

# DATA SHEET

## **BFQ135** NPN 6.5 GHz wideband transistor

Product specification  
Supersedes data of September 1995  
File under Discrete Semiconductors, SC14

1997 Nov 07

# NPN 6.5 GHz wideband transistor

# BFQ135

### FEATURES

- Optimum temperature profile and excellent reliability properties ensured by emitter-ballasting resistors and application of gold sandwich metallization.

### APPLICATIONS

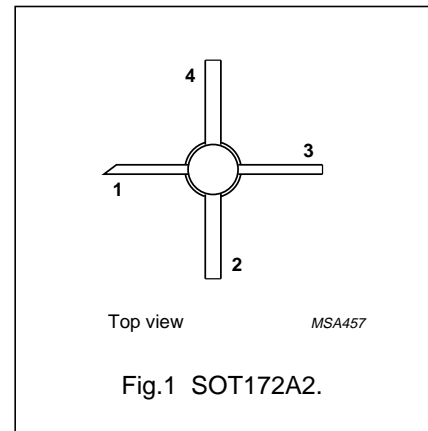
- MATV and microwave amplifiers, such as in aerial amplifiers, radar systems, oscilloscopes, spectrum analysers, etc.

### DESCRIPTION

NPN wideband transistor in a 4-lead dual-emitter SOT172A2 package with a ceramic cap. All leads are isolated from the mounting base.

### PINNING

PIN	DESCRIPTION
1	collector
2, 4	emitter
3	base



### QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{CE0}$	collector-emitter voltage	open base	–	–	19	V
$I_C$	collector current (DC)		–	–	150	mA
$P_{tot}$	total power dissipation	$T_c \leq 145\text{ }^\circ\text{C}$	–	–	2.7	W
$h_{FE}$	DC current gain	$I_C = 120\text{ mA}; V_{CE} = 18\text{ V}; T_{amb} = 25\text{ }^\circ\text{C}$	55	–	–	
$f_T$	transition frequency	$I_C = 120\text{ mA}; V_{CE} = 18\text{ V}; f = 1\text{ GHz}; T_{amb} = 25\text{ }^\circ\text{C}$	–	6.5	–	GHz
$G_{UM}$	maximum unilateral power gain	$I_C = 120\text{ mA}; V_{CE} = 18\text{ V}; f = 500\text{ MHz}; T_{amb} = 25\text{ }^\circ\text{C}$	–	17	–	dB
		$I_C = 120\text{ mA}; V_{CE} = 18\text{ V}; f = 800\text{ MHz}; T_{amb} = 25\text{ }^\circ\text{C}$	–	13.5	–	dB
$V_O$	output voltage	$d_{im} = -60\text{ dB}; I_C = 120\text{ mA}; V_{CE} = 18\text{ V}; R_L = 75\text{ }\Omega; f_p + f_q - f_r = 793.25\text{ MHz}; T_{amb} = 25\text{ }^\circ\text{C}$	–	1.2	–	V

### 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.

## NPN 6.5 GHz wideband transistor

BFQ135

**LIMITING VALUES**

In accordance with the Absolute Maximum Rating 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	–	19	V
$V_{EBO}$	emitter-base voltage	open collector	–	2	V
$I_C$	collector current (DC)		–	150	mA
$P_{tot}$	total power dissipation	$T_C \leq 145\text{ °C}$	–	2.7	W
$T_{stg}$	storage temperature		–65	+150	°C
$T_j$	junction temperature		–	200	°C

**THERMAL CHARACTERISTICS**

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

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BFQ135

## CHARACTERISTICS

T<sub>j</sub> = 25 °C unless otherwise specified.

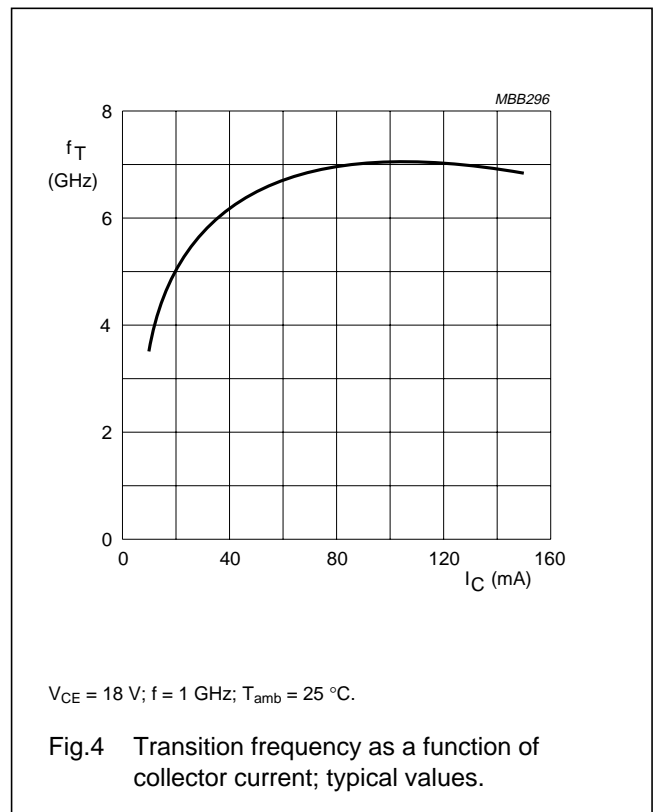
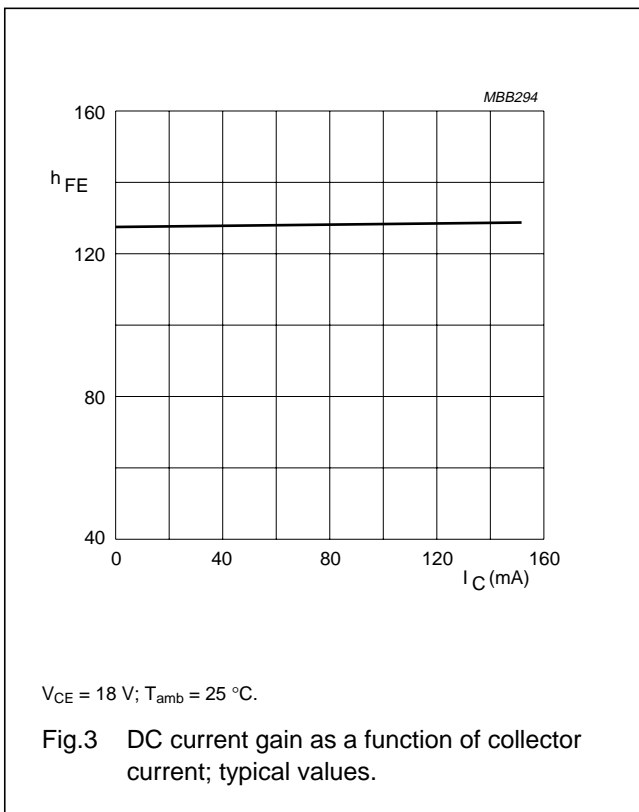
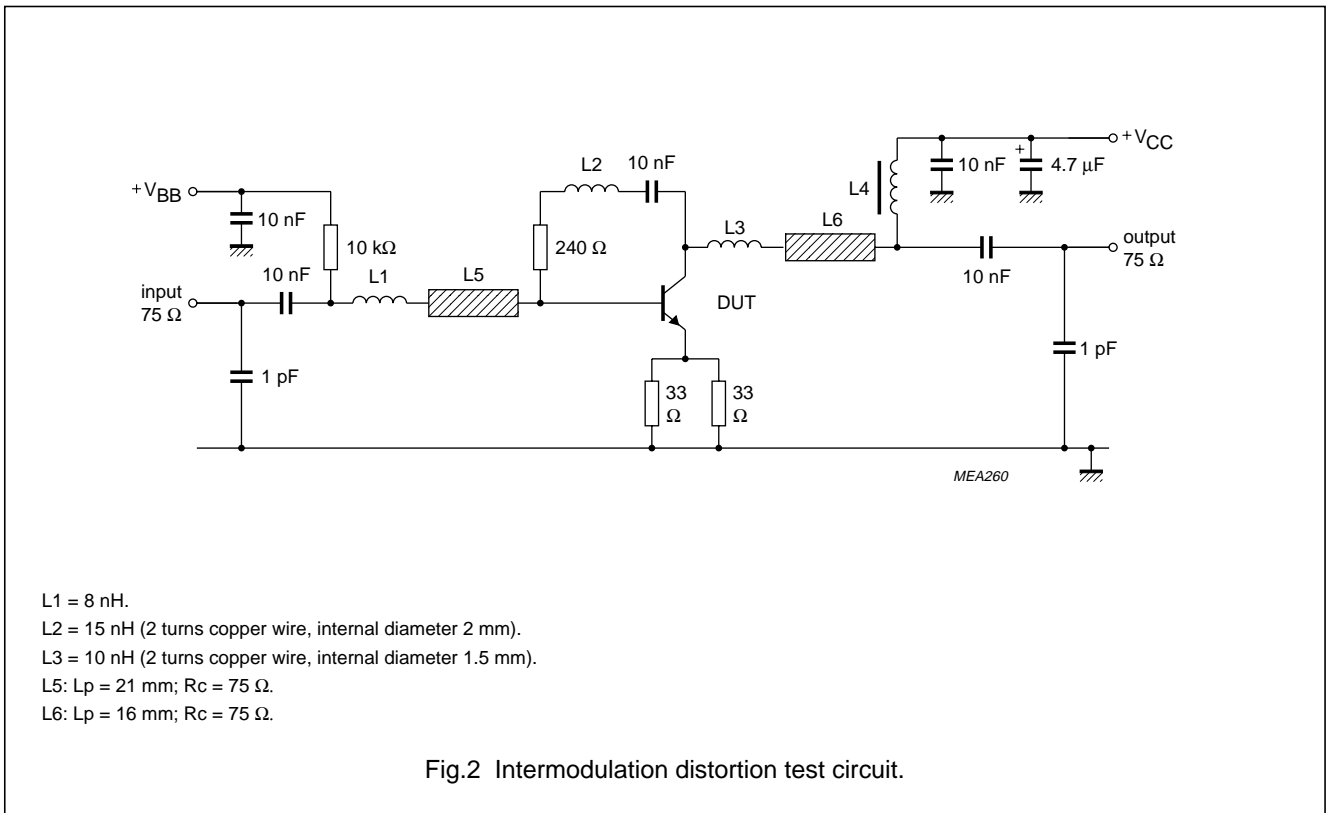
SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I <sub>CBO</sub>	collector cut-off current	I <sub>E</sub> = 0; V <sub>CB</sub> = 18 V	–	–	50	μA
h <sub>FE</sub>	DC current gain	I <sub>C</sub> = 120 mA; V <sub>CE</sub> = 18 V; T <sub>amb</sub> = 25 °C	55	–	–	
C <sub>c</sub>	collector capacitance	I <sub>E</sub> = i <sub>e</sub> = 0; V <sub>CB</sub> = 18 V; f = 1 MHz	–	1.8	–	pF
C <sub>e</sub>	emitter capacitance	I <sub>C</sub> = i <sub>c</sub> = 0; V <sub>EB</sub> = 0.5 V; f = 1 MHz	–	5.5	–	pF
C <sub>re</sub>	feedback capacitance	I <sub>C</sub> = 0; V <sub>CE</sub> = 18 V; f = 1 MHz	–	1	1.2	pF
f <sub>T</sub>	transition frequency	I <sub>C</sub> = 120 mA; V <sub>CE</sub> = 18 V; f = 1 GHz; T <sub>amb</sub> = 25 °C	–	6.5	–	GHz
G <sub>UM</sub>	maximum unilateral power gain (note 1)	I <sub>C</sub> = 120 mA; V <sub>CE</sub> = 18 V; f = 500 MHz; T <sub>amb</sub> = 25 °C	–	17	–	dB
		I <sub>C</sub> = 120 mA; V <sub>CE</sub> = 18 V; f = 800 MHz; T <sub>amb</sub> = 25 °C	–	13.5	–	dB
V <sub>O</sub>	output voltage	note 2	–	1.35	–	V
		note 3	–	1.2	–	V
d <sub>2</sub>	second order intermodulation distortion	note 4	–	–70	–	dB
		note 5	–	–70	–	dB

## Notes

- G<sub>UM</sub> is the maximum unilateral power gain, assuming S<sub>12</sub> is zero and  $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1 - |S_{11}|^2)(1 - |S_{22}|^2)}$  dB.
- d<sub>im</sub> = –60 dB (DIN 45004B); I<sub>C</sub> = 120 mA; V<sub>CE</sub> = 18 V; R<sub>L</sub> = 75 Ω; T<sub>amb</sub> = 25 °C;  
V<sub>p</sub> = V<sub>O</sub> at d<sub>im</sub> = –60 dB; f<sub>p</sub> = 445.25 MHz;  
V<sub>q</sub> = V<sub>O</sub> –6 dB; f<sub>q</sub> = 453.25 MHz;  
V<sub>r</sub> = V<sub>O</sub> –6 dB; f<sub>r</sub> = 455.25 MHz;  
measured at f<sub>p</sub> + f<sub>q</sub> – f<sub>r</sub> = 443.25 MHz.
- d<sub>im</sub> = –60 dB (DIN 45004B); I<sub>C</sub> = 120 mA; V<sub>CE</sub> = 18 V; R<sub>L</sub> = 75 Ω; T<sub>amb</sub> = 25 °C;  
V<sub>p</sub> = V<sub>O</sub> at d<sub>im</sub> = –60 dB; f<sub>p</sub> = 795.25 MHz;  
V<sub>q</sub> = V<sub>O</sub> –6 dB; f<sub>q</sub> = 803.25 MHz;  
V<sub>r</sub> = V<sub>O</sub> –6 dB; f<sub>r</sub> = 805.25 MHz;  
measured at f<sub>p</sub> + f<sub>q</sub> – f<sub>r</sub> = 793.25 MHz.
- I<sub>C</sub> = 90 mA; V<sub>CE</sub> = 18 V; V<sub>O</sub> = 50 dBmV; T<sub>amb</sub> = 25 °C;  
f<sub>p</sub> = 50 MHz; f<sub>q</sub> = 400 MHz;  
measured at f<sub>p</sub> + f<sub>q</sub> = 450 MHz.
- I<sub>C</sub> = 90 mA; V<sub>CE</sub> = 18 V; V<sub>O</sub> = 50 dBmV; T<sub>amb</sub> = 25 °C;  
f<sub>p</sub> = 250 MHz; f<sub>q</sub> = 560 MHz;  
measured at f<sub>p</sub> + f<sub>q</sub> = 810 MHz.

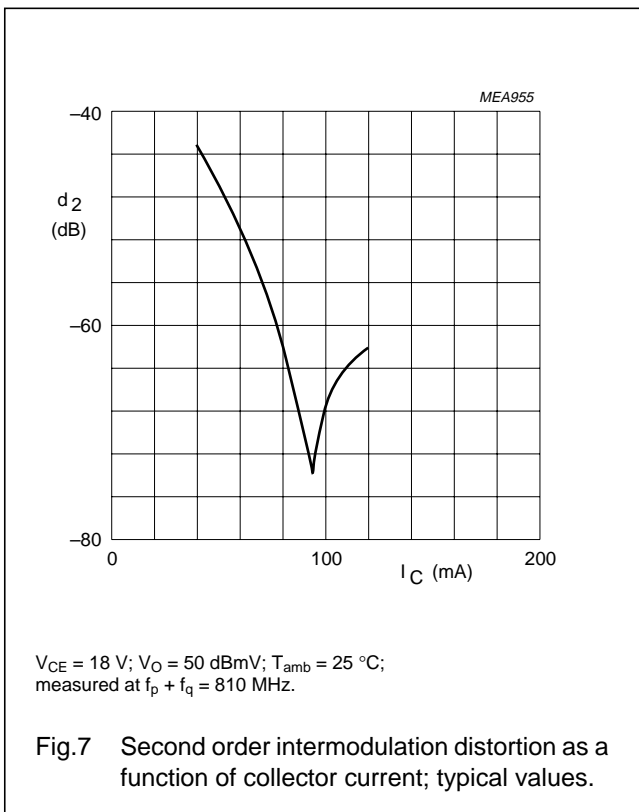
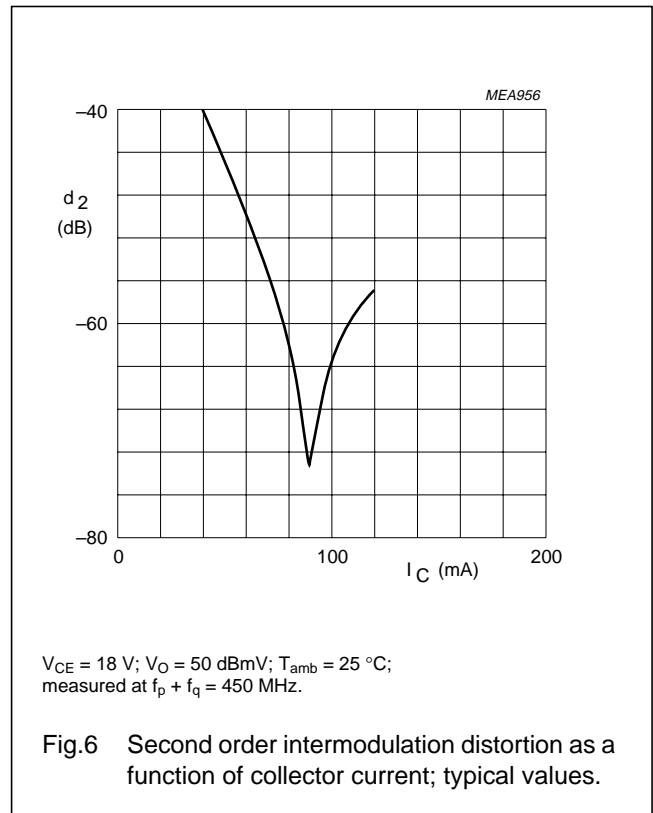
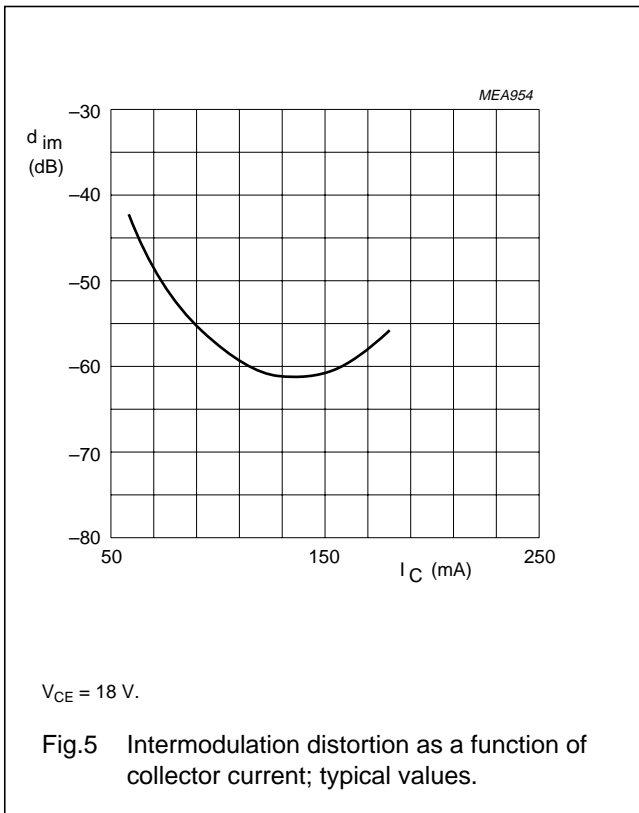
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BFQ135



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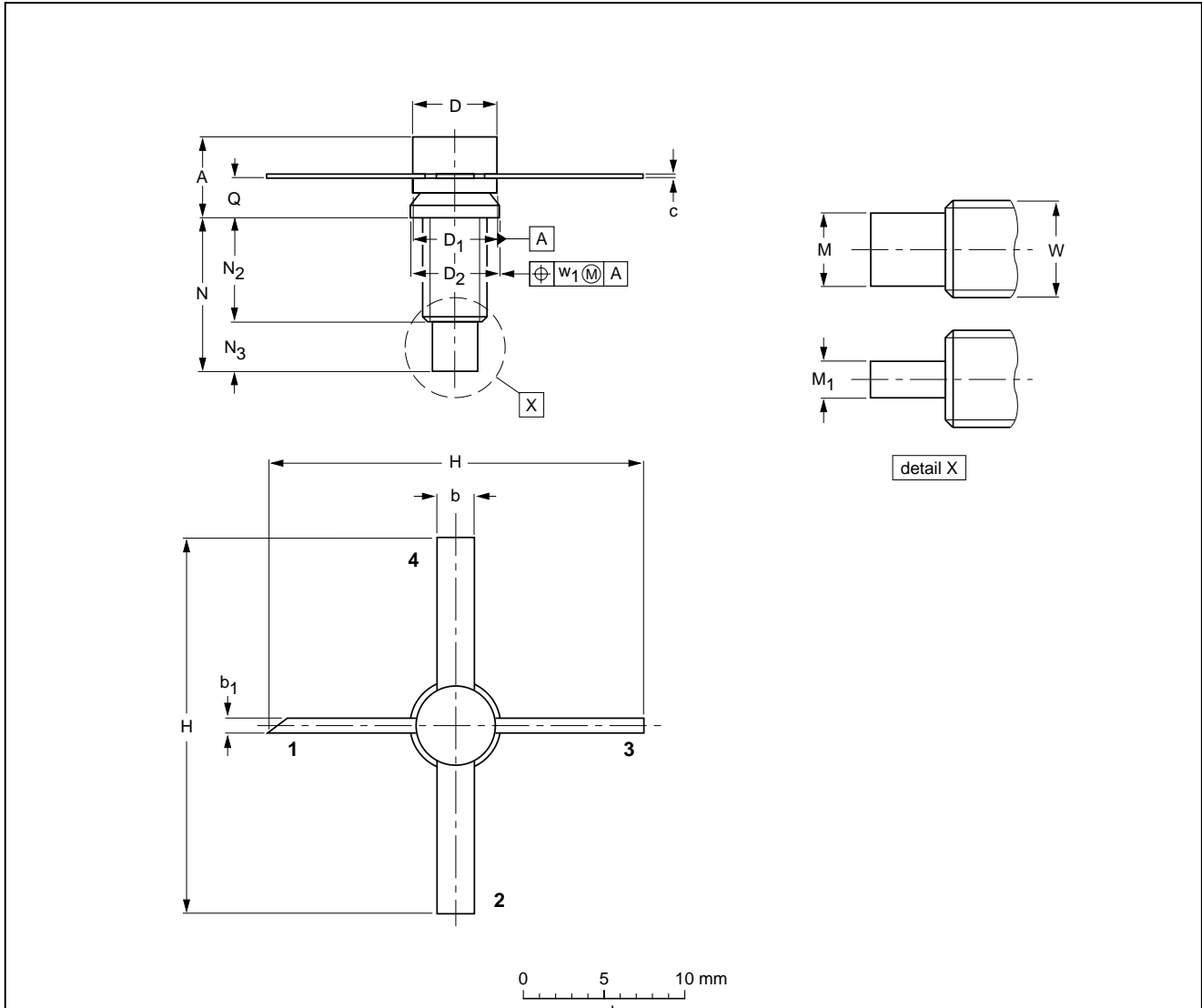
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PACKAGE OUTLINE

Studded ceramic package; 4 leads

SOT172A2



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

UNIT	A	b	b <sub>1</sub>	c	D	D <sub>1</sub>	D <sub>2</sub>	H	M	M <sub>1</sub>	N	N <sub>2</sub>	N <sub>3</sub>	Q	W	w <sub>1</sub>
mm	5.51 4.45	1.66 1.39	0.89 0.63	0.16 0.10	5.20 4.95	5.33 5.08	5.33 5.08	23.37 22.35	3.05 2.79	1.66 1.39	11.56 11.04	8.38 7.62	3.69 2.92	2.95 2.43	8-32 UNC	0.38
inches	0.217 0.175	0.065 0.055	0.035 0.025	0.006 0.004	0.205 0.195	0.210 0.200	0.210 0.200	0.92 0.88	0.12 0.11	0.065 0.055	0.465 0.435	0.33 0.30	0.145 0.115	0.116 0.096		0.015

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT172A2						97-06-28

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BFQ135

**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.
Short-form specification	The data in this specification is extracted from a full data sheet with the same type number and title. For detailed information see the relevant data sheet or data handbook.
<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.	

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These products are not designed for use in life support appliances, devices, or systems where malfunction of these products can reasonably be expected to result in personal injury. Philips customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Philips for any damages resulting from such improper use or sale.



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Printed in The Netherlands

127127/00/02/pp12

Date of release: 1997 Nov 07

Document order number: 9397 750 02763

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