

# DATA SHEET

**BFG35**

**NPN 4 GHz wideband transistor**

Product specification  
Supersedes data of 1995 Sep 12

1999 Aug 24



# NPN 4 GHz wideband transistor

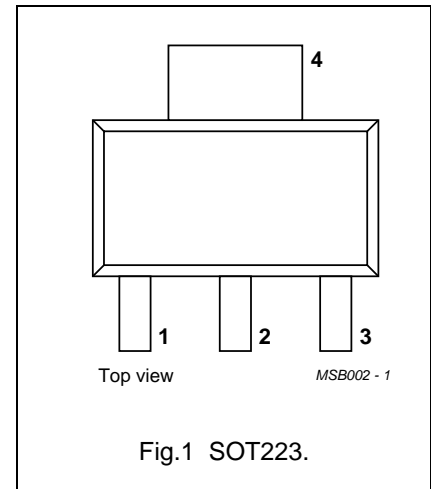
# BFG35

## DESCRIPTION

NPN planar epitaxial transistor mounted in a plastic SOT223 envelope, intended for wideband amplifier applications. It features high output voltage capabilities.

## PINNING

PIN	DESCRIPTION
1	emitter
2	base
3	emitter
4	collector



## QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{CEO}$	collector-emitter voltage	open base	–	–	18	V
$I_C$	DC collector current		–	–	150	mA
$P_{tot}$	total power dissipation	up to $T_s = 135\text{ °C}$ (note 1)	–	–	1	W
$h_{FE}$	DC current gain	$I_C = 100\text{ mA}$ ; $V_{CE} = 10\text{ V}$ ; $T_j = 25\text{ °C}$	25	70	–	
$f_T$	transition frequency	$I_C = 100\text{ mA}$ ; $V_{CE} = 10\text{ V}$ ; $f = 500\text{ MHz}$ ; $T_{amb} = 25\text{ °C}$	–	4	–	GHz
$G_{UM}$	maximum unilateral power gain	$I_C = 100\text{ mA}$ ; $V_{CE} = 10\text{ V}$ ; $f = 500\text{ MHz}$ ; $T_{amb} = 25\text{ °C}$	–	15	–	dB
		$I_C = 100\text{ mA}$ ; $V_{CE} = 10\text{ V}$ ; $f = 800\text{ MHz}$ ; $T_{amb} = 25\text{ °C}$	–	11	–	dB
$V_o$	output voltage	$I_C = 100\text{ mA}$ ; $V_{CE} = 10\text{ V}$ ; $d_{im} = -60\text{ dB}$ ; $R_L = 75\text{ }\Omega$ ; $f_{(p+q-r)} = 793.25\text{ MHz}$ ; $T_{amb} = 25\text{ °C}$	–	750	–	mV

## 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		–	150	mA
$P_{tot}$	total power dissipation	up to $T_s = 135\text{ °C}$ (note 1)	–	1	W
$T_{stg}$	storage temperature		–65	+150	°C
$T_j$	junction temperature		–	175	°C

## Note

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

NPN 4 GHz wideband transistor

BFG35

**THERMAL CHARACTERISTICS**

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j-s}$	thermal resistance from junction to soldering point	up to $T_s = 135\text{ °C}$ (note 1)	40	K/W

**Note**

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

**CHARACTERISTICS**

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$I_{CBO}$	collector cut-off current	$I_E = 0; V_{CB} = 10\text{ V}$	–	–	1	$\mu\text{A}$
$h_{FE}$	DC current gain	$I_C = 100\text{ mA}; V_{CE} = 10\text{ V}$	25	70	–	
$C_c$	collector capacitance	$I_E = i_e = 0; V_{CB} = 10\text{ V}; f = 1\text{ MHz}$	–	2	–	pF
$C_e$	emitter capacitance	$I_C = i_c = 0; V_{EB} = 0.5\text{ V}; f = 1\text{ MHz}$	–	10	–	pF
$C_{re}$	feedback capacitance	$I_C = 0; V_{CE} = 10\text{ V}; f = 1\text{ MHz}$	–	1.2	–	pF
$f_T$	transition frequency	$I_C = 100\text{ mA}; V_{CE} = 10\text{ V}; f = 500\text{ MHz}; T_{amb} = 25\text{ °C}$	–	4	–	GHz
$G_{UM}$	maximum unilateral power gain (note 1)	$I_C = 100\text{ mA}; V_{CE} = 10\text{ V}; f = 500\text{ MHz}; T_{amb} = 25\text{ °C}$	–	15	–	dB
		$I_C = 100\text{ mA}; V_{CE} = 10\text{ V}; f = 800\text{ MHz}; T_{amb} = 25\text{ °C}$	–	11	–	dB
$V_o$	output voltage	note 2	–	750	–	mV
		note 3	–	800	–	mV
$d_2$	second order intermodulation distortion	note 4	–	–55	–	dB
		note 5	–	–57	–	dB

**Notes**

- $G_{UM}$  is the maximum unilateral power gain, assuming  $S_{12}$  is zero and  $G_{UM} = 10 \log \frac{|s_{21}|^2}{(1 - |s_{11}|^2)(1 - |s_{22}|^2)}$  dB.
- $d_{im} = -60\text{ dB}$  (DIN 45004B);  $I_C = 100\text{ mA}; V_{CE} = 10\text{ V}; R_L = 75\ \Omega; T_{amb} = 25\text{ °C}$   
 $V_p = V_o$  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  $f_{(p+q-r)} = 793.25\text{ MHz}.$
- $d_{im} = -60\text{ dB}$  (DIN 45004B);  $I_C = 100\text{ mA}; V_{CE} = 10\text{ V}; R_L = 75\ \Omega; T_{amb} = 25\text{ °C}$   
 $V_p = V_o$  at  $d_{im} = -60\text{ dB}; f_p = 445.25\text{ MHz};$   
 $V_q = V_o - 6\text{ dB}; f_q = 453.25\text{ MHz};$   
 $V_r = V_o - 6\text{ dB}; f_r = 455.25\text{ MHz};$   
 measured at  $f_{(p+q-r)} = 443.25\text{ MHz}.$
- $I_C = 60\text{ mA}; V_{CE} = 10\text{ V}; R_L = 75\ \Omega;$   
 $V_p = V_q = V_o = 50\text{ dBmV};$   
 $f_{(p+q)} = 450\text{ MHz}; f_p = 50\text{ MHz}; f_q = 400\text{ MHz}.$
- $I_C = 60\text{ mA}; V_{CE} = 10\text{ V}; R_L = 75\ \Omega;$   
 $V_p = V_q = V_o = 50\text{ dBmV};$   
 $f_{(p+q)} = 810\text{ MHz}; f_p = 250\text{ MHz}; f_q = 560\text{ MHz}.$

NPN 4 GHz wideband transistor

BFG35

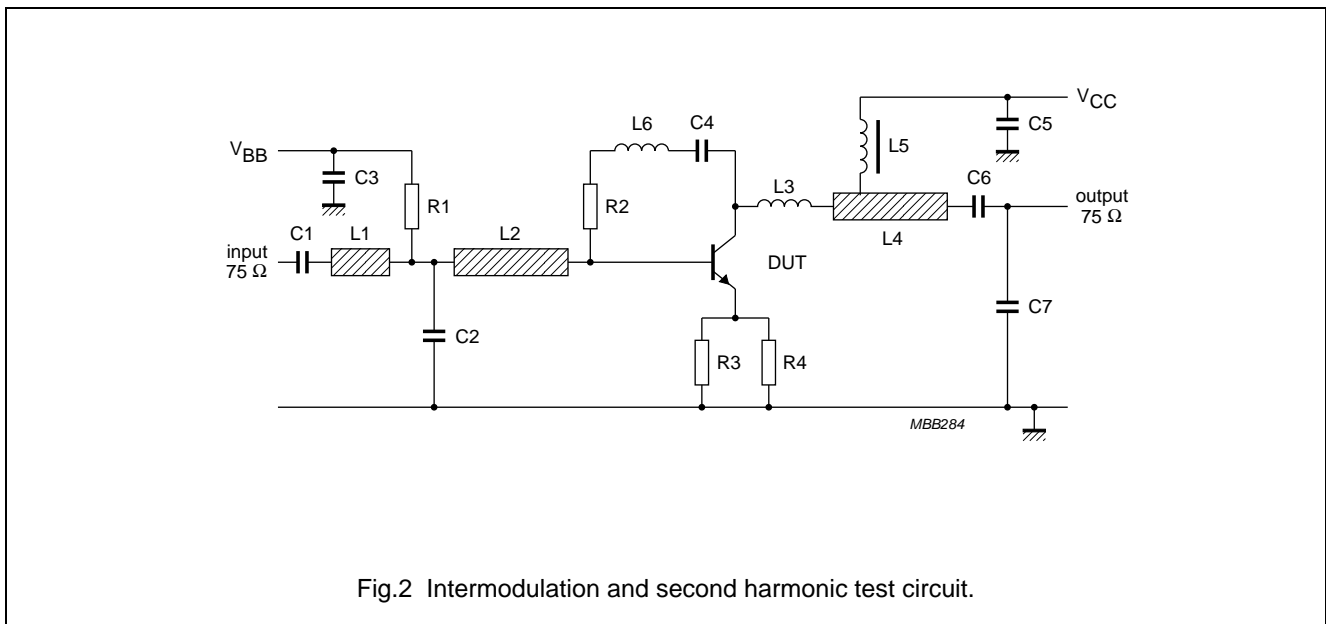


Fig.2 Intermodulation and second harmonic test circuit.

List of components (see test circuit)

DESIGNATION	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1, C3, C5, C6	multilayer ceramic capacitor	10 nF		2222 590 08627
C2, C7	multilayer ceramic capacitor	1 pF		2222 851 12108
C4 (note 1)	miniature ceramic plate capacitor	10 nF		2222 629 08103
L1	microstrip line	75 Ω	length 7mm; width 2.5 mm	
L2	microstrip line	75 Ω	length 22mm; width 2.5 mm	
L3 (note 1)	1.5 turns 0.4 mm copper wire		int. dia. 3 mm; winding pitch 1 mm	
L4	microstripline	75 Ω	length 19 mm; width 2.5 mm	
L5	Ferroxcube choke	5 μH		3122 108 20153
L6 (note 1)	0.4 mm copper wire	≈25 nH	length 30 mm	
R1	metal film resistor	10 kΩ		2322 180 73103
R2 (note 1)	metal film resistor	200 Ω		2322 180 73201
R3, R4	metal film resistor	27 Ω		2322 180 73279

Note

- Components C4, L3, L6 and R2 are mounted on the underside of the PCB.  
The circuit is constructed on a double copper-clad printed circuit board with PTFE dielectric ( $\epsilon_r = 2.2$ ); thickness  $\frac{1}{16}$  inch; thickness of copper sheet  $\frac{1}{32}$  inch.

NPN 4 GHz wideband transistor

BFG35

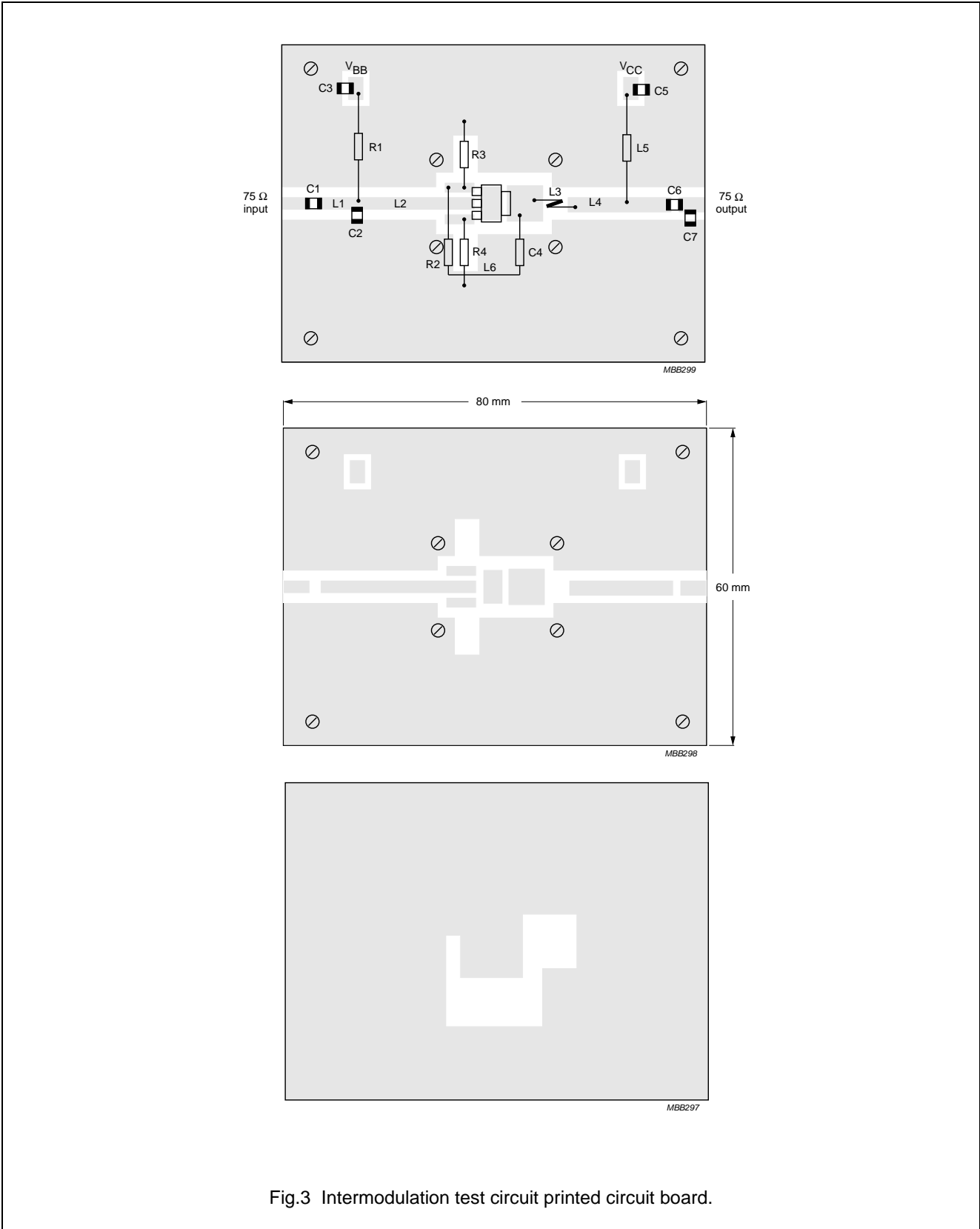
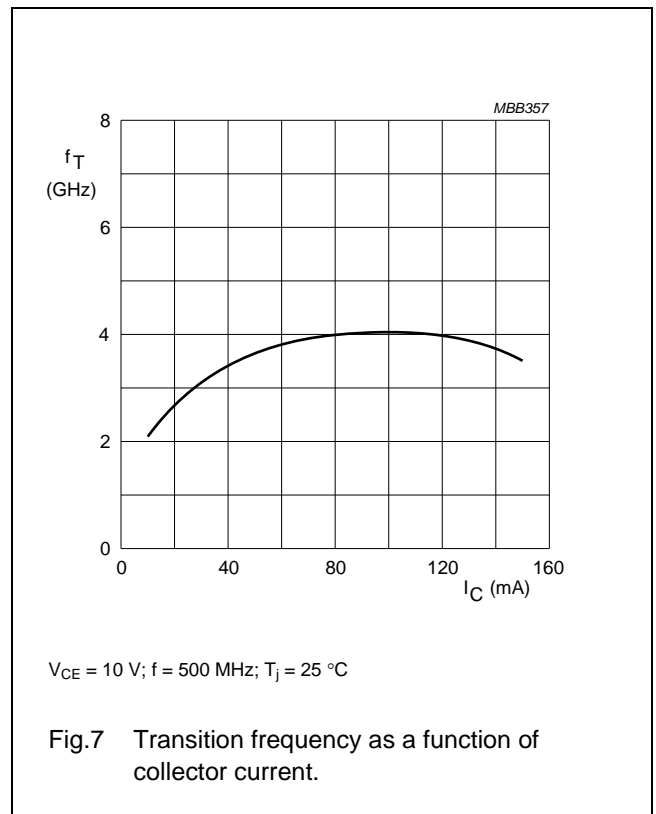
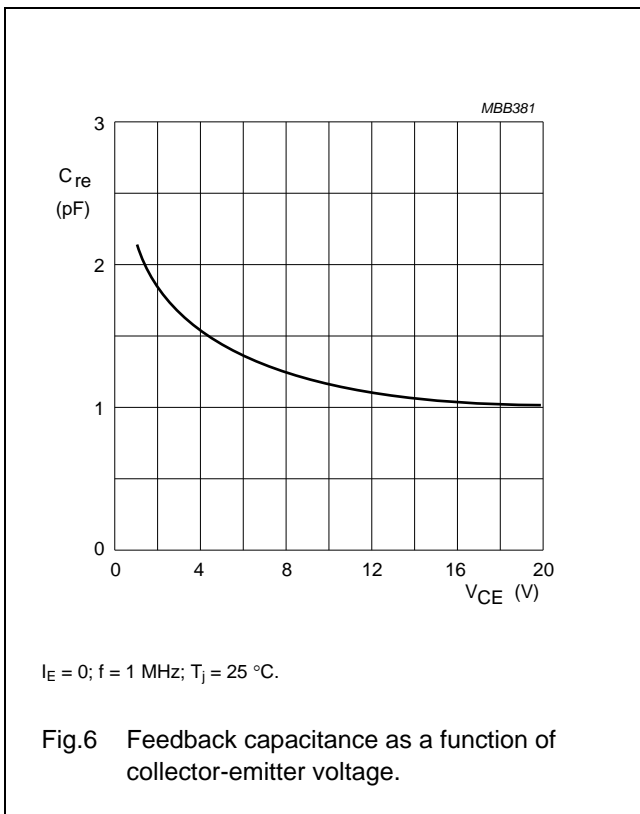
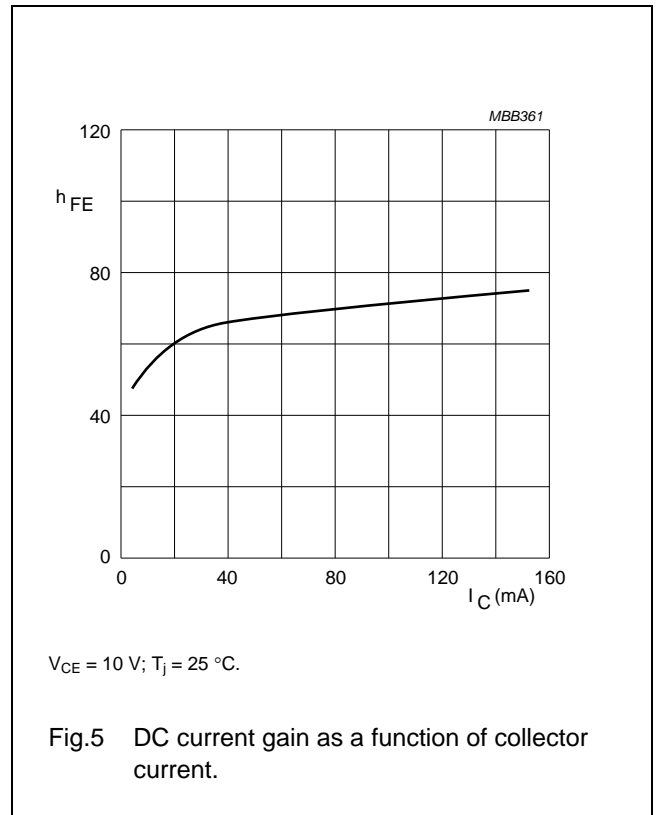
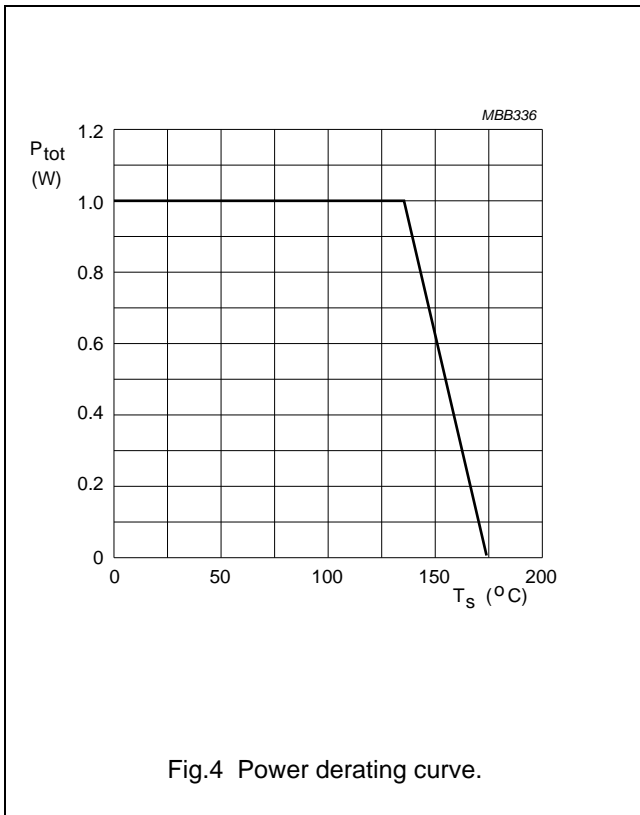


Fig.3 Intermodulation test circuit printed circuit board.

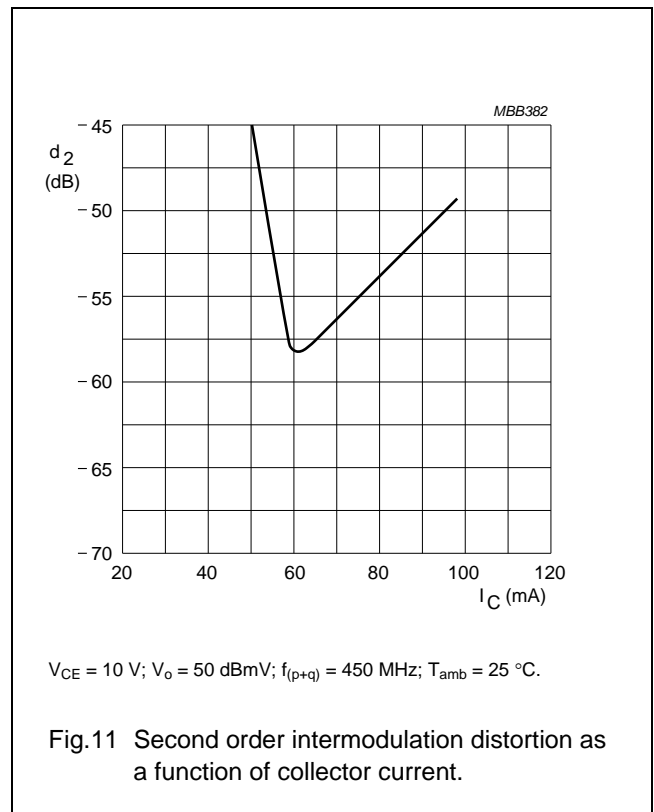
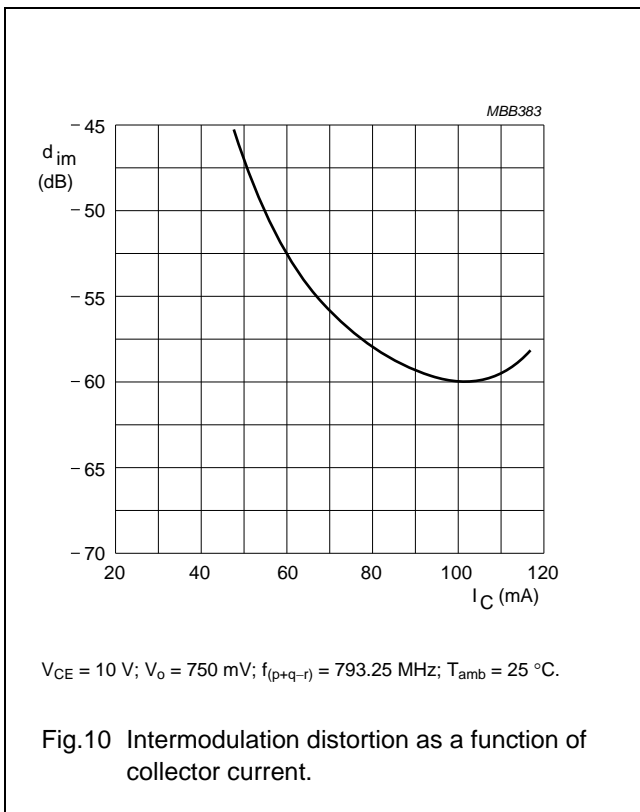
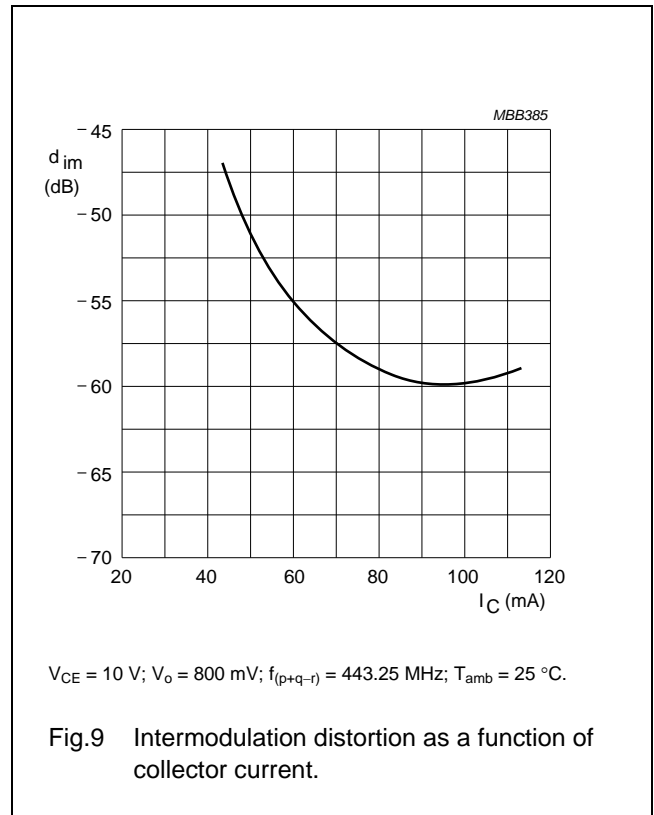
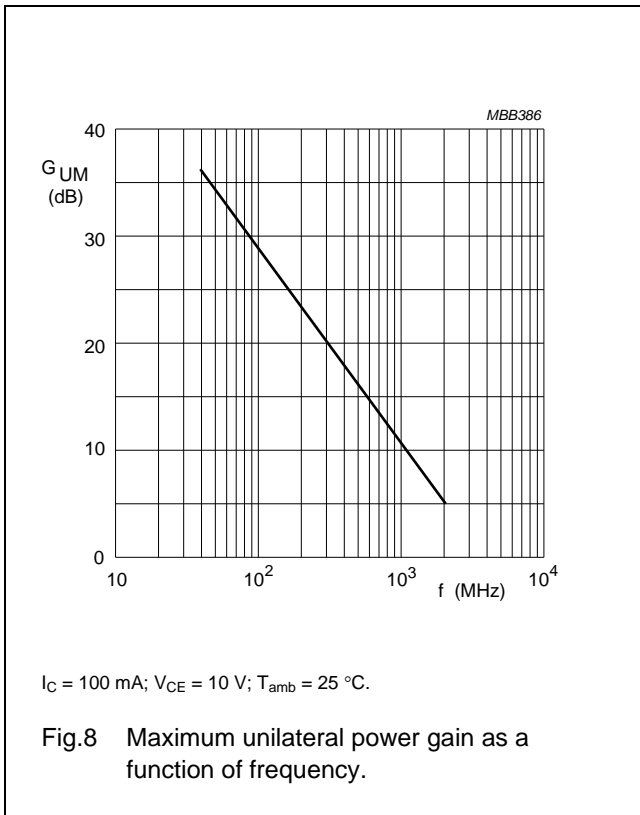
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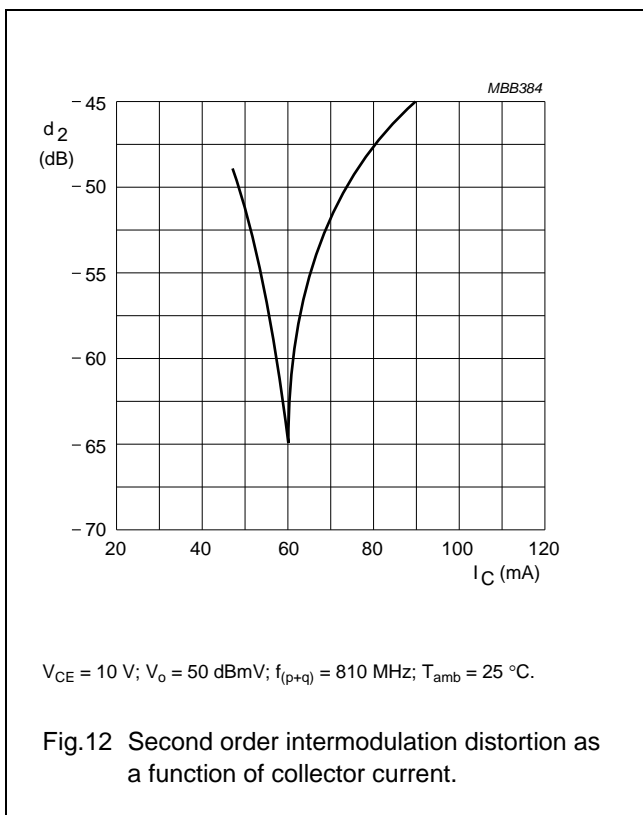
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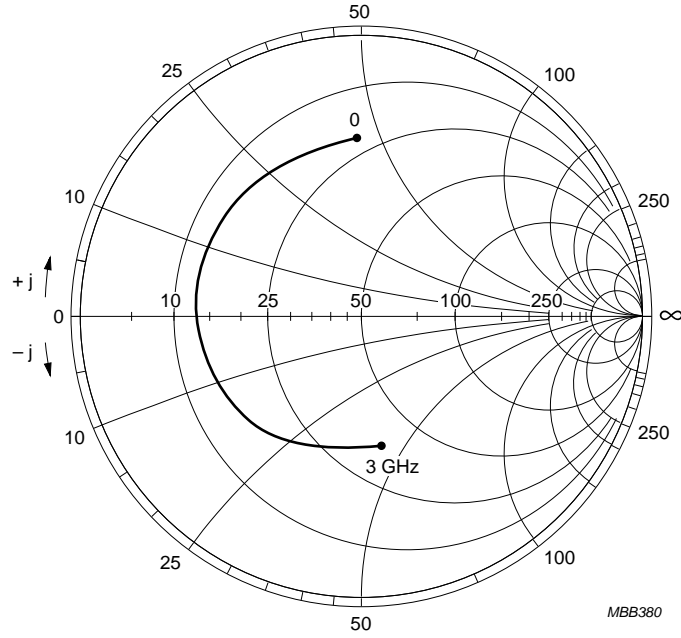
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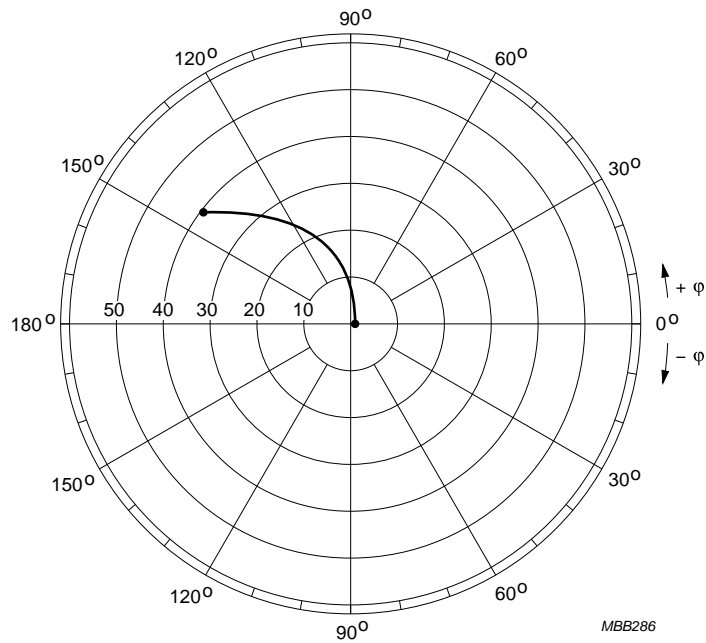
NPN 4 GHz wideband transistor

BFG35



$I_C = 100 \text{ mA}$ ;  $V_{CE} = 10 \text{ V}$ ;  $T_{amb} = 25 \text{ }^\circ\text{C}$ ;  $Z_0 = 50 \text{ } \Omega$ .

Fig.13 Common emitter input reflection coefficient ( $S_{11}$ ).

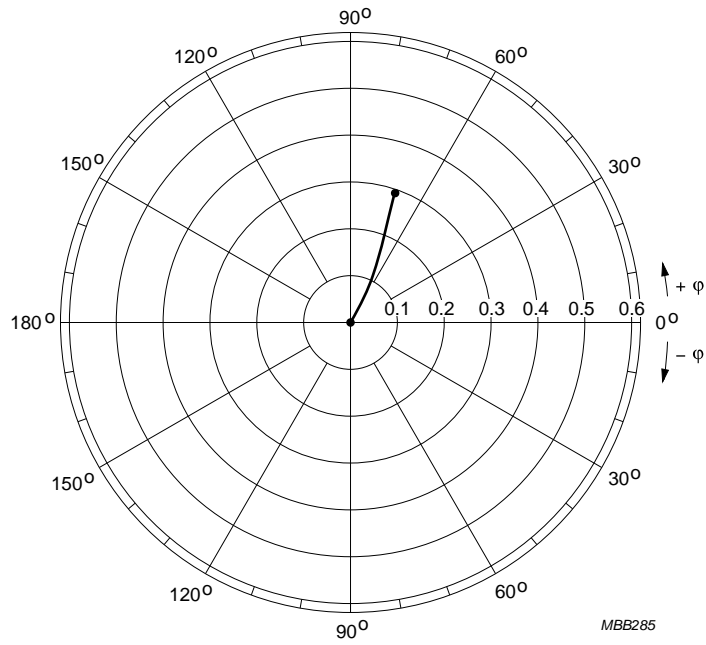


$I_C = 100 \text{ mA}$ ;  $V_{CE} = 10 \text{ V}$ ;  $T_{amb} = 25 \text{ }^\circ\text{C}$ .

Fig.14 Common emitter forward transmission coefficient ( $S_{21}$ ).

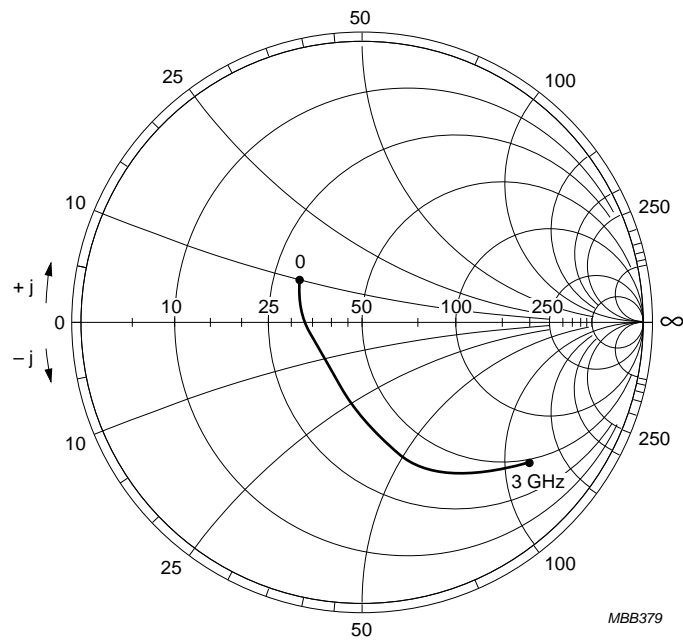
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BFG35



$I_C = 100 \text{ mA}$ ;  $V_{CE} = 10 \text{ V}$ ;  $T_{amb} = 25 \text{ }^\circ\text{C}$ .

Fig.15 Common emitter reverse transmission coefficient ( $S_{12}$ ).



$I_C = 100 \text{ mA}$ ;  $V_{CE} = 10 \text{ V}$ ;  $T_{amb} = 25 \text{ }^\circ\text{C}$ ;  $Z_0 = 50 \text{ } \Omega$ .

Fig.16 Common emitter output reflection coefficient ( $S_{22}$ ).

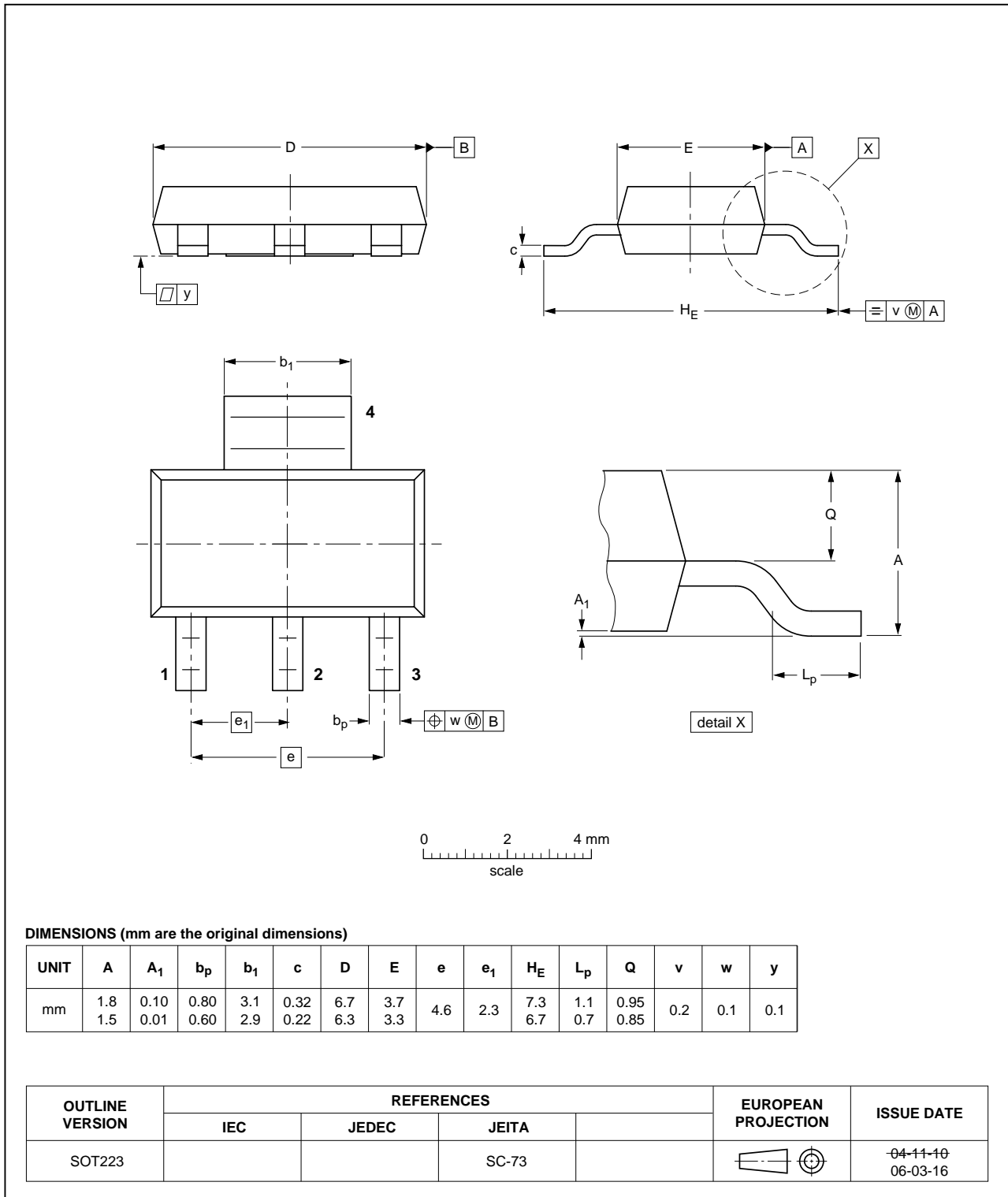
NPN 4 GHz wideband transistor

BFG35

PACKAGE OUTLINE

Plastic surface-mounted package with increased heatsink; 4 leads

SOT223



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# BFG35

## 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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## NPN 4 GHz wideband transistor

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