

NPN 4 GHz wideband transistor

BFQ34

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DESCRIPTION

NPN transistor encapsulated in a 4 lead SOT122A envelope with a ceramic cap. All leads are isolated from the stud.

It is primarily intended for driver and final stages in MATV system amplifiers. It is also suitable for use in low power band IV and V equipment. Diffused emitter-ballasting resistors and the application of gold sandwich metallization ensure an optimum temperature profile and excellent reliability properties. The device also features high output voltage capabilities.

A SOT5 (TO-39) version (ref: ON4497) is available on request.

PINNING

PIN	DESCRIPTION
Code: BFQ34/01	
1	collector
2	emitter
3	base
4	emitter

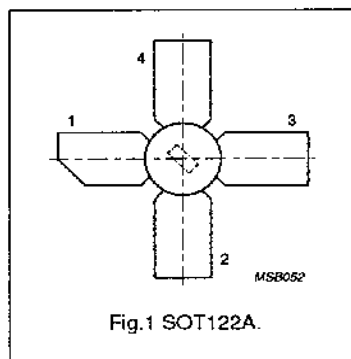


Fig.1 SOT122A.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	—	25	V
V_{CEO}	collector-emitter voltage	open base	—	18	V
I_C	collector current		—	150	mA
P_{tot}	total power dissipation	up to $T_c = 160^\circ\text{C}$	—	2.7	W
f_T	transition frequency	$I_C = 150\text{ mA}$; $V_{CE} = 15\text{ V}$; $f = 500\text{ MHz}$	4	—	GHz
V_O	output voltage	$I_C = 120\text{ mA}$; $V_{CE} = 15\text{ V}$; $R_L = 75\ \Omega$; $T_{amb} = 25^\circ\text{C}$; $d_{in} = -60\text{ dB}$; $f_{(p+g,r)} = 793.25\text{ MHz}$	1.2	—	V
P_{L1}	output power at 1 dB gain compression	$I_C = 120\text{ mA}$; $V_{CE} = 15\text{ V}$; $R_L = 75\ \Omega$; $f = 800\text{ MHz}$; $T_{amb} = 25^\circ\text{C}$	26	—	dBm
ITO	third order intercept point	$I_C = 120\text{ mA}$; $V_{CE} = 15\text{ V}$; $R_L = 75\ \Omega$; $T_{amb} = 25^\circ\text{C}$	45	—	dBm

WARNING

Product and environmental safety - toxic materials

This product contains beryllium oxide. The product is entirely safe provided that the BeO disc is not damaged. All persons who handle, use or dispose of this product should be aware of its nature and of the necessary safety precautions. After use, dispose of as chemical or special waste according to the regulations applying at the location of the user. It must never be thrown out with the general or domestic waste.

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LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CB0}	collector-base voltage	open emitter	—	25	V
V_{CE0}	collector-emitter voltage	open base	—	18	V
V_{EB0}	emitter-base voltage	open collector	—	2	V
I_C	DC collector current		—	150	mA
P_{tot}	total power dissipation	up to $T_c = 160\text{ }^{\circ}\text{C}$	—	2.7	W
T_{stg}	storage temperature		-65	150	$^{\circ}\text{C}$
T_J	junction temperature		—	200	$^{\circ}\text{C}$

THERMAL RESISTANCE

SYMBOL	PARAMETER	THERMAL RESISTANCE
$R_{th\ j-c}$	thermal resistance from junction to case	15 K/W

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CHARACTERISTICS

 $T_j = 25\text{ }^{\circ}\text{C}$ unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	$I_E = 0; V_{CB} = 15\text{ V}$	—	—	100	μA
h_{FE}	DC current gain	$I_C = 75\text{ mA}; V_{CE} = 15\text{ V}$	25	70	—	
		$I_C = 150\text{ mA}; V_{CE} = 15\text{ V}$	25	70	—	
f_T	transition frequency	$I_C = 75\text{ mA}; V_{CE} = 15\text{ V}; f = 500\text{ MHz}$	3	3.5	—	GHz
		$I_C = 150\text{ mA}; V_{CE} = 15\text{ V}; f = 500\text{ MHz}$	3.5	4	—	GHz
C_o	collector capacitance	$I_E = 0; V_{CB} = 15\text{ V}; f = 1\text{ MHz}$	—	2	2.75	pF
C_e	emitter capacitance	$I_C = 0; V_{EB} = 0.5\text{ V}; f = 1\text{ MHz}$	—	11	—	pF
C_{fb}	feedback capacitance	$I_C = 10\text{ mA}; V_{CE} = 15\text{ V}; f = 1\text{ MHz}; T_{amb} = 25\text{ }^{\circ}\text{C}$	—	1	1.35	pF
C_{cs}	collector-stud capacitance	note 1	—	0.8	—	pF
F	noise figure (see Fig.2)	$I_C = 120\text{ mA}; V_{CE} = 15\text{ V}; f = 500\text{ MHz}; T_{amb} = 25\text{ }^{\circ}\text{C}$	—	8	—	dB
G_{UM}	maximum unilateral power gain (note 2)	$I_C = 120\text{ mA}; V_{CE} = 15\text{ V}; f = 500\text{ MHz}; T_{amb} = 25\text{ }^{\circ}\text{C}$	—	16.3	—	dB
V_o	output voltage	Figs 2 and 7 and note 3	—	1.2	—	dB
P_{L1}	output power at 1 dB gain compression (see Fig.2)	note 4	—	26	—	dBm
ITO	third order intercept point (see Fig.2)	note 5	—	45	—	dBm

Notes

1. Measured with grounded emitter and base.

2. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1 - |S_{11}|^2)(1 - |S_{22}|^2)}$ dB.

3. $d_{im} = -60\text{ dB}$ (DIN 45004B, par. 6.3.: 3-tone); $I_C = 120\text{ mA}; V_{CE} = 15\text{ V}; R_L = 75\text{ }\Omega; T_{amb} = 25\text{ }^{\circ}\text{C};$
 $V_p = V_o$ at $d_{im} = -60\text{ dB}; f_p = 795.25\text{ MHz};$
 $V_q = V_o - 6\text{ dB}; f_q = 803.25\text{ MHz};$
 $V_r = V_o - 6\text{ dB}; f_r = 805.25\text{ MHz};$
 measured at $f_{(p-q-r)} = 793.25\text{ MHz}.$

4. $I_C = 120\text{ mA}; V_{CE} = 15\text{ V}; T_{amb} = 25\text{ }^{\circ}\text{C}; R_L = 75\text{ }\Omega;$
 measured at $f = 800\text{ MHz}.$

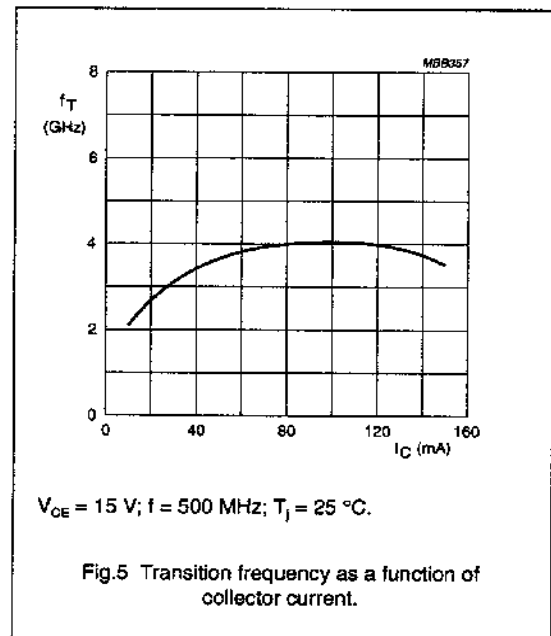
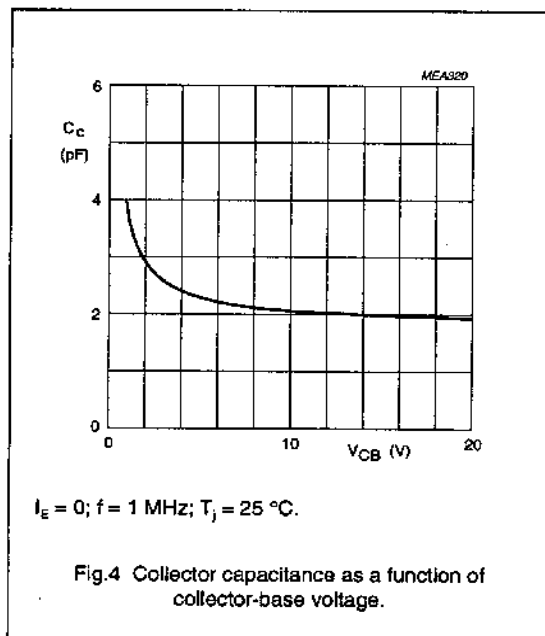
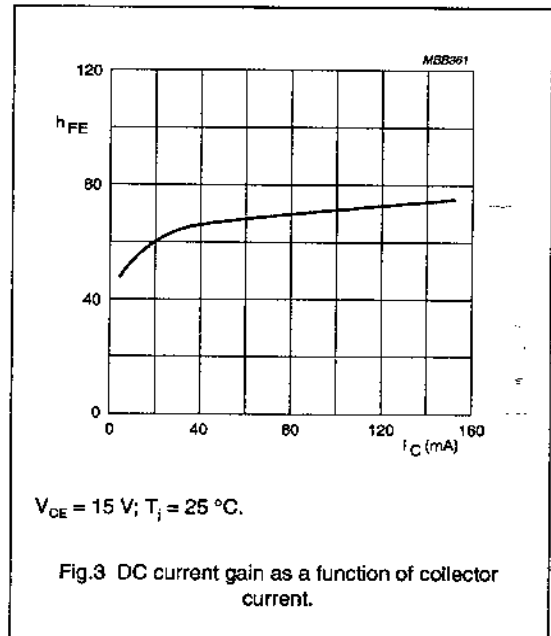
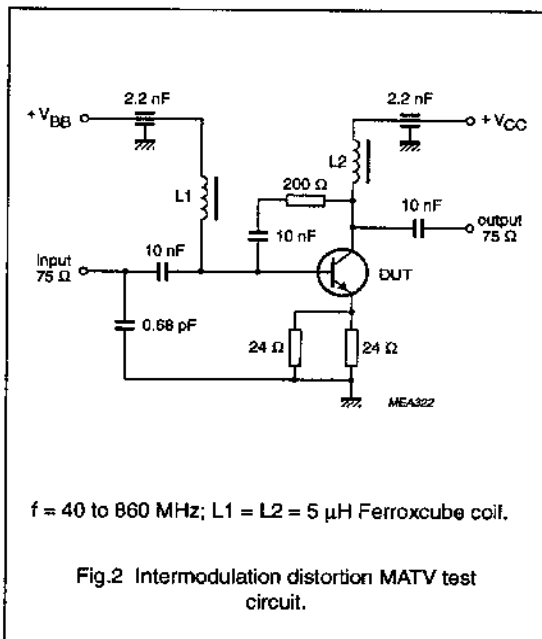
5. $I_C = 120\text{ mA}; V_{CE} = 15\text{ V}; R_L = 75\text{ }\Omega; T_{amb} = 25\text{ }^{\circ}\text{C};$
 $P_p = \text{ITO} - 6\text{ dB}; f_p = 800\text{ MHz};$
 $P_q = \text{ITO} - 6\text{ dB}; f_q = 801\text{ MHz};$
 measured at $f_{(2q-p)} = 802\text{ MHz}$ and at $f_{(2p-q)} = 799\text{ MHz}.$

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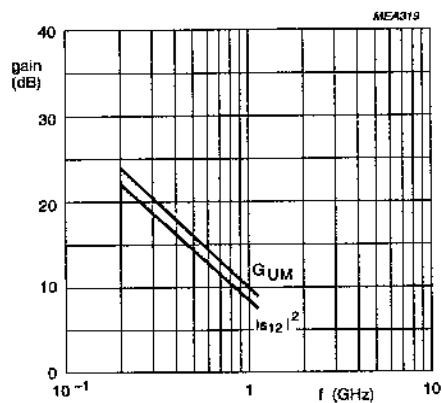


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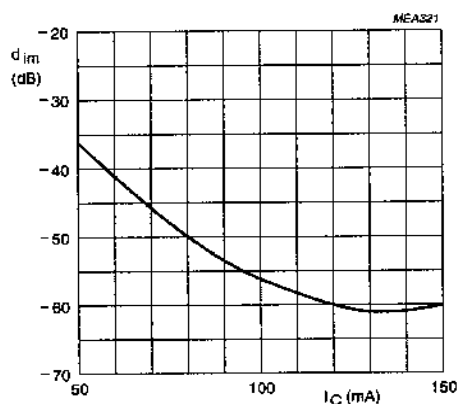
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$I_C = 120 \text{ mA}$; $V_{CE} = 15 \text{ V}$; $T_{amb} = 25^\circ \text{C}$.

Fig.6 Gain as a function of frequency.



$V_O = 1.2 \text{ V}$; $V_{CE} = 15 \text{ V}$; $f_{(p-q-r)} = 793.25 \text{ MHz}$

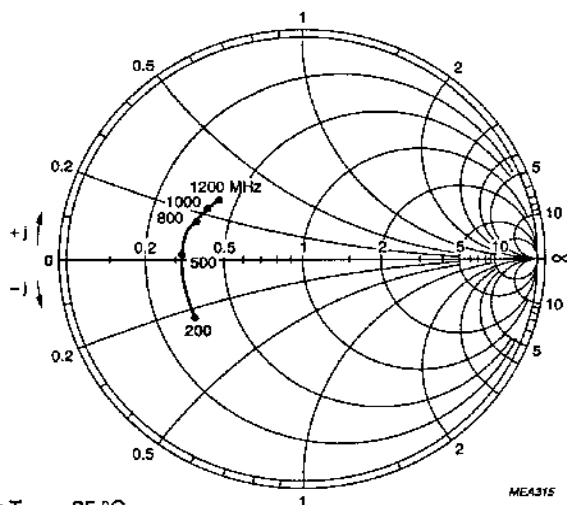
Fig.7 Intermodulation distortion as a function of collector current.

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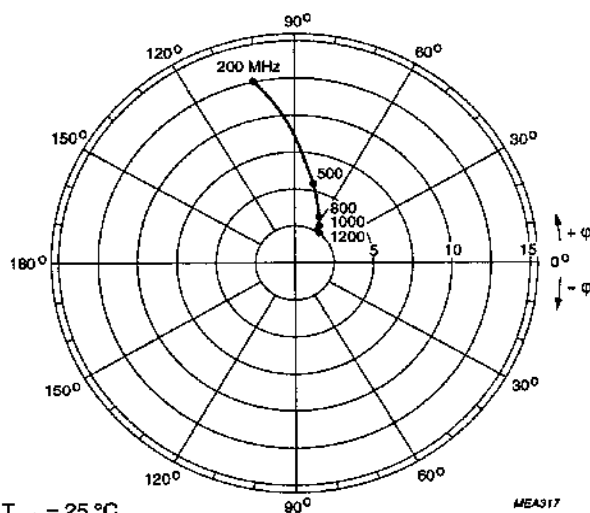
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$I_C = 120 \text{ mA}$; $V_{CE} = 15 \text{ V}$; $T_{amb} = 25^\circ \text{C}$.

Fig.8 Common emitter input reflection coefficient (S_{11}).



$I_C = 120 \text{ mA}$; $V_{CE} = 15 \text{ V}$; $T_{amb} = 25^\circ \text{C}$.

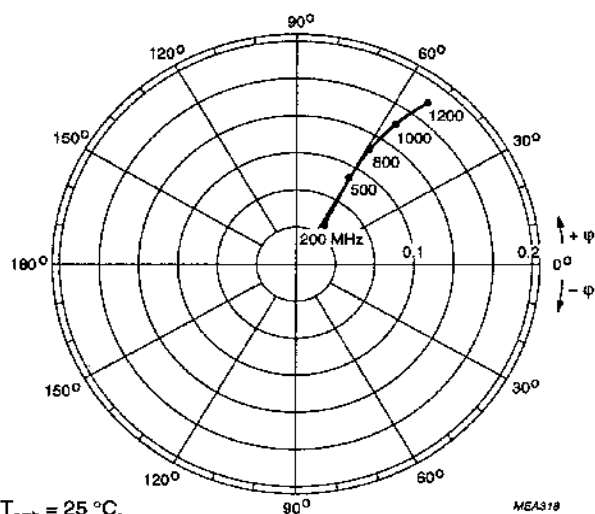
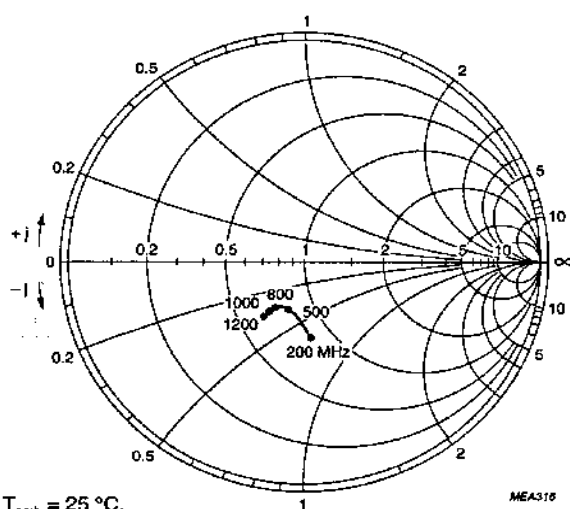
Fig.9 Common emitter forward transmission coefficient (S_{21}).

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Fig.10 Common emitter reverse transmission coefficient (S_{12}).Fig.11 Common emitter output reflection coefficient (S_{22}).

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Table 1 Common emitter scattering parameters, $I_C = 50$ mA; $V_{CE} = 7.5$ V

f (MHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂		G _{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.5	-72	0.02	64	30.5	147	0.9	-34	36.3
200	0.6	-154	0.06	52	11.3	101	0.4	-84	23.2
500	0.5	177	0.08	58	4.9	78	0.3	-104	15.6
800	0.5	160	0.12	58	3.2	63	0.3	-113	11.8
1000	0.5	150	0.15	57	2.6	54	0.3	-118	9.9
1200	0.5	142	0.18	54	2.2	46	0.3	-122	8.3

Table 2 Common emitter scattering parameters, $I_C = 75$ mA; $V_{CE} = 7.5$ V

f (MHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂		G _{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.5	-76	0.02	64	32.1	144	0.8	-36	36.2
200	0.5	-156	0.05	53	11.6	100	0.4	-90	23.4
500	0.5	176	0.08	59	5.0	78	0.2	-112	15.7
800	0.5	160	0.13	63	3.3	63	0.2	-121	11.9
1000	0.5	150	0.16	57	2.7	55	0.2	-124	10.1
1200	0.5	142	0.18	54	2.3	47	0.3	-128	8.6

Table 3 Common emitter scattering parameters, $I_C = 100$ mA; $V_{CE} = 7.5$ V

f (MHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂		G _{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.4	-79	0.02	63	33.0	145	0.8	-37	36.2
200	0.5	-152	0.06	54	11.8	100	0.4	-93	23.5
500	0.5	175	0.09	60	5.1	78	0.2	-117	15.8
800	0.5	159	0.13	59	3.3	64	0.2	-126	11.9
1000	0.5	150	0.16	57	2.7	55	0.2	-129	10.1
1200	0.5	142	0.19	54	2.3	47	0.3	-131	8.6

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Table 4 Common emitter scattering parameters, $I_C = 120$ mA; $V_{CE} = 7.5$ V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.4	-81	0.02	63	33.5	145	0.8	-38	36.2
200	0.5	-157	0.05	55	12.0	99	0.4	-95	23.6
500	0.5	175	0.09	60	5.1	77	0.2	-119	15.8
800	0.5	159	0.13	59	3.3	63	0.2	-128	11.9
1000	0.5	149	0.16	56	2.7	55	0.2	-131	10.0
1200	0.5	141	0.19	53	2.3	47	0.3	-132	8.5

Table 5 Common emitter scattering parameters, $I_C = 150$ mA; $V_{CE} = 7.5$ V

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		G_{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.4	-82	0.02	63	33.6	145	0.8	-39	36.1
200	0.5	-158	0.05	55	11.8	99	0.3	-96	23.5
500	0.5	175	0.09	60	5.1	77	0.2	-121	15.8
800	0.5	159	0.13	59	3.3	63	0.2	-129	11.9
1000	0.5	149	0.16	56	2.7	55	0.2	-132	10.1
1200	0.5	141	0.19	53	2.3	47	0.3	-134	8.6

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Table 6 Common emitter scattering parameters, $I_C = 50$ mA; $V_{CE} = 15$ V

f (MHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂		G _{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.5	-65	0.02	62	31.0	148	0.8	-30	36.0
200	0.5	-149	0.04	52	12.0	102	0.4	-73	23.7
500	0.5	179	0.08	58	5.2	78	0.3	-89	16.0
800	0.5	162	0.12	59	3.4	64	0.3	-99	12.2
1000	0.5	152	0.14	57	2.8	55	0.3	-104	10.4
1200	0.5	144	0.2	55	2.3	47	0.3	-109	8.7

Table 7 Common emitter scattering parameters, $I_C = 75$ mA; $V_{CE} = 15$ V

f (MHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂		G _{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.5	-68	0.02	62	32.9	148	0.8	-32	36.2
200	0.5	-151	0.04	53	12.5	101	0.4	-79	23.9
500	0.5	178	0.08	59	5.4	78	0.2	-97	16.2
800	0.5	161	0.12	59	3.5	64	0.2	-106	12.3
1000	0.5	152	0.15	57	2.8	56	0.3	-110	10.3
1200	0.4	144	0.17	55	2.4	48	0.3	-114	8.9

Table 8 Common emitter scattering parameters, $I_C = 100$ mA; $V_{CE} = 15$ V

f (MHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂		G _{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.5	-69	0.02	62	33.9	147	0.8	-34	36.3
200	0.5	-151	0.04	54	12.6	101	0.4	-82	23.9
500	0.5	178	0.08	59	5.5	78	0.2	-101	16.3
800	0.5	161	0.12	59	3.5	64	0.2	-109	12.3
1000	0.5	152	0.15	57	2.9	56	0.3	-113	10.5
1200	0.4	144	0.18	54	2.4	48	0.3	-117	8.8

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Table 9 Common emitter scattering parameters, $I_C = 120$ mA; $V_{CE} = 15$ V

f (MHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂		G _{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.5	-69	0.02	62	34.6	146	0.8	-32	36.5
200	0.5	-151	0.04	54	12.7	101	0.4	-83	24.0
500	0.5	178	0.08	60	5.5	78	0.2	-103	16.3
800	0.5	161	0.12	59	3.5	64	0.2	-112	12.3
1000	0.5	152	0.15	57	2.9	56	0.2	-115	10.5
1200	0.4	144	0.18	54	2.4	48	0.3	-118	8.8

Table 10 Common emitter scattering parameters, $I_C = 150$ mA; $V_{CE} = 15$ V

f (MHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂		G _{UM} (dB)
	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	MAG. (RAT)	ANG. (DEG)	
40	0.5	-70	0.02	61	34.8	146	0.8	-35	36.5
200	0.5	-152	0.04	54	12.6	100	0.3	-84	23.9
500	0.5	178	0.08	60	5.4	78	0.2	-103	16.1
800	0.5	162	0.12	59	3.5	64	0.2	-111	12.3
1000	0.5	152	0.15	57	2.8	55	0.2	-114	9.6
1200	0.4	144	0.18	54	2.3	48	0.3	-117	8.9