

# DATA SHEET

**BFG94**

**NPN 6 GHz wideband transistor**

Product specification

September 1995



# NPN 6 GHz wideband transistor

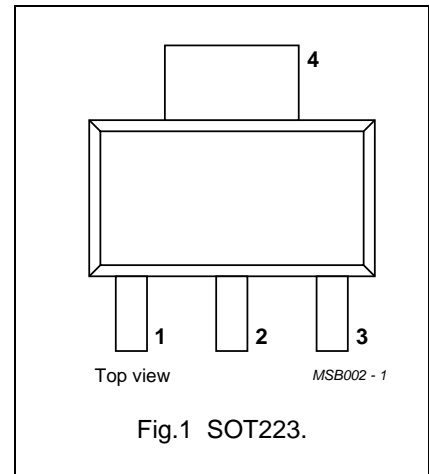
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### FEATURES

- 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<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> = 10 V	–	–	100	nA
h <sub>FE</sub>	DC current gain	I <sub>C</sub> = 30 mA; V <sub>CE</sub> = 5 V	45	90	–	
		I <sub>C</sub> = 45 mA; V <sub>CE</sub> = 10 V	–	100	–	
C <sub>c</sub>	collector capacitance	I <sub>E</sub> = i <sub>e</sub> = 0; V <sub>CB</sub> = 10 V; f = 1 MHz	–	0.9	2	pF
C <sub>e</sub>	emitter capacitance	I <sub>C</sub> = i <sub>e</sub> = 0; V <sub>EB</sub> = 0.5 V; f = 1 MHz	–	2.9	4.5	pF
C <sub>re</sub>	feedback capacitance	I <sub>C</sub> = i <sub>c</sub> = 0; V <sub>CE</sub> = 10 V; f = 1 MHz	–	0.5	0.8	pF
f <sub>T</sub>	transition frequency	I <sub>C</sub> = 45 mA; V <sub>CE</sub> = 10 V; f = 1 GHz; T <sub>amb</sub> = 25 °C	4	–	–	GHz
		I <sub>C</sub> = 30 mA; V <sub>CE</sub> = 5 V; f = 1 GHz; T <sub>amb</sub> = 25 °C	4	6	–	GHz
G <sub>UM</sub>	maximum unilateral power gain (note1)	I <sub>C</sub> = 45 mA; V <sub>CE</sub> = 10 V; f = 1 GHz; T <sub>amb</sub> = 25 °C	11.5	13.5	–	dB
F	minimum noise figure	Γ <sub>s</sub> = Γ <sub>opt</sub> ; I <sub>C</sub> = 45 mA; V <sub>CE</sub> = 10 V; f = 500 MHz	–	2.7	–	dB
		Γ <sub>s</sub> = Γ <sub>opt</sub> ; I <sub>C</sub> = 45 mA; V <sub>CE</sub> = 10 V; f = 1 GHz	–	3	–	dB
V <sub>O</sub>	output voltage	note 2	–	500	–	mV
d <sub>2</sub>	second order intermodulation distortion	note 3	–	–51	–	dB
P <sub>L1</sub>	output power at 1 dB gain compression	I <sub>C</sub> = 45 mA; V <sub>CE</sub> = 10 V; R <sub>L</sub> = 50 Ω; T <sub>amb</sub> = 25 °C; measured at f = 1 GHz	–	21.5	–	dBm
ITO	third order intercept point	note 4	–	34	–	dBm

## Notes

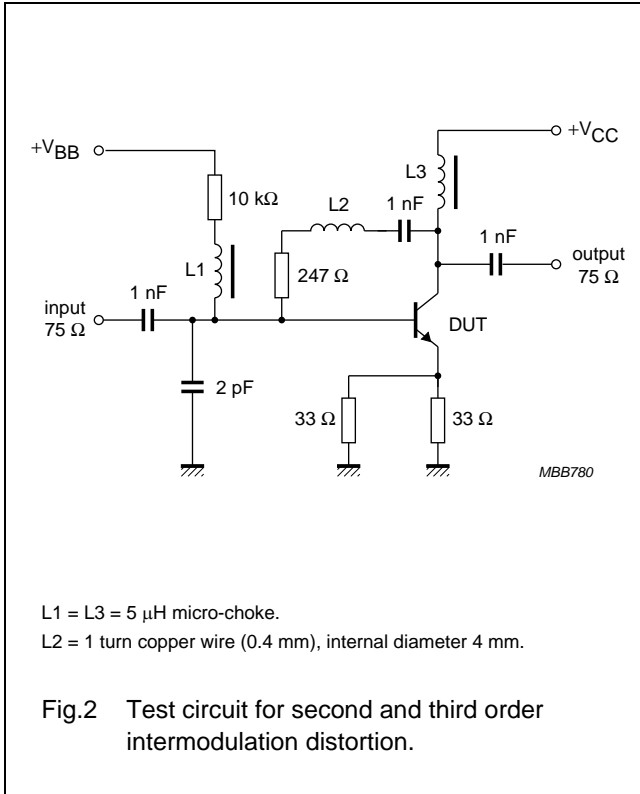
1. G<sub>UM</sub> is the maximum unilateral power gain, assuming S<sub>12</sub> is zero and

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

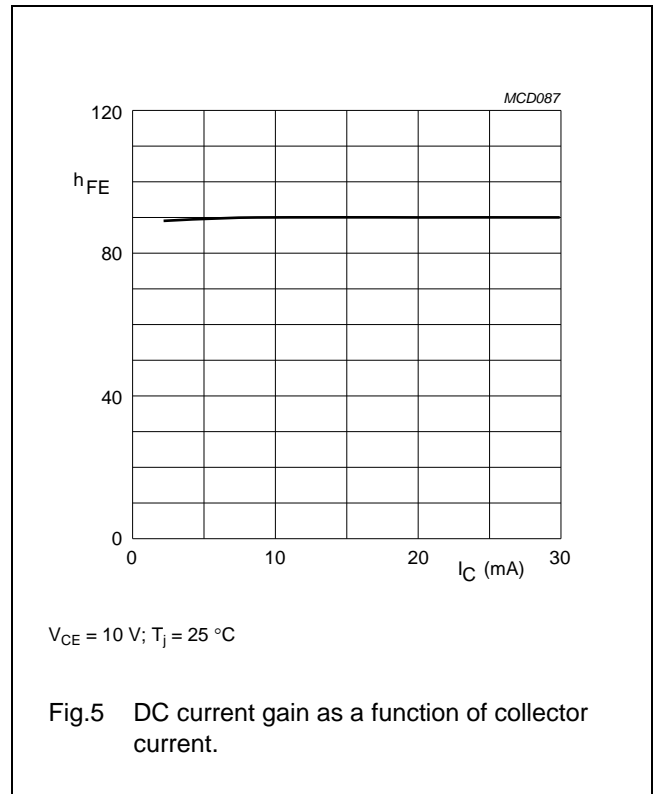
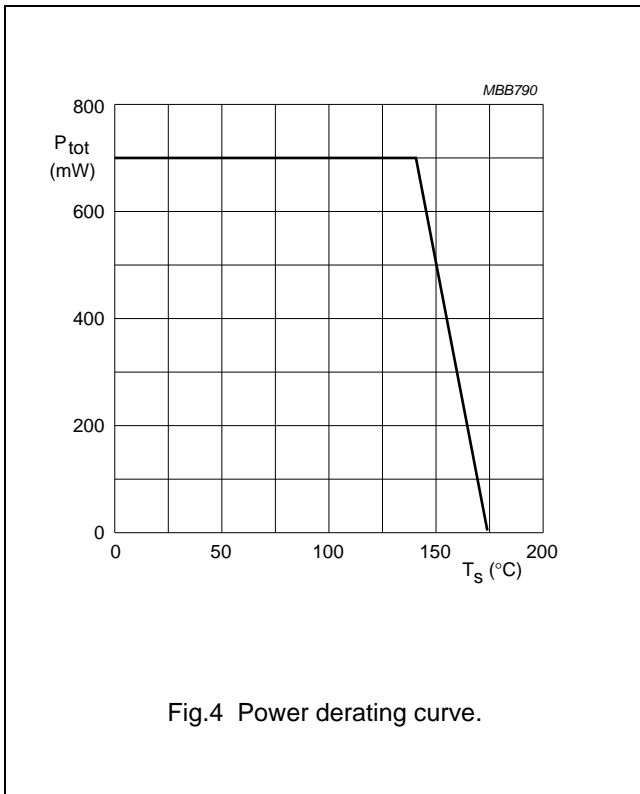
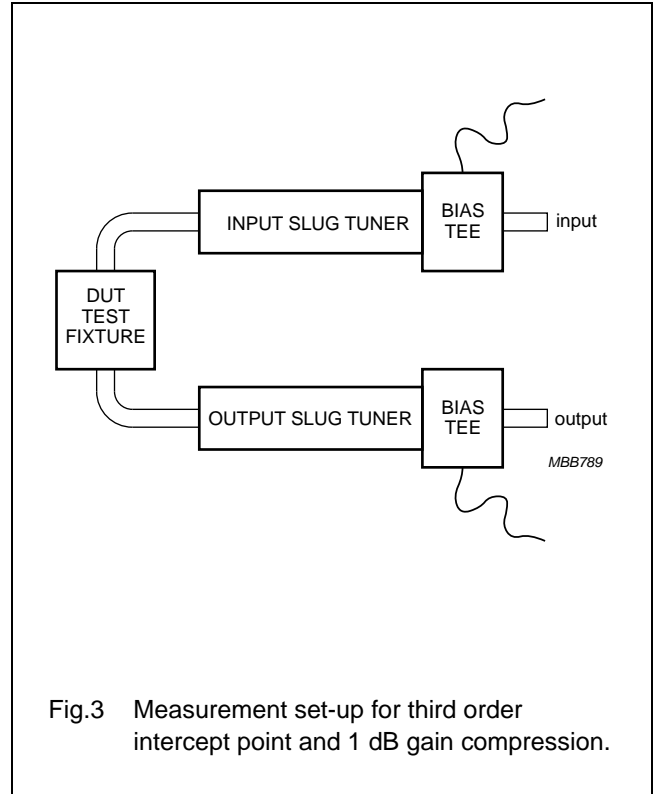
2. d<sub>im</sub> = –60 dB (DIN 45004B, par 6.3: 3-tone); I<sub>C</sub> = 45 mA; V<sub>CE</sub> = 10 V; R<sub>L</sub> = 75 Ω; T<sub>amb</sub> = 25 °C;  
V<sub>p</sub> = V<sub>O</sub> at d<sub>im</sub> = –60 dB; f<sub>p</sub> = 795.25 MHz;  
V<sub>q</sub> = V<sub>O</sub> –6 dB; V<sub>r</sub> = V<sub>O</sub> –6 dB;  
f<sub>q</sub> = 803.25 MHz; f<sub>r</sub> = 805.25 MHz;  
measured at f<sub>(p+q-r)</sub> = 793.25 MHz.
3. I<sub>C</sub> = 45 mA; V<sub>CE</sub> = 10 V; R<sub>L</sub> = 75 Ω; T<sub>amb</sub> = 25 °C;  
V<sub>q</sub> = V<sub>O</sub> = 280 mV;  
f<sub>p</sub> = 250 MHz; f<sub>q</sub> = 560 MHz;  
measured at f<sub>(p+q)</sub> = 810 MHz.
4. I<sub>C</sub> = 45 mA; V<sub>CE</sub> = 10 V; R<sub>L</sub> = 50 Ω; T<sub>amb</sub> = 25 °C;  
f<sub>p</sub> = 1000 MHz; f<sub>q</sub> = 1001 MHz;  
measured at f<sub>(2p-q)</sub> and f<sub>(2q-p)</sub>.

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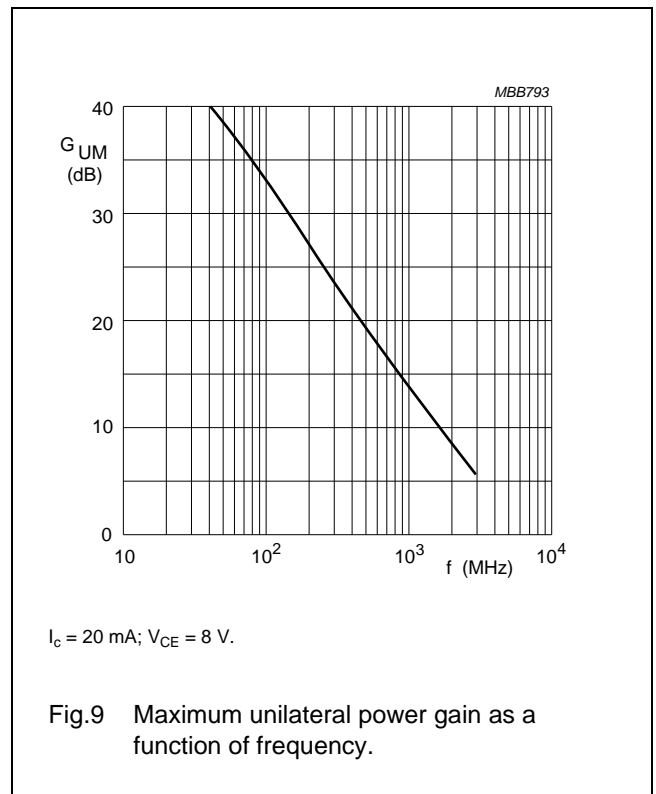
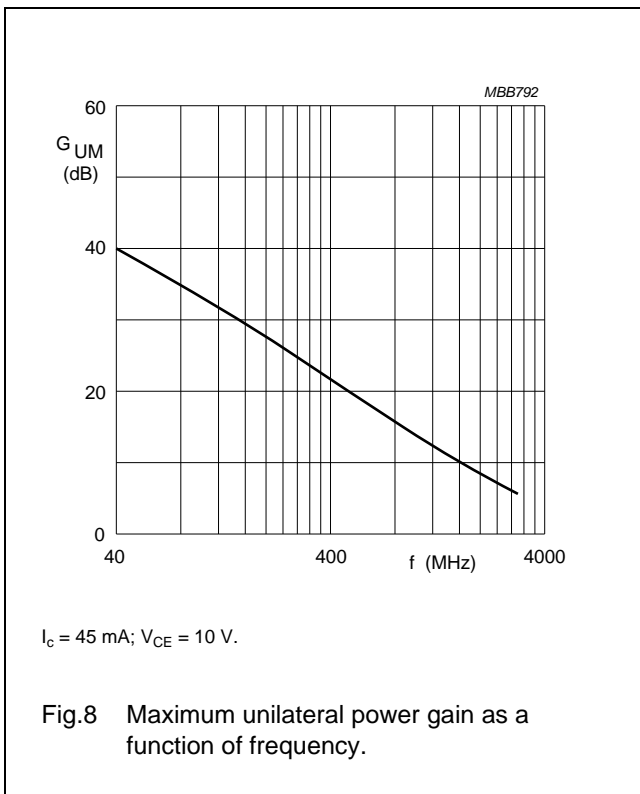
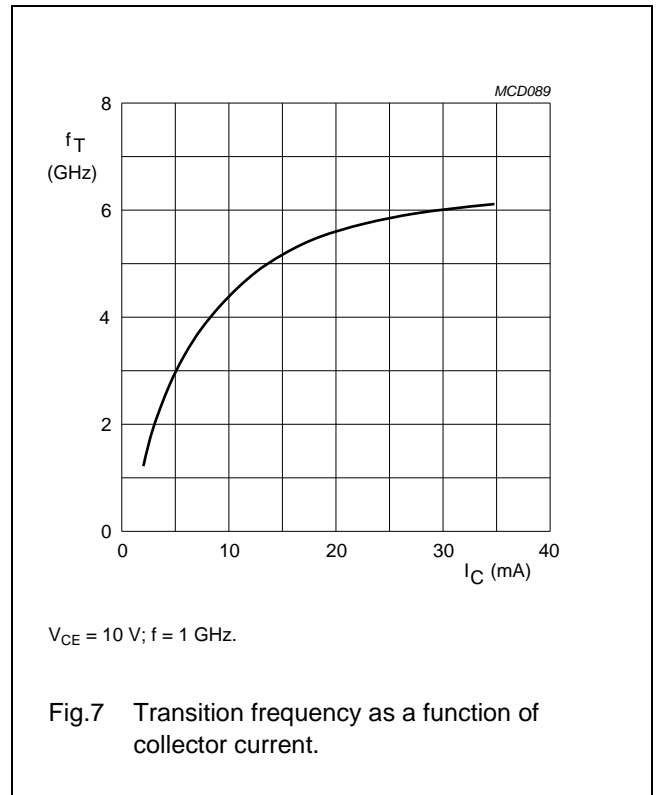
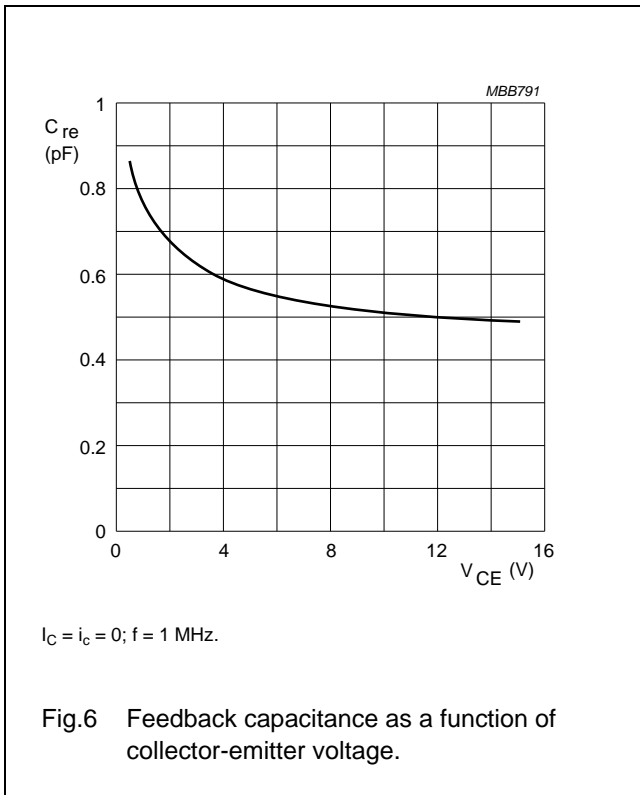


L1 = L3 = 5 μH micro-choke.  
 L2 = 1 turn copper wire (0.4 mm), internal diameter 4 mm.



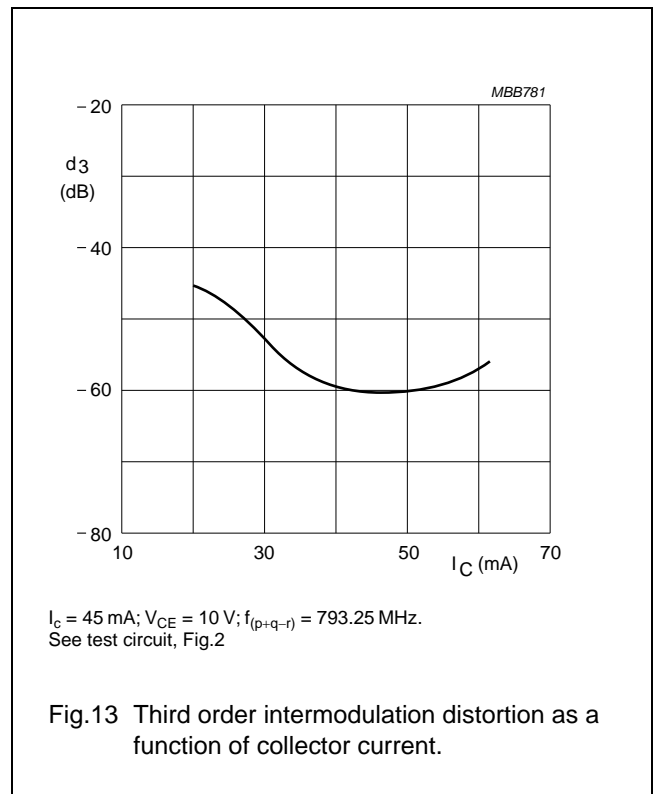
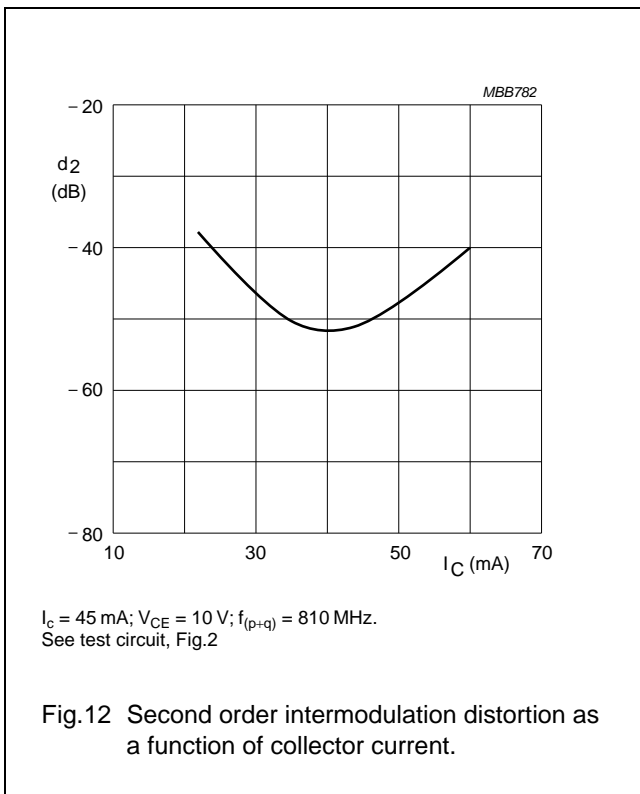
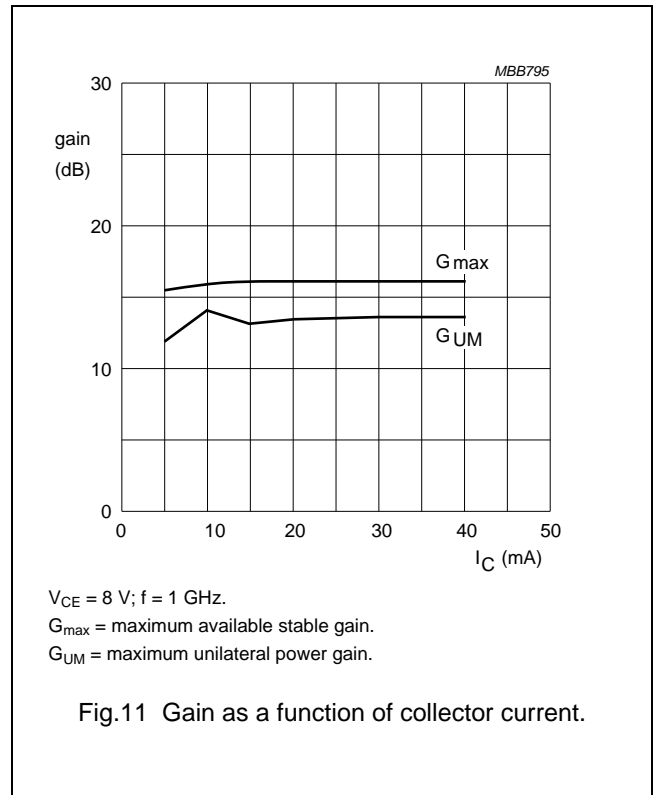
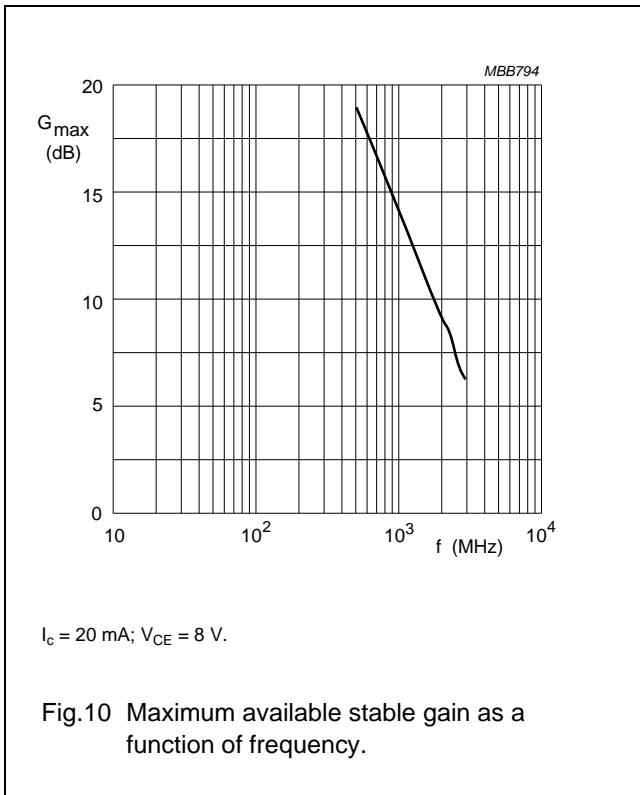
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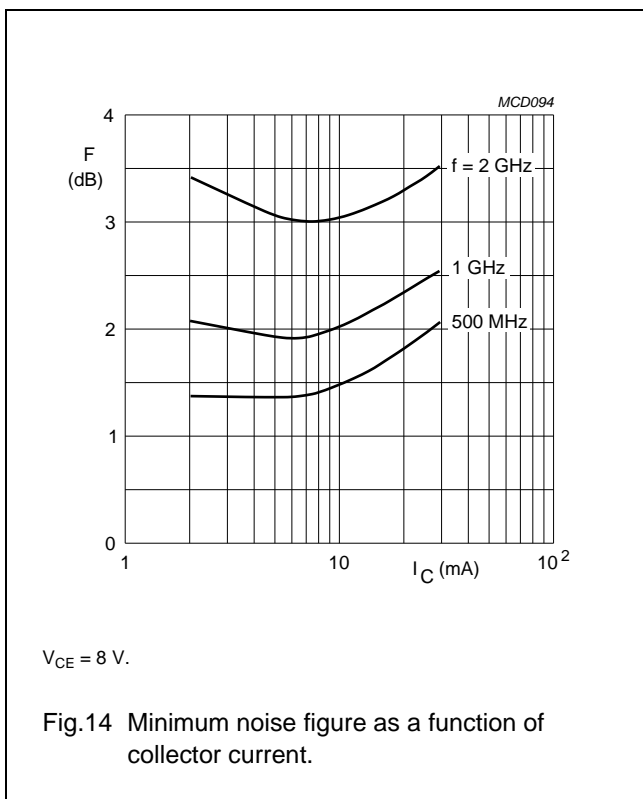
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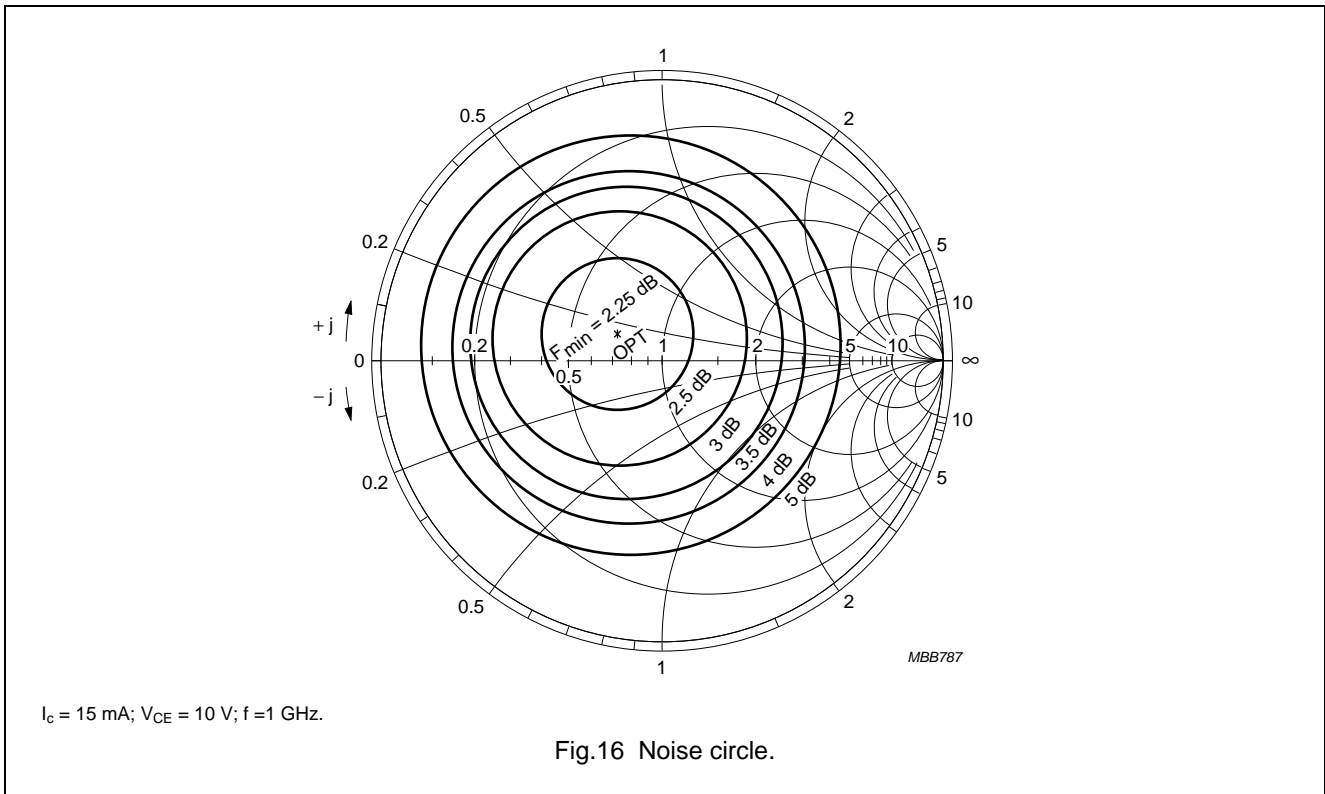
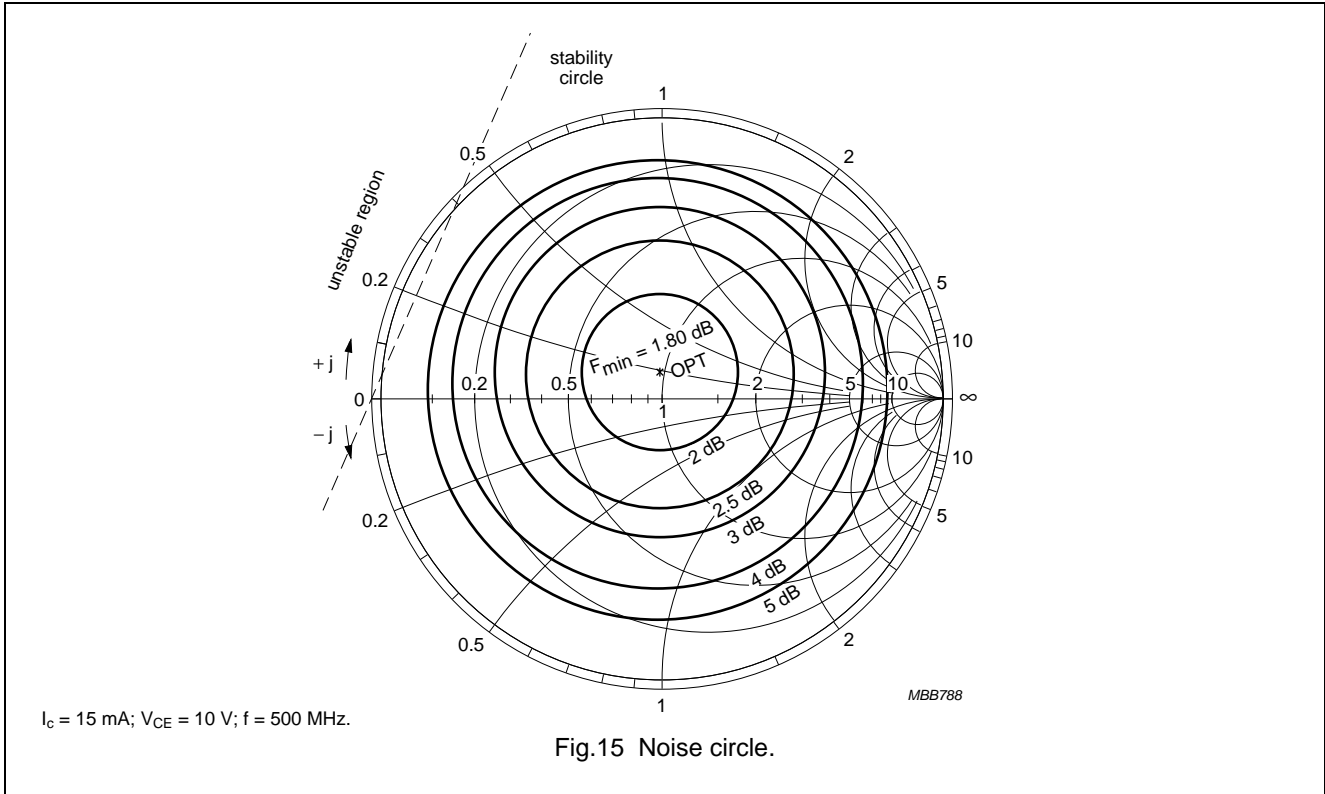
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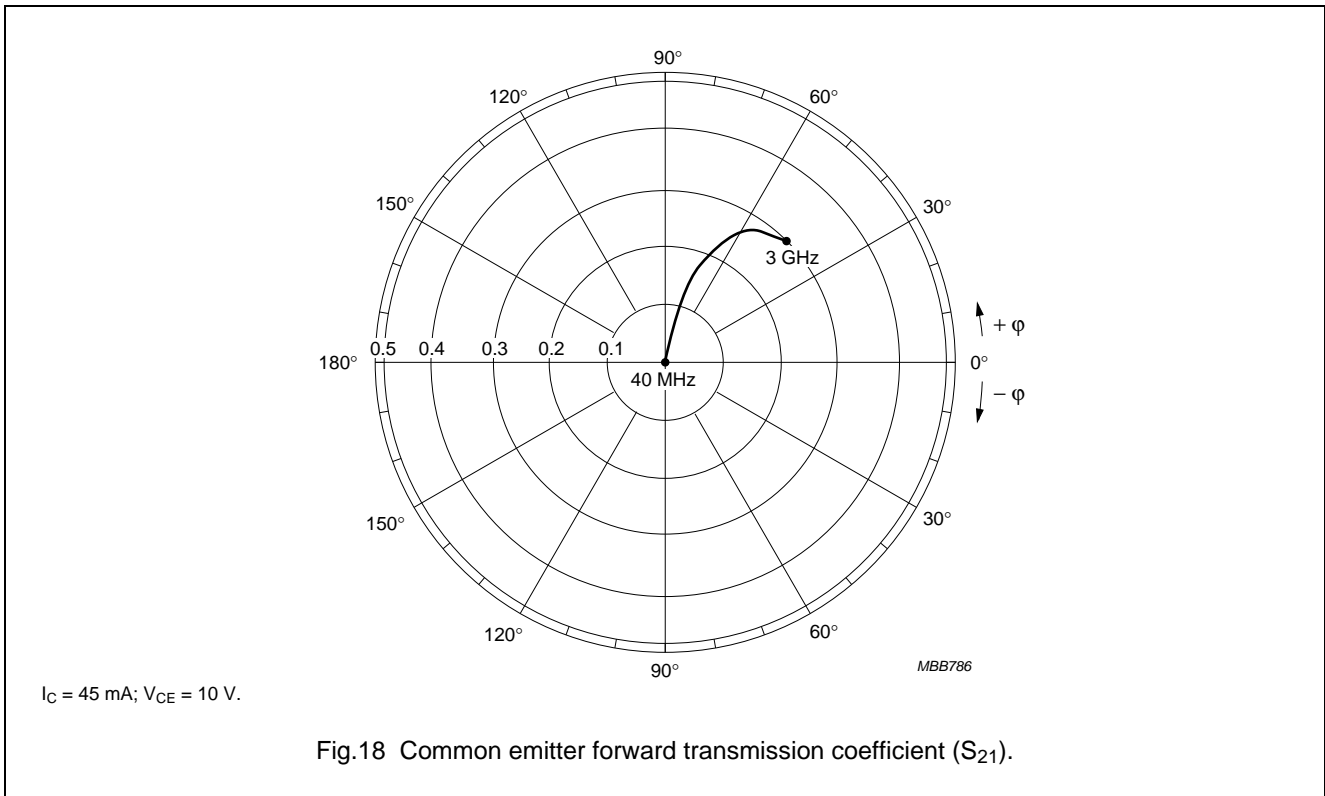
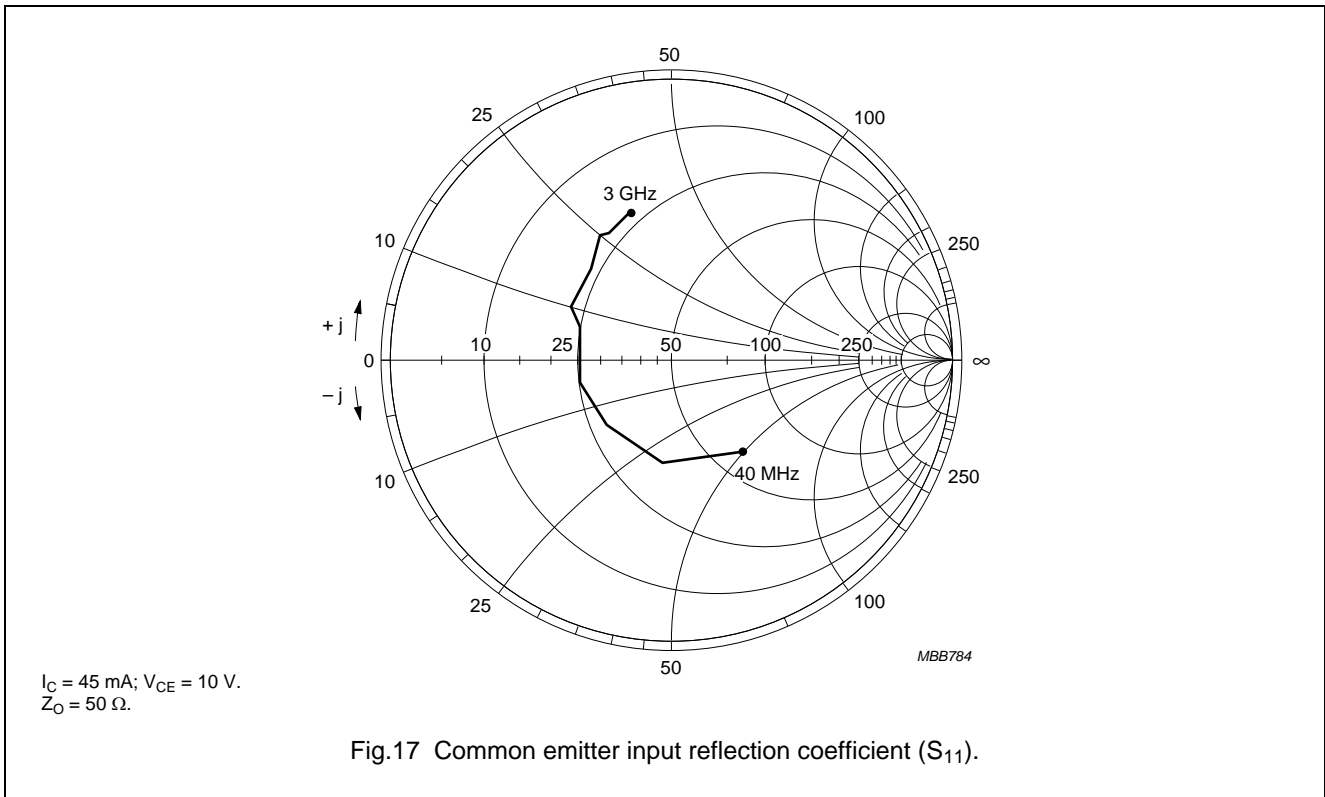
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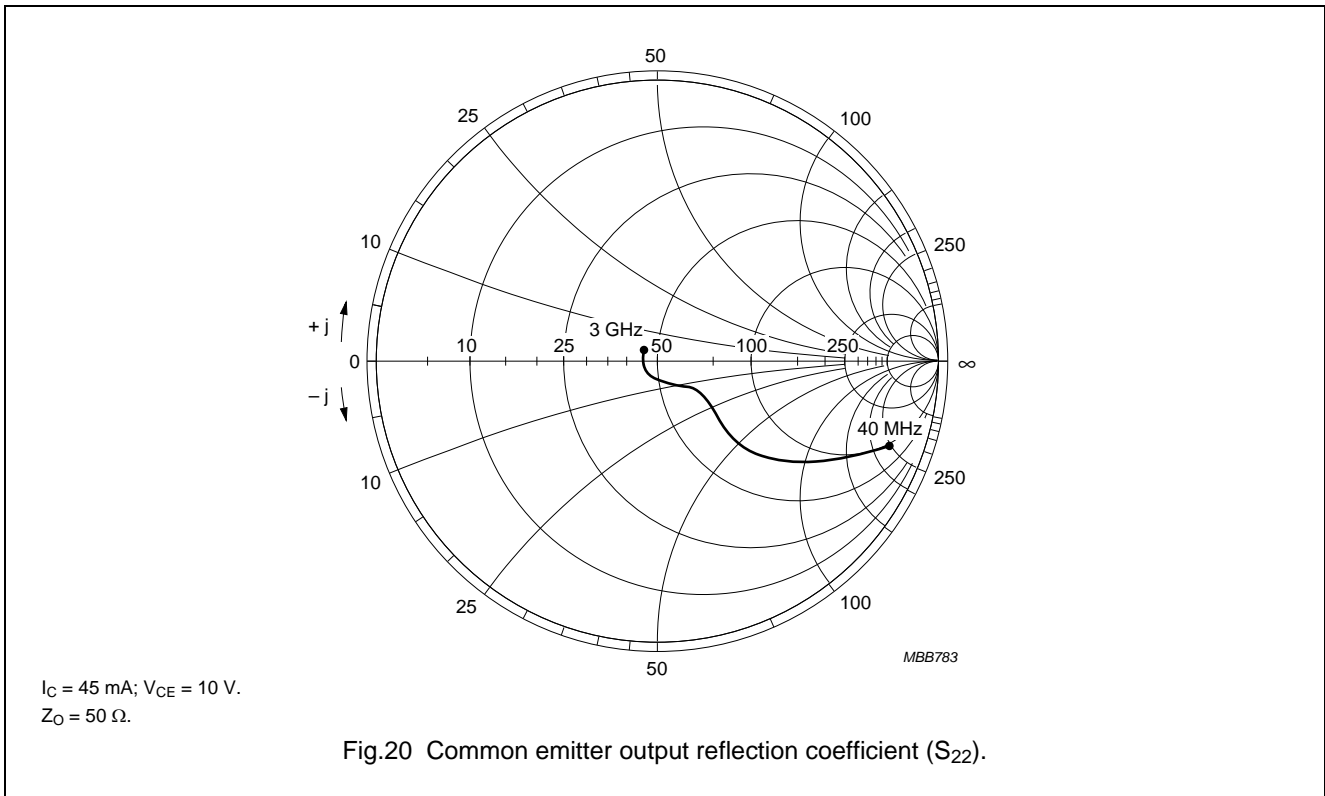
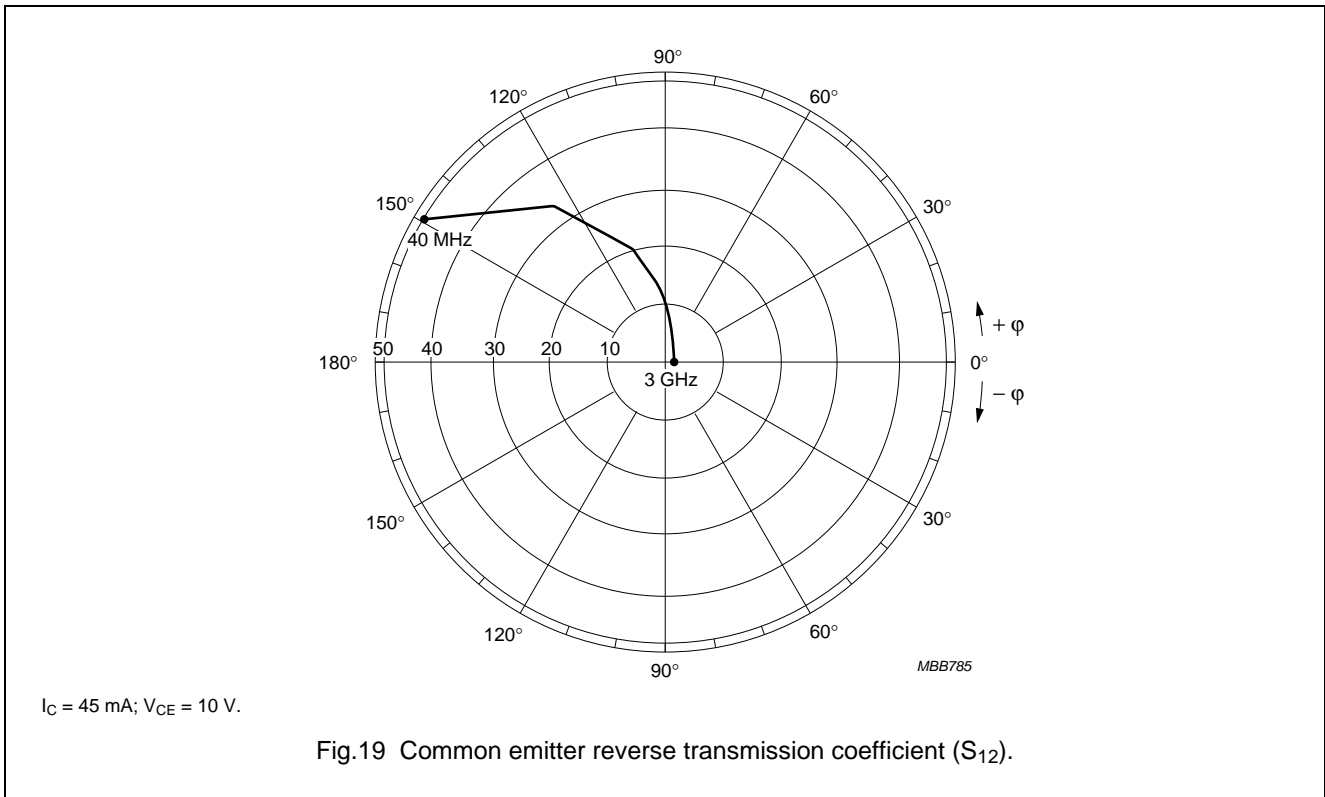
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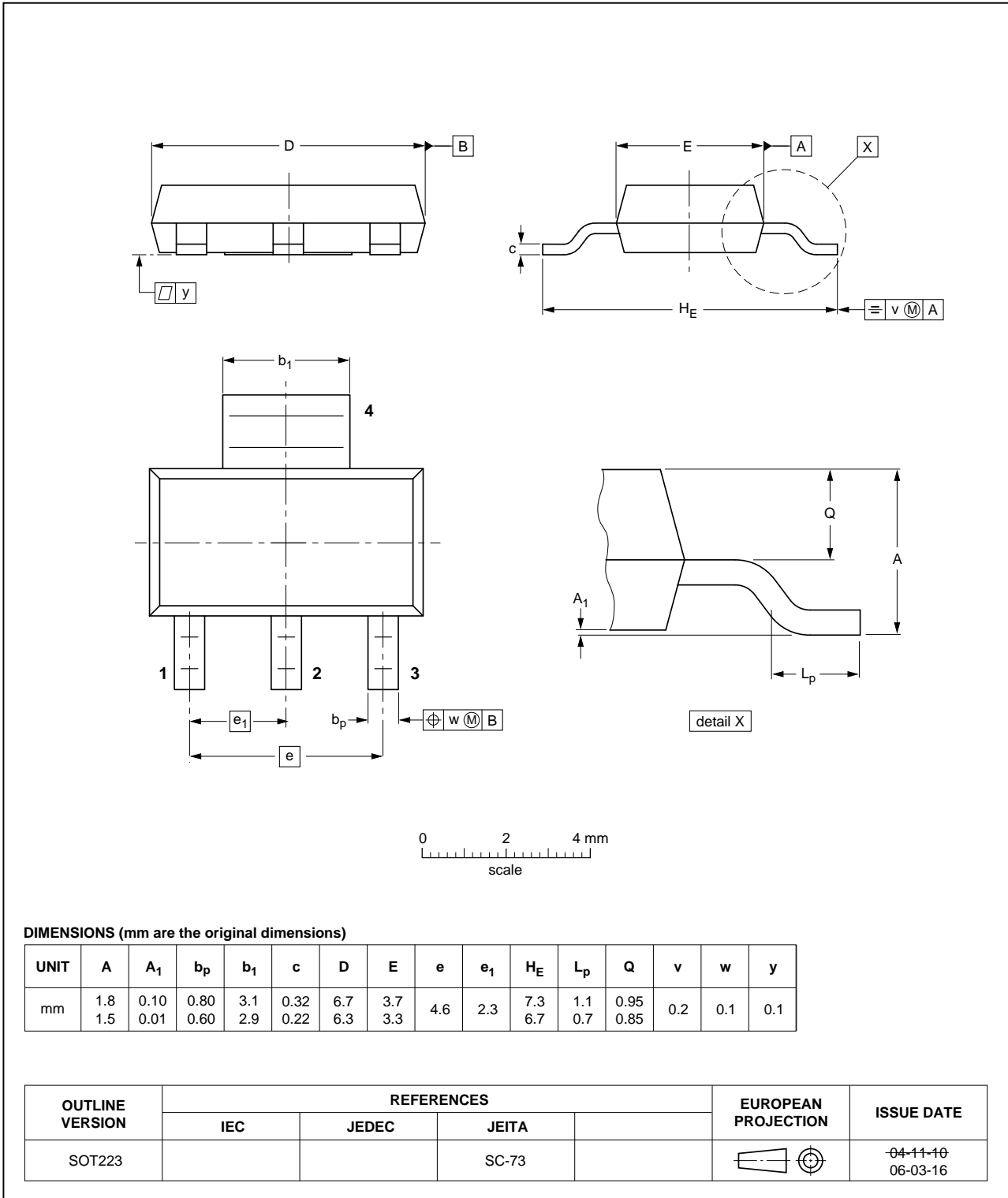
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PACKAGE OUTLINE

Plastic surface-mounted package with increased heatsink; 4 leads

SOT223



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## DATA SHEET STATUS

DOCUMENT STATUS <sup>(1)</sup>	PRODUCT STATUS <sup>(2)</sup>	DEFINITION
Objective data sheet	Development	This document contains data from the objective specification for product development.
Preliminary data sheet	Qualification	This document contains data from the preliminary specification.
Product data sheet	Production	This document contains the product specification.

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