

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	$T_{sp} \leq 103\text{ }^\circ\text{C}$	1]	-	135	mW

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Table 1: Quick reference data ...continued

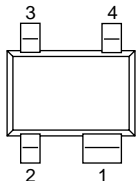
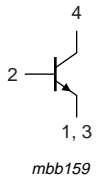
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
h_{FE}	DC current gain	$I_C = 25 \text{ mA}; V_{CE} = 2 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	50	80	120	
C_{CBS}	collector-base capacitance	$V_{CB} = 2 \text{ V}; f = 1 \text{ MHz}$	-	105	-	fF
f_T	transition frequency	$I_C = 25 \text{ mA}; V_{CE} = 2 \text{ V}; f = 2 \text{ GHz}; T_{amb} = 25 \text{ }^\circ\text{C}$	-	25	-	GHz
$G_{p(max)}$	maximum power gain	$I_C = 25 \text{ mA}; V_{CE} = 2 \text{ V}; f = 2 \text{ GHz}; T_{amb} = 25 \text{ }^\circ\text{C}$	[2]	-	22	dB
NF	noise figure	$I_C = 2 \text{ mA}; V_{CE} = 2 \text{ V}; f = 2 \text{ GHz}; \Gamma_S = \Gamma_{opt}$	-	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		

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	$T_{sp} \leq 103\text{ }^\circ\text{C}$	[1]	135	mW
T_{stg}	storage temperature		-65	+150	$^\circ\text{C}$
T_j	junction temperature		-	150	$^\circ\text{C}$

[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	$T_{sp} \leq 103\text{ }^\circ\text{C}$	[1] 340	K/W

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

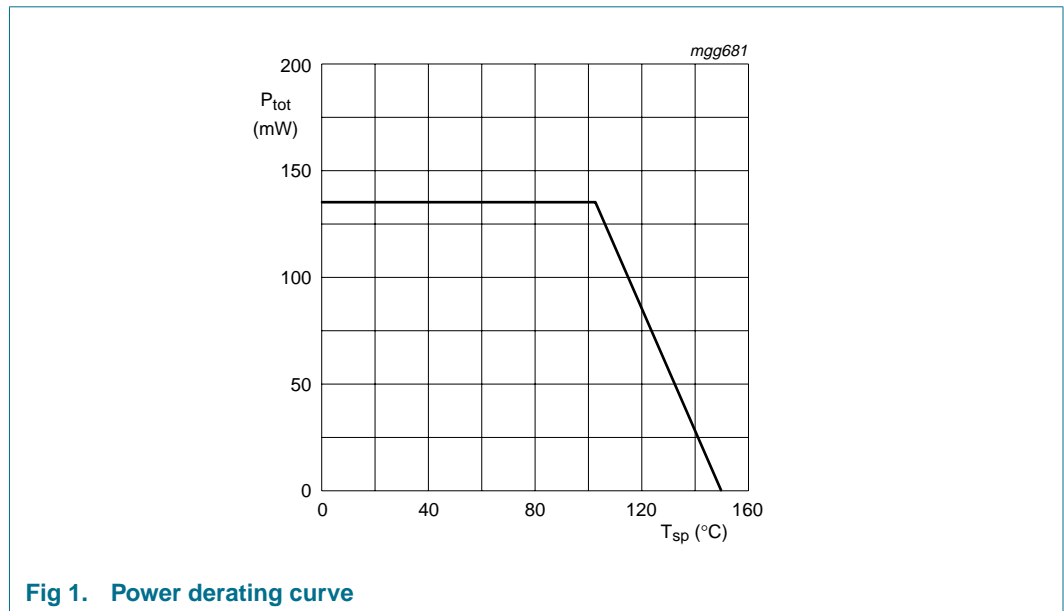


Fig 1. Power derating curve

7. Characteristics

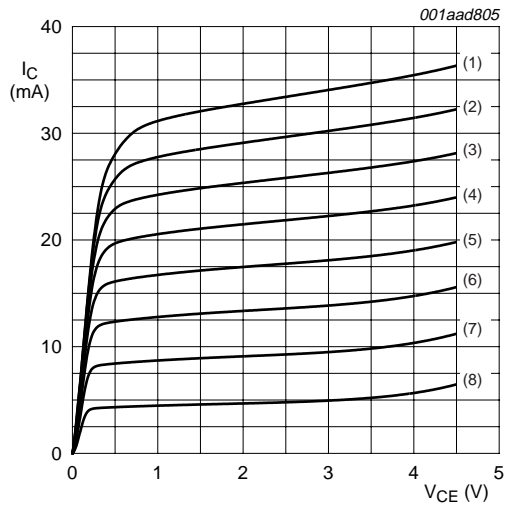
Table 7: Characteristics

$T_j = 25\text{ °C}$; unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{(BR)CBO}$	collector-base breakdown voltage	$I_C = 2.5\ \mu\text{A}$; $I_E = 0\ \text{mA}$	10	-	-	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	$I_C = 1\ \text{mA}$; $I_B = 0\ \text{mA}$	4.5	-	-	V
$V_{(BR)EBO}$	open-collector emitter-base breakdown voltage	$I_E = 2.5\ \mu\text{A}$; $I_C = 0\ \text{mA}$	1	-	-	V
I_{CBO}	collector-base cut-off current	$I_E = 0\ \text{mA}$; $V_{CB} = 4.5\ \text{V}$	-	-	15	nA
h_{FE}	DC current gain	$I_C = 25\ \text{mA}$; $V_{CE} = 2\ \text{V}$	50	80	120	
C_{CES}	collector-emitter capacitance	$V_{CB} = 2\ \text{V}$; $f = 1\ \text{MHz}$	-	385	-	fF
C_{EBS}	emitter-base capacitance	$V_{EB} = 0.5\ \text{V}$; $f = 1\ \text{MHz}$	-	515	-	fF
C_{CBS}	collector-base capacitance	$V_{CB} = 2\ \text{V}$; $f = 1\ \text{MHz}$	-	105	-	fF
f_T	transition frequency	$I_C = 25\ \text{mA}$; $V_{CE} = 2\ \text{V}$; $f = 2\ \text{GHz}$; $T_{amb} = 25\text{ °C}$	-	25	-	GHz
$G_{p(max)}$	maximum power gain	$I_C = 25\ \text{mA}$; $V_{CE} = 2\ \text{V}$; $f = 2\ \text{GHz}$; $T_{amb} = 25\text{ °C}$	[1]	22	-	dB
$ S_{21} ^2$	insertion power gain	$I_C = 25\ \text{mA}$; $V_{CE} = 2\ \text{V}$; $f = 2\ \text{GHz}$; $T_{amb} = 25\text{ °C}$	-	18	-	dB
NF	noise figure	$I_C = 2\ \text{mA}$; $V_{CE} = 2\ \text{V}$; $f = 900\ \text{MHz}$; $\Gamma_S = \Gamma_{opt}$	-	0.8	-	dB
		$I_C = 2\ \text{mA}$; $V_{CE} = 2\ \text{V}$; $f = 2\ \text{GHz}$; $\Gamma_S = \Gamma_{opt}$	-	1.2	-	dB
$P_{L(1dB)}$	output power at 1 dB gain compression	$I_C = 25\ \text{mA}$; $V_{CE} = 2\ \text{V}$; $f = 2\ \text{GHz}$; $Z_S = Z_{S(opt)}$; $Z_L = Z_{L(opt)}$	[2]	12	-	dBm
IP3	third-order intercept point	$I_C = 25\ \text{mA}$; $V_{CE} = 2\ \text{V}$; $f = 2\ \text{GHz}$; $Z_S = Z_{S(opt)}$; $Z_L = Z_{L(opt)}$	[2]	22	-	dBm

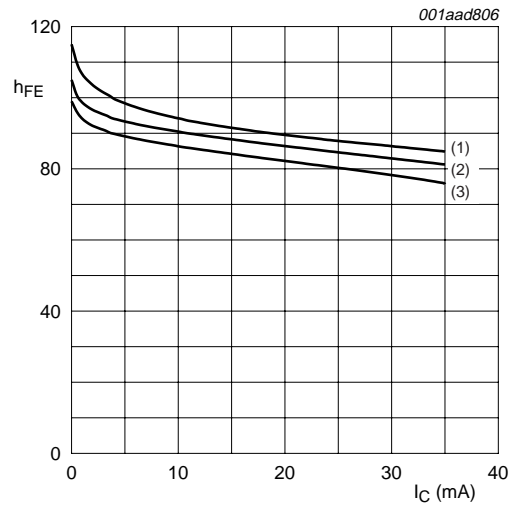
[1] $G_{p(max)}$ is the maximum power gain, if $K > 1$. If $K < 1$ then $G_{p(max)} = \text{MSG}$, see [Figure 8](#).

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



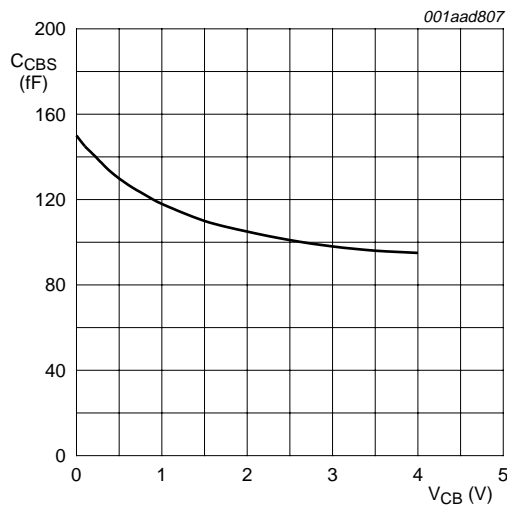
- (1) $I_B = 400 \mu A$
- (2) $I_B = 350 \mu A$
- (3) $I_B = 300 \mu A$
- (4) $I_B = 250 \mu A$
- (5) $I_B = 200 \mu A$
- (6) $I_B = 150 \mu A$
- (7) $I_B = 100 \mu A$
- (8) $I_B = 50 \mu A$

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



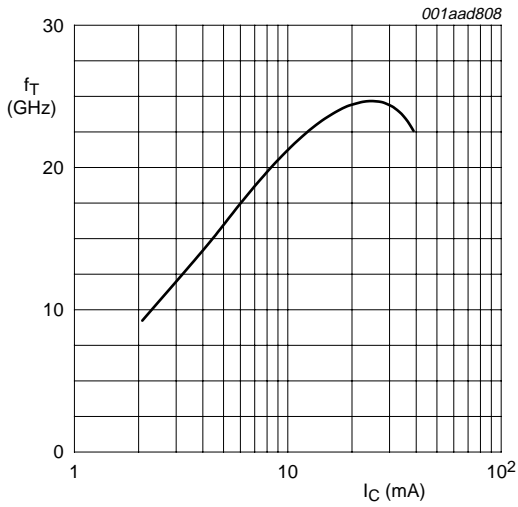
- (1) $V_{CE} = 3 V$
- (2) $V_{CE} = 2 V$
- (3) $V_{CE} = 1 V$

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



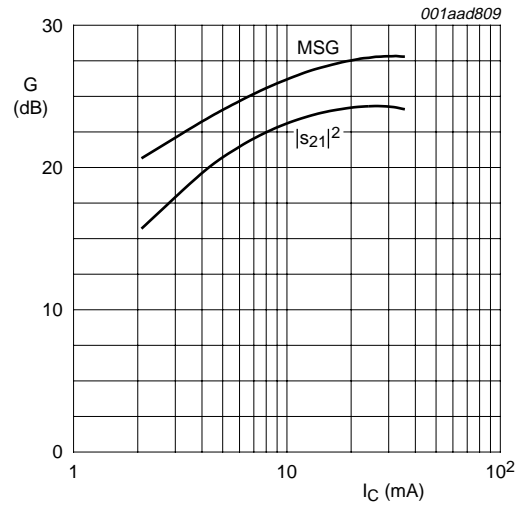
$f = 1 \text{ MHz}$

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



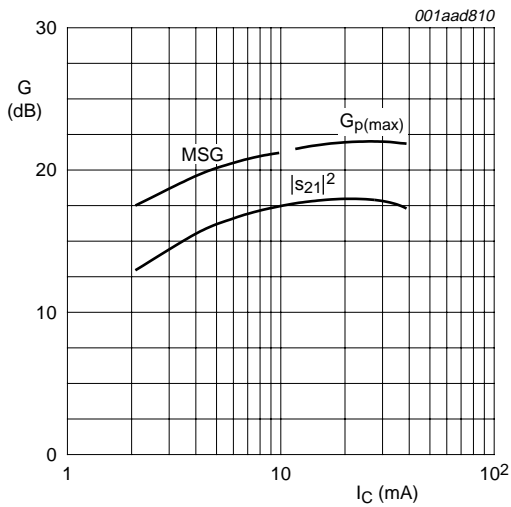
$V_{CE} = 2\text{ V}; f = 2\text{ GHz}; T_{amb} = 25\text{ }^{\circ}\text{C}$

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



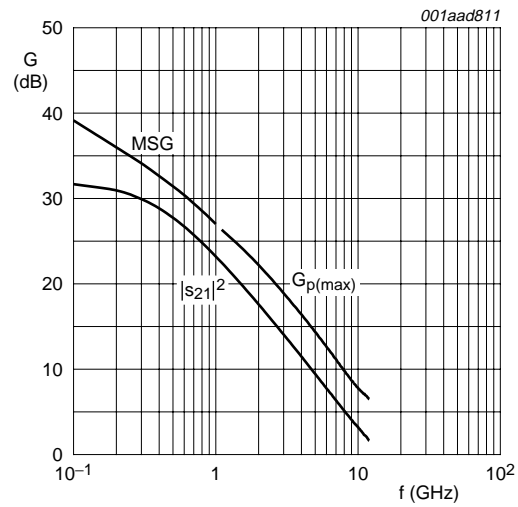
$V_{CE} = 2\text{ V}; f = 0.9\text{ GHz}; T_{amb} = 25\text{ }^{\circ}\text{C}$

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



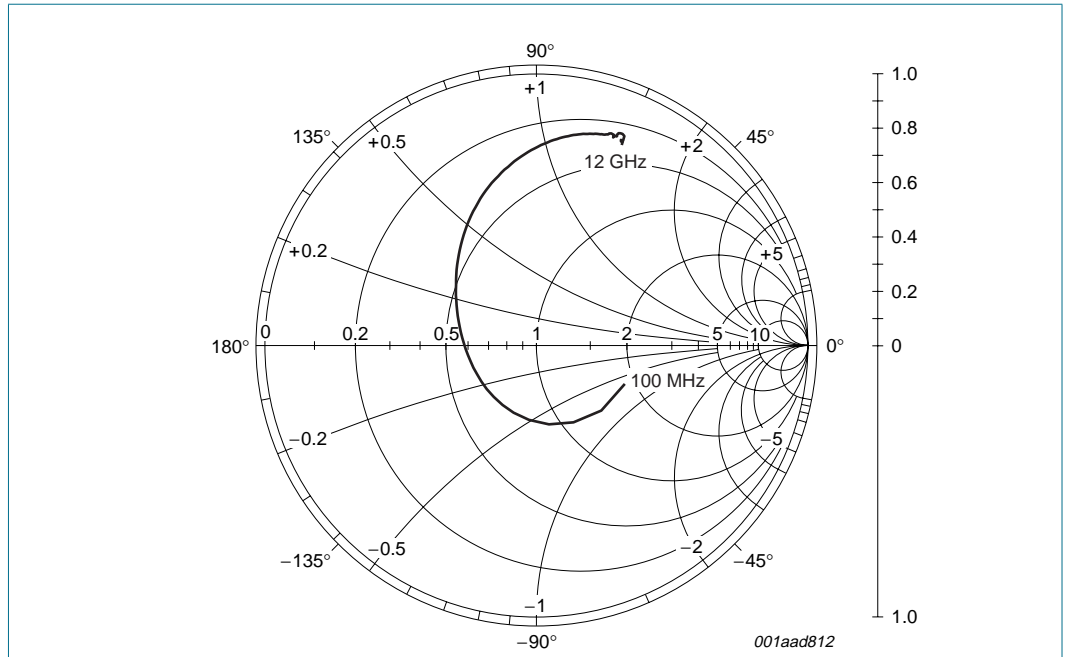
$V_{CE} = 2\text{ V}; f = 2\text{ GHz}; T_{amb} = 25\text{ }^{\circ}\text{C}$

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



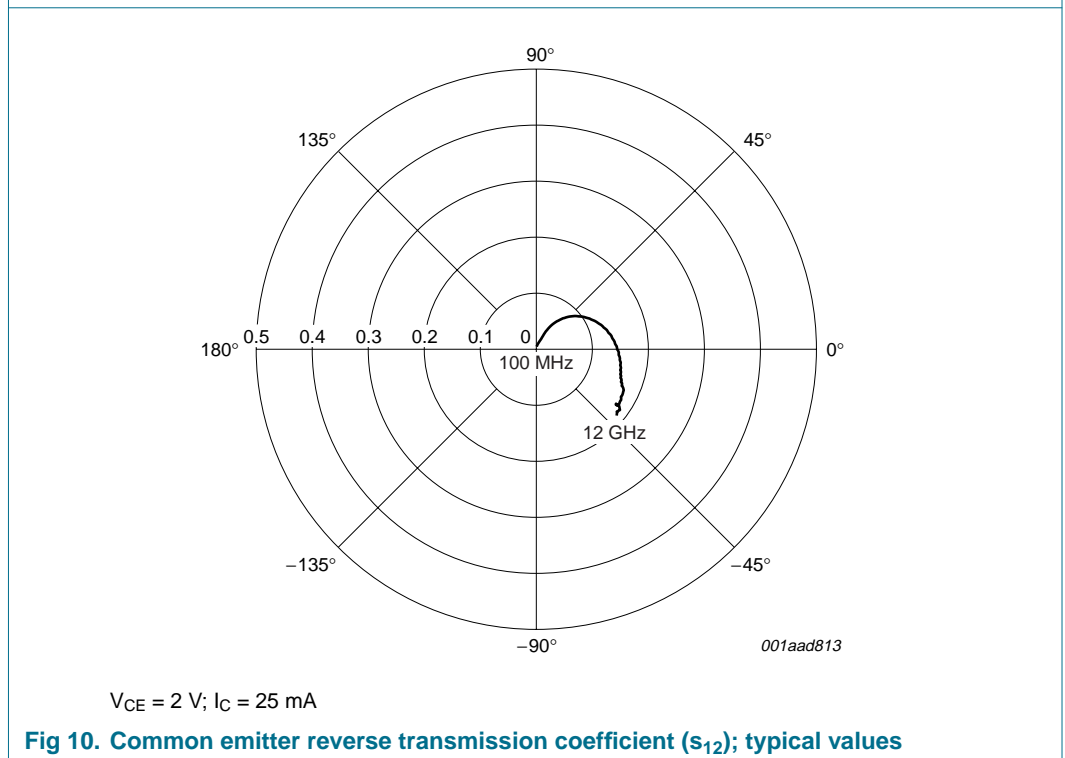
$V_{CE} = 2\text{ V}; I_C = 25\text{ mA}; T_{amb} = 25\text{ }^{\circ}\text{C}$

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



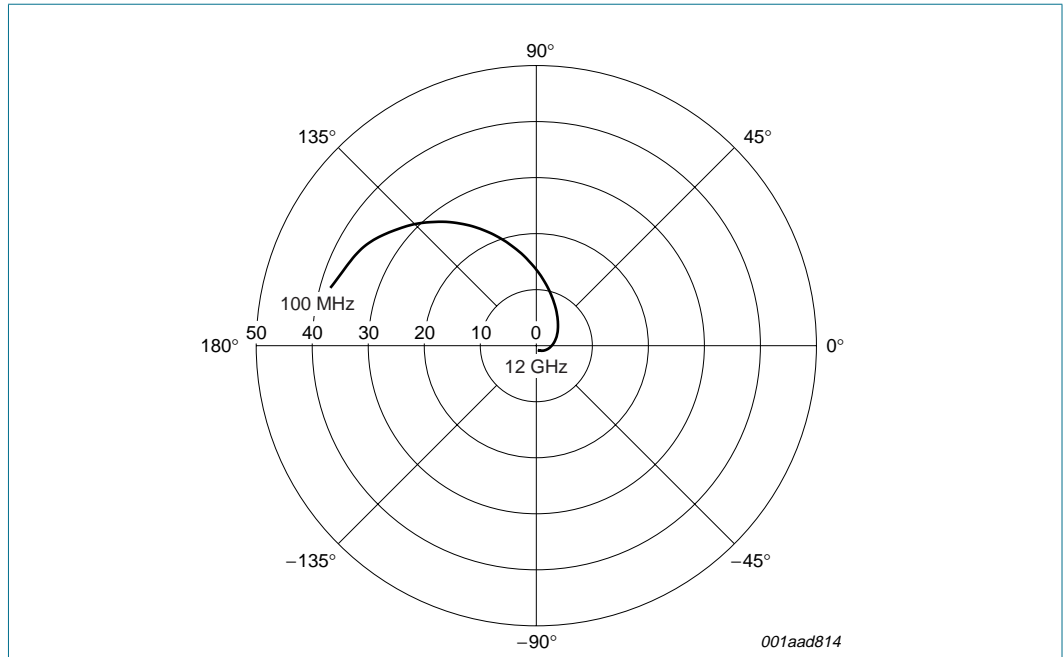
$V_{CE} = 2\text{ V}; I_C = 25\text{ mA}; Z_o = 50\ \Omega$

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



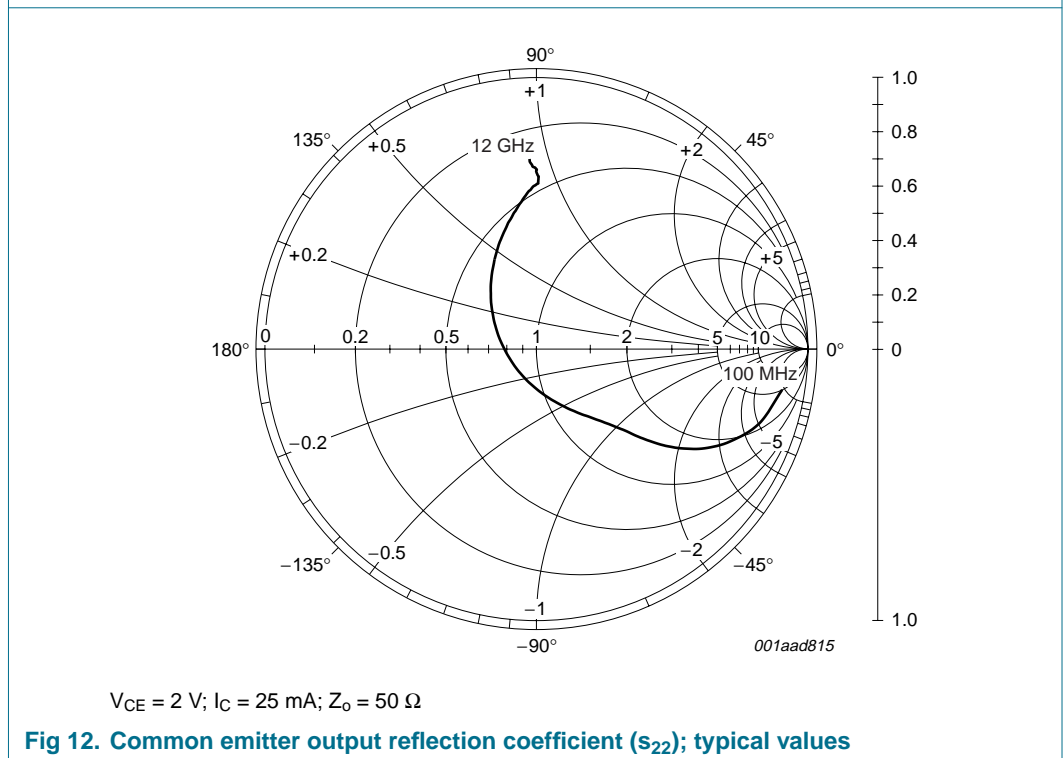
$V_{CE} = 2\text{ V}; I_C = 25\text{ mA}$

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



$V_{CE} = 2\text{ V}; I_C = 25\text{ mA}$

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



$V_{CE} = 2\text{ V}; I_C = 25\text{ mA}; Z_o = 50\ \Omega$

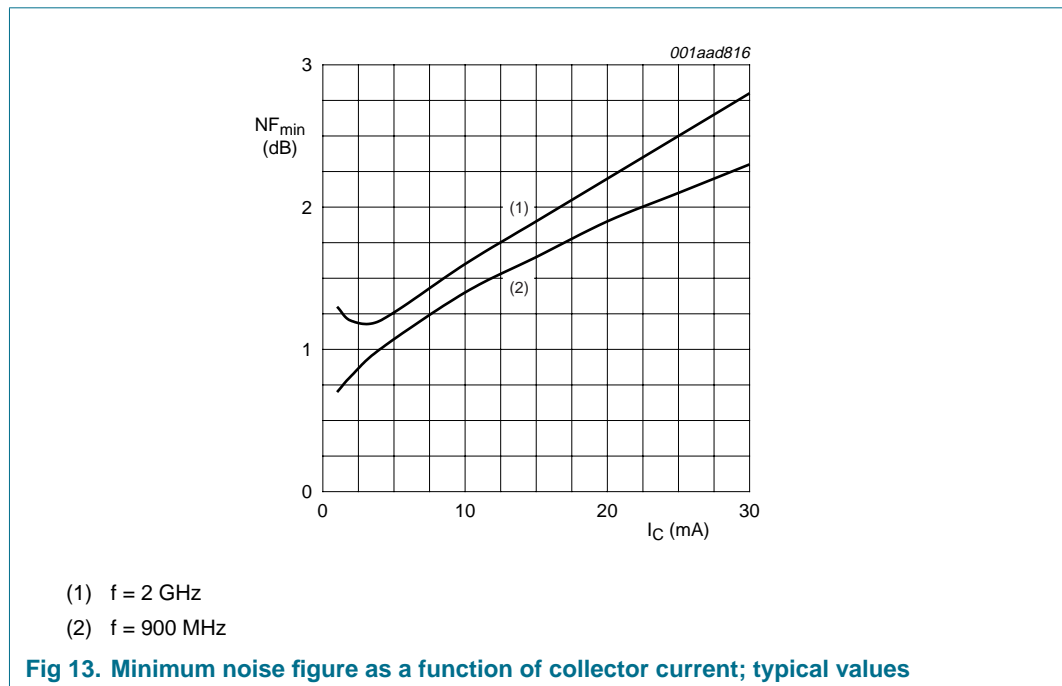
Fig 12. Common emitter output reflection coefficient (s_{22}); typical values

7.1 Noise data

Table 8: Noise data

$V_{CE} = 2\text{ V}$; typical values.

f (MHz)	I _C (mA)	NF _{min} (dB)	Γ _{opt}		r _n (Ω)
			ratio	(deg)	
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



8. Package outline

Plastic surface-mounted package; reverse pinning; 4 leads

SOT343R

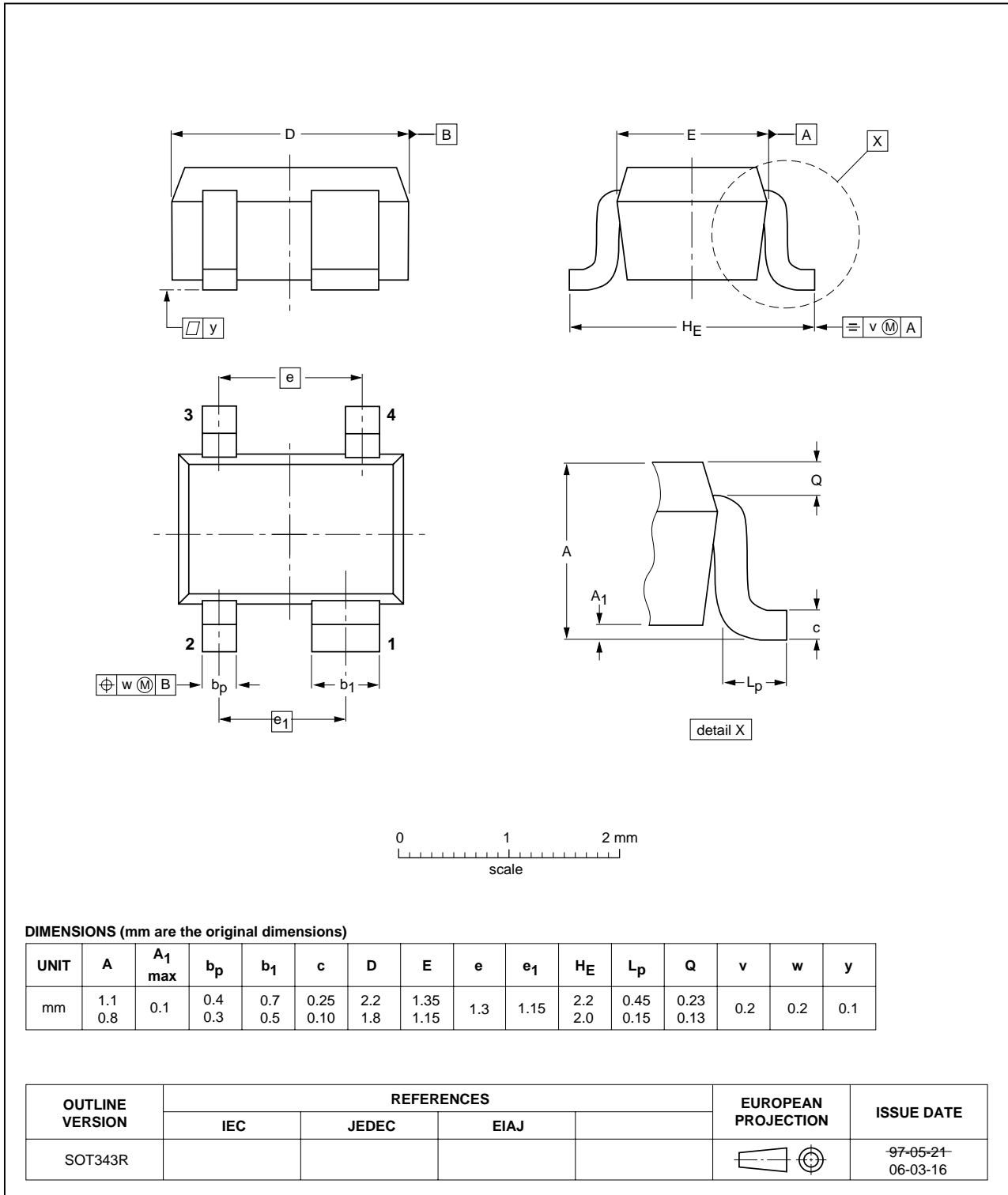


Fig 14. Package outline SOT343R

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.
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