DATA SHEET

BFG35
NPN 4 GHz wideband transistor

Product specification
Supersedes data of November 1992
File under discrete semiconductors, SC14

1995 Sep 12

DESCRIPTION

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

PNP complement is the BFG55.

PINNING

PIN	DESCRIPTION
1	emitter
2	base
3	emitter
4	collector

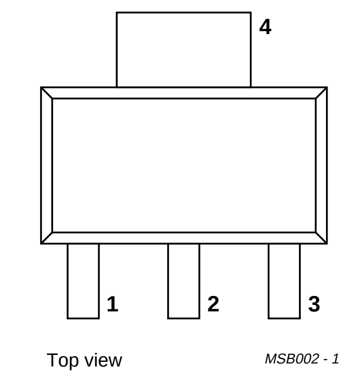


Fig.1 SOT223.

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 °C (note 1)	–	–	1	W
h_{FE}	DC current gain	I_C = 100 mA; V_{CE} = 10 V; T_j = 25 °C	25	70	–	
f_T	transition frequency	I_C = 100 mA; V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C	–	4	–	GHz
G_{UM}	maximum unilateral power gain	I_C = 100 mA; V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C	–	15	–	dB
		I_C = 100 mA; V_{CE} = 10 V; f = 800 MHz; T_{amb} = 25 °C	–	11	–	dB
V_o	output voltage	I_C = 100 mA; V_{CE} = 10 V; d_{im} = –60 dB; R_L = 75 Ω; $f_{(p+q-r)}$ = 793.25 MHz; T_{amb} = 25 °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 °C (note 1)	–	1	W
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	175	°C

Note

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

THERMAL CHARACTERISTICS

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

Note

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

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector cut-off current	I_E = 0; V_{CB} = 10 V	–	–	1	μA
h_{FE}	DC current gain	I_C = 100 mA; V_{CE} = 10 V	25	70	–	
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 10 V; f = 1 MHz	–	2	–	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = 0.5 V; f = 1 MHz	–	10	–	pF
C_{re}	feedback capacitance	I_C = 0; V_{CE} = 10 V; f = 1 MHz	–	1.2	–	pF
f_T	transition frequency	I_C = 100 mA; V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C	–	4	–	GHz
G_{UM}	maximum unilateral power gain (note 1)	I_C = 100 mA; V_{CE} = 10 V; f = 500 MHz; T_{amb} = 25 °C	–	15	–	dB
		I_C = 100 mA; V_{CE} = 10 V; f = 800 MHz; T_{amb} = 25 °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

1. 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.
2. d_{im} = –60 dB (DIN 45004B); I_C = 100 mA; V_{CE} = 10 V; R_L = 75 Ω; T_{amb} = 25 °C
$V_p = V_o$ at d_{im} = –60 dB; f_p = 795.25 MHz;
$V_q = V_o$ –6 dB; f_q = 803.25 MHz;
$V_r = V_o$ –6 dB; f_r = 805.25 MHz;
measured at $f_{(p+q-r)}$ = 793.25 MHz.
3. d_{im} = –60 dB (DIN 45004B); I_C = 100 mA; V_{CE} = 10 V; R_L = 75 Ω; T_{amb} = 25 °C
$V_p = V_o$ at d_{im} = –60 dB; f_p = 445.25 MHz;
$V_q = V_o$ –6 dB; f_q = 453.25 MHz;
$V_r = V_o$ –6 dB; f_r = 455.25 MHz;
measured at $f_{(p+q-r)}$ = 443.25 MHz.
4. I_C = 60 mA; V_{CE} = 10 V; R_L = 75 Ω;
$V_p = V_q = V_o$ = 50 dBmV;
$f_{(p+q)}$ = 450 MHz; f_p = 50 MHz; f_q = 400 MHz.
5. I_C = 60 mA; V_{CE} = 10 V; R_L = 75 Ω;
$V_p = V_q = V_O$ = 50 dBmV;
$f_{(p+q)}$ = 810 MHz; f_p = 250 MHz; f_q = 560 MHz.

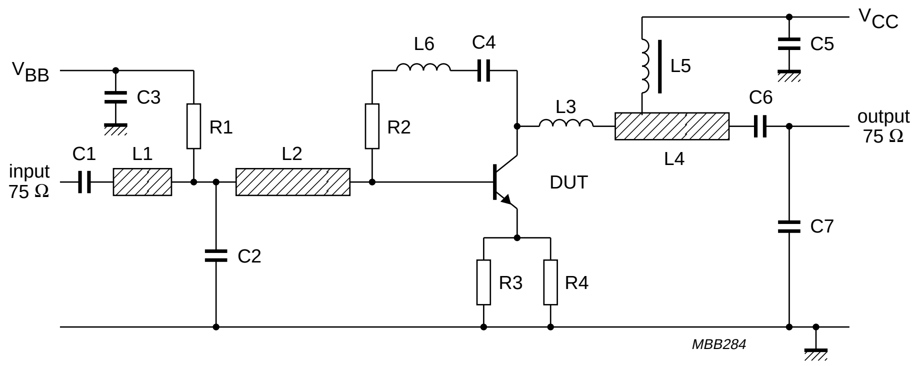


Fig.2 Intermodulation and second harmonic test circuit.

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	microstripline	75 Ω	length 7mm; width 2.5 mm	
L2	microstripline	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

Notes

1. 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 (ε_r = 2.2); thickness $^1/_{16}$ inch; thickness of copper sheet $^1/_{32}$ inch.

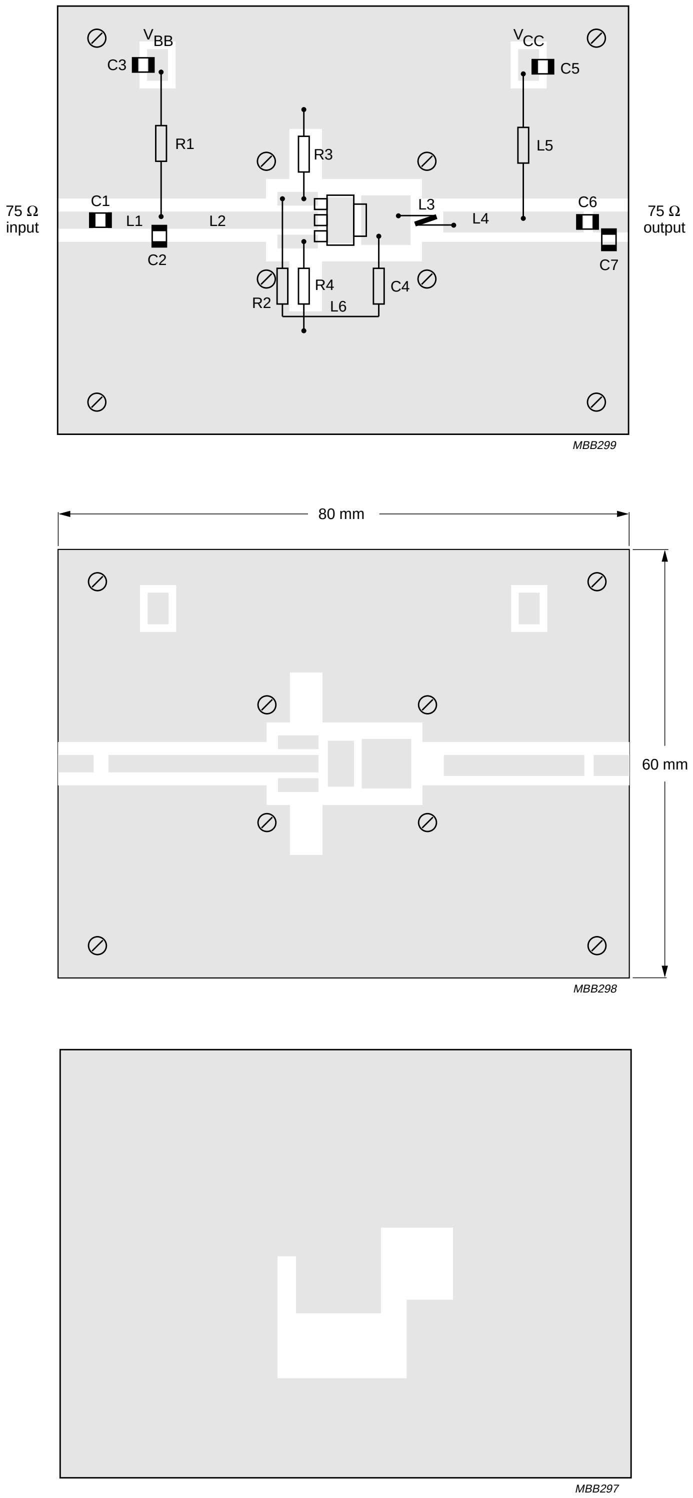


Fig.3 Intermodulation test circuit printed circuit board.

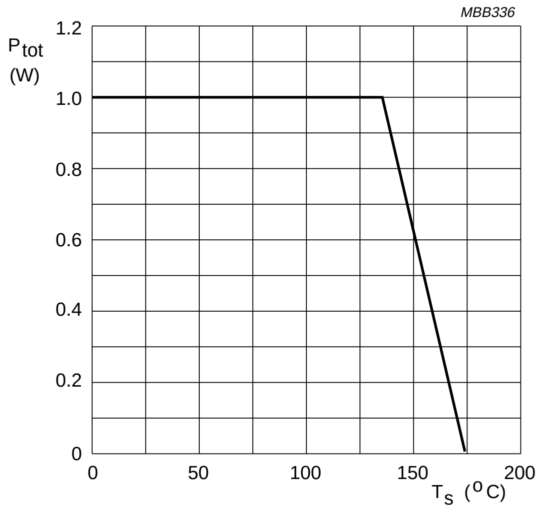
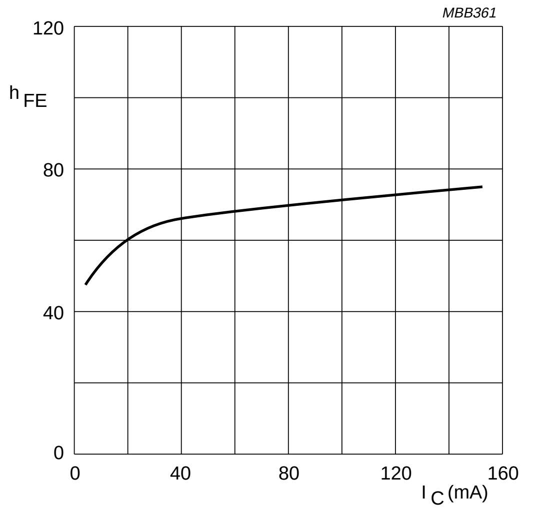
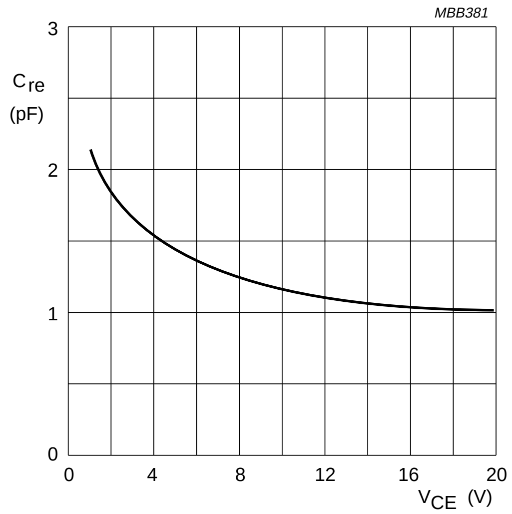


Fig.4 Power derating curve.



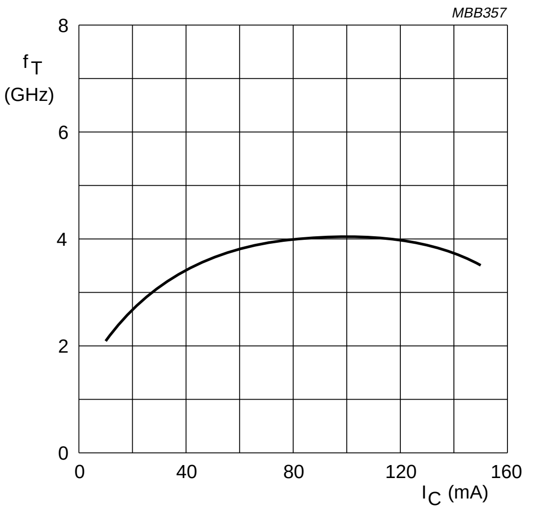
V_{CE} = 10 V; T_j = 25 °C.

Fig.5 DC current gain as a function of collector current.



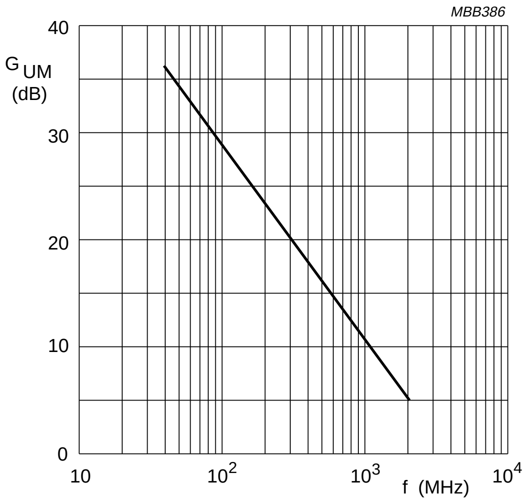
I_E = 0; f = 1 MHz; T_j = 25 °C.

Fig.6 Feedback capacitance as a function of collector-emitter voltage.



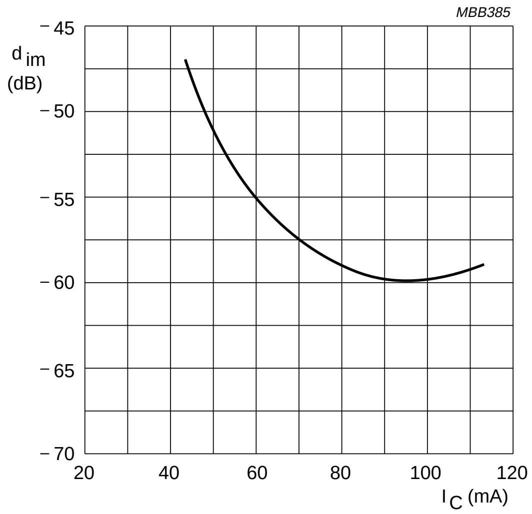
V_{CE} = 10 V; f = 500 MHz; T_j = 25 °C

Fig.7 Transition frequency as a function of collector current.



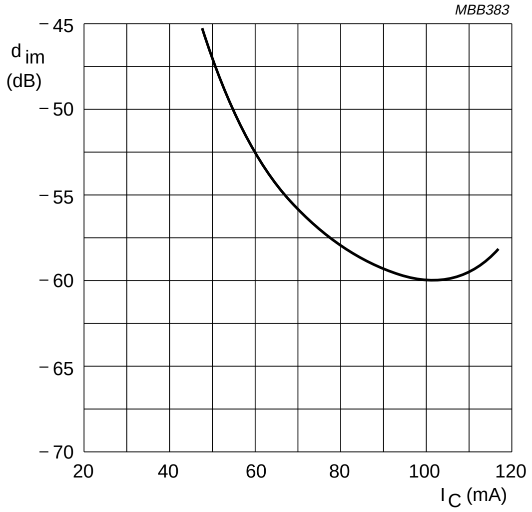
I_C = 100 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

Fig.8 Maximum unilateral power gain as a function of frequency.



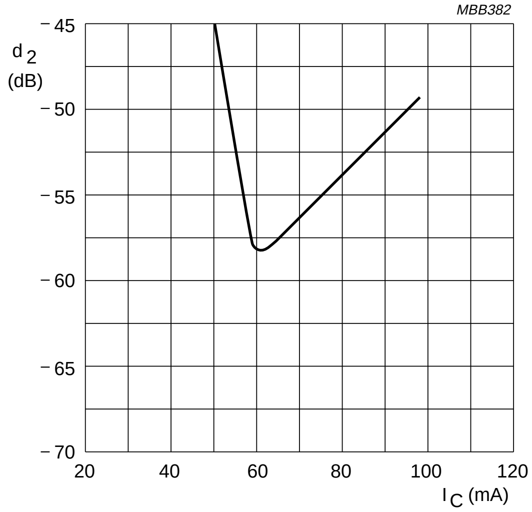
V_{CE} = 10 V; V_o = 800 mV; $f_{(p+q-r)}$ = 443.25 MHz; T_{amb} = 25 °C.

Fig.9 Intermodulation distortion as a function of collector current.



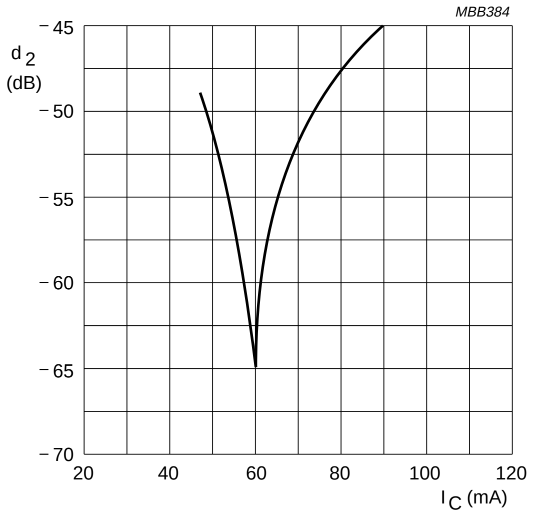
V_{CE} = 10 V; V_o = 750 mV; $f_{(p+q-r)}$ = 793.25 MHz; T_{amb} = 25 °C.

Fig.10 Intermodulation distortion as a function of collector current.



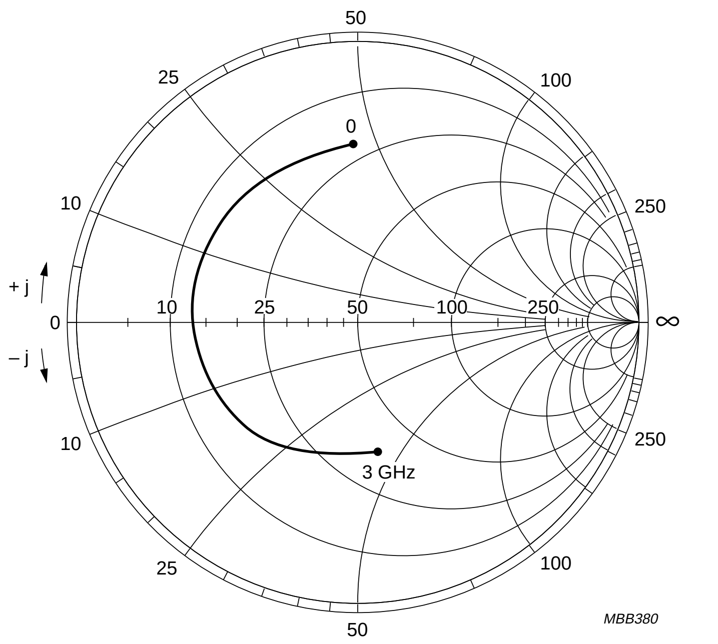
V_{CE} = 10 V; V_o = 50 dBmV; $f_{(p+q)}$ = 450 MHz; T_{amb} = 25 °C.

Fig.11 Second order intermodulation distortion as a function of collector current.



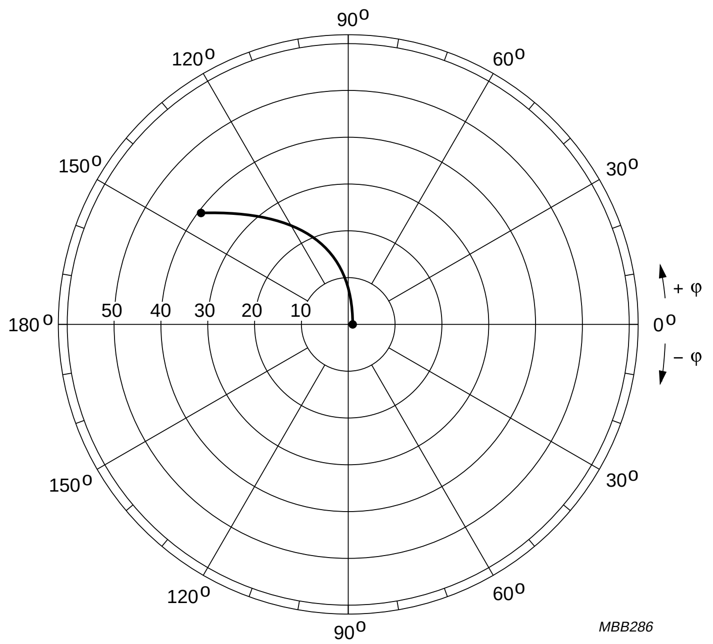
V_{CE} = 10 V; V_o = 50 dBmV; $f_{(p+q)}$ = 810 MHz; T_{amb} = 25 °C.

Fig.12 Second order intermodulation distortion as a function of collector current.



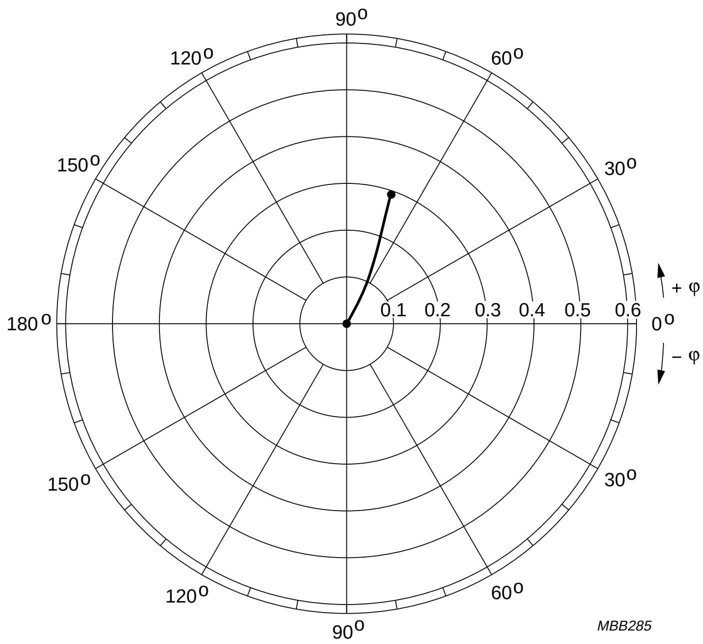
I_C = 100 mA; V_{CE} = 10 V; T_{amb} = 25 °C; Z_o = 50 Ω.

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



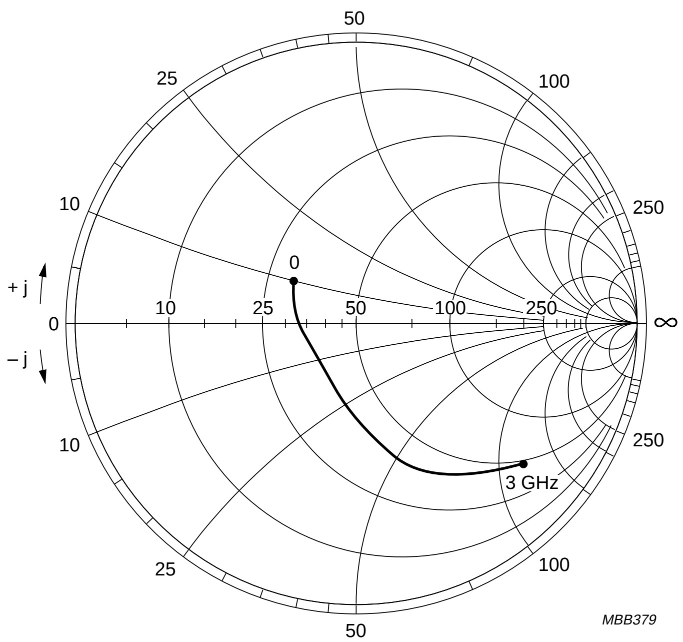
I_C = 100 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

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



I_C = 100 mA; V_{CE} = 10 V; T_{amb} = 25 °C.

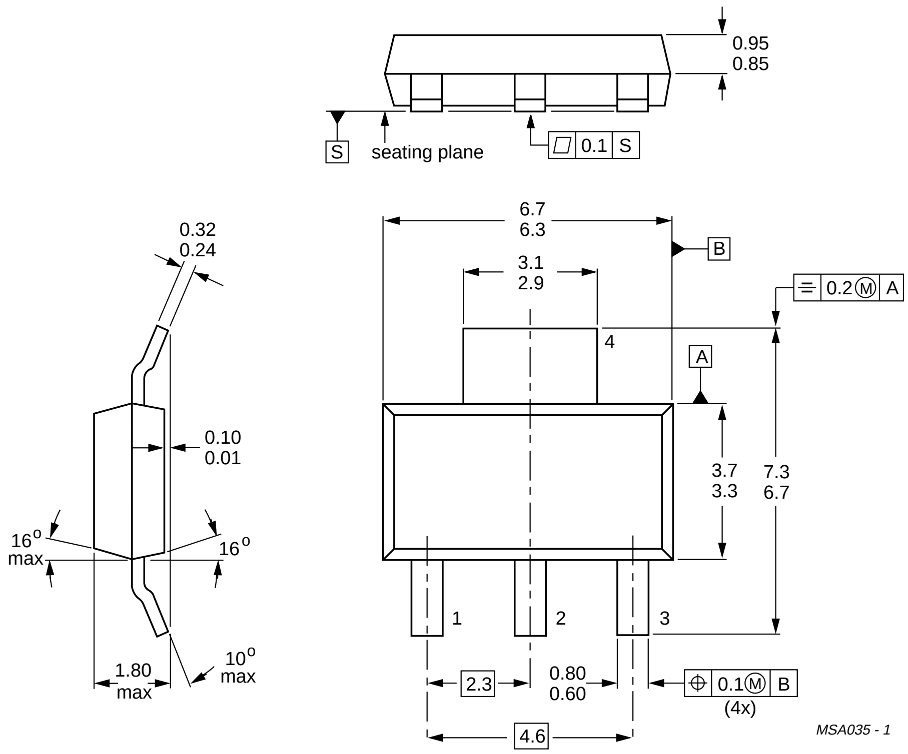
Fig.15 Common emitter reverse transmission coefficient (S_{12}).



I_C = 100 mA; V_{CE} = 10 V; T_{amb} = 25 °C; Z_o = 50 Ω.

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

PACKAGE OUTLINE



Dimensions in mm.

Fig.17 SOT223.

DEFINITIONS

Data sheet status	
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.
Limiting values	
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.	
Application information	
Where application information is given, it is advisory and does not form part of the specification.	

LIFE SUPPORT APPLICATIONS