NPN 4 GHz wideband transistor

BFQ34T

DESCRIPTION

NPN transistor in a plastic SOT37 envelope, intended for wideband amplification applications. The device features high output voltage capabilities.

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

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

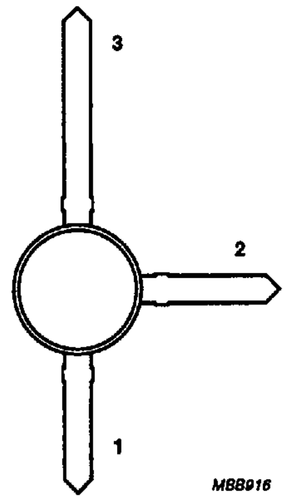

Fig.1 SOT37.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	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_s = 145 °C (note 1)	–	–	1	W
h_{FE}	DC current gain	I_C = 100 mA; V_{CE} = 10 V; T_j = 25 °C	25	70	–	
f_T	transition frequency	I_C = 100 mA; V_{CE} = 10 V; f = 800 MHz; T_j = 25 °C	–	3.7	–	GHz
G_{UM}	maximum unilateral power gain	I_C = 100 mA; V_{CE} = 10 V; f = 800 MHz; T_{amb} = 25 °C	–	12	–	dB
V_O	output voltage	d_{im} = –60 dB; I_C = 90 mA; V_{CE} = 10 V; R_L = 75 Ω; T_{amb} = 25 °C; $f_{(p+q-r)}$ = 793.25 MHz	–	750	–	mV
P_{L1}	output power at 1 dB gain compression	V_{CE} = 10 V; I_C = 90 mA; f = 800 MHz; T_{amb} = 25 °C	–	22	–	dBm
ITO	third order intercept point	I_C = 90 mA; V_{CE} = 10 V; f = 800 MHz; T_{amb} = 25 °C	–	41	–	dBm

Note

1. T_s is the temperature at the soldering point of the collector lead.

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LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	25	V
V_{CEO}	collector-emitter voltage	open base	–	18	V
V_{EBO}	emitter-base voltage	open collector	–	2	V
I_C	DC collector current		–	150	mA
P_{tot}	total power dissipation	up to T_s = 145 °C (note 1)	–	1	W
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	175	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 145 °C (note 1)	30 K/W

Note

1. T_s is the temperature at the soldering point of the collector lead.

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CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 15 V	–	–	100	µA
h_{FE}	DC current gain	I_C = 100 mA; V_{CE} = 10 V	25	70	–	
f_T	transition frequency	I_C = 100 mA; V_{CE} = 10 V; f = 800 MHz	–	3.7	–	GHz
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 10 V; f = 1 MHz	–	2	–	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = 0.5 V; f = 1 MHz	–	10	–	pF
C_{re}	feedback capacitance	I_C = 0; V_{CE} = 10 V; f = 1 MHz	–	1.2	–	pF
G_{UM}	maximum unilateral power gain (note 1)	I_C = 100 mA; V_{CE} = 10 V; f = 800 MHz; T_{amb} = 25 °C	–	12	–	dB
d_2	second order intermodulation distortion (Fig.2)	note 2	–	−55	–	dB
V_O	output voltage	note 3	–	1	–	V
		note 4	–	750	–	mV
P_{L1}	output power at 1 dB gain compression	I_C = 90 mA; V_{CE} = 10 V; T_{amb} = 25 °C; measured at f = 800 MHz	–	22	–	dBm
ITO	third order intercept point	I_C = 90 mA; V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C	–	41	–	dBm

Notes

1. 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.
2. I_C = 60 mA; V_{CE} = 10 V; R_L = 75 Ω; T_{amb} = 25 °C;
   $V_q = V_p = V_O$ = 48 dBmV; f_p = 560 MHz;
   $V_q = V_O$ = 50 dBmV; f_q = 250 MHz;
   measured at $f_{(p+q)}$ = 810 MHz.
3. d_{im} = −60 dB (DIN 45004B); I_C = 100 mA; V_{CE} = 10 V; R_L = 75 Ω; T_{amb} = 25 °C;
   $V_p = V_O$ at d_{im} = −60 dB; f_p = 287.25 MHz;
   $V_q = V_O$ −6 dB; f_q = 294.25 MHz;
   $V_r = V_O$ −6 dB; f_r = 295.25 MHz;
   measured at $f_{(p+q-r)}$ = 285.25 MHz.
4. d_{im} = −60 dB (DIN 45004B); I_C = 90 mA; V_{CE} = 10 V; R_L = 75 Ω; T_{amb} = 25 °C;
   $V_p = V_O$ at d_{im} = −60 dB; f_p = 797.25 MHz;
   $V_q = V_O$ −6 dB; f_q = 803.25 MHz;
   $V_r = V_O$ −6 dB; f_r = 805.25 MHz;
   measured at $f_{(p+q-r)}$ = 793.25 MHz.

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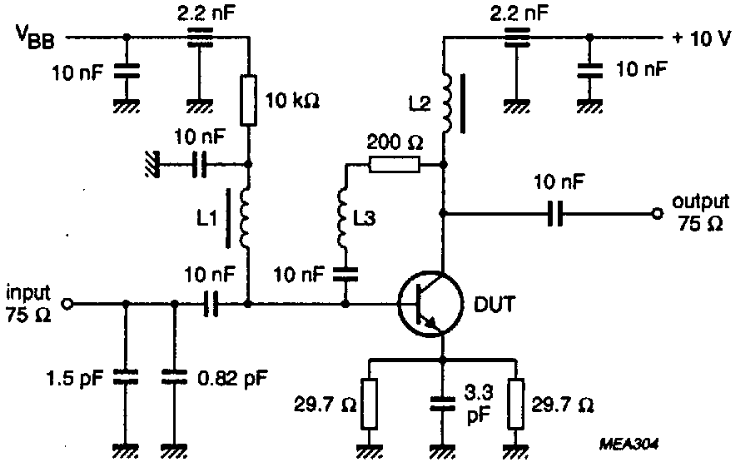


L1 = L2 = 5 µH Ferroxcube choke.

L3 = 2 turns 0.5 mm copper wire; winding pitch 2 mm; internal diameter 4 mm.

Fig.2 Intermodulation distortion and second order intermodulation distortion MATV test circuit.

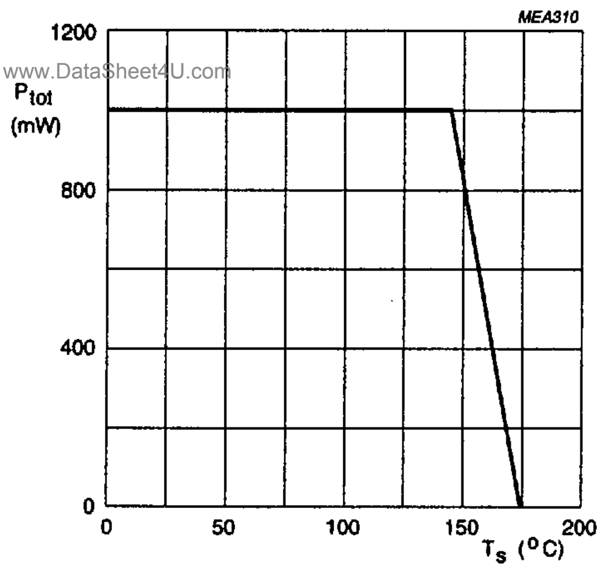
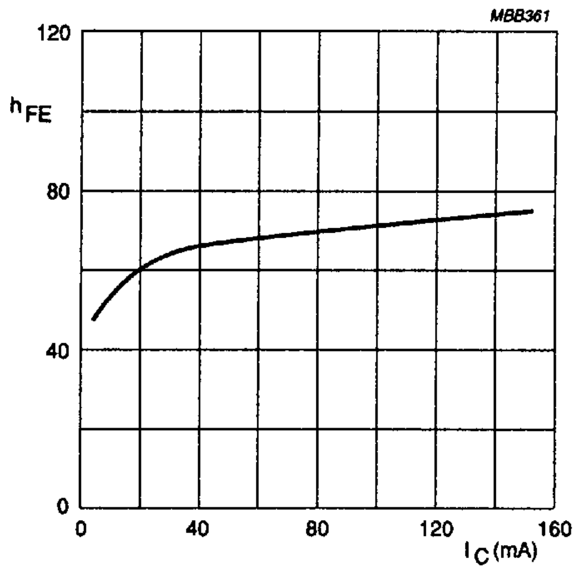


Fig.3 Power derating curve.



V_{CE} = 10 V; T_j = 25 °C.

Fig.4 DC current gain as a function of collector current.

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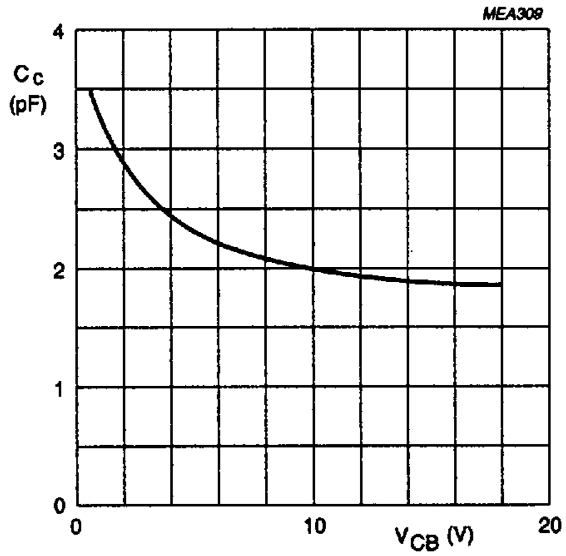
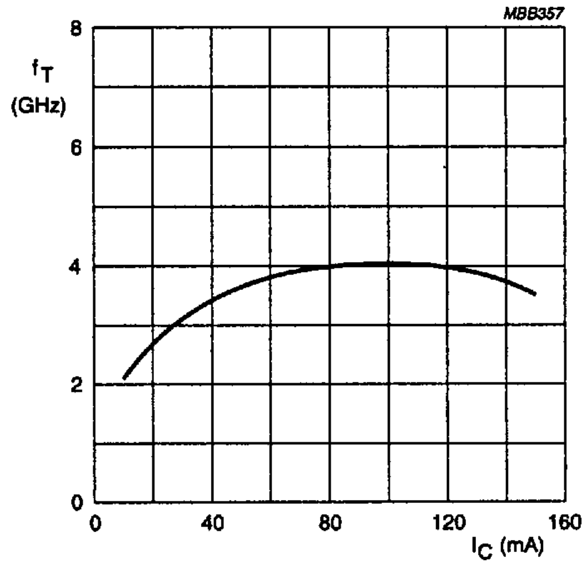


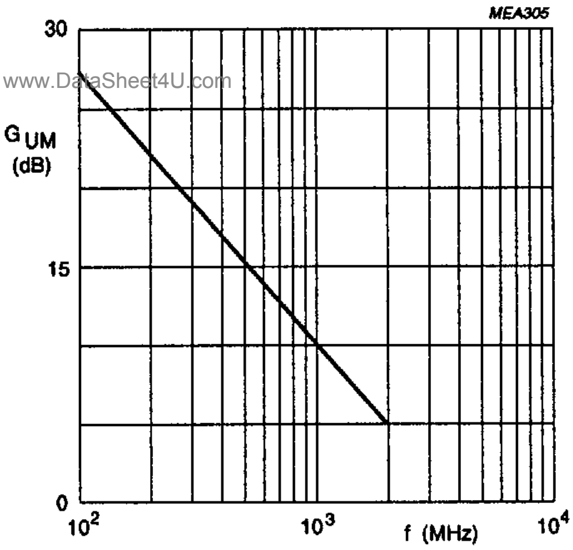
$I_E = 0$; f = 1 MHz; $T_j = 25$ °C.

Fig.5 Collector capacitance as a function of collector-base voltage.



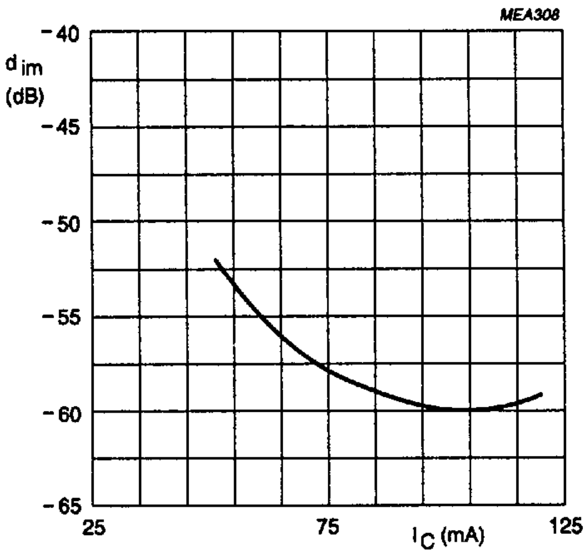
$V_{CE} = 10$ V; f = 800 MHz; $T_j = 25$ °C.

Fig.6 Transition frequency as a function of collector current.



$I_C = 100$ mA; $V_{CE} = 10$ V; $T_{amb} = 25$ °C.

Fig.7 Maximum unilateral power gain as a function of frequency.



$V_{CE} = 10$ V; $V_O = 750$ mV; $T_{amb} = 25$ °C;
$f_{(p+q-r)} = 793.25$ MHz.

Fig.8 Intermodulation distortion as a function of collector current.

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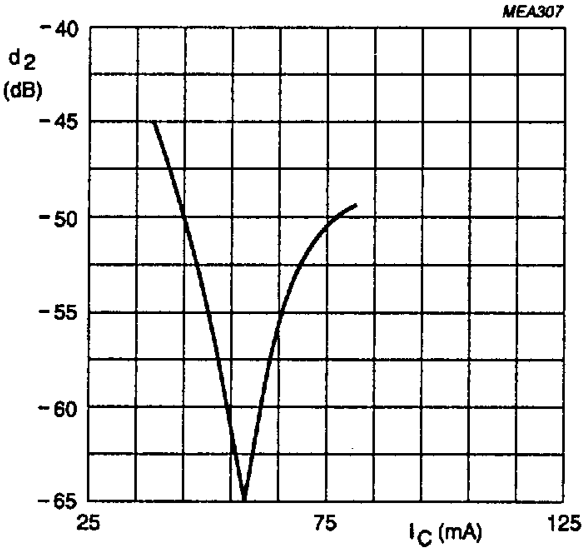
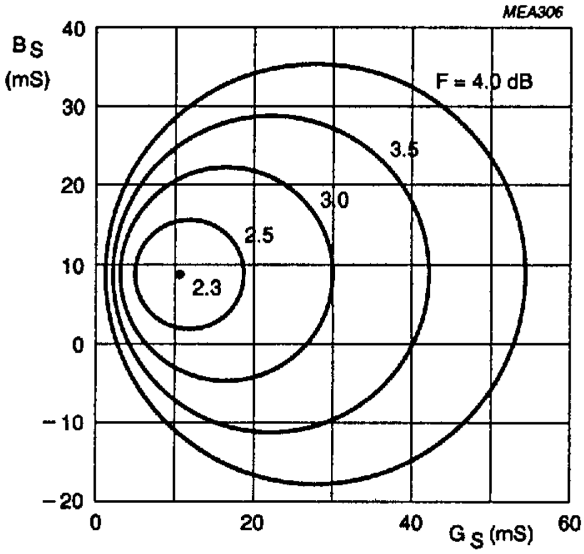


V_{CE} = 10 V; V_O = 48 dBmV; T_{amb} = 25 °C;
f_p = 560 MHz; f_q = 250 MHz; $f_{(p+q)}$ = 810 MHz.

Fig.9 Second order intermodulation distortion as a function of collector current.



I_C = 20 mA; V_{CE} = 10 V; f = 800 MHz; T_{amb} = 25 °C.

Fig.10 Noise circle figure.

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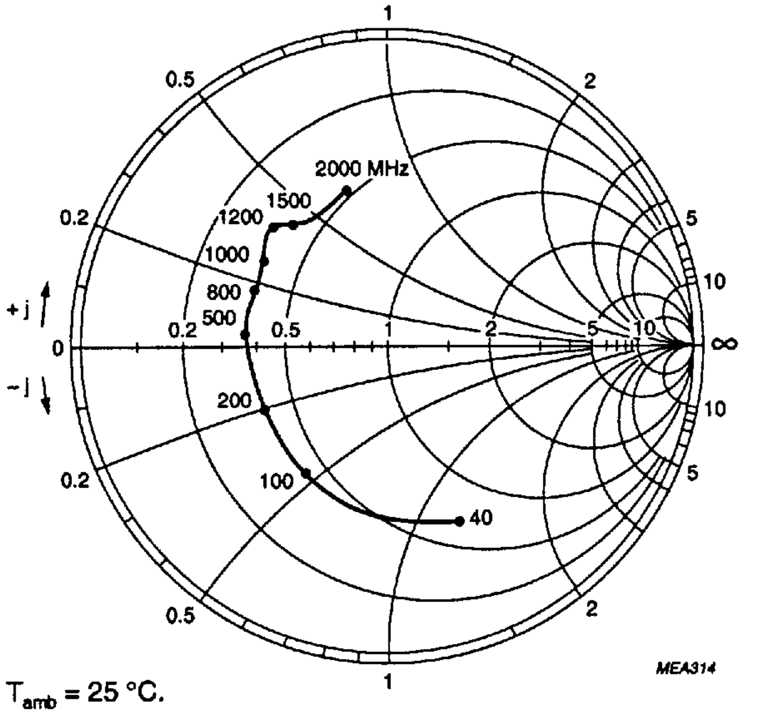
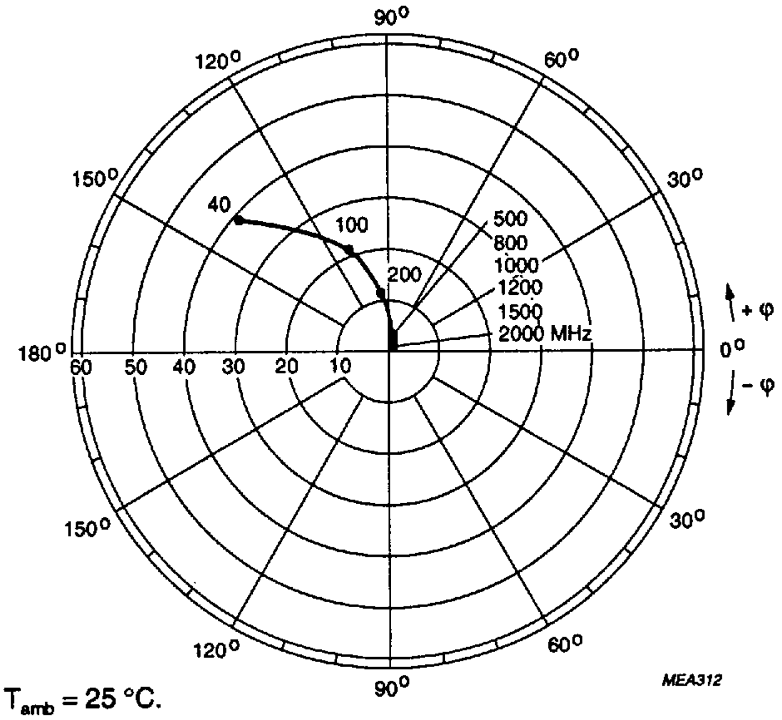


I_C = 100 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

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



I_C = 100 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.12 Common emitter forward transmission coefficient (S_{21}).

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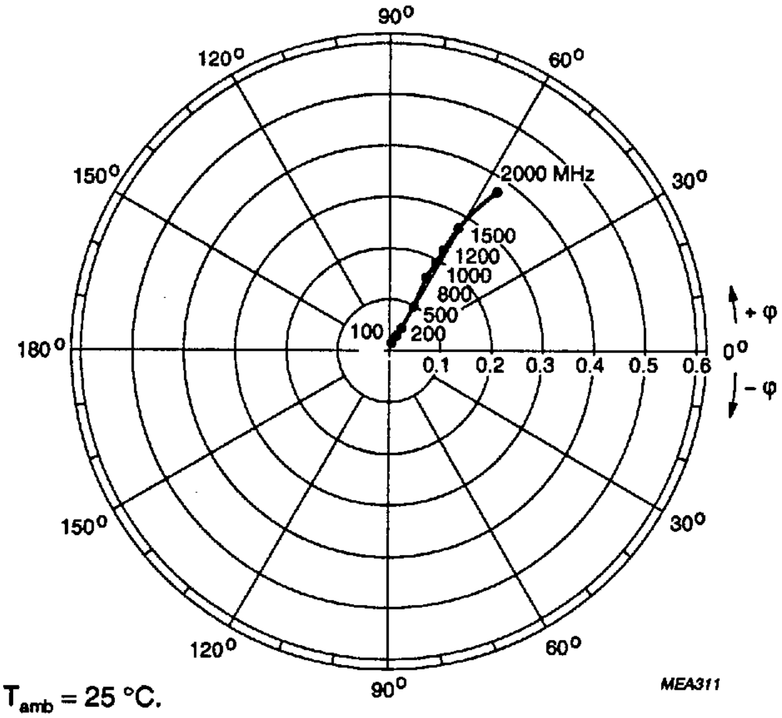
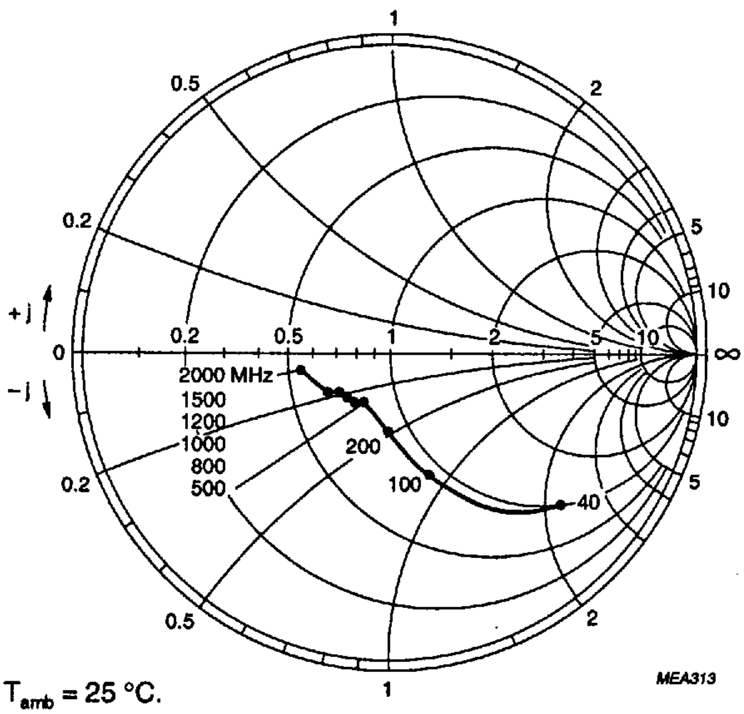


I_C = 100 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.13 Common emitter reverse transmission coefficient (S_{12}).



I_C = 100 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.14 Common emitter output reflection coefficient (S_{22}).

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Table 1 Common emitter scattering parameters, I_C = 70 mA; V_{CE} = 10 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.459	−73.8	32.733	142.7	0.019	65.0	0.801	−35.7	35.8
100	0.469	−126.0	19.677	116.6	0.033	56.9	0.500	−61.7	28.2
200	0.479	−156.6	10.977	98.5	0.048	58.6	0.307	−78.8	22.4
300	0.483	−171.9	7.424	89.5	0.063	61.8	0.241	−88.2	18.8
400	0.507	179.1	5.674	82.8	0.078	64.1	0.216	−94.6	16.6
500	0.507	172.8	4.597	77.4	0.093	66.0	0.211	−100.5	14.7
600	0.488	165.6	3.858	73.2	0.108	66.2	0.212	−105.1	13.1
700	0.511	159.7	3.356	68.7	0.124	65.8	0.217	−108.3	12.0
800	0.507	153.1	2.937	64.2	0.138	66.5	0.223	−111.7	10.9
900	0.521	147.9	2.643	60.4	0.156	66.1	0.229	−114.9	10.1
1000	0.526	142.5	2.364	56.4	0.172	65.3	0.237	−118.5	9.1
1200	0.554	133.2	2.041	49.9	0.203	63.5	0.254	−127.3	8.1
1400	0.549	125.2	1.760	42.5	0.229	61.7	0.281	−136.1	6.8
1600	0.578	118.3	1.552	36.3	0.263	60.1	0.315	−142.3	6.0
1800	0.580	109.9	1.403	30.5	0.292	56.7	0.344	−148.6	5.3
2000	0.613	100.8	1.302	25.5	0.322	54.6	0.363	−154.8	5.0

Table 2 Common emitter scattering parameters, I_C = 100 mA; V_{CE} = 10 V

f (MHz)	S_{11} MAG. (RAT)	S_{11} ANG. (DEG)	S_{21} MAG. (RAT)	S_{21} ANG. (DEG)	S_{12} MAG. (RAT)	S_{12} ANG. (DEG)	S_{22} MAG. (RAT)	S_{22} ANG. (DEG)	G_{UM} (dB)
40	0.463	−74.1	33.964	141.6	0.020	64.0	0.786	−37.5	35.8
100	0.475	−126.8	20.065	115.5	0.033	58.0	0.481	−64.3	28.3
200	0.484	−156.8	11.112	98.0	0.048	57.9	0.294	−82.6	22.5
300	0.479	−173.0	7.528	89.3	0.062	61.6	0.230	−92.9	18.9
400	0.494	177.7	5.729	82.6	0.079	64.5	0.210	−99.6	16.6
500	0.487	172.5	4.642	77.2	0.094	65.6	0.204	−105.5	14.7
600	0.487	164.6	3.896	73.1	0.110	66.5	0.205	−110.0	13.2
700	0.503	159.6	3.382	68.7	0.127	66.0	0.210	−113.1	12.0
800	0.506	151.9	2.965	64.1	0.141	66.1	0.216	−116.1	10.9
900	0.512	148.2	2.667	60.5	0.159	65.2	0.221	−119.3	10.1
1000	0.525	142.8	2.384	56.6	0.174	64.7	0.228	−122.5	9.2
1200	0.544	133.5	2.069	50.4	0.205	62.8	0.245	−131.4	8.1
1400	0.555	124.4	1.773	42.8	0.232	61.1	0.273	−139.3	6.9
1600	0.579	117.7	1.578	36.7	0.264	59.3	0.307	−145.3	6.2
1800	0.587	110.0	1.434	31.1	0.293	55.8	0.332	−151.1	5.5
2000	0.617	101.6	1.310	26.5	0.322	53.5	0.353	−157.1	5.0