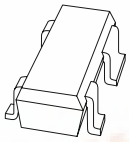

BFG424W

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 SOT343R 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	$T_{sp} \leq 103$ °C	[1]	-	-	135	mW

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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		-	105	-	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]	-	22	-	dB
NF	noise figure	I_C = 2 mA; V_{CE} = 2 V; f = 2 GHz; $\Gamma_S = \Gamma_{opt}$		-	1.2	-	dB

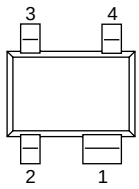
[1] T_{sp} is the temperature at the soldering point of the emitter pins.

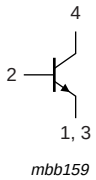
[2] $G_{p(max)}$ is the maximum power gain, if K > 1. If K < 1 then $G_{p(max)}$ = Maximum Stable Gain (MSG), see Figure 8.

2. Pinning information

Table 2: Pinning

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





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3. Ordering information

Table 3: Ordering information

Type number	Package		
	Name	Description	Version
BFG424W	-	plastic surface mounted package; reverse pinning; 4 leads	SOT343R

4. Marking

Table 4: Marking

Type number	Marking code [1]
BFG424W	ND*

[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	$T_{sp} \leq 103$ °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
$R_{th(j-sp)}$	thermal resistance from junction to solder point	$T_{sp} \leq 103$ °C	[1]	340	K/W

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

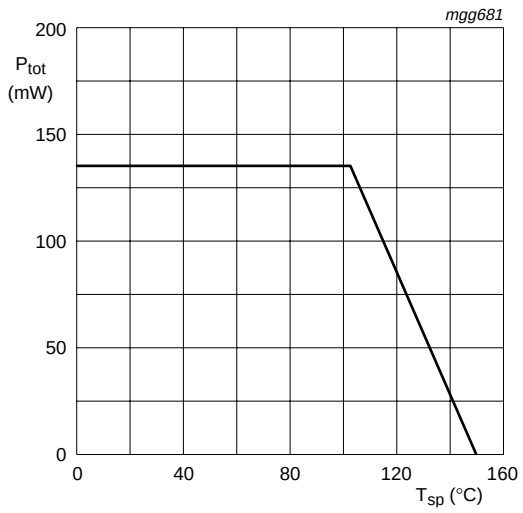


Fig 1. Power derating curve

7. Characteristics

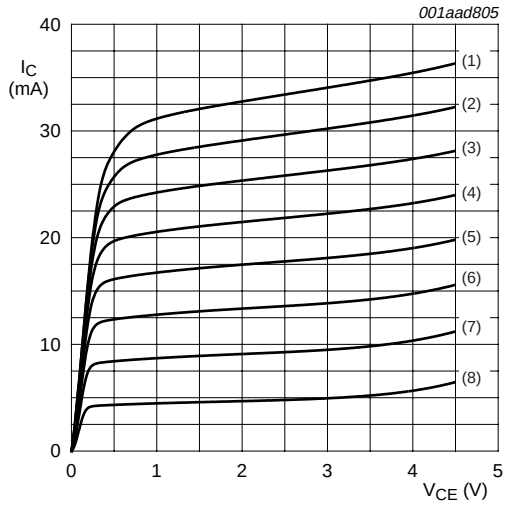
Table 7: Characteristics

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		-	385	-	fF
C_{EBS}	emitter-base capacitance	V_{EB} = 0.5 V; f = 1 MHz		-	515	-	fF
C_{CBS}	collector-base capacitance	V_{CB} = 2 V; f = 1 MHz		-	105	-	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]	-	22	-	dB
$\|s_{21}\|^2$	insertion power gain	I_C = 25 mA; V_{CE} = 2 V; f = 2 GHz; T_{amb} = 25 °C		-	18	-	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

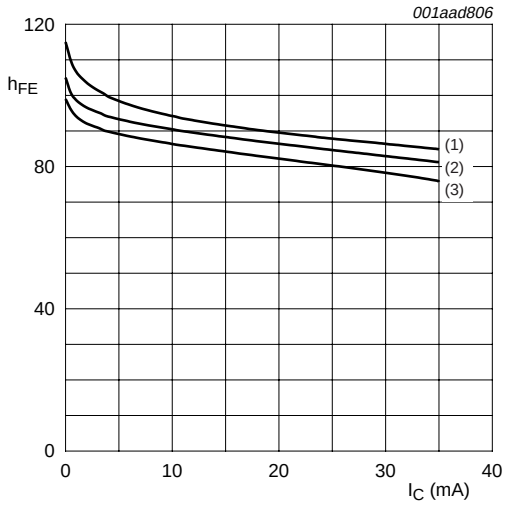
[1] $G_{p(max)}$ is the maximum power gain, if K > 1. If K < 1 then $G_{p(max)}$ = MSG, see Figure 8.

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



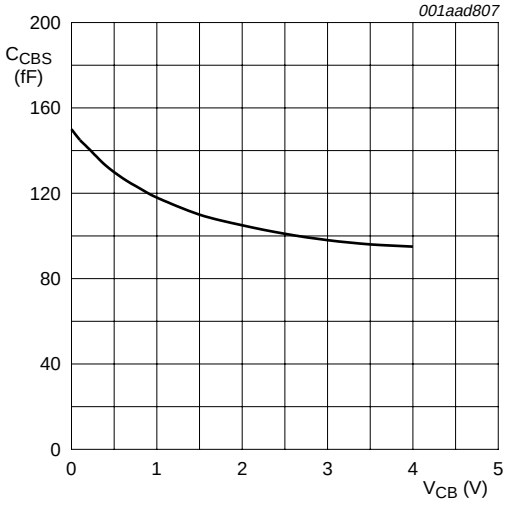
(1) I_B = 400 µA
(2) I_B = 350 µA
(3) I_B = 300 µA
(4) I_B = 250 µA
(5) I_B = 200 µA
(6) I_B = 150 µA
(7) I_B = 100 µA
(8) I_B = 50 µA

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



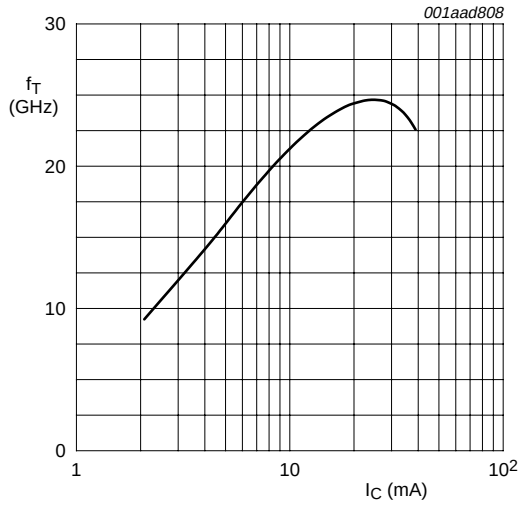
(1) V_{CE} = 3 V
(2) V_{CE} = 2 V
(3) V_{CE} = 1 V

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



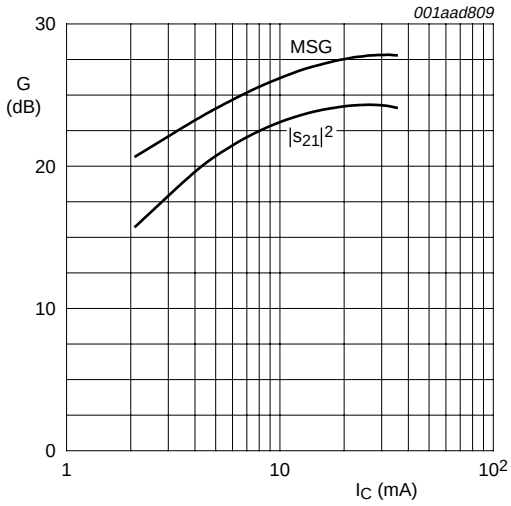
f = 1 MHz

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



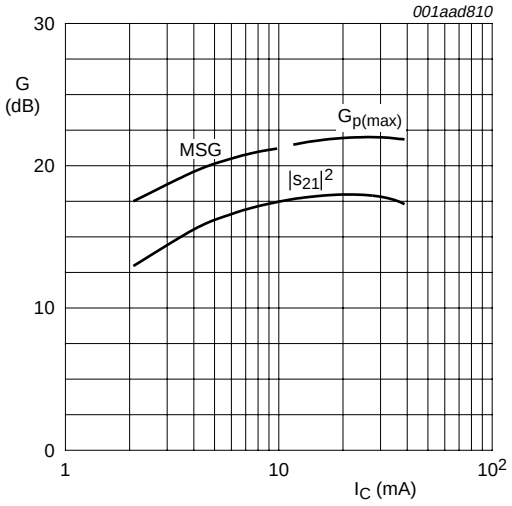
V_{CE} = 2 V; f = 2 GHz; T_{amb} = 25 °C

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



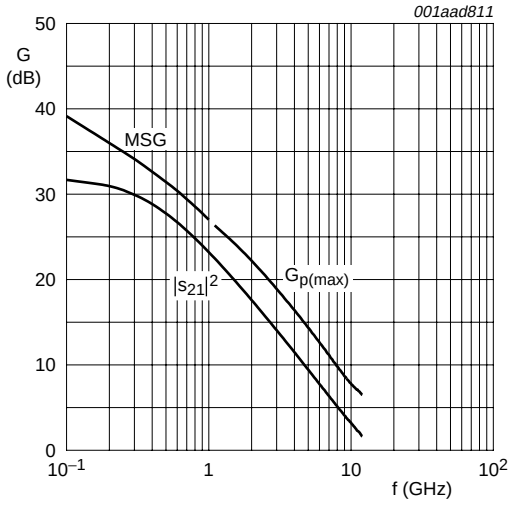
V_{CE} = 2 V; f = 0.9 GHz; T_{amb} = 25 °C

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



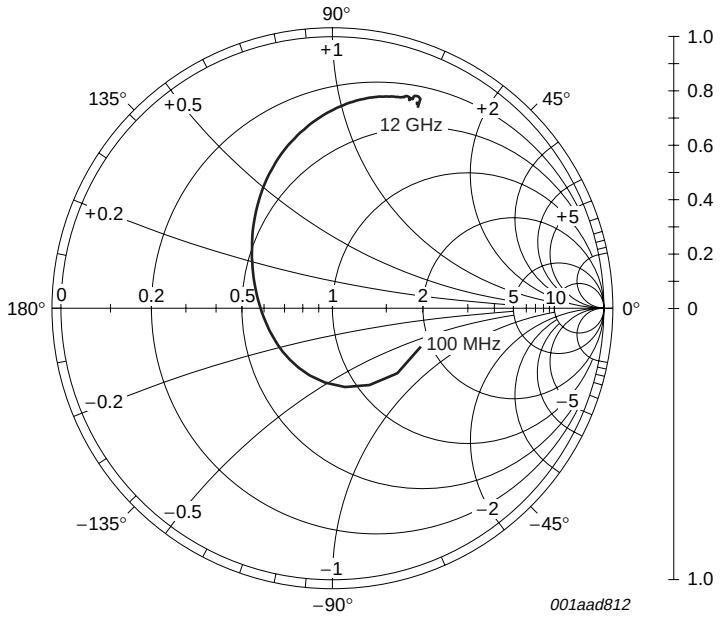
V_{CE} = 2 V; f = 2 GHz; T_{amb} = 25 °C

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



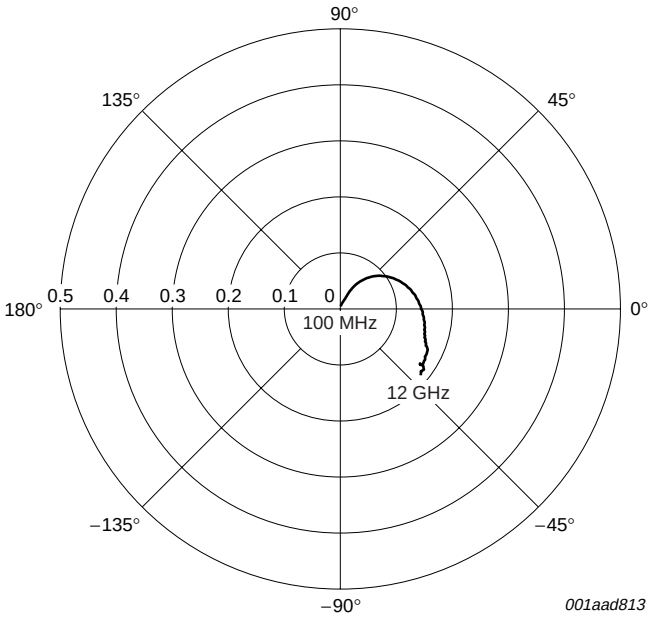
V_{CE} = 2 V; I_C = 25 mA; T_{amb} = 25 °C

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



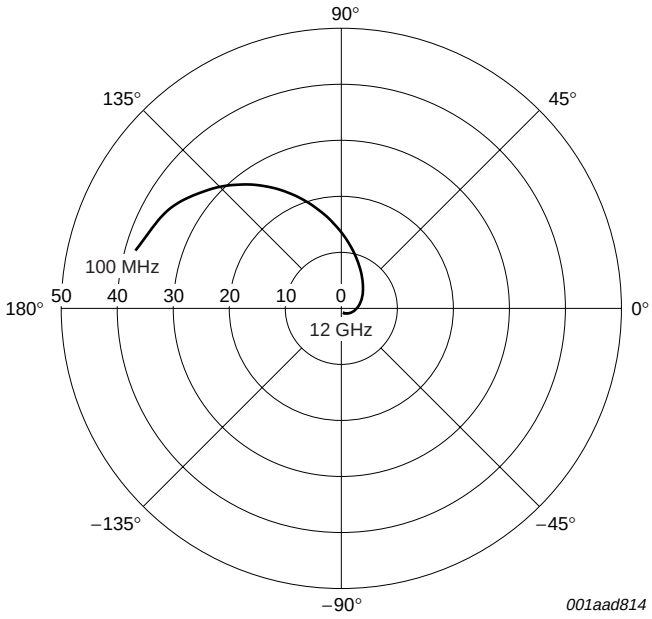
V_{CE} = 2 V; I_C = 25 mA; Z_o = 50 Ω

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



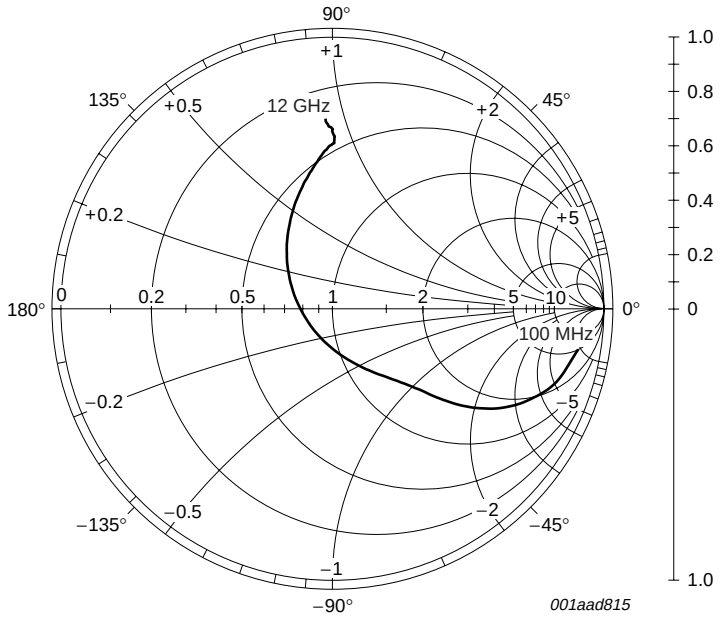
V_{CE} = 2 V; I_C = 25 mA

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

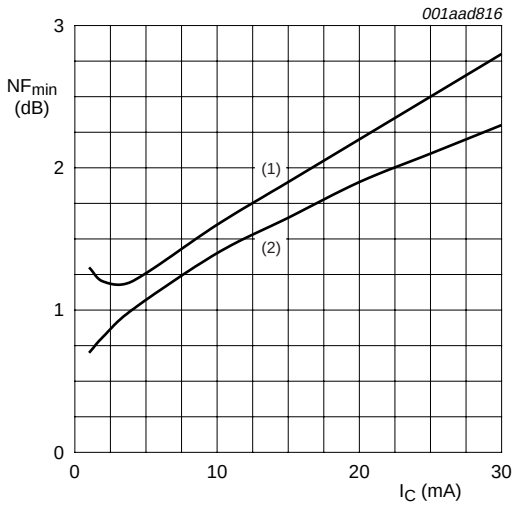
Fig 12. Common emitter output reflection coefficient (s_{22}); typical values

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



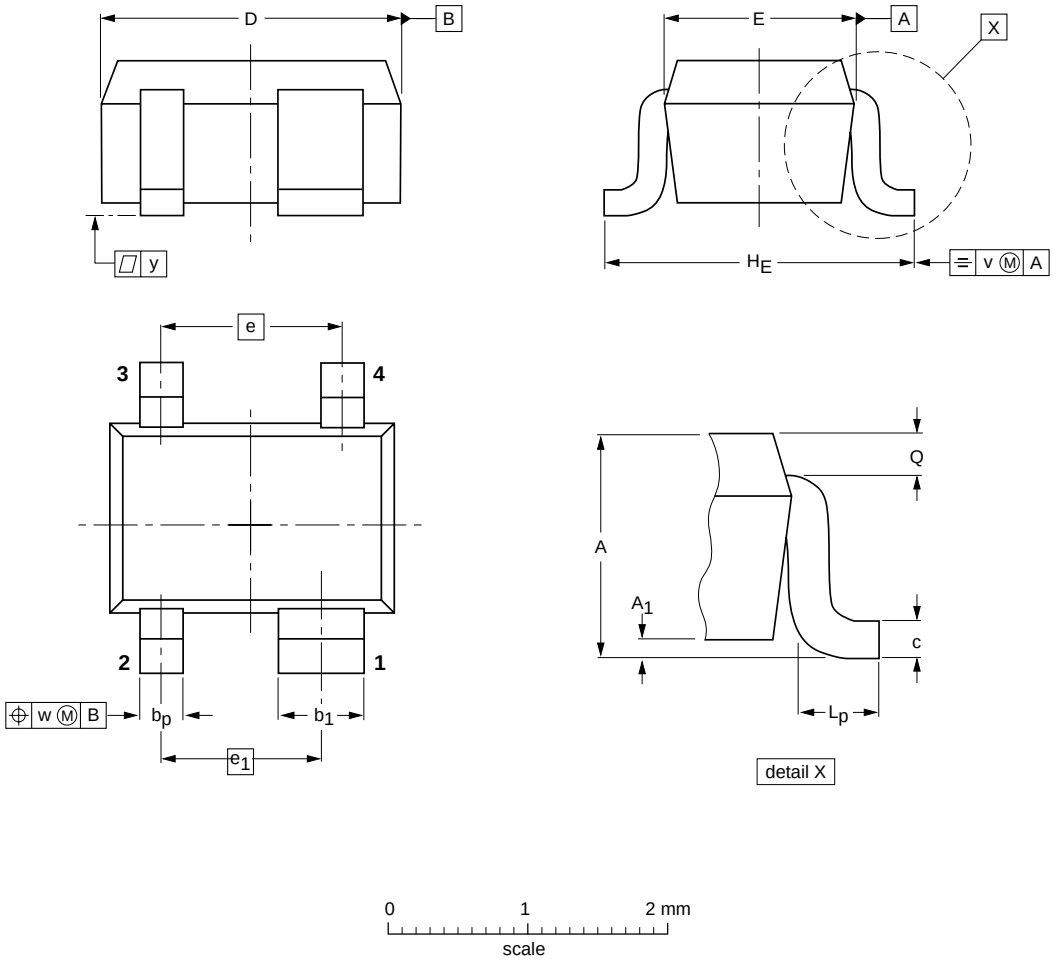
(1) f = 2 GHz

(2) f = 900 MHz

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

8. Package outline

Plastic surface-mounted package; reverse pinning; 4 leads **SOT343R**



DIMENSIONS (mm are the original dimensions)

UNIT	A	A_1 max	b_p	b_1	c	D	E	e	e_1	H_E	L_p	Q	v	w	y
mm	1.1 0.8	0.1	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	0.45 0.15	0.23 0.13	0.2	0.2	0.1

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT343R						~~97-05-21~~ 06-03-16

Fig 14. Package outline SOT343R

9. Revision history

Table 9: Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BFG424W_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.
II	Preliminary data	Qualification	This data sheet contains data from the preliminary specification. Supplementary data will be published at a later date. Philips Semiconductors reserves the right to change the specification without notice, in order to improve the design and supply the best possible product.
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[1] Please consult the most recently issued data sheet before initiating or completing a design.

[2] The product status of the device(s) described in this data sheet may have changed since this data sheet was published. The latest information is available on the Internet at URL http://www.semiconductors.philips.com.

[3] For data sheets describing multiple type numbers, the highest-level product status determines the data sheet status.

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Short-form specification — The data in a short-form 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 definition — Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 60134). 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.

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15. Contents

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