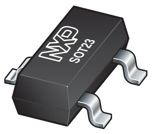


BFR520

NPN 9 GHz wideband transistor

Rev. 4 — 13 September 2011 Product data sheet

1. Product profile

1.1 General description

The BFR520 is an NPN silicon planar epitaxial transistor in a SOT23 plastic package.

1.2 Features and benefits

- High power gain
- Low noise figure
- High transition frequency
- Gold metallization ensures excellent reliability.

1.3 Applications

- RF front end wideband applications in the GHz range
  - Analog and digital cellular telephones
  - Cordless telephones (CT1, CT2, DECT, etc.)
  - Radar detectors
  - Pagers and satellite TV tuners (SATV)
  - Repeater amplifiers in fiber-optic systems.

1.4 Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{CBO}	collector-base voltage		-	-	20	V
V_{CES}	collector-emitter voltage	$R_{BE} = 0\ \Omega$	-	-	15	V
I_C	collector current (DC)		-	-	70	mA
P_{tot}	total power dissipation	up to $T_{sp} = 97$ °C [1]	-	-	300	mW
h_{FE}	DC current gain	$I_C = 20$ mA; $V_{CE} = 6$ V	60	120	250	
C_{re}	feedback capacitance	$I_C = i_c = 0$ A; $V_{CB} = 6$ V; f = 1 MHz	-	0.4	-	pF
f_T	transition frequency	$I_C = 20$ mA; $V_{CE} = 6$ V; f = 1 GHz	-	9	-	GHz
G_{UM}	maximum unilateral power gain	$I_C = 20$ mA; $V_{CE} = 6$ V; $T_{amb} = 25$ °C				
		f = 900 MHz	-	15	-	dB
		f = 2 GHz	-	9	-	dB

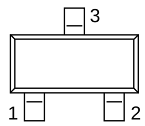
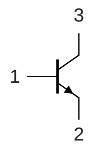
Table 1. Quick reference data *...continued*

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$\|s_{21}\|^2$	insertion power gain	I_C = 20 mA; V_{CE} = 6 V; T_{amb} = 25 °C; f = 900 MHz	13	14	-	dB
NF	noise figure	$\Gamma_s = \Gamma_{opt}$; T_{amb} = 25 °C				
		I_C = 5 mA; V_{CE} = 6 V; f = 900 MHz	-	1.1	1.6	dB
		I_C = 20 mA; V_{CE} = 6 V; f = 900 MHz	-	1.6	2.1	dB
		I_C = 5 mA; V_{CE} = 8 V; f = 2 GHz	-	1.9	-	dB

[1] T_{sp} is the temperature at the soldering point of the collector tab.

2. Pinning information

Table 2. Pinning

Pin	Description	Simplified outline	Symbol
1	base		 sym021
2	emitter		
3	collector		

3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
BFR520	-	plastic surface mounted package; 3 leads	SOT23

4. Marking

Table 4. Marking

Type number	Marking code[1]
BFR520	32*

[1] * = p: Made in Hong Kong
* = t: Made in Malaysia
* = W: Made in China.

5. Limiting values

Table 5. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions		Min	Max	Unit
V_{CBO}	collector-base voltage	open emitter		-	20	V
V_{CES}	collector-emitter voltage	$R_{BE} = 0\ \Omega$		-	15	V
V_{EBO}	emitter-base voltage	open collector		-	2.5	V
I_C	collector current (DC)			-	70	mA
P_{tot}	total power dissipation	up to T_{sp} = 97 °C	[1]	-	300	mW
T_{stg}	storage temperature			–65	150	°C
T_j	junction temperature			-	175	°C

[1] T_{sp} is the temperature at the soldering point of the collector tab.

6. Thermal characteristics

Table 6. Thermal characteristics

Symbol	Parameter	Conditions		Typ	Unit
$R_{th(j-s)}$	thermal resistance from junction to soldering point		[1]	260	K/W

[1] T_{sp} is the temperature at the soldering point of the collector tab.

7. Characteristics

Table 7. Characteristics

T_j = 25 °C unless otherwise specified.

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
I_{CBO}	collector cut-off current	I_E = 0 A; V_{CB} = 6 V		-	-	50	nA
h_{FE}	DC current gain	I_C = 20 mA; V_{CE} = 6 V		60	120	250	
C_e	emitter capacitance	$I_C = i_c$ = 0 A; V_{EB} = 0.5 V; f = 1 MHz		-	1	-	pF
C_c	collector capacitance	$I_E = i_e$ = 0 A; V_{CB} = 6 V; f = 1 MHz		-	0.5	-	pF
C_{re}	feedback capacitance	I_C = 0 A; V_{CB} = 6 V; f = 1 MHz		-	0.4	-	pF
f_T	transition frequency	I_C = 20 mA; V_{CE} = 6 V; f = 1 GHz		-	9	-	GHz
G_{UM}	maximum unilateral power gain	I_C = 20 mA; V_{CE} = 6 V; T_{amb} = 25 °C	[1]				
		f = 900 MHz		-	15	-	dB
		f = 2 GHz		-	9	-	dB
$\|s_{21}\|^2$	insertion power gain	I_C = 20 mA; V_{CE} = 6 V; T_{amb} = 25 °C; f = 900 MHz		13	14	-	dB

Table 7. Characteristics *...continued*

T_j = 25 °C unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
NF	noise figure	$\Gamma_s = \Gamma_{opt}$; V_{CE} = 6 V; T_{amb} = 25 °C				
		I_C = 5 mA; f = 900 MHz	-	1.1	1.6	dB
		I_C = 20 mA; f = 900 MHz	-	1.6	2.1	dB
		I_C = 5 mA; f = 2 GHz	-	1.9	-	dB
$P_{L(1dB)}$	output power at 1 dB gain compression	I_C = 20 mA; V_{CE} = 6 V; R_L = 50 Ω; T_{amb} = 25 °C; f = 900 MHz	-	17	-	dBm
ITO	third order intercept point	[2]	-	26	-	dBm

[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] I_C = 20 mA; V_{CE} = 6 V; R_L = 50 Ω; T_{amb} = 25 °C; f_p = 900 MHz; f_q = 902 MHz
Measured at $f_{(2p-q)}$ = 898 MHz and $f_{(2q-p)}$ = 904 MHz.

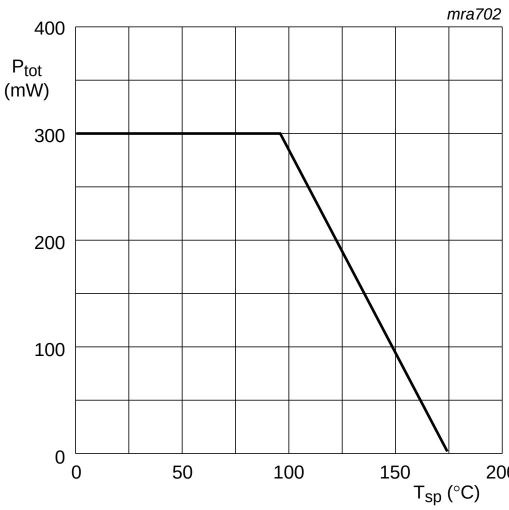
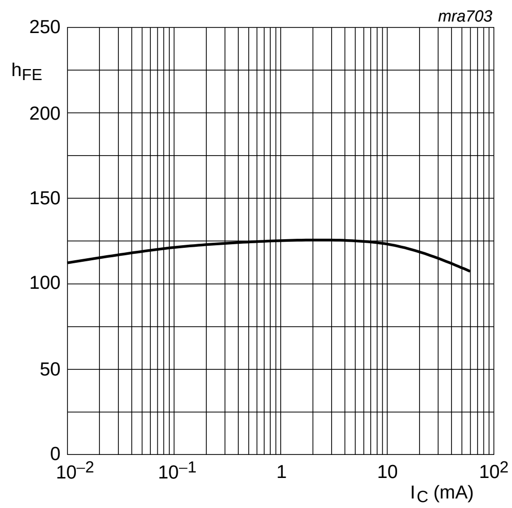
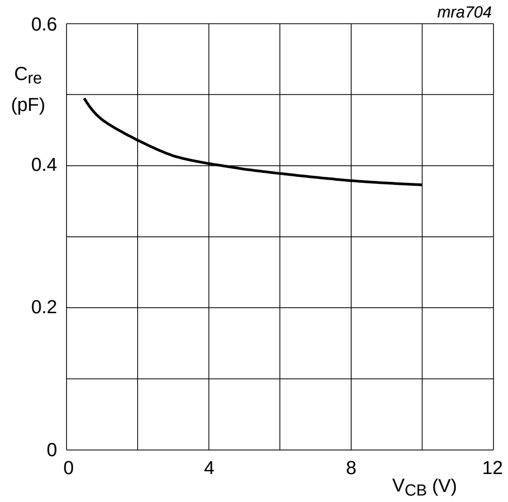


Fig 1. Power derating curve.



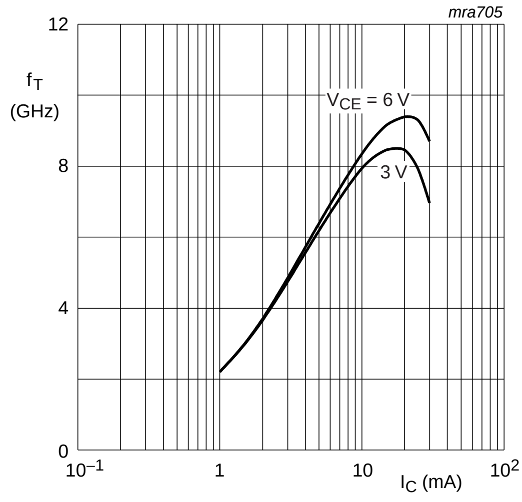
V_{CE} = 6 V.

Fig 2. DC current gain as a function of collector current.



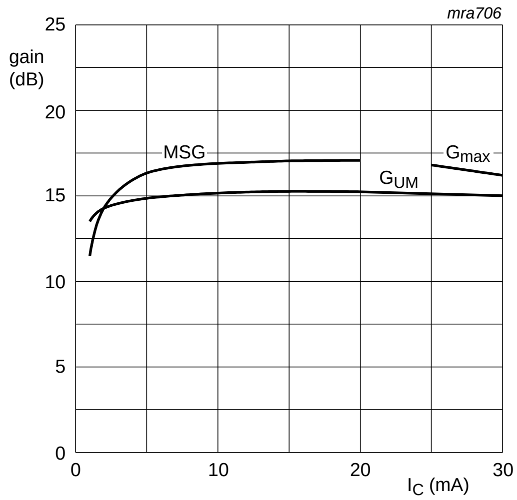
I_C = 0 A; f = 1 MHz.

Fig 3. Feedback capacitance as a function of collector-base voltage.



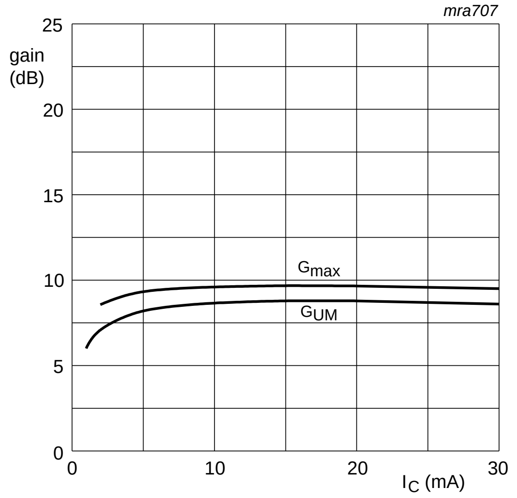
T_{amb} = 25 °C; f = 1 GHz.

Fig 4. Transition frequency as a function of collector current.



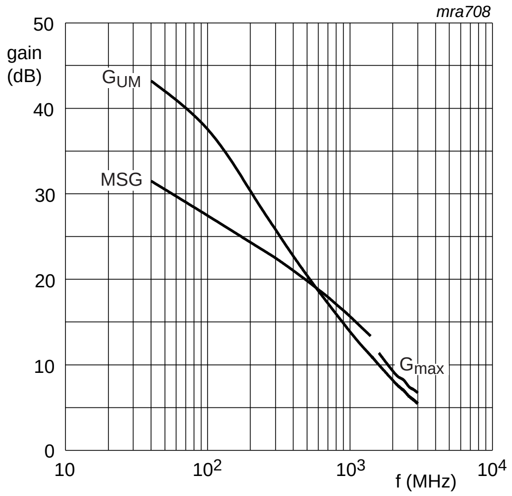
V_{CE} = 6 V; f = 900 MHz.

Fig 5. Gain as a function of collector current; f = 900 MHz.



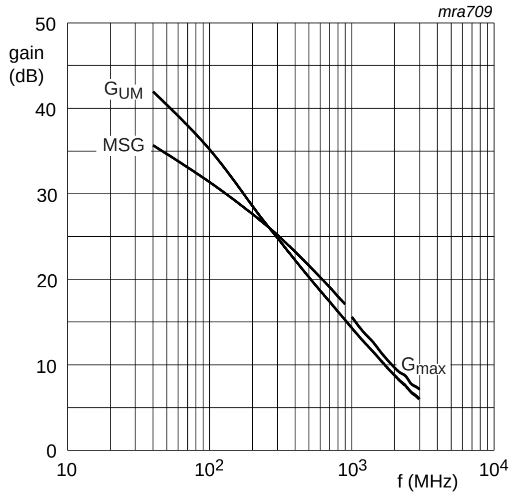
V_{CE} = 6 V; f = 2 GHz.

Fig 6. Gain as a function of collector current; f = 2 GHz.



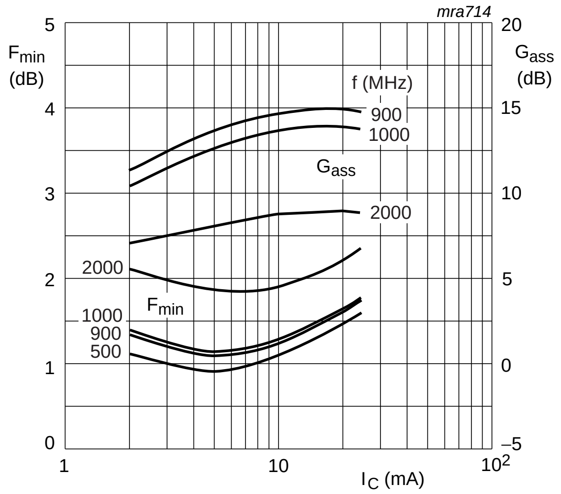
V_{CE} = 6 V; I_C = 5 mA.

Fig 7. Gain as a function of frequency; I_C = 5 mA.



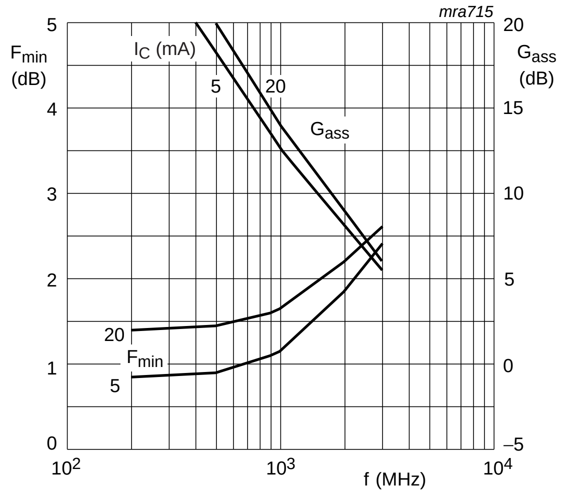
V_{CE} = 6 V; I_C = 20 mA.

Fig 8. Gain as a function of frequency; I_C = 20 mA.



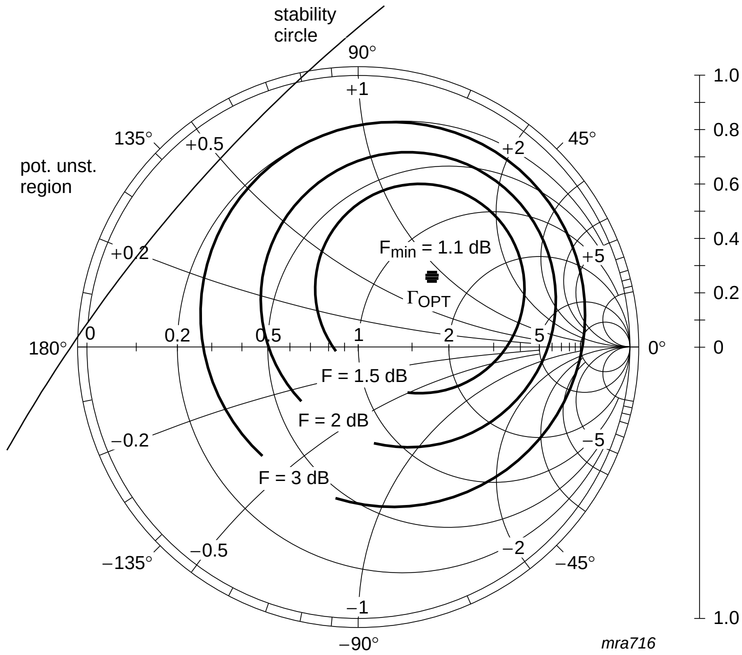
V_{CE} = 6 V.

Fig 9. Minimum noise figure and associated available gain as functions of collector current.



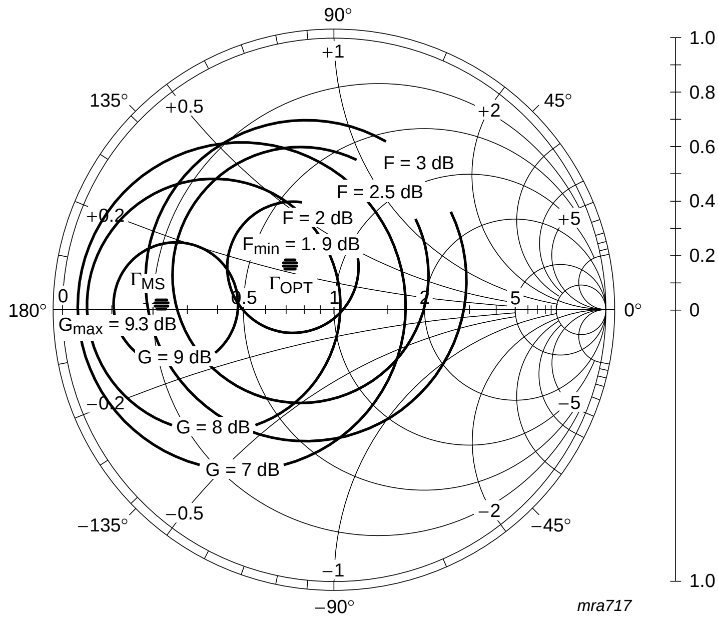
V_{CE} = 6 V.

Fig 10. Minimum noise figure and associated available gain as functions of frequency.



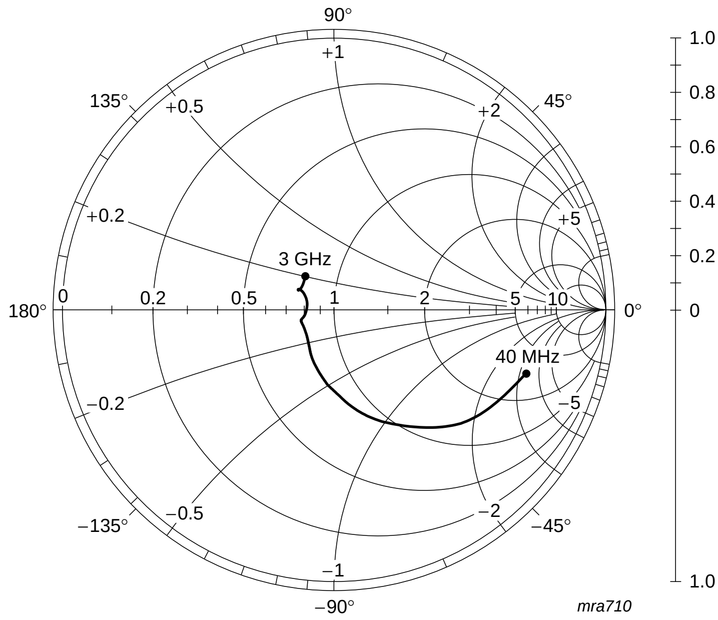
Z_o = 50 Ω; V_{CE} = 6 V; I_C = 5 mA; f = 900 MHz.

Fig 11. Noise circle figure; f = 900 MHz.



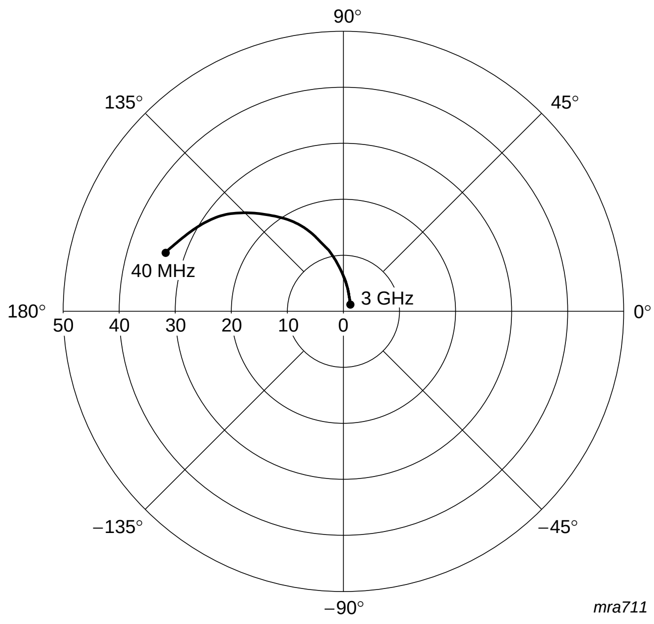
Z_o = 50 Ω; V_{CE} = 6 V; I_C = 5 mA; f = 2000 MHz.

Fig 12. Noise circle figure; f = 2000 MHz.



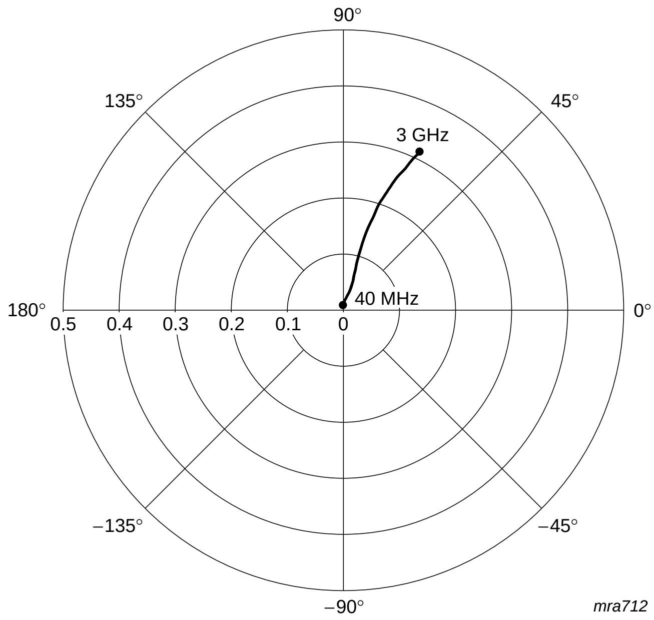
V_{CE} = 6 V; I_C = 20 mA; Z_o = 50 Ω.

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



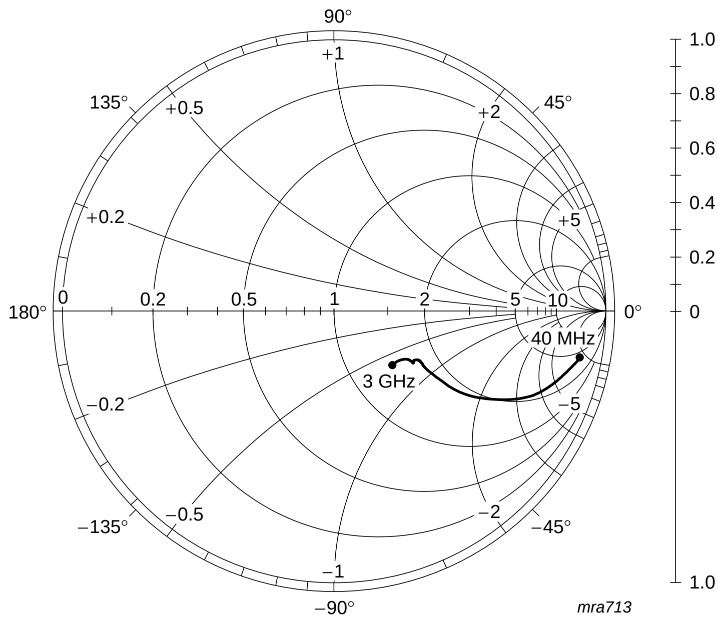
V_{CE} = 6 V; I_C = 20 mA.

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



V_{CE} = 6 V; I_C = 20 mA.

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

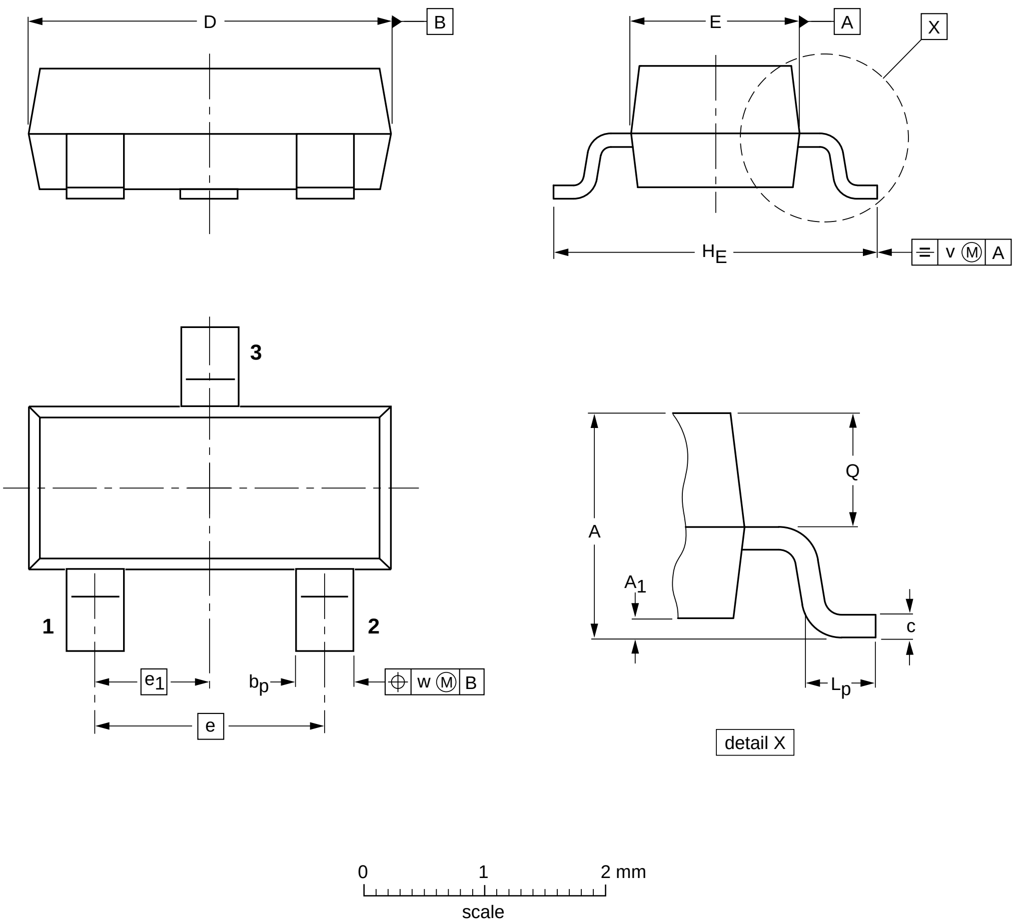


V_{CE} = 6 V; I_C = 20 mA; Z_o = 50 Ω.

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

8. Package outline

Plastic surface-mounted package; 3 leads **SOT23**



DIMENSIONS (mm are the original dimensions)

UNIT	A	A_1 max.	b_p	c	D	E	e	e_1	H_E	L_p	Q	v	w
mm	1.1 0.9	0.1	0.48 0.38	0.15 0.09	3.0 2.8	1.4 1.2	1.9	0.95	2.5 2.1	0.45 0.15	0.55 0.45	0.2	0.1

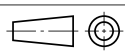
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT23		TO-236AB				~~04-11-04~~ 06-03-16

Fig 17. Package outline SOT23 (TO-236AB).