DATA SHEET

BFG198
NPN 8 GHz wideband transistor

Product specification
File under Discrete Semiconductors, SC14

1995 Sep 12

Philips
Semiconductors

PHILIPS

NPN 8 GHz wideband transistor — BFG198

DESCRIPTION

NPN planar epitaxial transistor in a plastic SOT223 envelope, intended for wideband amplifier applications. The device features a high gain and excellent output voltage capabilities.

PINNING

PIN	DESCRIPTION
1	emitter
2	base
3	emitter
4	collector

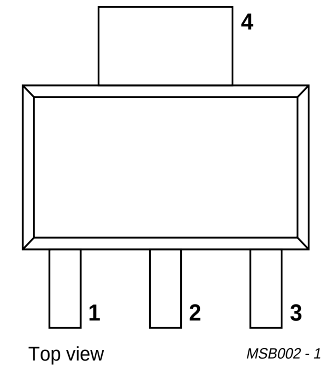


Fig.1 SOT223.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	–	10	V
I_C	DC collector current		–	–	100	mA
P_{tot}	total power dissipation	up to T_s = 135 °C (note 1)	–	–	1	W
h_{FE}	DC current gain	I_C = 50 mA; V_{CE} = 5 V; T_j = 25 °C	40	90	–	
f_T	transition frequency	I_C = 50 mA; V_{CE} = 8 V; f = 1 GHz; T_{amb} = 25 °C	–	8	–	GHz
G_{UM}	maximum unilateral power gain	I_C = 50 mA; V_{CE} = 8 V; f = 500 MHz; T_{amb} = 25 °C	–	18	–	dB
		I_C = 50 mA; V_{CE} = 8 V; f = 800 MHz; T_{amb} = 25 °C	–	15	–	dB
V_o	output voltage	d_{im} = –60 dB; I_C = 70 mA; V_{CE} = 8 V; R_L = 75 Ω; T_{amb} = 25 °C; $f_{(p+q-r)}$ = 793.25 MHz	–	700	–	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	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	10	V
V_{EBO}	emitter-base voltage	open collector	–	2.5	V
I_C	DC collector current		–	100	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	$I_E = 0$; $V_{CB} = 5$ V	–	–	100	nA
h_{FE}	DC current gain	$I_C = 50$ mA; $V_{CE} = 5$ V	40	90	–	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 8$ V; f = 1 MHz	–	1.5	–	pF
C_e	emitter capacitance	$I_C = i_c = 0$; $V_{EB} = 0.5$ V; f = 1 MHz	–	4	–	pF
C_{re}	feedback capacitance	$I_C = 0$; $V_{CE} = 8$ V; f = 1 MHz	–	0.8	–	pF
f_T	transition frequency	$I_C = 50$ mA; $V_{CE} = 8$ V; f = 1 GHz; $T_{amb} = 25$ °C	–	8	–	GHz
G_{UM}	maximum unilateral power gain; note 1	$I_C = 50$ mA; $V_{CE} = 8$ V; f = 500 MHz; $T_{amb} = 25$ °C	–	18	–	dB
		$I_C = 50$ mA; $V_{CE} = 8$ V; f = 800 MHz; $T_{amb} = 25$ °C	–	15	–	dB
V_o	output voltage	note 2	–	750	–	mV
		note 3	–	700	–	mV
d_2	second order intermodulation distortion	note 4	–	–55	–	dB

Note

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 = 70 mA; V_{CE} = 8 V; R_L = 75 Ω; T_{amb} = 25 °C;
   $V_p = V_o$ at d_{im} = –60 dB;
   $V_q = V_o$ –6 dB; f_p = 445.25 MHz;
   $V_r = V_o$ –6 dB; f_q = 453.25 MHz; f_r = 455.25 MHz
   measured at $f_{(p+q-r)}$ = 443.25 MHz.
3. d_{im} = –60 dB (DIN 45004B); I_C = 70 mA; V_{CE} = 8 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.
4. I_C = 50 mA; V_{CE} = 8 V; V_o = 50 dBmV;
   $f_{(p+q)}$ = 810 MHz; f_p = 250 MHz; f_q = 560 MHz.

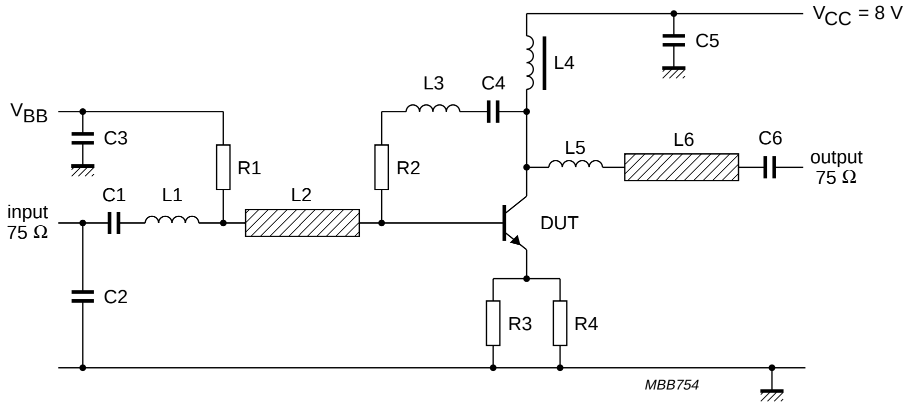


Fig.2 Intermodulation distortion and second order intermodulation distortion test circuit.

List of components (see test circuit)

DESIGNATION	DESCRIPTION	VALUE	UNIT	DIMENSIONS	CATALOGUE NO.
C2	multilayer ceramic capacitor	1.2	pF		2222 851 12128
C1, C4, C6, C7	multilayer ceramic capacitor	10	nF		2222 590 08627
C3	multilayer ceramic capacitor	10	nF		2222 851 12128
C5 (note 1)	multilayer ceramic capacitor	10	nF		2222 629 08103
C8	multilayer ceramic capacitor	1.5	pF		2222 851 12158
L1 (note 1)	1.5 turns 0.4 mm copper wire			int. dia. 3 mm; winding pitch 1 mm	
L2	microstripline	75	Ω	length 22 mm; width 2.5 mm	
L3 (note 1)	0.4 mm copper wire	≈24	nH	length 30 mm	
L4 (note 1)	0.4 mm copper wire	≈3.6	nH	length 4 mm	
L5	microstripline	75	Ω	length 19 mm; width 2.5 mm	
L6	Ferroxcube choke	5	µH		3122 108 20153
R1	metal film resistor	10	Ω		2322 180 73103
R2 (note 1)	metal film resistor	220	Ω		2322 180 73221
R3, R4	metal film resistor	30	Ω		2322 180 73309

Note

1. Components C5, L1, L3, L4, 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 2 x 35 µm; see Fig.2.

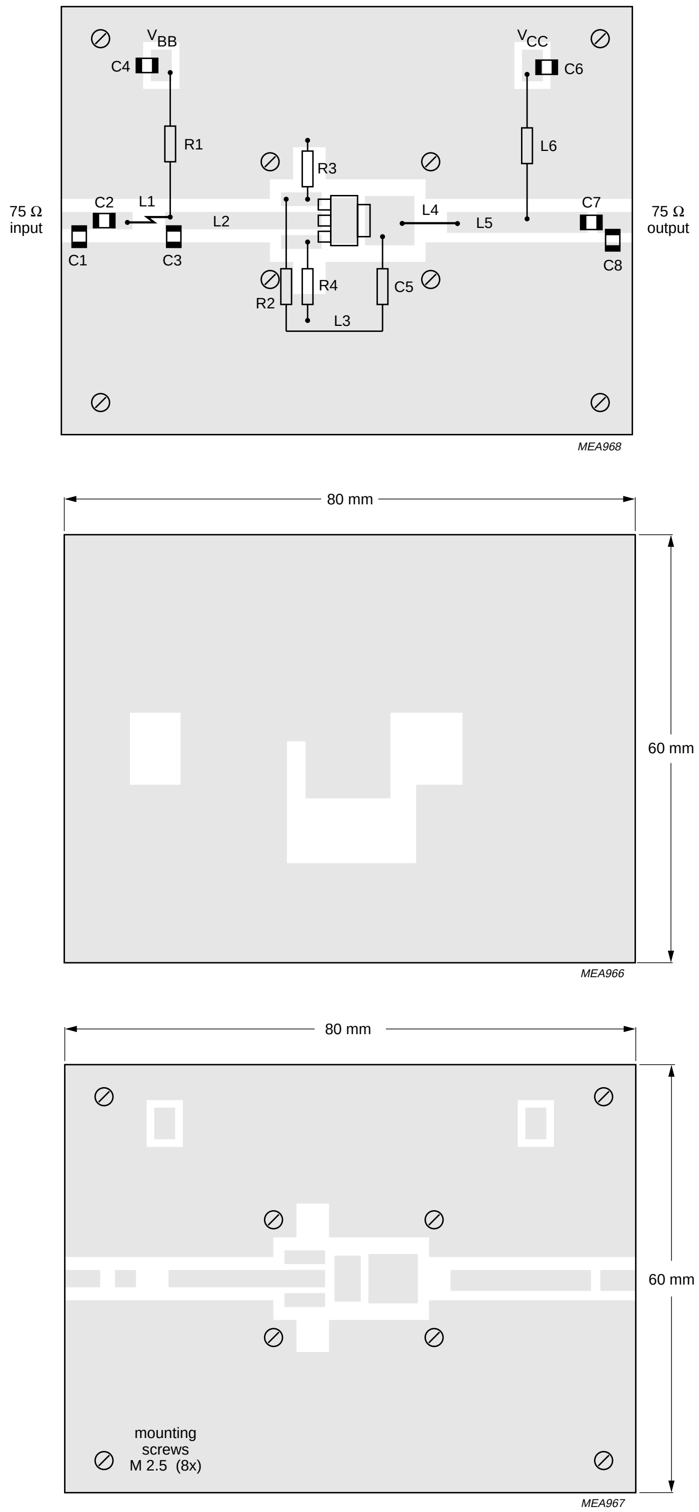


Fig.3 Intermodulation distortion and second order intermodulation distortion printed-circuit board.

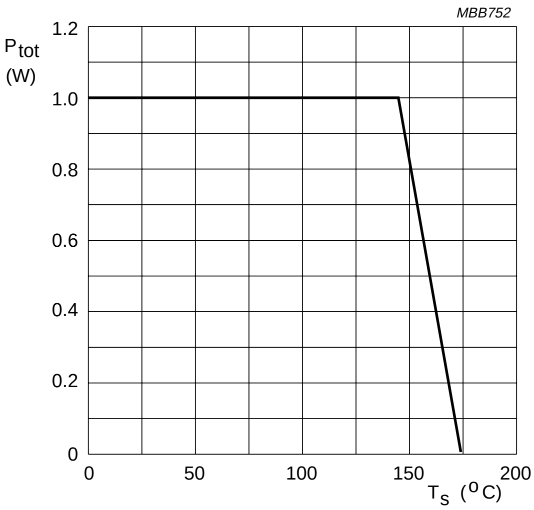
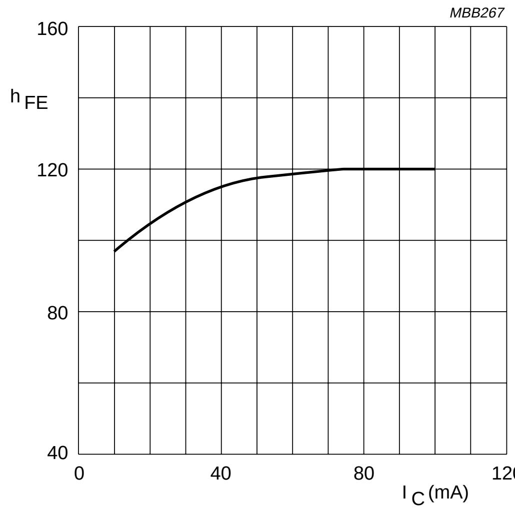
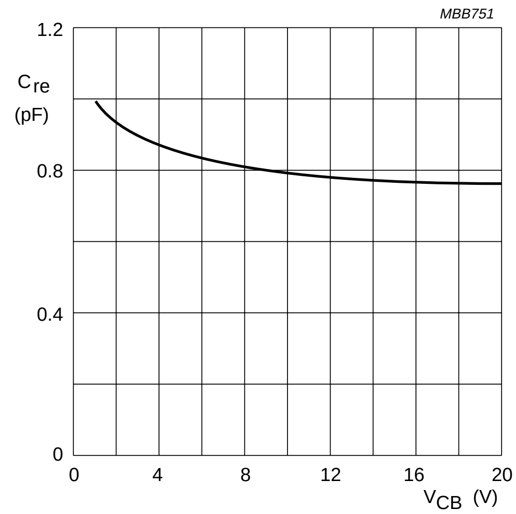


Fig.4 Power derating curve.



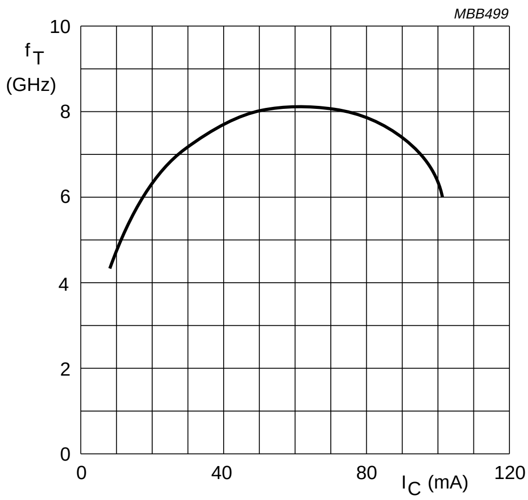
V_{CE} = 5 V; T_j = 25 °C.

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



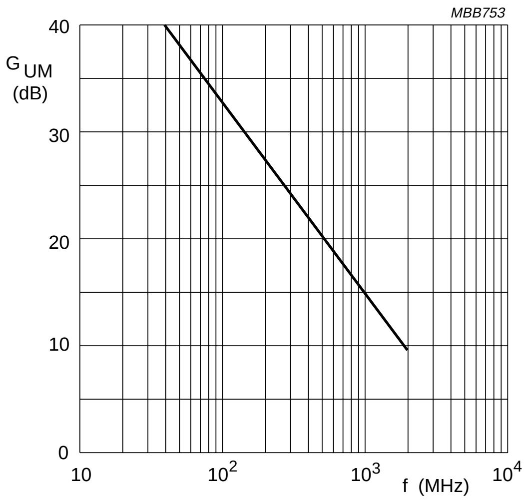
I_E = 0; f = 1 MHz; T_j = 25 °C.

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



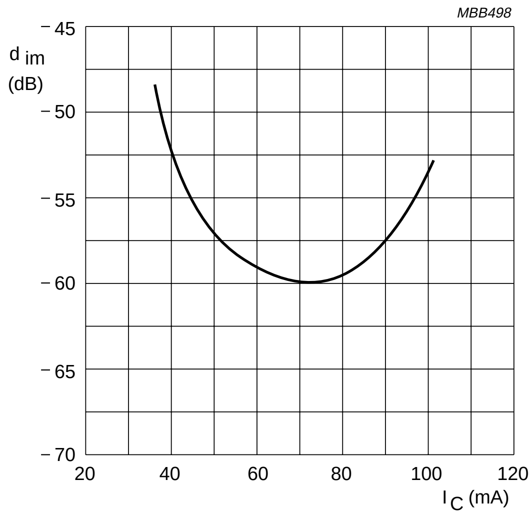
V_{CE} = 8 V; f = 1 GHz; T_{amb} = 25 °C.

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



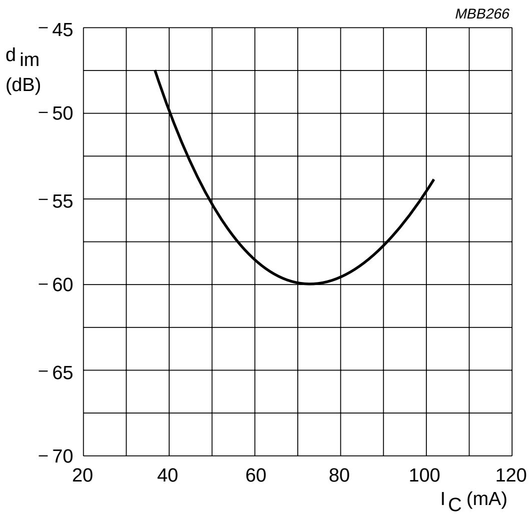
I_C = 50 mA; V_{CE} = 8 V; T_{amb} = 25 °C;

Fig.8 Maximum gain as a function of frequency.



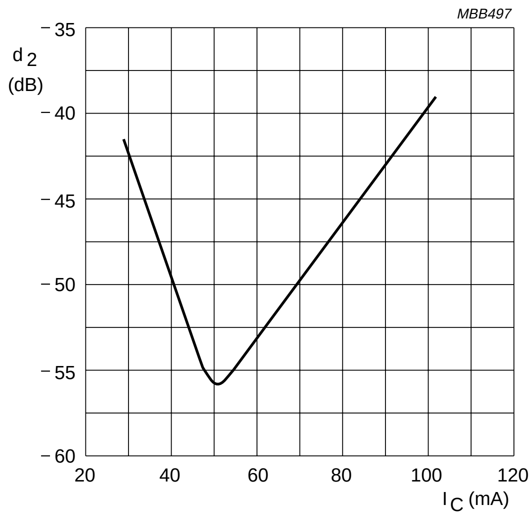
V_{CE} = 8 V; V_o = 750 mV; T_{amb} = 25 °C;
$f_{(p+q-r)}$ = 443.25 MHz.

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



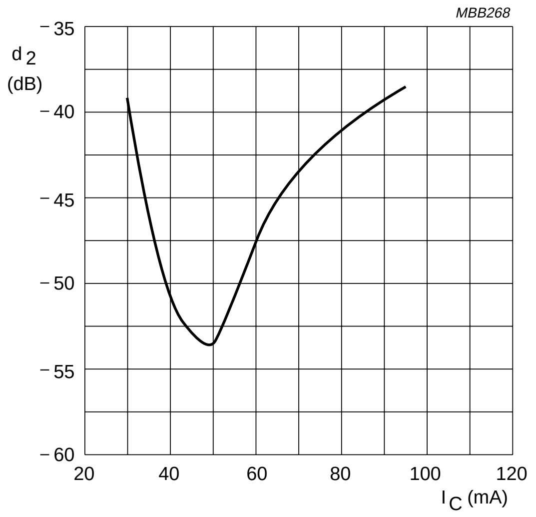
V_{CE} = 8 V; V_o = 700 mV; T_{amb} = 25 °C;
$f_{(p+q)}$ = 793.25 MHz.

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



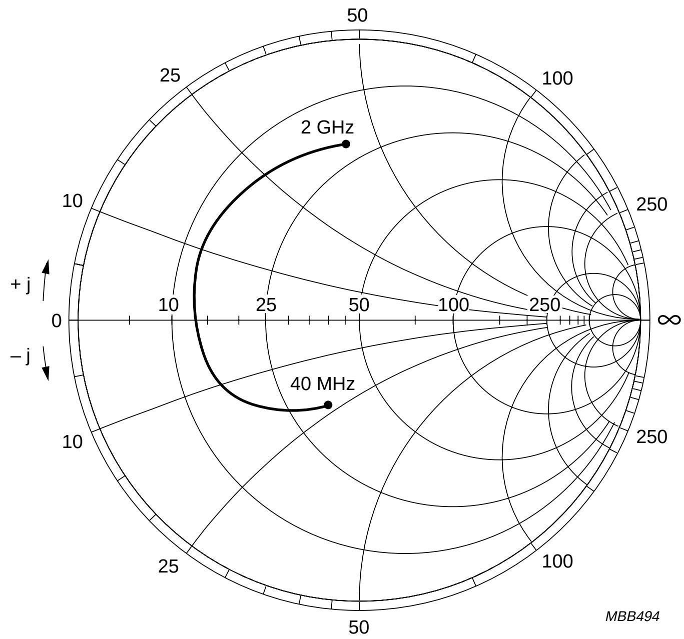
V_{CE} = 8 V; V_o = 50 dBmV; T_{amb} = 25 °C
$f_{(p+q)}$ = 450 MHz.

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



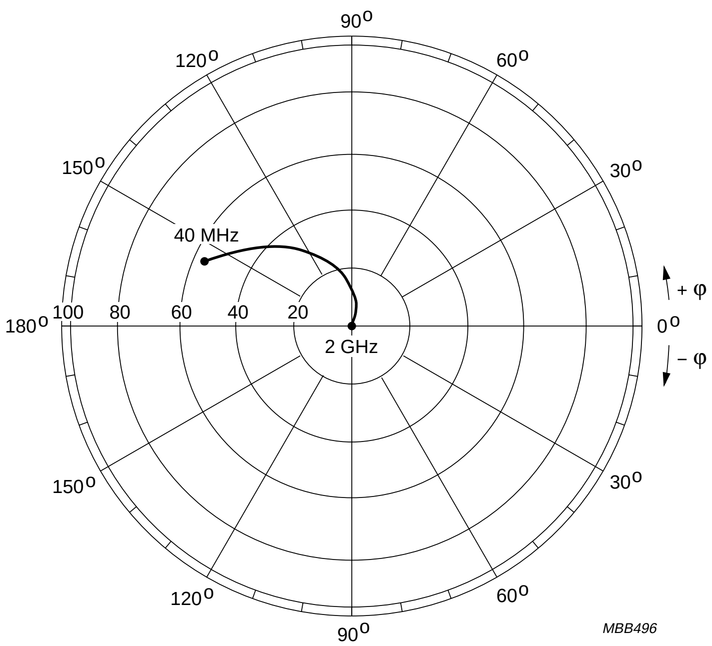
V_{CE} = 8 V; V_o = 50 dBmV; T_{amb} = 25 °C
$f_{(p+q)}$ = 810 MHz.

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



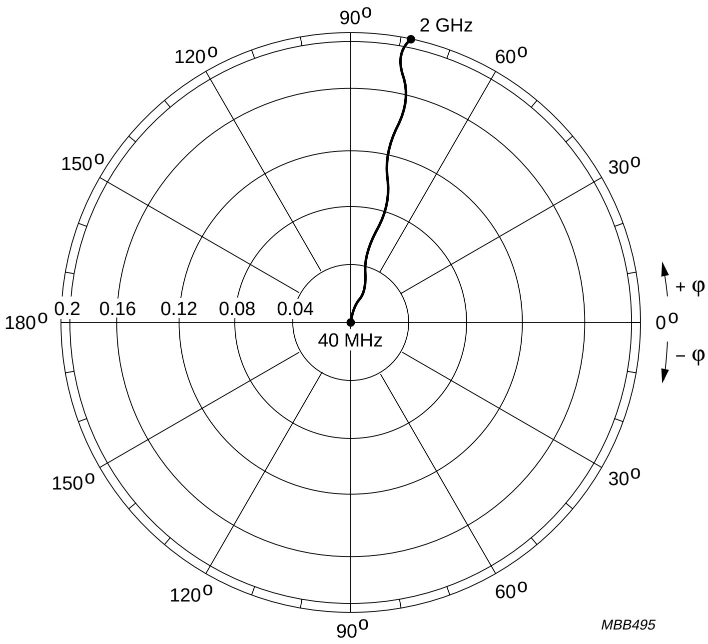
I_C = 50 mA; V_{CE} = 8 V; T_{amb} = 25 °C; Z_o = 50 Ω.

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



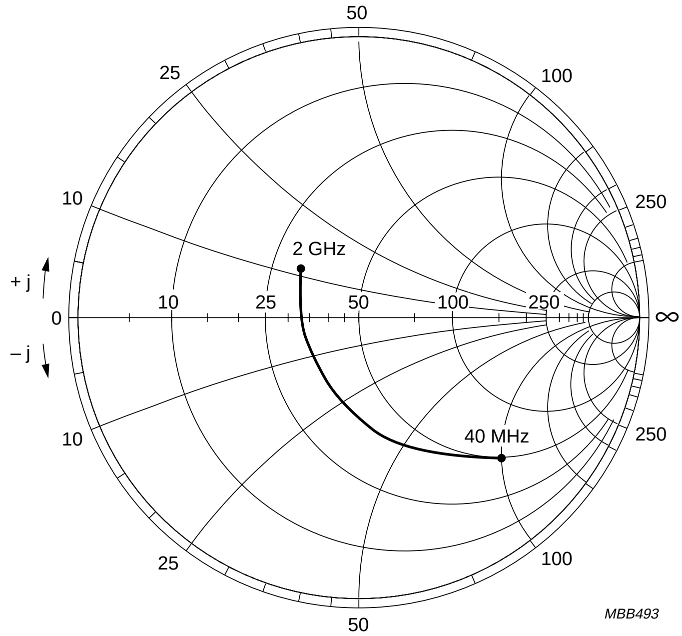
I_C = 50 mA; V_{CE} = 8 V; T_{amb} = 25 °C.

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



I_C = 50 mA; V_{CE} = 8 V; T_{amb} = 25 °C.

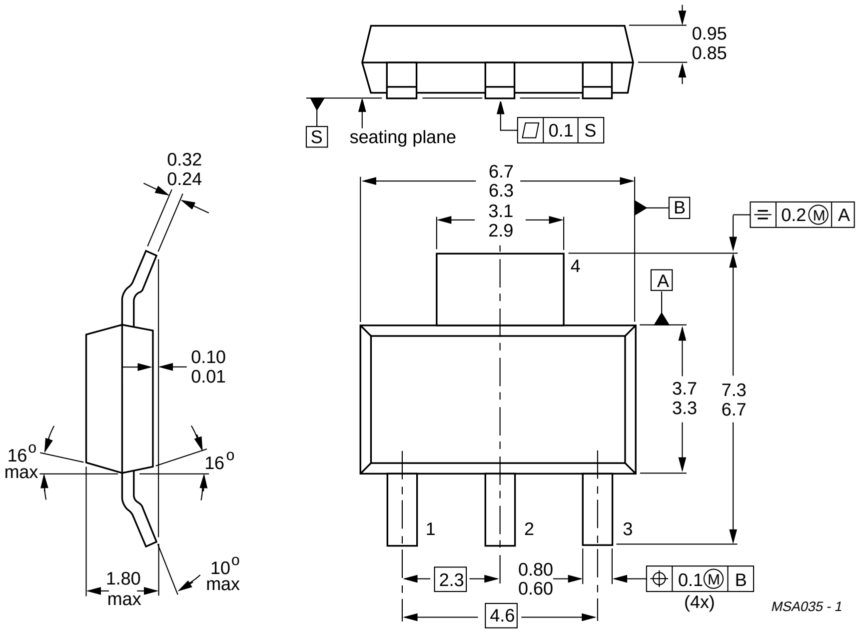
Fig.15 Common emitter reverse transmission coefficient (S_{12}).



I_C = 50 mA; V_{CE} = 8 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.
Short-form specification	The data in this specification is extracted from a full data sheet with the same type number and title. For detailed information see the relevant data sheet or data handbook.
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

These products are not designed for use in life support appliances, devices, or systems where malfunction of these products can reasonably be expected to result in personal injury. Philips customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Philips for any damages resulting from such improper use or sale.