

# DATA SHEET

**BFQ68**

**NPN 4 GHz wideband transistor**

Product specification  
File under Discrete Semiconductors, SC14

September 1995

# NPN 4 GHz wideband transistor

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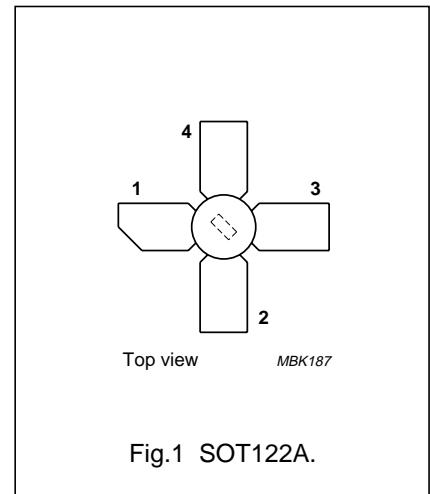
### DESCRIPTION

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



### QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$V_{CE0}$	collector-emitter voltage	open base	—	18	V
$I_C$	collector current		—	300	mA
$P_{tot}$	total power dissipation	up to $T_c = 110\text{ °C}$	—	4.5	W
$f_T$	transition frequency	$I_C = 240\text{ mA}$ ; $V_{CE} = 15\text{ V}$ ; $f = 500\text{ MHz}$ ; $T_j = 25\text{ °C}$	4	—	GHz
$V_o$	output voltage	$I_C = 240\text{ mA}$ ; $V_{CE} = 15\text{ V}$ ; $d_{im} = -60\text{ dB}$ ; $R_L = 75\text{ }\Omega$ ; $f_{(p+q-r)} = 793.25\text{ MHz}$ ; $T_{amb} = 25\text{ °C}$	1.6	—	V
$P_{L1}$	output power at 1 dB gain compression	$I_C = 240\text{ mA}$ ; $V_{CE} = 15\text{ V}$ ; $R_L = 75\text{ }\Omega$ ; $f = 800\text{ MHz}$ ; $T_{amb} = 25\text{ °C}$	28	—	dBm
ITO	third order intercept point	$I_C = 240\text{ mA}$ ; $V_{CE} = 15\text{ V}$ ; $R_L = 75\text{ }\Omega$ ; $f = 800\text{ MHz}$ ; $T_{amb} = 25\text{ °C}$	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.

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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		–	300	mA
$P_{tot}$	total power dissipation	up to $T_C = 110\text{ °C}$	–	4.5	W
$T_{stg}$	storage temperature		–65	150	°C
$T_j$	junction temperature		–	200	°C

**THERMAL RESISTANCE**

SYMBOL	PARAMETER	THERMAL RESISTANCE
$R_{th\ j-c}$	thermal resistance from junction to case	20 K/W

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## CHARACTERISTICS

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

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

## Notes

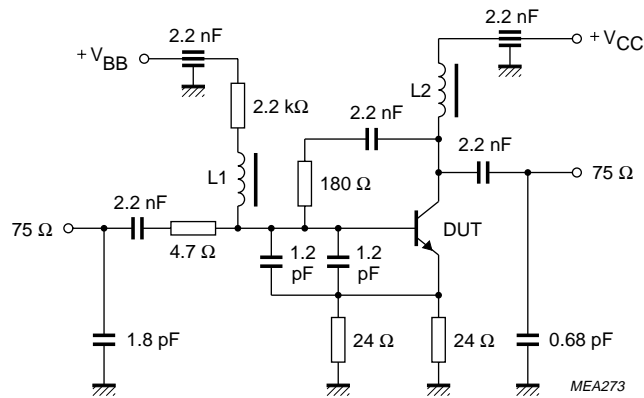
1. Measured with emitter and base grounded.
2.  $G_{UM}$  is the maximum unilateral power gain, assuming  $S_{12}$  is zero and

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

3.  $d_{im} = -60\text{ dB}$  (see Figs 2 and 7) (DIN 45004B);  $I_C = 240\text{ mA}; V_{CE} = 15\text{ V}; R_L = 75\ \Omega; T_{amb} = 25\text{ °C};$   
 $V_p = V_o$  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.  $I_C = 240\text{ mA}; V_{CE} = 15\text{ V}; R_L = 75\ \Omega; T_{amb} = 25\text{ °C};$   
 $P_p = \text{ITO} - 6\text{ dB}; f_p = 800\text{ MHz};$   
 $P_q = \text{ITO} - 6\text{ dB}; f_q = 801\text{ MHz};$   
measured at  $f_{(2q-p)} = 802\text{ MHz}$  and at  $f_{(2p-q)} = 799\text{ MHz}.$

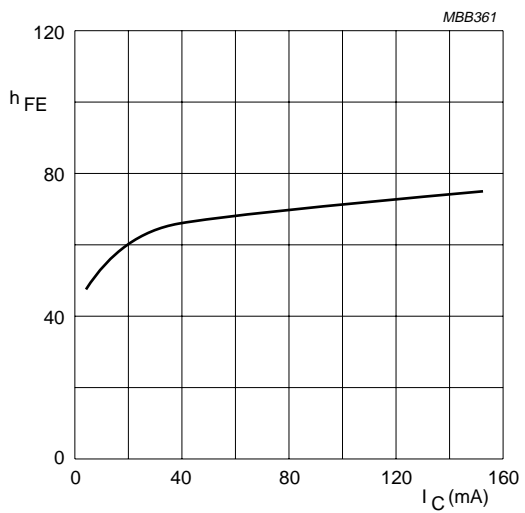
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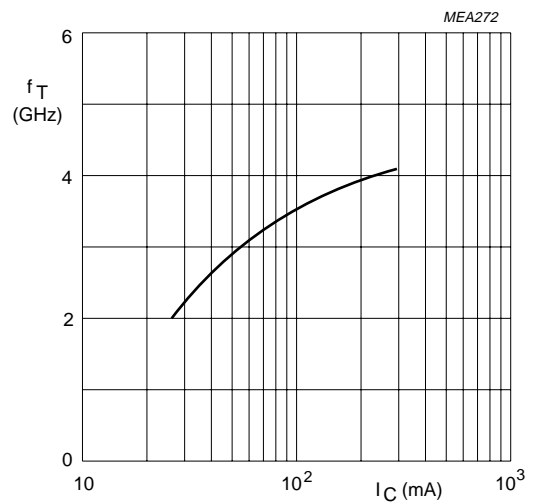
f = 40 to 860 MHz.  
L1 = L2 = 5 μH Ferroxcube choke.

Fig.2 Intermodulation distortion MATV test circuit.



V<sub>CE</sub> = 10 V; T<sub>j</sub> = 25 °C.

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

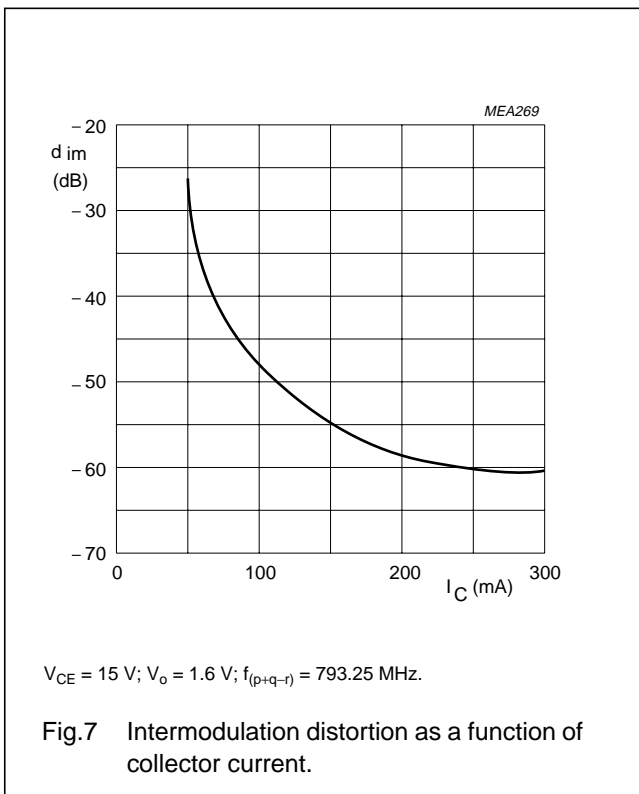
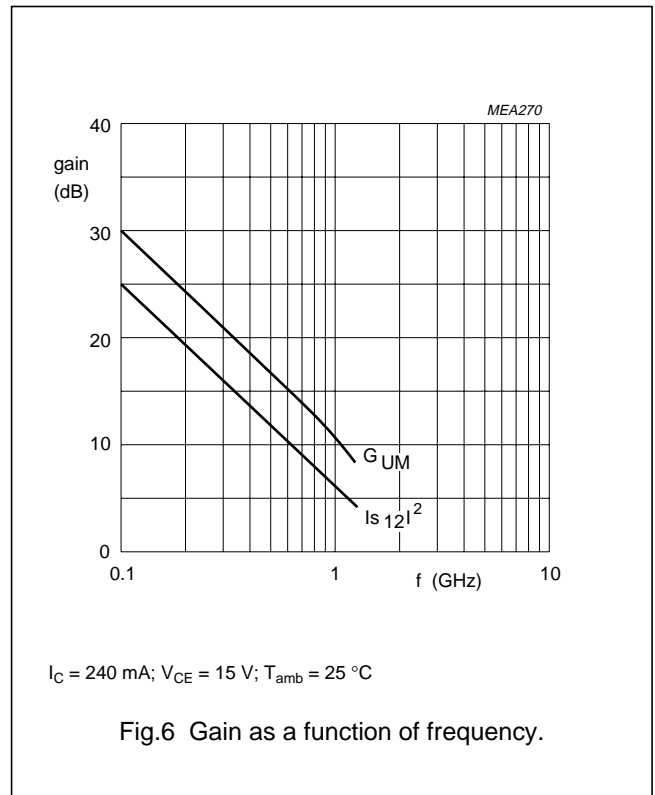
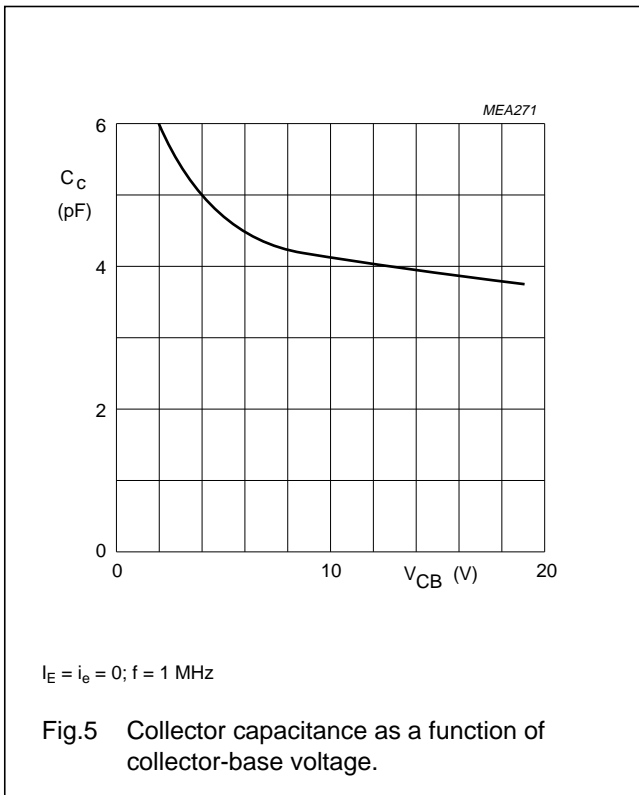


V<sub>CE</sub> = 15 V; f = 500 MHz; T<sub>j</sub> = 25 °C

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

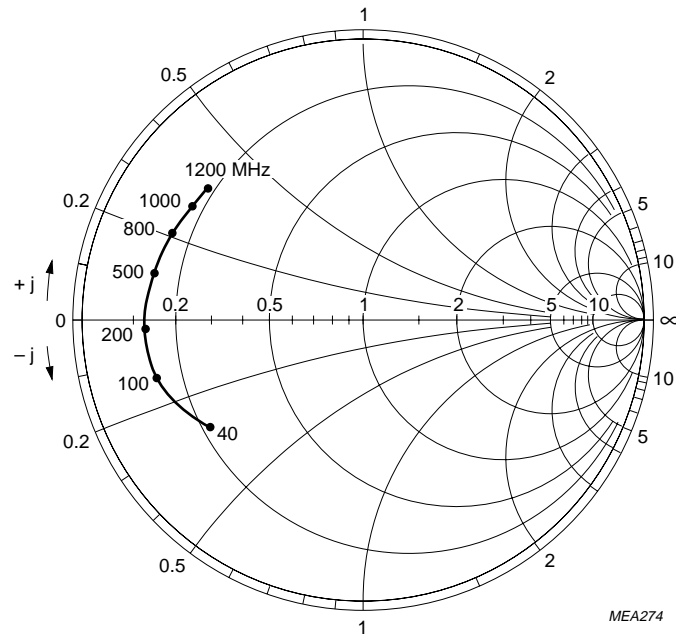
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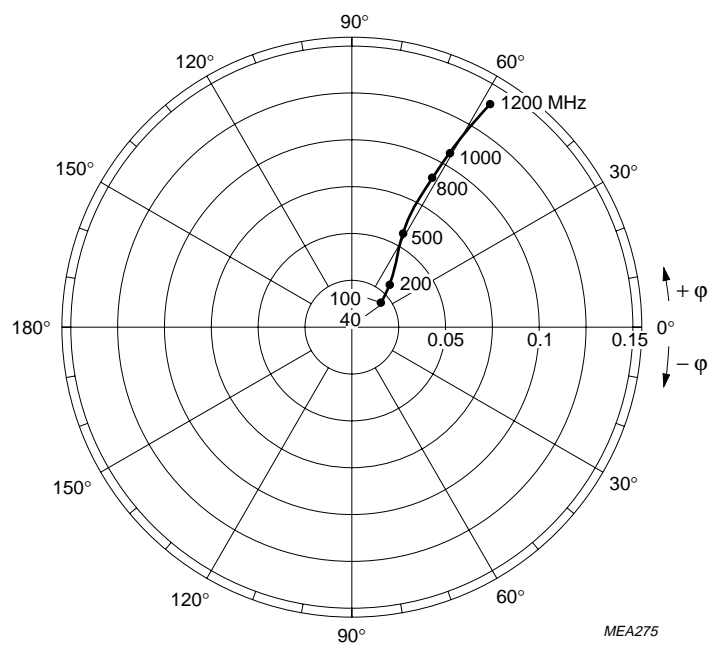
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MEA274

$I_C = 240 \text{ mA}$ ;  $V_{CE} = 15 \text{ V}$ ;  $T_{amb} = 25 \text{ }^\circ\text{C}$ .  
 $Z_o = 50 \text{ } \Omega$ .

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



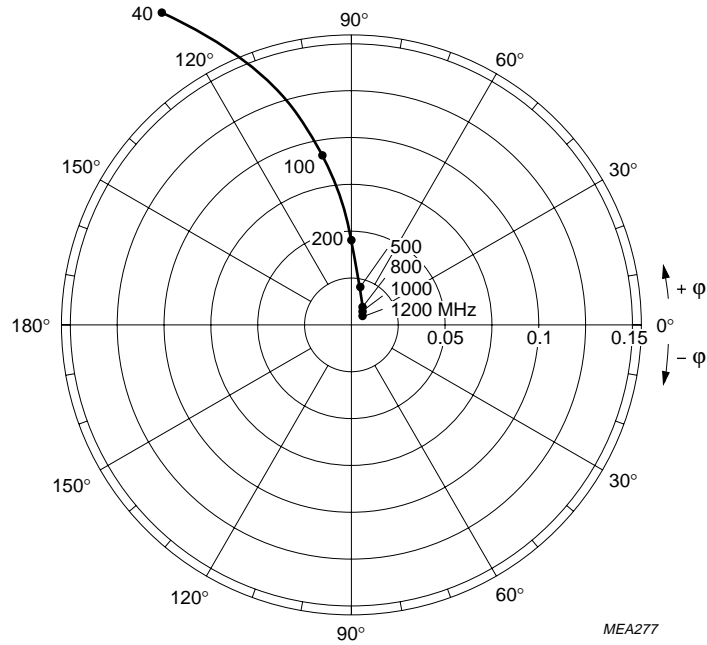
MEA275

$I_C = 240 \text{ mA}$ ;  $V_{CE} = 15 \text{ V}$ ;  $T_{amb} = 25 \text{ }^\circ\text{C}$ .

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

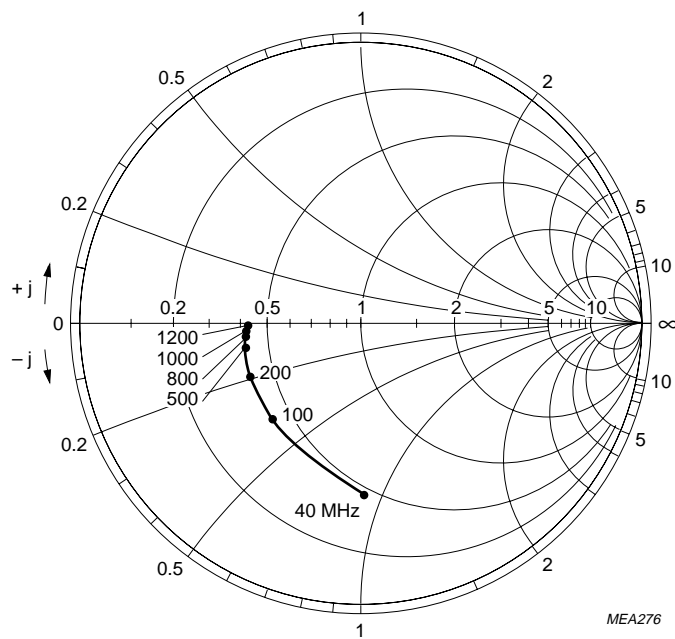
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$I_C = 240 \text{ mA}$ ;  $V_{CE} = 15 \text{ V}$ ;  $T_{amb} = 25 \text{ }^\circ\text{C}$ .

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



$I_C = 240 \text{ mA}$ ;  $V_{CE} = 15 \text{ V}$ ;  $T_{amb} = 25 \text{ }^\circ\text{C}$ .  
 $Z_0 = 50 \text{ } \Omega$ .

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



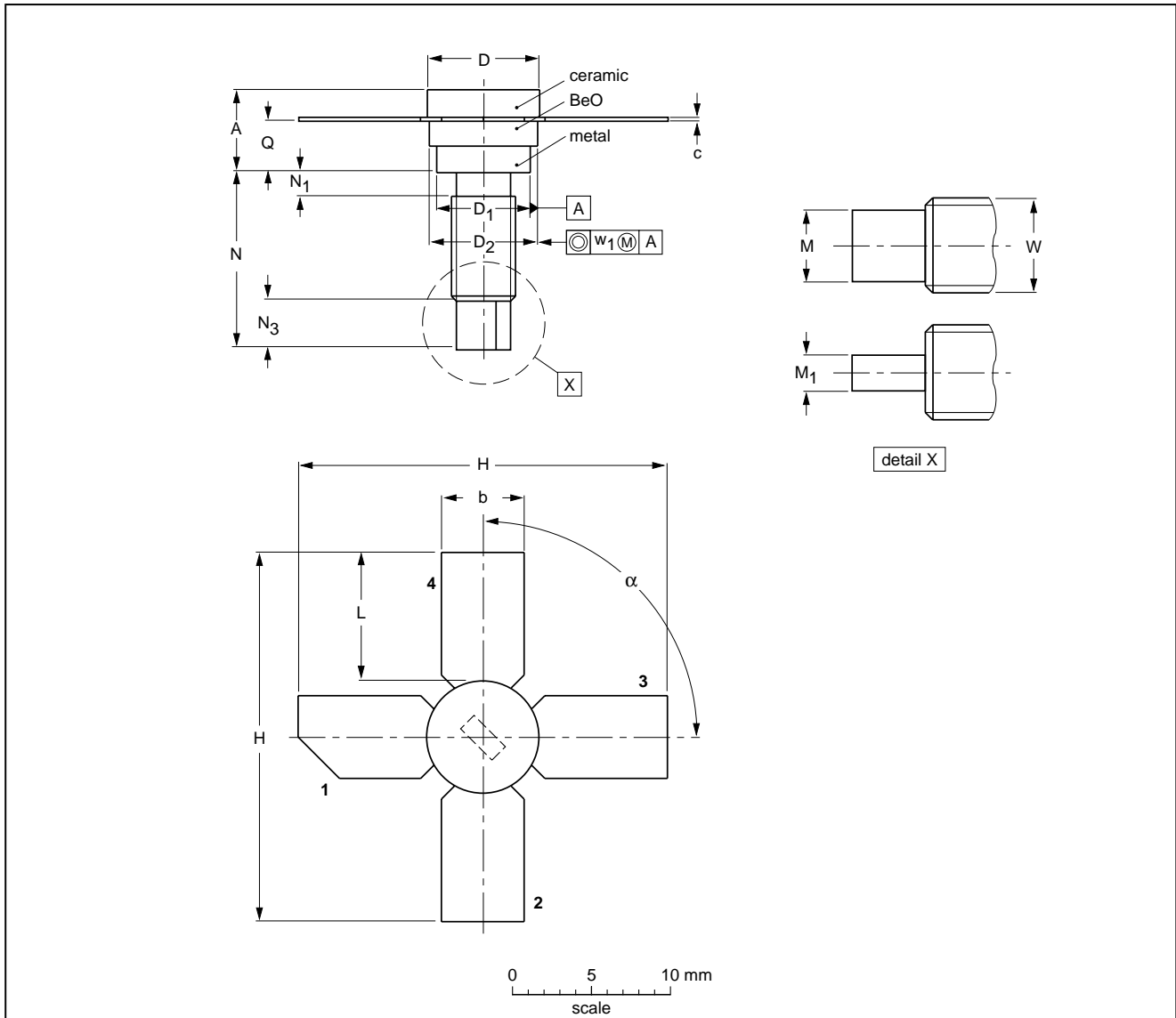
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PACKAGE OUTLINE

Studded ceramic package; 4 leads

SOT122A



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

UNIT	A	b	c	D	D <sub>1</sub>	D <sub>2</sub>	H	L	M <sub>1</sub>	M	N	N <sub>1</sub> max.	N <sub>3</sub>	Q	W	w <sub>1</sub>	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

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**DEFINITIONS**

<b>Data Sheet Status</b>	
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.
<b>Limiting values</b>	
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.	
<b>Application information</b>	
Where application information is given, it is advisory and does not form part of the specification.	

**LIFE SUPPORT APPLICATIONS**

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