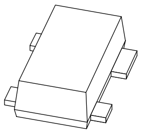


BFG424F

NPN 25 GHz wideband transistor

Rev. 01 — 21 March 2006 Product data sheet

1. Product profile

1.1 General description

NPN double polysilicon wideband transistor with buried layer for low voltage applications in a plastic, 4-pin dual-emitter SOT343F package.

CAUTION

This device is sensitive to ElectroStatic Discharge (ESD). Therefore care should be taken during transport and handling.

1.2 Features

- Very high power gain
- Low noise figure
- High transition frequency
- Emitter is thermal lead
- Low feedback capacitance

1.3 Applications

- Radio Frequency (RF) front end wideband applications such as:
  - analog and digital cellular telephones
  - cordless telephones (Cordless Telephone (CT), Personal Handy-phone System (PHS), Digital Enhanced Cordless Telecommunications (DECT), etc.)
  - radar detectors
  - pagers
  - Satellite Antenna TeleVison (SATV) tuners
  - high frequency oscillators e.g. Dielectric Resonator Oscillator (DRO) for Low Noise Block (LNB)

1.4 Quick reference data

Table 1: Quick reference data

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_{CBO}	collector-base voltage	open emitter		-	-	10	V
V_{CEO}	collector-emitter voltage	open base		-	-	4.5	V
I_C	collector current			-	25	30	mA
P_{tot}	total power dissipation	$T_{sp} \leq 90$ °C	[1]	-	-	135	mW

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

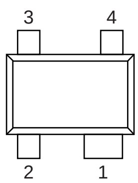
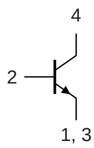
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
h_{FE}	DC current gain	I_C = 25 mA; V_{CE} = 2 V; T_j = 25 °C		50	80	120	
C_{CBS}	collector-base capacitance	V_{CB} = 2 V; f = 1 MHz		-	102	-	fF
f_T	transition frequency	I_C = 25 mA; V_{CE} = 2 V; f = 2 GHz; T_{amb} = 25 °C		-	25	-	GHz
$G_{p(max)}$	maximum power gain	I_C = 25 mA; V_{CE} = 2 V; f = 2 GHz; T_{amb} = 25 °C	[2]	-	23	-	dB
NF	noise figure	I_C = 2 mA; V_{CE} = 2 V; f = 2 GHz; $\Gamma_S = \Gamma_{opt}$		-	1.2	-	dB

[1] T_{sp} is the temperature at the soldering point of the emitter pins.

[2] $G_{p(max)}$ is the maximum power gain, if K > 1. If K < 1 then $G_{p(max)}$ = Maximum Stable Gain (MSG), see Figure 8.

2. Pinning information

Table 2: Pinning

Pin	Description	Simplified outline	Symbol
1	emitter		 mbb159
2	base		
3	emitter		
4	collector		

3. Ordering information

Table 3: Ordering information

Type number	Package		
	Name	Description	Version
BFG424F	-	plastic surface mounted flat pack package; reverse pinning; 4 leads	SOT343F

4. Marking

Table 4: Marking

Type number	Marking code [1]
BFG424F	NE*

[1] * = p: made in Hong Kong.

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		-	10	V
V_{CEO}	collector-emitter voltage	open base		-	4.5	V
V_{EBO}	emitter-base voltage	open collector		-	1	V
I_C	collector current			-	30	mA
P_{tot}	total power dissipation	$T_{sp} \leq 90$ °C	[1]	-	135	mW
T_{stg}	storage temperature			–65	+150	°C
T_j	junction temperature			-	150	°C

[1] T_{sp} is the temperature at the soldering point of the emitter pins.

6. Thermal characteristics

Table 6: Thermal characteristics

Symbol	Parameter	Conditions		Typ	Unit
$R_{th(j\text{-}sp)}$	thermal resistance from junction to solder point	$T_{sp} \leq 90$ °C	[1]	340	K/W

[1] T_{sp} is the temperature at the soldering point of the emitter pins.

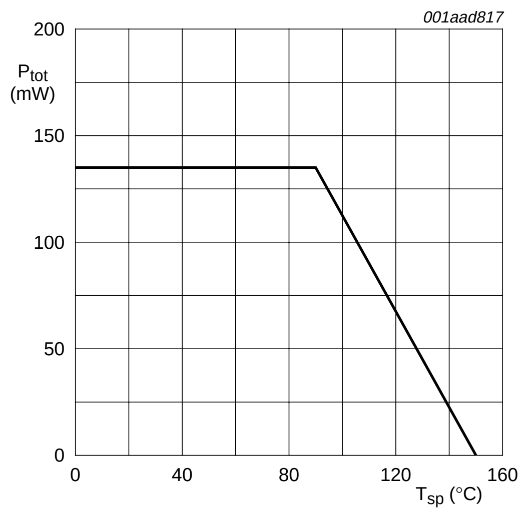


Fig 1. Power derating curve

7. Characteristics

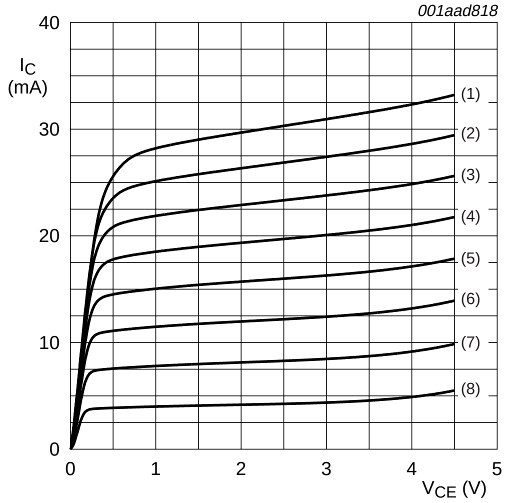
Table 7: Characteristics

T_j = 25 °C; unless otherwise specified.

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$V_{(BR)CBO}$	collector-base breakdown voltage	I_C = 2.5 μA; I_E = 0 mA		10	-	-	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	I_C = 1 mA; I_B = 0 mA		4.5	-	-	V
$V_{(BR)EBO}$	open-collector emitter-base breakdown voltage	I_E = 2.5 μA; I_C = 0 mA		1	-	-	V
I_{CBO}	collector-base cut-off current	I_E = 0 mA; V_{CB} = 4.5 V		-	-	15	nA
h_{FE}	DC current gain	I_C = 25 mA; V_{CE} = 2 V		50	80	120	
C_{CES}	collector-emitter capacitance	V_{CB} = 2 V; f = 1 MHz		-	363	-	fF
C_{EBS}	emitter-base capacitance	V_{EB} = 0.5 V; f = 1 MHz		-	475	-	fF
C_{CBS}	collector-base capacitance	V_{CB} = 2 V; f = 1 MHz		-	102	-	fF
f_T	transition frequency	I_C = 25 mA; V_{CE} = 2 V; f = 2 GHz; T_{amb} = 25 °C		-	25	-	GHz
$G_{p(max)}$	maximum power gain	I_C = 25 mA; V_{CE} = 2 V; f = 2 GHz; T_{amb} = 25 °C	[1]	-	23	-	dB
$\|s_{21}\|^2$	insertion power gain	I_C = 25 mA; V_{CE} = 2 V; f = 2 GHz; T_{amb} = 25 °C		-	18.5	-	dB
NF	noise figure	I_C = 2 mA; V_{CE} = 2 V; f = 900 MHz; $\Gamma_S = \Gamma_{opt}$		-	0.8	-	dB
		I_C = 2 mA; V_{CE} = 2 V; f = 2 GHz; $\Gamma_S = \Gamma_{opt}$		-	1.2	-	dB
$P_{L(1dB)}$	output power at 1 dB gain compression	I_C = 25 mA; V_{CE} = 2 V; f = 2 GHz; $Z_S = Z_{S(opt)}$; $Z_L = Z_{L(opt)}$	[2]	-	12	-	dBm
IP3	third-order intercept point	I_C = 25 mA; V_{CE} = 2 V; f = 2 GHz; $Z_S = Z_{S(opt)}$; $Z_L = Z_{L(opt)}$	[2]	-	22	-	dBm

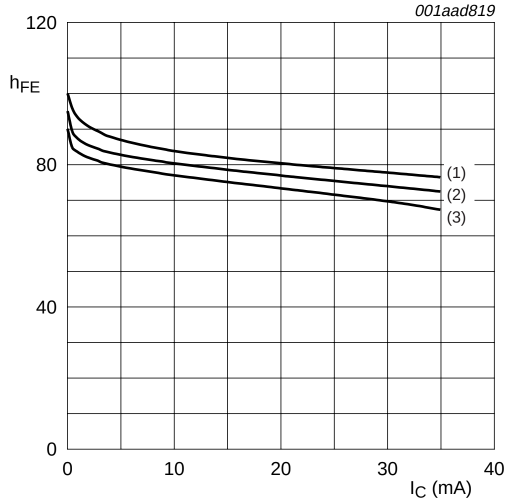
[1] $G_{p(max)}$ is the maximum power gain, if K > 1. If K < 1 then $G_{p(max)}$ = MSG, see Figure 8.

[2] Z_S is optimized for noise; Z_L is optimized for gain.



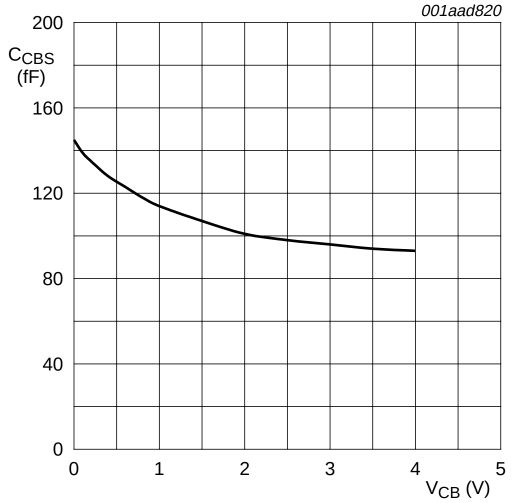
(1) I_B = 400 µA
(2) I_B = 350 µA
(3) I_B = 300 µA
(4) I_B = 250 µA
(5) I_B = 200 µA
(6) I_B = 150 µA
(7) I_B = 100 µA
(8) I_B = 50 µA

Fig 2. Collector current as a function of collector-emitter voltage; typical values



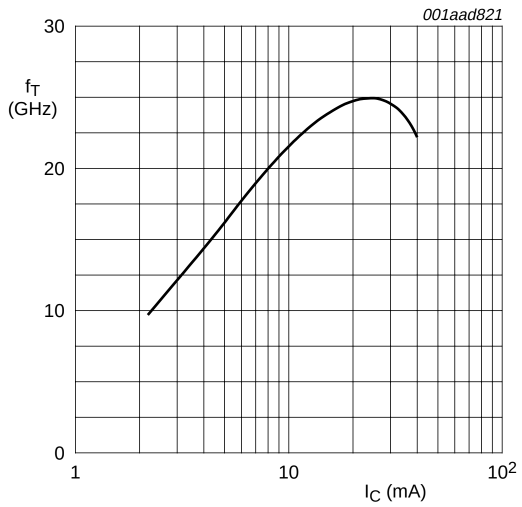
(1) V_{CE} = 3 V
(2) V_{CE} = 2 V
(3) V_{CE} = 1 V

Fig 3. DC current gain as a function of collector current; typical values



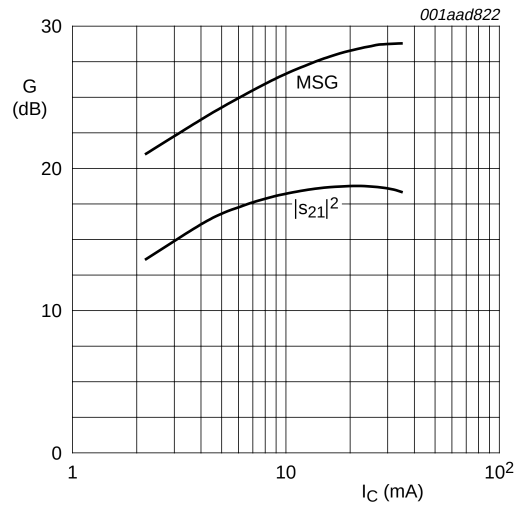
f = 1 MHz

Fig 4. Collector-base capacitance as a function of collector-base voltage; typical values



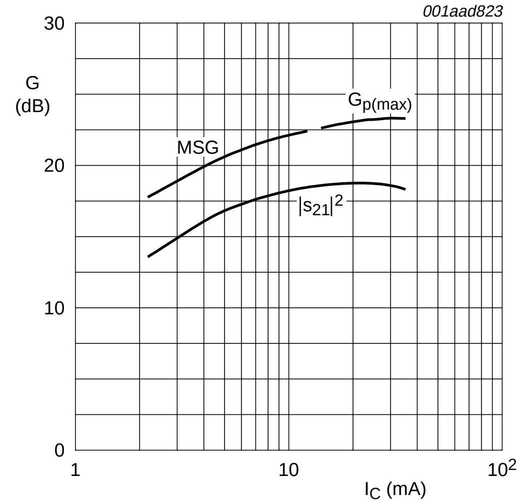
V_{CE} = 2 V; f = 2 GHz; T_{amb} = 25 °C

Fig 5. Transition frequency as a function of collector current; typical values



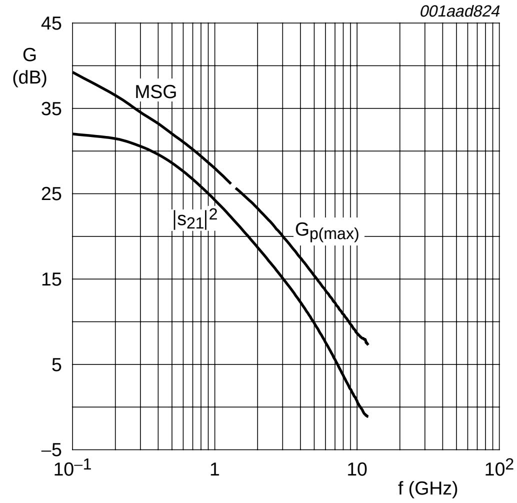
V_{CE} = 2 V; f = 0.9 GHz; T_{amb} = 25 °C

Fig 6. Gain as a function of collector current; typical values



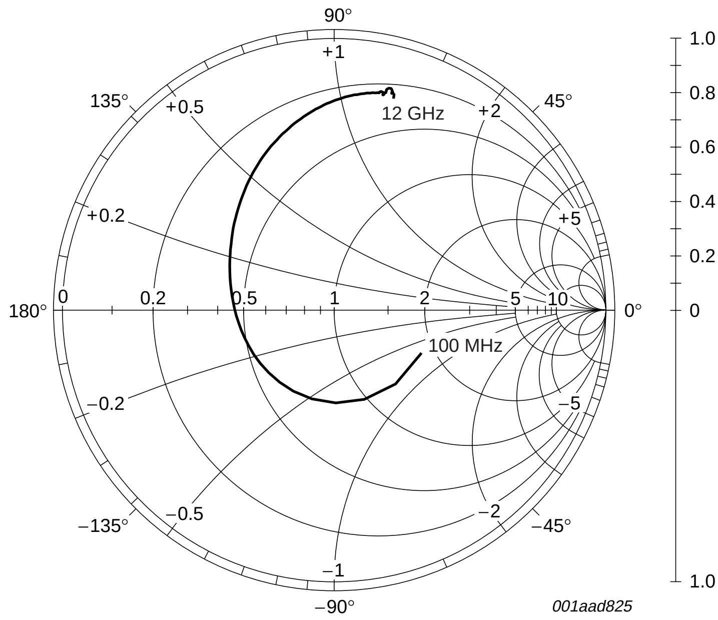
V_{CE} = 2 V; f = 2 GHz; T_{amb} = 25 °C

Fig 7. Gain as a function of collector current; typical values



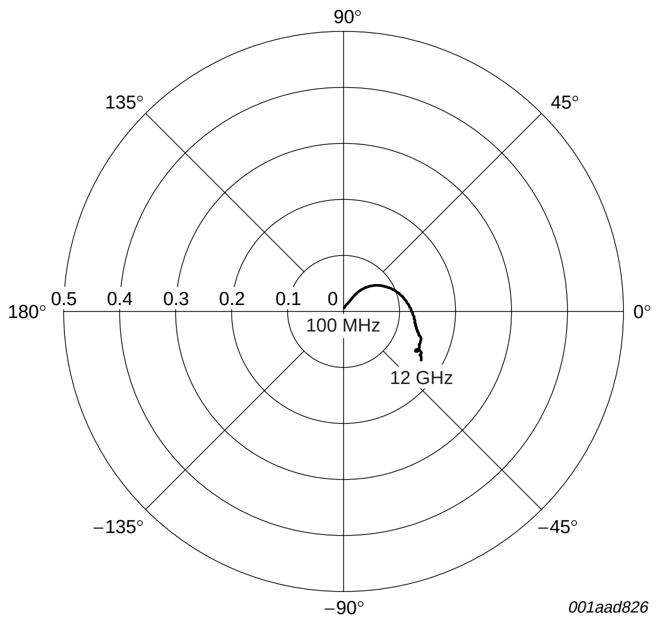
V_{CE} = 2 V; I_C = 25 mA; T_{amb} = 25 °C

Fig 8. Gain as a function of frequency; typical values



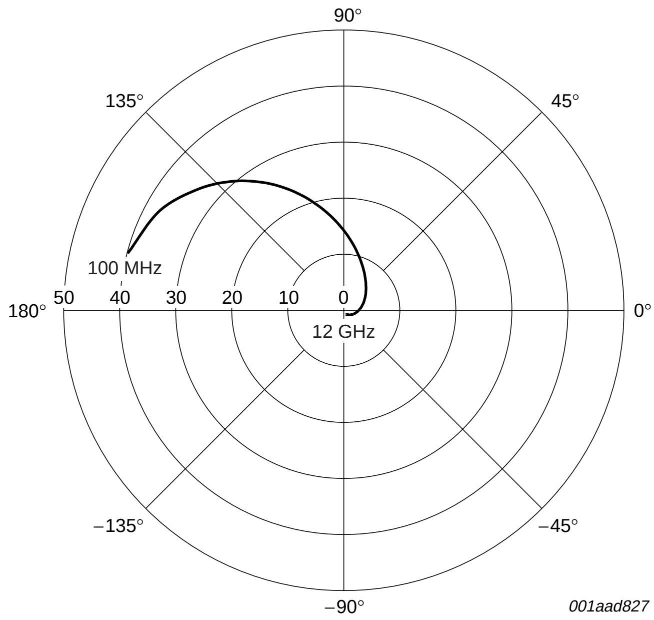
V_{CE} = 2 V; I_C = 25 mA; Z_o = 50 Ω

Fig 9. Common emitter input reflection coefficient (s_{11}); typical values



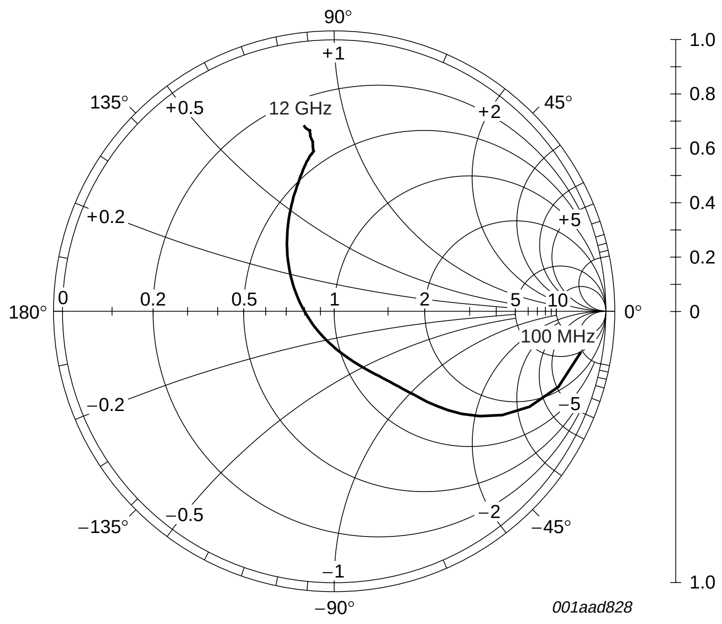
V_{CE} = 2 V; I_C = 25 mA

Fig 10. Common emitter reverse transmission coefficient (s_{12}); typical values



V_{CE} = 2 V; I_C = 25 mA

Fig 11. Common emitter forward transmission coefficient (s_{21}); typical values



V_{CE} = 2 V; I_C = 25 mA; Z_o = 50 Ω

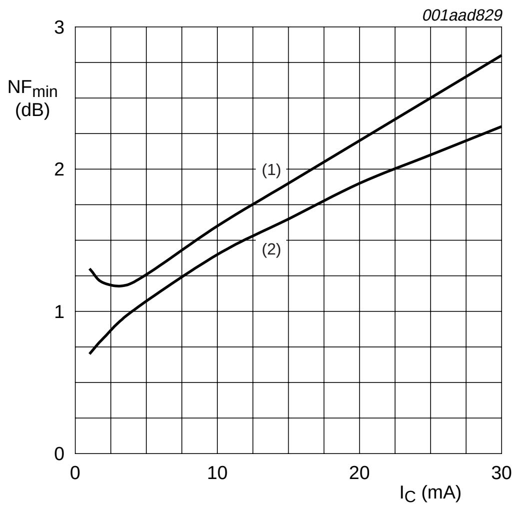
Fig 12. Common emitter input reflection coefficient (s_{22}); typical values

7.1 Noise data

Table 8: Noise data

V_{CE} = 2 V; typical values.

f	I_C	NF_{min}	Γ_{opt}		r_n
(MHz)	(mA)	(dB)	ratio	(deg)	(Ω)
900	1	0.7	0.67	19.1	0.40
	2	0.81	0.48	17.8	0.27
	4	1	0.28	11.7	0.24
	10	1.4	0.02	–63.9	0.19
	15	1.65	0.11	–162.4	0.18
	20	1.9	0.19	–165.5	0.18
	25	2.1	0.25	–166.3	0.19
	30	2.3	0.29	–166.5	0.19
2000	1	1.3	0.56	57.5	0.36
	2	1.2	0.43	57.2	0.25
	4	1.2	0.22	60.8	0.18
	10	1.6	0.06	137.4	0.19
	15	1.9	0.13	–162.1	0.20
	20	2.2	0.17	–155.5	0.20
	25	2.5	0.22	–152.2	0.21
	30	2.8	0.27	–150.8	0.25



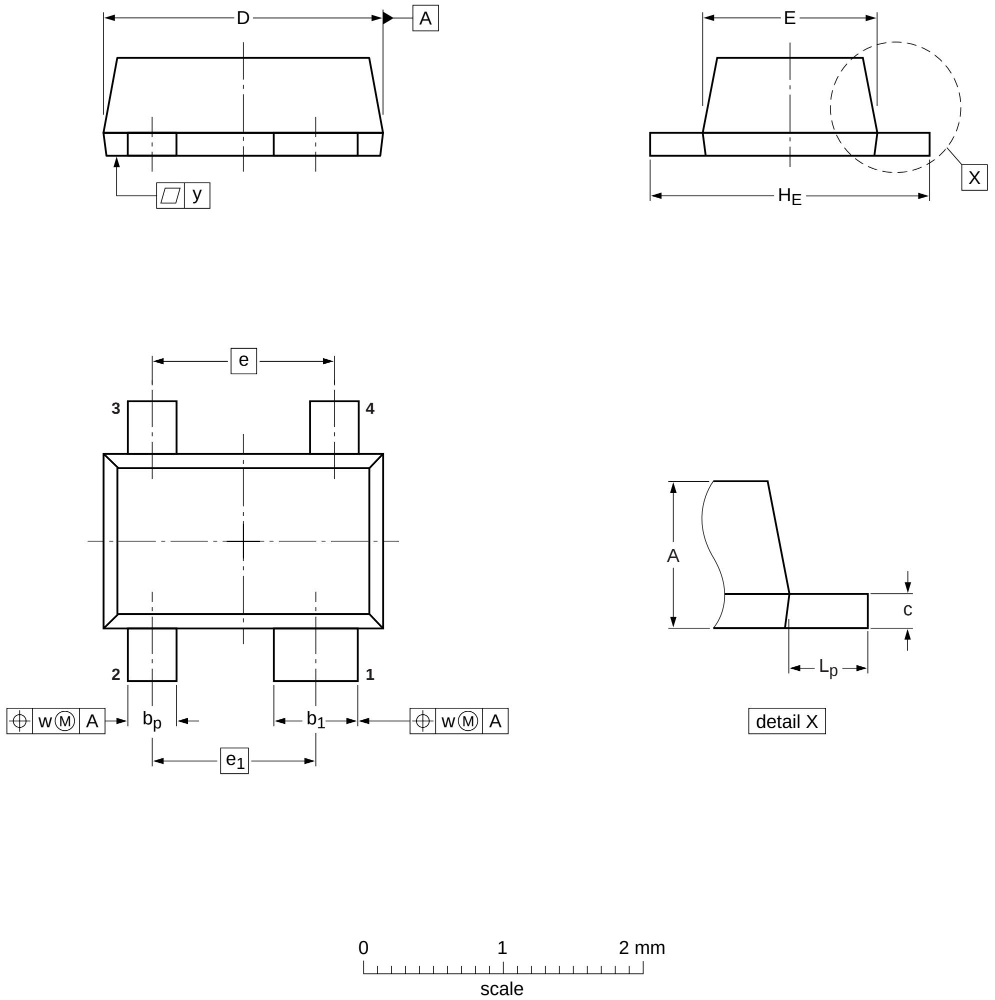
(1) f = 2 GHz

(2) f = 900 MHz

Fig 13. Minimum noise figure as a function of collector current; typical values

8. Package outline

Plastic surface-mounted flat pack package; reverse pinning; 4 leads **SOT343F**



DIMENSIONS (mm are the original dimensions)

UNIT	A max	b_p	b_1	c	D	E	e	e_1	H_E	L_p	w	y
mm	0.75 0.65	0.4 0.3	0.7 0.5	0.25 0.10	2.2 1.8	1.35 1.15	1.3	1.15	2.2 2.0	0.48 0.38	0.2	0.1

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT343F						~~05-07-12~~ 06-03-16

Fig 14. Package outline SOT343F

9. Revision history

Table 9: Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BFG424F_1	20060321	Product data sheet	-	-

10. Data sheet status

Level	Data sheet status [1]	Product status [2] [3]	Definition
I	Objective data	Development	This data sheet contains data from the objective specification for product development. Philips Semiconductors reserves the right to change the specification in any manner without notice.
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[3] For data sheets describing multiple type numbers, the highest-level product status determines the data sheet status.

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15. Contents

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