

# DATA SHEET

**BFG135**

**NPN 7GHz wideband transistor**

Product specification  
File under discrete semiconductors, SC14

1995 Sep 13

## NPN 7GHz wideband transistor

## BFG135

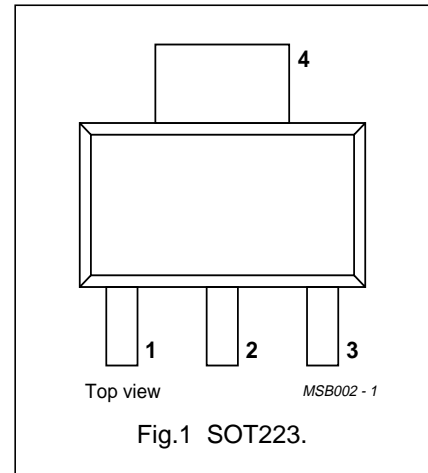
## DESCRIPTION

NPN silicon planar epitaxial transistor in a plastic SOT223 envelope, intended for wideband amplifier applications. The small emitter structures, with integrated emitter-ballasting resistors, ensure high output voltage capabilities at a low distortion level.

The distribution of the active areas across the surface of the device gives an excellent temperature profile.

## PINNING

PIN	DESCRIPTION
1	emitter
2	base
3	emitter
4	collector



## QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{CB0}$	collector-base voltage	open emitter	–	–	25	V
$V_{CEO}$	collector-emitter voltage	open base	–	–	15	V
$I_C$	DC collector current		–	–	150	mA
$P_{tot}$	total power dissipation	up to $T_s = 145\text{ °C}$ (note 1)	–	–	1	W
$h_{FE}$	DC current gain	$I_C = 100\text{ mA}$ ; $V_{CE} = 10\text{ V}$ ; $T_j = 25\text{ °C}$	80	130	–	
$f_T$	transition frequency	$I_C = 100\text{ mA}$ ; $V_{CE} = 10\text{ V}$ ; $f = 1\text{ GHz}$ ; $T_{amb} = 25\text{ °C}$	–	7	–	GHz
$G_{UM}$	maximum unilateral power gain	$I_C = 100\text{ mA}$ ; $V_{CE} = 10\text{ V}$ ; $f = 500\text{ MHz}$ ; $T_{amb} = 25\text{ °C}$	–	16	–	dB
		$I_C = 100\text{ mA}$ ; $V_{CE} = 10\text{ V}$ ; $f = 800\text{ MHz}$ ; $T_{amb} = 25\text{ °C}$	–	12	–	dB
$V_o$	output voltage	$d_{im} = -60\text{ dB}$ ; $I_C = 100\text{ mA}$ ; $V_{CE} = 10\text{ V}$ ; $R_L = 75\text{ }\Omega$ ; $T_{amb} = 25\text{ °C}$ ; $f_{(p+q-r)} = 793.25\text{ MHz}$	–	850	–	mV

## LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$V_{CB0}$	collector-base voltage	open emitter	–	25	V
$V_{CEO}$	collector-emitter voltage	open base	–	15	V
$V_{EBO}$	emitter-base voltage	open collector	–	2	V
$I_C$	DC collector current		–	150	mA
$P_{tot}$	total power dissipation	up to $T_s = 145\text{ °C}$ (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 7GHz wideband transistor

BFG135

## THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	THERMAL RESISTANCE
$R_{th\ j-s}$	thermal resistance from junction to soldering point	up to $T_s = 145\text{ °C}$ (note 1)	30 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	$I_C = 100\text{ mA}; V_{CE} = 10\text{ V}$	80	130	–	
$C_c$	collector capacitance	$I_E = i_e = 0; V_{CB} = 10\text{ V}; f = 1\text{ MHz}$	–	2	–	pF
$C_e$	emitter capacitance	$I_C = i_c = 0; V_{EB} = 0.5\text{ V}; f = 1\text{ MHz}$	–	7	–	pF
$C_{re}$	feedback capacitance	$I_C = 0; V_{CE} = 10\text{ V}; f = 1\text{ MHz}$	–	1.2	–	pF
$f_T$	transition frequency	$I_C = 100\text{ mA}; V_{CE} = 10\text{ V}; f = 1\text{ GHz}; T_{amb} = 25\text{ °C}$	–	7	–	GHz
$G_{UM}$	maximum unilateral power gain	$I_C = 100\text{ mA}; V_{CE} = 10\text{ V}; f = 500\text{ MHz}; T_{amb} = 25\text{ °C}$	–	16	–	dB
		$I_C = 100\text{ mA}; V_{CE} = 10\text{ V}; f = 800\text{ MHz}; T_{amb} = 25\text{ °C}$	–	12	–	dB
$V_o$	output voltage	note 1	–	900	–	mV
		note 2	–	850	–	mV
$d_2$	second order intermodulation distortion	$I_C = 90\text{ mA}; V_{CE} = 10\text{ V}; V_O = 50\text{ dBmV}; T_{amb} = 25\text{ °C}; f_{(p+q)} = 450\text{ MHz}; f_p = 50\text{ MHz}; f_q = 400\text{ MHz}$	–	–58	–	dB
		$I_C = 90\text{ mA}; V_{CE} = 10\text{ V}; V_O = 50\text{ dBmV}; T_{amb} = 25\text{ °C}; f_{(p+q)} = 810\text{ MHz}; f_p = 250\text{ MHz}; f_q = 560\text{ MHz}$	–	–53	–	dB

## Notes

- $d_{im} = -60\text{ dB}$  (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  $f_{(p+q-r)} = 443.25\text{ MHz}$ .
- $d_{im} = -60\text{ dB}$  (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  $f_{(p+q-r)} = 793.25\text{ MHz}$ .

## NPN 7GHz wideband transistor

BFG135

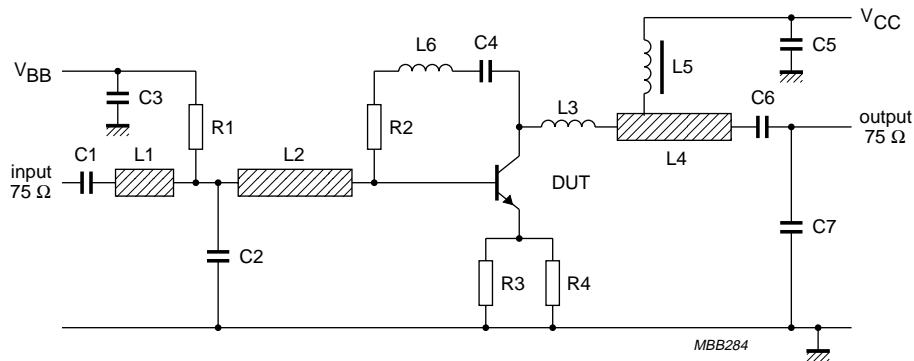


Fig.2 Intermodulation distortion and second order intermodulation distortion test circuit.

## List of components (see test circuit)

DESIGNATION	DESCRIPTION	VALUE	UNIT	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	microstripline	75	$\Omega$	length 7 mm; width 2.5 mm	
L2	microstripline	75	$\Omega$	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	$\Omega$	length 19 mm; width 2.5 mm	
L5	Ferrocube choke	5	$\mu$ H		3122 108 20153
L6 (note 1)	0.4 mm copper wire	$\approx 25$	nH	length 30 mm	
R1	metal film resistor	10	k $\Omega$		2322 180 73103
R2 (note 1)	metal film resistor	200	$\Omega$		2322 180 73201
R3, R4	metal film resistor	27	$\Omega$		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 7GHz wideband transistor

BFG135

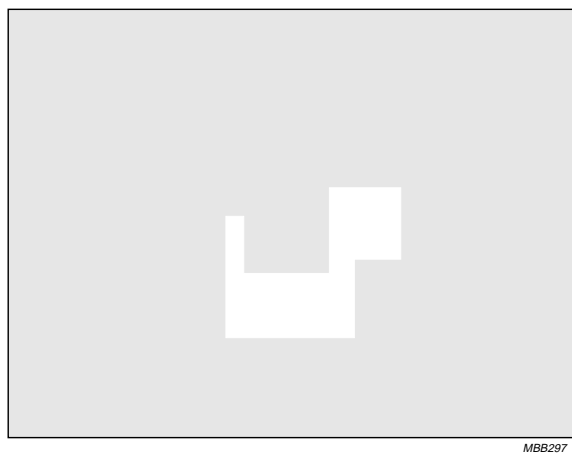
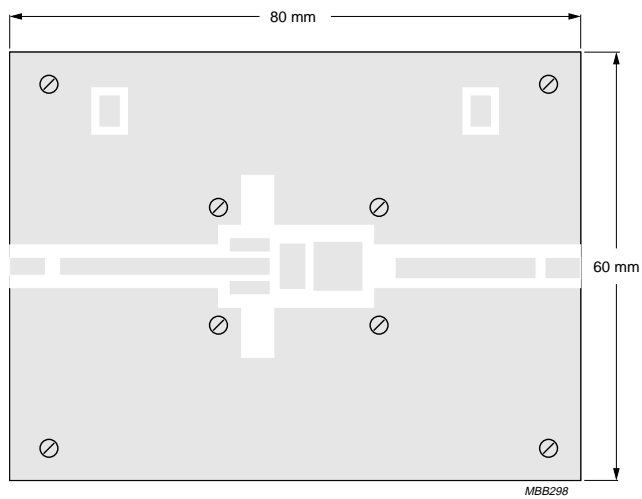
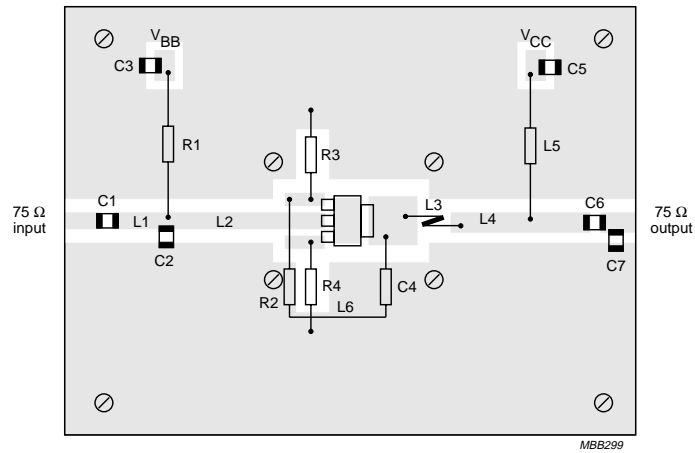
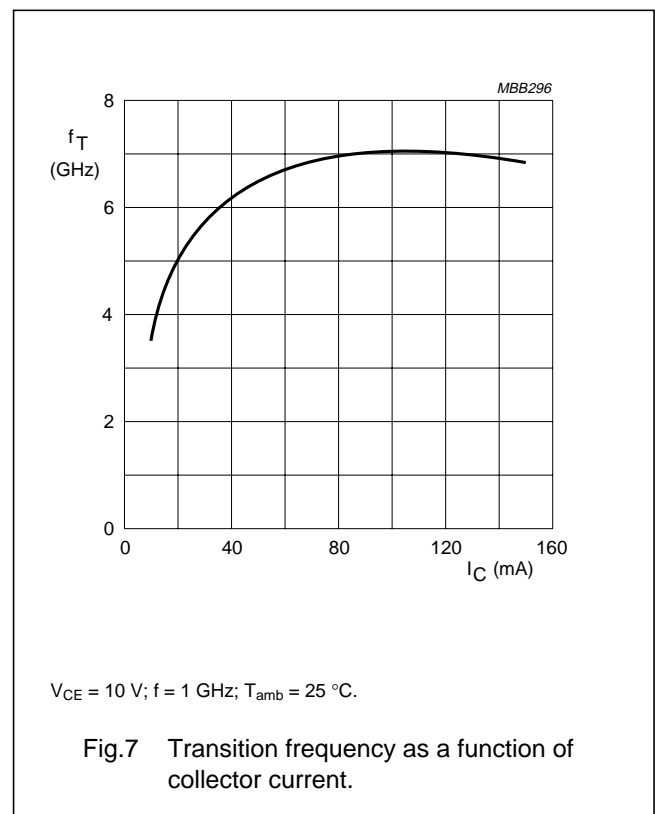
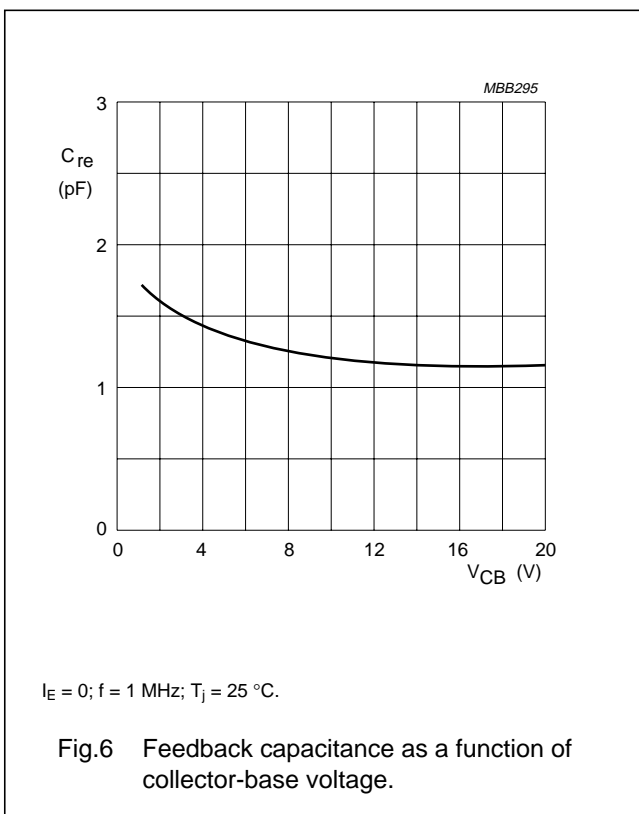
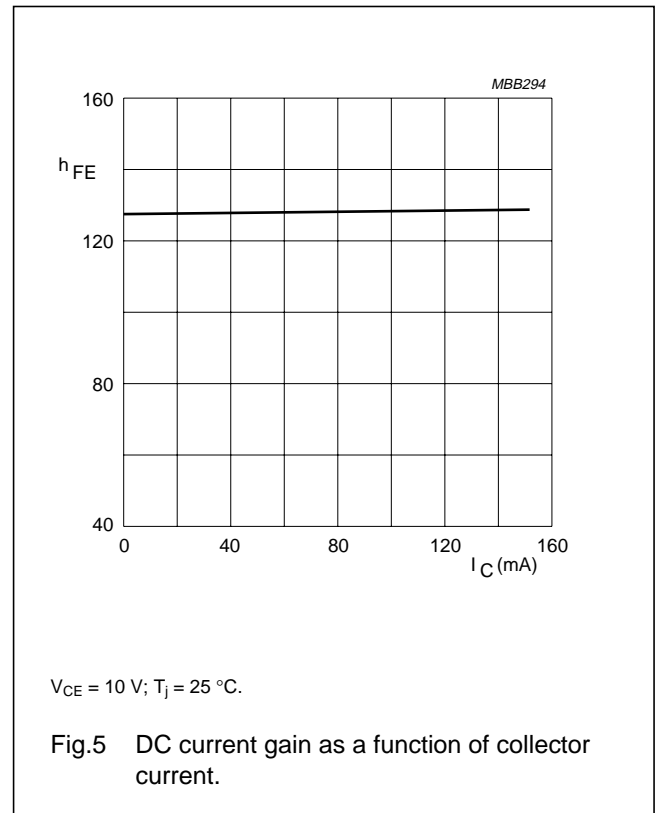
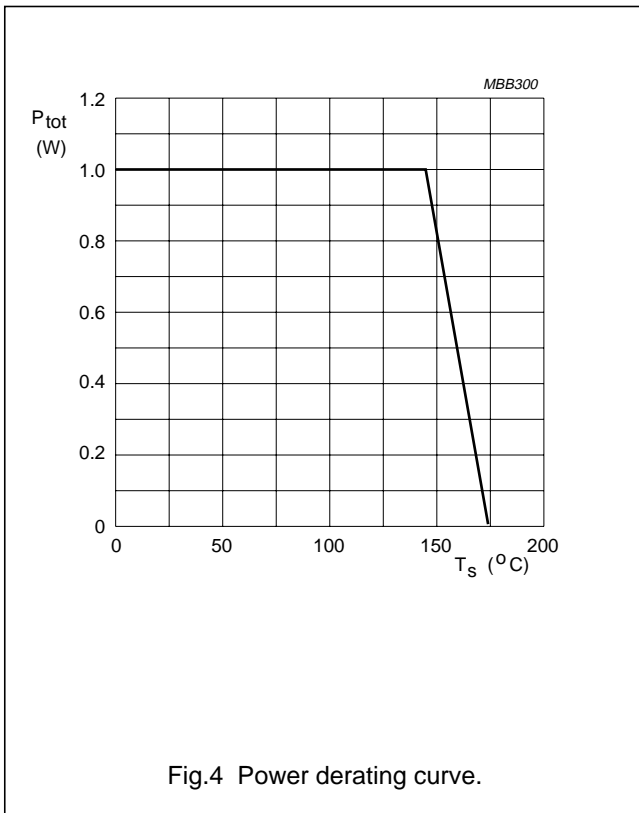


Fig.3 Intermodulation distortion test printed-circuit board.

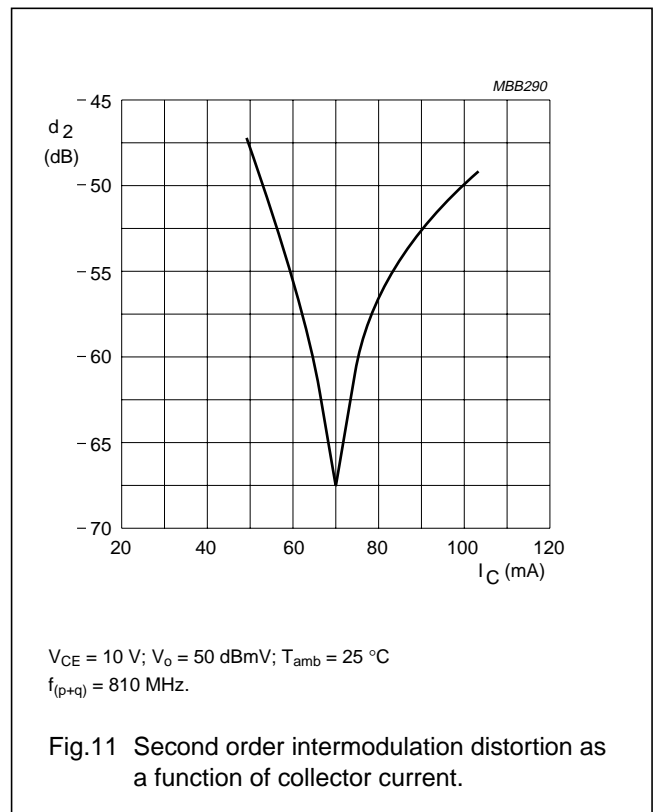
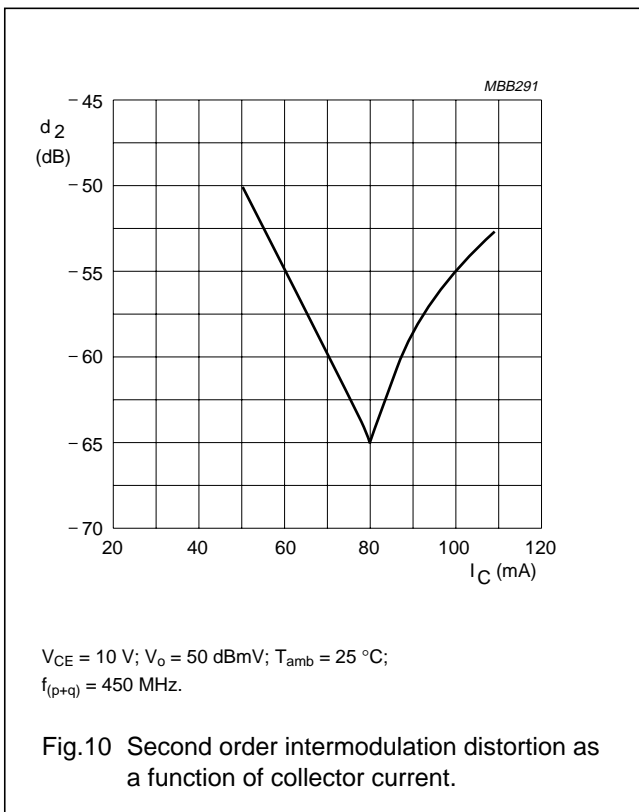
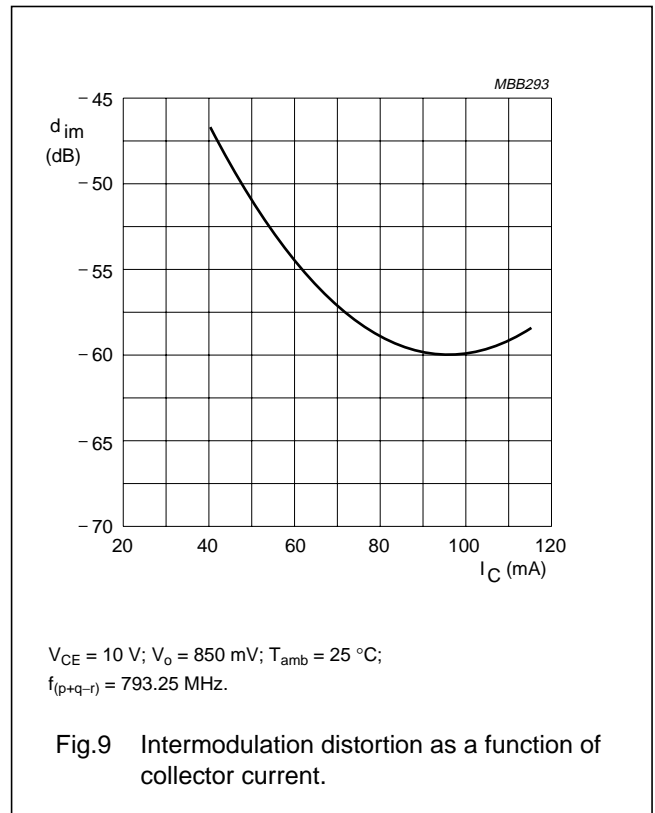
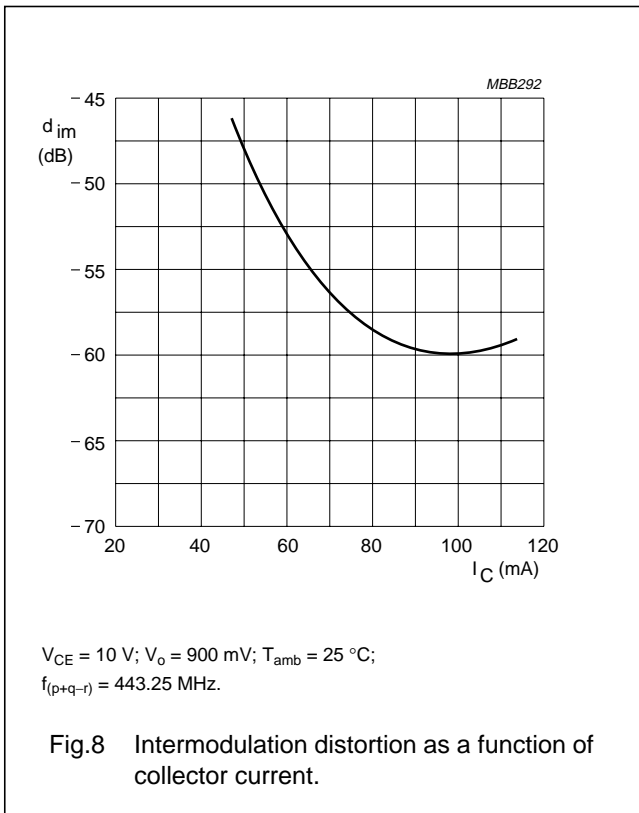
NPN 7GHz wideband transistor

BFG135



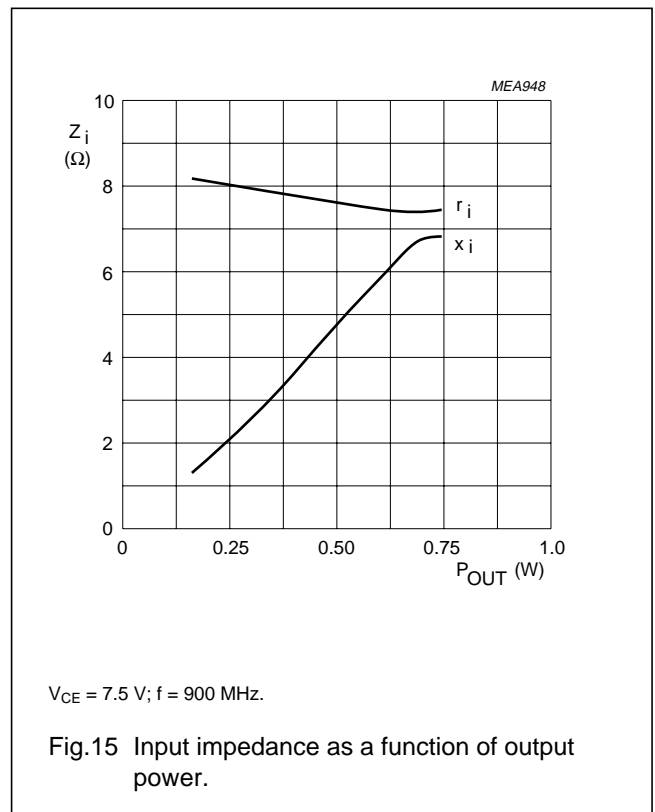
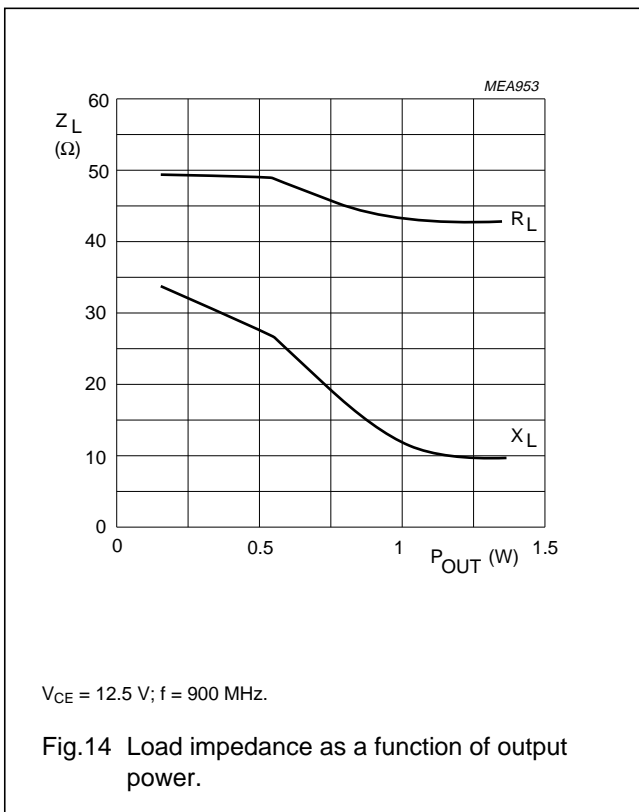
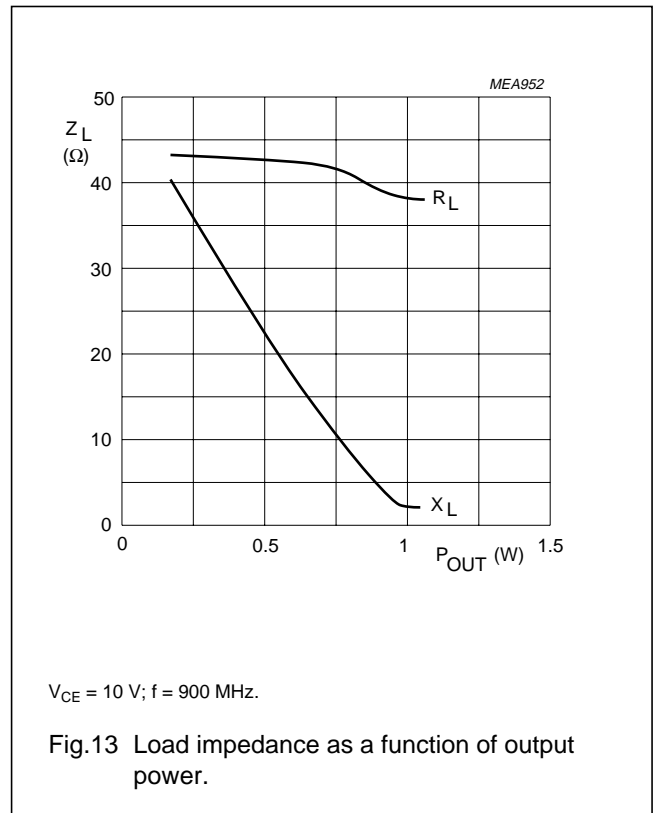
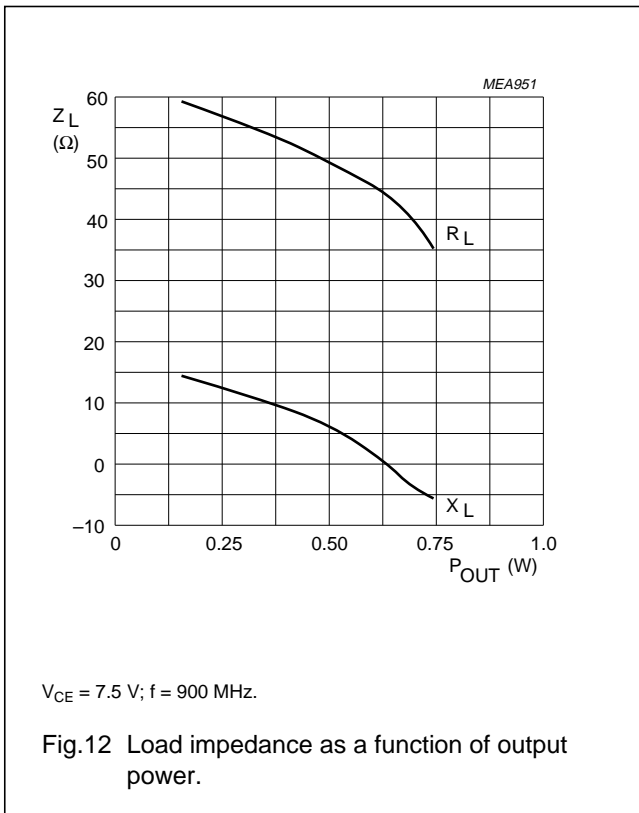
NPN 7GHz wideband transistor

BFG135



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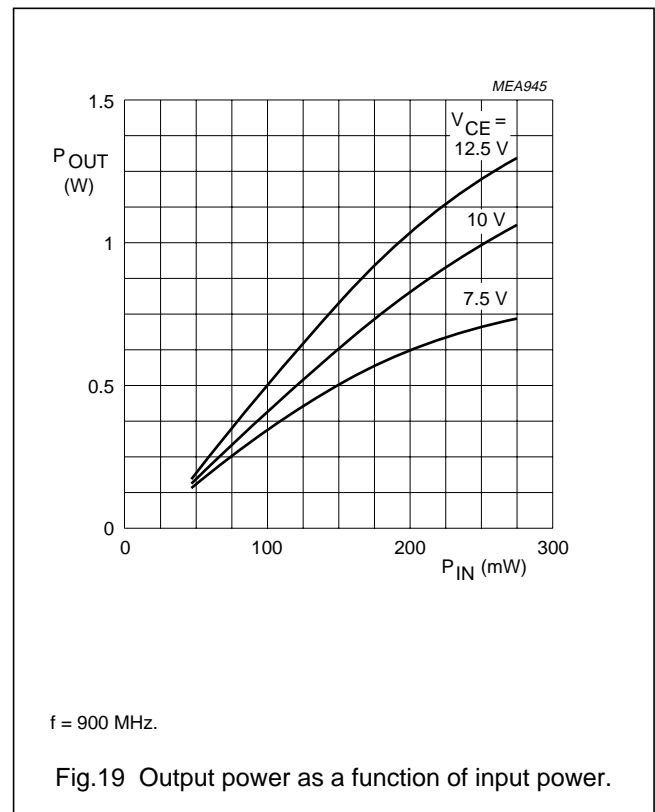
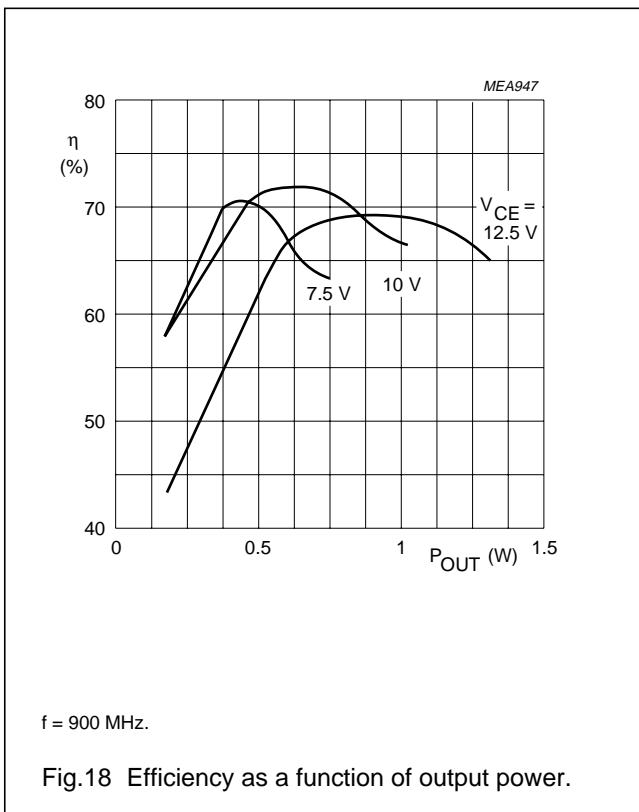
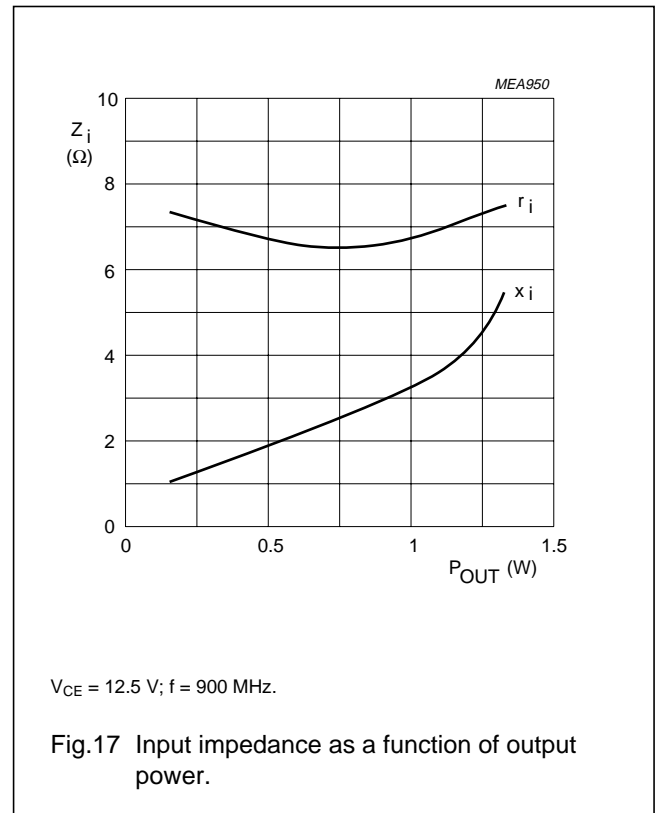
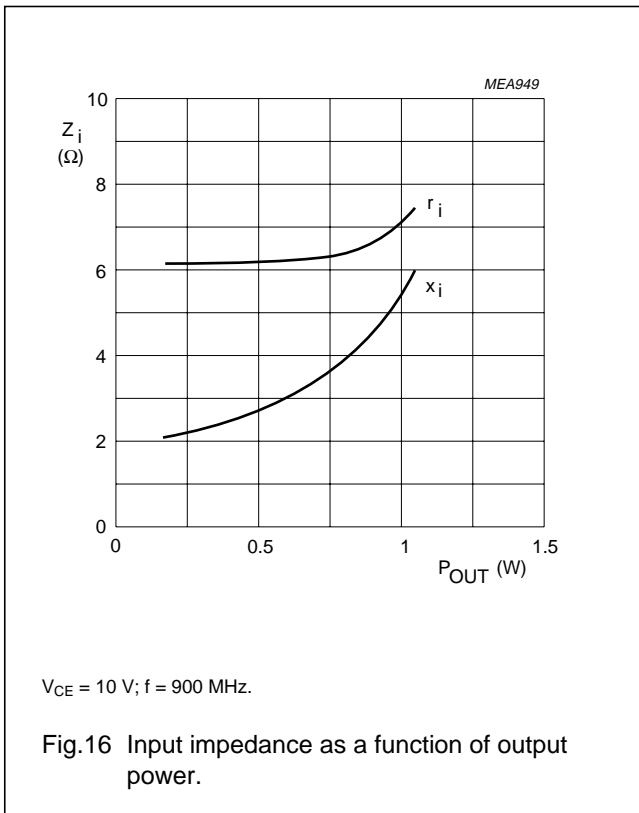
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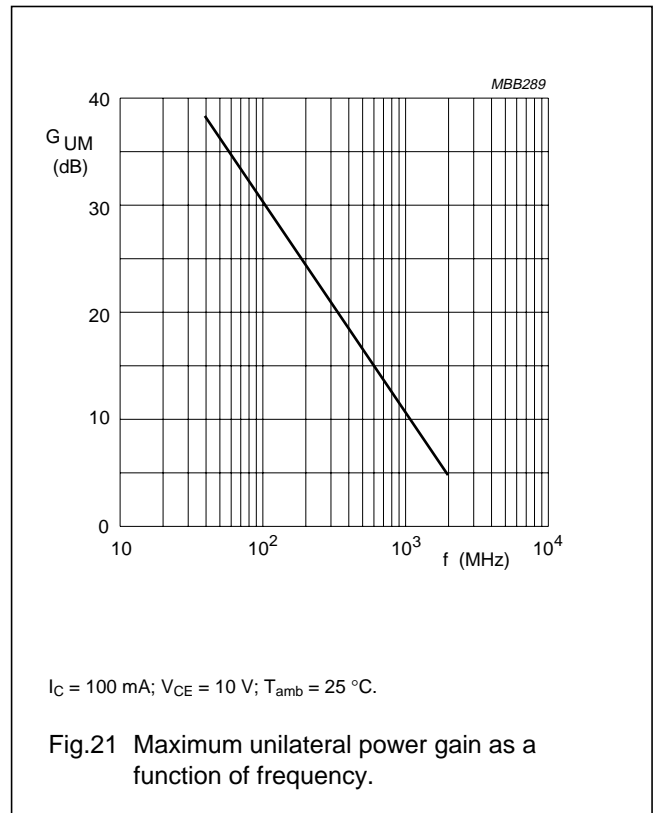
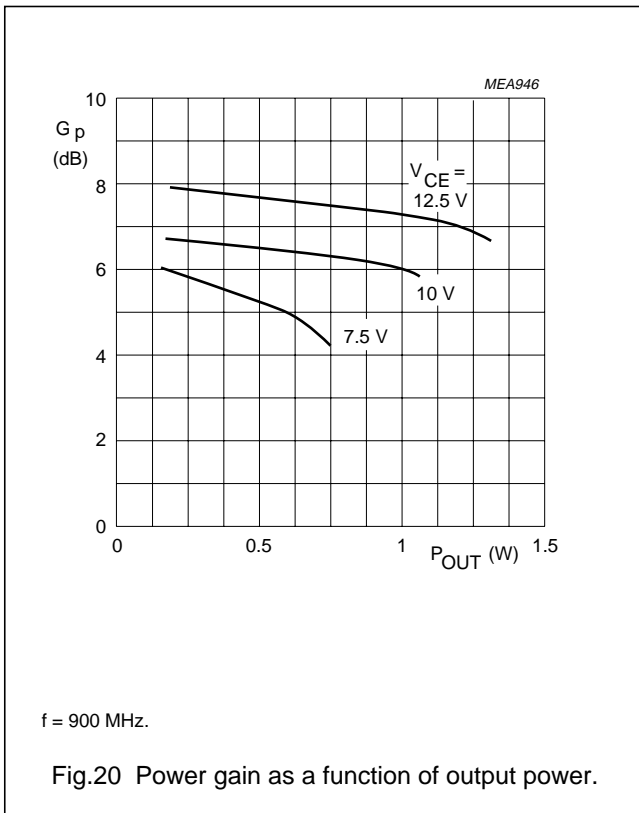
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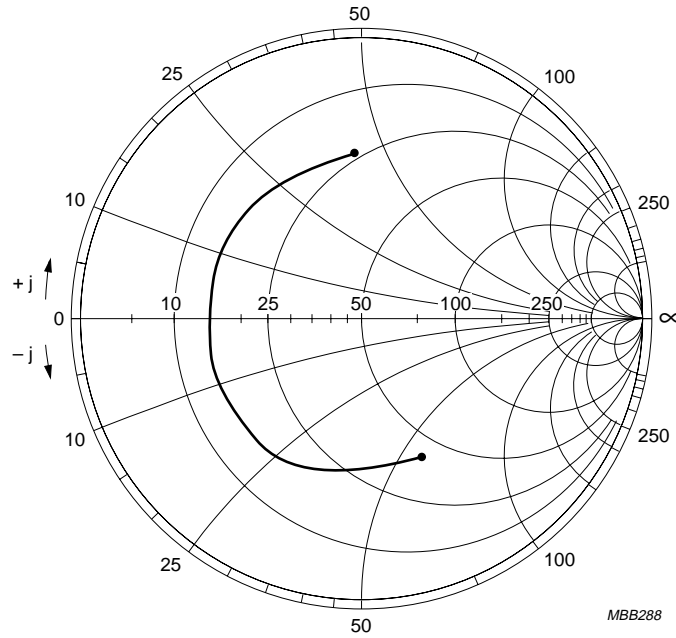
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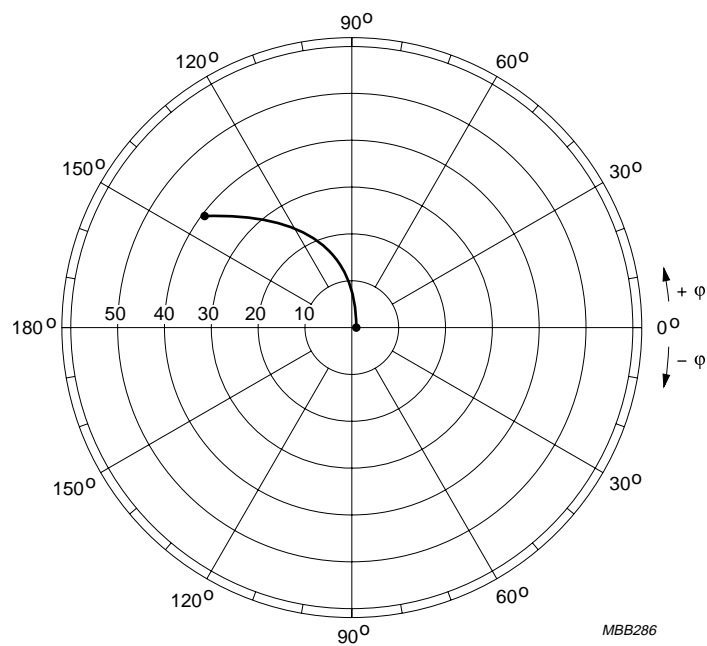
NPN 7GHz wideband transistor

BFG135



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

Fig.22 Common emitter input reflection coefficient ( $S_{11}$ ).

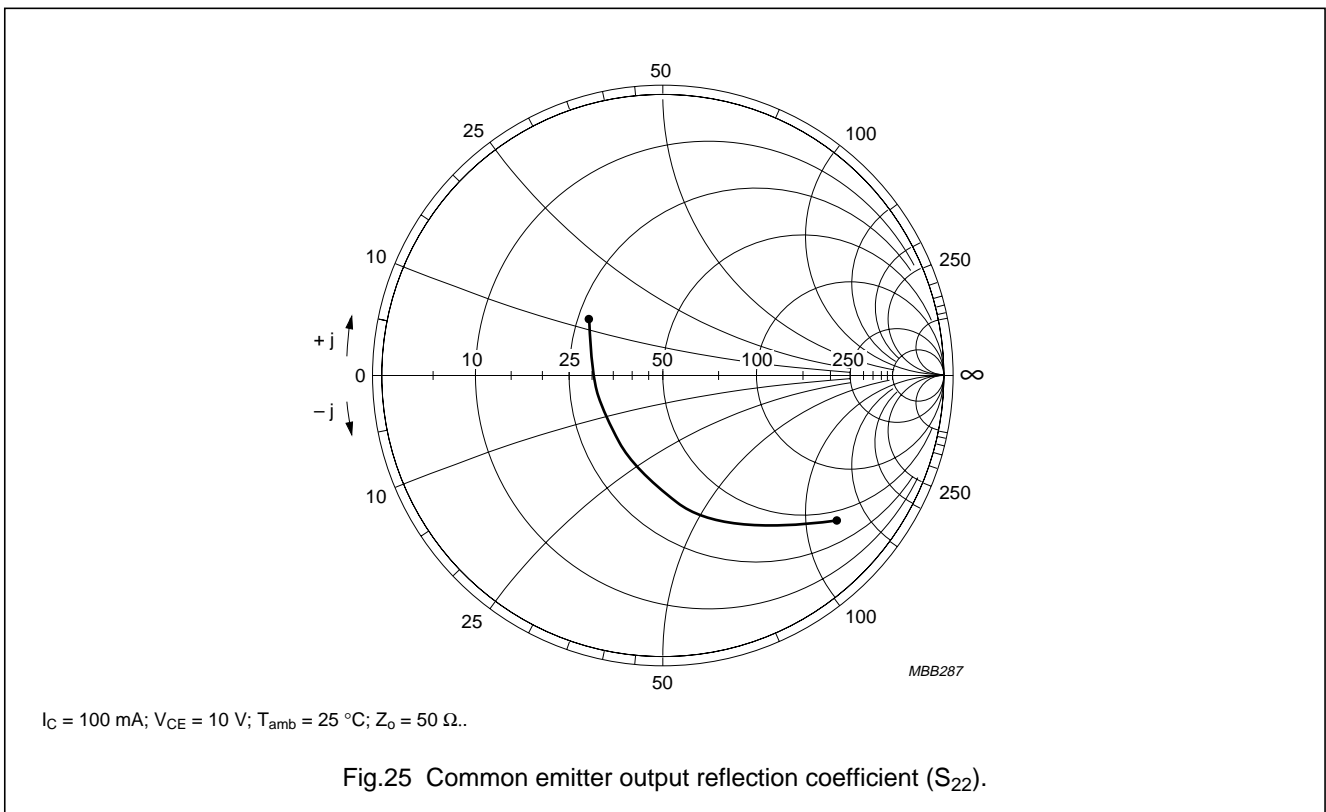
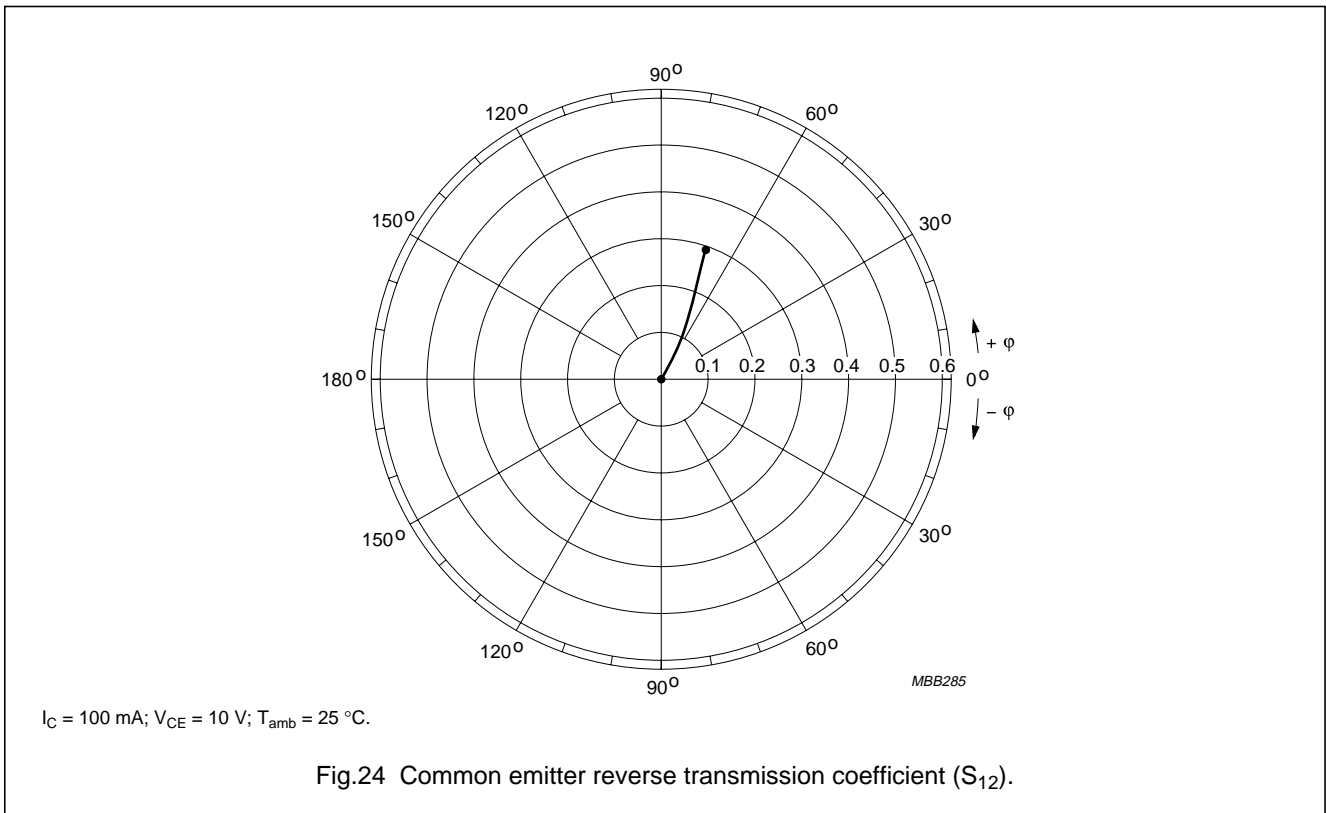


$I_C = 100 \text{ mA}; V_{CE} = 10 \text{ V}; T_{amb} = 25 \text{ }^\circ\text{C}.$

Fig.23 Common emitter forward transmission coefficient ( $S_{21}$ ).

NPN 7GHz wideband transistor

BFG135



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