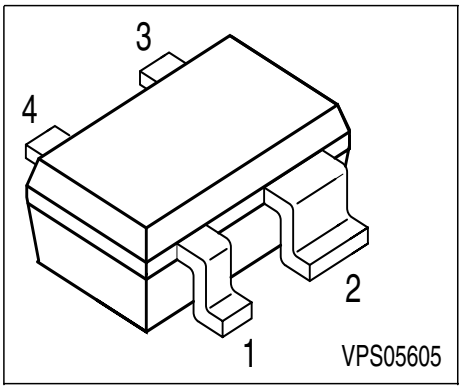
**NPN Silicon RF Transistor**




- For highest gain low noise amplifier at 1.8 GHz
- Outstanding $G_{ms}$ = 21 dB
  Noise Figure $F$ = 0.9 dB
- Gold metallization for high reliability
- SIEGET 45 - Line

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

| Type | Marking | Pin Configuration | | | | | | Package |
|---|---|---|---|---|---|---|---|---|
| BFP540 | ATs | 1=B | 2=E | 3=C | 4=E | - | - | SOT343 |

**Maximum Ratings**

| Parameter | Symbol | Value | Unit |
|---|---|---|---|
| Collector-emitter voltage | $V_{CEO}$ | 4.5 | V |
| Collector-emitter voltage | $V_{CES}$ | 14 | |
| Collector-base voltage | $V_{CBO}$ | 14 | |
| Emitter-base voltage | $V_{EBO}$ | 1 | |
| Collector current | $I_C$ | 80 | mA |
| Base current | $I_B$ | 8 | |
| Total power dissipation[1)] $T_S \leq 77°C$ | $P_{tot}$ | 250 | mW |
| Junction temperature | $T_j$ | 150 | °C |
| Ambient temperature | $T_A$ | -65 ... 150 | |
| Storage temperature | $T_{stg}$ | -65 ... 150 | |

**Thermal Resistance**

| Parameter | Symbol | Value | Unit |
|---|---|---|---|
| Junction - soldering point[2)] | $R_{thJS}$ | ≤ 290 | 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 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 | $V_{(BR)CEO}$ | 4.5 | 5 | - | V |
| Collector-emitter cutoff current<br>$V_{CE}$ = 14 V, $V_{BE}$ = 0 | $I_{CES}$ | - | - | 10 | µA |
| Collector-base cutoff current<br>$V_{CB}$ = 5 V, $I_E$ = 0 | $I_{CBO}$ | - | - | 100 | nA |
| Emitter-base cutoff current<br>$V_{EB}$ = 0.5 V, $I_C$ = 0 | $I_{EBO}$ | - | - | 10 | µA |
| DC current gain<br>$I_C$ = 20 mA, $V_{CE}$ = 3.5 V | $h_{FE}$ | 50 | 110 | 200 | - |

**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>$I_C$ = 50 mA, $V_{CE}$ = 4 V, $f$ = 1 GHz | $f_T$ | 21 | 30 | - | GHz |
| Collector-base capacitance<br>$V_{CB}$ = 2 V, $f$ = 1 MHz | $C_{cb}$ | - | 0.14 | 0.24 | pF |
| Collector emitter capacitance<br>$V_{CE}$ = 2 V, $f$ = 1 MHz | $C_{ce}$ | - | 0.33 | - | |
| Emitter-base capacitance<br>$V_{EB}$ = 0.5 V, $f$ = 1 MHz | $C_{eb}$ | - | 0.65 | - | |
| Noise figure<br>$I_C$ = 5 mA, $V_{CE}$ = 2 V, $f$ = 1.8 GHz, $Z_S = Z_{Sopt}$<br>$I_C$ = 5 mA, $V_{CE}$ = 2 V, $f$ = 3 GHz, $Z_S = Z_{Sopt}$ | $F$ | <br>-<br>- | <br>0.9<br>1.3 | <br>1.4<br>- | dB |
| Power gain, maximum stable[1)]<br>$I_C$ = 20 mA, $V_{CE}$ = 2 V, $Z_S = Z_{Sopt}$,<br>$Z_L = Z_{Lopt}$ , $f$ = 1.8 GHz | $G_{ms}$ | - | 21.5 | - | dB |
| Power gain, maximum available[1)]<br>$I_C$ = 20 mA, $V_{CE}$ = 2 V, $Z_S = Z_{Sopt}$,<br>$Z_L = Z_{Lopt}$, $f$ = 3 GHz | $G_{ma}$ | - | 16 | - | dB |
| Transducer gain<br>$I_C$ = 20 mA, $V_{CE}$ = 2 V, $Z_S = Z_L$ = 50 Ω,<br>$f$ = 1.8 GHz<br>$I_C$ = 20 mA, $V_{CE}$ = 2 V, $Z_S = Z_L$ = 50 Ω,<br>$f$ = 3 GHz | $\lvert S_{21e}\rvert^2$ | <br><br>16<br><br>- | <br><br>18.5<br><br>14.5 | <br><br>-<br><br>- | dB |
| Third order intercept point at output[2)]<br>$V_{CE}$ = 2 V, $I_C$ = 20 mA, $f$ = 1.8 GHz,<br>$Z_S = Z_L$ = 50 Ω | $IP_3$ | - | 24.5 | - | dBm |
| 1dB Compression point at output<br>$I_C$ = 20 mA, $V_{CE}$ = 2 V, $Z_S = Z_L$ = 50 Ω,<br>$f$ = 1.8 GHz | $P_{-1dB}$ | - | 11 | - | |

[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

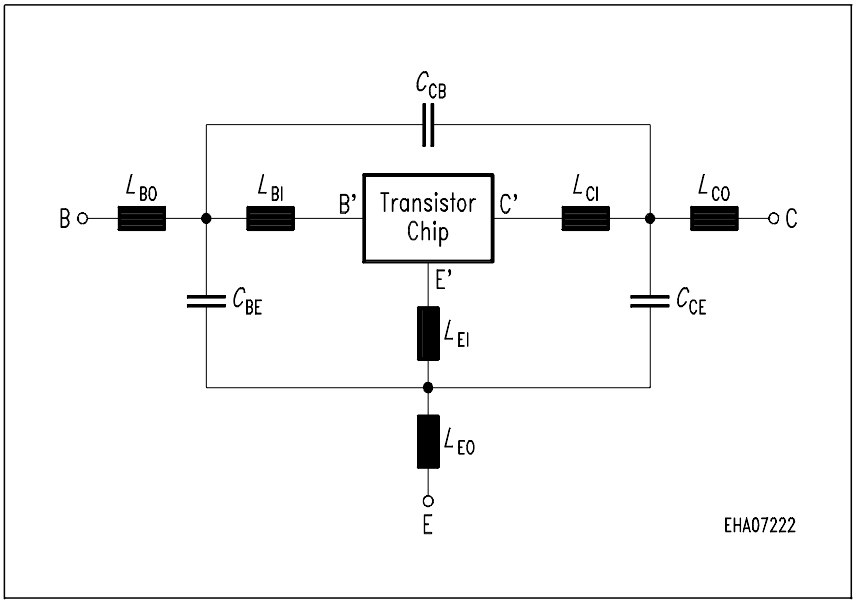
## SPICE Parameter (Gummel-Poon Model, Berkley-SPICE 2G.6 Syntax):

### Transitor Chip Data:

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| IS = | 82.84 | aA | BF = | 107.5 | - | NF = | 1 | - |
| VAF = | 28.383 | V | IKF = | 0.48731 | A | ISE = | 11.15 | fA |
| NE = | 3.19 | - | BR = | 5.5 | - | NR = | 1 | - |
| VAR = | 19.705 | V | IKR = | 0.02 | A | ISC = | 19.237 | aA |
| NC = | 1.172 | - | RB = | 5.4 | Ω | IRB = | 0.72983 | mA |
| RBM = | 1.3 | Ω | RE = | 0.31111 | - | RC = | 4 | Ω |
| CJE = | 1.8063 | fF | VJE = | 0.8051 | V | MJE = | 0.46576 | - |
| TF = | 6.76 | ps | XTF = | 0.4219 | - | VTF = | 0.23794 | V |
| ITF = | 1 | mA | PTF = | 0 | deg | CJC = | 234 | fF |
| VJC = | 0.81969 | V | MJC = | 0.30232 | - | XCJC = | 0.3 | - |
| TR = | 2.324 | ns | CJS = | 0 | fF | VJS = | 0.75 | V |
| MJS = | 0 | - | XTB = | 0 | - | EG = | 1.11 | eV |
| XTI = | 3 | - | FC = | 0.73234 | | TNOM | 300 | K |

All parameters are ready to use, no scalling is necessary.

### Package Equivalent Circuit:




| | | |
|---|---|---|
| $L_{BI}$ = | 0.47 | nH |
| $L_{BO}$ = | 0.53 | nH |
| $L_{EI}$ = | 0.23 | nH |
| $L_{EO}$ = | 0.05 | nH |
| $L_{CI}$ = | 0.56 | pH |
| $L_{EO}$ = | 0.58 | nH |
| $C_{BE}$ = | 136 | fF |
| $C_{CB}$ = | 6.9 | fF |
| $C_{CE}$ = | 134 | fF |

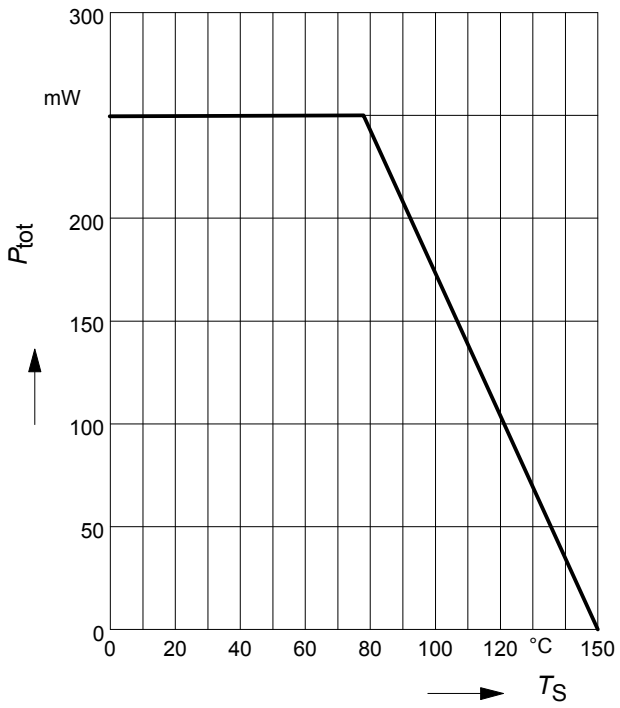
Valid up to 6GHz

For examples and ready to use parameters
please contact your local Infineon Technologies
distributor or sales office to obtain a Infineon
Technologies CD-ROM or see Internet:
http//www.infineon.com/silicondiscretes

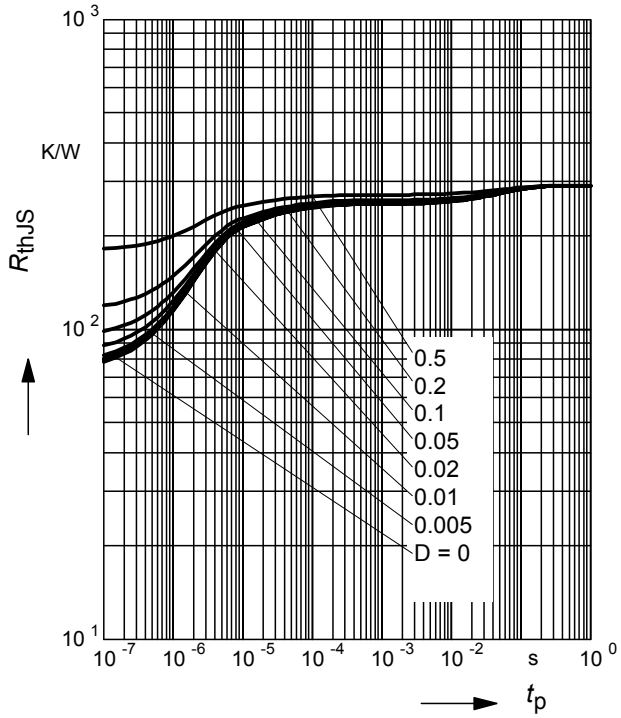
### For non-linear simulation:

- Use transistor chip parameters in Berkeley SPICE 2G.6 syntax for all simulators.
- Simulation of the package is not necessary for frequencies < 100MHz.
  For higher frequencies please add the wiring of the package equivalent circuit around the non-linear transistor.

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

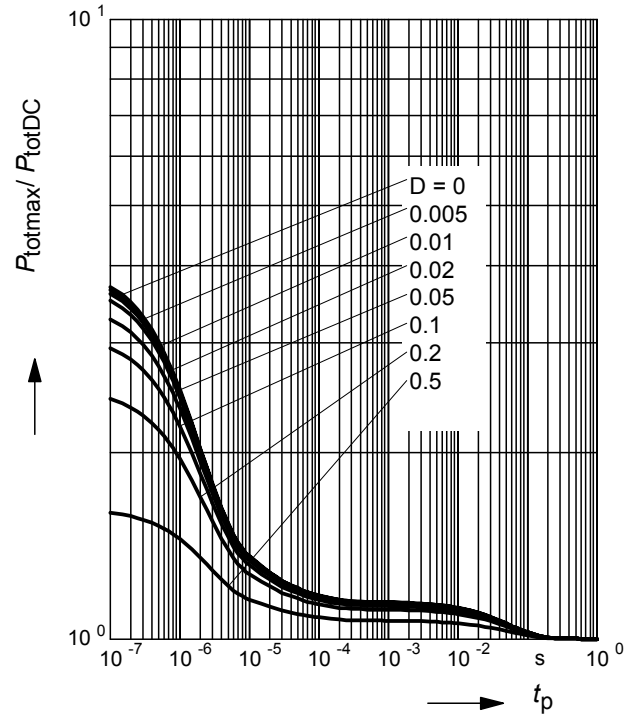



**Permissible Pulse Load** $R_{thJS} = f(t_p)$



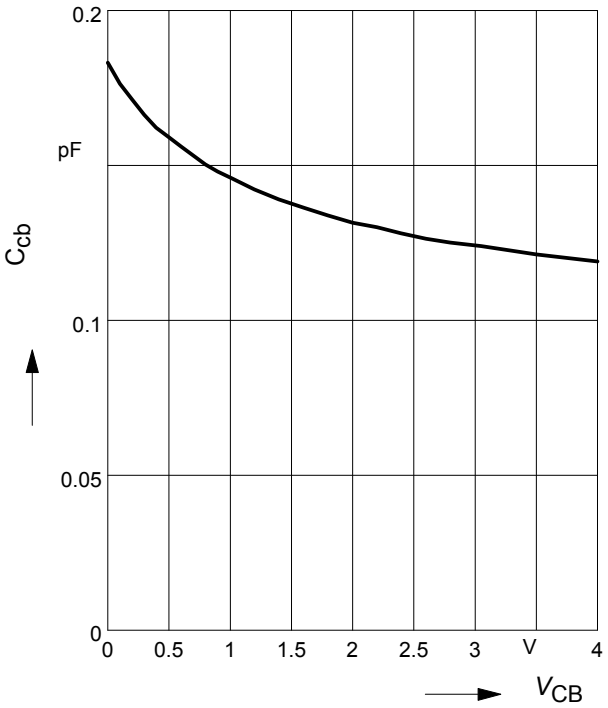

**Permissible Pulse Load**

$P_{totmax}/P_{totDC} = f(t_p)$




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

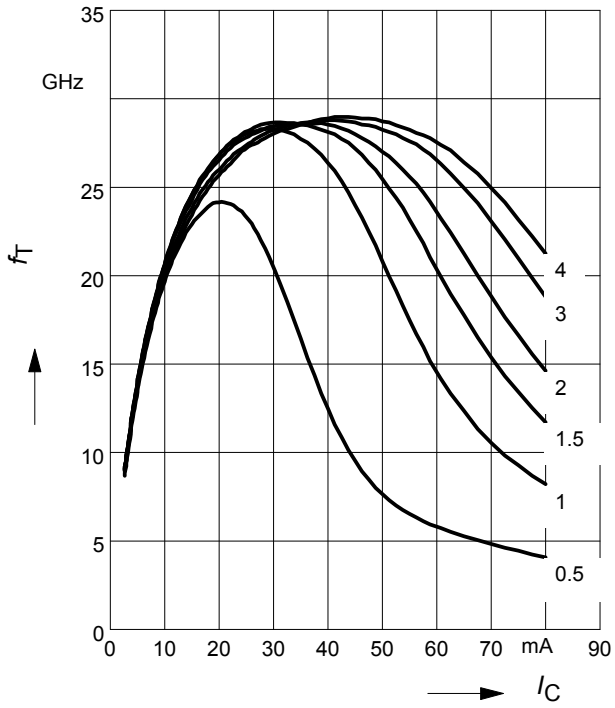
$f$ = 1MHz



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

$f$ = 1GHz

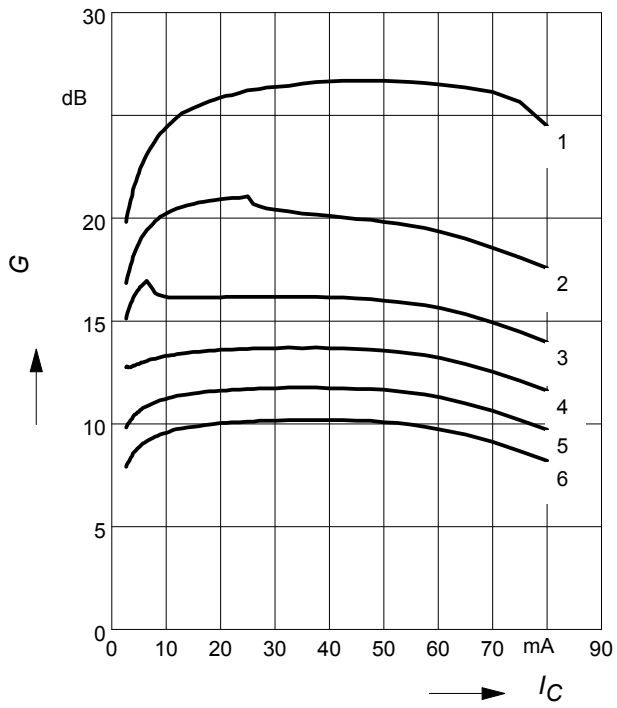
$V_{CE}$ = Parameter in V




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

$V_{CE}$ = 2V

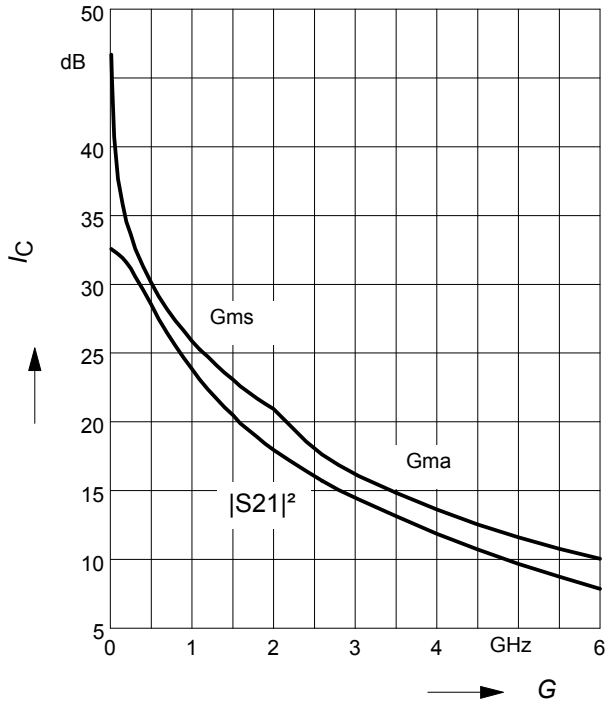
$f$ = Parameter in GHz




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

$|S_{21}|^2 = f$ (f)

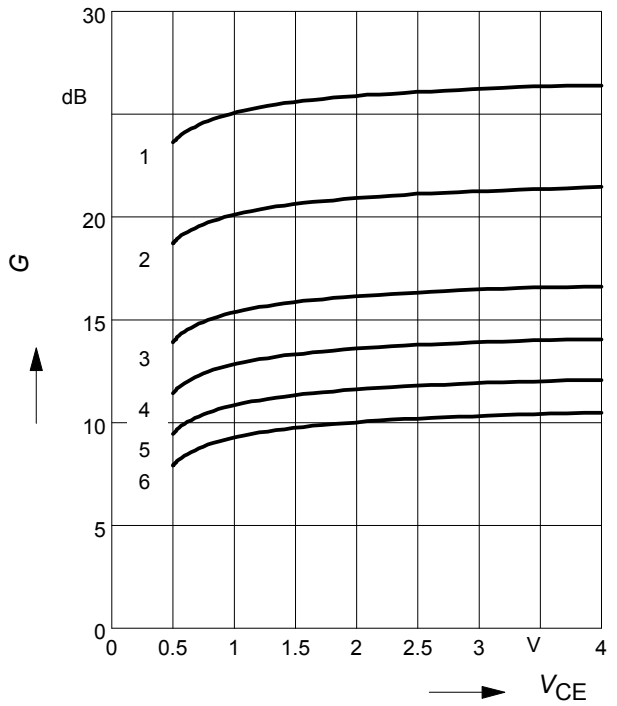
$V_{CE}$ = 2V, $I_C$ = 20mA




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

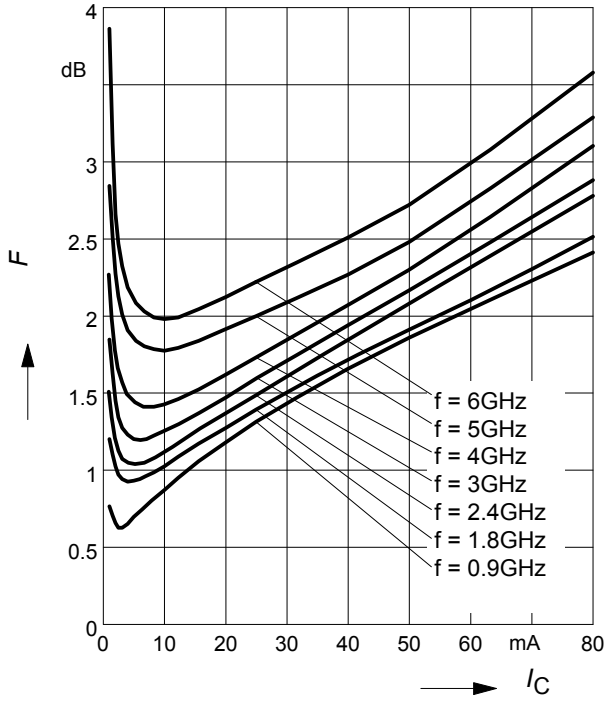
$I_C$ = 20mA

$f$ = Parameter in GHz



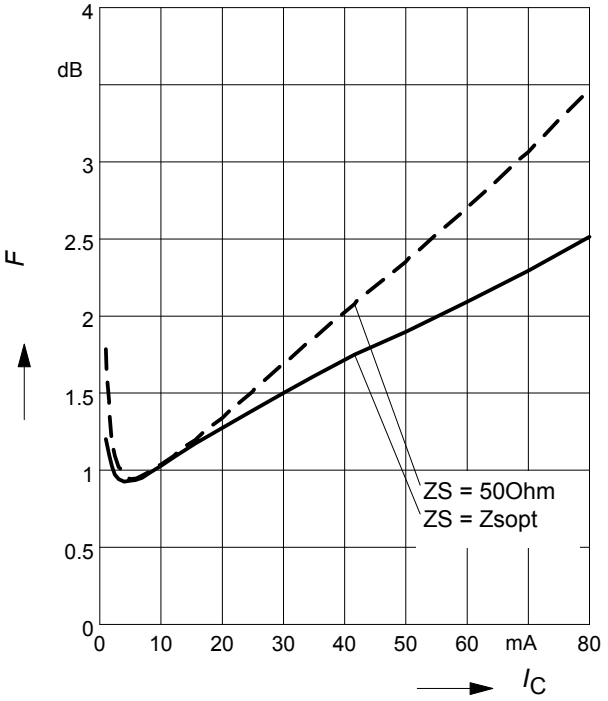
**Noise figure** $F = f(I_C)$

$V_{CE}$ = 2V, $Z_S = Z_{Sopt}$



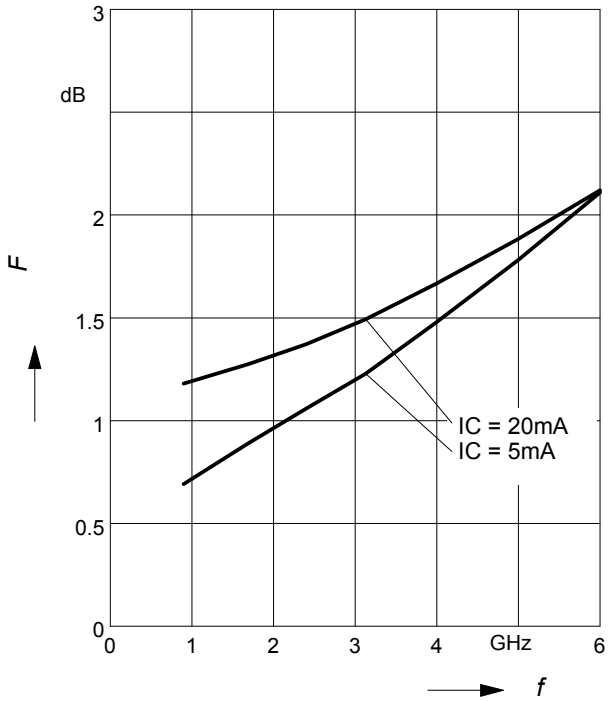

**Noise figure** $F = f(I_C)$

$V_{CE}$ = 2V, $f$ = 1.8GHz



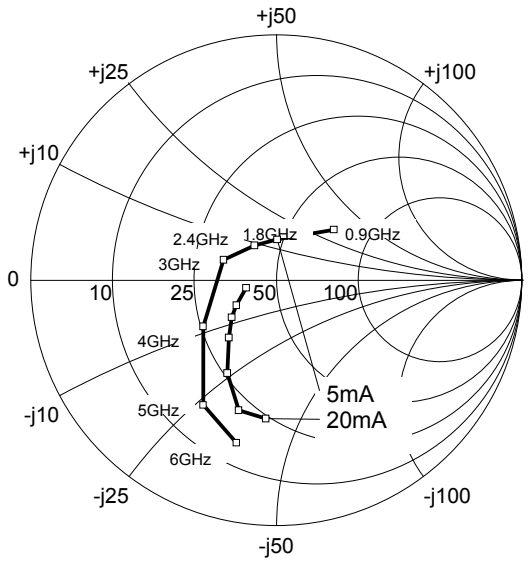

**Noise figure** $F = f(f)$

$V_{CE}$ = 2V, $Z_S = Z_{Sopt}$




**Source impedance** for min. noise figure vs. frequency

$V_{CE}$ = 2V, $I_C$ = 5mA / 20mA



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