

# DATA SHEET

**BFG94**

**NPN 6 GHz wideband transistor**

Product specification  
File under Discrete Semiconductors, SC14

September 1995

## NPN 6 GHz wideband transistor

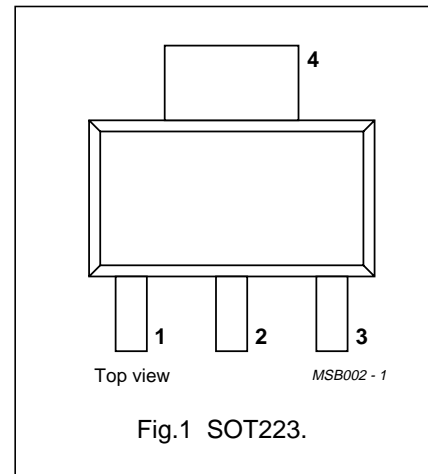
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## FEATURES

- High power gain
- Low noise figure
- Low intermodulation distortion
- Gold metallization ensures excellent reliability.

## PINNING

PIN	DESCRIPTION
1	emitter
2	base
3	emitter
4	collector



## DESCRIPTION

NPN transistor mounted in a plastic SOT223 envelope. It is primarily intended for use in communication and instrumentation systems.

## QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{CBO}$	collector-base voltage	open emitter	–	–	15	V
$V_{CEO}$	collector-emitter voltage	open base	–	–	12	V
$I_C$	DC collector current		–	–	60	mA
$P_{tot}$	total power dissipation	up to $T_s = 140\text{ °C}$ (note 1)	–	–	700	mW
$C_{re}$	feedback capacitance	$I_C = 0$ ; $V_{CE} = 10\text{ V}$ ; $f = 1\text{ MHz}$	–	–	0.8	pF
$f_T$	transition frequency	$I_C = 45\text{ mA}$ ; $V_{CE} = 10\text{ V}$ ; $f = 1\text{ GHz}$ ; $T_{amb} = 25\text{ °C}$	4	6	–	GHz
$G_{UM}$	maximum unilateral power gain	$I_C = 45\text{ mA}$ ; $V_{CE} = 10\text{ V}$ ; $f = 1\text{ GHz}$ ; $T_{amb} = 25\text{ °C}$	11.5	13.5	–	dB
$V_O$	output voltage	$I_C = 45\text{ mA}$ ; $V_{CE} = 10\text{ V}$ ; $d_{im} = -60\text{ dB}$ ; $R_L = 75\text{ }\Omega$ ; $f = 800\text{ MHz}$ ; $T_{amb} = 25\text{ °C}$	–	500	–	mV
$P_{L1}$	output power at 1 dB gain compression	$I_C = 45\text{ mA}$ ; $V_{CE} = 10\text{ V}$ ; $f = 1\text{ GHz}$ ; $T_{amb} = 25\text{ °C}$	–	21.5	–	dBm

## Note

1.  $T_s$  is the temperature at the soldering point of the collector tab.

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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	–	15	V
$V_{CEO}$	collector-emitter voltage	open base	–	12	V
$V_{EBO}$	emitter-base voltage	open collector	–	2	V
$I_C$	DC collector current		–	60	mA
$P_{tot}$	total power dissipation	up to $T_s = 140\text{ °C}$ (note 1)	–	700	mW
$T_{stg}$	storage temperature		–65	150	°C
$T_j$	junction temperature		–	175	°C

**THERMAL RESISTANCE**

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j-s}$	thermal resistance from junction to soldering point	up to $T_s = 140\text{ °C}$ (note 1)	50 K/W

**Note**

- $T_s$  is the temperature at the soldering point of the collector tab.

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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	$I_E = 0; V_{CB} = 10\text{ V}$	–	–	100	nA
$h_{FE}$	DC current gain	$I_C = 30\text{ mA}; V_{CE} = 5\text{ V}$	45	90	–	
		$I_C = 45\text{ mA}; V_{CE} = 10\text{ V}$	–	100	–	
$C_c$	collector capacitance	$I_E = i_e = 0; V_{CB} = 10\text{ V}; f = 1\text{ MHz}$	–	0.9	2	pF
$C_e$	emitter capacitance	$I_C = i_e = 0; V_{EB} = 0.5\text{ V}; f = 1\text{ MHz}$	–	2.9	4.5	pF
$C_{re}$	feedback capacitance	$I_C = i_c = 0; V_{CE} = 10\text{ V}; f = 1\text{ MHz}$	–	0.5	0.8	pF
$f_T$	transition frequency	$I_C = 45\text{ mA}; V_{CE} = 10\text{ V}; f = 1\text{ GHz}; T_{amb} = 25\text{ °C}$	4	–	–	GHz
		$I_C = 30\text{ mA}; V_{CE} = 5\text{ V}; f = 1\text{ GHz}; T_{amb} = 25\text{ °C}$	4	6	–	GHz
$G_{UM}$	maximum unilateral power gain (note1)	$I_C = 45\text{ mA}; V_{CE} = 10\text{ V}; f = 1\text{ GHz}; T_{amb} = 25\text{ °C}$	11.5	13.5	–	dB
F	minimum noise figure	$\Gamma_s = \Gamma_{opt}; I_C = 45\text{ mA}; V_{CE} = 10\text{ V}; f = 500\text{ MHz}$	–	2.7	–	dB
		$\Gamma_s = \Gamma_{opt}; I_C = 45\text{ mA}; V_{CE} = 10\text{ V}; f = 1\text{ GHz}$	–	3	–	dB
$V_O$	output voltage	note 2	–	500	–	mV
$d_2$	second order intermodulation distortion	note 3	–	–51	–	dB
$P_{L1}$	output power at 1 dB gain compression	$I_C = 45\text{ mA}; V_{CE} = 10\text{ V}; R_L = 50\text{ }\Omega; T_{amb} = 25\text{ °C};$ measured at $f = 1\text{ GHz}$	–	21.5	–	dBm
ITO	third order intercept point	note 4	–	34	–	dBm

## Notes

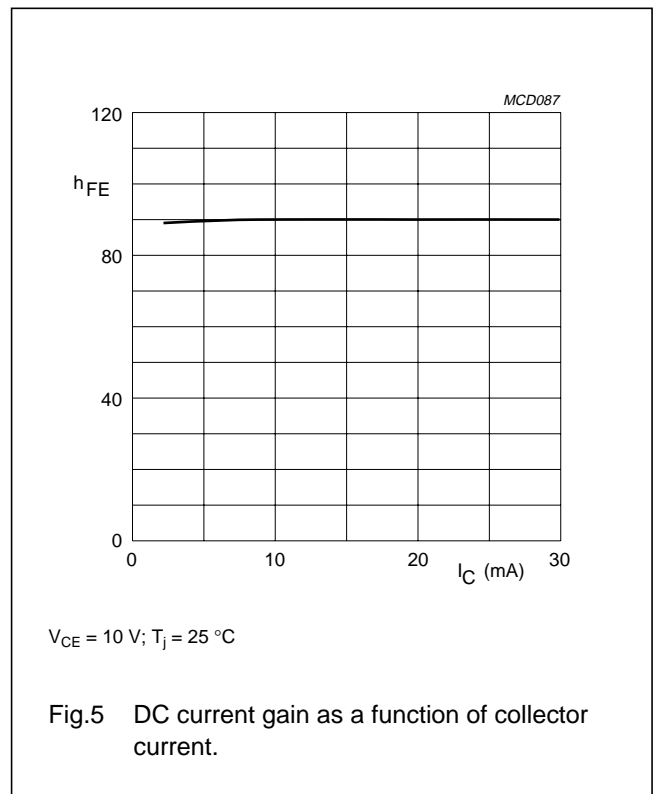
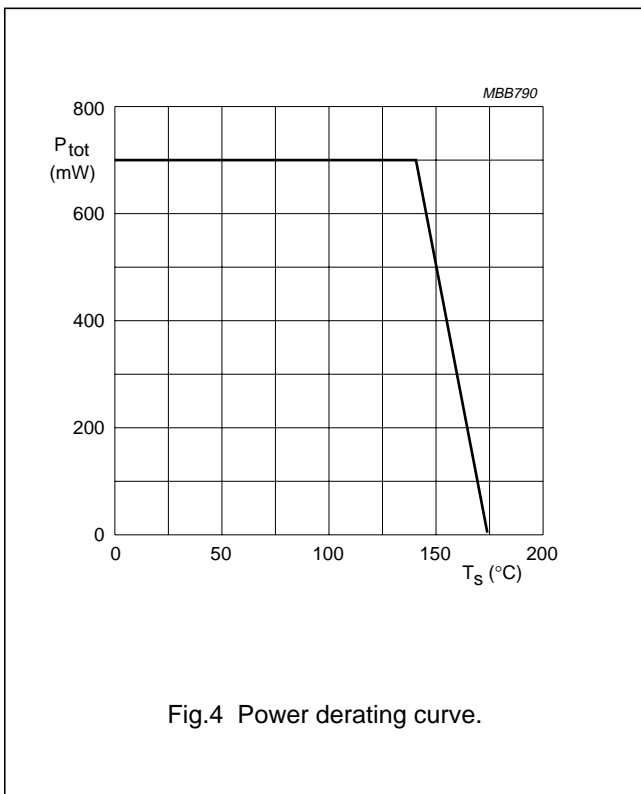
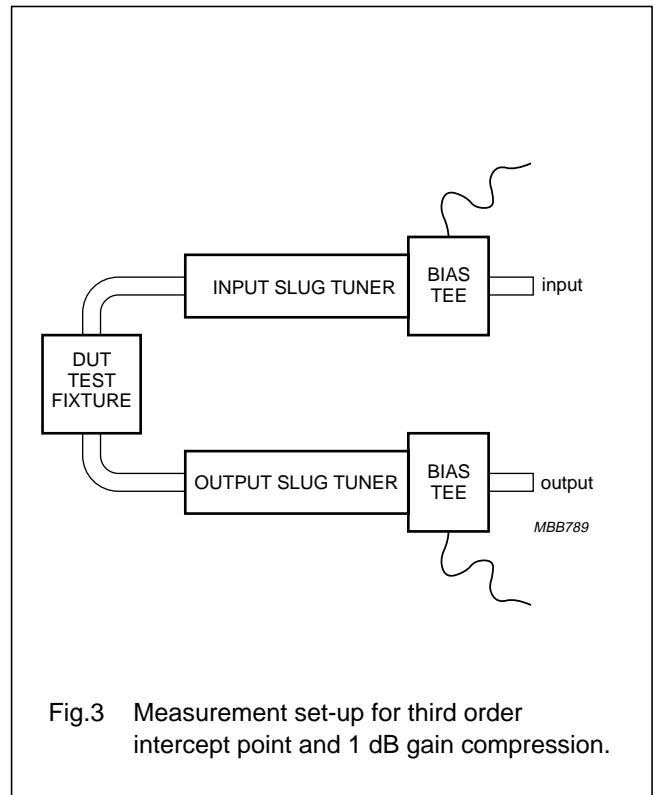
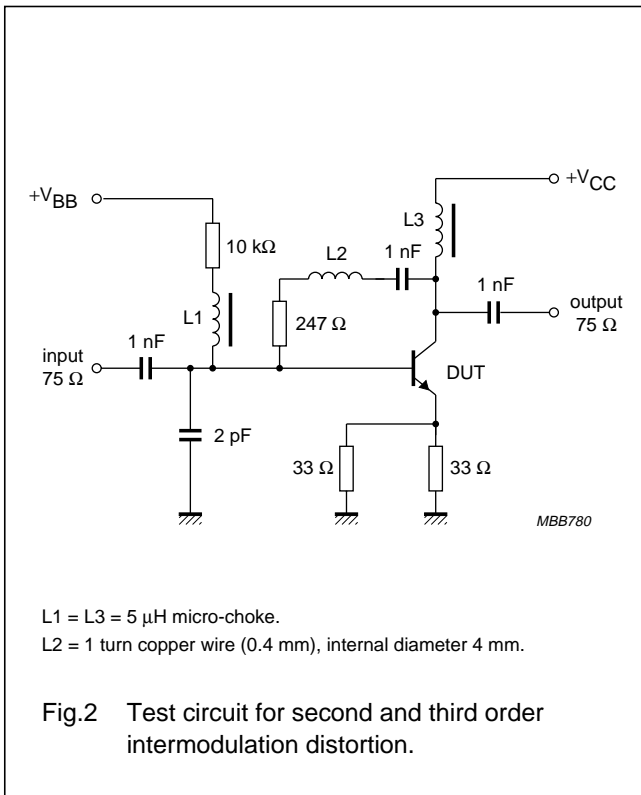
1.  $G_{UM}$  is the maximum unilateral power gain, assuming  $S_{12}$  is zero and

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

2.  $d_{im} = -60\text{ dB}$  (DIN 45004B, par 6.3: 3-tone);  $I_C = 45\text{ mA}; V_{CE} = 10\text{ V}; R_L = 75\text{ }\Omega; T_{amb} = 25\text{ °C};$   
 $V_p = V_O$  at  $d_{im} = -60\text{ dB}; f_p = 795.25\text{ MHz};$   
 $V_q = V_O - 6\text{ dB}; V_r = V_O - 6\text{ dB};$   
 $f_q = 803.25\text{ MHz}; f_r = 805.25\text{ MHz};$   
 measured at  $f_{(p+q-r)} = 793.25\text{ MHz}.$
3.  $I_C = 45\text{ mA}; V_{CE} = 10\text{ V}; R_L = 75\text{ }\Omega; T_{amb} = 25\text{ °C};$   
 $V_q = V_O = 280\text{ mV};$   
 $f_p = 250\text{ MHz}; f_q = 560\text{ MHz};$   
 measured at  $f_{(p+q)} = 810\text{ MHz}.$
4.  $I_C = 45\text{ mA}; V_{CE} = 10\text{ V}; R_L = 50\text{ }\Omega; T_{amb} = 25\text{ °C};$   
 $f_p = 1000\text{ MHz}; f_q = 1001\text{ MHz};$   
 measured at  $f_{(2p-q)}$  and  $f_{(2q-p)}.$

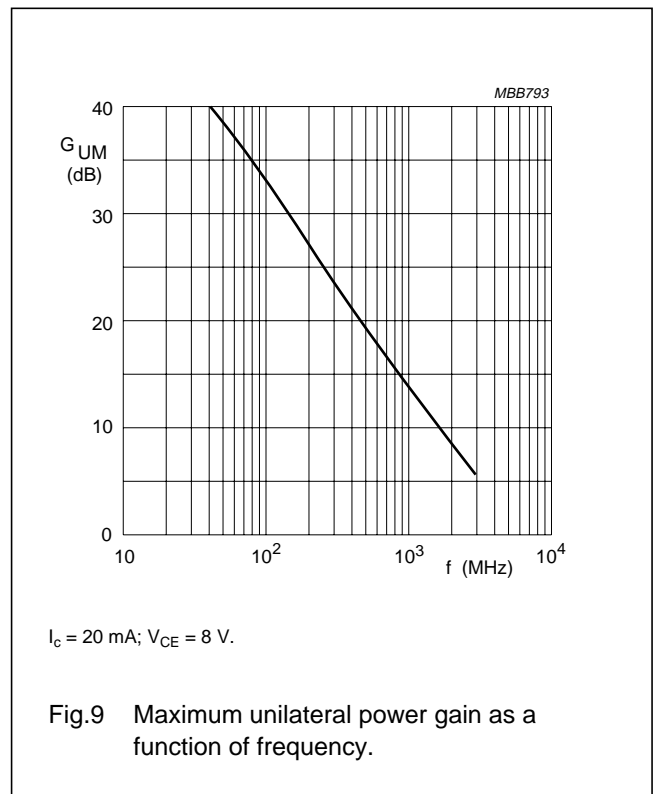
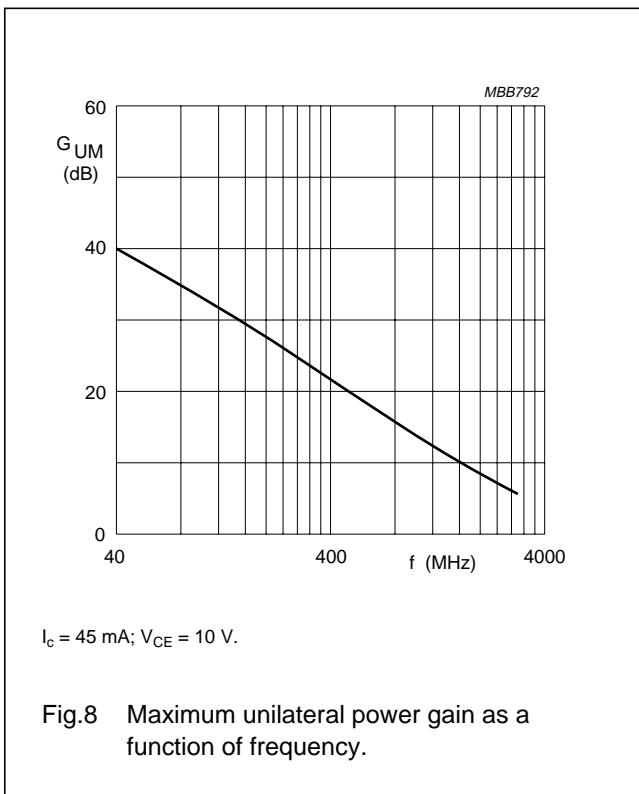
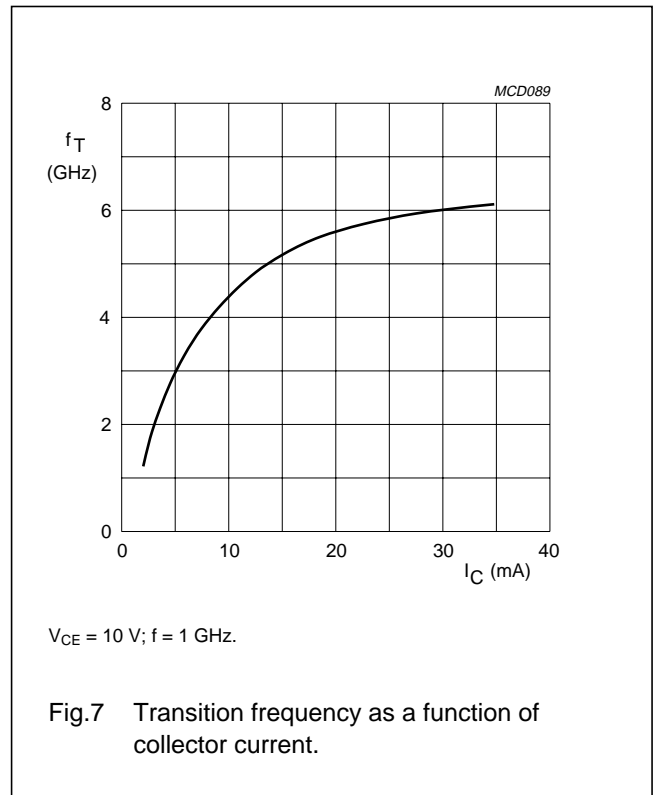
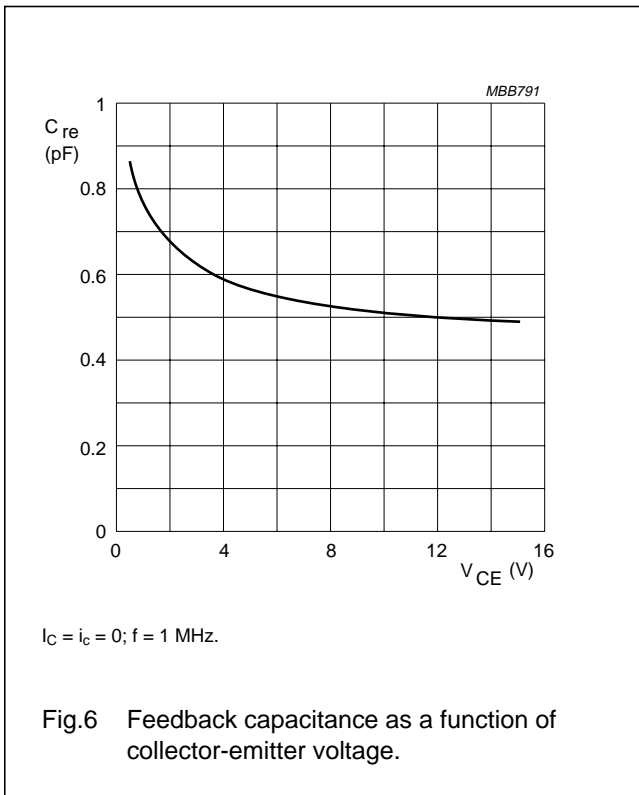
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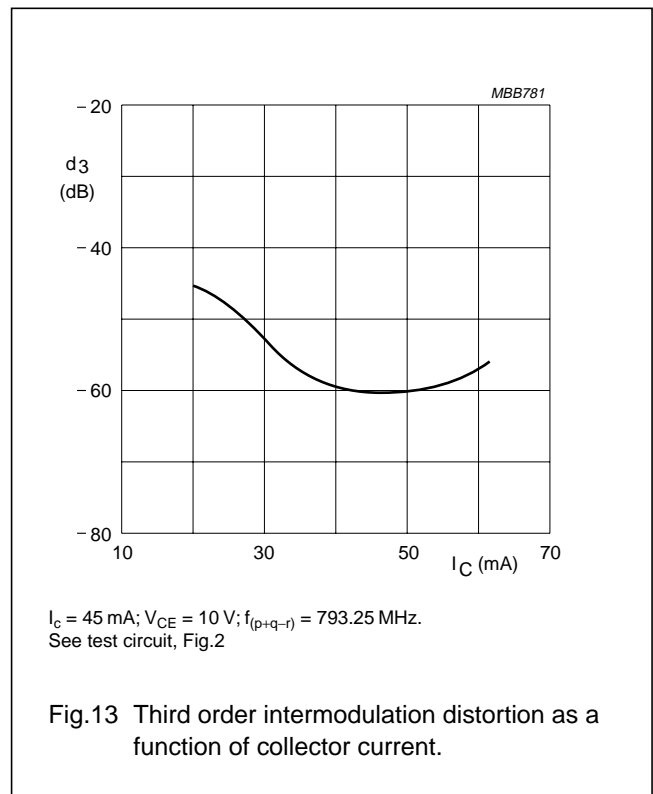
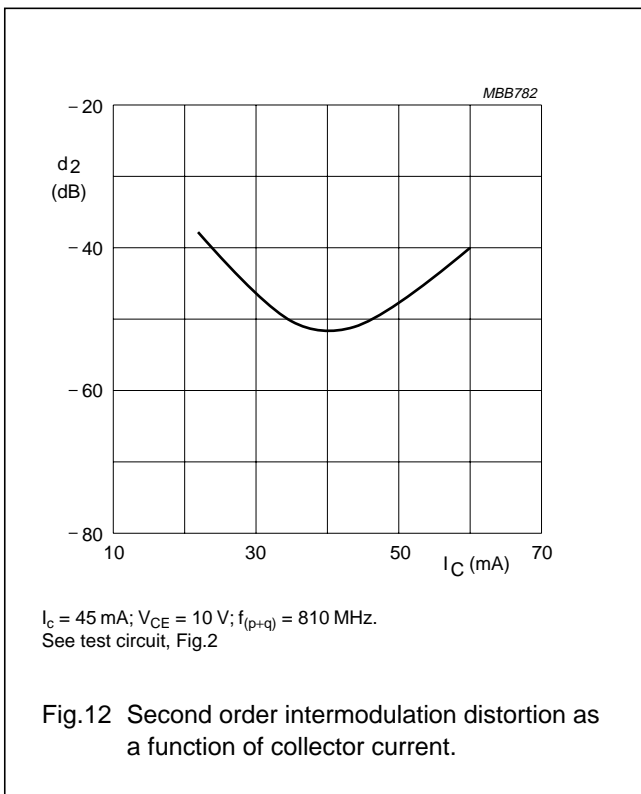
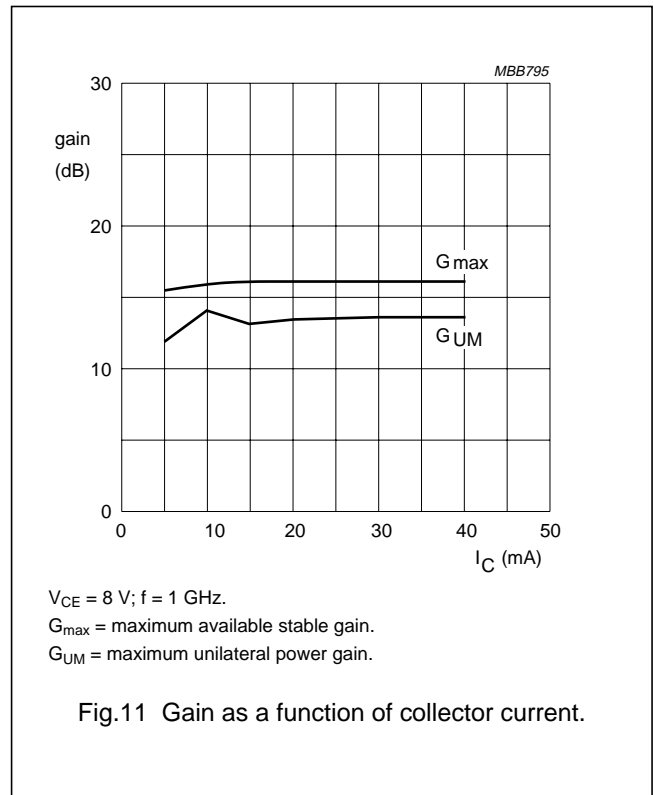
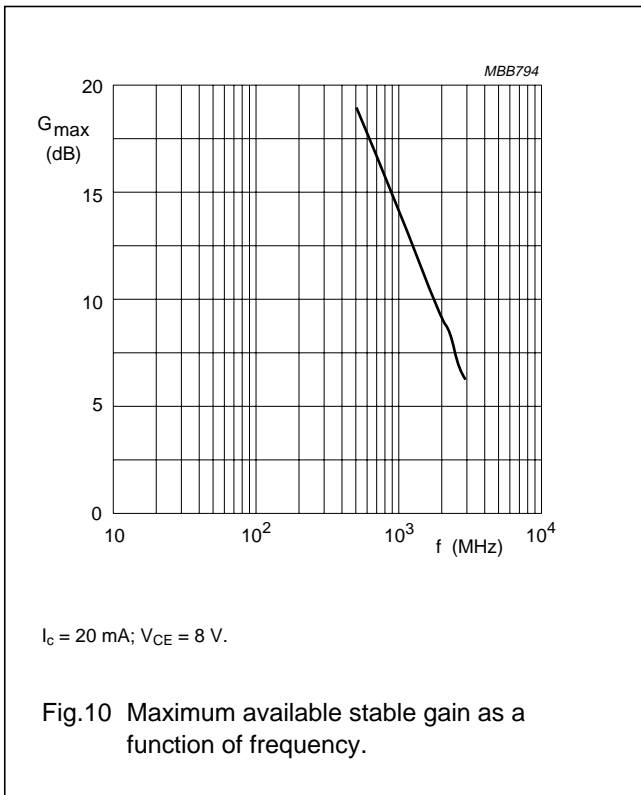
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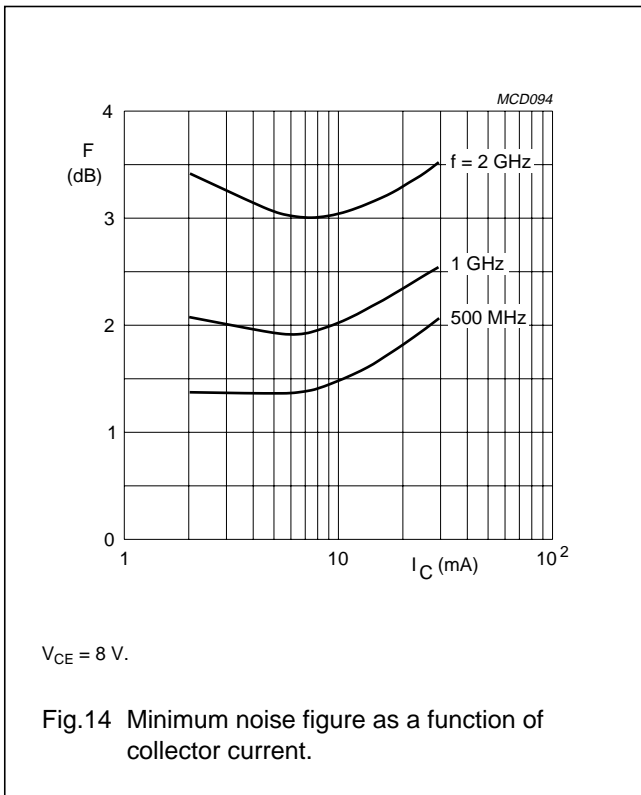
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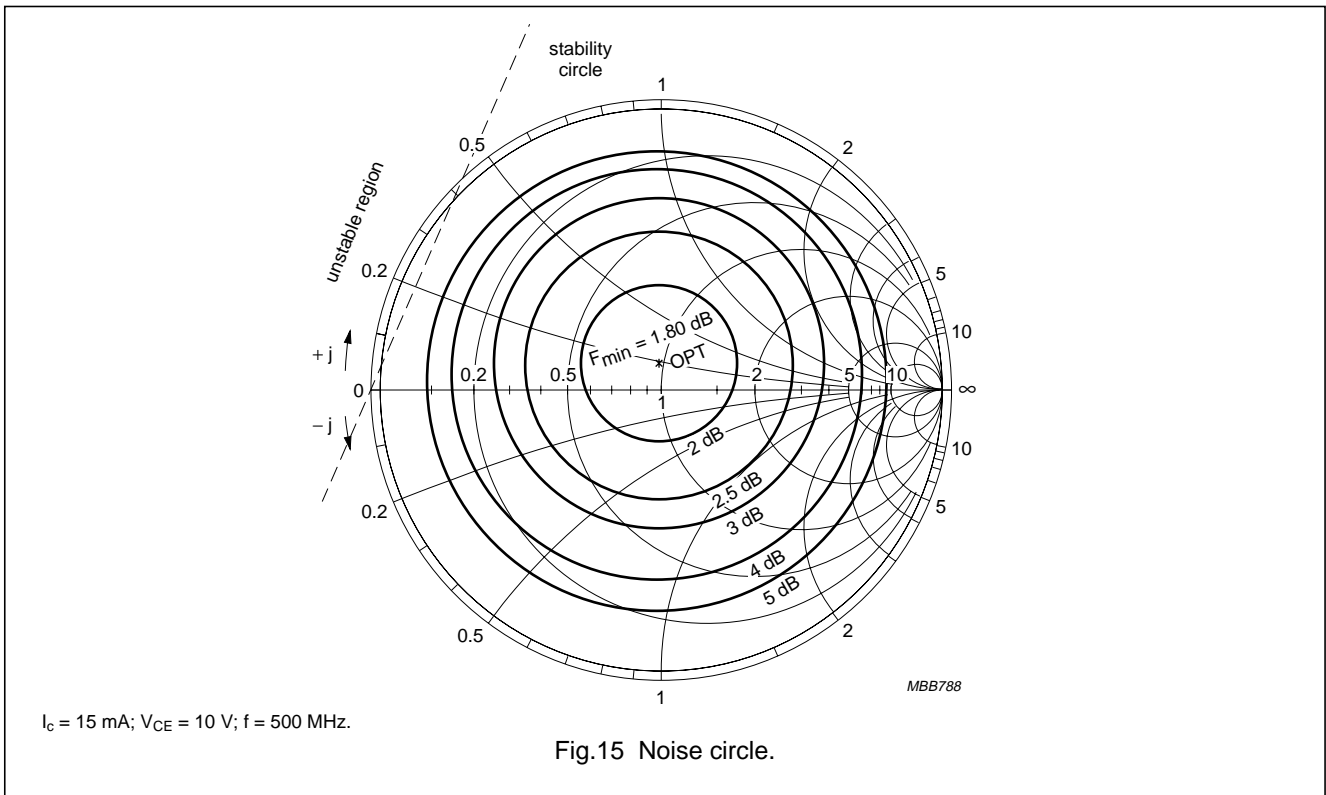


Fig.15 Noise circle.

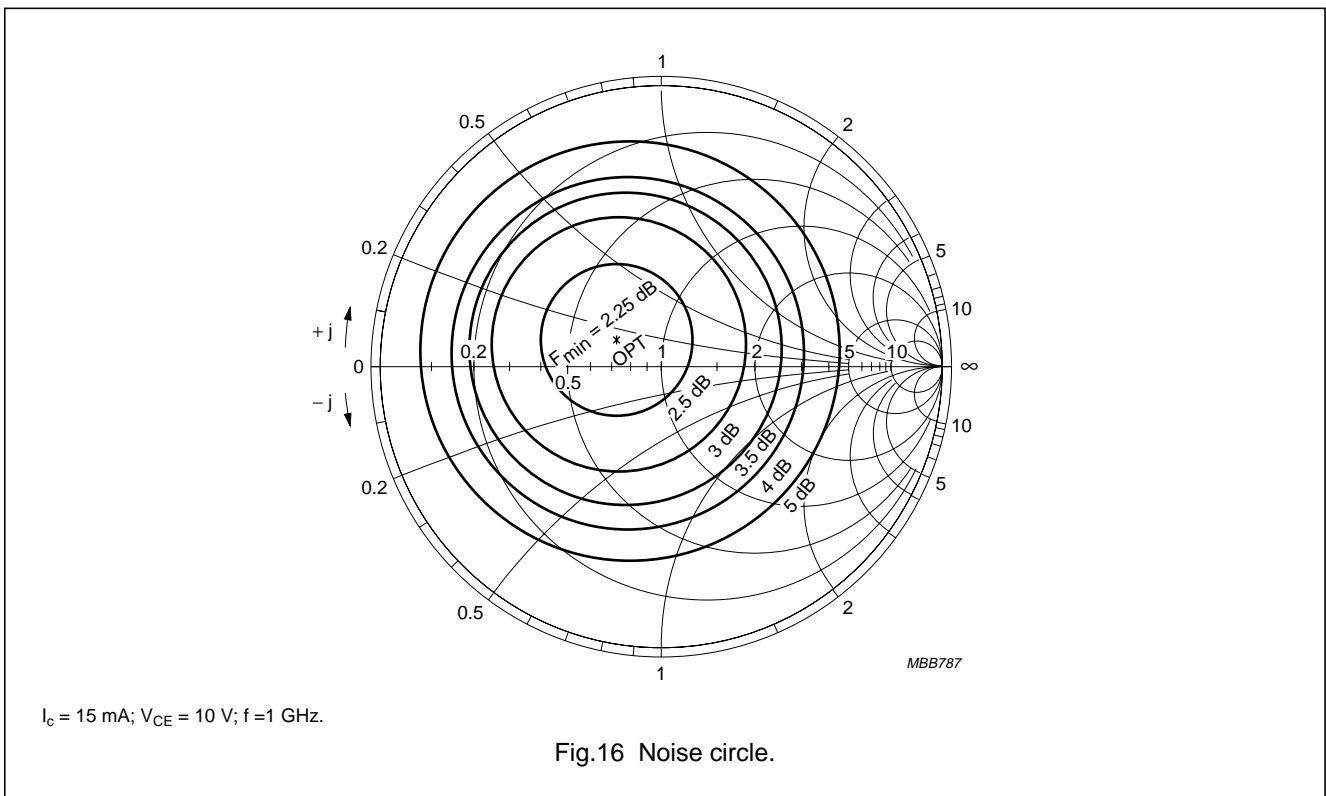
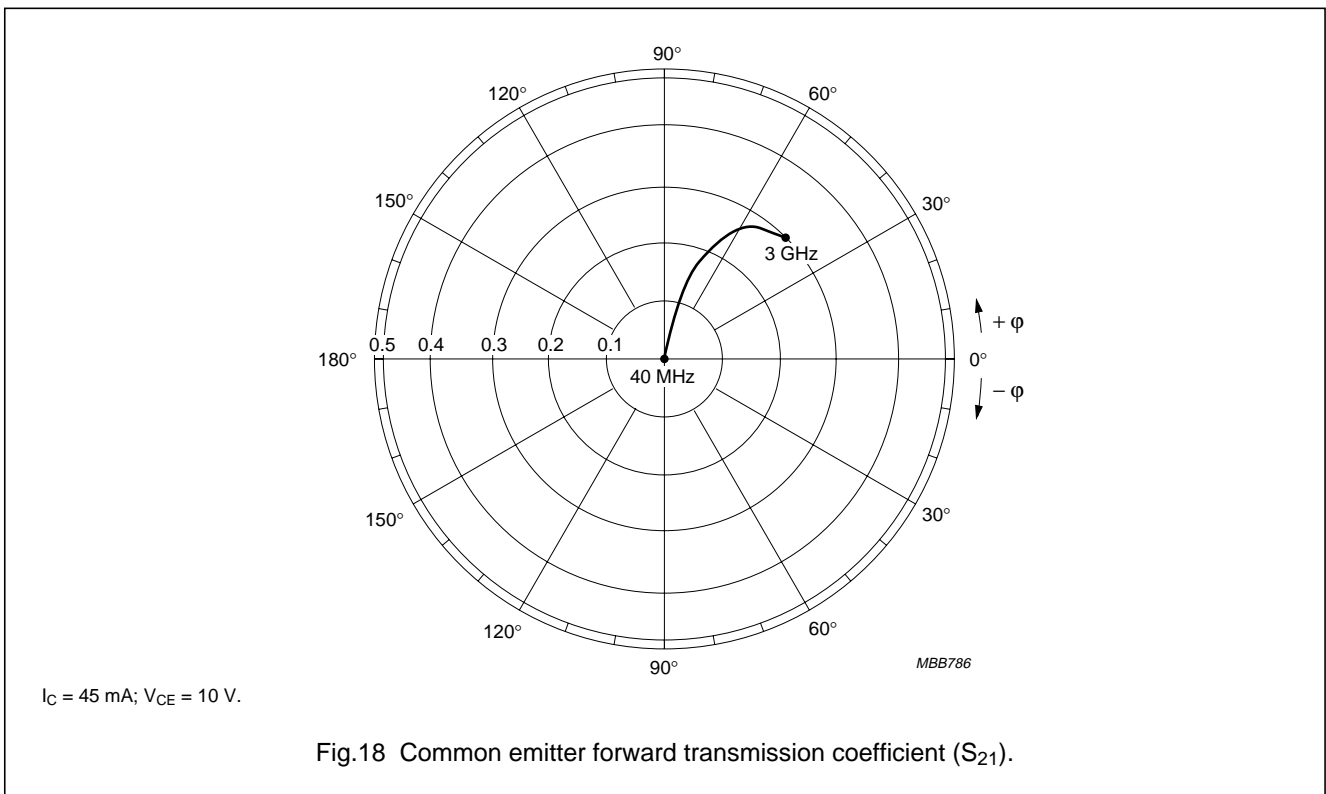
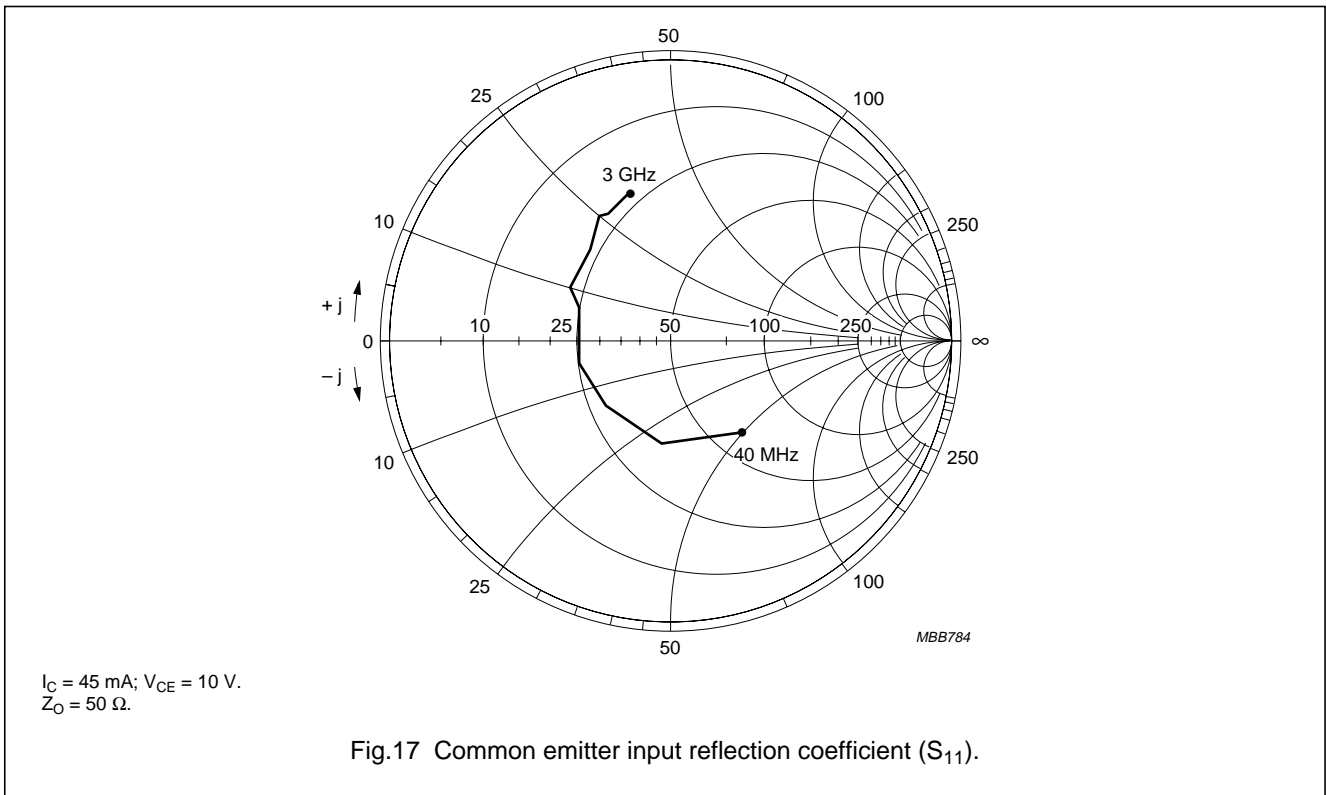


Fig.16 Noise circle.

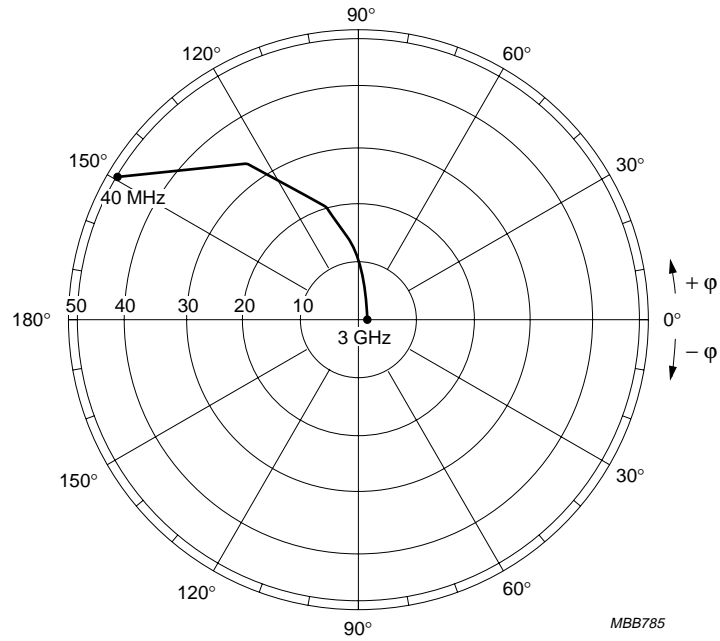
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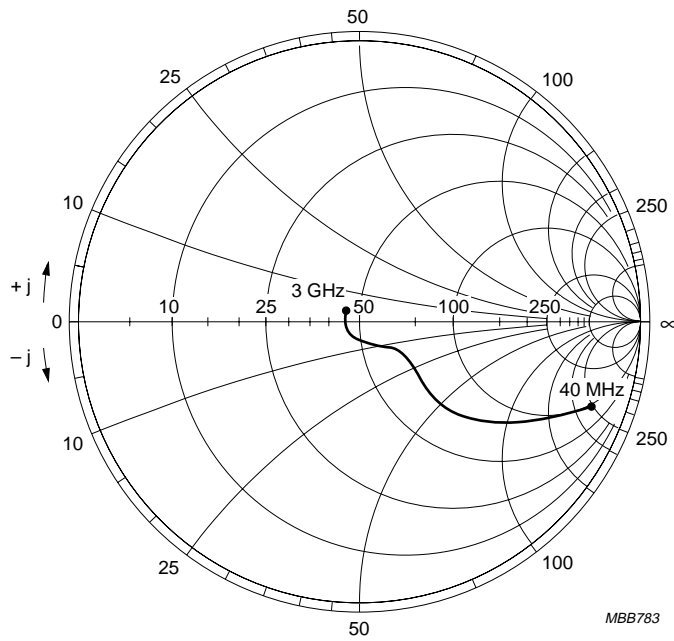
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$I_C = 45 \text{ mA}; V_{CE} = 10 \text{ V}.$

Fig.19 Common emitter reverse transmission coefficient ( $S_{12}$ ).



$I_C = 45 \text{ mA}; V_{CE} = 10 \text{ V}.$   
 $Z_O = 50 \Omega.$

Fig.20 Common emitter output reflection coefficient ( $S_{22}$ ).

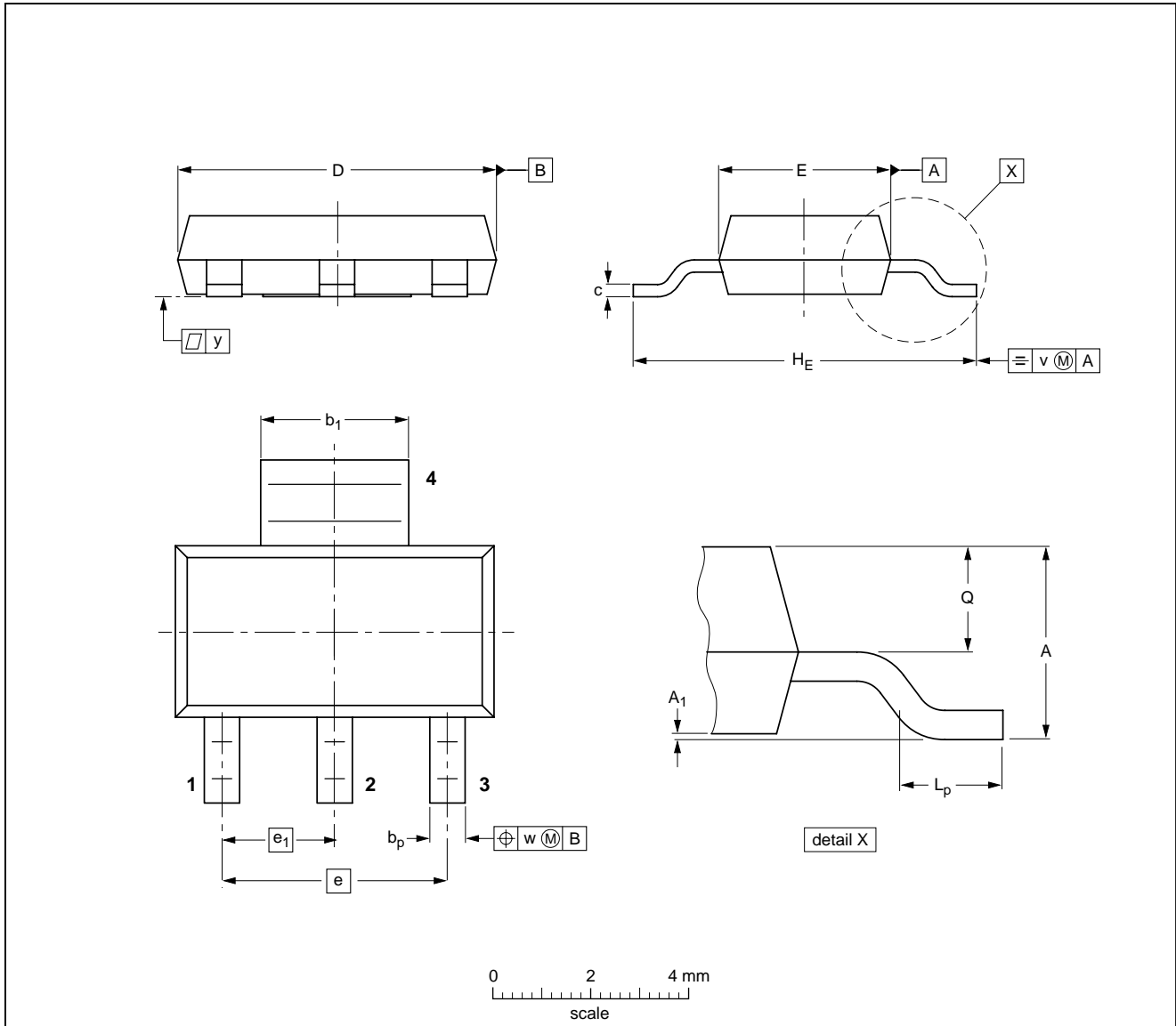
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PACKAGE OUTLINE

Plastic surface mounted package; collector pad for good heat transfer; 4 leads

SOT223



DIMENSIONS (mm are the original dimensions)

UNIT	A	A <sub>1</sub>	b <sub>p</sub>	b <sub>1</sub>	c	D	E	e	e <sub>1</sub>	H <sub>E</sub>	L <sub>p</sub>	Q	v	w	y
mm	1.8 1.5	0.10 0.01	0.80 0.60	3.1 2.9	0.32 0.22	6.7 6.3	3.7 3.3	4.6	2.3	7.3 6.7	1.1 0.7	0.95 0.85	0.2	0.1	0.1

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT223						96-11-11 97-02-28

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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.	

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