

# DATA SHEET

**BFG35**

**NPN 4 GHz wideband transistor**

Product specification  
Supersedes data of 1995 Sep 12

1999 Aug 24

## NPN 4 GHz wideband transistor

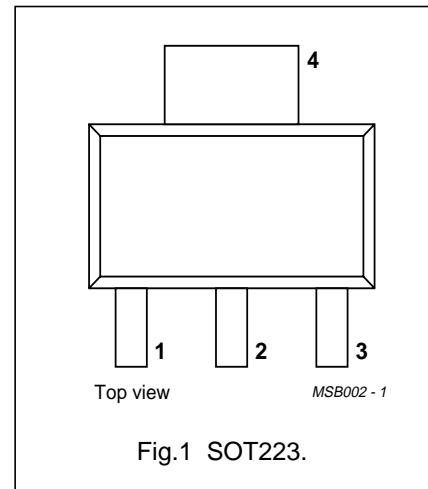
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## DESCRIPTION

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.

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## 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  $f_{(p+q-r)} = 443.25\text{ MHz}$ .
- $I_C = 60\text{ mA}; V_{CE} = 10\text{ V}; R_L = 75\ \Omega;$   
 $V_p = V_q = V_o = 50\text{ dBmV};$   
 $f_{(p+q)} = 450\text{ MHz}; f_p = 50\text{ MHz}; f_q = 400\text{ MHz}.$
- $I_C = 60\text{ mA}; V_{CE} = 10\text{ V}; R_L = 75\ \Omega;$   
 $V_p = V_q = V_o = 50\text{ dBmV};$   
 $f_{(p+q)} = 810\text{ MHz}; f_p = 250\text{ MHz}; f_q = 560\text{ MHz}.$

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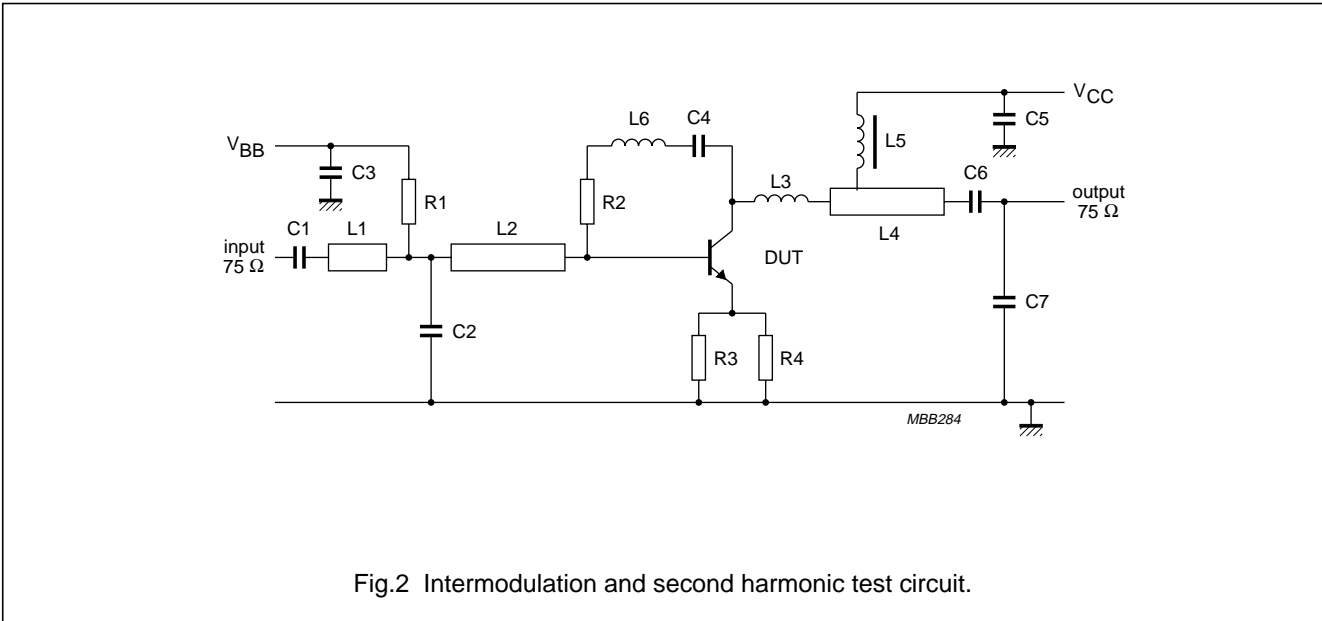


Fig.2 Intermodulation and second harmonic test circuit.

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  $1/16$  inch; thickness of copper sheet  $1/32$  inch.

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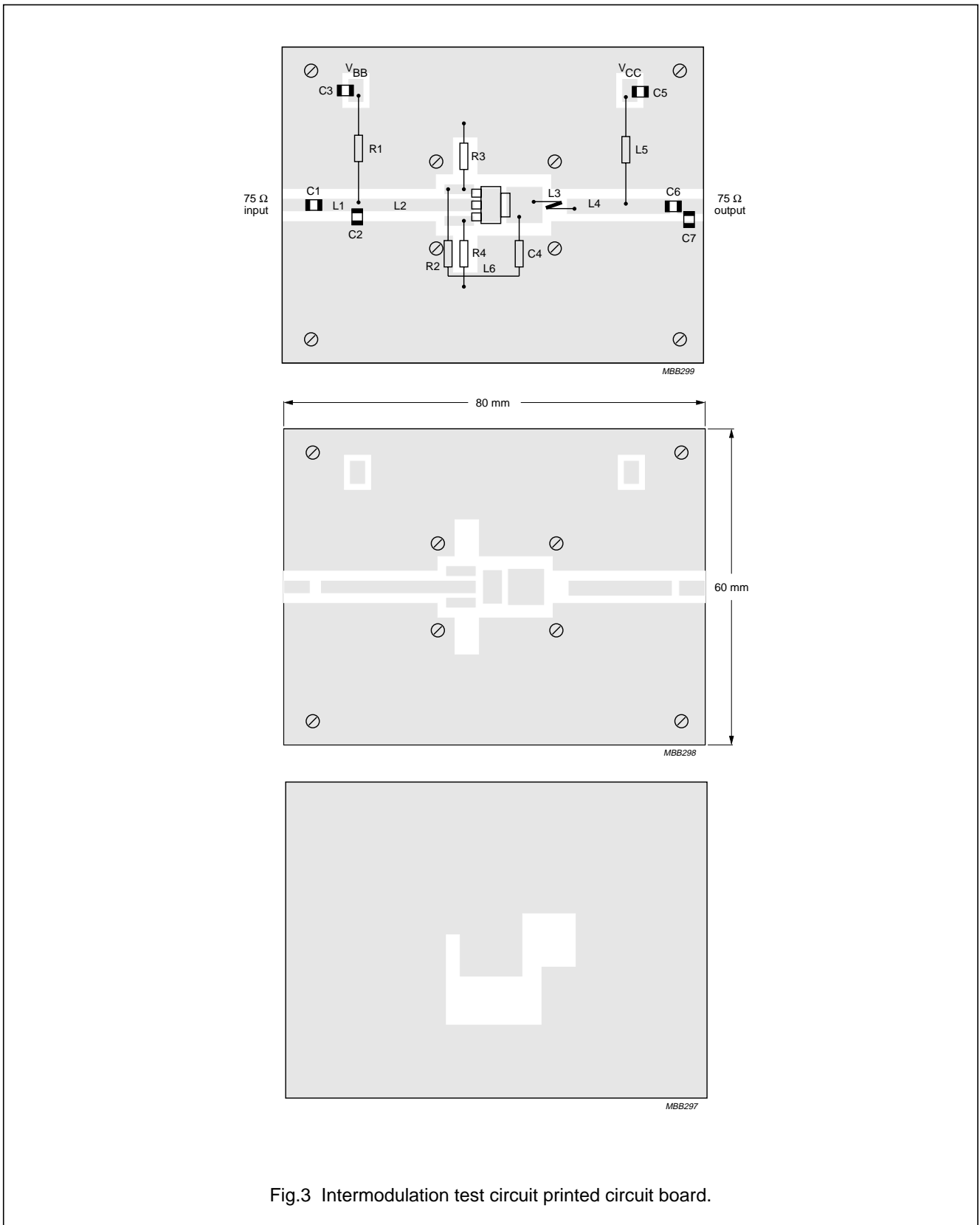
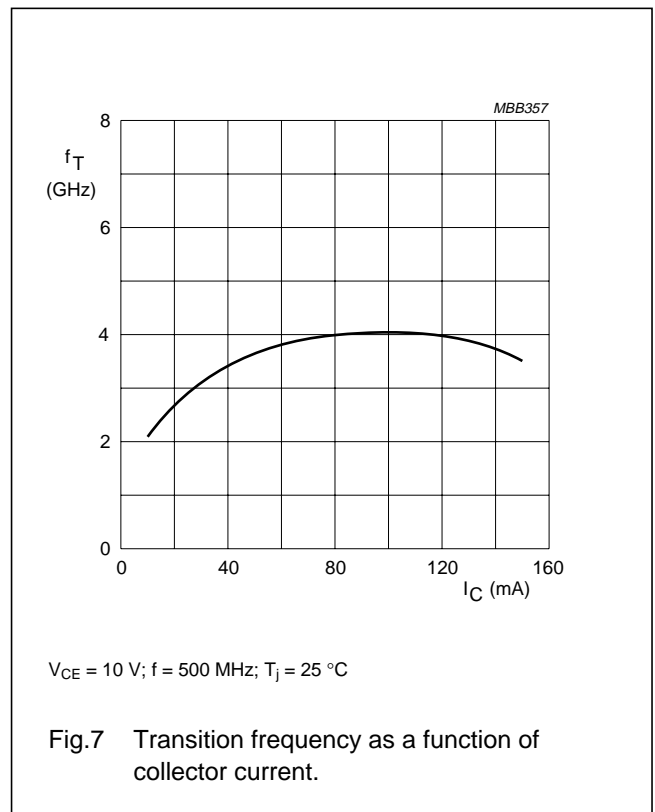
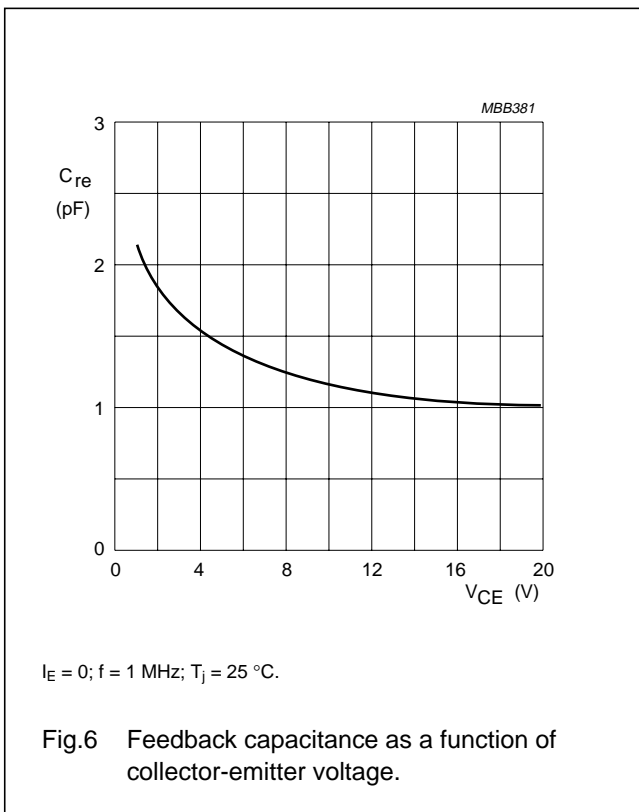
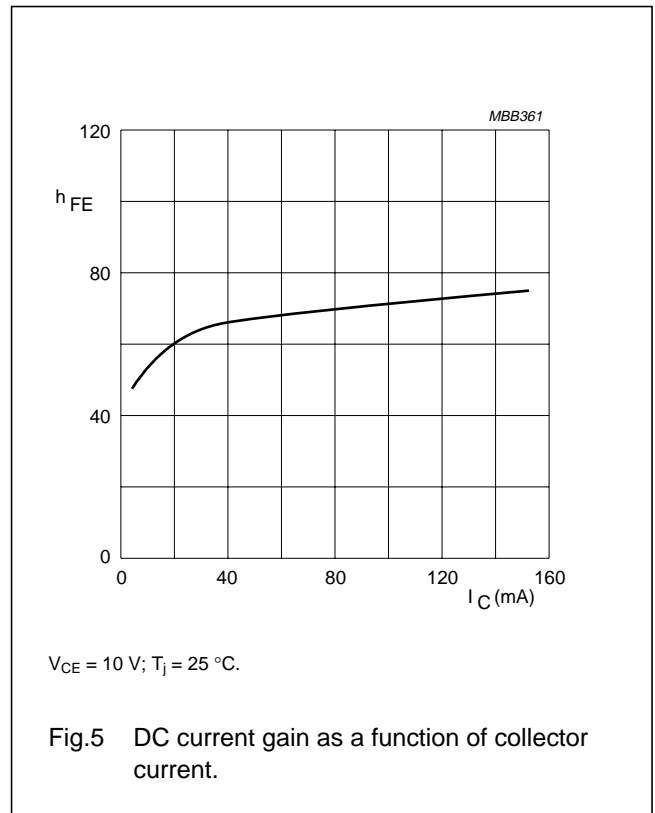
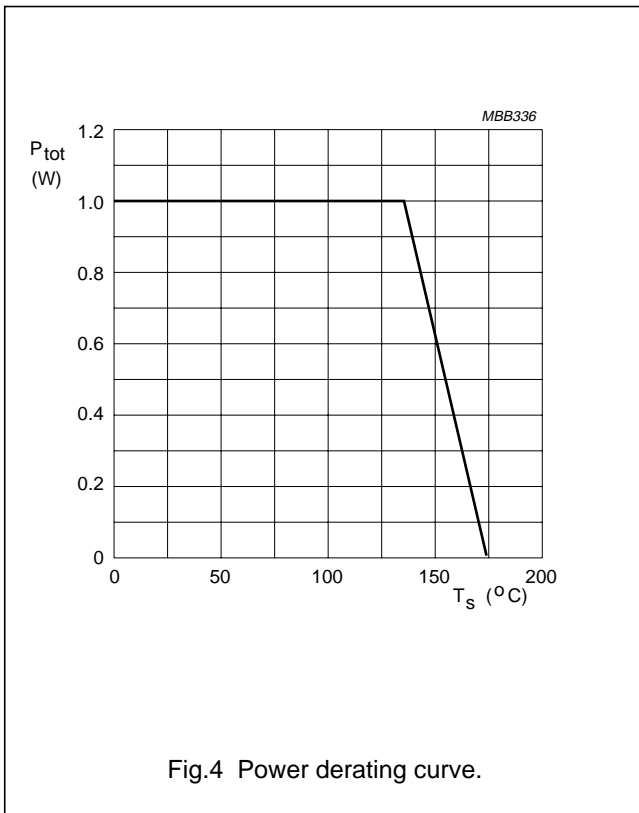


Fig.3 Intermodulation test circuit printed circuit board.

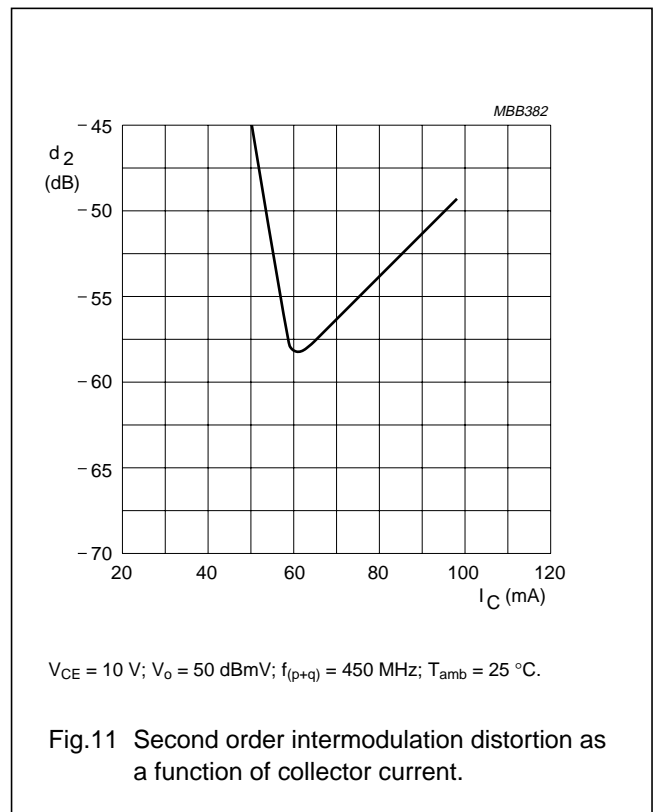
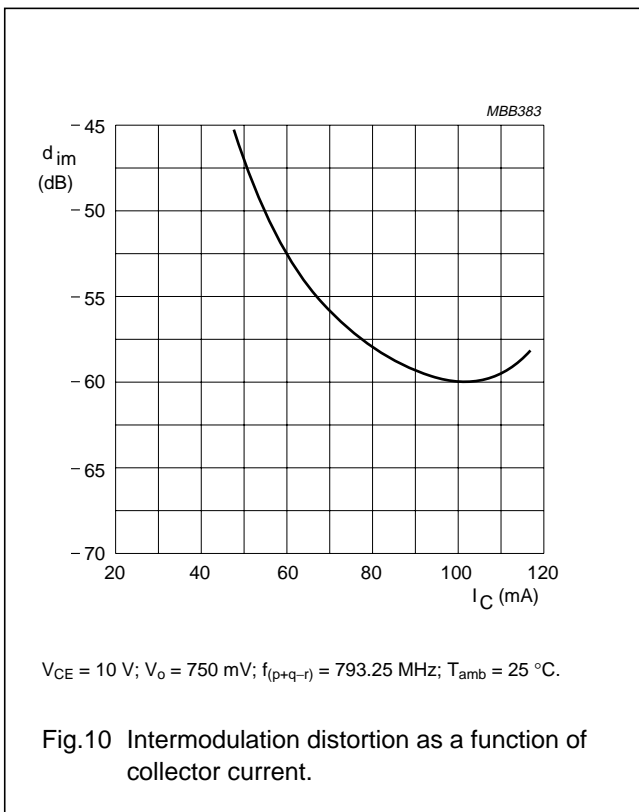
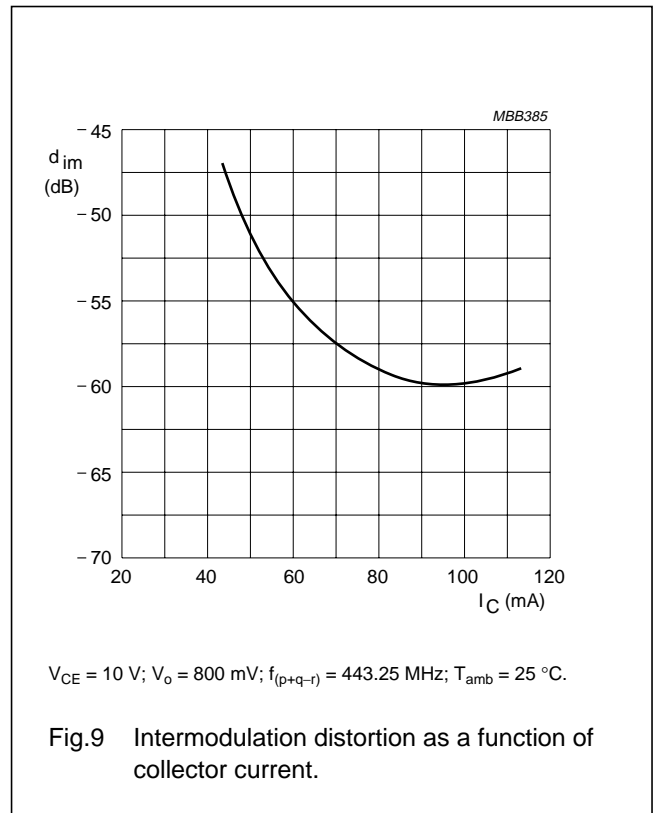
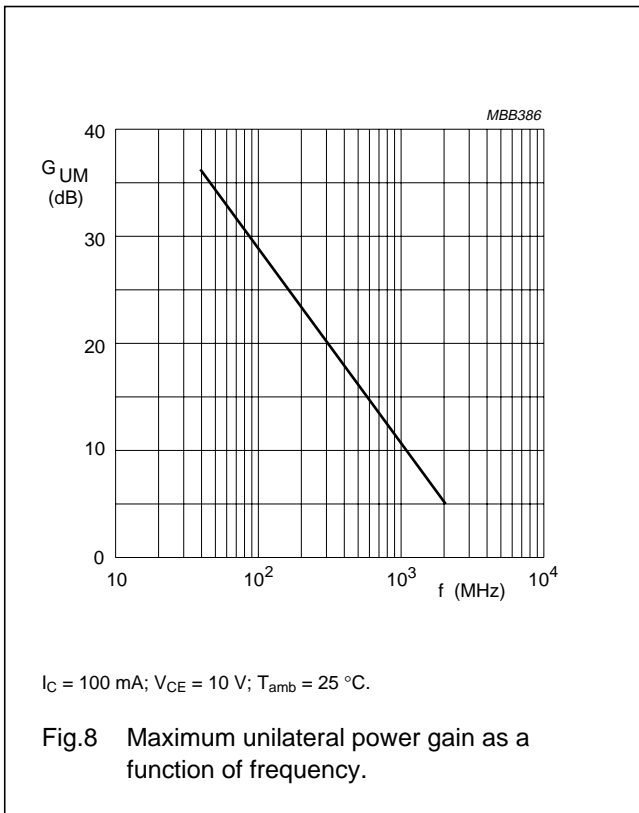
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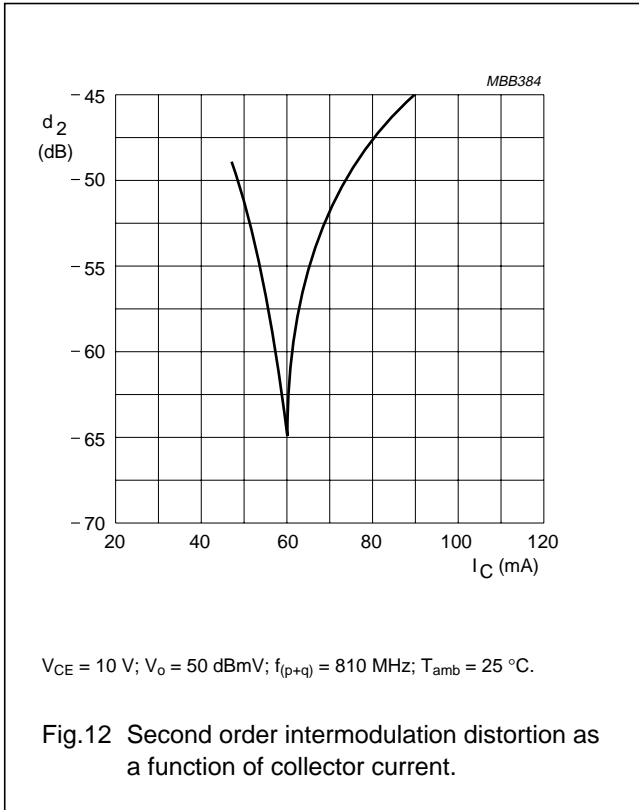
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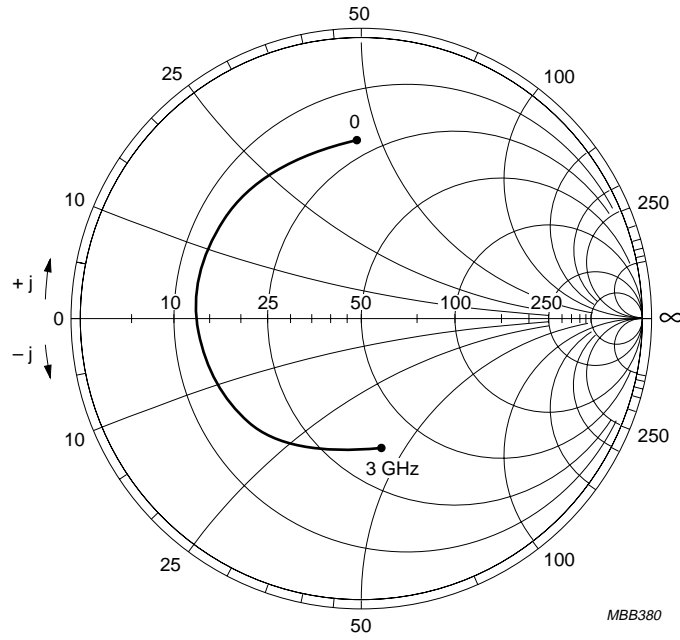
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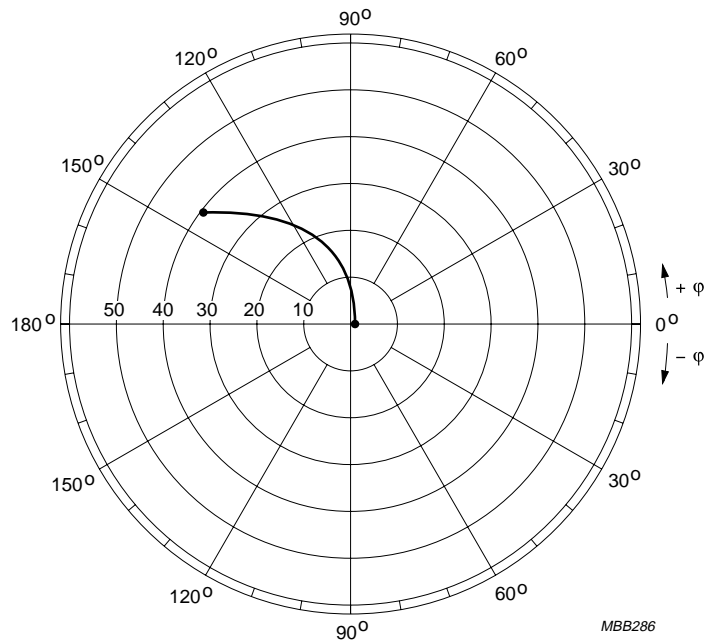
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$I_C = 100 \text{ mA}$ ;  $V_{CE} = 10 \text{ V}$ ;  $T_{amb} = 25 \text{ }^\circ\text{C}$ ;  $Z_o = 50 \text{ } \Omega$ .

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

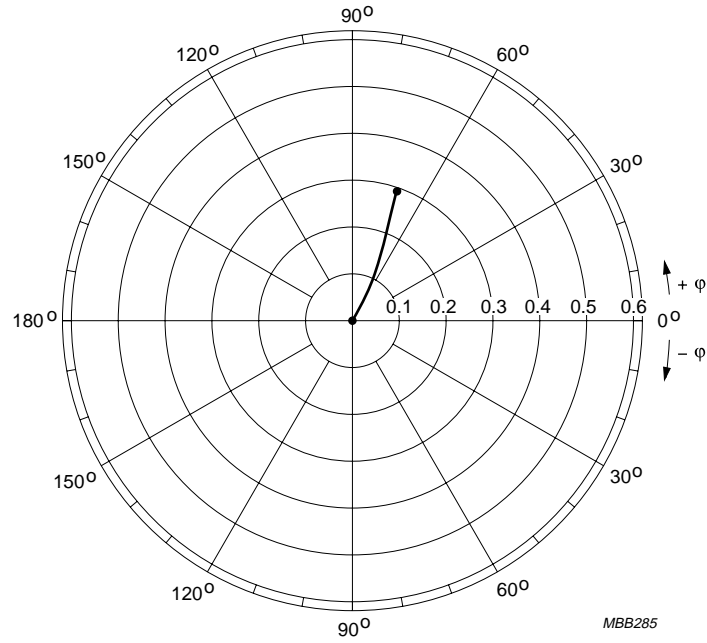


$I_C = 100 \text{ mA}$ ;  $V_{CE} = 10 \text{ V}$ ;  $T_{amb} = 25 \text{ }^\circ\text{C}$ .

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

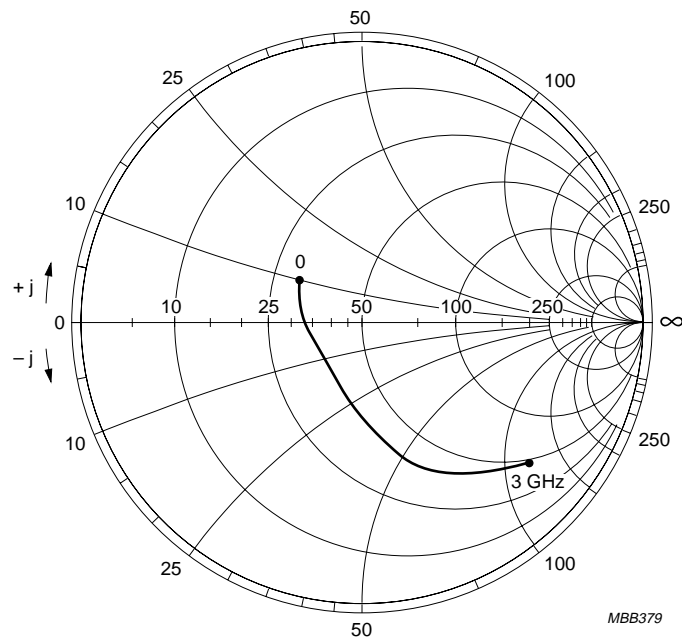
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$I_C = 100 \text{ mA}; V_{CE} = 10 \text{ V}; T_{amb} = 25 \text{ }^\circ\text{C}.$

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



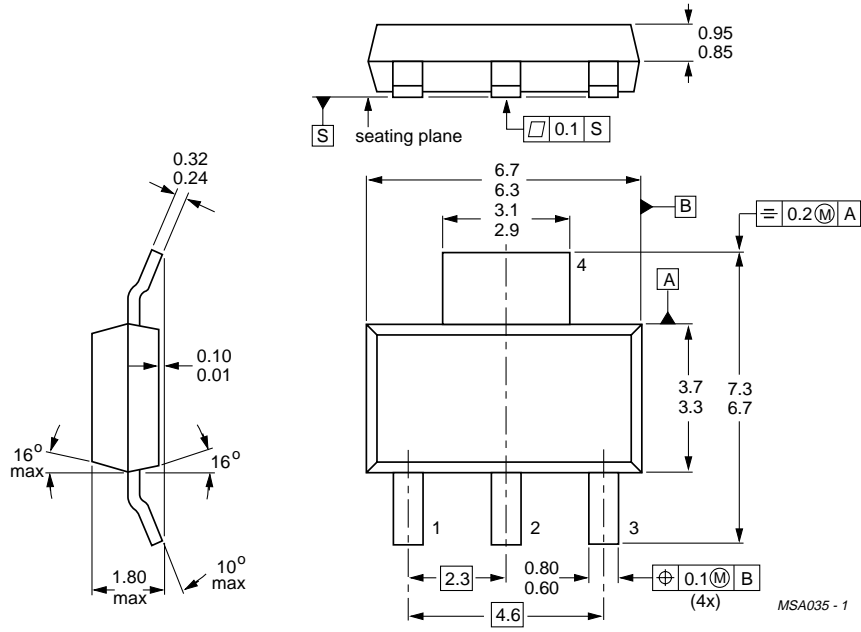
$I_C = 100 \text{ mA}; V_{CE} = 10 \text{ V}; T_{amb} = 25 \text{ }^\circ\text{C}; Z_0 = 50 \text{ } \Omega.$

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

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PACKAGE OUTLINE



Dimensions in mm.

Fig.17 SOT223.

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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.	
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