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

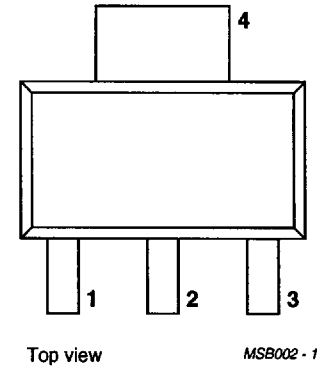


Fig.1 SOT223.

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.

7110826 0093906 341

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.

7110826 0093907 288

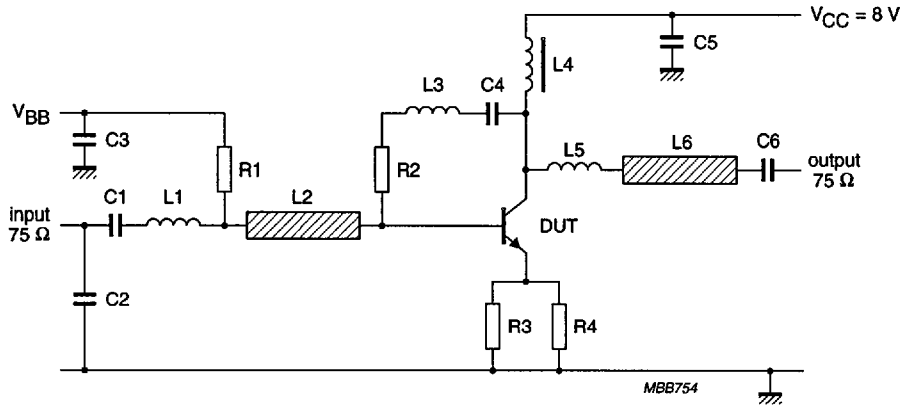


Fig.2 Intermodulation distortion and second order intermodulation distortion test circuit.

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 ($\varepsilon_r = 2.2$); thickness $^1/_{16}$ inch; thickness of copper sheet 2 x 35 μm; see Fig.2.

7110826 0093908 114

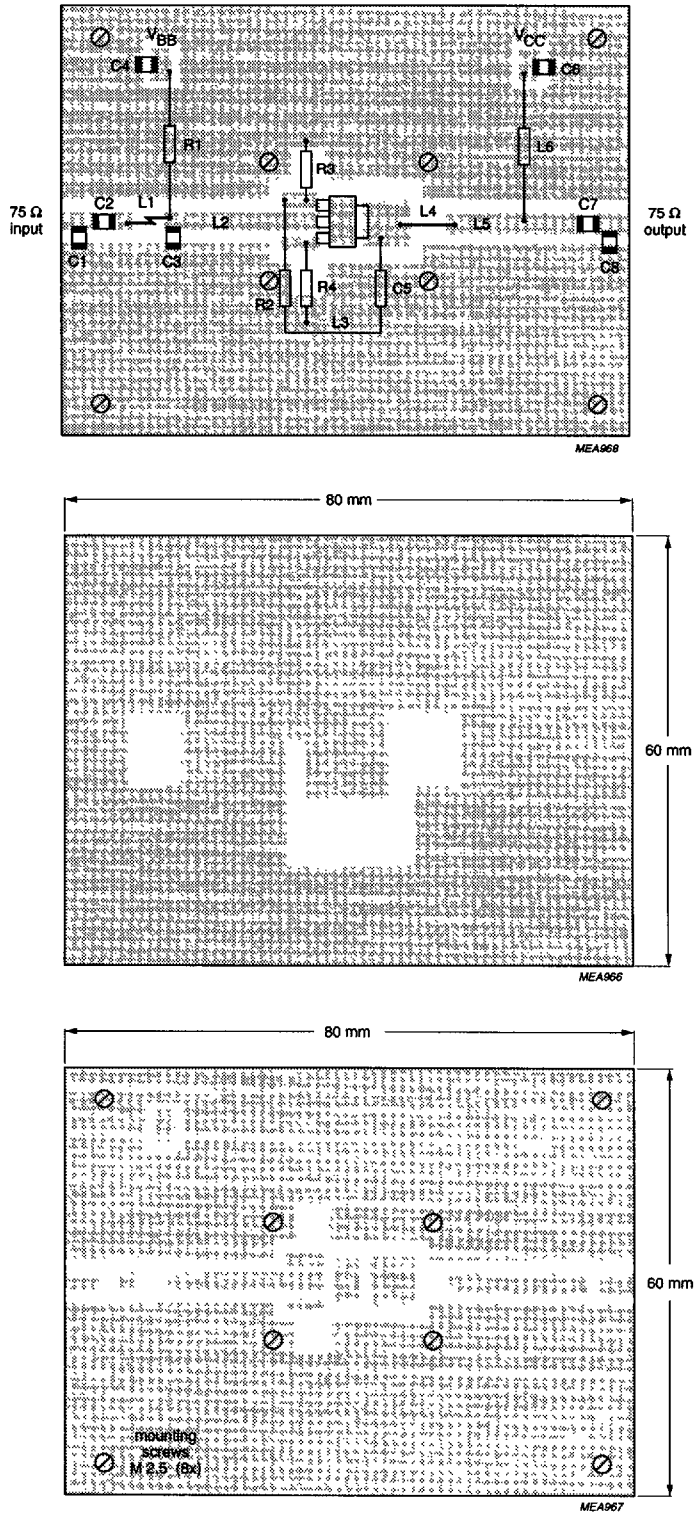


Fig.3 Intermodulation distortion and second order intermodulation distortion printed-circuit board.

7110826 0093909 050

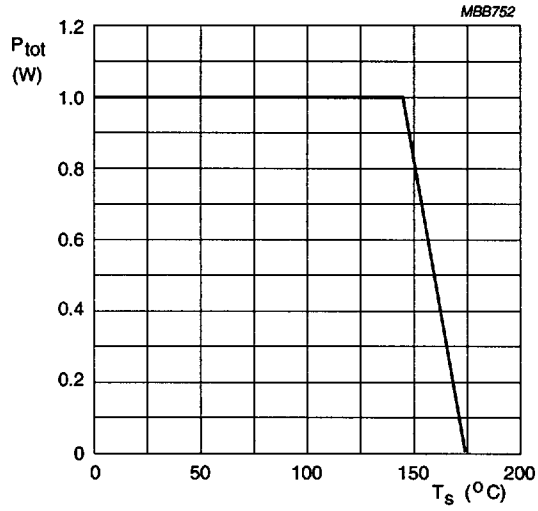
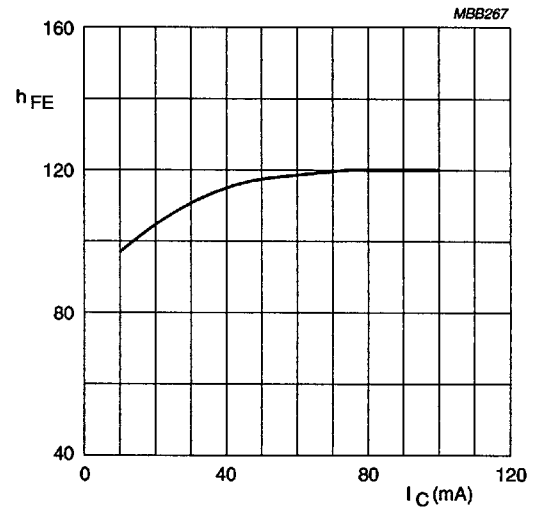
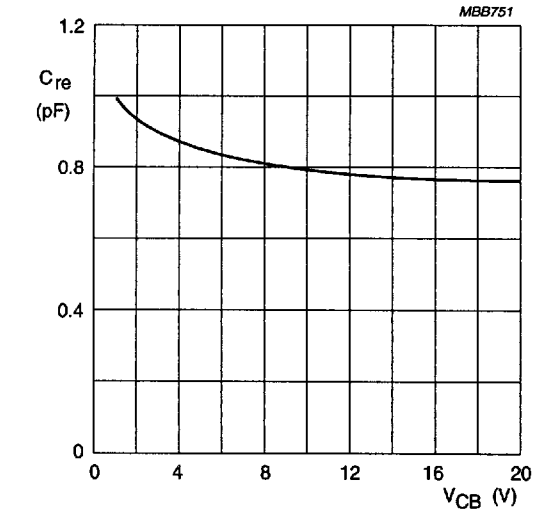


Fig.4 Power derating curve.



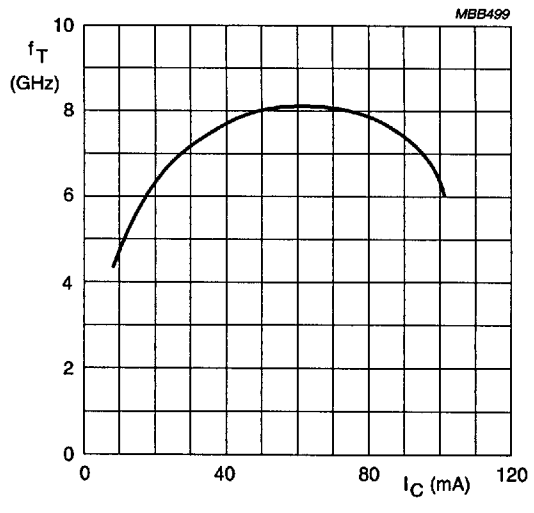
V_{CE} = 5 V; T_j = 25 °C.

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



I_E = 0; f = 1 MHz; T_j = 25 °C.

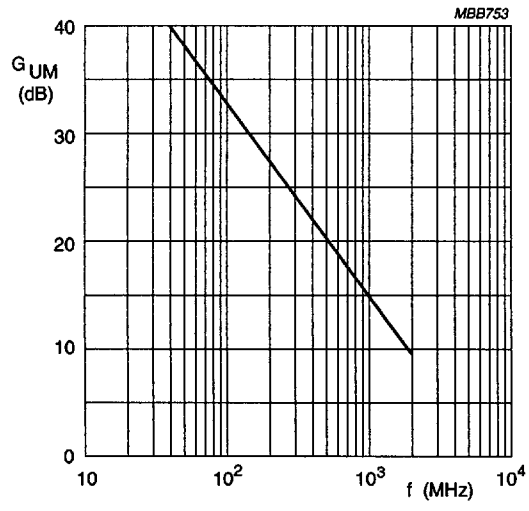
Fig.6 Feedback capacitance as a function of collector-base voltage.



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

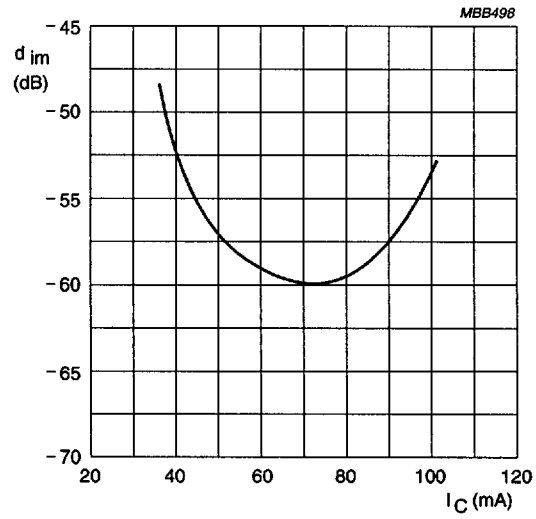
Fig.7 Transition frequency as a function of collector current.

7110826 0093910 872



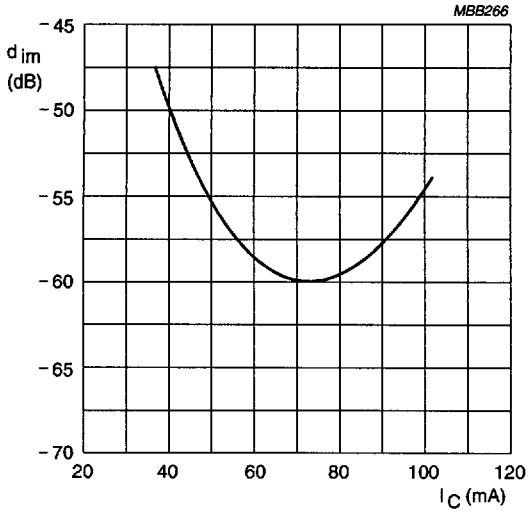
I_C = 50 mA; V_{CE} = 8 V; T_{amb} = 25 °C;

Fig.8 Maximum gain as a function of frequency.



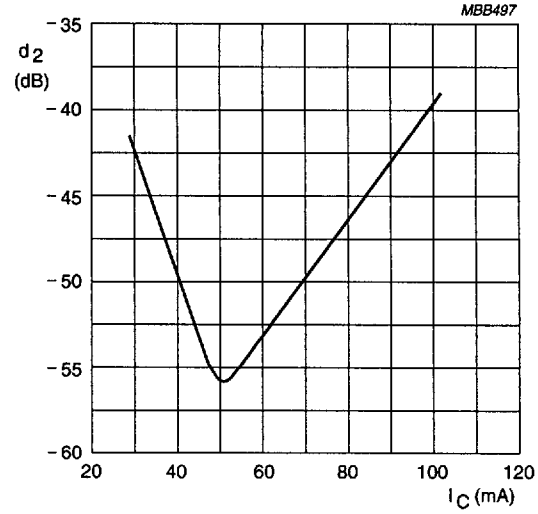
V_{CE} = 8 V; V_o = 750 mV; T_{amb} = 25 °C;
$f_{(p+q-r)}$ = 443.25 MHz.

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.

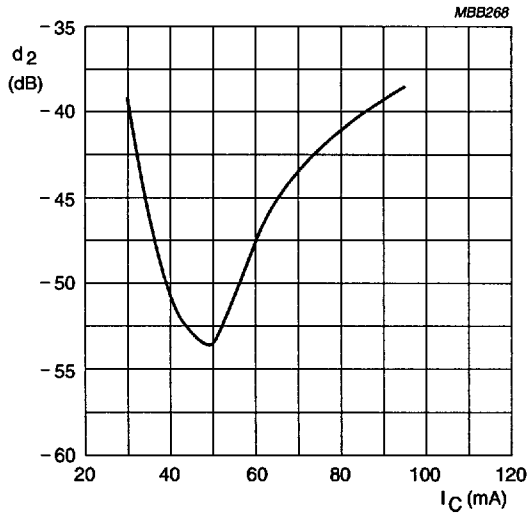
Fig.10 Intermodulation distortion as a function of collector current.



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.

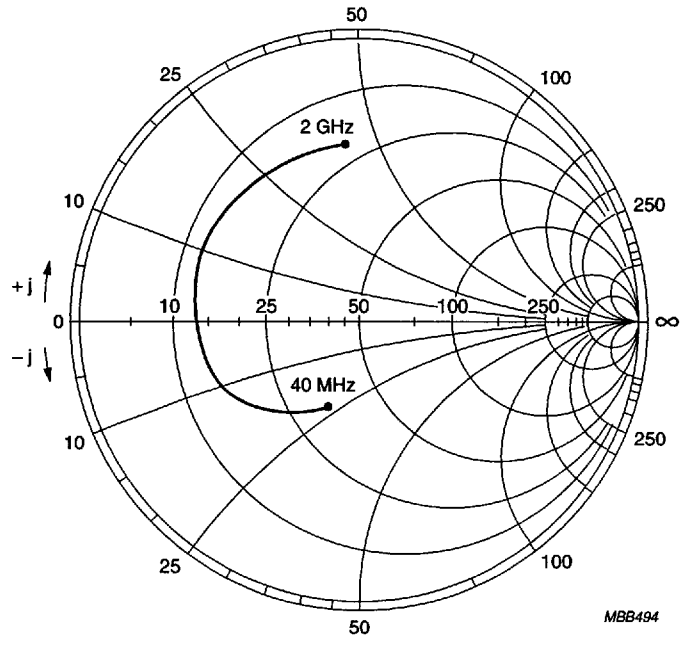
7110826 0093911 709



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

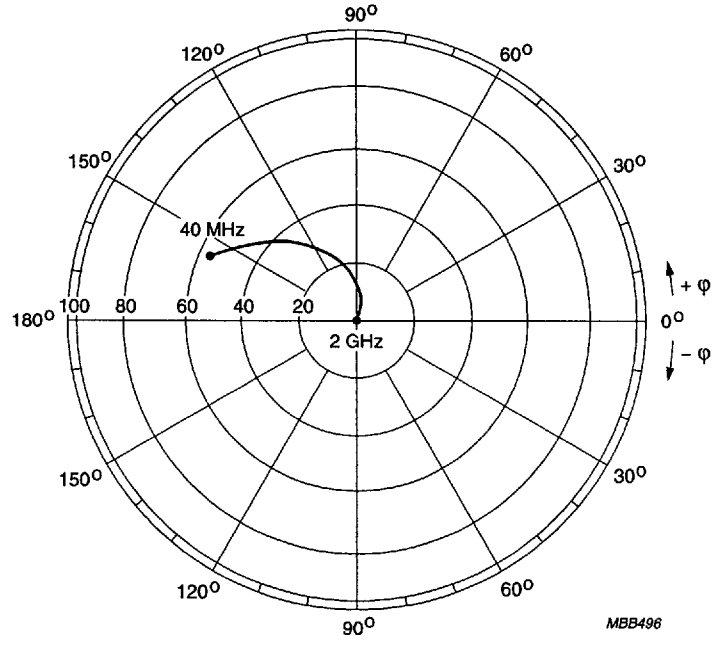
Fig.12 Second order intermodulation distortion as a function of collector current.

7110826 0093912 645



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

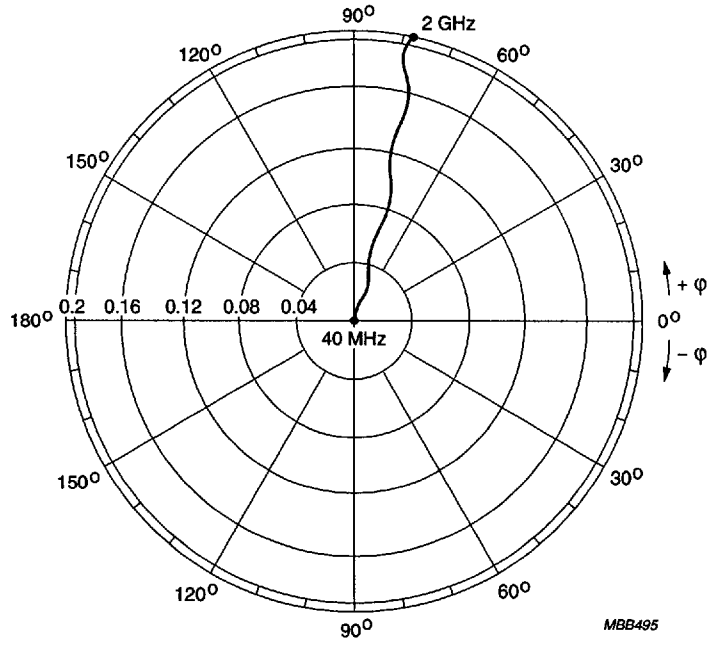
Fig.13 Common emitter input reflection coefficient (S_{11}).



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

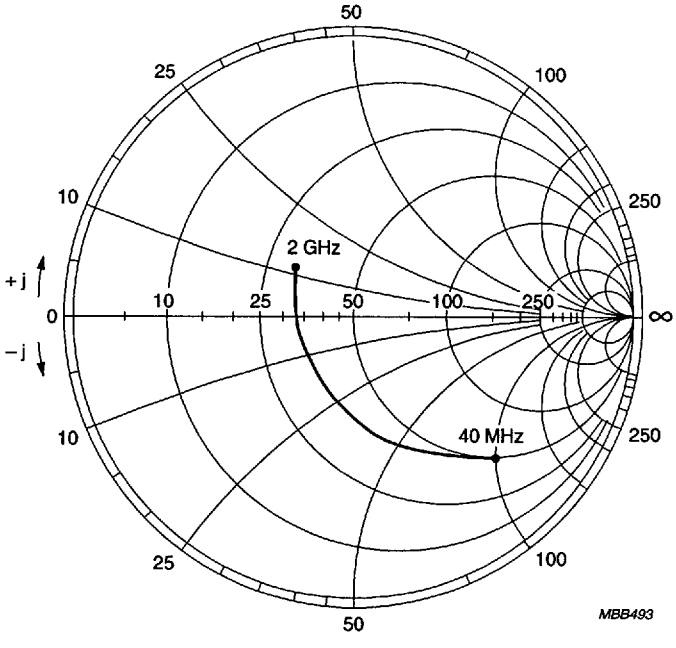
Fig.14 Common emitter forward transmission coefficient (S_{21}).

7110826 0093913 581



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

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

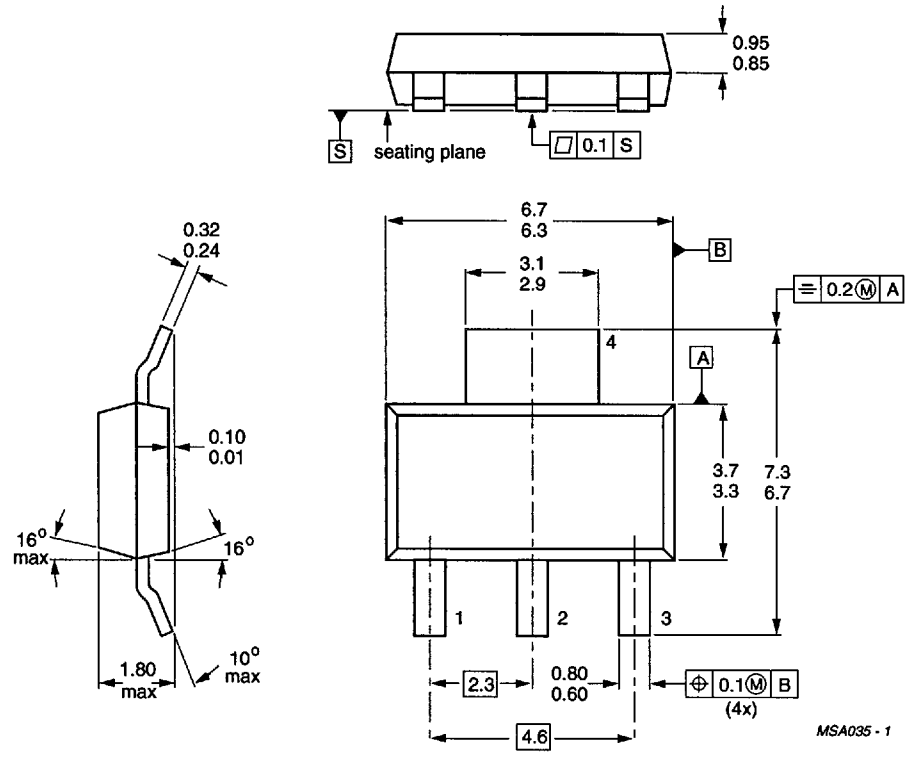


I_C = 50 mA; V_{CE} = 8 V; T_{amb} = 25 °C; Z_o = 50 Ω.

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

7110826 0093914 418

PACKAGE OUTLINE



Dimensions in mm.

Fig.17 SOT223.

7110826 0093915 354