NPN 4 GHz wideband transistor

BFQ34

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

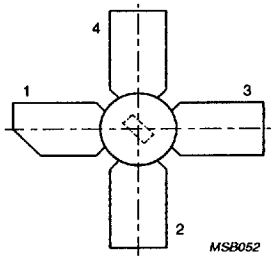


Fig.1 SOT122A.

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 °C	–	2.7	W
f_T	transition frequency	I_C = 150 mA; V_{CE} = 15 V; f = 500 MHz	4	–	GHz
V_O	output voltage	I_C = 120 mA; V_{CE} = 15 V; R_L = 75 Ω; T_{amb} = 25 °C; d_{im} = –60 dB $f_{(p+q-r)}$ = 793.25 MHz	1.2	–	V
P_{L1}	output power at 1 dB gain compression	I_C = 120 mA; V_{CE} = 15 V; R_L = 75 Ω; f = 800 MHz; T_{amb} = 25 °C	26	–	dBm
ITO	third order intercept point	I_C = 120 mA; V_{CE} = 15 V; R_L = 75 Ω; T_{amb} = 25 °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.

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_c = 160 °C	–	2.7	W
T_{stg}	storage temperature		–65	150	°C
T_j	junction temperature		–	200	°C

THERMAL RESISTANCE

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

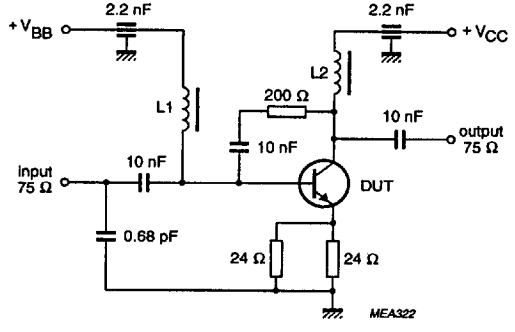
CHARACTERISTICS

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 = 75 mA; V_{CE} = 15 V	25	70	–	
		I_C = 150 mA; V_{CE} = 15 V	25	70	–	
f_T	transition frequency	I_C = 75 mA; V_{CE} = 15 V; f = 500 MHz	3	3.5	–	GHz
		I_C = 150 mA; V_{CE} = 15 V; f = 500 MHz	3.5	4	–	GHz
C_c	collector capacitance	I_E = 0; V_{CB} = 15 V; f = 1 MHz	–	2	2.75	pF
C_e	emitter capacitance	I_C = 0; V_{EB} = 0.5 V; f = 1 MHz	–	11	–	pF
C_{re}	feedback capacitance	I_C = 10 mA; V_{CE} = 15 V; f = 1 MHz; T_{amb} = 25 °C	–	1	1.35	pF
C_{c-s}	collector-stud capacitance	note 1	–	0.8	–	pF
F	noise figure (see Fig.2)	I_C = 120 mA; V_{CE} = 15 V; f = 500 MHz; T_{amb} = 25 °C	–	8	–	dB
G_{UM}	maximum unilateral power gain (note 2)	I_C = 120 mA; V_{CE} = 15 V; f = 500 MHz; T_{amb} = 25 °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

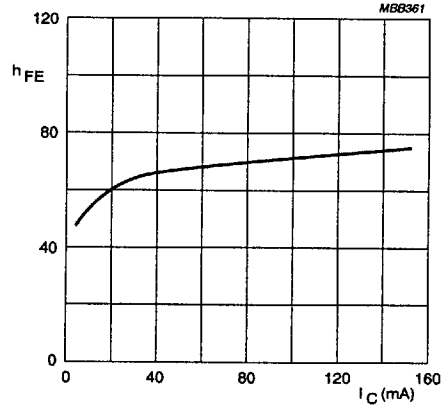
Notes

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 dB (DIN 45004B, par. 6.3.: 3-tone); I_C = 120 mA; V_{CE} = 15 V; R_L = 75 Ω; T_{amb} = 25 °C;
   $V_p = V_O$ at d_{im} = –60 dB; f_p = 795.25 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.
4. I_C = 120 mA; V_{CE} = 15 V; T_{amb} = 25 °C; R_L = 75 Ω;
   measured at f = 800 MHz.
5. I_C = 120 mA; V_{CE} = 15 V; R_L = 75 Ω; T_{amb} = 25 °C;
   P_p = ITO – 6 dB; f_p = 800 MHz;
   P_q = ITO – 6 dB; f_q = 801 MHz;
   measured at $f_{(2q-p)}$ = 802 MHz and at $f_{(2p-q)}$ = 799 MHz.



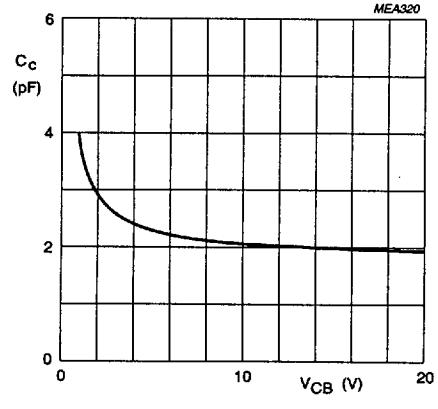
f = 40 to 860 MHz; L1 = L2 = 5 µH Ferroxcube coil.

Fig.2 Intermodulation distortion MATV test circuit.



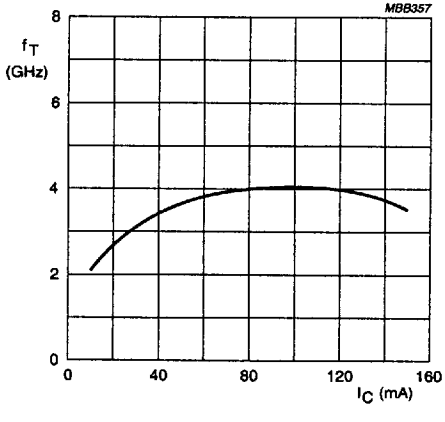
V_{CE} = 15 V; T_j = 25 °C.

Fig.3 DC current gain as a function of collector current.



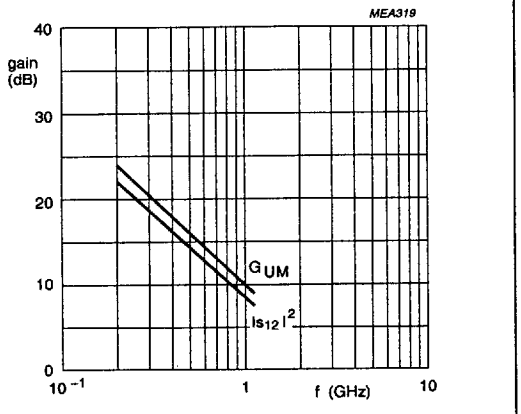
I_E = 0; f = 1 MHz; T_j = 25 °C.

Fig.4 Collector capacitance as a function of collector-base voltage.



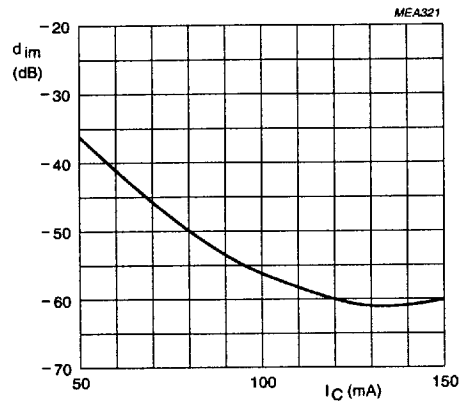
V_{CE} = 15 V; f = 500 MHz; T_j = 25 °C.

Fig.5 Transition frequency as a function of collector current.



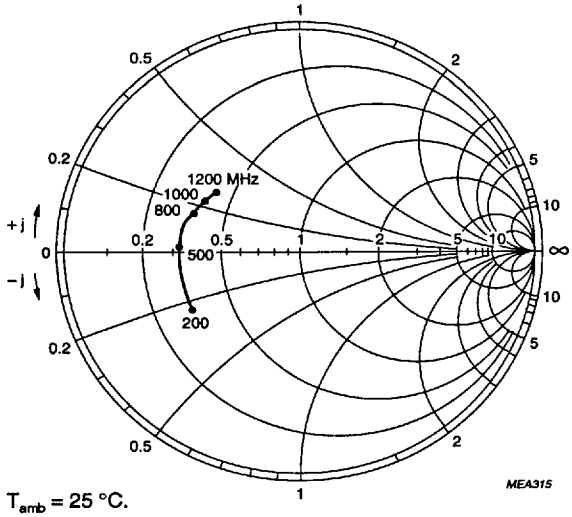
I_C = 120 mA; V_{CE} = 15 V; T_{amb} = 25 °C.

Fig.6 Gain as a function of frequency.



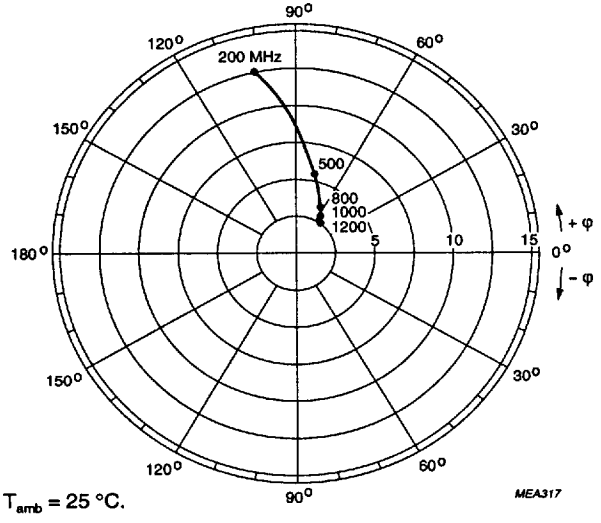
V_O = 1.2 V; V_{CE} = 15 V; $f_{(p+q-r)}$ = 793.25 MHz

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



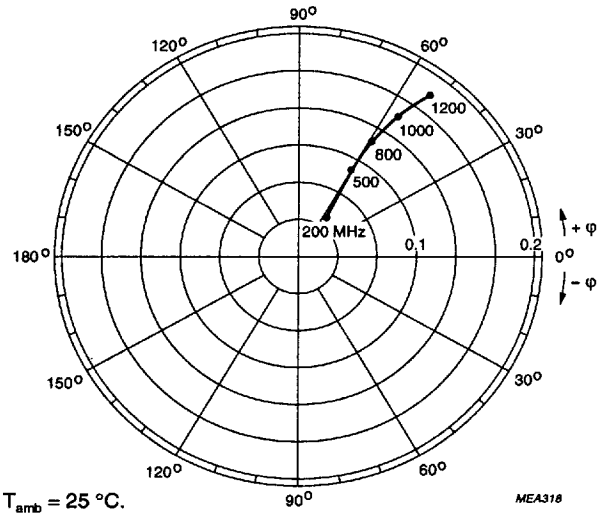
I_C = 120 mA; V_{CE} = 15 V; T_{amb} = 25 °C.

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



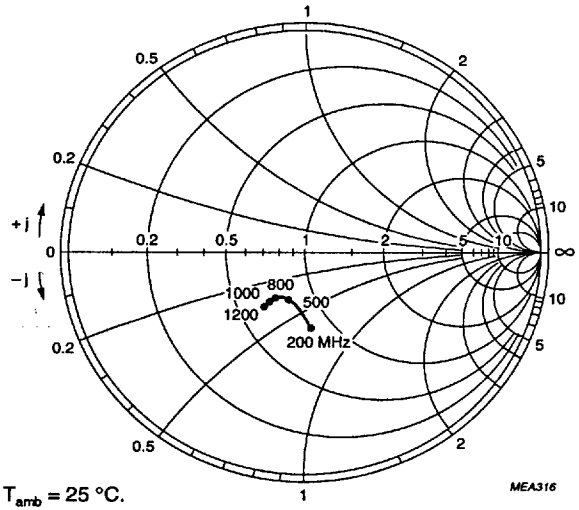
I_C = 120 mA; V_{CE} = 15 V; T_{amb} = 25 °C.

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



I_C = 120 mA; V_{CE} = 15 V; T_{amb} = 25 °C.

Fig.10 Common emitter reverse transmission coefficient (S_{12}).



I_C = 120 mA; V_{CE} = 15 V; T_{amb} = 25 °C.

Fig.11 Common emitter output reflection coefficient (S_{22}).

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

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

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

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