DATA SHEET

BFQ68
NPN 4 GHz wideband transistor

Product specification
File under Discrete Semiconductors, SC14

September 1995

Philips
Semiconductors

PHILIPS

NPN 4 GHz wideband transistor BFQ68

DESCRIPTION

NPN transistor mounted in a four-lead dual-emitter SOT122A envelope with a ceramic cap. All leads are isolated from the stud. Diffused emitter-ballasting resistors and the application of gold sandwich metallization ensure an optimum temperature profile and excellent reliability properties. It features very high output voltage capabilities.

It is primarily intended for final stages in MATV system amplifiers, and is also suitable for use in low power band IV and V equipment.

PINNING

PIN	DESCRIPTION
1	collector
2	emitter
3	base
4	emitter

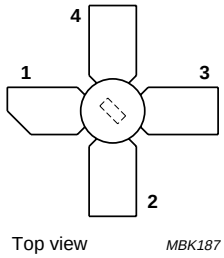


Fig.1 SOT122A.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CEO}	collector-emitter voltage	open base	–	18	V
I_C	collector current		–	300	mA
P_{tot}	total power dissipation	up to T_c = 110 °C	–	4.5	W
f_T	transition frequency	I_C = 240 mA; V_{CE} = 15 V; f = 500 MHz; T_j = 25 °C	4	–	GHz
V_o	output voltage	I_c = 240 mA; V_{CE} = 15 V; d_{im} = –60 dB; R_L = 75 Ω; $f_{(p+q-r)}$ = 793.25 MHz; T_{amb} = 25 °C	1.6	–	V
P_{L1}	output power at 1 dB gain compression	I_c = 240 mA; V_{CE} = 15 V; R_L = 75 Ω; f = 800 MHz; T_{amb} = 25 °C	28	–	dBm
ITO	third order intercept point	I_c = 240 mA; V_{CE} = 15 V; R_L = 75 Ω; f = 800 MHz; T_{amb} = 25 °C	47	–	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		–	300	mA
P_{tot}	total power dissipation	up to T_c = 110 °C	–	4.5	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	20 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

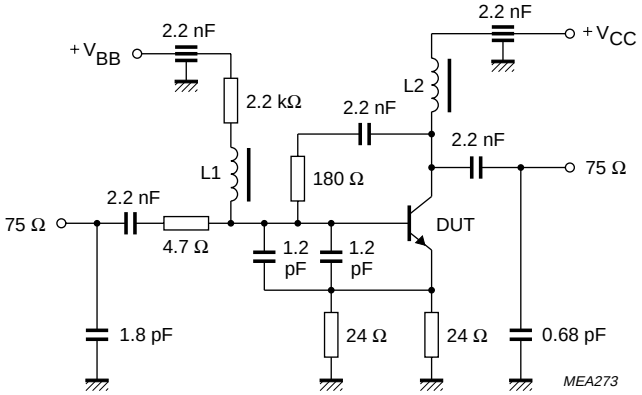
SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 15 V	–	–	50	μA
h_{FE}	DC current gain	I_C = 240 mA; V_{CE} = 15 V	25	75	–	
f_T	transition frequency	I_C = 240 mA; V_{CE} = 15 V; f = 500 MHz	–	4	–	GHz
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 15 V; f = 1 MHz	–	3.8	–	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = 0.5 V; f = 1 MHz	–	20	–	pF
C_{re}	feedback capacitance	I_C = 0; V_{CE} = 15 V; f = 1 MHz	–	2.3	–	pF
C_{cs}	collector-stud capacitance	note 1	–	0.8	–	pF
G_{UM}	maximum unilateral power gain (note 2)	I_C = 240 mA; V_{CE} = 15 V; f = 800 MHz; T_{amb} = 25 °C	–	13	–	dB
V_o	output voltage	note 3	–	1.6	–	V
P_{L1}	output power at 1 dB gain compression (see Fig.2)	I_C = 240 mA; V_{CE} = 15 V; R_L = 75 Ω; T_{amb} = 25 °C; measured at f = 800 MHz	–	28	–	dBm
ITO	third order intercept point (see Fig.2)	note 4	–	47	–	dBm

Notes

1. Measured with emitter and base grounded.
2. G_{UM} is the maximum unilateral power gain, assuming S_{12} is zero and

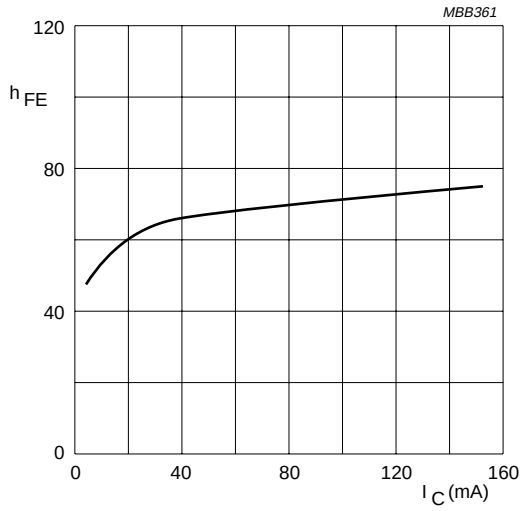
$$G_{UM} = 10 \log \frac{|S_{21}|^2}{\left(1-|S_{11}|^2\right)\left(1-|S_{22}|^2\right)} \text{ dB.}$$

3. d_{im} = −60 dB (see Figs 2 and 7) (DIN 45004B); I_C = 240 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 = 240 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.



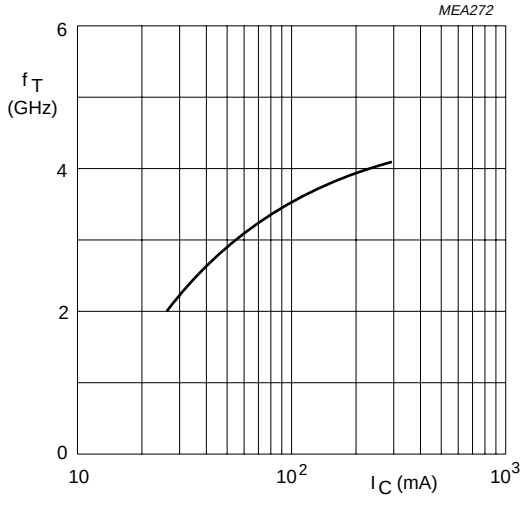
f = 40 to 860 MHz.
L1 = L2 = 5 μH Ferroxcube choke.

Fig.2 Intermodulation distortion MATV test circuit.



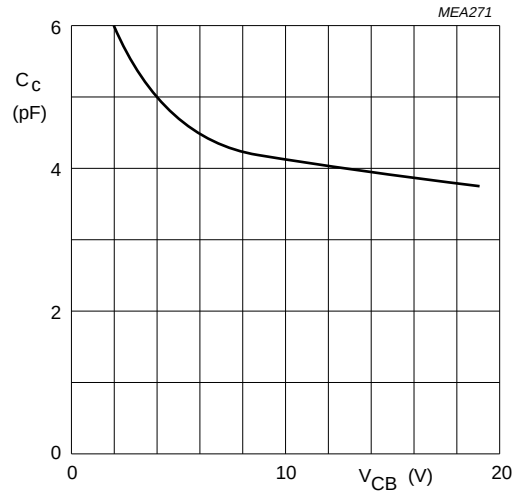
V_{CE} = 10 V; T_j = 25 °C.

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



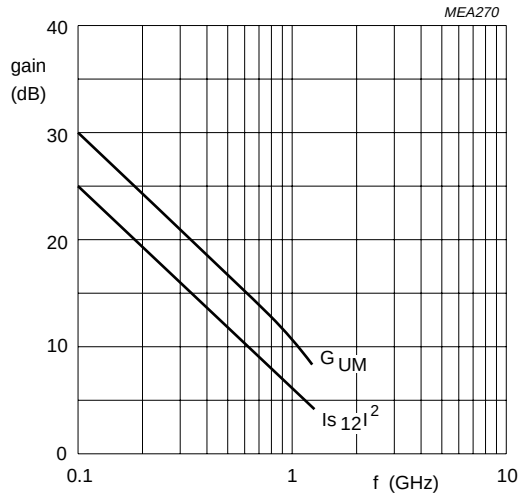
V_{CE} = 15 V; f = 500 MHz; T_j = 25 °C

Fig.4 Transition frequency as a function of collector current.



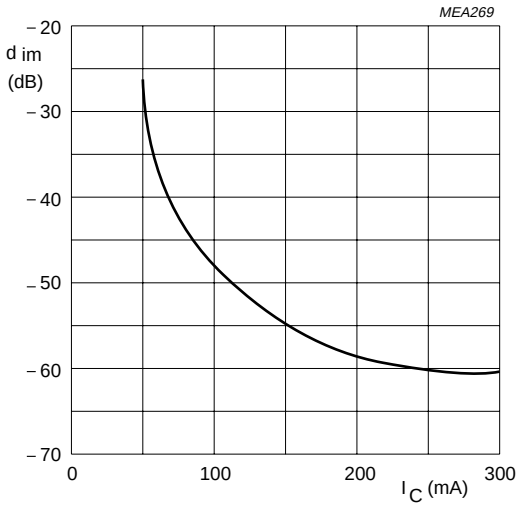
$I_E = i_e = 0$; f = 1 MHz

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



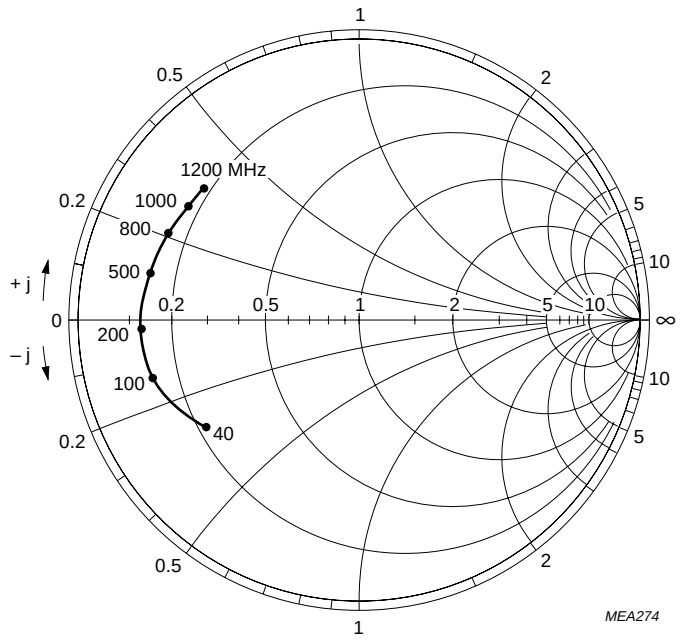
I_C = 240 mA; V_{CE} = 15 V; T_{amb} = 25 °C

Fig.6 Gain as a function of frequency.



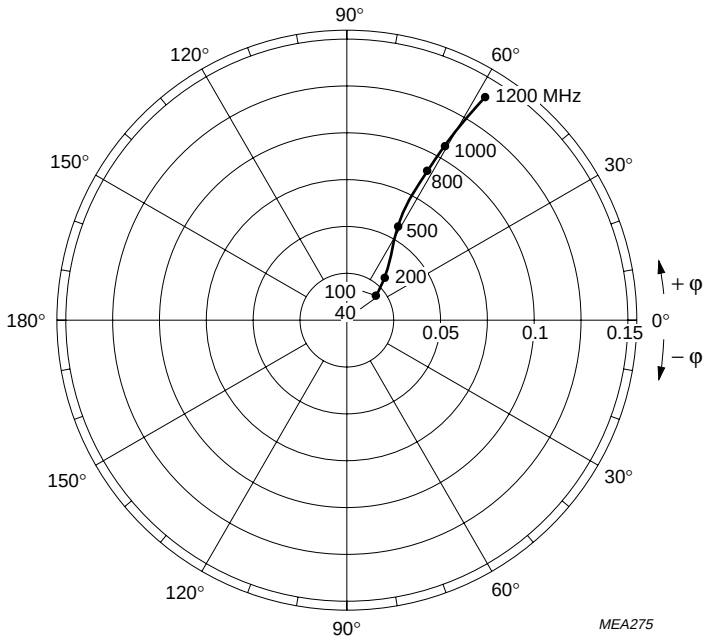
V_{CE} = 15 V; V_o = 1.6 V; $f_{(p+q-r)}$ = 793.25 MHz.

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



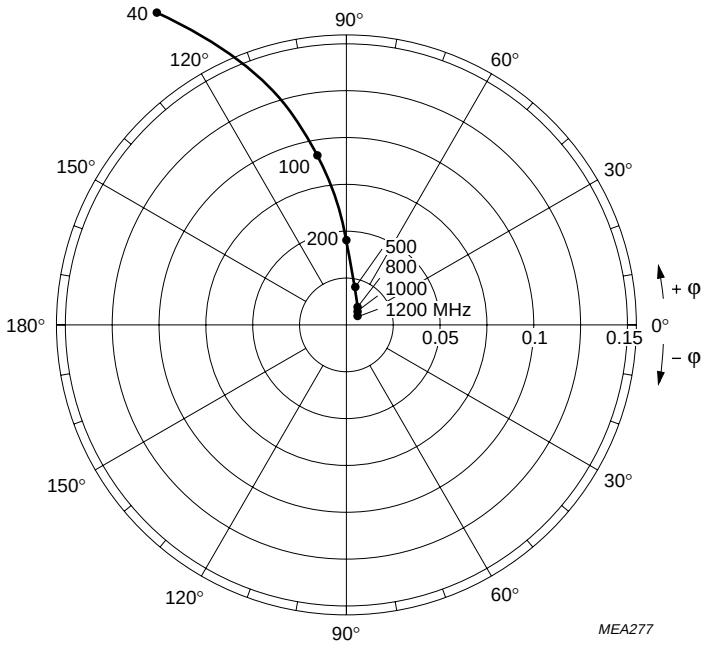
I_C = 240 mA; V_{CE} = 15 V; T_{amb} = 25 °C.
Z_o = 50 Ω.

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



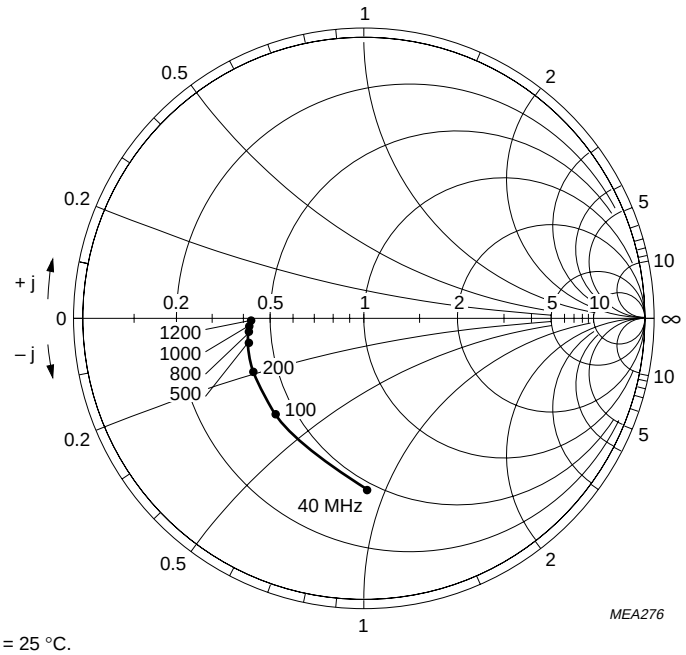
I_C = 240 mA; V_{CE} = 15 V; T_{amb} = 25 °C.

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



I_C = 240 mA; V_{CE} = 15 V; T_{amb} = 25 °C.

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

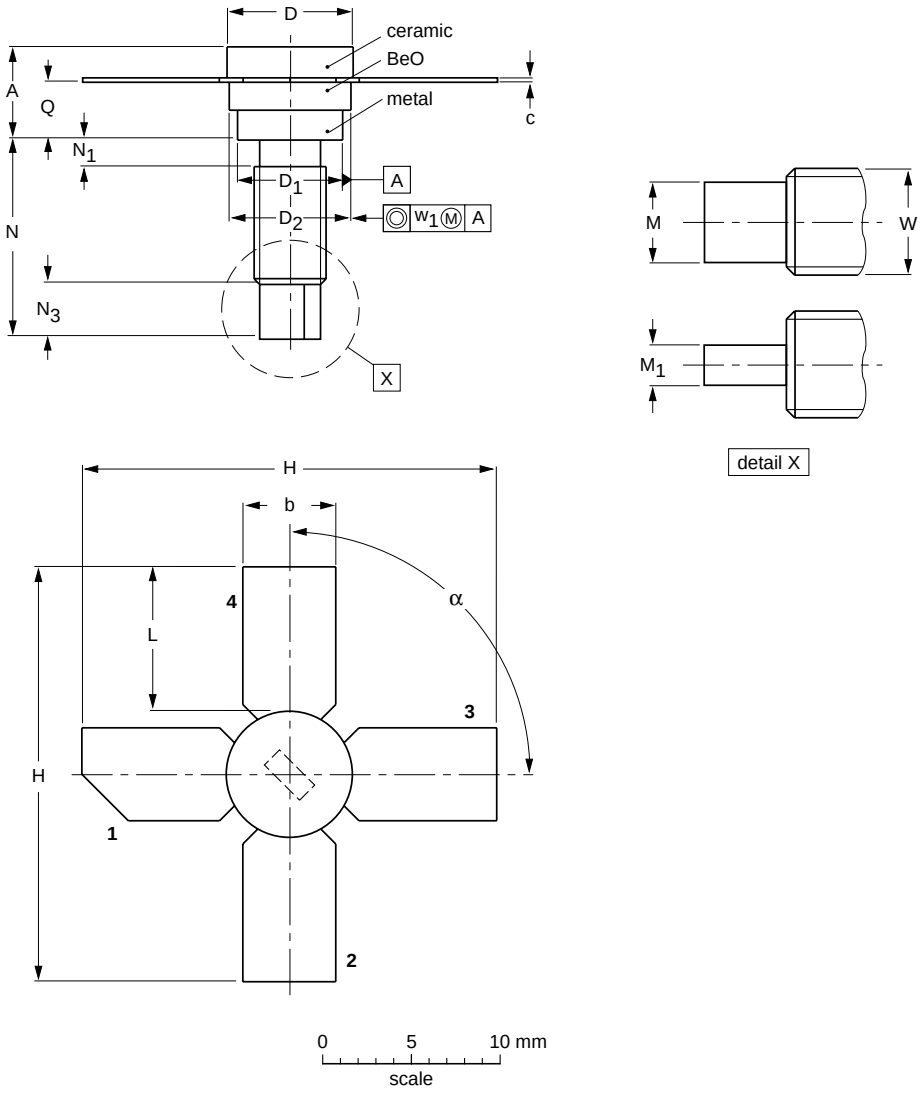


I_C = 240 mA; V_{CE} = 15 V; T_{amb} = 25 °C.
Z_o = 50 Ω.

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

PACKAGE OUTLINE

Studded ceramic package; 4 leads **SOT122A**



DIMENSIONS (millimetre dimensions are derived from the original inch dimensions)

UNIT	A	b	c	D	D_1	D_2	H	L	M_1	M	N	N_1 max.	N_3	Q	W	w_1	α
mm	5.97 4.74	5.85 5.58	0.18 0.14	7.50 7.23	6.48 6.22	7.24 6.93	27.56 25.78	9.91 9.14	3.18 2.66	1.66 1.39	11.82 11.04	1.02	3.86 2.92	3.38 2.74	8-32 UNC	0.381	90°

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT122A						97-04-18

DEFINITIONS

Data Sheet Status	
Objective specification	This data sheet contains target or goal specifications for product development.
Preliminary specification	This data sheet contains preliminary data; supplementary data may be published later.
Product specification	This data sheet contains final product specifications.
Limiting values	
Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.	
Application information	
Where application information is given, it is advisory and does not form part of the specification.	

LIFE SUPPORT APPLICATIONS

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