = f(I_C)$
$V_{CE} = 8$ V, $f = 200$ MHz



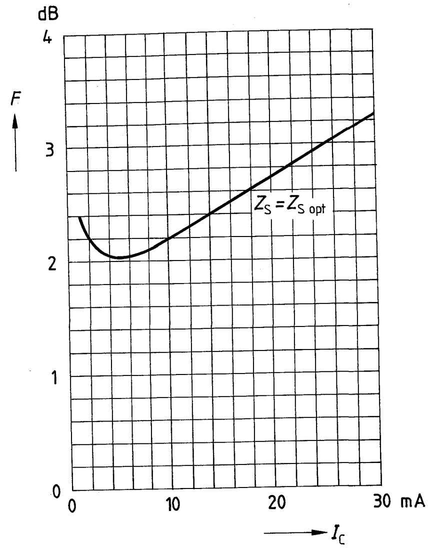
Collector-base capacitance $C_{cb} = f(V_{CB})$
$V_{BE} = v_{be} = 0$, $f = 1$ MHz



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)

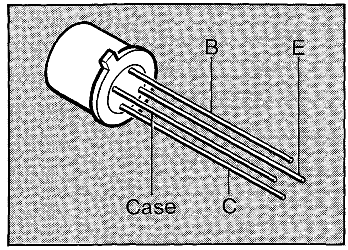


Common Emitter S Parameters
I_C = 25 mA, V_{CE} = 8 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.347	–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

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

Type	Marking	Ordering code	Package[1])
BFT 66	BFT 66	Q 62702 – F456	TO-72

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CEO}	15	V
Collector-emitter voltage, $V_{BE} = 0$	V_{CES}	20	V
Collector-base voltage	V_{CBO}	20	V
Emitter-base voltage	V_{EBO}	2.5	V
Collector current	I_C	30	mA
Base current	I_B	4	mA
Total power dissipation, $T_A \leq 60$ °C	P_{tot}	200	mW
Junction temperature	T_j	200	°C
Ambient temperature range	T_A	–65 ... +175	°C
Storage temperature range	T_{stg}	–65 ... +175	°C

Thermal Resistance

Junction – ambient	R_{thJA}	≤700	K/W
Junction – case	R_{thJC}	≤400	K/W

1) For detailed dimensions see chapter Package Outlines.

Electrical Characteristics

at T_A = 25 °C, unless otherwise specified.

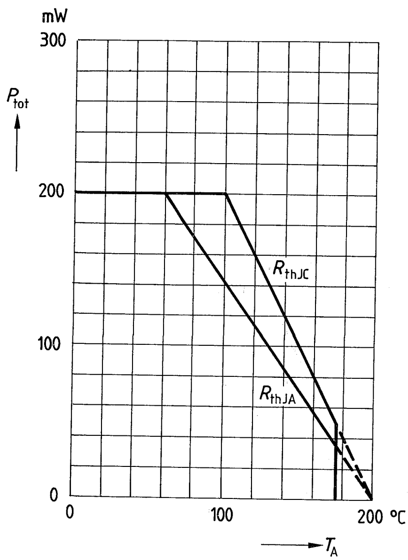
DC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CEO}$	15	–	–	V
Collector-emitter cutoff current V_{CE} = 20 V, V_{BE} = 0	I_{CES}	–	–	100	µA
Collector-base cutoff current V_{CB} = 10 V, I_E = 0	I_{CBO}	–	–	50	nA
Emitter-base cutoff current V_{EB} = 25 V, I_C = 0	I_{EBO}	–	–	100	µA
DC current gain I_C = 3 mA, V_{CE} = 6 V	h_{FE}	50	–	250	

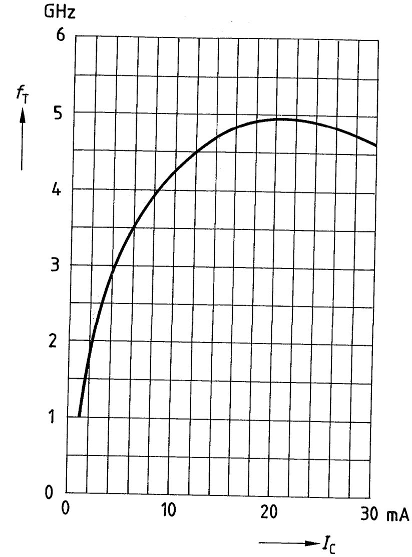
AC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
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	–	pF
Output capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{obs}	–	1.3	–	pF
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	–	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	$V_{o1} = V_{o2}$	–	240	–	mV
Third order intercept point I_C = 20 mA, V_{CE} = 6 V, f = 800 MHz	IP_3	–	30.5	–	dBm

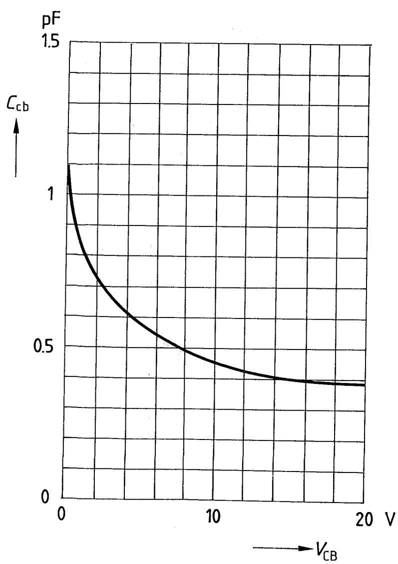
Total power dissipation $P_{tot} = f(T_A)$



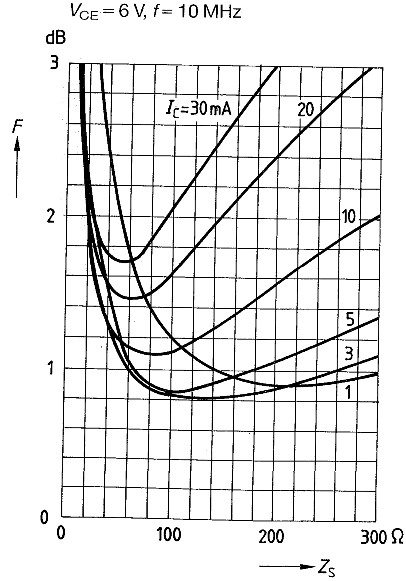
Transition frequency $f_T = f(I_C)$
$V_{CE} = 6$ V, $f = 200$ MHz



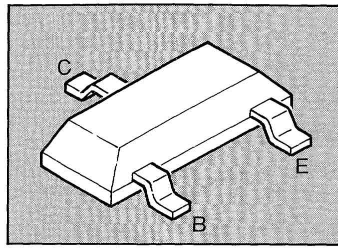
Collector-base capacitance $C_{cb} = f(V_{CB})$
$V_{BE} = v_{be} = 0$, $f = 1$ MHz



Noise figure $F = f(Z_S)$
$V_{CE} = 6$ V, $f = 10$ MHz



- 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)	Package[1])
BFT 92	W 1	Q 62702 – F1062	SOT-23

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CEO}	15	V
Collector-base voltage	V_{CBO}	20	V
Emitter-base voltage	V_{EBO}	2	V
Collector current	I_C	25	mA
Peak collector current, $f \geq 10$ MHz	I_{CM}	35	mA
Total power dissipation, $T_A \leq 60$ °C[2])	P_{tot}	200	mW
Junction temperature	T_j	150	°C
Ambient temperature range	T_A	–65 ... +150	°C
Storage temperature range	T_{stg}	–65 ... +150	°C

Thermal Resistance

Junction – ambient[2])	R_{thJA}	≤440	K/W

1) For detailed dimensions 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.

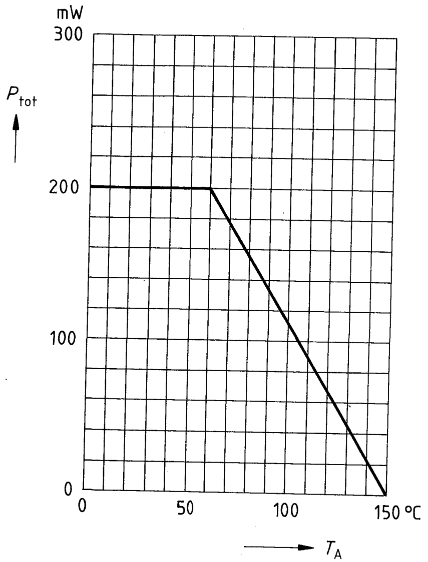
DC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CEO}$	15	–	–	V
Collector-base cutoff current V_{CB} = 10 V, I_E = 0	I_{CBO}	–	–	50	nA
DC current gain I_C = 14 mA, V_{CE} = 10 V	h_{FE}	20	50	–	–

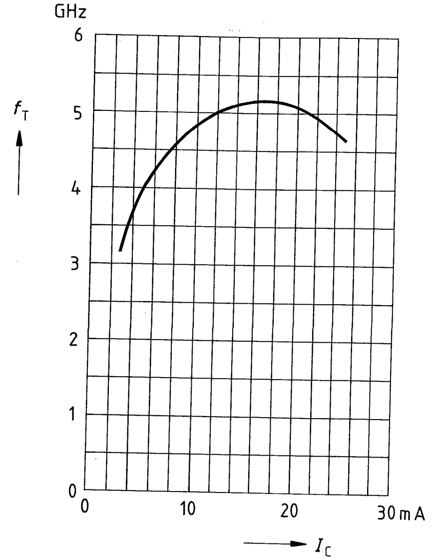
AC characteristics

Parameter	**Symbol**	**Values**			**Unit**
		min	**typ**	**max**	
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 $V_{EB} = 0.5$ V, $I_C = i_c = 0$, $f = 1$ MHz	C_{ibo}	–	0.8	–	pF
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	–	dB

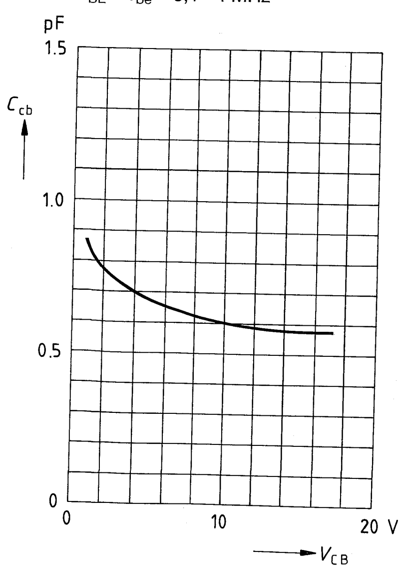
Total power dissipation $P_{tot} = f(T_A)$
Package mounted on alumina



Transition frequency $f_T = f(I_C)$
$V_{CE} = 10$ V, $f = 500$ MHz

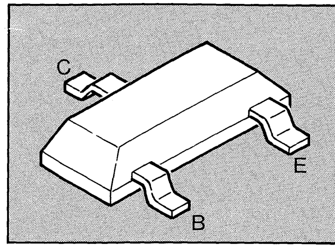


Collector-base capacitance $C_{cb} = f(V_{CB})$
$V_{BE} = v_{be} = 0$, $f = 1$ MHz



PNP Silicon RF Transistor BFT 93

- For low-distortion broadband amplifiers up to 1 GHz at collector currents from 2 to 30 mA.
- Complementary type: BFR 93P (NPN).



ESD: Electrostatic discharge sensitive device, observe handling precautions!

Type	Marking	Ordering code (tape and reel)	Package[1])
BFT 93	X1	Q 62702 – F1063	SOT-23

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CEO}	12	V
Collector-base voltage	V_{CBO}	15	V
Emitter-base voltage	V_{EBO}	2	V
Collector current	I_C	35	mA
Peak collector current, $f \geq 10$ MHz	I_{CM}	50	mA
Total power dissipation, $T_A \leq 60$ °C[2])	P_{tot}	200	mW
Junction temperature	T_j	150	°C
Ambient temperature range	T_A	–65 ... +150	°C
Storage temperature range	T_{stg}	–65 ... +150	°C

Thermal Resistance

Junction – ambient[2])	R_{thJA}	≤440	K/W

1) For detailed dimensions 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.

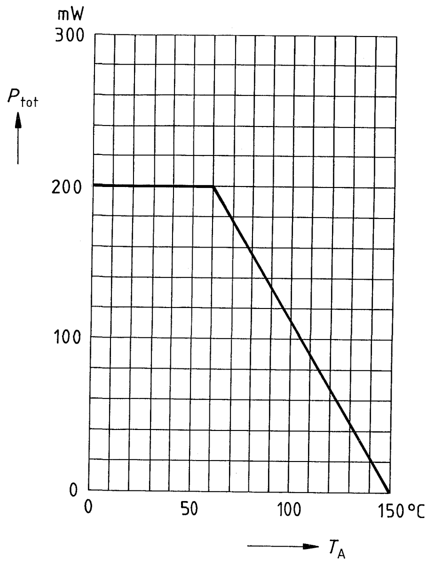
DC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
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}	20	50	–	–

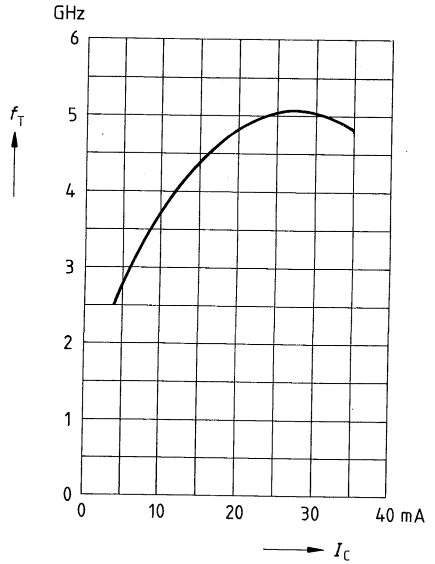
AC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
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 $V_{EB} = 0.5$ V, $I_C = i_c = 0$, $f = 1$ MHz	C_{ibo}	–	1.8	–	pF
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	–	dB

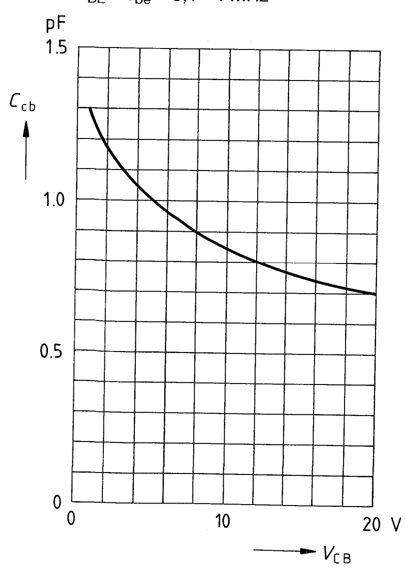
Total power dissipation $P_{tot} = f(T_A)$
Package mounted on alumina



Transition frequency $f_T = f(I_C)$
$V_{CE} = 5$ V, $f = 500$ MHz



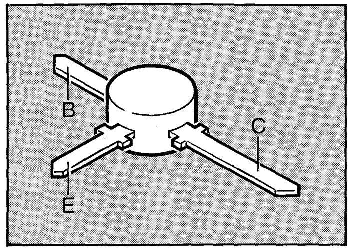
Collector-base capacitance $C_{cb} = f(V_{CB})$
$V_{BE} = v_{be} = 0$, $f = 1$ MHz



NPN Silicon RF Transistor

BFT 97

- For low-noise IF and broadband amplifiers in antenna and telecommunications systems at collector currents from 2 to 20 mA.



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

Type	Marking	Ordering code	Package[1])
BFT 97	BFT 97	Q 62702 – F514	T-plast

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CEO}	15	V
Collector-base voltage	V_{CBO}	20	V
Emitter-base voltage	V_{EBO}	2.5	V
Collector current	I_C	30	mA
Base current	I_B	4	mA
Total power dissipation, $T_A \leq 70$ °C[2])	P_{tot}	200	mW
Junction temperature	T_j	150	°C
Ambient temperature range	T_A	–65 ... +150	°C
Storage temperature range	T_{stg}	–65 ... +150	°C

Thermal Resistance

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

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

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

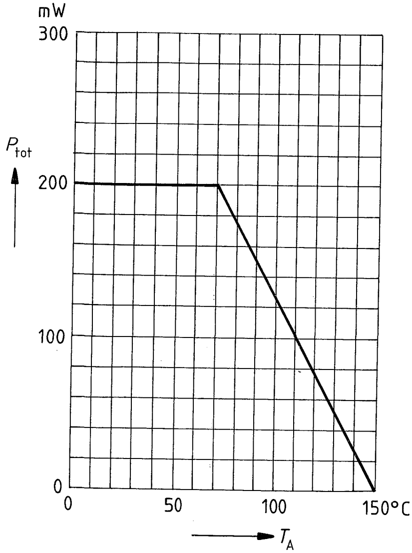
DC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CEO}$	15	–	–	V
Collector-emitter cutoff current V_{CE} = 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 = 10 mA, V_{CE} = 6 V	h_{FE}	30	–	–	–

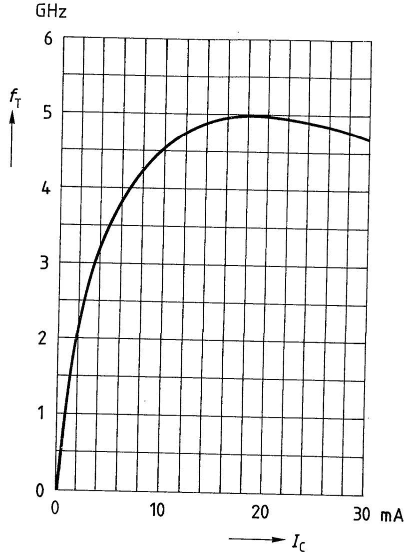
AC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
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	–	pF
Output capacitance $V_{CE} = 6$ V, $V_{BE} = v_{be} = 0$, $f = 1$ MHz	C_{obs}	–	0.85	–	pF
Noise figure $I_C = 3$ mA, $V_{CE} = 6$ V, $f = 10$ MHz, $Z_S = 75\ \Omega$ $I_C = 3$ mA, $V_{CE} = 6$ V, $f = 200$ MHz, $Z_S = 75\ \Omega$ $I_C = 4$ mA, $V_{CE} = 6$ V, $f = 800$ MHz, $Z_S = 60\ \Omega$	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, $Z_S = Z_L = 50\ \Omega$	$V_{o1} = V_{o2}$	–	170	–	mV
Third order intercept point $I_C = 20$ mA, $V_{CE} = 6$ V, $f = 800$ MHz	IP_3	–	27.5	–	dBm

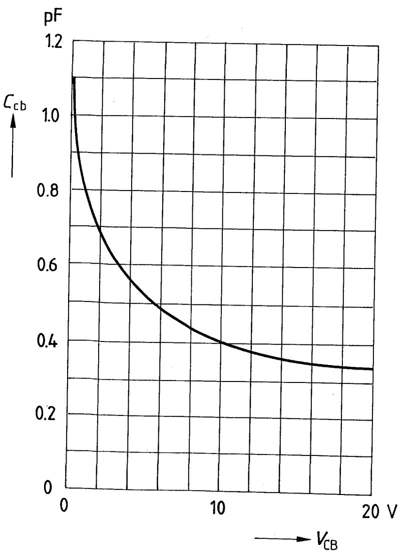
Total power dissipation $P_{tot} = f(T_A)$
Package mounted on glass epoxy



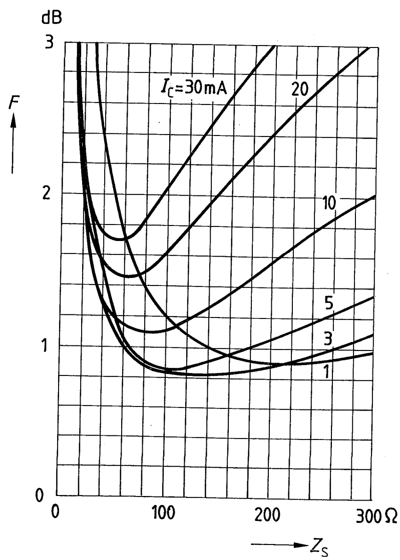
Transition frequency $f_T = f(I_C)$
$V_{CE} = 6$ V, $f = 200$ MHz



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



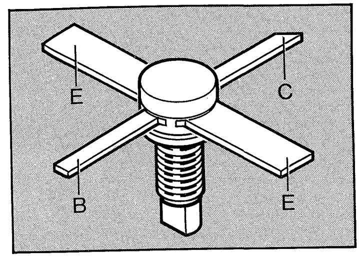
Noise figure $F = f(Z_S)$
$V_{CE} = 6$ V, $f = 10$ MHz



NPN Silicon RF Transistors

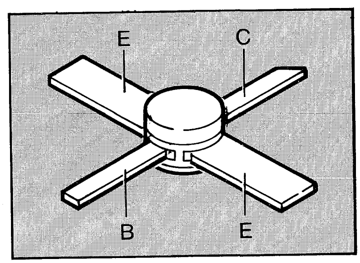
BFT 98
BFT 98B

- 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	Package[1])
BFT 98	BFT 98	Q 62702 – F523	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	Package[1])
BFT 98B	BFT 98B	Q 62702 – F1084	TO-117

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CEO}	20	V
Collector-emitter voltage, $V_{BE} = 0$	V_{CES}	30	V
Emitter-base voltage	V_{EBO}	3	V
Collector current	I_C	200	mA
Peak collector current, $t \leq 100$ µs	I_{CM}	250	mA
Base current	I_B	50	mA
Total power dissipation, $T_C \leq 70$ °C[2])	P_{tot}	2.25	W
Junction temperature	T_j	150	°C
Ambient temperature range	T_A	−65 ... +150	°C
Storage temperature range	T_{stg}	−65 ... +175	°C

Thermal Resistance

Junction – ambient	R_{thJA}	≤85	K/W
Junction – case (bottom plate)	R_{thJC}	≤35	K/W

1) For detailed dimensions 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.

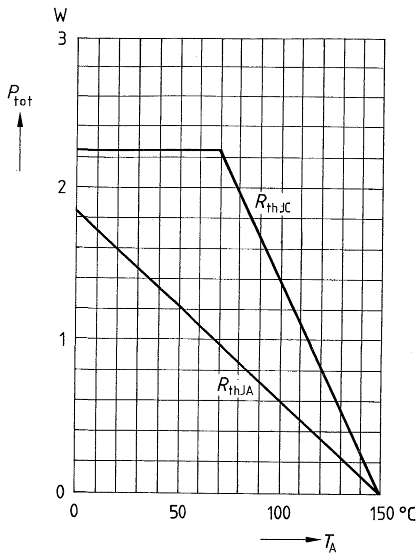
DC characteristics

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

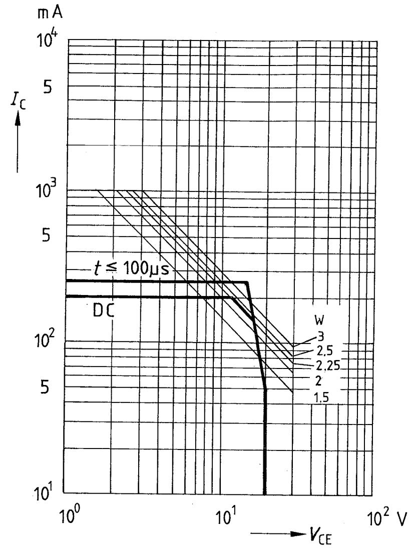
AC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
Transition frequency I_C = 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

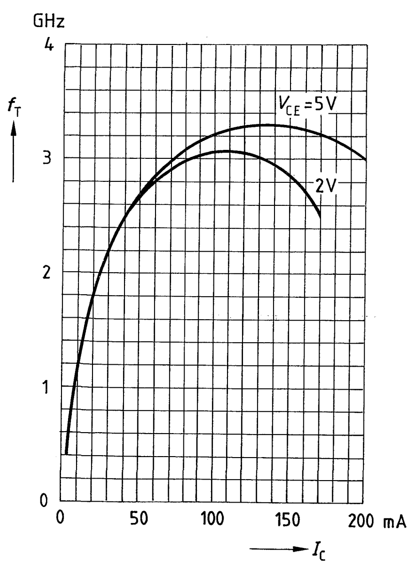
Total power dissipation $P_{tot} = f(T_A)$



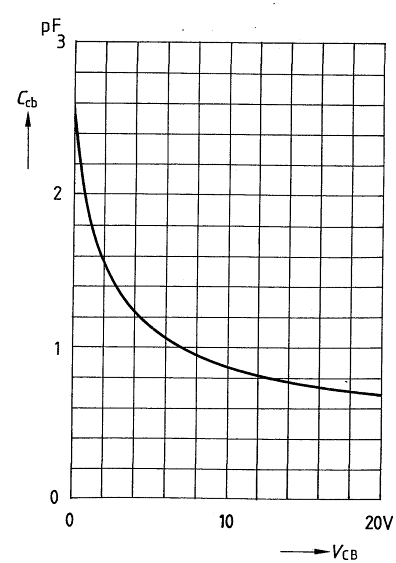
Operating range $I_C = f(V_{CE})$
$T_C = 70\ °C$, $R_{thJC} = 35\ K/W$



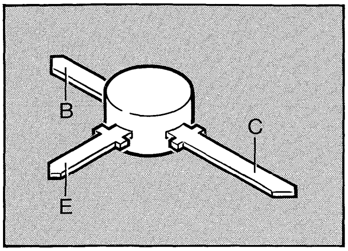
Transition frequency $f_T = f(I_C)$
$f = 200\ MHz$



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



- For low-distortion broadband amplifier output stages up to 1 GHz at collector currents up to 120 mA and oscillators.



Type	Marking	Ordering code	Package[1])
BFT 98T	BFT 98T	Q 62702 – F877	T-plast

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CEO}	20	V
Collector-emitter voltage, $V_{BE} = 0$	V_{CES}	30	V
Emitter-base voltage	V_{EBO}	3	V
Collector current	I_C	150	mA
Peak collector current, $f \geq 1$ MHz	I_{CM}	250	mA
Base current	I_B	50	mA
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	°C
Storage temperature range	T_{stg}	–65 ... +150	°C

Thermal Resistance

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

1) For detailed dimensions see chapter Package Outlines.
2) Package mounted on glass epoxy 35 mm × 35 mm × 1.5 mm.

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

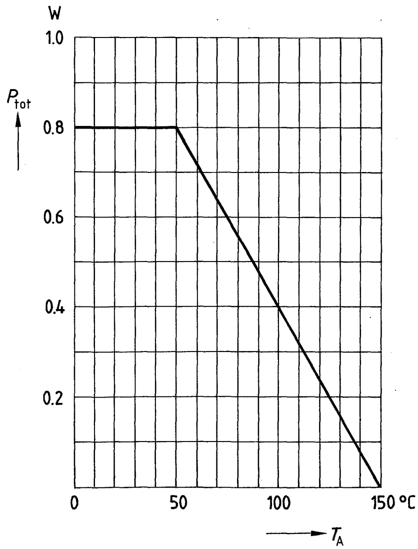
DC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
Collector-base cutoff current V_{CB} = 15 V, I_E = 0	I_{CBO}	–	–	100	nA
DC current gain I_C = 80 mA, V_{CE} = 8 V	h_{FE}	25	50	–	–

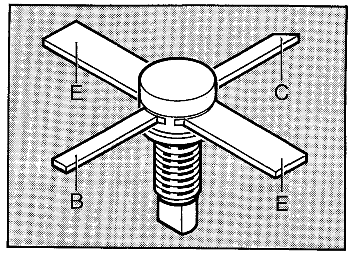
AC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
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, $Z_S = Z_L = 50\ \Omega$	$V_{o1} = V_{o2}$	–	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

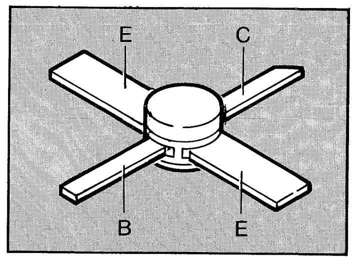


- For low-distortion broadband amplifier output stages up to 1 GHz at collector currents up to 250 mA.
- With integrated emitter stabilizing resistors.



Type	Marking	Ordering code	Package[1])
BFT 99	BFT 99	Q 62702 – F524	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	Package[1])
BFT 99A	BFT 99A	Q 62702 – F901	TO-117

1) For detailed dimensions see chapter Package Outlines.

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CEO}	20	V
Collector-emitter voltage, $V_{BE} = 0$	V_{CES}	30	V
Emitter-base voltage	V_{EBO}	3	V
Collector current	I_C	350	mA
Peak collector current, $t \leq 100$ µs	I_{CM}	500	mA
Base current	I_B	50	mA
Total power dissipation, $T_C \leq 70$ °C	P_{tot}	4	W
Junction temperature	T_j	150	°C
Ambient temperature range	T_A	–65 ... +150	°C
Storage temperature range	T_{stg}	–65 ... +175	°C

Thermal Resistance

Junction – ambient	R_{thJA}	≤70	K/W
Junction – case (bottom plate)	R_{thJC}	≤20	K/W

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

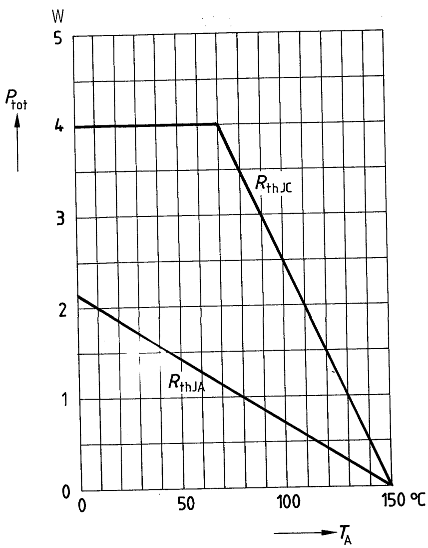
DC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
Collector-base cutoff current V_{CB} = 15 V, I_E = 0	I_{CBO}	–	–	200	nA
DC current gain I_C = 200 mA, V_{CE} = 15 V	h_{FE}	25	55	–	–

AC characteristics

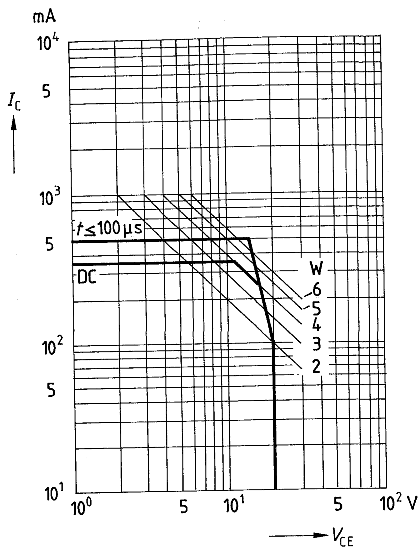
Parameter	Symbol	Values			Unit
		min	typ	max	
Transition frequency I_C = 200 mA, V_{CE} = 15 V, f = 200 MHz	f_T	2.5	3.3	–	GHz
Collector-base capacitance V_{CB} = 15 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{cb}	–	1.5	1.9	pF
Power gain I_C = 240 mA, V_{CE} = 15 V, f = 800 MHz, $Z_S = Z_{Sopt}$, $Z_L = Z_{Lopt}$	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 $P_{tot} = f(T_A)$

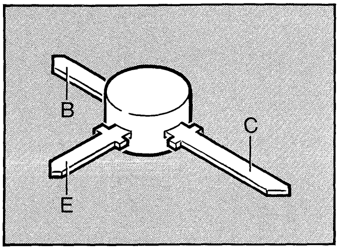


Operating range $I_C = f(V_{CE})$

$T_C = 70°$ C, $R_{thJC} \leq 20$ K/W



- For broadband amplifiers up to 1 GHz at collector currents from 1 to 20 mA.



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

Type	Marking	Ordering code	Package[1])
BFW 92	BFW 92	Q 62702 – F321	T-plast

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CEO}	15	V
Collector-base voltage	V_{CBO}	25	V
Emitter-base voltage	V_{EBO}	2.5	V
Collector current	I_C	25	mA
Peak collector current, $f \geq 10$ MHz	I_{CM}	50	mA
Total power dissipation, $T_A \leq 70$ °C[2])	P_{tot}	200	mW
Junction temperature	T_j	150	°C
Ambient temperature range	T_A	–65 ... +150	°C
Storage temperature range	T_{stg}	–65 ... +150	°C

Thermal Resistance

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

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

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

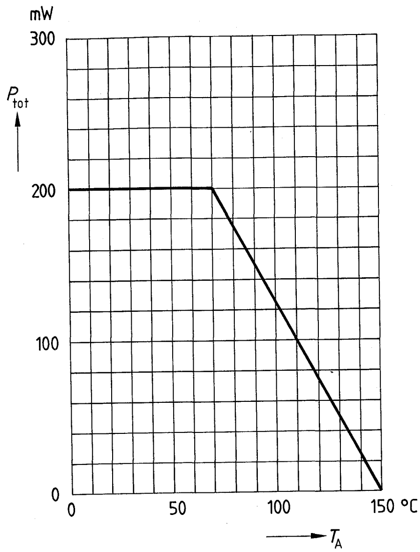
DC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CEO}$	15	–	–	V
Collector-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 = 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

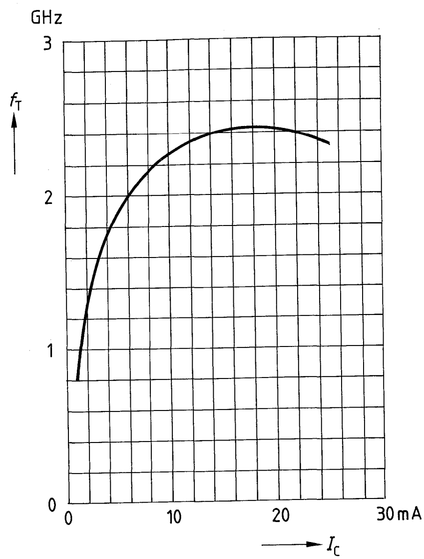
AC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
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	–	pF
Output capacitance $V_{CE} = 5$ V, $V_{BE} = v_{be} = 0$, $f = 1$ MHz	C_{obs}	–	0.8	–	pF
Noise figure $I_C = 2$ mA, $V_{CE} = 5$ V, $f = 800$ MHz, $Z_S = 60\ \Omega$	F	–	4	–	dB
Power gain $I_C = 14$ mA, $V_{CE} = 5$ V, $f = 800$ MHz, $Z_S = 60\ \Omega$, $Z_L = Z_{Lopt}$	G_{pe}	–	11	–	dB
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, $Z_S = Z_L = 50\ \Omega$	$V_{o1} = V_{o2}$	–	100	–	mV
Third order intercept point $I_C = 14$ mA, $V_{CE} = 5$ V, $f = 800$ MHz	IP_3	–	23	–	dBm

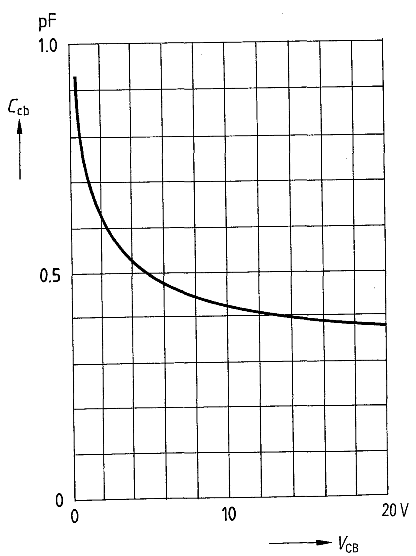
Total power dissipation $P_{tot} = f\ (T_A)$
Package mounted on glass epoxy



Transition frequency $f_T = f\ (I_C)$
$V_{CE} = 5\ V$, $f = 200\ MHz$



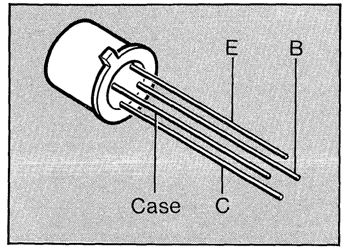
Collector-base capacitance $C_{cb} = f\ (V_{CB})$
$V_{BE} = v_{be} = 0$, $f = 1\ MHz$



NPN Silicon RF Transistor

BFX 59
BFX 59F

- For broadband amplifiers at collector currents up to 30 mA.



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

Type	Marking	Ordering code	Package[1])
BFX 59 BFX 59F	BFX 59 BFX 59F	Q 60206 – X59 Q 60206 – X59 – S5	TO-72

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CEO}	20	V
Collector-base voltage	V_{CBO}	30	V
Emitter-base voltage	V_{EBO}	3	V
Collector current	I_C	100	mA
Base current	I_B	30	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	°C
Storage temperature range	T_{stg}	–65 ... +175	°C

Thermal Resistance

Junction – ambient	R_{thJA}	≤650	K/W
Junction – case	R_{thJC}	≤350	K/W

1) For detailed dimensions see chapter Package Outlines.

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

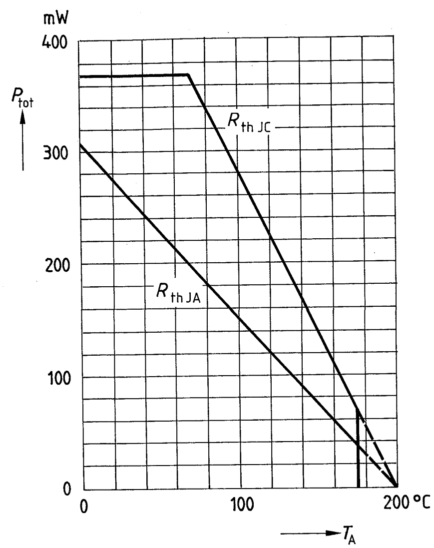
DC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CEO}$	20	–	–	V
Collector-base cutoff current V_{CB} = 20 V, I_E = 0	I_{CBO}	–	0.3	10	nA
Emitter-base cutoff current V_{EB} = 3 V, I_C = 0	I_{EBO}	–	–	10	µA
DC current gain I_C = 10 mA, V_{CE} = 10 V	h_{FE}	30	–	200	–

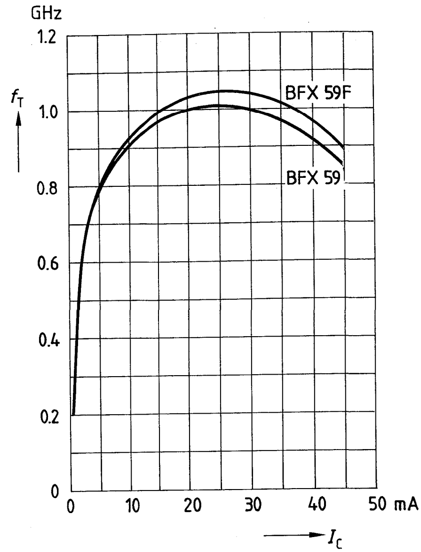
AC characteristics

Parameter		Symbol	Values min	Values typ	Values max	Unit
Transition frequency		f_T				GHz
I_C = 8 mA, V_{CE} = 10 V, f = 100 MHz			600	900	–	
I_C = 20 mA, V_{CE} = 10 V, f = 100 MHz	BFX 59		700	1000	–	
	BFX 59F		700	1050	–	
I_C = 35 mA, V_{CE} = 10 V, f = 100 MHz	BFX 59F		700	1000	–	
Collector-base capacitance	BFX 59	C_{cb}	0.4	–	0.7	pF
V_{CB} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	BFX 59F		0.55	–	0.9	
Noise figure		F				dB
I_C = 3 mA, V_{CE} = 10 V, f = 300 KHz, Z_S = 300 Ω			–	2.6	–	
I_C = 3 mA, V_{CE} = 10 V, f = 200 MHz, Z_S = 60 Ω			–	3.4	4.5	

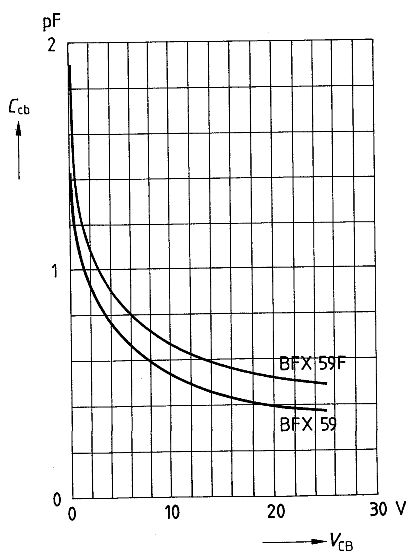
Total power dissipation $P_{tot} = f(T_A)$



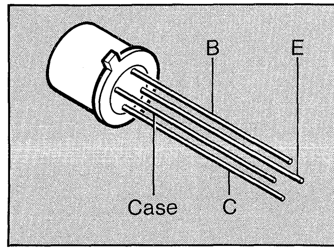
Transition frequency $f_T = f(I_C)$
$V_{CE} = 10$ V, $f = 100$ MHz



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



- 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	Package[1])
BFX 60	BFX 60	Q 60206 – X60	TO-72

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CEO}	25	V
Collector-base voltage	V_{CBO}	40	V
Emitter-base voltage	V_{EBO}	4	V
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	°C
Storage temperature range	T_{stg}	–65 ... +175	°C

Thermal Resistance

Junction – ambient	R_{thJA}	≤650	K/W
Junction – case	R_{thJC}	≤350	K/W

1) For detailed dimensions see chapter Package Outlines.

Electrical Characteristics

at T_A = 25 °C, unless otherwise specified.

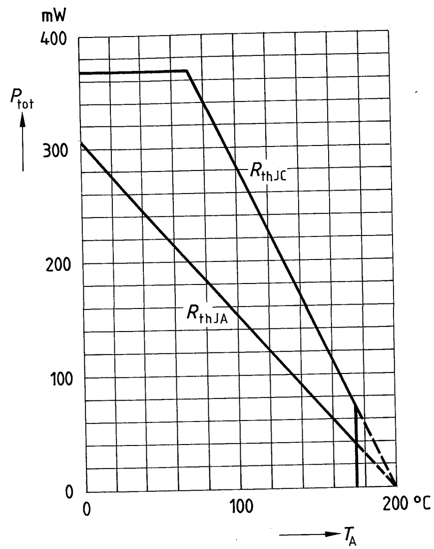
DC characteristics

Parameter	Symbol	Value			Unit
		min	typ	max	
Collector-emitter breakdown voltage I_C = 2 mA, I_B = 0	$V_{(BR)CEO}$	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_{EBO}	–	–	1	µA
DC current gain I_C = 7 mA, V_{CE} = 10 V	h_{FE}	50	100	–	–
Base-emitter voltage I_C = 7 mA, V_{CE} = 10 V	V_{BE}	–	0.74	0.9	V

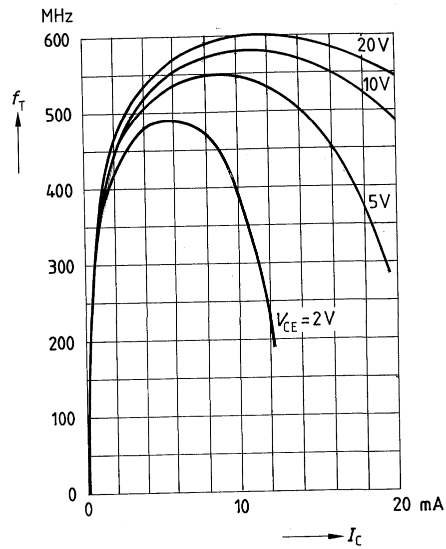
AC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
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, $Z_S = 60\ \Omega$	F	–	5	–	dB

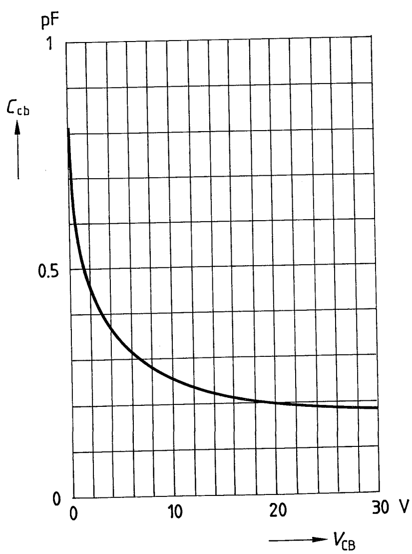
Total power dissipation $P_{tot} = f(T_A)$



Transition frequency $f_T = f(I_C)$
$f = 100$ MHz



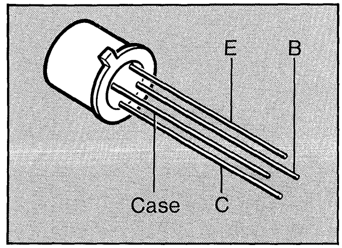
Collector-base capacitance $C_{cb} = f(V_{CB})$
$V_{BE} = V_{be} = 0$, $f = 1$ MHz



NPN Silicon RF Transistor

BFY 90

- For broadband amplifiers up to 1 GHz and non-saturated switches at collector currents from 1 to 20 mA.
- CECC-type available: CECC 50002/253.



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

Type	Marking	Ordering code (tape and reel)	Package[1])
BFY 90	BFY 90	Q 62702 – F297	TO-72

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CEO}	15	V
Collector-base voltage	V_{CBO}	30	V
Emitter-base voltage	V_{EBO}	2.5	V
Collector current	I_C	25	mA
Peak collector current, $f \geq 10$ MHz	I_{CM}	50	mA
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	°C
Storage temperature range	T_{stg}	–65 ... +175	°C

Thermal Resistance

Junction – ambient	R_{thJA}	≤700	K/W
Junction – case	R_{thJC}	≤400	K/W

1) For detailed dimensions see chapter Package Outlines.

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

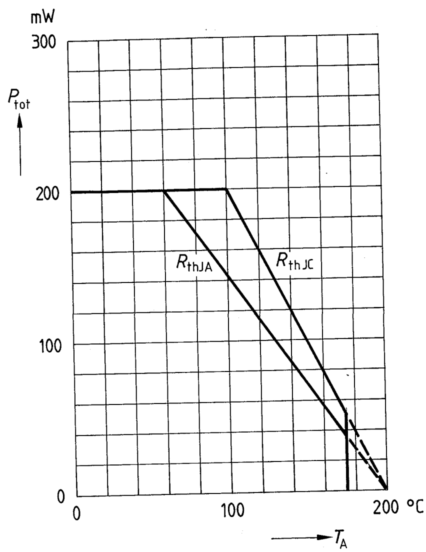
DC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
Collector-emitter breakdown voltage $I_C = 1$ mA, $I_B = 0$	$V_{(BR)CEO}$	15	–	–	V
Collector-base cutoff current $V_{CB} = 15$ 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	V

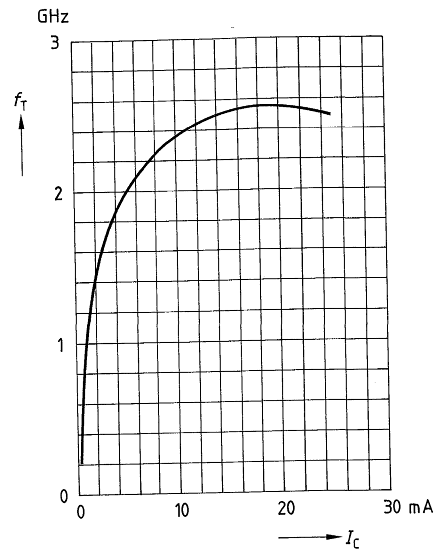
AC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
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	pF
Noise figure I_C = 2 mA, V_{CE} = 5 V, f = 800 MHz, Z_S = 50 Ω	F	–	–	6	dB
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	–	dB
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

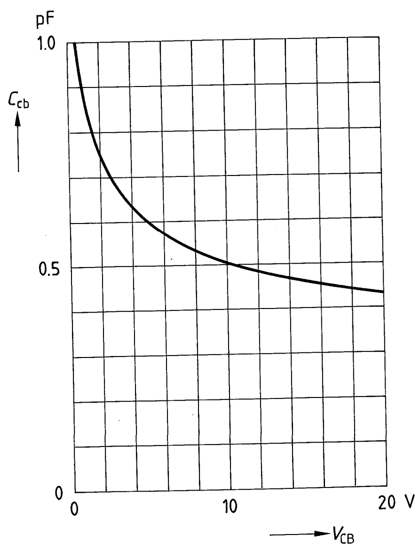
Total power dissipation $P_{tot} = f(T_A)$



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



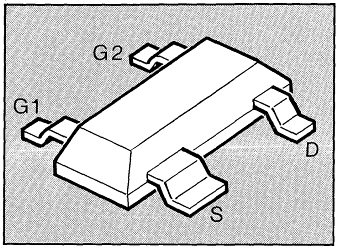
Common Emitter S Parameters
I_C = 12 mA, V_{CE} = 5 V, Z_0 = 50 Ω

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

GaAs-FET

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

Type	Marking	Ordering code (tape and reel)	Package[1])
CF 739	MS	Q 62702 – F1215	SOT-143

Maximum Ratings

Parameter	Symbol	Value	Unit
Drain-source voltage	V_{DS}	10	V
Gate 1-source voltage	$-V_{G1S}$	6	V
Gate 2-source voltage	$-V_{G2S}$	6	V
Drain current	I_D	80	mA
Gate 1-source peak current	$+I_{G1SM}$	1	mA
Gate 2-source peak current	$+I_{G2SM}$	1	mA
Total power dissipation, $T_A \leq 42$ °C[2])	P_{tot}	240	mW
Channel temperature	T_{ch}	150	°C
Storage temperature range	T_{stg}	–55 ... +125	°C

Thermal Resistance

Junction – ambient[2])	R_{thJA}	≤450	K/W

1) For detailed dimensions 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.

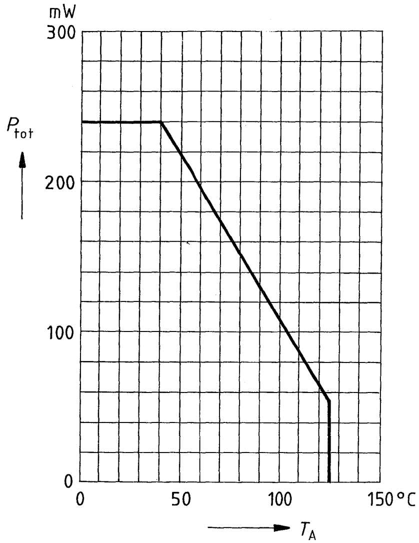
DC characteristics

Parameter	Symbol	Values min	Values typ	Values max	Unit
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	µA
Drain current V_{G1S} = 0, V_{G2S} = 0, V_{DS} = 3 V	I_{DSS}	10	–	80	mA
Gate 1-source pinch-off voltage V_{G2S} = 0, V_{DS} = 5 V, I_D = 200 µA	$-V_{G1S(P)}$	–	–	4.5	V
Gate 2-source pinch-off voltage V_{G1S} = 0, V_{DS} = 5 V, I_D = 200 µA	$-V_{G2S(P)}$	–	–	4.5	V

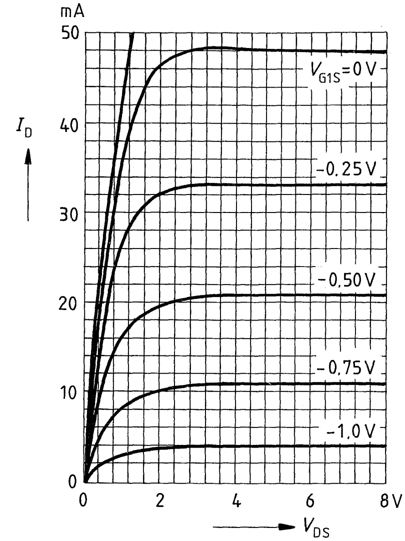
AC characteristics

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_{g1ss}	–	0.95	–	pF
Output capacitance V_{G2S} = 2 V, V_{DS} = 5 V, I_D = 10 mA, f = 1 MHz	C_{dss}	–	0.5	–	pF
Noise figure V_{G2S} = 2 V, V_{DS} = 5 V, I_D = 10 mA, f = 1.75 GHz	F	–	1.8	–	dB
Power gain V_{G2S} = 2 V, V_{DS} = 5 V, I_D = 10 mA, f = 1.75 GHz	G_{ps}	–	17	–	dB

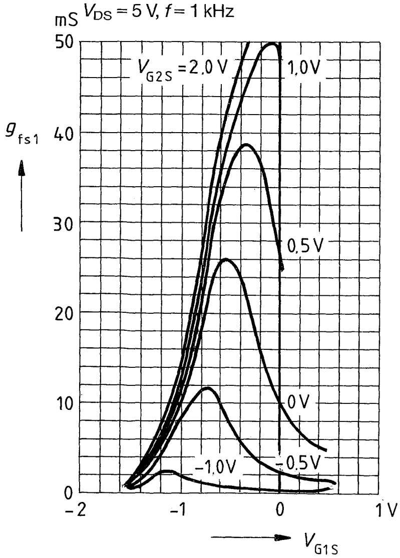
Total power dissipation $P_{tot} = f(T_A)$
package mounted on alumina



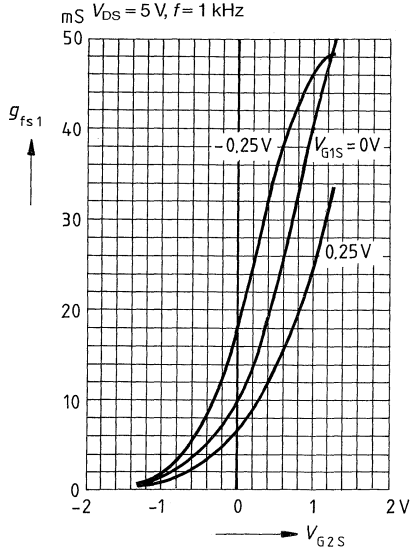
Output characteristics $I_D = f(V_{DS})$
$V_{G2S} = 2$ V



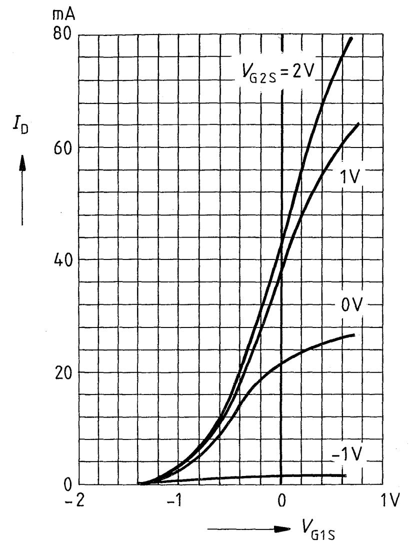
Gate 1 forward transconductance
$g_{fs1} = f(V_{G1S})$
$V_{DS} = 5$ V, $f = 1$ kHz



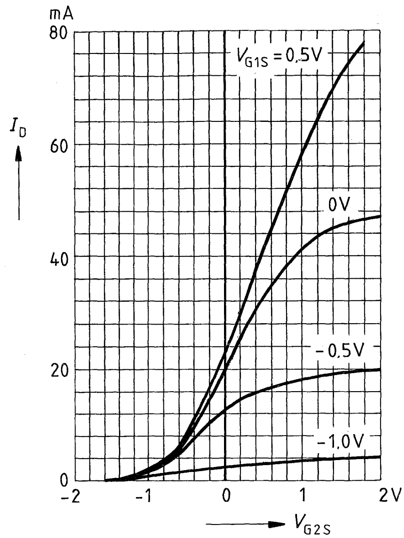
Gate 1 forward transconductance
$g_{fs1} = f(V_{G2S})$
$V_{DS} = 5$ V, $f = 1$ kHz



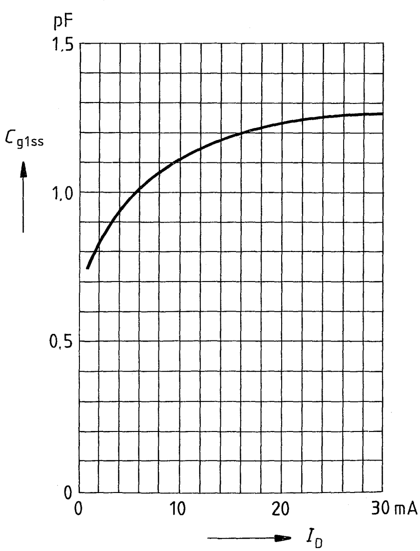
Drain current $I_D = f(V_{G1S})$
$V_{DS} = 5$ V



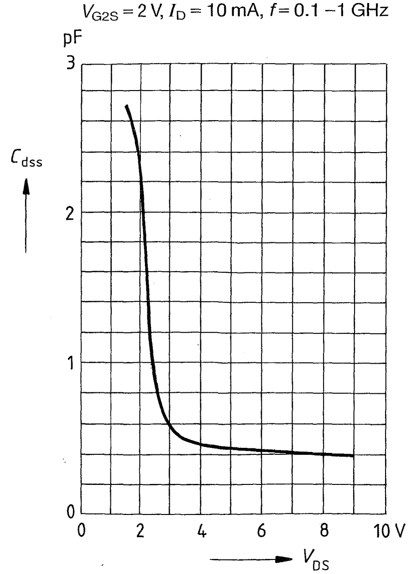
Drain current $I_D = f(V_{G2S})$
$V_{DS} = 5$ V



Gate 1 input capacitance $C_{g1ss} = f(I_D)$
$V_{G2S} = 2$ V, $V_{DS} = 5$ V, $f = 0.1$ –1 GHz

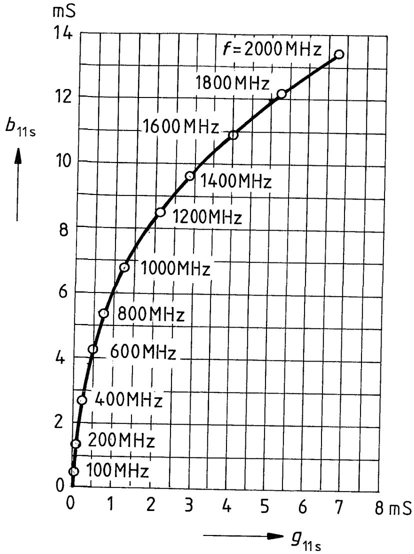


Output capacitance $C_{dss} = f(V_{DS})$
$V_{G2S} = 2$ V, $I_D = 10$ mA, $f = 0.1$ –1 GHz

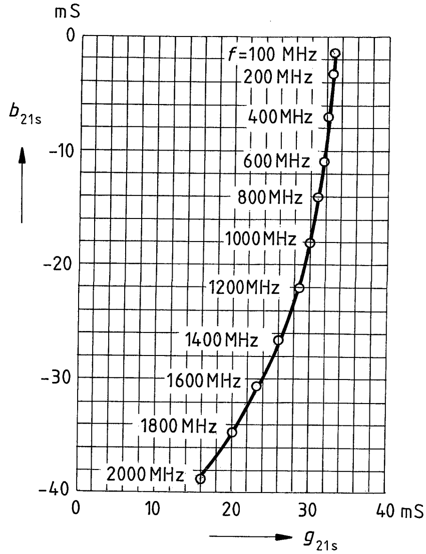


Common Source Admittance Parameters, G_2 RF grounded

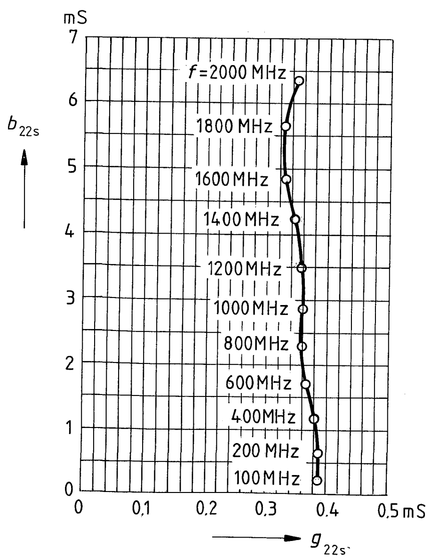
Gate 1 input admittance y_{11s}
$V_{DS} = 5$ V, $V_{G2S} = 2$ V, $I_D = 10$ mA



Gate 1 forward transfer admittance y_{21s}
$V_{DS} = 5$ V, $V_{G2S} = 2$ V, $I_D = 10$ mA

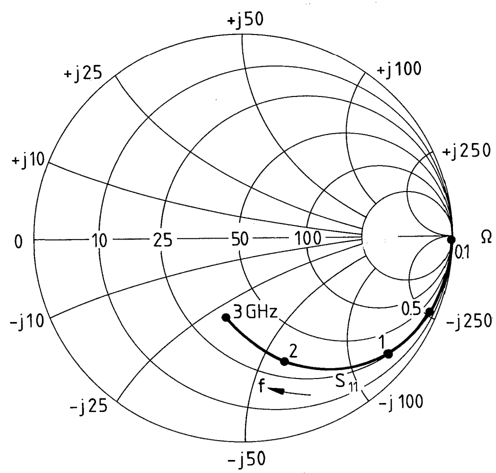


Output admittance y_{22s}
$V_{DS} = 5$ V, $V_{G2S} = 2$ V, $I_D = 10$ mA

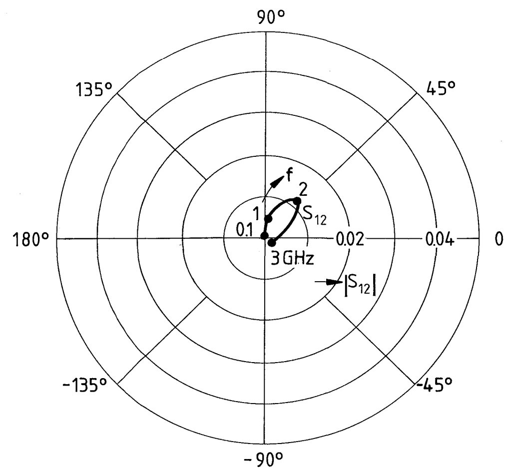


Common Source S Parameters, G_2 RF grounded

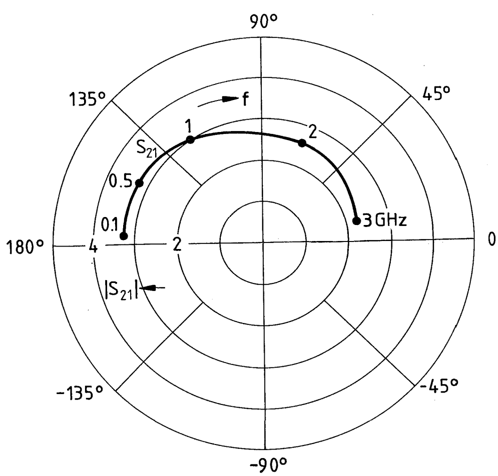
S_{11} = f (*f*), *Z*-plane
V_{DS} = 5 V, V_{G2S} = 2 V, I_D = 10 mA, Z_0 = 50 Ω



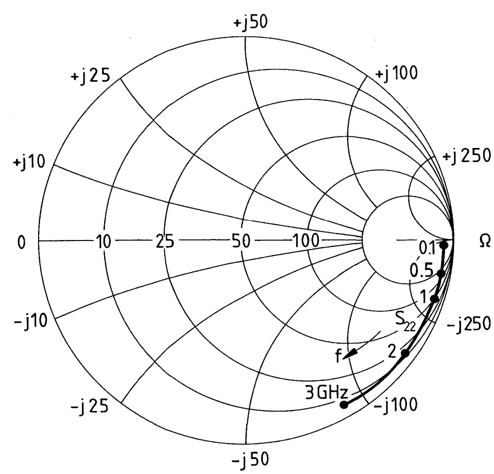
S_{12} = f (*f*)
V_{DS} = 5 V, V_{G2S} = 2 V, I_D = 10 mA, Z_0 = 50 Ω



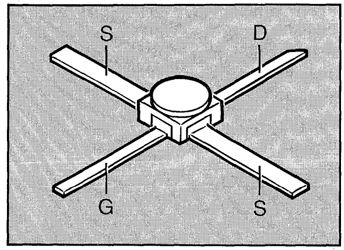
S_{21} = f (*f*)
V_{DS} = 5 V, V_{G2S} = 2 V, I_D = 10 mA, Z_0 = 50 Ω



S_{22} = f (*f*), *Z*-plane
V_{DS} = 5 V, V_{G2S} = 2 V, I_D = 10 mA, Z_0 = 50 Ω



- Low noise
- High gain
- Suitable up to 14 GHz
- Ion-implanted planar structure
- All gold metallization



ESD: Electrostatic discharge sensitive device, observe handling precautions!

Type	Marking	Ordering code (tape and reel)	Package[1])
CFY 10	C 10	Q 62703 – F11	100 mil

Maximum Ratings

Parameter	Symbol	Value	Unit
Drain-source voltage	V_{DS}	5	V
Gate-source voltage	V_{GS}	–5 ... +0.5	V
Drain current	I_D	100	mA
Channel temperature	T_{ch}	125	°C
Storage temperature range	T_{stg}	–65 ... +125	°C
Total power dissipation	P_{tot}	500	mW

Thermal Resistance

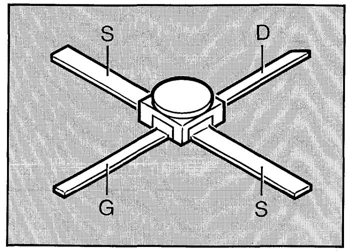
Channel – case	R_{thchC}	200	K/W

1) For detailed dimensions see chapter Package Outlines.

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

Parameter	Symbol	Values min	Values typ	Values max	Unit
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 –	dB
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	 – – –	dB

- For low-noise broadband applications up to 14 GHz
- For front ends
- Ion-implanted planar structure
- All gold metallization
- Rugged metal/ceramic Microstripline hermetic package



ESD: Electrostatic discharge sensitive device, observe handling precautions!

Type	Marking	Ordering code (tape and reel)	Package[1])
CFY 11	C 11	Q 62703 – F0001	100 mil

Maximum Ratings

Parameter	Symbol	Value	Unit
Drain-source voltage	V_{DS}	5	V
Gate-source voltage	V_{GS}	–5 ... +0.5	V
Drain current	I_D	100	mA
Channel temperature	T_{ch}	125	°C
Storage temperature range	T_{stg}	–65 ... +125	°C
Total power dissipation	P_{tot}	500	mW

Thermal Resistance

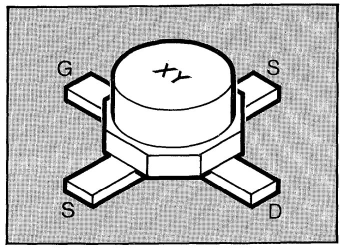
Channel – case	R_{thchC}	200	K/W

1) For detailed dimensions see chapter Package Outlines.

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

Parameter	Symbol	Values			Unit
		min	typ	max	
DC characteristics					
Drain-source saturation current V_{DS} = 4 V, V_{GS} = 0	I_{DSS}	–	60	–	mA
Pinch-off voltage	V_P	–	–2.5	–	V
Transconductance V_{DS} = 4 V, V_{DS} = 0 ... –0.5 V	g_m	–	40	–	mS
Noise figure I_{DS} = 0.15 I_{DSS}, V_{DS} = 4 V, f = 2 GHz f = 4 GHz f = 6 GHz f = 12 GHz	F	 1.0 1.5 2.0 3.6	 – – – –	 – – – –	dB
Associated gain I_{DS} = 0.15 I_{DSS}, V_{DS} = 4 V, f = 2 GHz f = 4 GHz f = 6 GHz f = 12 GHz	G_a	 – – – –	 13.5 12.0 10.0 14.5	 – – – –	dB
Maximum available gain I_{DS} = I_{DSS}, V_{DS} = 4 V, f = 2 GHz f = 4 GHz f = 6 GHz f = 12 GHz	*MAG*	 – – – –	 22.0 16.0 12.5 6.5	 – – – –	dB
Output power at 1 dB compression I_{DS} = I_{DSS}, V_{DS} = 4 V, f = 2 GHz f = 4 GHz f = 6 GHz f = 12 GHz	P_{1dB}	 – – – –	 15.0 13.4 12.4 10.5	 – – – –	dBm

- Low noise
- High gain
- Ion-implanted planar structure
- All gold metallization
- For front-end amplifiers
- For oscillators
- For antenna amplifiers from UHF to 15 GHz



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

Type	Marking	Ordering code (tape and reel)	Package[1])
CFY 18-18	B3	Q 62703 – F33	Cerec-XF
CFY 18-20	B4	Q 62703 – F23	
CFY 18-23	B5	Q 62703 – F24	

Maximum Ratings

Parameter	Symbol	Value	Unit
Drain-source voltage	V_{DS}	5	V
Drain-gate voltage	V_{DG}	8	V
Gate-source voltage	V_{GS}	–5 ... +0.5	V
Drain current	I_D	100	mA
Total power dissipation	P_{tot}	300	mW
Channel temperature	T_{Ch}	150	°C
Storage temperature range	T_{stg}	–65 ... +150	°C

Thermal Resistance

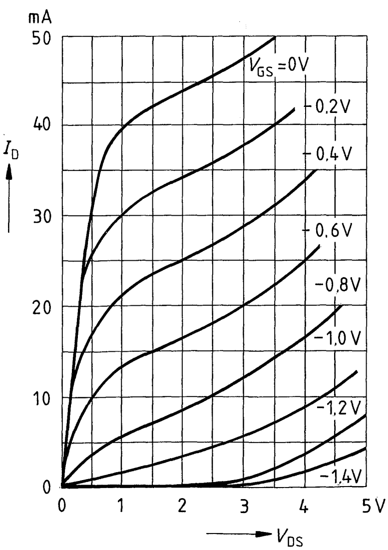
Channel – case	R_{thChC}	300	K/W

1) For detailed dimensions see chapter Package Outlines.

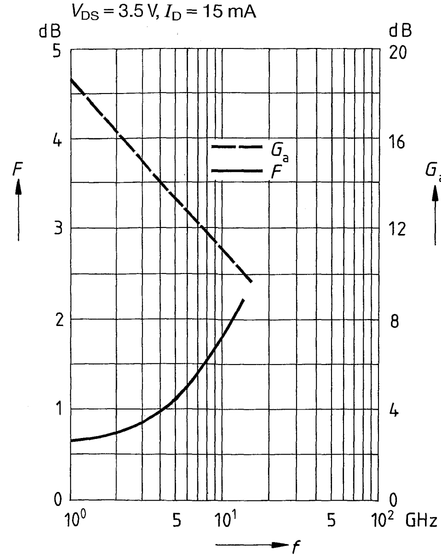
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter		Symbol	Values			Unit
			min	typ	max	
Drain-source saturation current V_{DS} = 3.5 V, V_{GS} = 0		I_{DSS}	20	50	80	mA
Pinch-off voltage V_{DS} = 3.5 V, I_D = 1 mA		V_P	–0.5	–1.3	–4	V
Transconductance V_{DS} = 3.5 V, I_D = 15 mA		g_m	20	30	–	mS
Gate leakage current V_{DS} = 3.5 V, I_D = 15 mA		I_G	–	0.1	2	µA
Noise figure I_{DS} = 15 mA, V_{DS} = 3 V, f = 12 GHz	CFY 18-18 CFY 18-20 CFY 18-23	F	– – –	1.7 1.9 2.2	1.8 2.0 2.3	dB
Associated gain I_{DS} = 15 mA, V_{DS} = 3 V, f = 12 GHz	CFY 18-18 CFY 18-20 CFY 18-23	G_a	9.0 8.5 8.5	9.5 9.0 9.0	– – –	dB

Output characteristics
$I_D = f(V_{DS})$



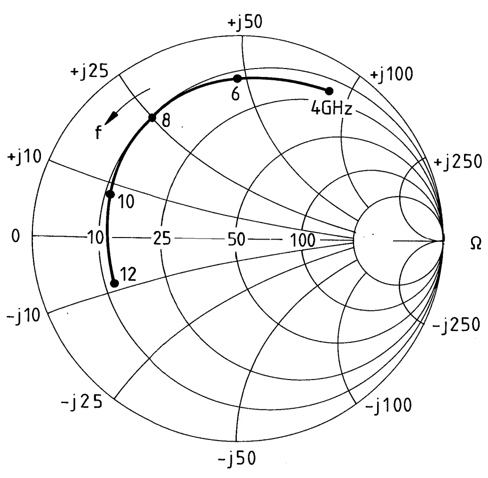
Noise figure $F = f(f)$ and associated gain $G_a = f(f)$
V_{DS} = 3.5 V, I_D = 15 mA



Noise Parameters CFY 18-18, $F = f(f)$
V_{DS} = 3.5 V, I_D = 15 mA

f	F_{min}	G_a	F_{opt}		R_N	N	$F_{50\Omega}$
GHz	dB	dB	MAG	ANG	Ω	–	dB
4	0.6	16	0.85	58	36	0.08	2.9
6	0.8	14	0.79	91	27	0.13	3.1
8	1.0	12	0.72	125	12.3	0.17	3.0
10	1.3	11	0.65	163	3.7	0.24	3.1
12	1.7	10	0.62	–162	2.8	0.17	2.8

Source impedance for min. noise figure
V_{DS} = 3.5 V, I_D = 15 mA



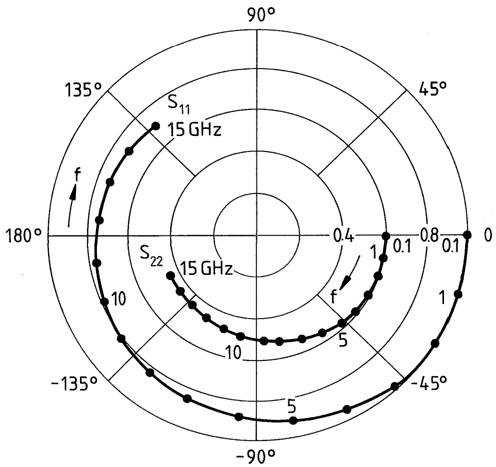
Common Source S Parameters
CFY 18-18, CFY 18-20
I_D = 10 mA, V_{DS} = 3.5 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	1.00	– 1.5	2.11	179	–	–	0.63	– 1
0.2	1.00	– 3	2.11	177	–	–	0.62	– 2
0.4	1.00	– 6	2.12	174	0.01	95	0.62	– 4
0.6	1.00	– 9.5	2.12	170	0.01	85	0.62	– 6
0.8	1.00	– 12.5	2.13	167	0.01	80	0.62	– 7
1.0	1.00	– 15.5	2.12	165	0.01	78	0.62	– 9
1.2	1.00	– 19	2.13	162	0.02	77	0.62	–11
1.4	0.99	– 22	2.11	158	0.02	75	0.62	–13
1.6	0.99	– 25	2.11	156	0.02	75	0.62	–15
1.8	0.99	– 28	2.12	152	0.02	73	0.62	–17
2.0	0.98	– 31	2.11	149	0.03	71	0.61	–18
2.2	0.98	– 34	2.12	146	0.03	69	0.61	–20
2.4	0.98	– 38	2.11	143	0.03	66	0.61	–22
2.6	0.97	– 41	2.11	140	0.03	65	0.61	–24
2.8	0.97	– 44	2.11	137	0.04	62	0.60	–26
3.0	0.97	– 47	2.10	134	0.04	61	0.60	–28
3.2	0.96	– 51	2.10	131	0.04	59	0.60	–30
3.4	0.96	– 54	2.10	128	0.04	57	0.60	–32
3.6	0.95	– 56	2.09	125	0.04	56	0.59	–34
3.8	0.95	– 60	2.09	122	0.05	54	0.59	–35
4.0	0.94	– 63	2.08	119	0.05	53	0.58	–37
4.2	0.93	– 66	2.07	116	0.05	51	0.58	–39
4.4	0.93	– 69	2.08	113	0.05	48	0.58	–41
4.6	0.93	– 73	2.07	110	0.05	47	0.57	–43
4.8	0.92	– 76	2.06	107	0.06	45	0.57	–45
5.0	0.91	– 79	2.06	105	0.06	43	0.57	–46
5.2	0.91	– 82	2.05	102	0.06	42	0.56	–49
5.4	0.90	– 86	2.03	98	0.06	40	0.56	–50
5.6	0.89	– 89	2.03	96	0.06	39	0.55	–52
5.8	0.89	– 92	2.03	93	0.06	38	0.55	–54
6.0	0.88	– 95	2.02	90	0.06	35	0.55	–56
6.2	0.87	– 98	2.01	87	0.06	34	0.54	–58
6.4	0.87	–102	2.00	84	0.06	32	0.54	–60
6.6	0.86	–105	1.99	81	0.07	31	0.53	–62
6.8	0.86	–108	1.97	78	0.07	30	0.53	–64
7.0	0.85	–112	1.96	75	0.07	29	0.52	–66
7.2	0.84	–115	1.96	73	0.07	28	0.52	–68
7.4	0.84	–118	1.94	70	0.07	26	0.52	–70
7.6	0.83	–121	1.93	67	0.07	25	0.51	–72
7.8	0.83	–124	1.92	64	0.07	24	0.51	–75
8.0	0.83	–127	1.91	61	0.07	23	0.51	–77
8.2	0.82	–130	1.90	58	0.07	22	0.50	–79

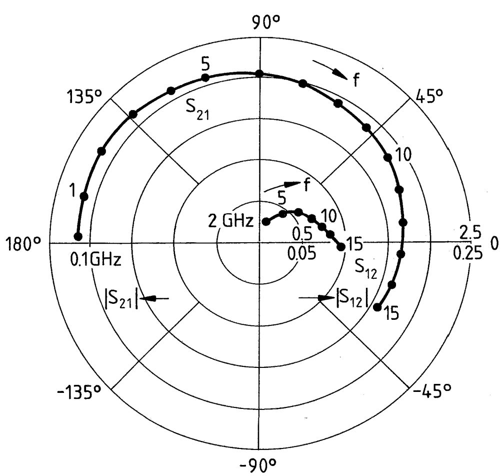
f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
8.4	0.82	–134	1.89	55	0.07	21	0.50	– 81
8.6	0.81	–137	1.88	53	0.07	20	0.50	– 83
8.8	0.80	–139	1.86	50	0.07	19	0.50	– 85
9.0	0.80	–142	1.85	48	0.07	18	0.49	– 87
9.2	0.80	–145	1.84	45	0.07	16	0.49	– 89
9.4	0.80	–148	1.83	42	0.07	16	0.49	– 91
9.6	0.79	–151	1.82	39	0.07	15	0.49	– 93
9.8	0.79	–154	1.81	37	0.07	14	0.48	– 95
10.0	0.78	–157	1.81	34	0.08	13	0.48	– 98
10.2	0.78	–160	1.79	31	0.08	12	0.48	–100
10.4	0.77	–163	1.79	29	0.08	12	0.48	–102
10.6	0.77	–165	1.78	26	0.08	11	0.47	–104
10.8	0.76	–168	1.76	23	0.08	11	0.47	–106
11.0	0.76	–171	1.75	21	0.08	10	0.46	–108
11.2	0.75	–174	1.75	18	0.08	9	0.46	–110
11.4	0.75	–177	1.74	16	0.08	9	0.46	–112
11.6	0.75	180	1.74	13	0.08	8	0.46	–115
11.8	0.74	177	1.72	10	0.08	7	0.45	–117
12.0	0.74	174	1.71	8	0.08	7	0.45	–120
12.2	0.74	171	1.70	5	0.08	5	0.45	–122
12.4	0.73	168	1.69	3	0.08	6	0.45	–124
12.6	0.73	165	1.68	0	0.08	5	0.44	–127
12.8	0.73	162	1.67	– 3	0.09	4	0.44	–129
13.0	0.73	159	1.66	– 5	0.09	3	0.44	–132
13.2	0.73	156	1.66	– 8	0.09	3	0.44	–134
13.4	0.72	154	1.65	–11	0.09	2	0.44	–136
13.6	0.72	151	1.65	–13	0.09	1	0.44	–139
13.8	0.72	148	1.62	–16	0.09	1	0.44	–144
14.0	0.72	145	1.62	–18	0.09	0	0.44	–144
14.2	0.71	143	1.61	–21	0.09	–1	0.44	–146
14.4	0.71	140	1.60	–23	0.09	–2	0.44	–148
14.6	0.71	137	1.61	–26	0.10	–3	0.43	–150
14.8	0.71	135	1.60	–28	0.10	–4	0.43	–153
15.0	0.71	132	1.60	–31	0.10	–6	0.43	–155

CFY 18-18, CFY 18-20

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 = 10 mA, V_{DS} = 3.5 V, Z_0 = 50 Ω



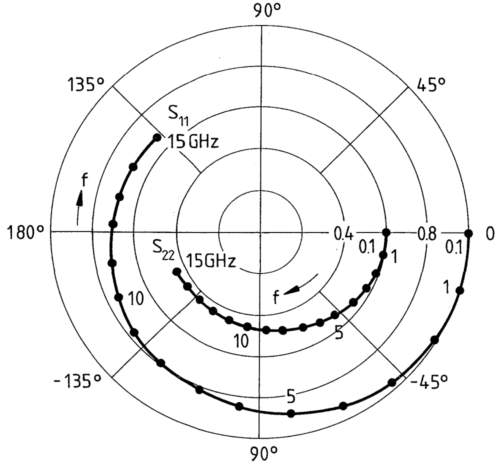
Common Source S Parameters
CFY 18-18, CFY 18-20
I_D = 30 mA, V_{DS} = 3.5 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	1.00	– 2	2.98	178.5	–	–	0.61	– 1.5
0.2	1.00	– 2.5	2.95	177	–	–	0.60	– 2
0.4	1.00	– 6.5	2.93	174	0.00	100	0.60	– 4
0.6	1.00	– 10	2.93	170	0.01	88	0.60	– 6
0.8	1.00	– 13.5	2.93	167	0.01	81	0.60	– 8
1.0	1.00	– 16.5	2.94	164	0.01	78	0.60	–10
1.2	1.00	– 20	2.93	161	0.01	81	0.60	–12
1.4	0.99	– 23	2.91	157	0.02	78	0.60	–14
1.6	0.99	– 26	2.90	154	0.02	78	0.60	–16
1.8	0.99	– 29	2.91	152	0.02	73	0.60	–17
2.0	0.98	– 32	2.90	149	0.02	73	0.59	–19
2.2	0.98	– 35	2.89	146	0.02	70	0.59	–21
2.4	0.97	– 39	2.89	143	0.03	69	0.59	–23
2.6	0.97	– 43	2.88	139	0.03	67	0.59	–25
2.8	0.96	– 46	2.87	136	0.03	65	0.58	–27
3.0	0.96	– 49	2.86	133	0.03	64	0.58	–29
3.2	0.96	– 52	2.85	130	0.03	62	0.58	–30
3.4	0.95	– 55	2.84	127	0.04	61	0.57	–32
3.6	0.94	– 58	2.82	124	0.04	60	0.57	–34
3.8	0.94	– 62	2.81	121	0.04	58	0.57	–36
4.0	0.93	– 65	2.79	118	0.04	56	0.56	–38
4.2	0.92	– 68	2.77	115	0.04	55	0.56	–40
4.4	0.92	– 71	2.76	112	0.04	53	0.56	–42
4.6	0.91	– 74	2.74	109	0.04	53	0.55	–44
4.8	0.90	– 77	2.73	106	0.05	51	0.55	–46
5.0	0.90	– 81	2.72	104	0.05	50	0.54	–47
5.2	0.89	– 84	2.70	100	0.05	48	0.54	–50
5.4	0.88	– 87	2.68	97	0.05	47	0.54	–51
5.6	0.87	– 90	2.67	95	0.05	47	0.53	–53
5.8	0.87	– 94	2.65	92	0.05	45	0.53	–55
6.0	0.86	– 97	2.63	89	0.05	44	0.52	–57
6.2	0.85	–100	2.61	86	0.05	43	0.52	–59
6.4	0.85	–103	2.59	83	0.05	41	0.51	–61
6.6	0.84	–106	2.58	80	0.06	40	0.51	–64
6.8	0.83	–109	2.55	77	0.06	40	0.50	–65
7.0	0.83	–112	2.53	74	0.06	39	0.50	–67
7.2	0.82	–116	2.51	71	0.06	38	0.50	–69
7.4	0.81	–119	2.49	69	0.06	36	0.49	–72
7.6	0.81	–122	2.47	67	0.06	36	0.49	–74
7.8	0.81	–125	2.45	63	0.06	35	0.49	–76
8.0	0.80	–127	2.43	61	0.06	34	0.49	–78
8.2	0.80	–130	2.40	58	0.06	34	0.48	–80

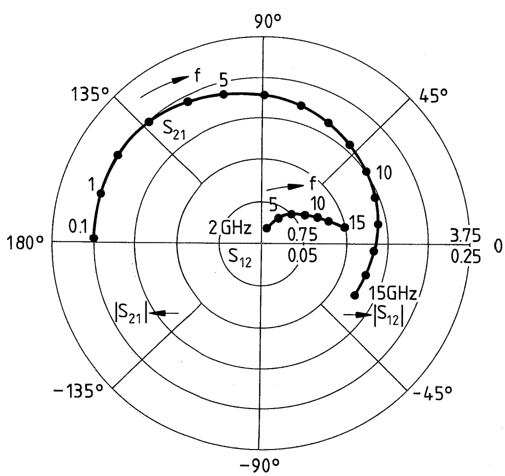
f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
8.4	0.79	–133	2.38	55	0.06	32	0.48	– 82
8.6	0.79	–136	2.36	53	0.07	33	0.48	– 84
8.8	0.78	–138	2.34	50	0.07	33	0.47	– 87
9.0	0.77	–141	2.32	48	0.07	31	0.47	– 88
9.2	0.77	–143	2.30	45	0.07	31	0.47	– 90
9.4	0.77	–146	2.28	42	0.07	30	0.47	– 93
9.6	0.77	–149	2.27	39	0.07	30	0.47	– 94
9.8	0.76	–152	2.26	37	0.07	29	0.47	– 97
10.0	0.76	–155	2.24	34	0.07	28	0.47	– 99
10.2	0.75	–157	2.23	32	0.08	26	0.46	–100
10.4	0.74	–160	2.22	29	0.08	26	0.46	–102
10.6	0.74	–162	2.20	27	0.08	26	0.46	–105
10.8	0.73	–165	2.18	24	0.08	25	0.45	–107
11.0	0.73	–168	2.17	22	0.08	24	0.45	–109
11.2	0.73	–170	2.16	19	0.08	23	0.45	–111
11.4	0.72	–173	2.15	16	0.08	22	0.45	–113
11.6	0.72	–176	2.14	14	0.09	22	0.45	–115
11.8	0.72	–179	2.12	12	0.09	20	0.44	–118
12.0	0.71	178	2.10	9	0.09	19	0.44	–121
12.2	0.71	175	2.09	6	0.09	18	0.44	–123
12.4	0.70	173	2.08	4	0.09	17	0.44	–125
12.6	0.70	170	2.06	1	0.09	16	0.44	–128
12.8	0.70	167	2.05	– 1	0.09	16	0.44	–130
13.0	0.70	165	2.04	– 4	0.10	14	0.44	–132
13.2	0.70	162	2.04	– 6	0.10	13	0.43	–135
13.4	0.69	159	2.03	– 9	0.10	12	0.43	–137
13.6	0.69	156	2.01	–11	0.10	10	0.43	–139
13.8	0.69	154	1.99	–14	0.10	9	0.43	–141
14.0	0.69	151	2.00	–17	0.10	8	0.43	–144
14.2	0.68	148	1.97	–19	0.11	6	0.43	–147
14.4	0.68	146	1.97	–22	0.11	5	0.43	–149
14.6	0.68	143	1.98	–24	0.11	4	0.43	–151
14.8	0.67	140	1.96	–27	0.11	2	0.44	–153
15.0	0.67	138	1.97	–29	0.12	0	0.44	–155

CFY 18-18, CFY 18-20

S_{11}, S_{22} = f (f)
I_D = 30 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



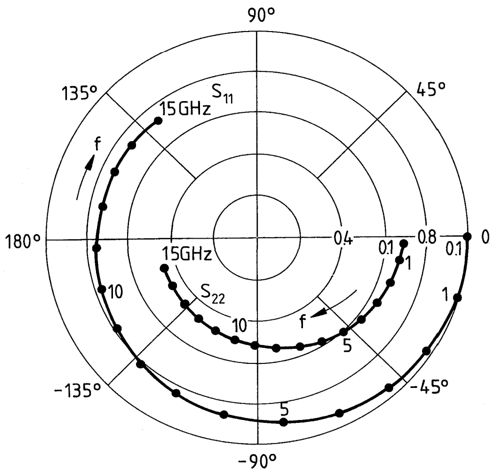
Common Source S Parameters
CFY 18-12, 18-15, 18-23, (18-25, 18-27)
I_D = 10 mA, V_{DS} = 3.5 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	1.00	– 1.5	1.90	179	–	–	0.68	– 1.5
0.2	1.00	– 3	1.89	177	–	–	0.67	– 2
0.4	1.00	– 6.5	1.90	174	0.01	85	0.67	– 4
0.6	1.00	– 10	1.91	171	0.01	81	0.67	– 6
0.8	1.00	– 13.5	1.91	168	0.01	82	0.67	– 8
1.0	1.00	– 16.5	1.91	165	0.01	81	0.66	– 9
1.2	1.00	– 20	1.91	162	0.02	78	0.66	–11
1.4	0.99	– 23	1.90	159	0.02	73	0.66	–13
1.6	0.99	– 26	1.90	156	0.02	72	0.66	–15
1.8	0.99	– 30	1.91	153	0.03	70	0.66	–17
2.0	0.98	– 33	1.90	150	0.03	69	0.66	–19
2.2	0.98	– 36	1.90	147	0.03	66	0.65	–21
2.4	0.97	– 40	1.90	144	0.03	65	0.65	–23
2.6	0.97	– 43	1.90	142	0.04	63	0.65	–25
2.8	0.96	– 46	1.89	138	0.04	61	0.65	–27
3.0	0.96	– 49	1.89	135	0.04	59	0.64	–29
3.2	0.96	– 52	1.89	133	0.04	57	0.64	–30
3.4	0.95	– 56	1.89	130	0.05	56	0.64	–32
3.6	0.94	– 59	1.88	127	0.05	52	0.64	–34
3.8	0.94	– 62	1.88	124	0.05	51	0.63	–36
4.0	0.93	– 65	1.88	121	0.05	50	0.63	–38
4.2	0.93	– 69	1.87	118	0.05	47	0.63	–40
4.4	0.92	– 72	1.87	115	0.06	45	0.62	–42
4.6	0.92	– 76	1.87	112	0.06	43	0.62	–44
4.8	0.91	– 79	1.86	109	0.06	42	0.61	–45
5.0	0.90	– 82	1.86	106	0.06	41	0.61	–48
5.2	0.90	– 86	1.85	103	0.06	39	0.60	–50
5.4	0.89	– 90	1.84	100	0.06	37	0.60	–52
5.6	0.88	– 93	1.84	97	0.06	35	0.60	–54
5.8	0.87	– 96	1.83	94	0.06	33	0.59	–56
6.0	0.87	–100	1.82	91	0.07	32	0.59	–58
6.2	0.86	–103	1.82	88	0.07	30	0.58	–60
6.4	0.86	–106	1.81	86	0.07	28	0.57	–62
6.6	0.85	–110	1.80	83	0.07	26	0.57	–64
6.8	0.85	–113	1.78	80	0.07	26	0.57	–66
7.0	0.84	–117	1.78	77	0.07	24	0.56	–68
7.2	0.83	–120	1.77	75	0.07	23	0.56	–70
7.4	0.83	–123	1.76	72	0.07	20	0.55	–72
7.6	0.82	–126	1.74	69	0.07	20	0.55	–75
7.8	0.82	–129	1.74	66	0.07	18	0.54	–77
8.0	0.81	–132	1.72	64	0.07	18	0.54	–79
8.2	0.81	–135	1.71	61	0.07	16	0.54	–82

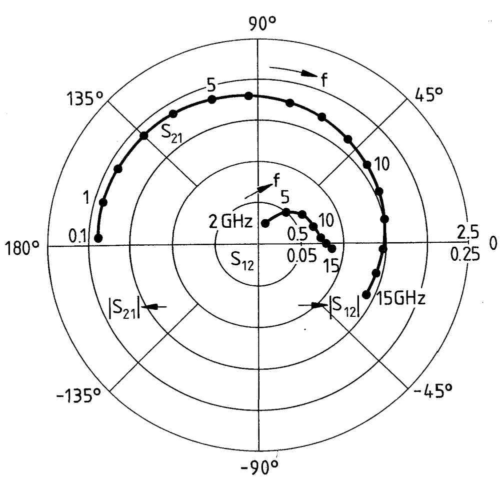
f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
8.4	0.81	–138	1.70	58	0.07	15	0.53	– 84
8.6	0.80	–141	1.69	55	0.07	14	0.53	– 86
8.8	0.80	–144	1.68	53	0.07	13	0.53	– 88
9.0	0.79	–147	1.67	50	0.07	12	0.53	– 90
9.2	0.79	–150	1.65	48	0.07	11	0.52	– 92
9.4	0.79	–153	1.65	45	0.07	11	0.52	– 95
9.6	0.79	–156	1.64	42	0.07	9	0.52	– 97
9.8	0.78	–159	1.63	40	0.07	9	0.52	– 99
10.0	0.78	–162	1.62	37	0.07	8	0.51	–101
10.2	0.77	–165	1.61	34	0.07	7	0.51	–103
10.4	0.77	–168	1.60	32	0.07	7	0.51	–105
10.6	0.76	–171	1.60	29	0.07	7	0.50	–107
10.8	0.76	–174	1.58	27	0.07	6	0.50	–110
11.0	0.76	–177	1.57	24	0.08	5	0.49	–112
11.2	0.75	180	1.57	21	0.07	4	0.49	–114
11.4	0.75	177	1.56	19	0.08	4	0.49	–117
11.6	0.75	174	1.54	16	0.08	4	0.48	–119
11.8	0.75	171	1.54	14	0.08	3	0.48	–122
12.0	0.74	168	1.53	11	0.08	2	0.48	–124
12.2	0.74	165	1.52	9	0.08	2	0.48	–127
12.4	0.74	163	1.51	6	0.08	2	0.47	–129
12.6	0.74	160	1.50	3	0.08	1	0.47	–132
12.8	0.74	157	1.49	1	0.08	0	0.47	–134
13.0	0.74	154	1.48	– 1	0.08	0	0.47	–136
13.2	0.74	152	1.47	– 4	0.08	–1	0.46	–139
13.4	0.74	149	1.47	– 6	0.08	–1	0.46	–142
13.6	0.74	147	1.46	– 8	0.08	–2	0.46	–144
13.8	0.73	144	1.44	–11	0.08	–2	0.46	–146
14.0	0.73	142	1.45	–14	0.08	–3	0.46	–149
14.2	0.73	140	1.44	–16	0.09	–4	0.46	–152
14.4	0.73	137	1.42	–18	0.09	–4	0.46	–154
14.6	0.73	134	1.43	–21	0.09	–5	0.45	–156
14.8	0.73	132	1.42	–23	0.09	–7	0.46	–159
15.0	0.73	129	1.42	–26	0.09	–7	0.46	–161

CFY 18-12, 18-15, 18-23 (18-25, 18-27)

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 = 10 mA, V_{DS} = 3.5 V, Z_0 = 50 Ω



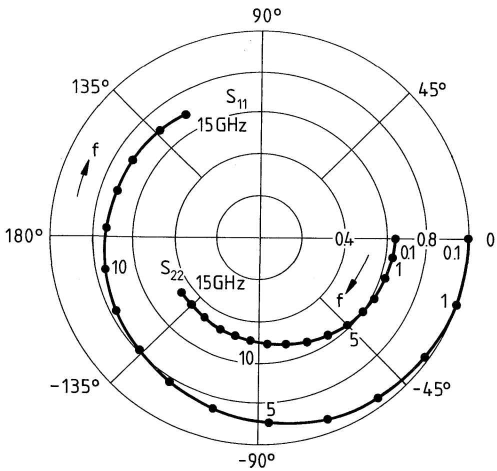
Common Source S Parameters
CFY 18-12, 18-15, 18-23 (18-25, 18-27)
I_D = 30 mA, V_{DS} = 3.5 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	1.00	– 2	2.83	178	–	–	0.64	– 1
0.2	1.00	– 3	2.82	176	–	–	0.65	– 2
0.4	1.00	– 7	2.82	174	0.01	88	0.65	– 4
0.6	1.00	– 11	2.82	171	0.01	86	0.65	– 6
0.8	1.00	– 14	2.82	167	0.01	84	0.65	– 8
1.0	1.00	– 18	2.81	164	0.01	82	0.65	– 9
1.2	1.00	– 21	2.80	161	0.02	78	0.65	–12
1.4	0.99	– 25	2.78	158	0.02	75	0.65	–14
1.6	0.99	– 28	2.77	155	0.02	73	0.65	–16
1.8	0.98	– 32	2.76	152	0.02	71	0.65	–17
2.0	0.98	– 35	2.74	149	0.02	70	0.64	–19
2.2	0.98	– 38	2.73	146	0.03	68	0.64	–21
2.4	0.97	– 42	2.72	143	0.03	65	0.64	–23
2.6	0.97	– 46	2.70	140	0.03	65	0.64	–25
2.8	0.96	– 49	2.68	137	0.03	62	0.64	–27
3.0	0.96	– 53	2.67	133	0.03	60	0.63	–29
3.2	0.95	– 57	2.65	130	0.04	58	0.63	–30
3.4	0.94	– 60	2.62	127	0.04	57	0.63	–32
3.6	0.94	– 63	2.60	125	0.04	55	0.62	–34
3.8	0.93	– 67	2.59	121	0.04	52	0.62	–36
4.0	0.92	– 70	2.57	118	0.04	51	0.62	–38
4.2	0.91	– 74	2.55	115	0.05	50	0.62	–40
4.4	0.91	– 77	2.53	112	0.05	48	0.61	–42
4.6	0.90	– 81	2.51	109	0.05	46	0.61	–43
4.8	0.89	– 84	2.49	106	0.05	45	0.60	–45
5.0	0.89	– 87	2.47	104	0.05	43	0.60	–47
5.2	0.88	– 91	2.45	101	0.05	42	0.60	–49
5.4	0.87	– 95	2.43	98	0.05	40	0.59	–51
5.6	0.86	– 98	2.42	95	0.05	39	0.59	–53
5.8	0.86	–101	2.40	92	0.05	38	0.59	–54
6.0	0.85	–105	2.39	89	0.05	37	0.58	–56
6.2	0.84	–109	2.37	86	0.05	36	0.58	–58
6.4	0.84	–112	2.36	83	0.05	35	0.57	–60
6.6	0.83	–115	2.35	80	0.06	34	0.57	–62
6.8	0.82	–118	2.33	78	0.06	33	0.57	–64
7.0	0.82	–121	2.31	74	0.06	32	0.56	–66
7.2	0.81	–125	2.29	72	0.06	31	0.56	–67
7.4	0.80	–129	2.26	69	0.06	31	0.56	–69
7.6	0.80	–132	2.24	66	0.06	30	0.55	–72
7.8	0.80	–135	2.23	64	0.06	28	0.55	–74
8.0	0.79	–138	2.21	61	0.06	28	0.55	–75
8.2	0.79	–141	2.19	58	0.06	27	0.55	–77

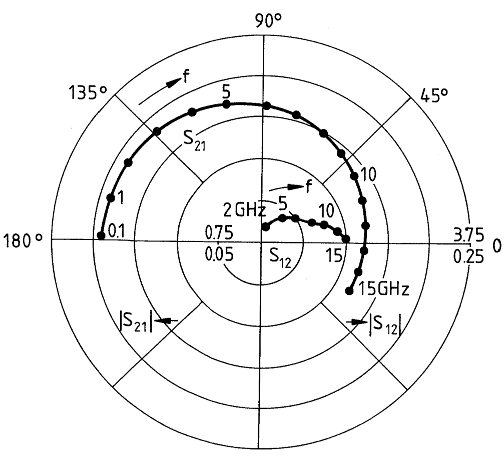
f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
8.4	0.79	–144	2.18	56	0.06	26	0.54	– 79
8.6	0.78	–147	2.17	53	0.06	26	0.54	– 81
8.8	0.77	–150	2.14	51	0.06	25	0.54	– 83
9.0	0.77	–153	2.12	48	0.06	26	0.54	– 85
9.2	0.76	–155	2.11	46	0.06	25	0.54	– 87
9.4	0.76	–159	2.09	43	0.06	25	0.54	– 89
9.6	0.76	–162	2.08	40	0.06	24	0.53	– 90
9.8	0.75	–164	2.07	38	0.06	23	0.53	– 92
10.0	0.75	–168	2.06	35	0.06	23	0.53	– 94
10.2	0.74	–170	2.04	32	0.07	23	0.53	– 96
10.4	0.74	–173	2.03	30	0.07	22	0.53	– 98
10.6	0.73	–176	2.02	27	0.07	22	0.52	– 99
10.8	0.73	–179	1.99	25	0.07	21	0.52	–101
11.0	0.72	178	1.98	22	0.07	20	0.51	–103
11.2	0.72	175	1.97	19	0.07	20	0.51	–105
11.4	0.72	172	1.96	17	0.07	20	0.51	–107
11.6	0.72	169	1.95	14	0.08	18	0.51	–109
11.8	0.72	166	1.94	12	0.08	17	0.51	–111
12.0	0.71	163	1.93	9	0.08	17	0.50	–113
12.2	0.71	160	1.91	7	0.08	17	0.50	–115
12.4	0.71	158	1.90	5	0.08	16	0.50	–117
12.6	0.71	155	1.89	2	0.08	15	0.50	–119
12.8	0.70	152	1.88	– 1	0.09	14	0.49	–122
13.0	0.70	149	1.87	– 3	0.09	13	0.49	–124
13.2	0.70	146	1.87	– 5	0.09	12	0.49	–126
13.4	0.70	144	1.85	– 8	0.09	11	0.49	–128
13.6	0.70	140	1.84	–10	0.09	10	0.49	–129
13.8	0.69	138	1.83	–12	0.09	9	0.48	–131
14.0	0.69	135	1.82	–15	0.10	7	0.48	–134
14.2	0.69	133	1.81	–17	0.10	6	0.48	–136
14.4	0.69	130	1.80	–20	0.10	5	0.48	–139
14.6	0.69	127	1.80	–23	0.10	4	0.48	–140
14.8	0.68	124	1.79	–25	0.10	3	0.48	–142
15.0	0.68	121	1.78	–27	0.11	2	0.48	–144

CFY 18-12, 18-15, 18-23 (18-25, 18-27)

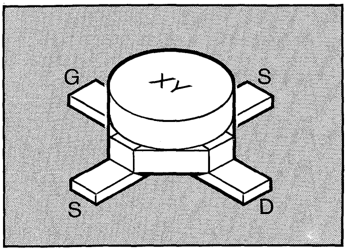
S_{11}, S_{22} = f (f)
I_D = 30 mA, V_{DS} = 3.5 V, Z_0 = 50 Ω



S_{12}, S_{21} = f (f)
I_D = 30 mA, V_{DS} = 3.5 V, Z_0 = 50 Ω



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

Type	Marking	Ordering code (tape and reel)	Package[1])
CFY 19-18	A1	Q 62703 – F14	Cerec-X
CFY 19-22	A2	Q 62703 – F3	
CFY 19-27	A3	Q 62703 – F5	

Maximum Ratings

Parameter	Symbol	Value	Unit
Drain-source voltage	V_{DS}	6	V
Drain-gate voltage	V_{DG}	8	V
Gate-source voltage	V_{GS}	–5 ... +0.5	V
Drain current	I_D	80	mA
Total power dissipation	P_{tot}	300	mW
Channel temperature	T_{ch}	175	°C
Storage temperature range	T_{stg}	–65 ... +150	°C

Thermal Resistance

Channel – case	R_{thchC}	≤300	K/W

1) For detailed dimensions see chapter Package Outlines

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	g_m	20	30	–	mS
	CFY 19-22		20	25	–	
	CFY 19-27		20	25	–	
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	CFY 19-18	F	–	1.2	–	dB
	CFY 19-22		–	1.4	–	
	CFY 19-27		–	1.7	–	
f = 6 GHz	CFY 19-18		–	1.7	1.8	
	CFY 19-22		–	1.9	2.2	
	CFY 19-27		–	2.2	2.7	
Power gain at noise matching I_{DS} = 15 mA, V_{DS} = 3.5 V f = 4 GHz	CFY 19-18	G_a	–	13	–	dB
	CFY 19-22		–	12	–	
	CFY 19-27		–	10.5	–	
f = 6 GHz	CFY 19-18		9.5	10	–	
	CFY 19-22		9.0	10	–	
	CFY 19-27		7.5	8.5	–	

Noise Parameter CFY 19-18
I_D = 15 mA, V_{DS} = 3.5 V

f	F_{min}	G_a	Γ_{opt}		R_N	N	$F_{50\Omega}$
GHz	dB	dB	MAG	ANG	Ω	–	dB
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

Common Source S Parameters
I_D = 10 mA, V_{DS} = 3.5 V, Z_0 = 50 Ω

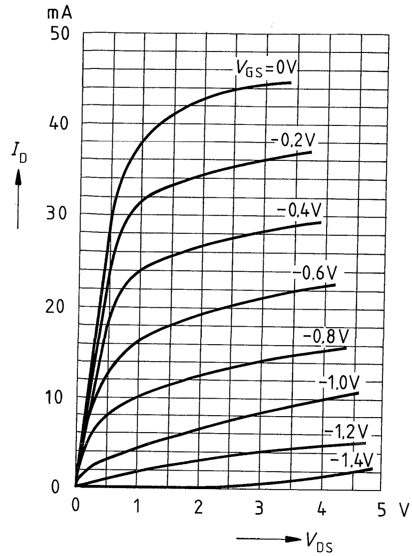
f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	1.00	– 1.8	2.29	178.1	0.002	72.8	0.76	– 0.8
0.2	1.00	– 3.5	2.29	175.9	0.005	86.2	0.76	– 2.2
0.4	1.00	– 7.6	2.30	171.4	0.010	86.2	0.76	– 4.6
0.6	1.00	– 11.4	2.30	167.1	0.015	78.7	0.76	– 7.2
0.8	0.99	– 15.6	2.31	162.7	0.020	78.6	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	9.83	– 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
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

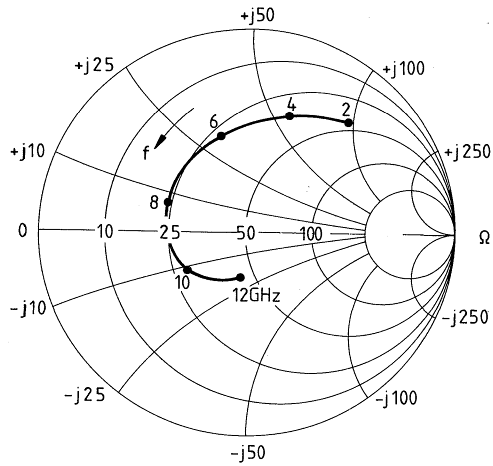
f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	1.00	– 2.2	3.26	177.8	0.001	98.5	0.74	– 1.0
0.2	1.00	– 4.2	3.27	175.4	0.003	75.4	0.73	– 2.0
0.4	1.00	– 9.1	3.28	170.3	0.008	79.8	0.73	– 4.6
0.6	0.99	– 13.7	3.27	165.5	0.013	82.0	0.73	– 7.1
0.8	0.99	– 18.6	3.27	160.6	0.017	77.1	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
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

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

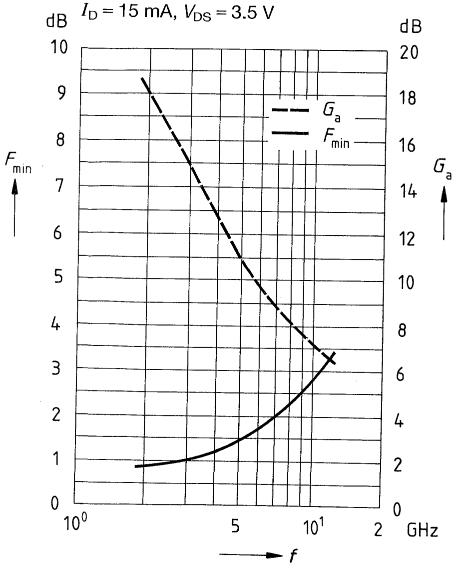
Output characteristics $I_D = f(V_{DS})$



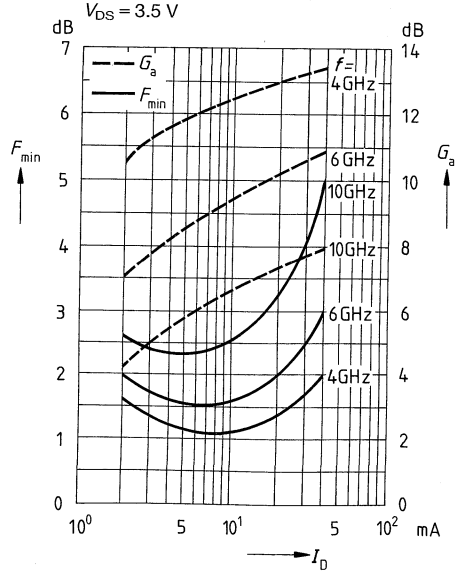
Source impedance for min. noise figure
I_D = 15 mA, V_{DS} = 3.5 V



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



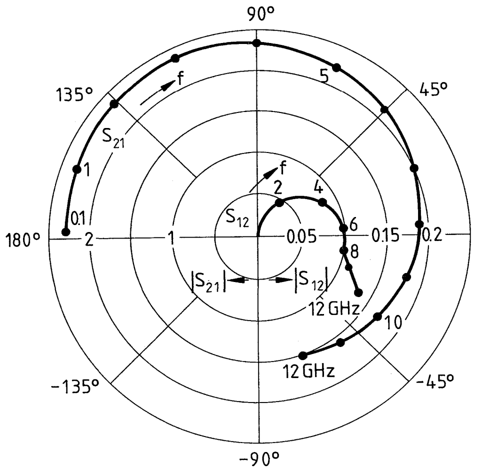
CFY 19-18
Minimum noise figure $F_{min} = f(I_D)$
Associated gain $G_a = f(I_D)$
V_{DS} = 3.5 V



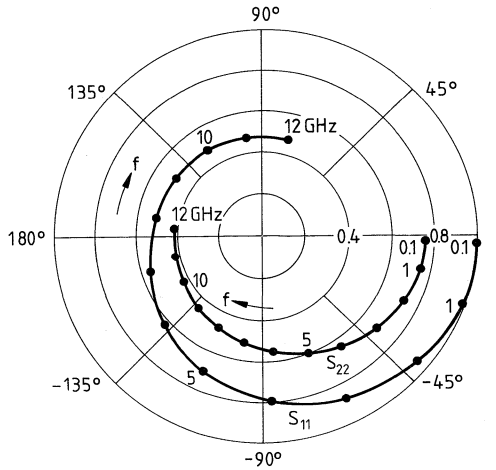
S Parameters

$I_D = 10$ mA, $V_{DS} = 3.5$ V, $Z_0 = 50\ \Omega$

S_{12}, S_{21} = f (*f*)

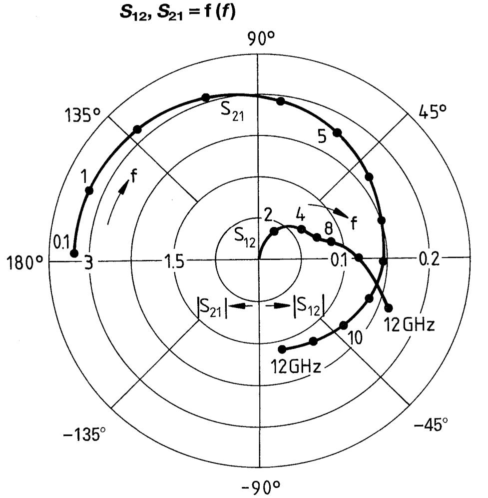


S_{11}, S_{22} = f (*f*)

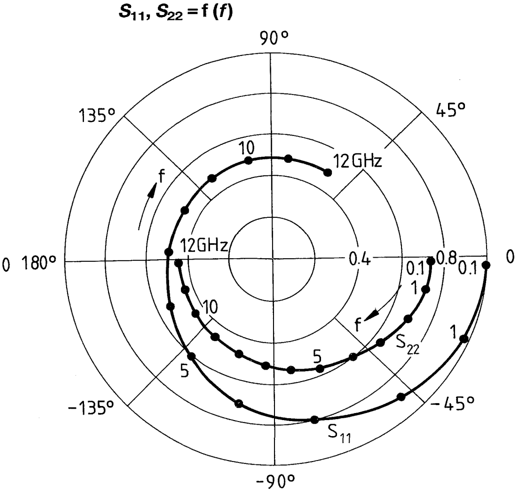


$I_D = 30$ mA, $V_{DS} = 3.5$ V, $Z_0 = 50\ \Omega$

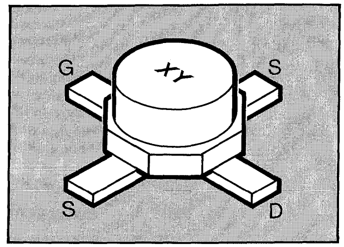
S_{12}, S_{21} = f (*f*)



S_{11}, S_{22} = f (*f*)



- 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)	Package[1])
CFY 25-17 CFY 25-20 CFY 25-23	C 5 C 6 C 7	Q 62703 – F106 Q 62703 – F107 Q 62703 – F108	Cerec-XF

Maximum Ratings

Parameter	Symbol	Value	Unit
Drain-source voltage	V_{DS}	5	V
Drain-gate voltage	V_{DG}	7	V
Gate-source voltage	V_{GS}	–5 ... +0	V
Drain current	I_D	80	mA
Total power dissipation, $T_c \leq 60$ °C	P_{tot}	250	mW
Channel temperature	T_{ch}	150	°C
Storage temperature range	T_{stg}	–65 ... +150	°C

Thermal Resistance

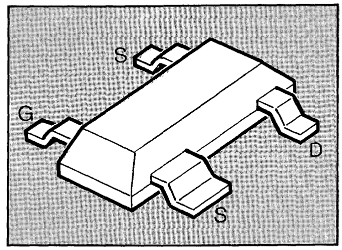
Channel – case	R_{thchC}	350	K/W

1) For detailed dimensions see chapter Package Outlines

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

Parameter		Symbol	Values			Unit
			min	typ	max	
DC characteristics						
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	–1.5	–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	25	35	–	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	 – – –	dB

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

Type	Marking	Ordering code (tape and reel)	Package[1])
CFY 30	A2	Q 62703 – F97	SOT-143

Maximum Ratings

Parameter	Symbol	Value	Unit
Drain voltage	V_{DS}	5	V
Drain-gate voltage	V_{DG}	7	V
Gate-source voltage	V_{GS}	–4 ... +0.5	V
Drain current	I_D	80	mA
Total power dissipation, $T_c \leq 90$ °C	P_{tot}	250	mW
Channel temperature	T_{ch}	150	°C
Storage temperature range	T_{stg}	–40 ... +150	°C

Thermal Resistance

Channel – case	R_{thchC}	≤240	K/W

1) For detailed dimensions see chapter Package Outlines.

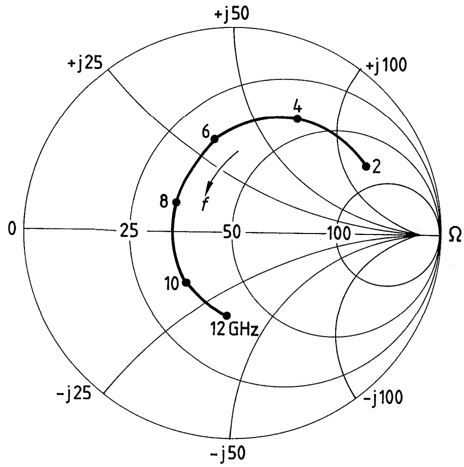
Electrical Characteristics
at T_A = 25 °C.

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	 – –	dB
Maximum available gain I_D = 15 mA, V_{DS} = 3.5 V, f = 6 GHz	*MAG*	–	11.2	–	dB
Maximum stable gain I_D = 15 mA, V_{DS} = 3.5 V, f = 4 GHz	*MSG*	–	14.4	–	dB
Power output at 1 dB compression I_D = 30 mA, V_{DS} = 4 V, f = 6 GHz	P_{1dB}	–	16	–	dBm

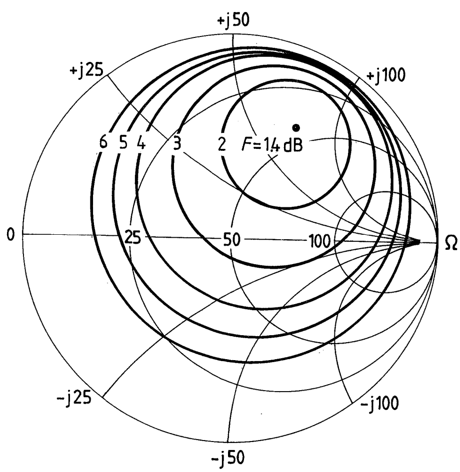
Common Source Noise Parameters
I_D = 15 mA, V_{DS} = 3.5 V, Z_0 = 50 Ω

f	F_{min}	G_a	Γ_{opt}		R_N	N	$F_{50\Omega}$	$G_{(F50\Omega)}$
GHz	dB	dB	MAG	ANG	Ω	–	dB	dB
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

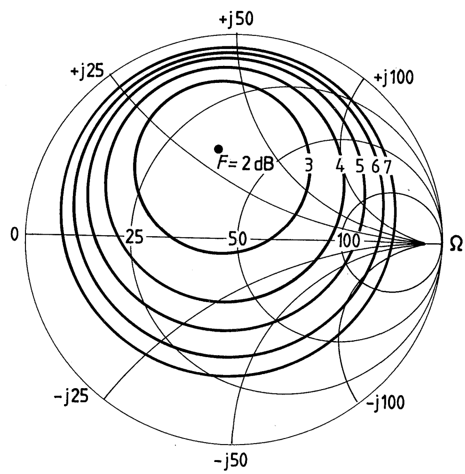
Source impedance for min. noise figure
$I_D = 15$ mA, $V_{DS} = 3.5$ V



Circles of constant noise figure
$I_D = 15$ mA, $V_{DS} = 3.5$ V, $f = 4$ GHz

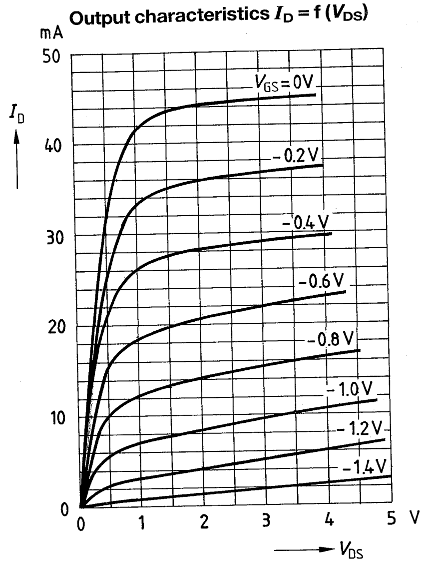


Circles of constant noise figure
$I_D = 15$ mA, $V_{DS} = 3.5$ V, $f = 6$ GHz

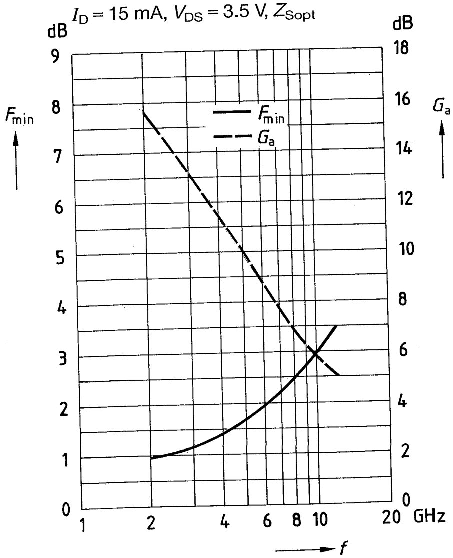


Characteristics at $T_A = 25\ °C$

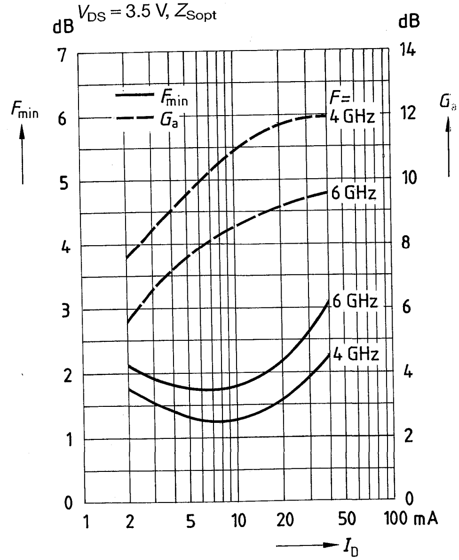
Output characteristics $I_D = f(V_{DS})$



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}



Common Source S Parameters

I_D = 15 mA, V_{DS} = 3.5 V, Z_0 = 50 Ω

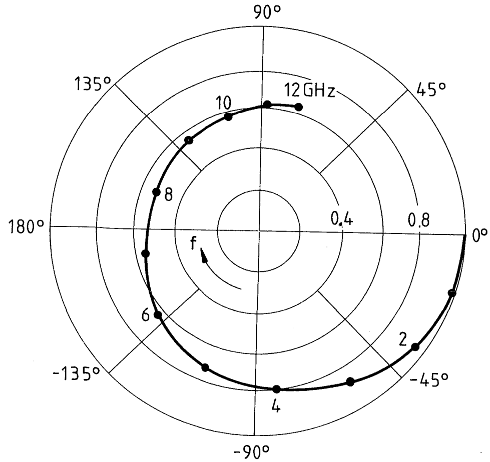
f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	1.00	– 1	2.43	178	0.003	87	0.70	– 1
0.2	1.00	– 3	2.43	176	0.005	86	0.70	– 3
0.4	1.00	– 6	2.43	171	0.010	23	0.69	– 5
0.6	1.00	– 10	2.43	167	0.015	81	0.69	– 8
0.8	0.99	– 14	2.43	162	0.020	78	0.68	– 11
1.0	0.99	– 17	2.43	158	0.025	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
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

I_D = 15 mA, V_{DS} = 3.5 V, Z_0 = 50 Ω

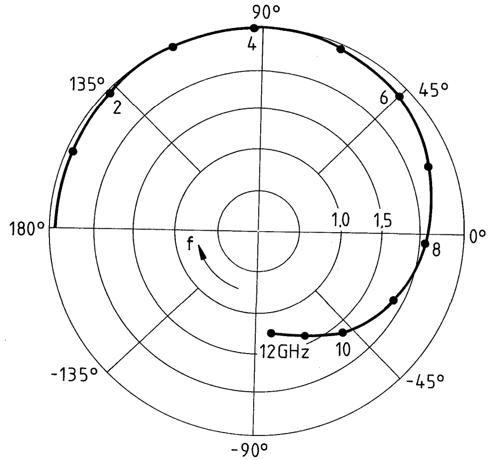
f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
9.0	0.55	129	1.88	–25	0.110	–39	0.18	163
9.2	0.56	124	1.83	–30	0.109	–42	0.19	155
9.4	0.56	119	1.78	–35	0.108	–44	0.20	148
9.6	0.57	114	1.72	–40	0.107	–46	0.21	141
9.8	0.57	110	1.66	–44	0.105	–48	0.22	134
10.0	0.58	106	1.61	–48	0.104	–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

I_D = 15 mA, V_{DS} = 3.5 V, Z_0 = 50 Ω

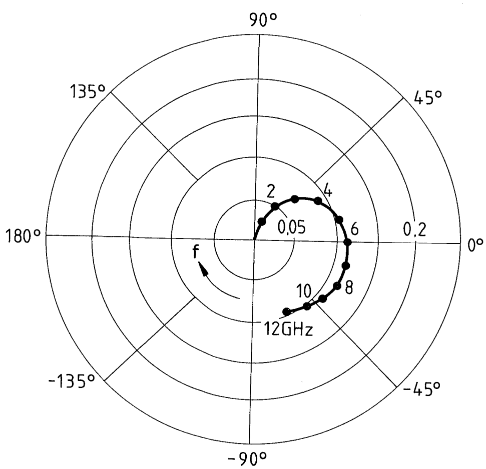
S_{11} = f (*f*)



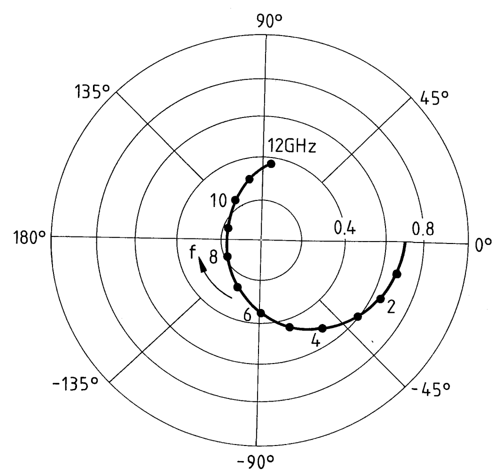
S_{12} = f (*f*)



S_{21} = f (*f*)



S_{22} = f (*f*)



Common Source S Parameters
I_D = 30 mA, V_{DS} = 3.5 V, Z_0 = 50 Ω

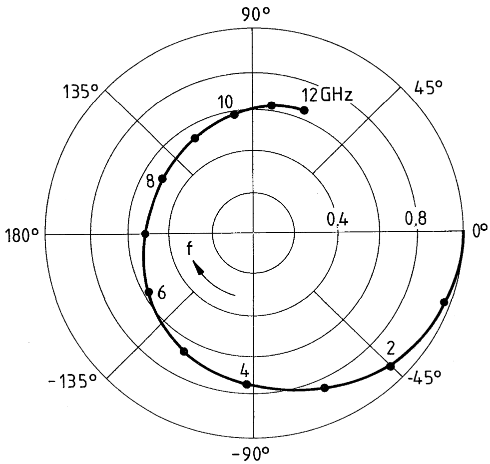
f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	1.00	– 2	3.23	178	0.002	85	0.71	– 1
0.2	1.00	– 4	3.22	176	0.004	82	0.71	– 3
0.4	1.00	– 8	3.21	171	0.009	79	0.70	– 6
0.6	0.99	– 12	3.20	167	0.013	76	0.69	– 9
0.8	0.99	– 16	3.19	162	0.017	73	0.69	– 11
1.0	0.98	– 20	3.18	157	0.021	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
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

I_D = 30 mA, V_{DS} = 3.5 V, Z_0 = 50 Ω

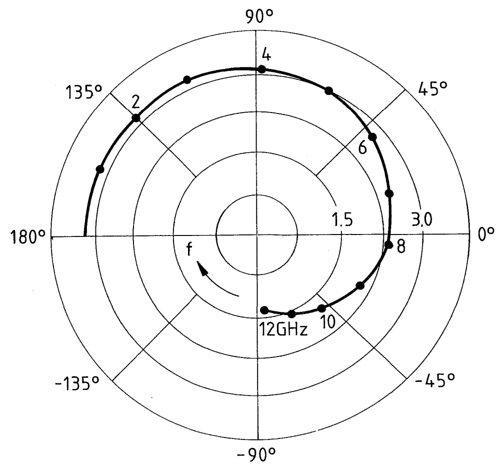
f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
9.0	0.53	120	2.09	–26	0.099	–31	0.16	167
9.2	0.54	115	2.04	–30	0.099	–33	0.17	158
9.4	0.55	111	1.98	–35	0.099	–35	0.18	150
9.6	0.55	107	1.93	–39	0.099	–37	0.19	142
9.8	0.56	103	1.87	–43	0.099	–39	0.21	135
10.0	0.57	99	1.82	–47	0.099	–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

$I_D = 30$ mA, $V_{DS} = 3.5$ V, $Z_0 = 50\ \Omega$

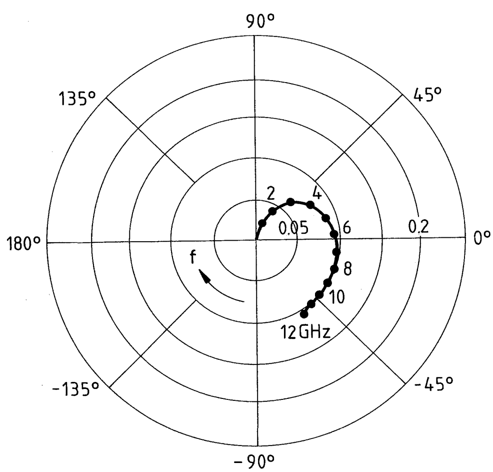
S_{11} = f (*f*)



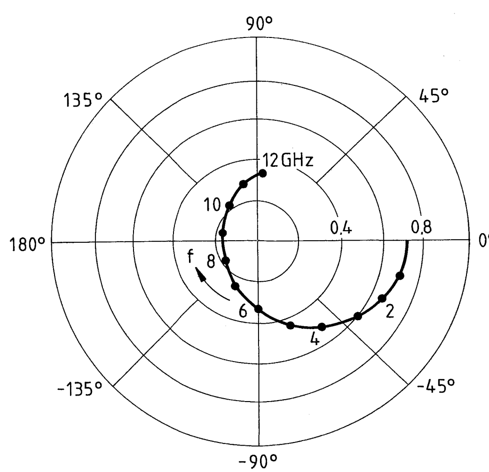
S_{12} = f (*f*)



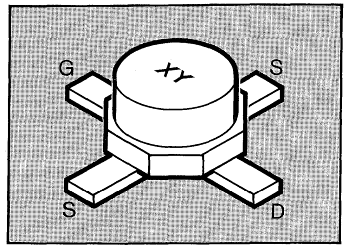
S_{21} = f (*f*)



S_{22} = f (*f*)



- 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: Electrostatic discharge sensitive device, observe handling precautions!

Type	Marking	Ordering code (tape and reel)	Package[1])
CFY 65-12 CFY 65-14	HA HB	Q 62703 – F101 Q 62703 – F102	Cerec – XF

Maximum Ratings

Parameter	Symbol	Value	Unit
Drain-source voltage	V_{DS}	4	V
Drain-gate voltage	V_{DG}	5.5	V
Gate-source voltage	V_{GS}	–3.0 ... +0	V
Drain current	I_D	70	mA
Total power dissipation	P_{tot}	200	mW
Channel temperature	T_{ch}	150	°C
Storage temperature range	T_{stg}	–65 ... +150	°C

Thermal Resistance

Channel – case	R_{thchC}	400	K/W

HEMT = **H**igh **E**lectron **M**obility **T**ransistor

1) For detailed dimensions 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 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	–	dB

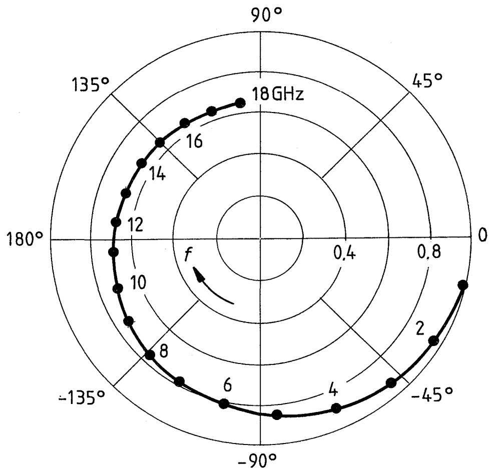
Common Source S Parameters

I_D = 10 mA, V_{DS} = 2 V, Z_0 = 50 Ω

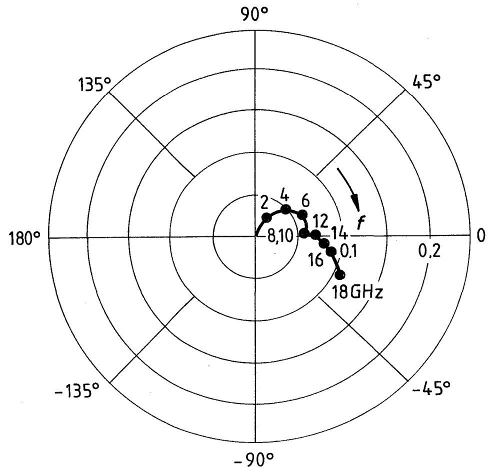
f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
1	1.00	– 16	3.36	162	0.014	77	0.67	– 13
2	0.96	– 33	3.29	146	0.028	65	0.66	– 25
3	0.93	– 49	3.25	131	0.040	55	0.63	– 37
4	0.89	– 67	3.14	114	0.050	43	0.61	– 49
5	0.85	– 85	3.07	98	0.057	35	0.59	– 61
6	0.81	–102	3.00	82	0.062	25	0.56	– 74
7	0.77	–119	2.82	65	0.063	16	0.54	– 88
8	0.75	–134	2.68	51	0.061	8	0.51	–101
9	0.73	–146	2.54	37	0.060	6	0.50	–111
10	0.70	–160	2.43	25	0.060	5	0.49	–123
11	0.69	–174	2.32	12	0.062	4	0.48	–134
12	0.67	173	2.25	– 1	0.066	3	0.47	–147
13	0.66	160	2.14	–13	0.072	0	0.47	–159
14	0.65	147	2.11	–25	0.076	– 5	0.47	–172
15	0.65	135	2.04	–36	0.081	– 8	0.48	178
16	0.65	123	1.94	–49	0.089	–13	0.49	168
17	0.65	111	1.91	–62	0.097	–19	0.50	156
18	0.65	99	1.87	–73	0.105	–26	0.50	145

$I_D = 10$ mA, $V_{DS} = 2$ V, $Z_0 = 50\ \Omega$

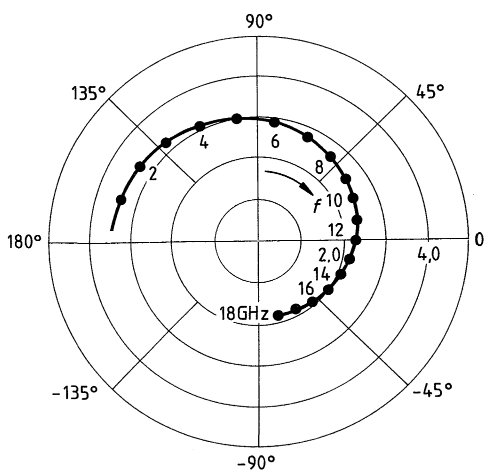
S_{11}



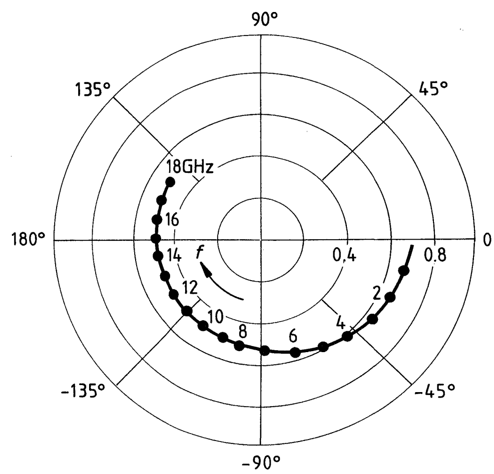
S_{12}



S_{21}



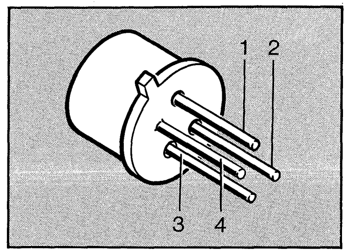
S_{22}



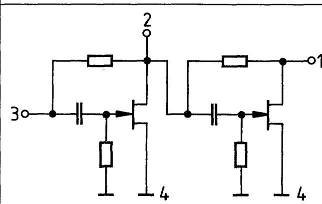
GaAs MMICs

GaAs-MMIC

- Two-stage monolithic microwave IC (MMIC amplifier)
- All gold metallization
- Chip fully passivated
- Operating voltage range: 3 to 6 V
- 50 Ω input/output; RL_{IN} RL_{OUT} >10 dB
- Gain: 21 dB at 500 MHz
- Low noise figure: 3.9 dB at 500 MHz
- Bandwidth: 2 GHz
- Hermetically sealed package



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

Type	Ordering code	Circuit diagram	Package[1])
CGY 21	Q 68000 – A5953		TO-12

Maximum Ratings

Parameter	Symbol	Value	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	°C

Thermal Resistance

Channel – case	R_{thchC}	50	K/W

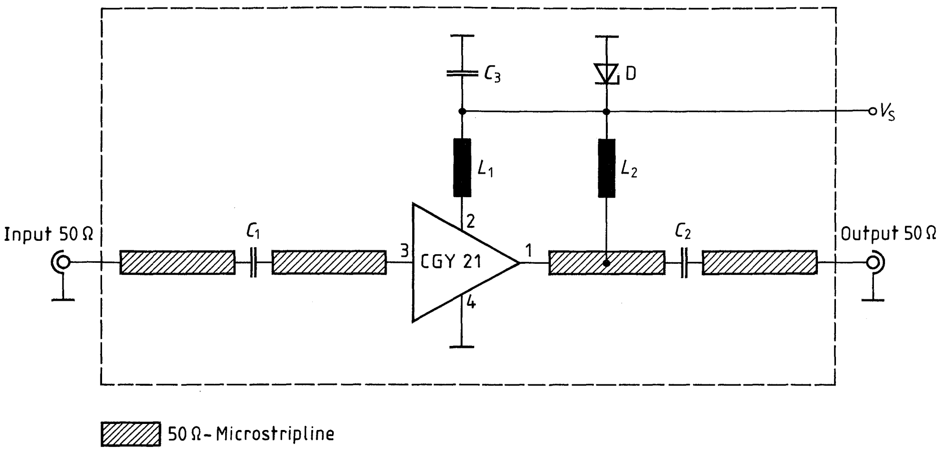
Note: Exceeding any of the maximum ratings may cause permanent damage to the device. Appropriate handling procedures are required to protect the electrostatic sensitive IC against degradation due to excess voltage or excess current spikes. Excellent ground connection of lead 4 and the package (e. g. 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.

1) For detailed dimensions see chapter Package Outlines.

DC 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	dB
Noise figure f = 100 MHz to 900 MHz	F	–	3.9	5.5	dB
Input return loss f = 100 MHz to 900 MHz	RL_{IN}	–	12	9.5	dB
Output return loss f = 100 MHz to 900 MHz	RL_{OUT}	–	12	9.5	dB
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	–	dBm

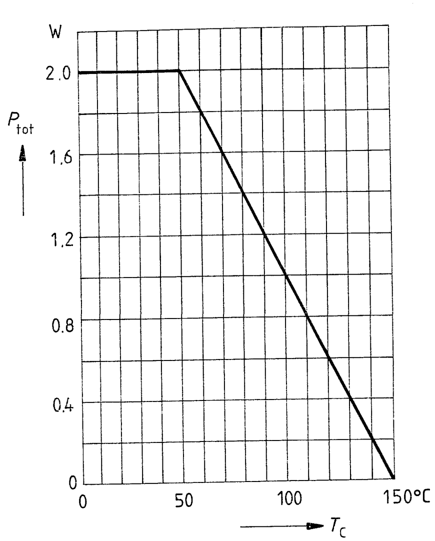
Application Circuit
f = 100 MHz to 900 MHz



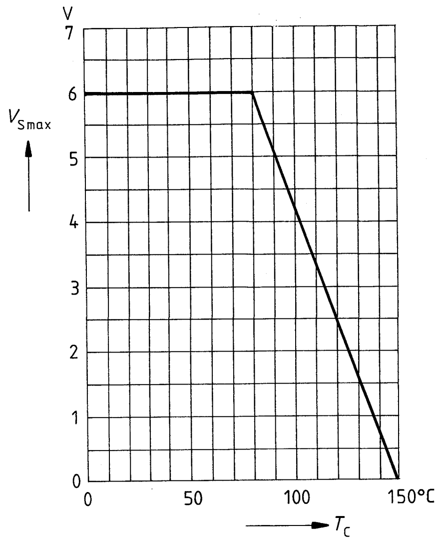
Summary of components

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)

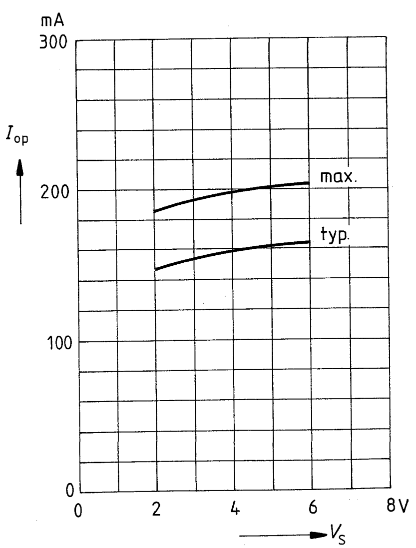
Max. power dissipation $P_{tot} = f(T_C)$



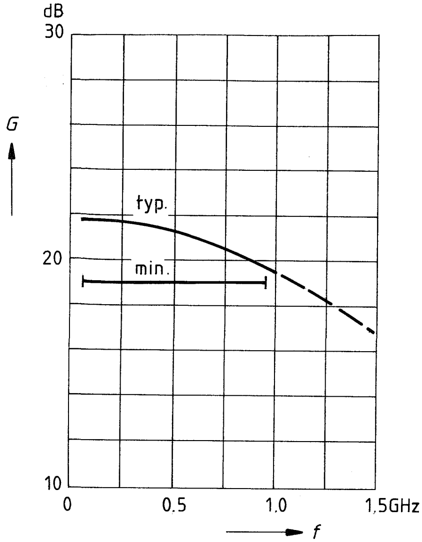
Max. supply voltage $V_{Smax} = f(T_C)$



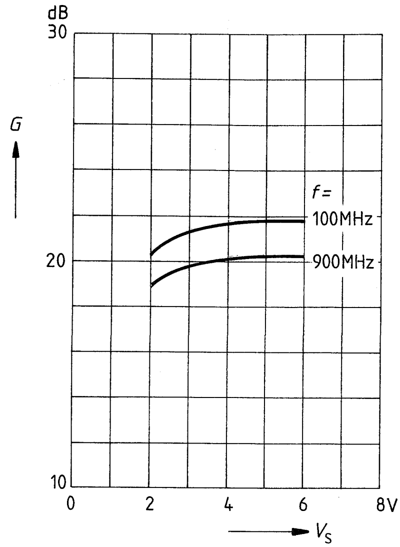
Operating current $I_{op} = f(V_S)$



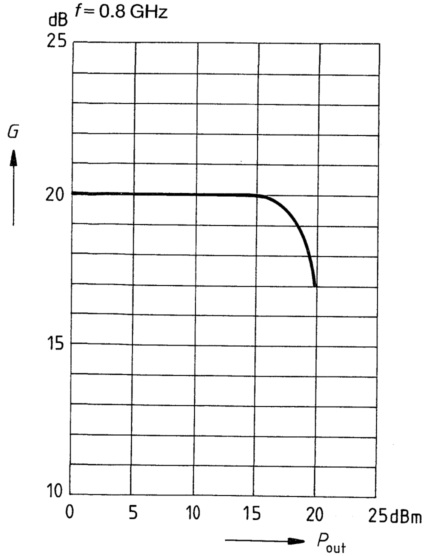
Power gain $G = f(f)$
$V_S = 4.5\ V$, $R_S = R_L = 50\ \Omega$



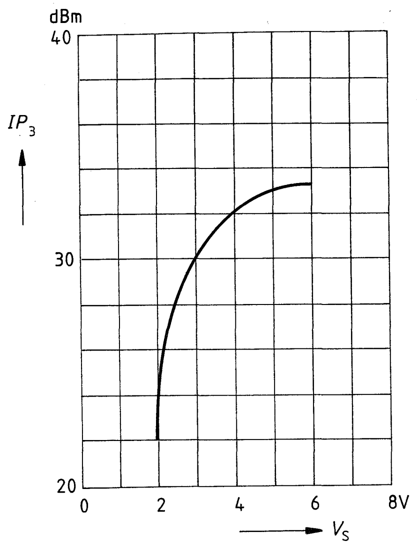
Power gain $G = f(V_S)$
$R_S = R_L = 50\ \Omega$



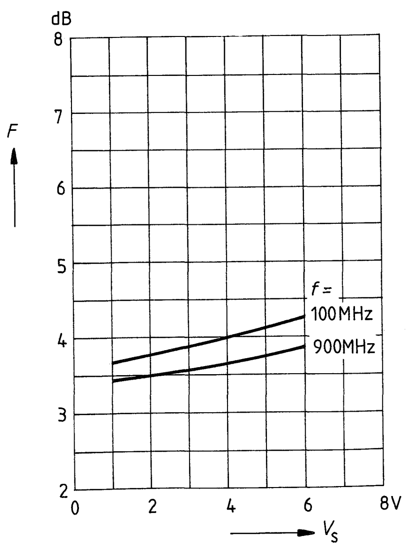
Power gain $G = f(P_{out})$
$V_S = 4.5\ V$, $R_S = R_L = 50\ \Omega$
$f = 0.8\ GHz$



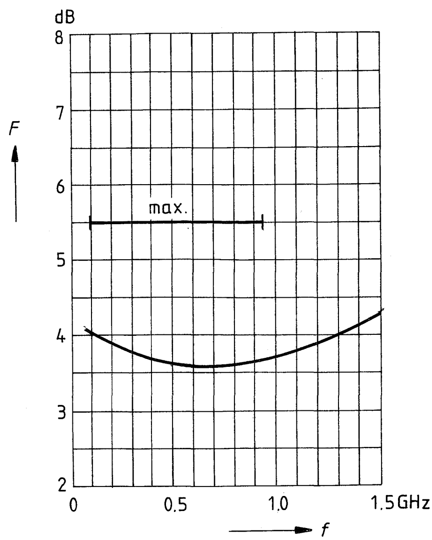
Third order intercept point $IP_3 = f(V_S)$
f = 800 MHz, $R_S = R_L = 50\ \Omega$



Noise figure $F = f(V_S)$
$R_S = R_L = 50\ \Omega$



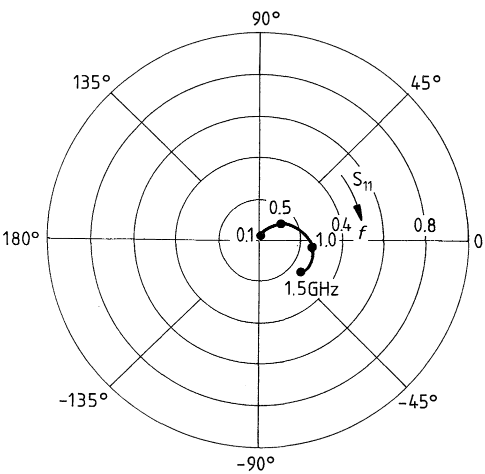
Noise figure $F = f(f)$
$V_S = 4.5$ V, $R_S = R_L = 50\ \Omega$



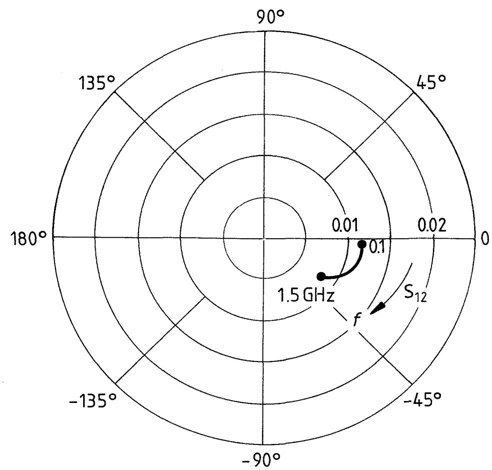
S Parameters
V_S = 4.5 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.02	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

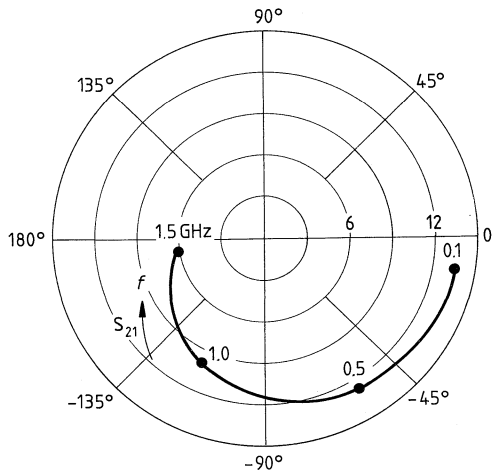
S_{11} = f (*f*)
V_S = 4.5 V, Z_0 = 50 Ω



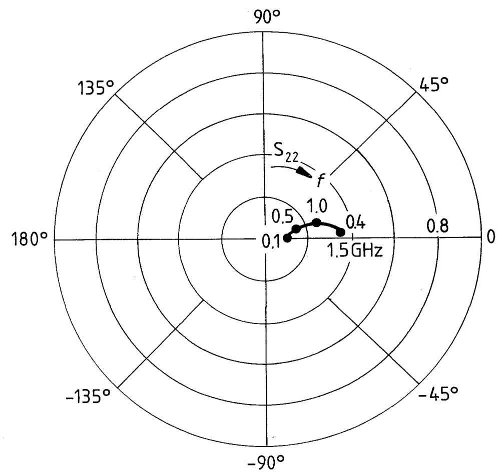
S_{12} = f (*f*)
V_S = 4.5 V, Z_0 = 50 Ω



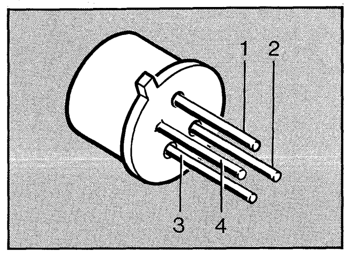
S_{21} = f (*f*)
V_S = 4.5 V, Z_0 = 50 Ω



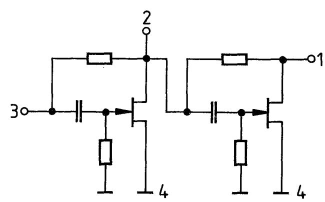
S_{22} = f (*f*)
V_S = 4.5 V, Z_0 = 50 Ω



- Two-stage monolithic microwave IC (MMIC amplifier)
- All-gold metallization
- Chip fully passivated
- Operating voltage range: 3 to 6 V
- 50 Ω input/output; RL_{IN} RL_{OUT} >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: Electro**s**tatic **d**ischarge sensitive device, observe handling precautions!

Type	Ordering code	Circuit diagram	Package[1])
CGY 31	Q 68000 – A6887	 1 RF output, V_S 2 Interstage, V_S 3 RF input 4 RF and DC ground, case	TO-12

Maximum Ratings

Parameter	Symbol	Value	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	°C

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.

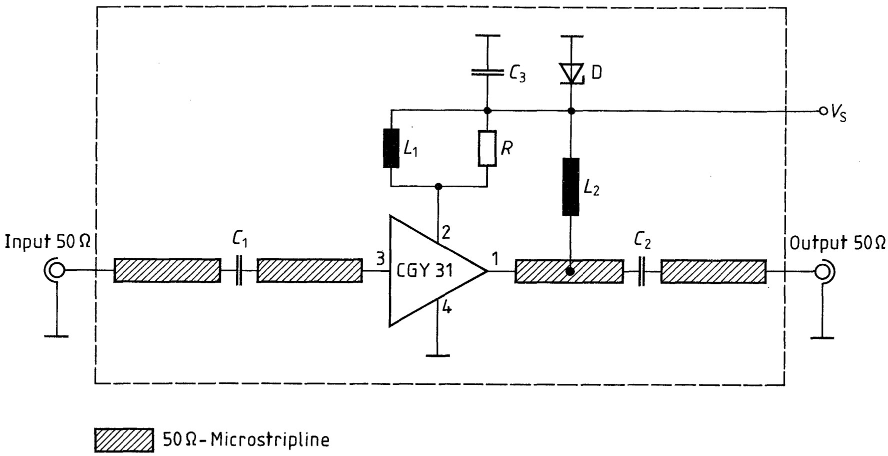
1) For detailed dimensions see chapter Package Outlines.

DC 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	dB
Noise figure f = 800 MHz to 1800 MHz	F	–	4.0	5.0	dB
Input return loss f = 800 MHz to 1800 MHz	RL_{IN}	–	13	9.5	dB
Output return loss f = 800 MHz to 1800 MHz	RL_{OUT}	–	12	9.5	dB
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	–	dBm

Application Circuit

f = 800 MHz to 1800 MHz

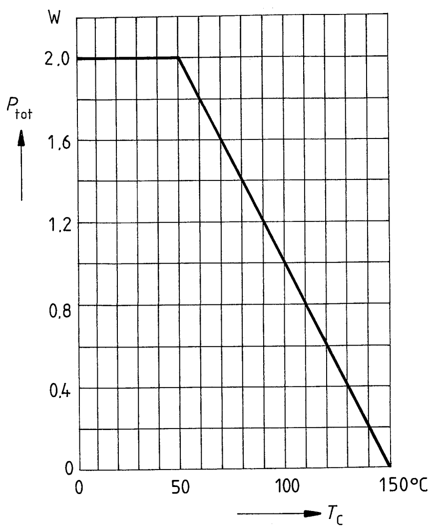


Summary of components

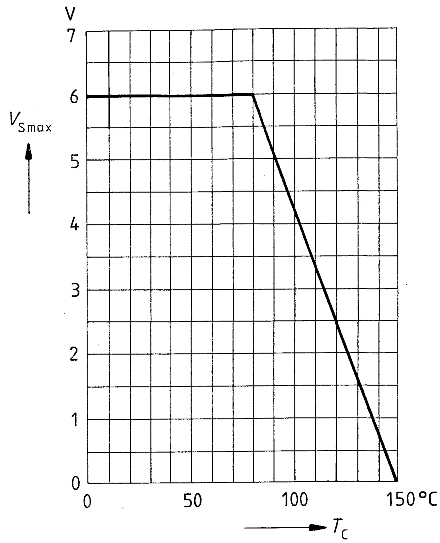
C_1, C_2 C_3	: 100 pF : 1 nF	} Chip capacitors
R_1 L_1	39 Ω 70 nH	Resistor, e.g. l = 4 mm; ∅ 1.8 mm with axial leads Inductance, e.g. 8 turns, 0.25 mm enamelled copper wire wound on R. The geometrical combination of L_1 and R influences the frequency response.
L_2	40 nH	Inductance, e.g. 5 turns, 0.25 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.

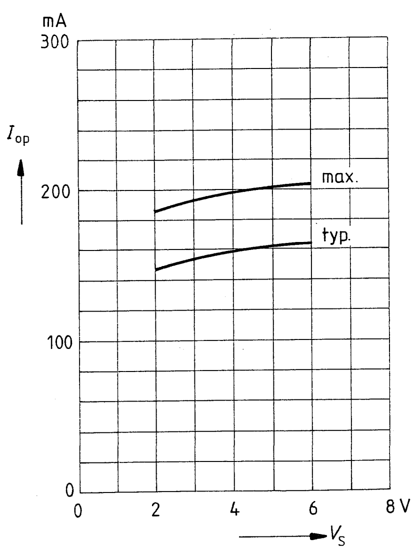
Max. power dissipation $P_{tot} = f(T_C)$



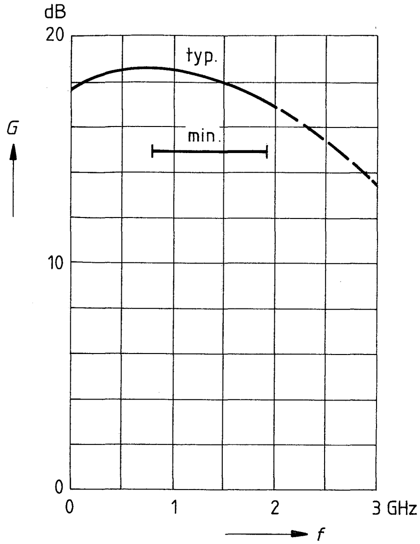
Max. supply voltage $V_{Smax} = f(T_C)$



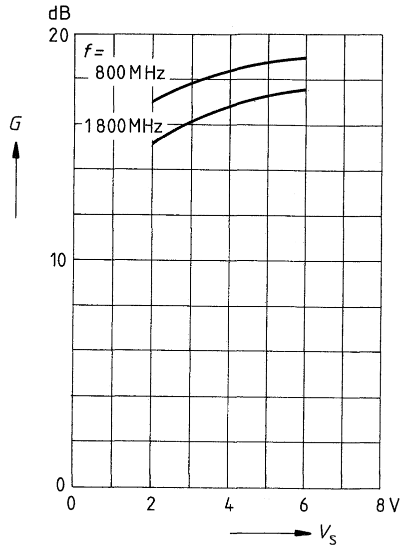
Operating current $I_{op} = f(V_S)$



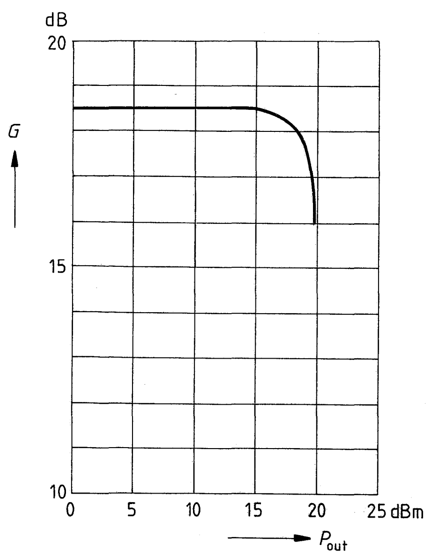
Power gain $G = f(f)$
$V_S = 4.5\ V$, $R_S = R_L = 50\ \Omega$



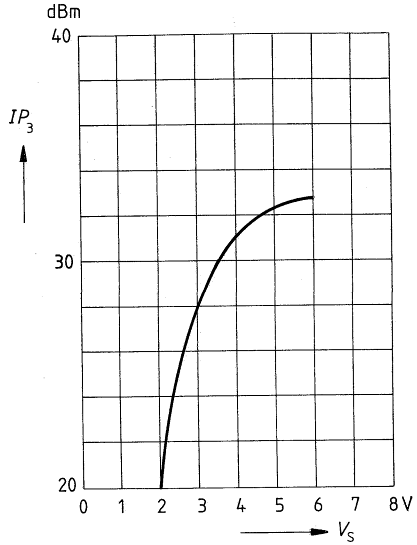
Power gain $G = f(V_S)$
$R_S = R_L = 50\ \Omega$



Power output $G = f(P_{out})$
$V_S = 4.5\ V$, $R_S = R_L = 50\ \Omega$
$f = 0.8\ GHz$



Third order intercept point IP_3 = f (V_S)
f = 0.8 GHz
$R_S = R_L$ = 50 Ω

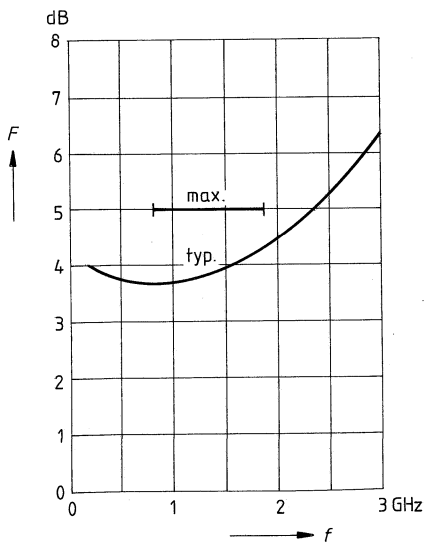


The intermodulation ratio d_{IM} can easily be determined.

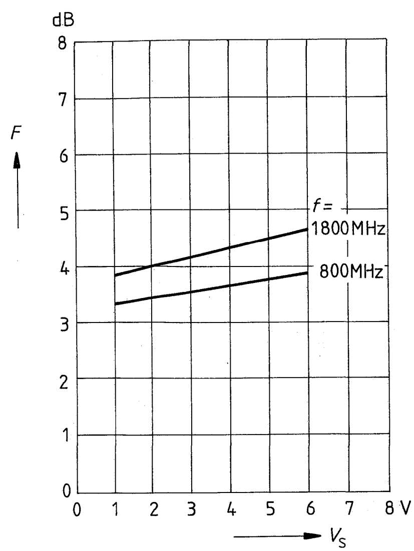
$d_{IM} = 2\,(IP_3 - P_0)$

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



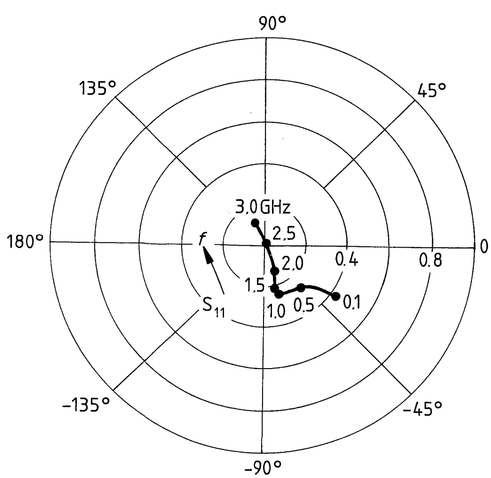
Noise figure F = f (V_S)
$R_S = R_L$ = 50 Ω



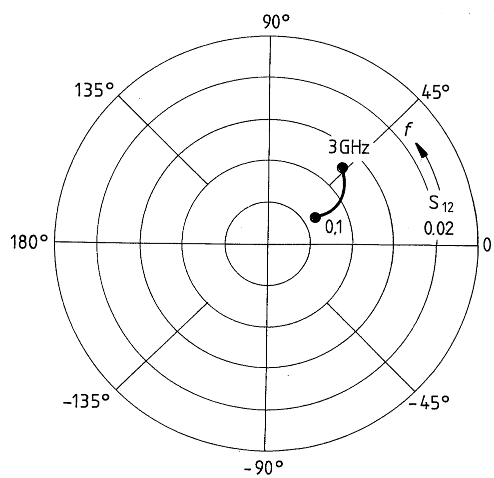
S Parameters
V_S = 4.5 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.42	–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

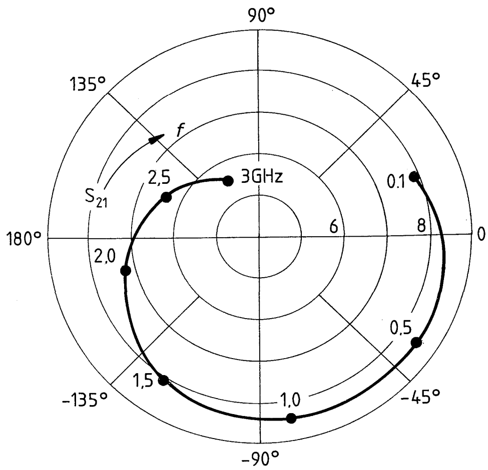
S_{11} = f (*f*)
V_S = 4.5 V, Z_0 = 50 Ω



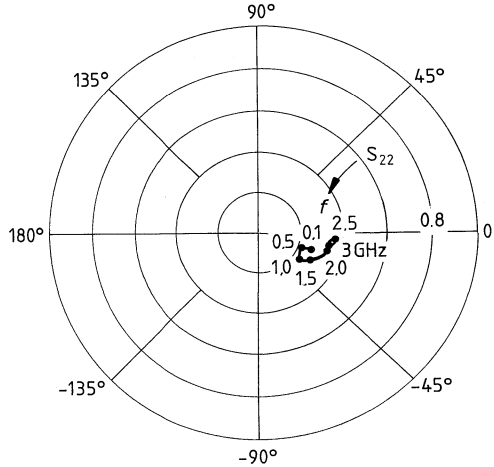
S_{12} = f (*f*)
V_S = 4.5 V, Z_0 = 50 Ω



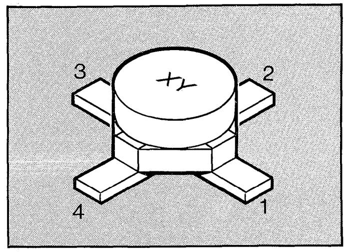
S_{21} = f (*f*)
V_S = 4.5 V, Z_0 = 50 Ω



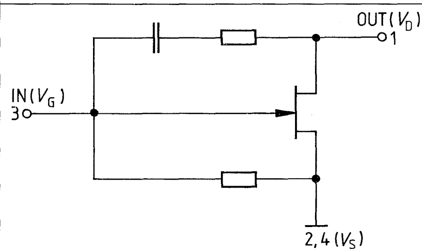
S_{22} = f (*f*)
V_S = 4.5, Z_0 = 50 Ω



- Single-stage, monolithic microwave IC (MMIC amplifier)
- Application range: 100 MHz to 3 GHz
- Gain: 9 dB typical, at 1.6 GHz
- Low noise figure: 2.7 dB typical, at 1.6 GHz
- Bandwidth: 3 GHz typical, at –3 dB, *VSWR* ≤ 2 : 1
- Operating voltage range: 3 to 5.5 V
- Individual current control with negative gate bias
- Hermetically sealed ceramic stripline package Cerec
- Packaging unit: 1000 items per 18 cm tape reel



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

Type	Marking	Ordering code (tape and reel)	Circuit diagram	Package[1])
CGY 40	40	Q 68000 – A4444		Cerec-X

Maximum Ratings

Parameter	Symbol	Value	Unit
Drain voltage	V_D	5.5	V
Current control gate voltage	V_G	–3 ... 0	V
Drain-gate voltage	V_{DG}	8.5	V
Input power	P_{IN}	16	dBm
Total power dissipation, T_C = 100 °C	P_{tot}	440	mW
Channel temperature	T_{ch}	150	°C
Storage temperature range	T_{stg}	–55 ... +150	°C

Thermal Resistance

Channel – case	R_{thchC}	115	K/W

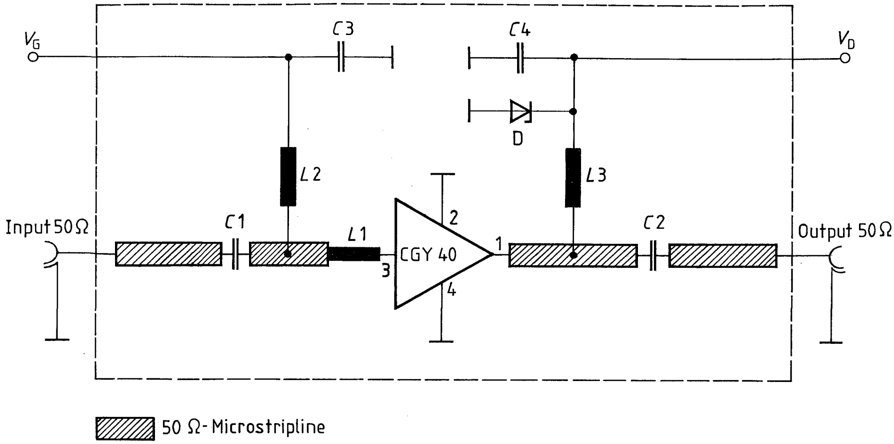
Note: Exceeding any of the maximum ratings may cause permanent damage to the device. Appropriate handling is required to protect the electrostatic-sensitive MMIC against degradation due to excess voltage or excess current spikes. Proper ground connection of leads 2 and 4 (with minimum inductance) is required to achieve the guaranteed RF performance, stable operating conditions and adequate cooling.

1) For detailed dimensions see chapter Package Outlines.

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	dB
Noise figure f = 200 to 1000 MHz f = 800 to 1800 MHz	F	 – –	 2.5 2.8	 – 4.0	dB
Input return loss f = 200 to 1000 MHz f = 800 to 1800 MHz	RL_{IN}	 – –	 13 12	 – 9.5	dB
Output return loss f = 200 to 1000 MHz f = 800 to 1800 MHz	RL_{OUT}	 – –	 12 12	 – 9.5	dB
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	–	dBm
Gain control dynamic range f = 200 to 1000 MHz f = 200 to 1800 MHz	ΔG	 – –	 30 20	 – –	dB

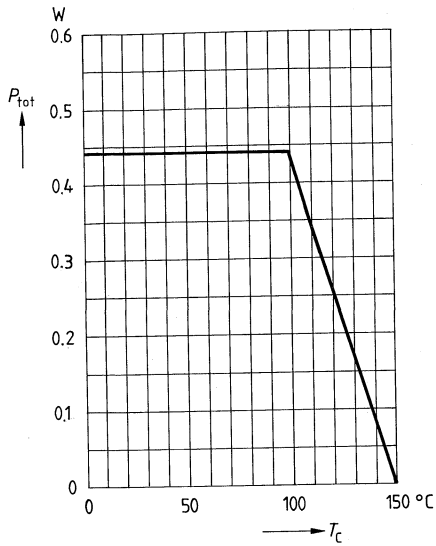
Application Circuit
f = 800 to 1800 MHz



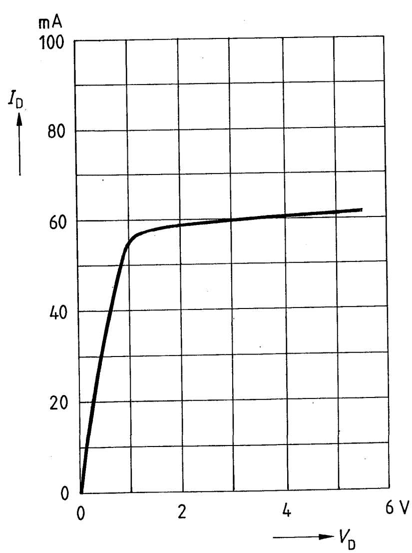
Summary of components

*C*1, *C*2 *C*3, *C*4	Chip capacitors Chip capacitor	100 pF 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)	

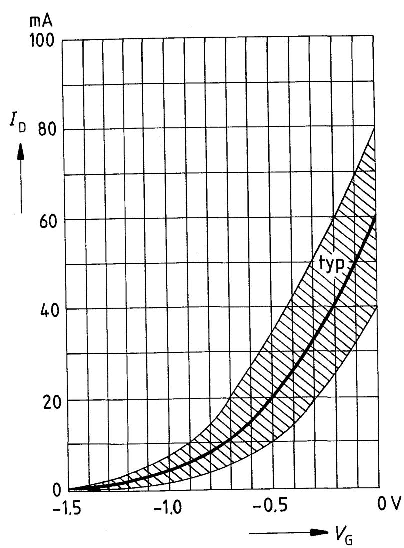
Total power dissipation $P_{tot} = f(T_C)$



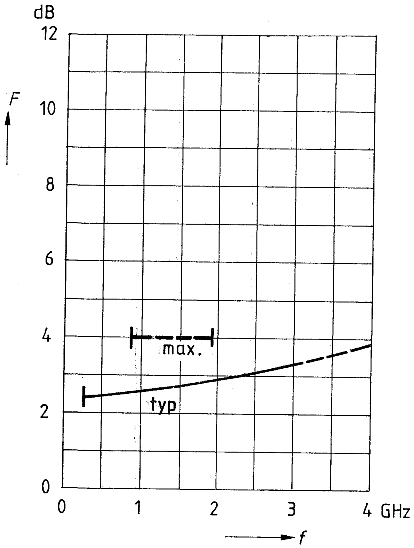
Drain current $I_D = f(V_D)$
$V_G = 0$



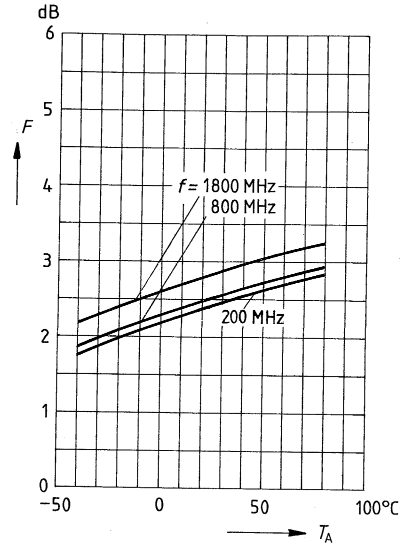
Drain current $I_D = f(V_G)$
$V_D = 4.5$ V



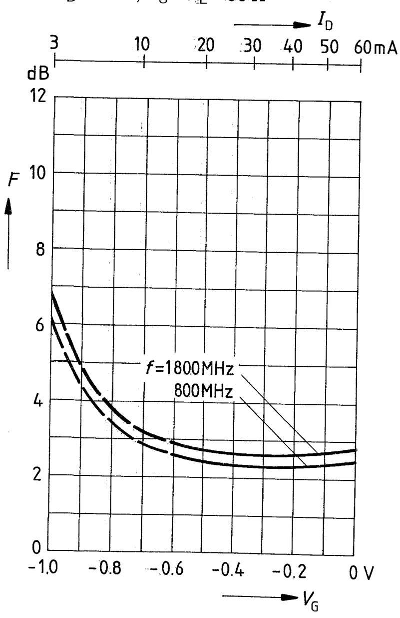
Noise figure $F = f(f)$
$V_D = 4.5$ V, $V_G = 0$, $R_S = R_L = 50\ \Omega$



Noise figure $F = f(T_A)$
$V_D = 4.5$ V, $V_G = 0$, $R_S = R_L = 50\ \Omega$

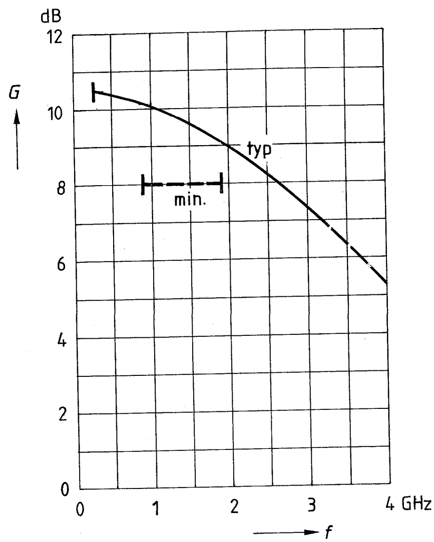


Noise figure $F = f(V_G)$
$V_D = 4.5$ V, $R_S = R_L = 50\ \Omega$

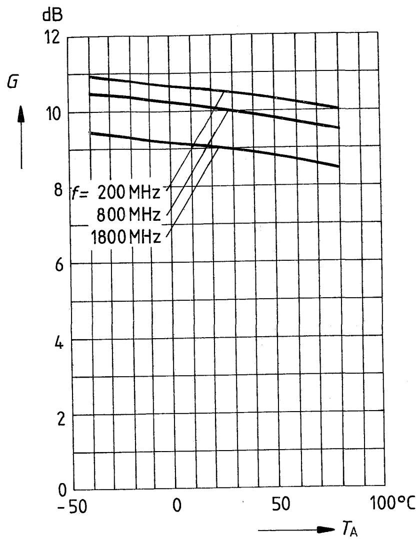


The gate voltage V_G refers to a typical drain current I_D of 60 mA with the supplementary information of the I_D values.

Power gain $G = f(f)$
$V_D = 4.5$ V, $V_G = 0$, $R_S = R_L = 50\ \Omega$

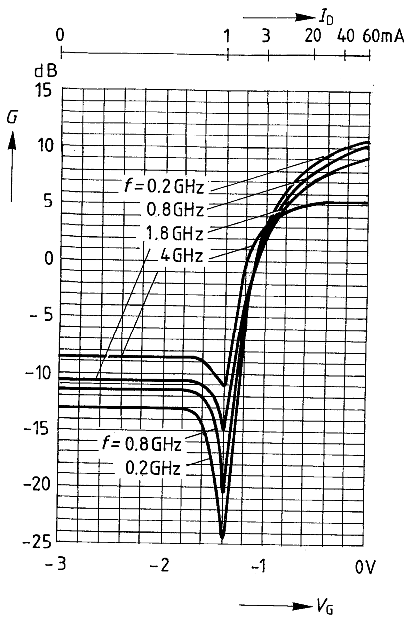


Power gain[1]) $G = f(T_A)$
$V_D = 4.5$ V, $V_G = 0$, $R_S = R_L = 50\ \Omega$

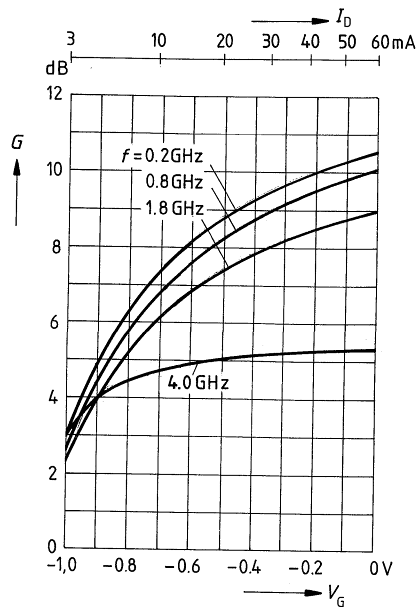


1) Mounted on PC-board (application circuit)

Power gain $G = f(V_G)$
$V_D = 4.5\ V$, $R_S = R_L = 50\ \Omega$

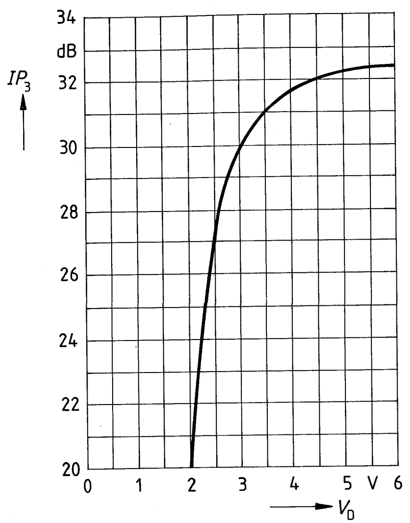


Power gain $G = f(V_G)$
$V_D = 4.5\ V$, $R_S = R_L = 50\ \Omega$



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.

Third order intercept point $IP_3 = f(V_D)$
$f = 800$ MHz, $V_G = 0$ V, $R_S = R_L = 50\ \Omega$



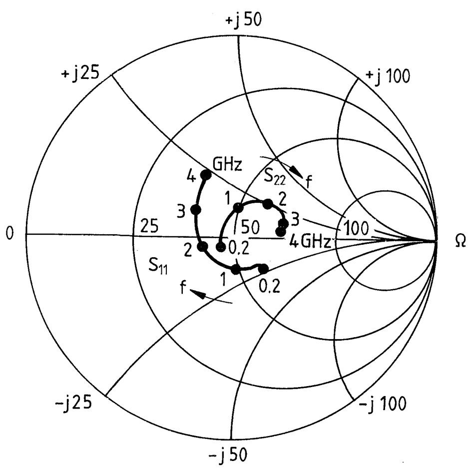
The intermodulation ratio d_{IM} can easily be determined.
$d_{IM} = 2\,(IP_3 - P_0)$

IP_3 = Intercept point
d_{IM} = Intermodulation ratio
P_0 = Power level of each carrier in dBm.

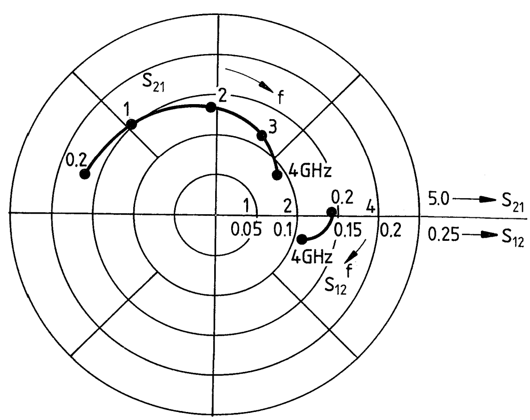
S Parameters
V_D = 4.5 V, V_G = 0, Z_0 = 50 Ω

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

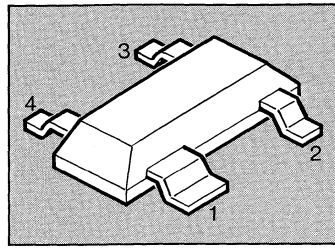
S_{11}, S_{22}
V_D = 4.5, V_G = 0, Z_0 = 50 Ω



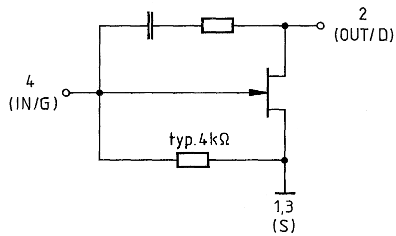
S_{12}, S_{21}
V_D = 4.5 V, V_G = 0, Z_0 = 50 Ω



- 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	Circuit diagram	Package[1])
CGY 50	G2	Q 68000 – A8370		SOT-143

Maximum Ratings

Parameter	Symbol	Value	Unit
Drain voltage (DC)	V_D	5.5	V
Peak drain voltage (DC + RF)	V_{Dp}	7.5	V
Current control gate voltage	V_G	–3 ... 0	V
Drain gate voltage	V_{DG}	7.5	V
Input power[2])	P_{IN}	16	dBm
Total power dissipation, $T_C \leq 100$ °C	P_{tot}	400	mW
Channel temperature	T_{ch}	150	°C
Storage temperature range	T_{stg}	–40 ... +150	°C

Thermal Resistance

Channel – case	R_{thchC}	≤125	K/W

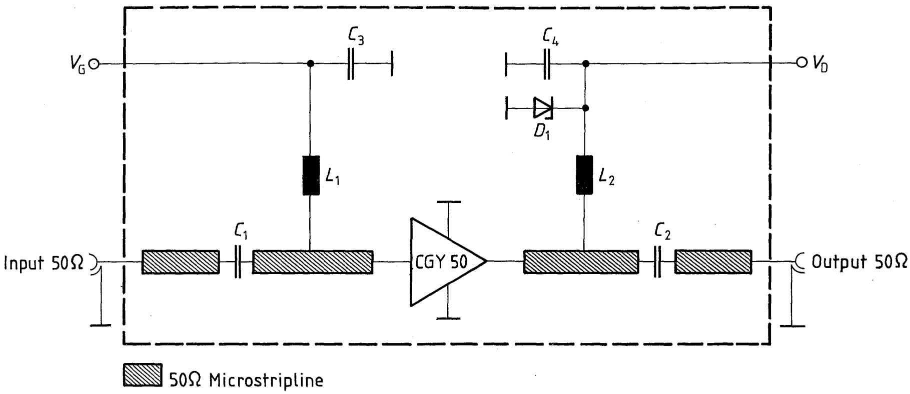
Note: Exceeding any of the maximum ratings may cause permanent damage to the device. Appropriate handling is required to protect the electrostatic-sensitive MMIC against degradation due to excess voltage or excess current spikes. Proper ground connection of leads 1 and 3 (with minimum inductance) is required to achieve the guaranteed RF performance, stable operating conditions and adequate cooling.

1) For detailed dimensions see chapter Package Outlines.
2) For application circuit see page 609.

DC 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	80	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	dB
Noise figure f = 200 to 1800 MHz	F	–	3.0	4.0	dB
Input return loss f = 200 to 1800 MHz	RL_{IN}	9.5	12	–	dB
Output return loss f = 200 to 1800 MHz	RL_{OUT}	9.5	12	–	dB
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	–	dBm
Gain control dynamic range f = 200 to 1800 MHz	ΔG	–	20	–	dB

Application Circuit
f = 800 to 1800 MHz

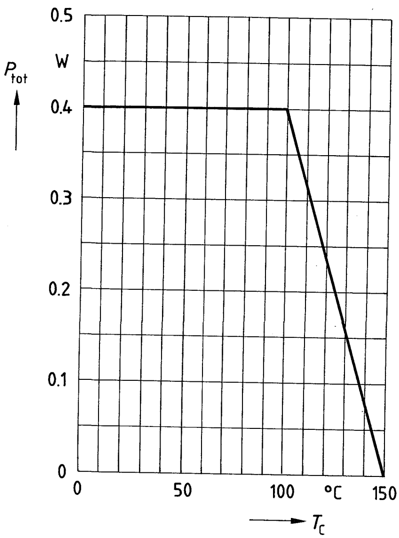


Summary of components

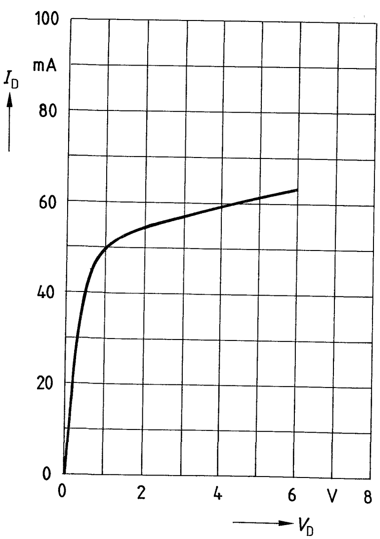
C_1, C_2 C_3, C_4	Chip capacitors 100 pF Chip capacitors 1 nF
L_1, L_2	Discrete inductor 1 µH or printed microstripline inductor
D_1	Z diode 5.6 V (type BZW 22 C5V6)

Note: Operating conditions for $P_{IN\ max}$: R_G = R_L = 50 Ω, $C_{1\ max}$ = 220 pF, V_D = 4.5 V; V_G current limited <2 mA.

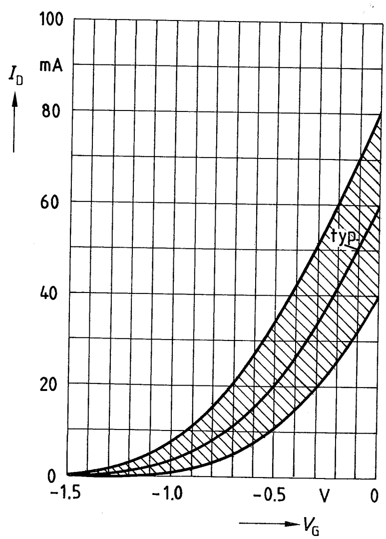
Total power dissipation $P_{tot} = f(T_C)$



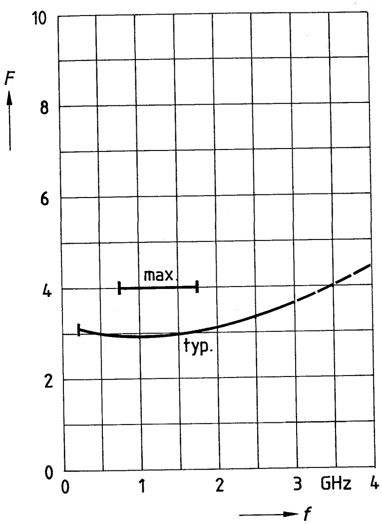
Drain current $I_D = f(V_D)$
$V_G = 0$ V



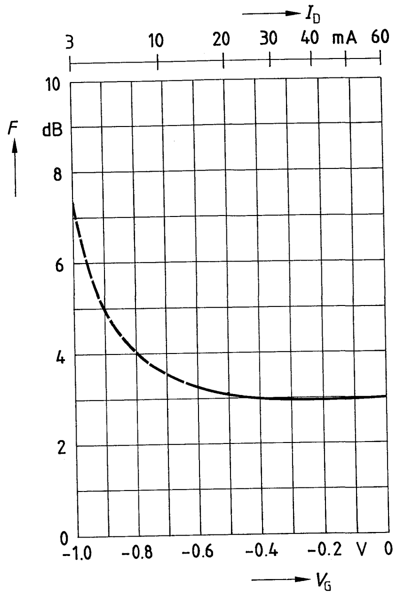
Drain current $I_D = f(V_G)$
$V_D = 4.5$ V



Noise figure $F = f(f)$
$V_D = 4.5$ V, $V_G = 0$ V, $R_S = R_L = 50\ \Omega$

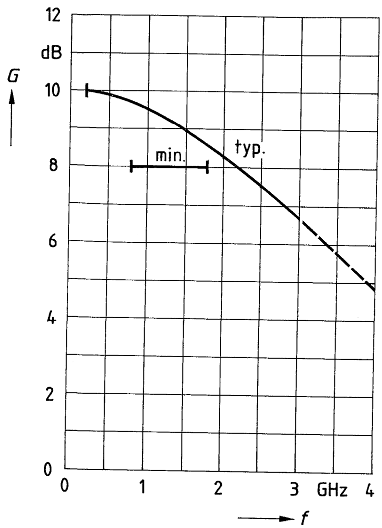


Noise figure $F = f(V_G)$[1])
$V_D = 4.5$ V, $R_S = R_L = 50\ \Omega$
$f = 200$ to 1800 MHz

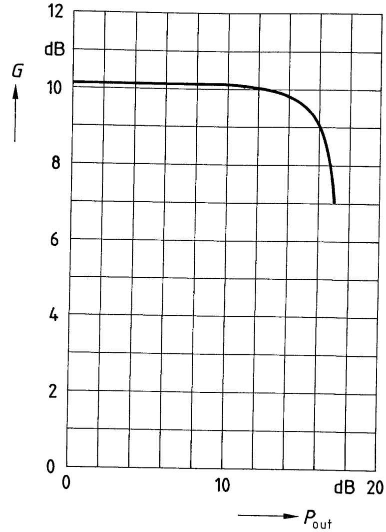


1) See next page.

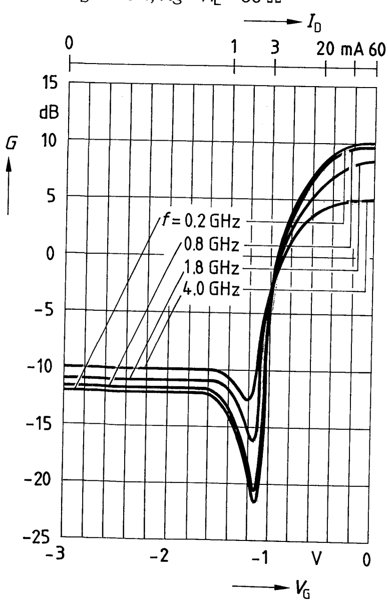
Power gain $G = f(f)$
$V_D = 4.5$ V, $V_G = 0$ V, $R_S = R_L = 50\ \Omega$



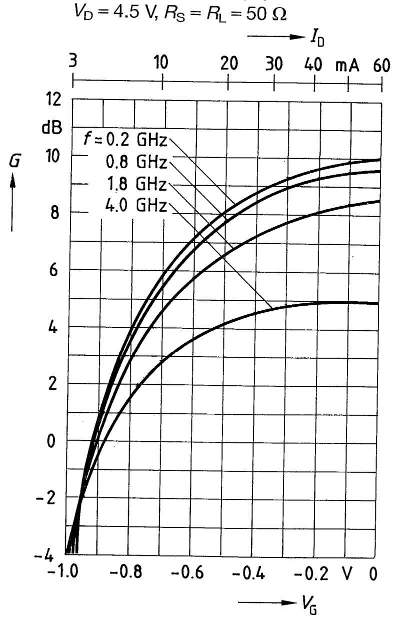
Power gain $G = f(P_{out})$
$V_D = 4.5$ V, $V_G = 0$ V, $R_S = R_L = 50\ \Omega$
$f = 800$ MHz



Power gain $G = f(V_G)$[1]
$V_D = 4.5$ V, $R_S = R_L = 50\ \Omega$

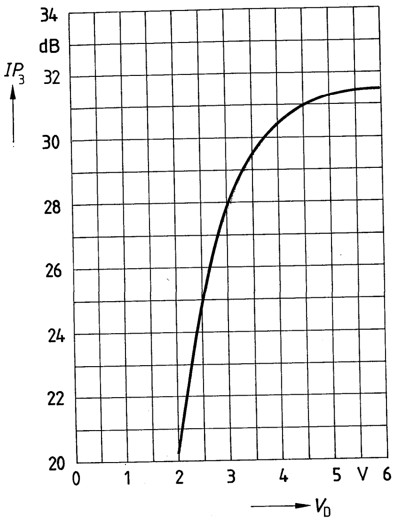


Power gain $G = f(V_G)$[1]
$V_D = 4.5$ V, $R_S = R_L = 50\ \Omega$



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.

Third order intercept point $IP_3 = f(V_D)$
$f = 800$ MHz, $V_G = 0$ V, $R_S = R_L = 50\ \Omega$



The intermodulation ratio d_{IM} can easily be determined.

$d_{IM} = 2\,(IP_3 - P_0)$

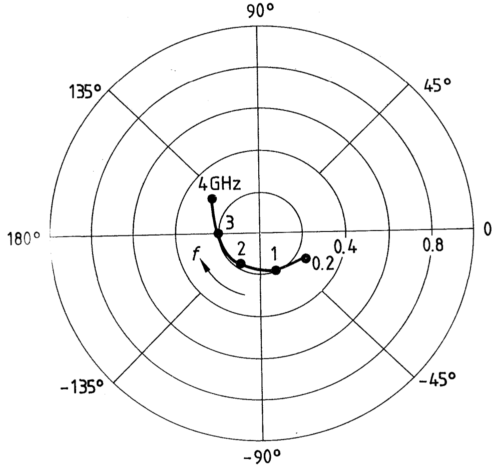
IP_3 = Intercept point
d_{IM} = Intermodulation ratio
P_0 = Power level of each carrier in dBm

S Parameters
V_D = 4.5 V, V_G = 0 V, Z_0 = 50 Ω

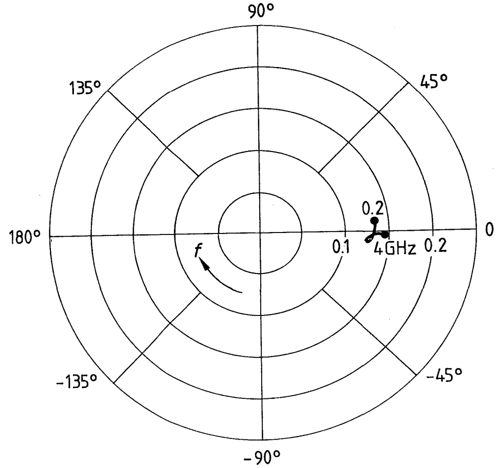
f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.2	0.25	– 31	3.30	164	0.14	5.0	0.05	–144
0.4	0.27	– 34	3.20	158	0.14	0.0	0.05	–133
0.6	0.21	– 44	3.17	150	0.13	–2.0	0.08	105
0.8	0.20	– 54	3.09	142	0.13	–3.0	0.01	91
1.0	0.19	– 65	3.00	134	0.13	–4.0	0.12	81
1.2	0.18	– 77	2.90	126	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 Parameters
$V_D = 4.5$ V, $V_G = 0$ V, $Z_0 = 50\ \Omega$

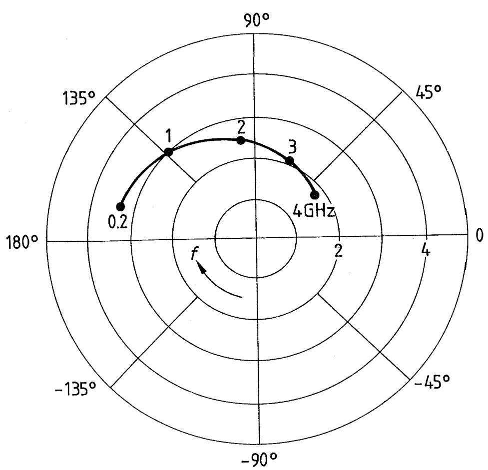
S_{11}



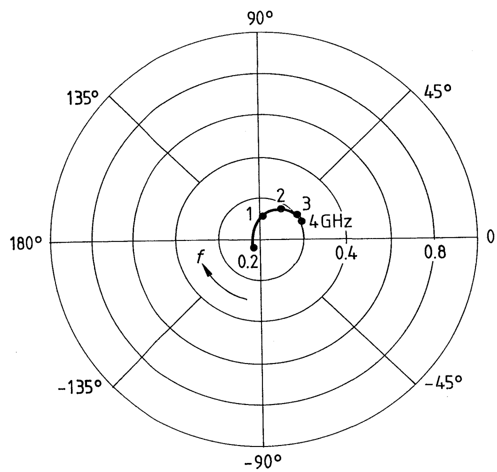
S_{12}



S_{21}



S_{22}



Siemens Worldwide (Addresses)

Siemens in Ihrer Nähe

Siemens AG, Bereich Halbleiter
Balanstraße 73, Postfach 801709, **D-8000 München 80**
☎ (089) 4144-0 Tx 52108-0 sie d FAX (089) 4144-2689

Siemens Worldwide

Federal Republic of Germany and Berlin (West)

Siemens AG
Salzufer 6–8
1000 Berlin 10
☎ (030) 3939-1, Tx 18100-278
FAX (030) 3939-2630
Ttx 308190 = sieznb

Siemens AG
Lahnweg 10
Postfach 1115
4000 Düsseldorf 1
☎ (0211) 399-0, Tx 21134401
FAX (0211) 399-2506

Siemens AG
Rödelheimer Landstraße 5–9
Postfach 111733
6000 Frankfurt 1
☎ (069) 797-0, Tx 414131-0
FAX (069) 797-2253

Siemens AG
Lindenplatz 2
Postfach 105609
2000 Hamburg 1
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P.O.B. 4583
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Jebsen & Co., Ltd.
Siemens Division
P.O.B. 97
Hongkong
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India
Siemens India Ltd.
Head Office "A" Building
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Worli
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Promotion Office
10-15 E, 5th floor
47 Ayer Rajah Crescent No. 06-12
Singapore 0513
☎ 7760283, Tx RS 21000

Taiwan
TAI Engineering Co. Ltd.
6th Floor Central Building
108, Chung Shan N. Rd. Sec. 2
P.O.Box 68-1882
Taipei
☎ 5363171, Tx 27860

AUSTRALIA

Siemens Ltd., Head Office
544 Church Street
Richmond (Melbourne), Vic. 3121
☎ (03) 4207111, Tx 30425

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