

BFG424W

NPN 25 GHz wideband transistor

Rev. 2 — 13 September 2011

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 and benefits

- 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



Table 1. Quick reference data ...continued

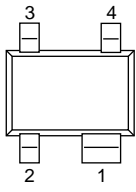
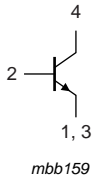
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
h_{FE}	DC current gain	$I_C = 25 \text{ mA}; V_{CE} = 2 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	50	80	120	
C_{CBS}	collector-base capacitance	$V_{CB} = 2 \text{ V}; f = 1 \text{ MHz}$	-	105	-	fF
f_T	transition frequency	$I_C = 25 \text{ mA}; V_{CE} = 2 \text{ V}; f = 2 \text{ GHz}; T_{amb} = 25 \text{ }^\circ\text{C}$	-	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.

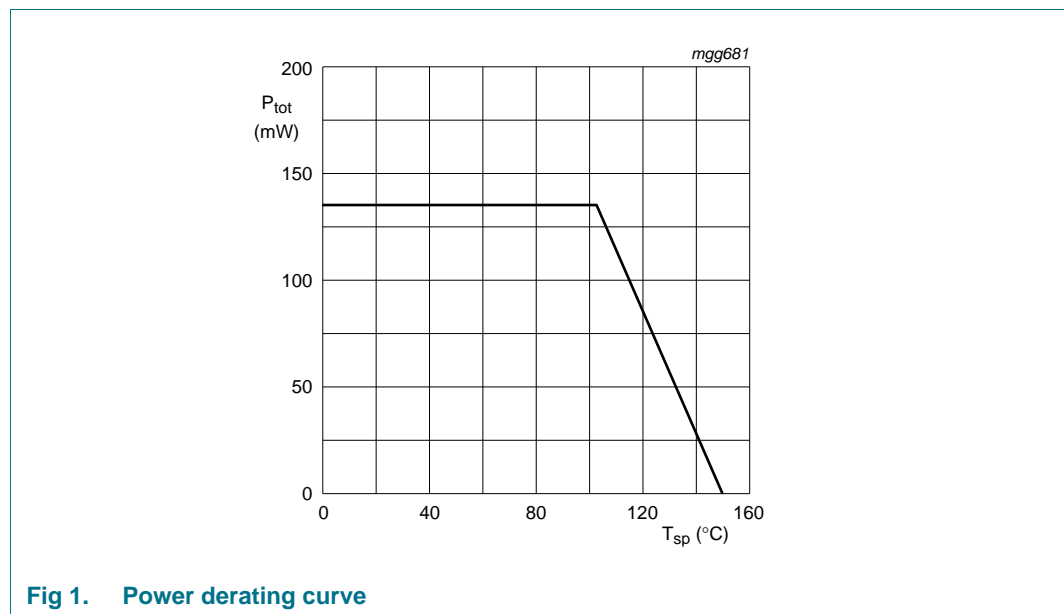


Fig 1. Power derating curve

7. Characteristics

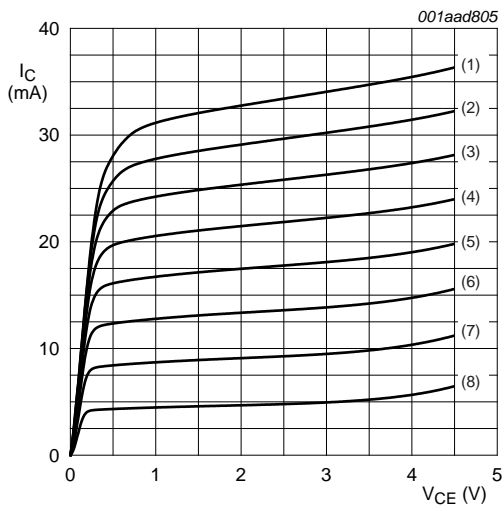
Table 7. Characteristics

$T_j = 25\text{ °C}$; 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

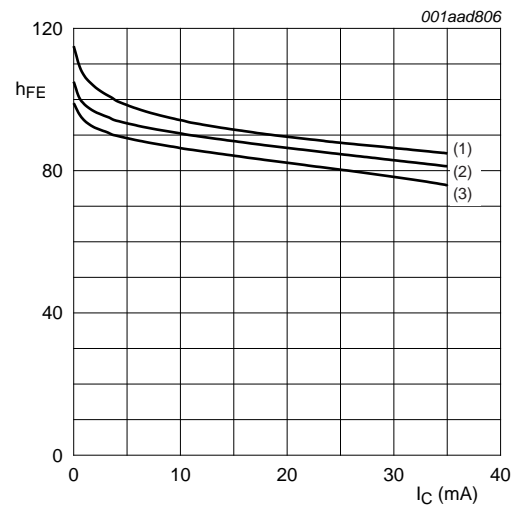
[1] $G_{p(max)}$ is the maximum power gain, if $K > 1$. If $K < 1$ then $G_{p(max)} = \text{MSG}$, see [Figure 8](#).

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



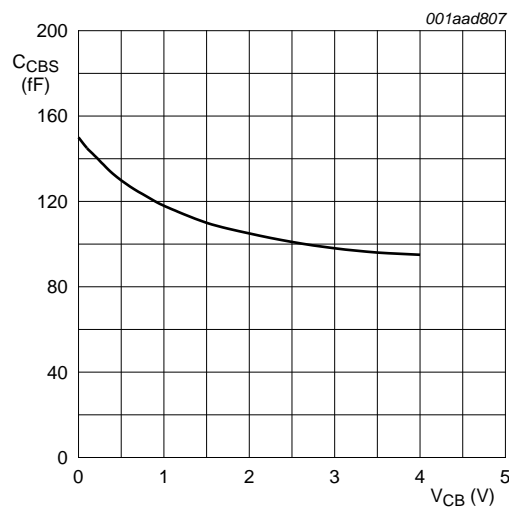
- (1) $I_B = 400 \mu A$
- (2) $I_B = 350 \mu A$
- (3) $I_B = 300 \mu A$
- (4) $I_B = 250 \mu A$
- (5) $I_B = 200 \mu A$
- (6) $I_B = 150 \mu A$
- (7) $I_B = 100 \mu A$
- (8) $I_B = 50 \mu A$

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



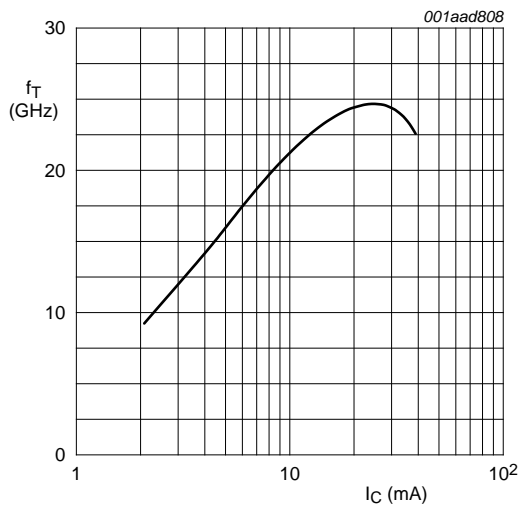
- (1) $V_{CE} = 3 V$
- (2) $V_{CE} = 2 V$
- (3) $V_{CE} = 1 V$

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



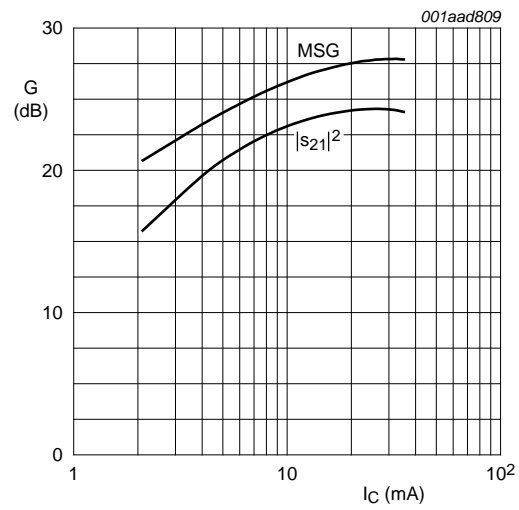
$f = 1 \text{ MHz}$

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



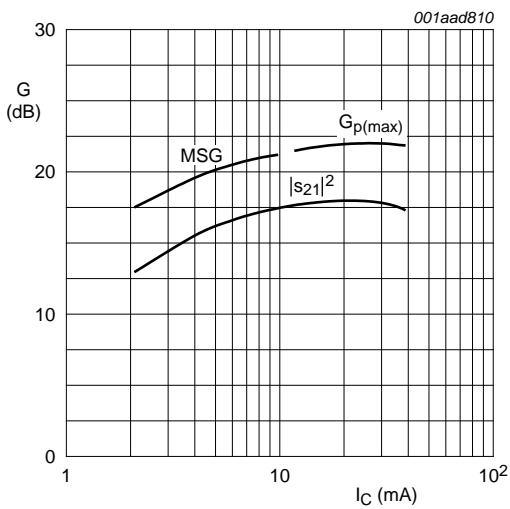
$V_{CE} = 2\text{ V}; f = 2\text{ GHz}; T_{amb} = 25\text{ }^{\circ}\text{C}$

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



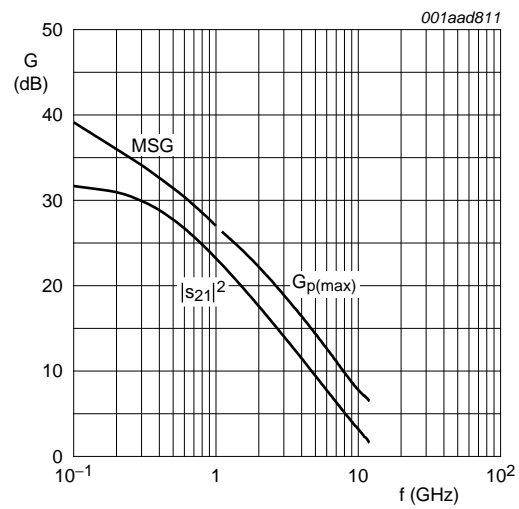
$V_{CE} = 2\text{ V}; f = 0.9\text{ GHz}; T_{amb} = 25\text{ }^{\circ}\text{C}$

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



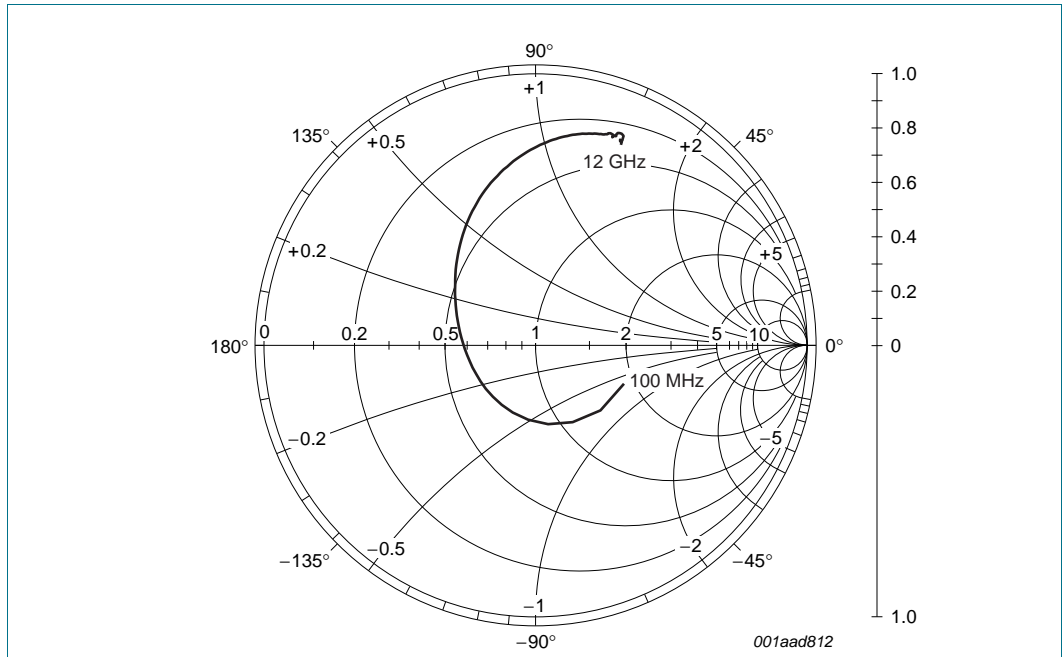
$V_{CE} = 2\text{ V}; f = 2\text{ GHz}; T_{amb} = 25\text{ }^{\circ}\text{C}$

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



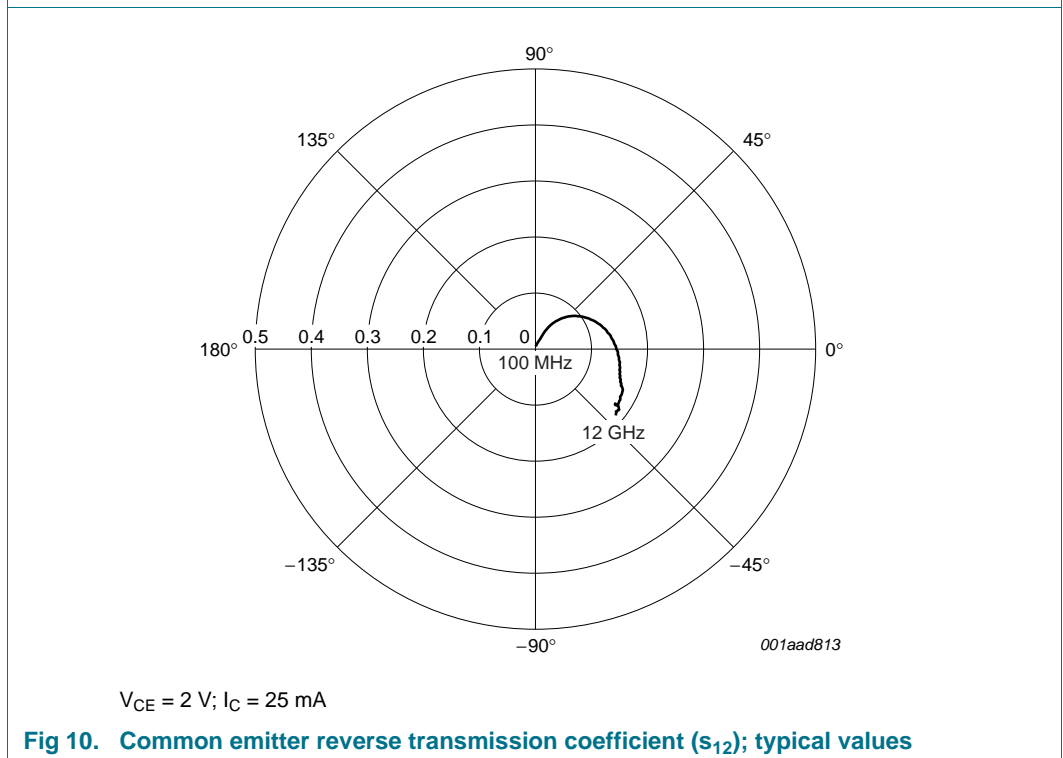
$V_{CE} = 2\text{ V}; I_C = 25\text{ mA}; T_{amb} = 25\text{ }^{\circ}\text{C}$

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



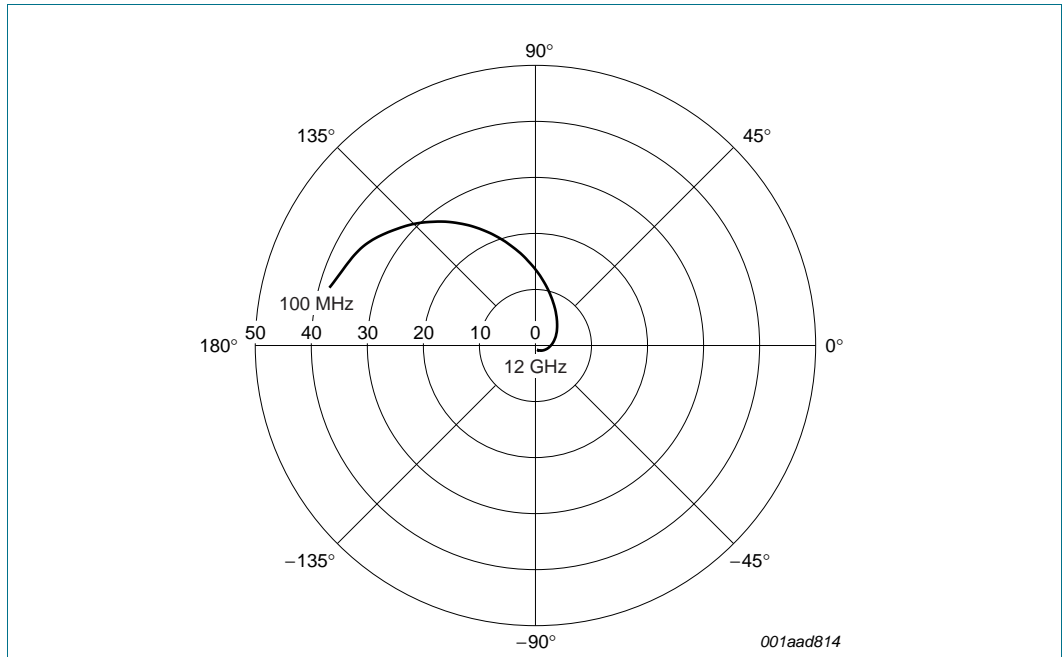
$V_{CE} = 2\text{ V}; I_C = 25\text{ mA}; Z_o = 50\ \Omega$

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



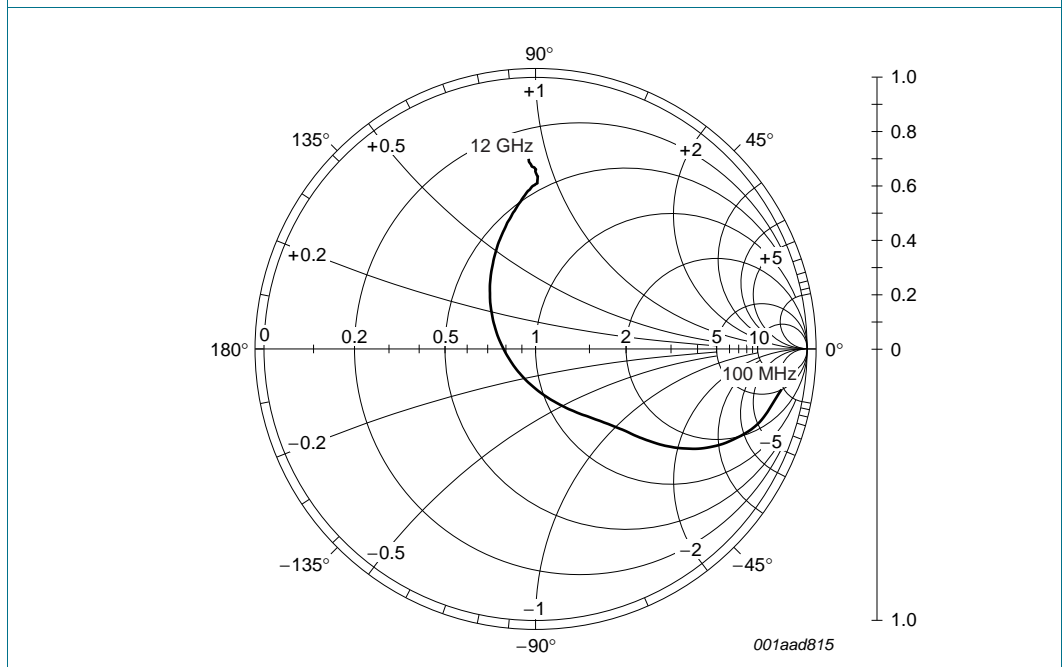
$V_{CE} = 2\text{ V}; I_C = 25\text{ mA}$

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



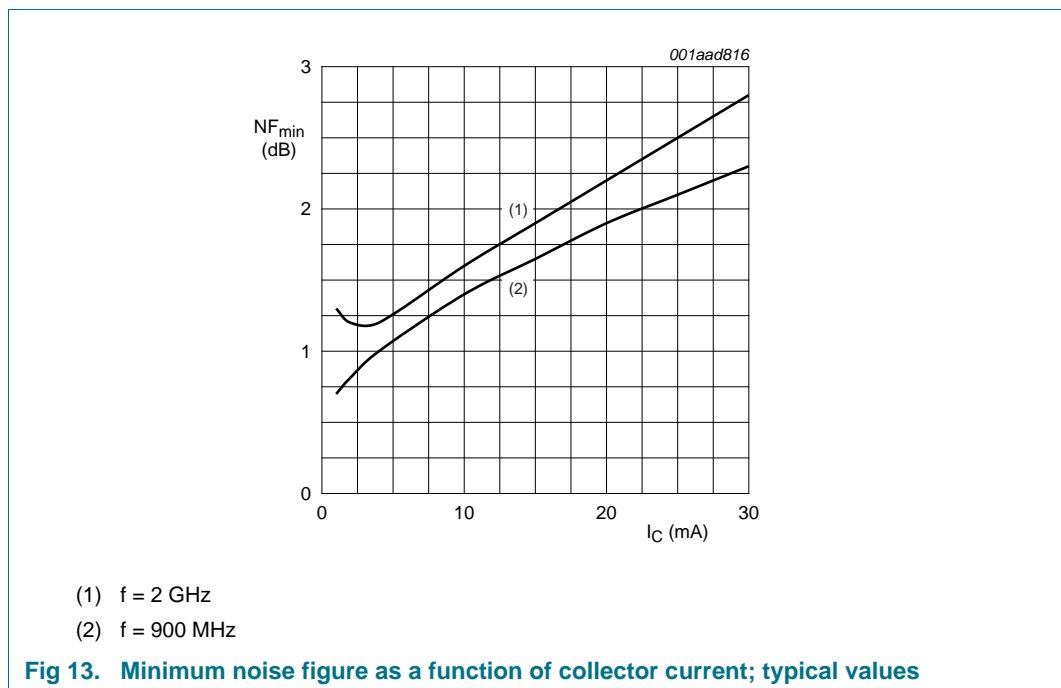
$V_{CE} = 2\text{ V}; I_C = 25\text{ mA}; Z_o = 50\ \Omega$

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

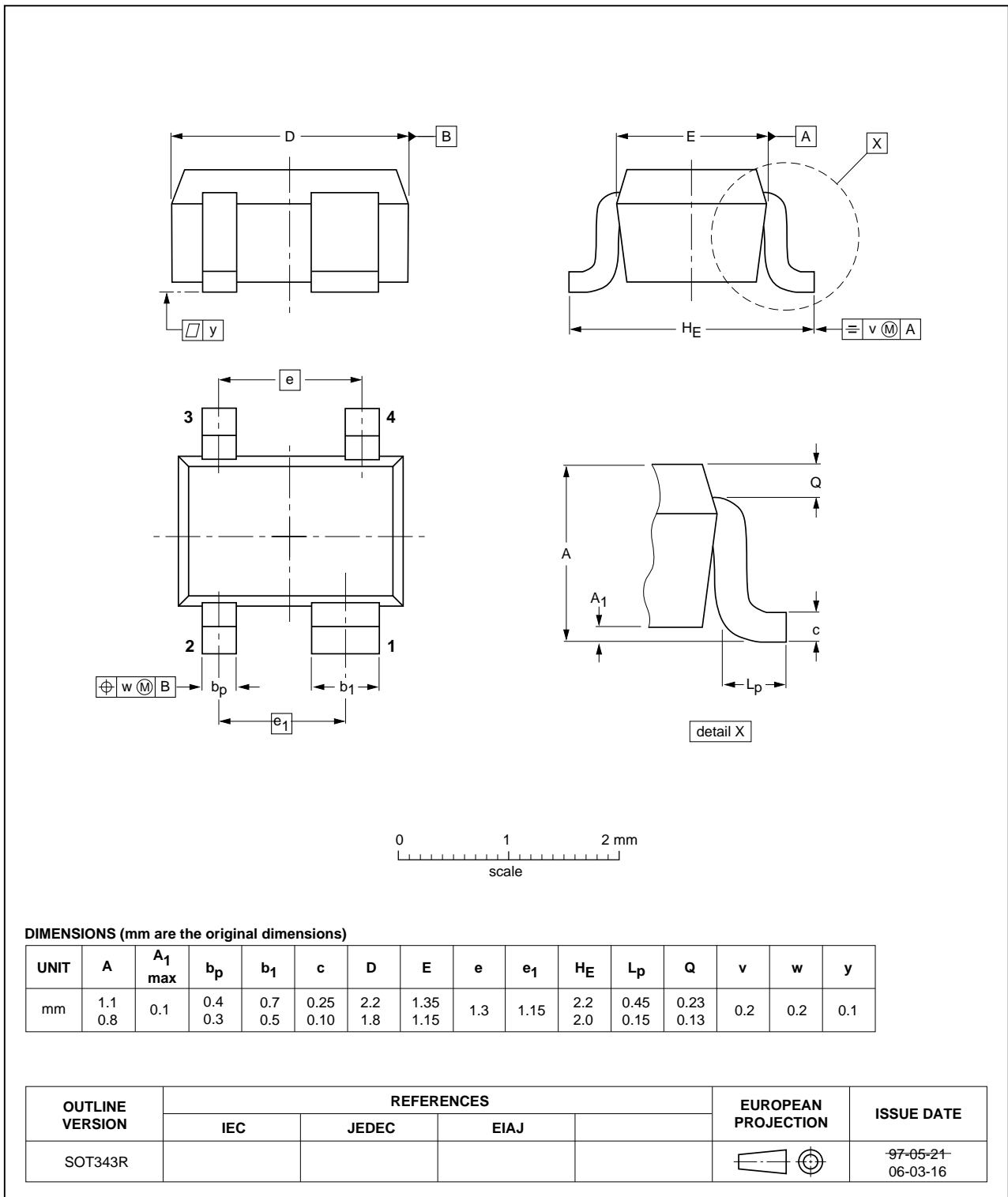


Fig 14. Package outline SOT343R

9. Revision history

Table 9. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BFG424W v.2	20110913	Product data sheet	-	BFG424W v.1
Modifications:		<ul style="list-style-type: none">• The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors.• Legal texts have been adapted to the new company name where appropriate.		
BFG424W v.1	20060321	Product data sheet	-	-

10. Legal information

10.1 Data sheet status

Document status ^{[1][2]}	Product status ^[3]	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

[1] Please consult the most recently issued document before initiating or completing a design.

[2] The term 'short data sheet' is explained in section "Definitions".

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