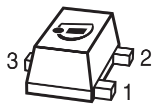
## NPN Silicon RF Transistor




- General purpose Low Noise Amplifier
- Ideal for low current operation
- High breakdown voltage enables operation in automotive applications
- Minimum noise figure 1.0 dB @ 1mA,1.5V,1.9GHz
- Small package 1,2 x 1,2 mm$^2$ with visible leads
- Pb-free (RoHS compliant) package
- Qualified according AEC Q101

AEC Qualified RoHS

**ESD** (**E**lectro**s**tatic **d**ischarge) sensitive device, observe handling precaution!

| Type | Marking | Pin Configuration | | | Package |
|---|---|---|---|---|---|
| BFR340F | FAs | 1 = B | 2 = E | 3 = C | TSFP-3 |

**Maximum Ratings** at $T_A$ = 25 °C, unless otherwise specified

| Parameter | Symbol | Value | Unit |
|---|---|---|---|
| Collector-emitter voltage | $V_{CEO}$ | 6 | V |
| Collector-emitter voltage | $V_{CES}$ | 15 | |
| Collector-base voltage | $V_{CBO}$ | 15 | |
| Emitter-base voltage | $V_{EBO}$ | 2 | |
| Collector current | $I_C$ | 20 | mA |
| Base current | $I_B$ | 2 | |
| Total power dissipation[1)]<br>$T_S \leq$ 110°C | $P_{tot}$ | 75 | mW |
| Junction temperature | $T_J$ | 150 | °C |
| Storage temperature | $T_{Stg}$ | -55 ... 150 | |

**Thermal Resistance**

| Parameter | Symbol | Value | Unit |
|---|---|---|---|
| Junction - soldering point[2)] | $R_{thJS}$ | $\leq$ 530 | K/W |

[1] $T_S$ is measured on the collector lead at the soldering point to the pcb

[2] For calculation of $R_{thJA}$ please refer to Application Note AN077 Thermal Resistance

**Electrical Characteristics** at $T_A$ = 25°C, unless otherwise specified

| Parameter | Symbol | Values | | | Unit |
|---|---|---|---|---|---|
| | | min. | typ. | max. | |
| **DC Characteristics** | | | | | |
| Collector-emitter breakdown voltage<br>$I_C$ = 1 mA, $I_B$ = 0 | $V_{(BR)CEO}$ | 6 | 9 | - | V |
| Collector-emitter cutoff current<br>$V_{CE}$ = 4 V, $V_{BE}$ = 0, $T_A$ = 25°C<br>$V_{CE}$ = 10 V, $V_{BE}$ = 0, $T_A$ = 85°C<br>Verified by random sampling | $I_{CES}$ | <br>-<br>- | <br>1<br>2 | <br>30<br>50 | nA |
| Collector-base cutoff current<br>$V_{CB}$ = 4 V, $I_E$ = 0 | $I_{CBO}$ | - | 1 | 30 | |
| Emitter-base cutoff current<br>$V_{EB}$ = 1 V, $I_C$ = 0 | $I_{EBO}$ | - | 1 | 500 | |
| DC current gain<br>$I_C$ = 5 mA, $V_{CE}$ = 3 V, pulse measured | $h_{FE}$ | 90 | 120 | 160 | - |

**Electrical Characteristics** at $T_A$ = 25°C, unless otherwise specified

| Parameter | Symbol | Values | | | Unit |
|---|---|---|---|---|---|
| | | min. | typ. | max. | |
| **AC Characteristics** (verified by random sampling) | | | | | |
| Transition frequency<br>$I_C$ = 6 mA, $V_{CE}$ = 3 V, $f$ = 1 GHz | $f_T$ | 11 | 14 | - | GHz |
| Collector-base capacitance<br>$V_{CB}$ = 5 V, $f$ = 1 MHz, $V_{BE}$ = 0 ,<br>emitter grounded | $C_{cb}$ | - | 0.21 | 0.4 | pF |
| Collector emitter capacitance<br>$V_{CE}$ = 5 V, $f$ = 1 MHz, $V_{BE}$ = 0 ,<br>base grounded | $C_{ce}$ | - | 0.17 | - | |
| Emitter-base capacitance<br>$V_{EB}$ = 0.5 V, $f$ = 1 MHz, $V_{CB}$ = 0 ,<br>collector grounded | $C_{eb}$ | - | 0.11 | - | |
| Minimum noise figure | $NF_{min}$ | | | | dB |
| $I_C$ = 3 mA, $V_{CE}$ = 1.5 V, $Z_S$ = $Z_{Sopt}$, $f$ = 100 MHz | | - | 0.9 | - | |
| $I_C$ = 1 mA, $V_{CE}$ = 1.5 V, $Z_S$ = $Z_{Sopt}$, $f$ = 1.9 GHz | | - | 1 | - | |
| $I_C$ = 1 mA, $V_{CE}$ = 1.5 V, $Z_S$ = $Z_{Sopt}$, $f$ = 2.4 GHz | | - | 1.2 | - | |

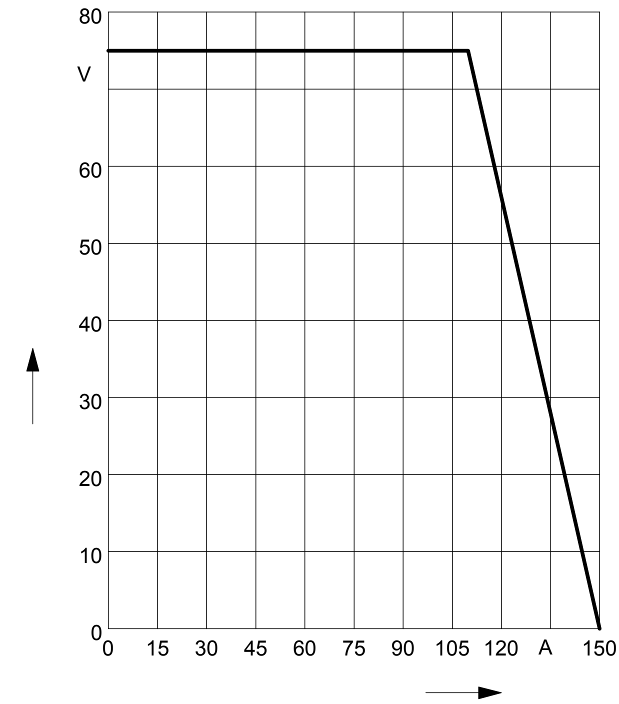
**Electrical Characteristics** at $T_A$ = 25°C, unless otherwise specified

| Parameter | Symbol | Values | | | Unit |
|---|---|---|---|---|---|
| | | min. | typ. | max. | |
| **AC Characteristics** (verified by random sampling) | | | | | |
| Maximum power gain[1] | $G_{max}$ | | | | dB |
| $I_C$ = 3 mA, $V_{CE}$ = 1.5 V, $Z_S = Z_{Sopt}$, $Z_L = Z_{Lopt}$ , $f$ = 100 MHz | | - | 28 | - | |
| $I_C$ = 5 mA, $V_{CE}$ = 3 V, $Z_S = Z_{Sopt}$, $Z_L = Z_{Lopt}$, $f$ = 1.8 GHz | | - | 16.5 | - | |
| $f$ = 3 GHz | | - | 13 | - | |
| Transducer gain | $\|S_{21e}\|^2$ | | | | dB |
| $I_C$ = 3 mA, $V_{CE}$ = 1.5 V, $Z_S = Z_L$ = 50Ω , $f$ = 100 MHz | | - | 19 | - | |
| $I_C$ = 5 mA, $V_{CE}$ = 3 V, $Z_S = Z_L$ = 50Ω , $f$ = 1.8 GHz | | - | 14 | - | |
| $f$ = 3 GHz | | - | 10 | - | |
| Third order intercept point at output[2] | $IP_3$ | | | | dBm |
| $V_{CE}$ = 3 V, $I_C$ = 5 mA, $f$ = 100 MHz, $Z_S = Z_L$ = 50Ω | | - | 14 | - | |
| $V_{CE}$ = 3 V, $I_C$ = 5 mA, $f$ = 1.8 GHz, $Z_S = Z_L$ = 50Ω | | - | 13 | - | |
| 1dB compression point at output | $P_{-1dB}$ | | | | |
| $V_{CE}$ = 3V, $I_C$ = 5 mA, $Z_S = Z_L$ = 50Ω, $f$ = 100 MHz | | - | -3 | - | |
| $V_{CE}$ = 3V, $I_C$ = 5 mA, $Z_S = Z_L$ = 50Ω, $f$ = 1.8 GHz | | - | -1 | - | |

[1] $G_{ma} = |S_{21e} / S_{12e}| (k-(k^2-1)^{1/2})$, $G_{ms} = |S_{21e} / S_{12e}|$

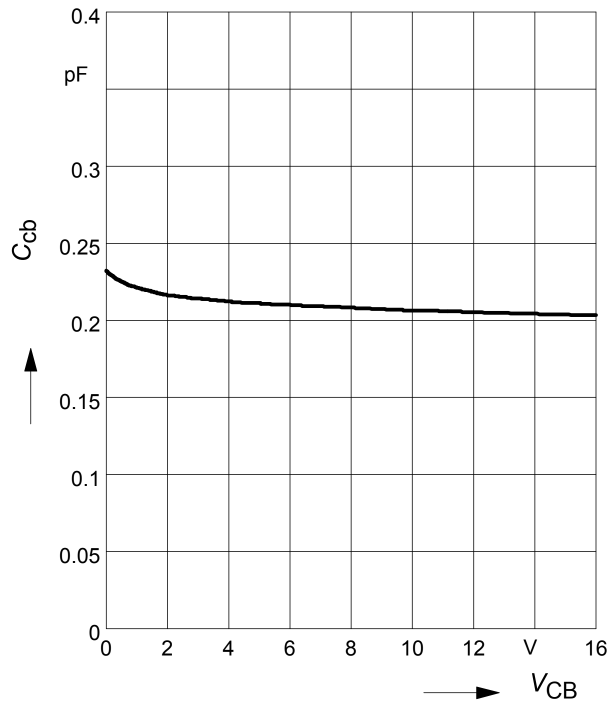
[2] IP3 value depends on termination of all intermodulation frequency components. Termination used for this measurement is 50Ω from 0.1 MHz to 6 GHz

### Total power dissipation $P_{tot} = f(T_S)$




### Collector-base capacitance $C_{cb} = f(V_{CB})$

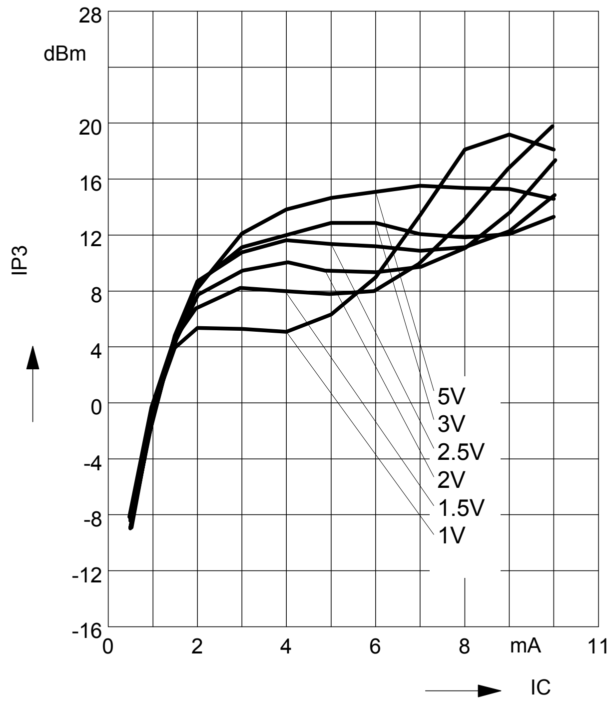
$f$ = 1MHz




### Third order Intercept Point $IP_3 = f(I_C)$

(Output, $Z_S = Z_L = 50\Omega$)

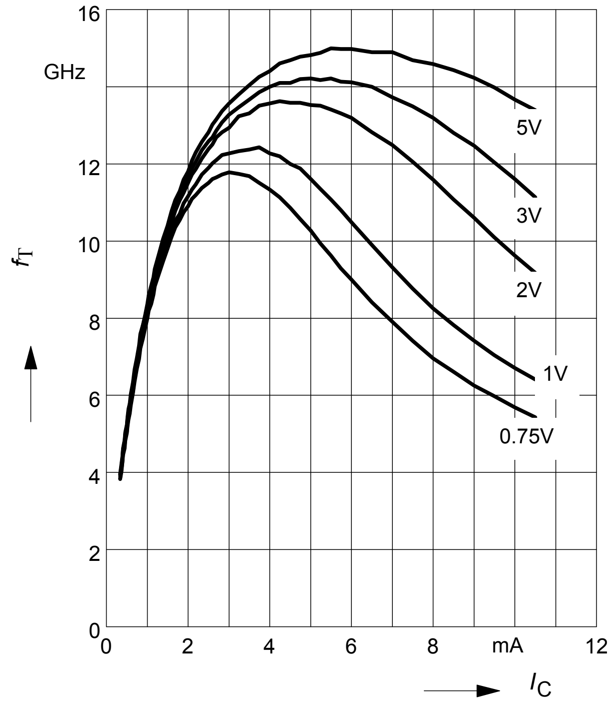
$V_{CE}$ = parameter, $f$ = 1.9GHz




### Transition frequency $f_T = f(I_C)$

$f$ = 1GHz

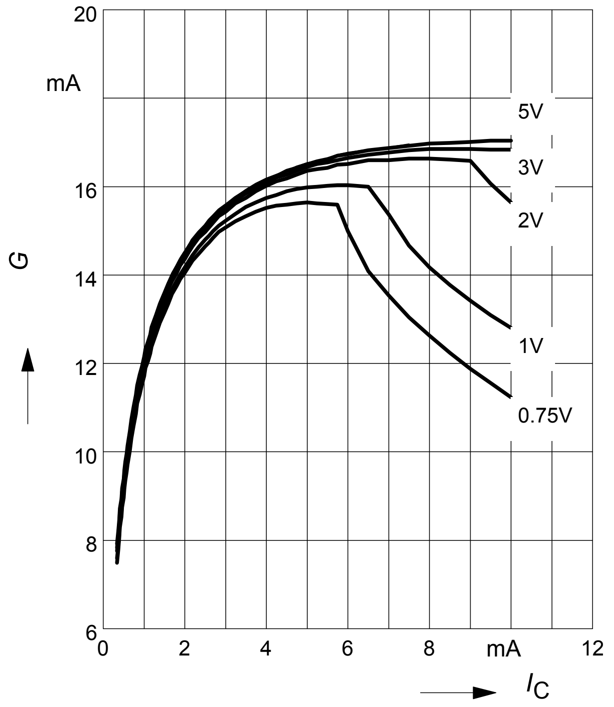
$V_{CE}$ = parameter



**Power gain** $G_{ma}$, $G_{ms}$ = $f(I_C)$

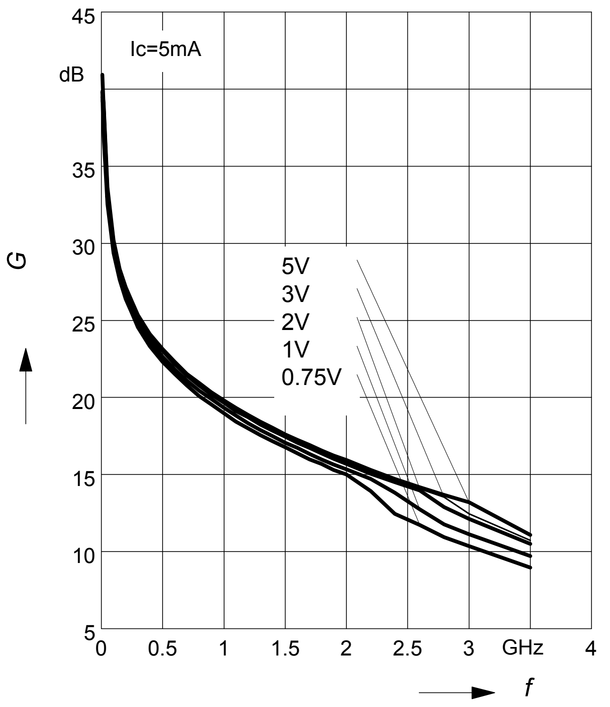
$f$ = 1.8GHz

$V_{CE}$ = parameter



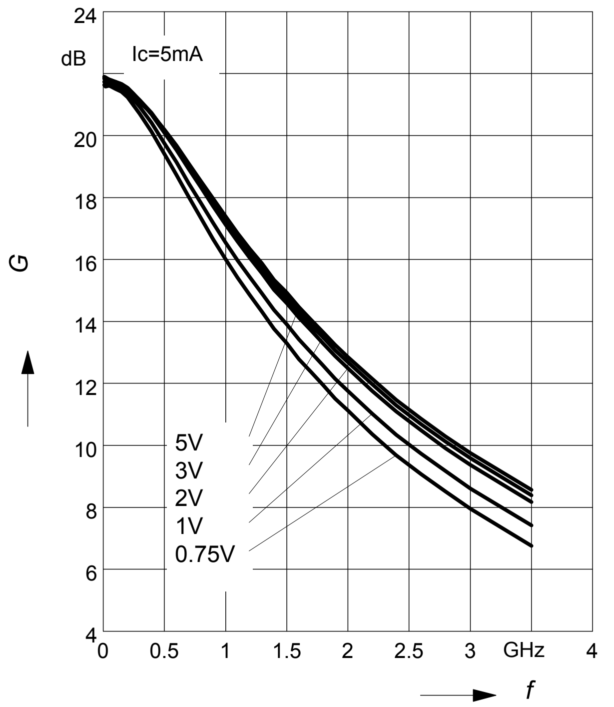

**Power Gain** $G_{ma}$, $G_{ms}$ = $f(f)$

$V_{CE}$ = parameter




**Insertion Power Gain** $|S_{21}|^2$ = $f(f)$

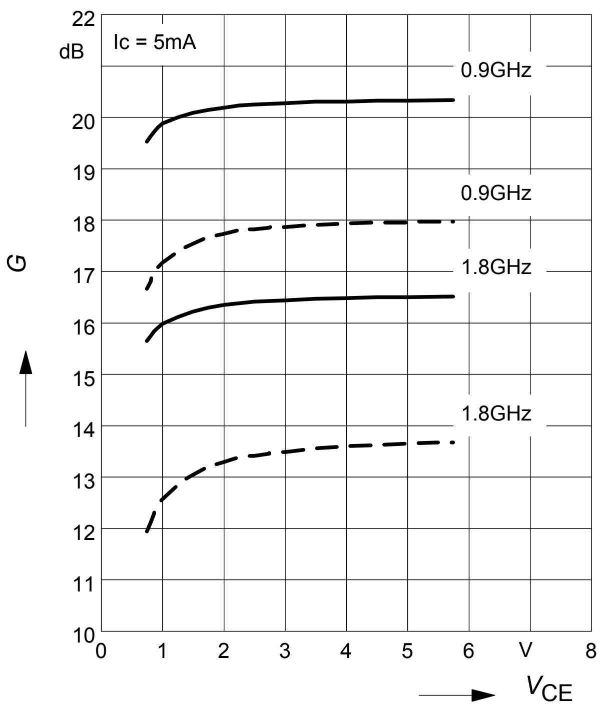
$V_{CE}$ = parameter



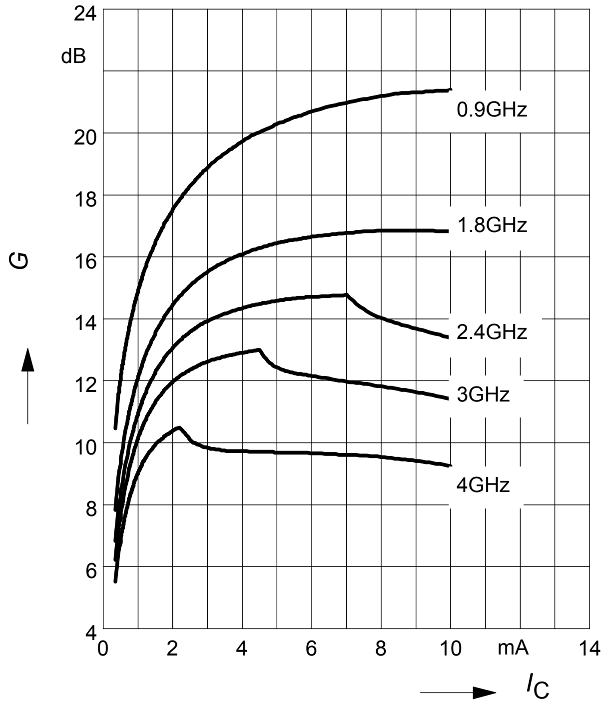

**Power Gain** $G_{ma}$, $G_{ms}$ = $f(V_{CE})$: ——

$|S_{21}|^2$ = $f(V_{CE})$: - - - -

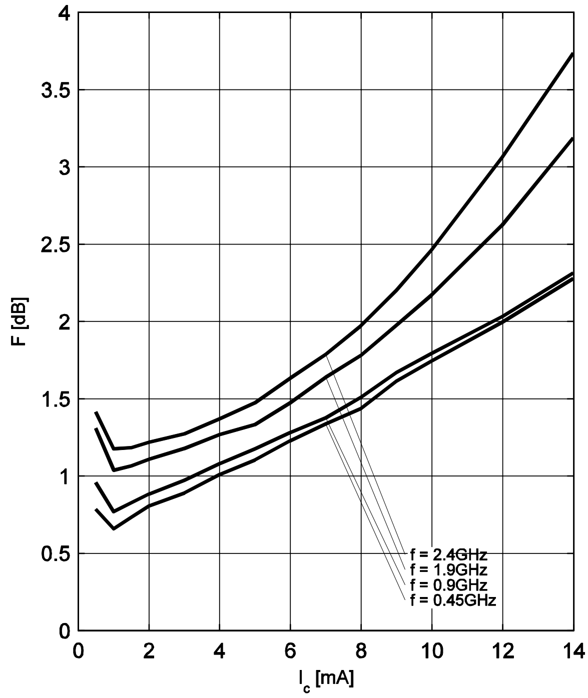
$f$ = parameter



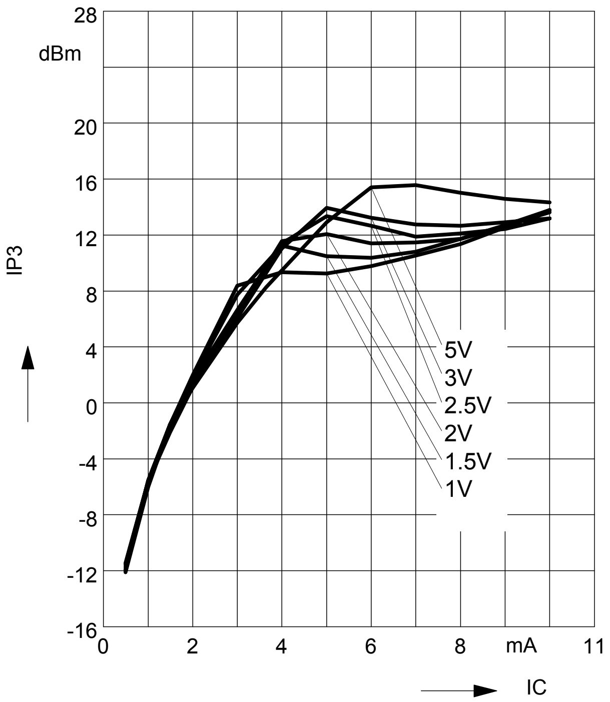
**Power gain** $G_{ma}$, $G_{ms}$ = $f$ ($I_C$)
$V_{CE}$ = 3V
$f$ = parameter



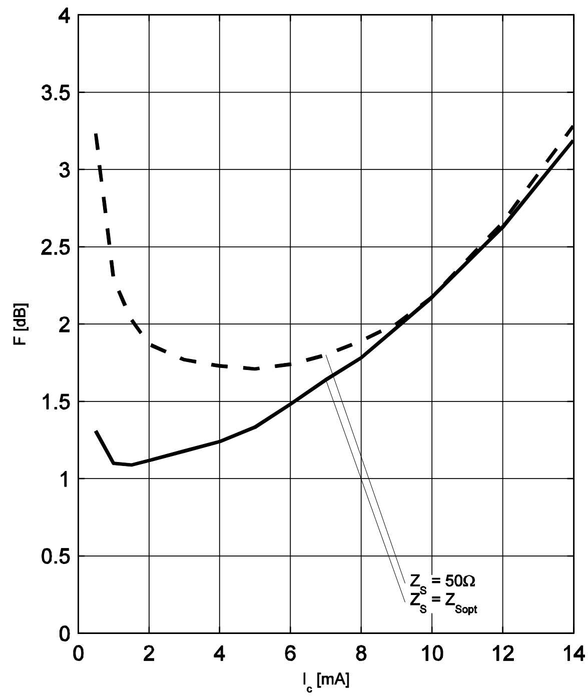

**Noise figure** $F$ = $f$($I_C$)
$V_{CE}$ = 1.5V, $Z_S$ = $Z_{Sopt}$




**Third order Intercept Point** $IP_3$=$f$($I_C$)
(Output, $Z_S$=$Z_L$=50Ω)
$V_{CE}$ = parameter, $f$ = 100MHz

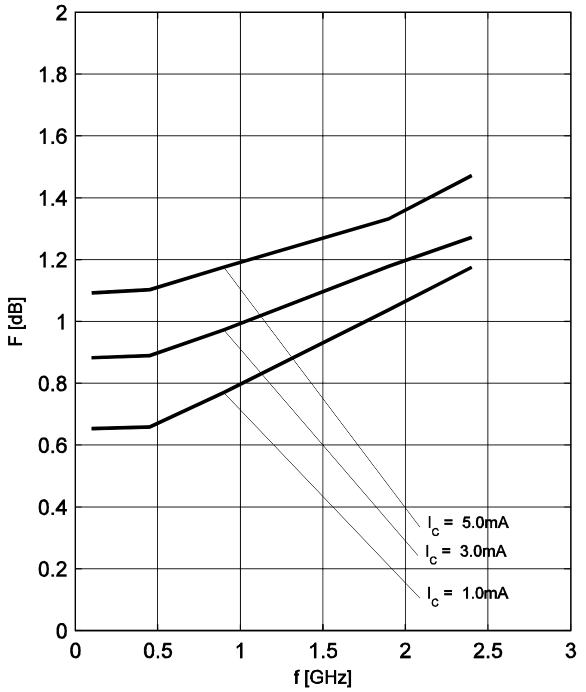



**Noise figure** $F$ = $f$($I_C$)
$V_{CE}$ = 1.5V, $f$ = 1.9GHz



**Noise figure** $F = f(f)$

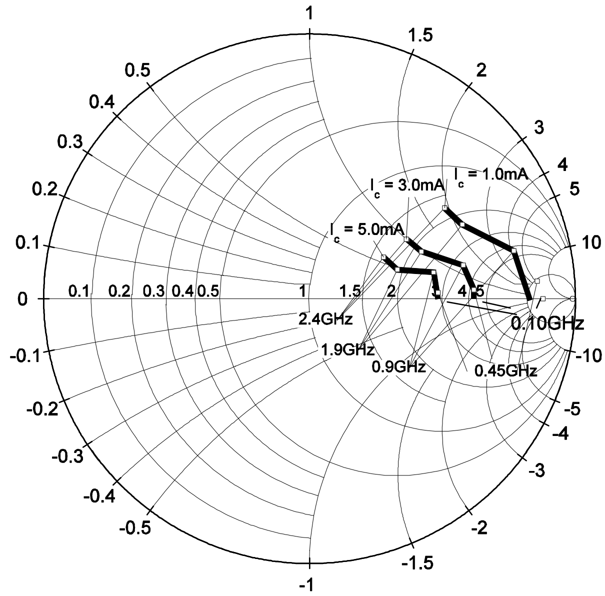
$V_{CE}$ = 1.5V, $Z_S=Z_{Sopt}$, $I_C$=Parameter




**Source impedance** for min.

noise figure vs. frequency

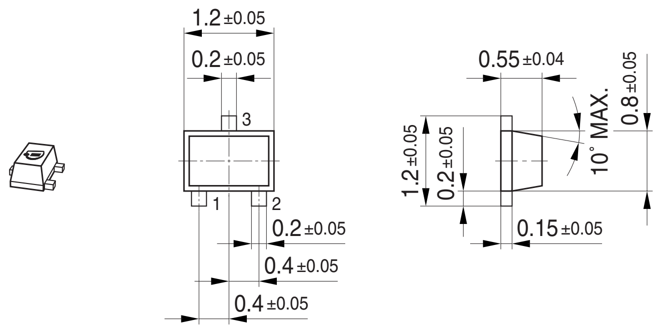
$V_{CE}$ = 1.5V, $I_C$=Parameter



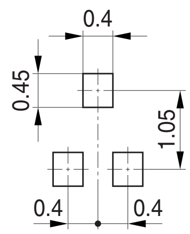
## SPICE Parameter

For the SPICE model as well as for the S-parameters (including noise parameters) please refer to our internet website www.infineon.com/rf.models.
Please consult our website and download the latest versions before actually starting your design.
You find the BFR340F SPICE model in the internet in MWO- and ADS- format which you can import into these circuit simulation tools very quickly and conveniently.
The simulation data have been generated and verified using typical devices.
The BFR340F SPICE model reflects the typical DC- and RF-performance with high accuracy.

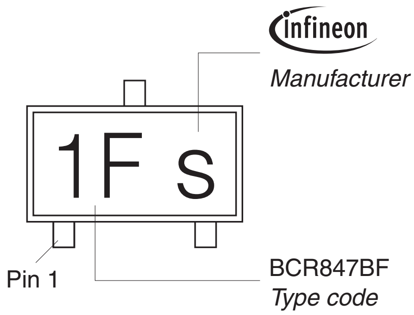
## Package Outline




## Foot Print

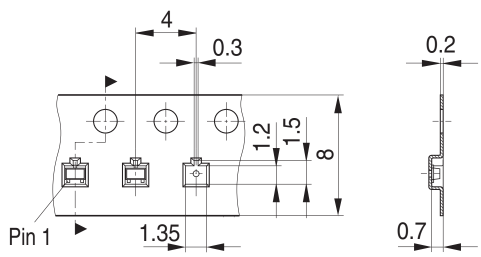



## Marking Layout (Example)




## Standard Packing

Reel ø180 mm = 3.000 Pieces/Reel
Reel ø330 mm = 10.000 Pieces/Reel



**Datasheet Revision History: 17 May 2010**

This datasheet replaces the revisions from 02 February 2010 and 30 March 2007.
The product itself has not been changed and the device characteristics remain unchanged.
Only the product description and information available in the datasheet has been expanded and updated.

| **Previous Revisions: 02 February 2010 and 30 March 2007** | |
|---|---|
| **Page** | **Subject (changes since last revision)** |
| 1 | Higher maximum collector and base currents, higher total power dissipation |
| 2 | Typical values for leakage currents included, maximum leakage currents reduced |
| 3 | Noise description at 100 MHz added |
| 4 | Gain and linearity description at 100 MHz added |
| 5 | Ptot curve adjusted to Ptot and ICmax changes |
| 5 - 8 | Curves for IP3 and noise at 100 MHz added |

**Edition 2009-11-16**

**Published by**
**Infineon Technologies AG**
**81726 Munich, Germany**



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