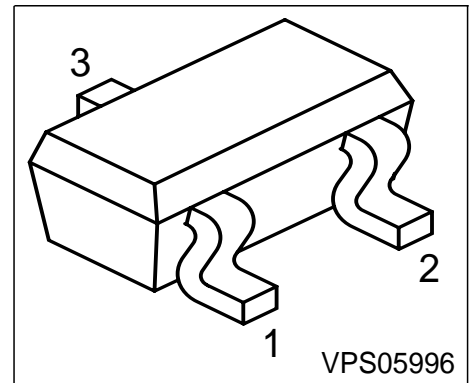


**NPN Silicon RF Transistor**
**Preliminary data**

- For low noise, high-gain broadband amplifiers at collector currents from 1 mA to 20 mA
- $f_T = 9$  GHz  
 $F = 1.0$  dB at 1 GHz


**ESD: Electrostatic discharge sensitive device, observe handling precaution!**

| Type    | Marking | Pin Configuration |       |       | Package |
|---------|---------|-------------------|-------|-------|---------|
| BFR949T | RKs     | 1 = B             | 2 = E | 3 = C | SC75    |

**Maximum Ratings**

| Parameter   | Symbol    | Value       | Unit |
|---|-----------|-------------|------|
| Collector-emitter voltage                                 | $V_{CEO}$ | 10          | V    |
| Collector-emitter voltage                                 | $V_{CES}$ | 20          |      |
| Collector-base voltage                                    | $V_{CBO}$ | 20          |      |
| Emitter-base voltage                                      | $V_{EBO}$ | 1.5         |      |
| Collector current   | $I_C$     | 35          | mA   |
| Base current  | $I_B$     | 4           |      |
| Total power dissipation<br>$T_S \leq 75^\circ\text{C}^1)$ | $P_{tot}$ | 250         | mW   |
| Junction temperature                                      | $T_j$     | 150         | °C   |
| Ambient temperature                                       | $T_A$     | -65 ... 150 |      |
| Storage temperature                                       | $T_{stg}$ | -65 ... 150 |      |

**Thermal Resistance**

|  |            |            |     |
|--|------------|------------|-----|
| Junction - soldering point <sup>2)</sup> | $R_{thJS}$ | $\leq 300$ | K/W |
|--|------------|------------|-----|

<sup>1</sup>  $T_S$  is measured on the collector lead at the soldering point to the pcb

<sup>2</sup>For calculation of  $R_{thJA}$  please refer to Application Note Thermal Resistance

**Electrical Characteristics** at  $T_A = 25^\circ\text{C}$ , unless otherwise specified

| Parameter  | Symbol        | Values |      |      | Unit          |
|--|---------------|--------|------|------|---------------|
|  |               | min.   | typ. | max. |               |
| <b>DC Characteristics</b>  |               |        |      |      |               |
| Collector-emitter breakdown voltage<br>$I_C = 1 \text{ mA}, I_B = 0$ | $V_{(BR)CEO}$ | 10     | -    | -    | V             |
| Base-emitter forward voltage<br>$I_E = 25\text{mA}$                  | $V_{BEF}$     | -      | -    | 1.05 |               |
| Collector-base cutoff current<br>$V_{CB} = 10 \text{ V}, I_E = 0$    | $I_{CBO}$     | -      | -    | 100  | nA            |
| Emitter-base cutoff current<br>$V_{EB} = 1 \text{ V}, I_C = 0$       | $I_{EBO}$     | -      | -    | 0.1  | $\mu\text{A}$ |
| DC current gain<br>$I_C = 5 \text{ mA}, V_{CE} = 6 \text{ V}$        | $h_{FE}$      | 100    | 140  | 200  | -             |

**Electrical Characteristics** at  $T_A = 25^\circ\text{C}$ , unless otherwise specified.

| Parameter   | Symbol        | Values |      |      | Unit |
|---|---------------|--------|------|------|------|
|   |               | min.   | typ. | max. |      |
| <b>AC characteristics</b> (verified by random sampling)   |               |        |      |      |      |
| Transition frequency<br>$I_C = 15 \text{ mA}, V_{CE} = 6 \text{ V}, f = 1 \text{ GHz}$  | $f_T$         | 7      | 9    | -    | GHz  |
| Collector-base capacitance<br>$V_{CB} = 10 \text{ V}, f = 1 \text{ MHz}$  | $C_{cb}$      | -      | 0.33 | 0.4  | pF   |
| Collector-emitter capacitance<br>$V_{CE} = 10 \text{ V}, f = 1 \text{ MHz}$   | $C_{ce}$      | -      | 0.2  | -    |      |
| Emitter-base capacitance<br>$V_{EB} = 0.5 \text{ V}, f = 1 \text{ MHz}$   | $C_{eb}$      | -      | 0.6  | -    |      |
| Noise figure<br>$I_C = 5 \text{ mA}, V_{CE} = 6 \text{ V}, Z_S = Z_{Sopt}, f = 1 \text{ GHz}$<br>$I_C = 3 \text{ mA}, V_{CE} = 8 \text{ V}, Z_S = Z_{Sopt}, f = 1.8 \text{ GHz}$                  | $F$           | -      | 1    | 2.5  | dB   |
|   |               | -      | 1.5  | -    |      |
| Power gain, maximum stable <sup>1)</sup><br>$I_C = 10 \text{ mA}, V_{CE} = 8 \text{ V}, Z_S = Z_{Sopt}, Z_L = Z_{Lopt}, f = 900 \text{ MHz}$  | $G_{ms}$      | -      | 20   | -    |      |
| Power gain, maximum available <sup>2)</sup><br>$I_C = 10 \text{ mA}, V_{CE} = 8 \text{ V}, Z_S = Z_{Sopt}, Z_L = Z_{Lopt}, f = 1.8 \text{ GHz}$   | $G_{ma}$      | -      | 14   | -    |      |
| Transducer gain<br>$I_C = 15 \text{ mA}, V_{CE} = 6 \text{ V}, Z_S = Z_L = 50\Omega, f = 1 \text{ GHz}$<br>$I_C = 10 \text{ mA}, V_{CE} = 8 \text{ V}, Z_S = Z_L = 50\Omega, f = 1.8 \text{ GHz}$ | $ S_{21e} ^2$ | 13     | 16   | -    |      |
|   |               | -      | 11   | -    |      |

$$^1G_{ms} = |S_{21} / S_{12}|$$

$$^2G_{ma} = |S_{21} / S_{12}| (k - (k^2 - 1)^{1/2})$$

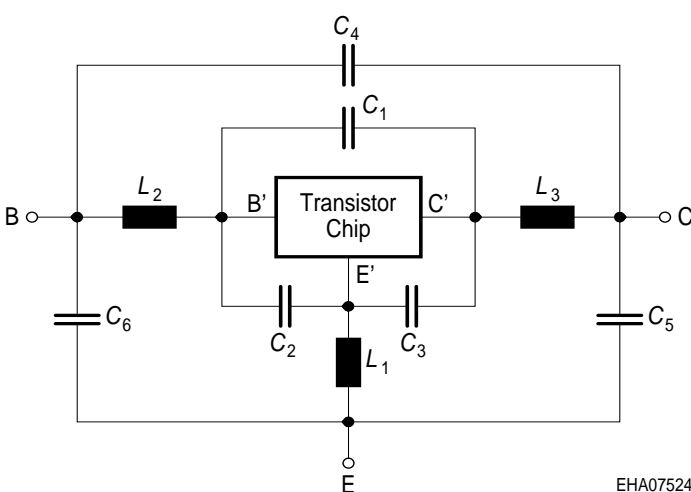
**SPICE Parameters (Gummel-Poon Model, Berkley-SPICE 2G.6 Syntax) :**

**Transistor Chip Data**

|       |        |          |       |         |          |        |       |          |
|-------|--------|----------|-------|---------|----------|--------|-------|----------|
| IS =  | 4.36   | fA       | BF =  | 120     | -        | NF =   | 1.085 | -        |
| VAF = | 30     | V        | IKF = | 0.152   | A        | ISE =  | 1.86  | pA       |
| NE =  | 1.998  | -        | BR =  | 33.322  | -        | NR =   | 1.095 | -        |
| VAR = | 41.889 | V        | IKR = | 0.063   | A        | ISC =  | 3.68  | pA       |
| NC =  | 1.569  | -        | RB =  | 20.766  | $\Omega$ | IRB =  | 72.2  | $\mu$ A  |
| RBM = | 0.823  | $\Omega$ | RE =  | 0.101   |          | RC =   | 0.849 | $\Omega$ |
| CJE = | 291    | fF       | VJE = | 0.586   | V        | MJE =  | 0.456 | -        |
| TF =  | 8.77   | ps       | XTF = | 0.00894 | -        | VTF =  | 0.198 | V        |
| ITF = | 1.336  | mA       | PTF = | 0       | deg      | CJC =  | 459   | fF       |
| VJC = | 1.048  | V        | MJC = | 0.334   | -        | XCJC = | 0.217 | -        |
| TR =  | 1.39   | ns       | CJS = | 0       | fF       | VJS =  | 0.75  | V        |
| MJS = | 0      | -        | NK =  | 0.5     | -        | EG =   | 1.11  | eV       |
| .     | -      |          | FC =  | 0.924   | -        | TNOM   | 300   | K        |

All parameters are ready to use, no scaling is necessary.  
 Extracted on behalf of Infineon Technologies AG by:  
 Institut für Mobil-und Satellitentechnik (IMST)

**Package Equivalent Circuit:**

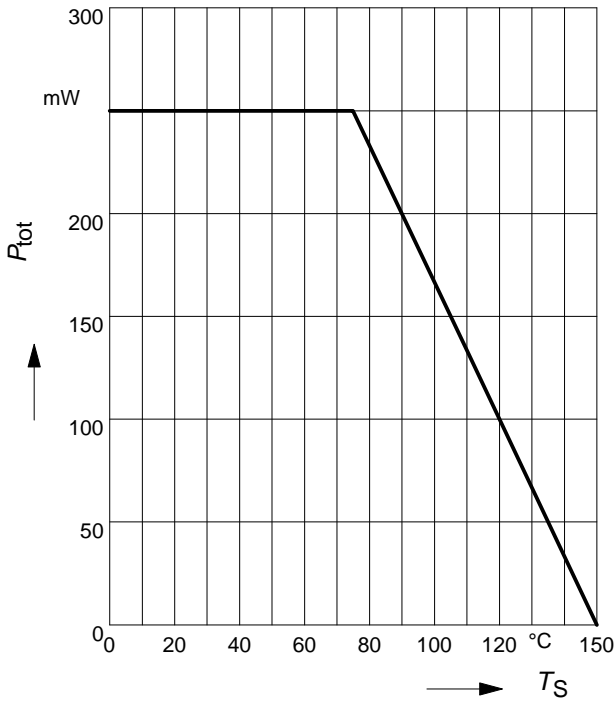


|         |       |    |
|---------|-------|----|
| $L_1 =$ | 0.762 | nH |
| $L_2 =$ | 0.706 | nH |
| $L_3 =$ | 0.382 | nH |
| $C_1 =$ | 62    | fF |
| $C_2 =$ | 84    | fF |
| $C_3 =$ | 180   | fF |
| $C_4 =$ | 7     | fF |
| $C_5 =$ | 40    | fF |
| $C_6 =$ | 48    | fF |

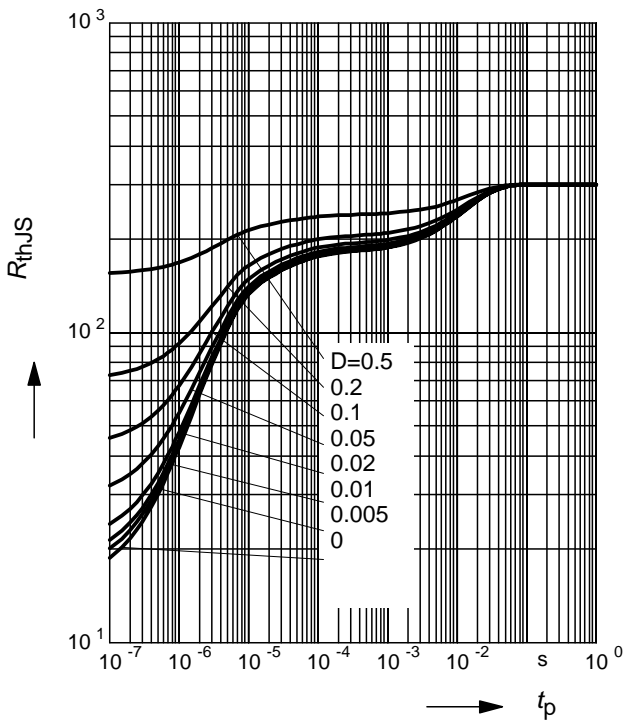
Valid up to 6GHz

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>

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

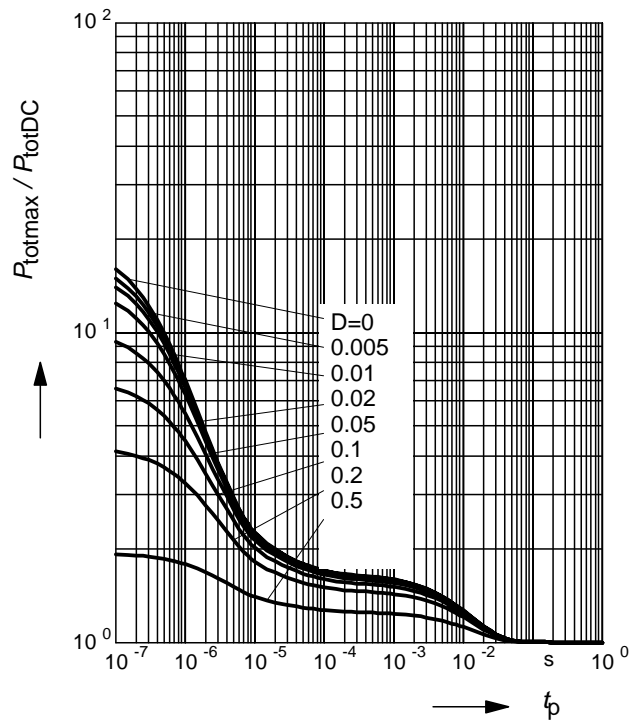


**Permissible Pulse Load  $R_{thJS} = f(t_p)$**



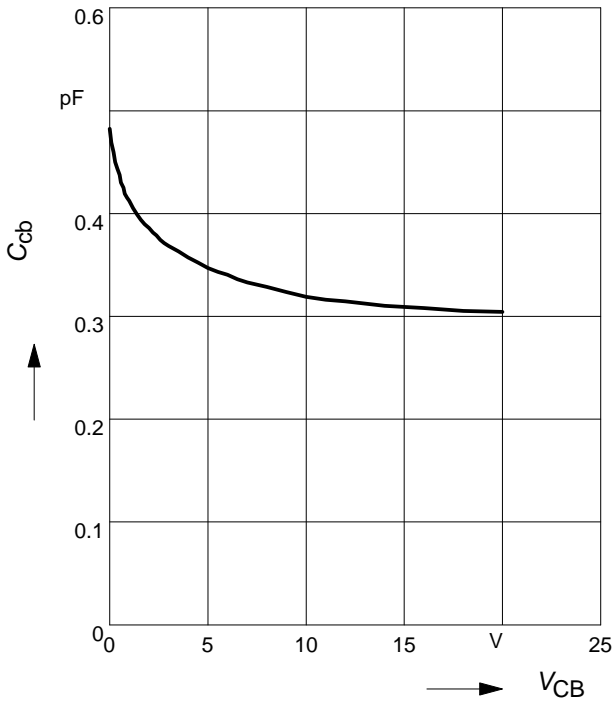
**Permissible Pulse Load**

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



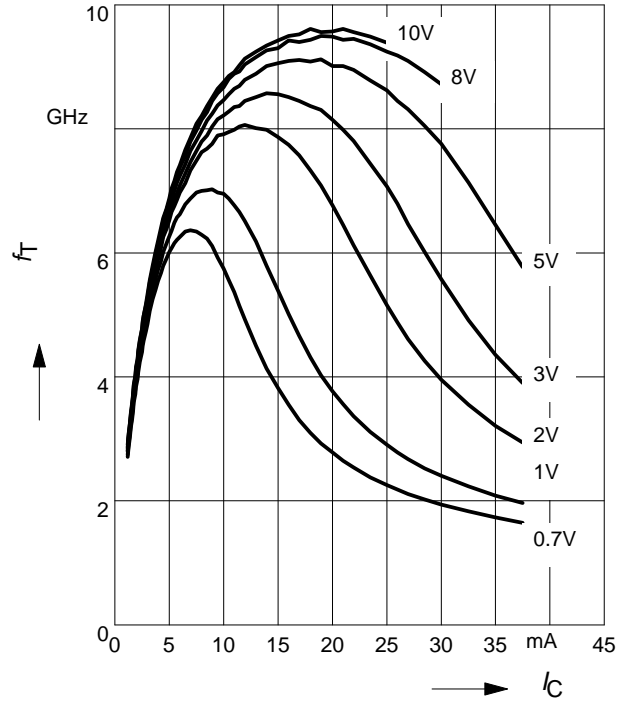
**Collector-base capacitance  $C_{cb} = f(V_{CB})$**

$f = 1\text{MHz}$



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

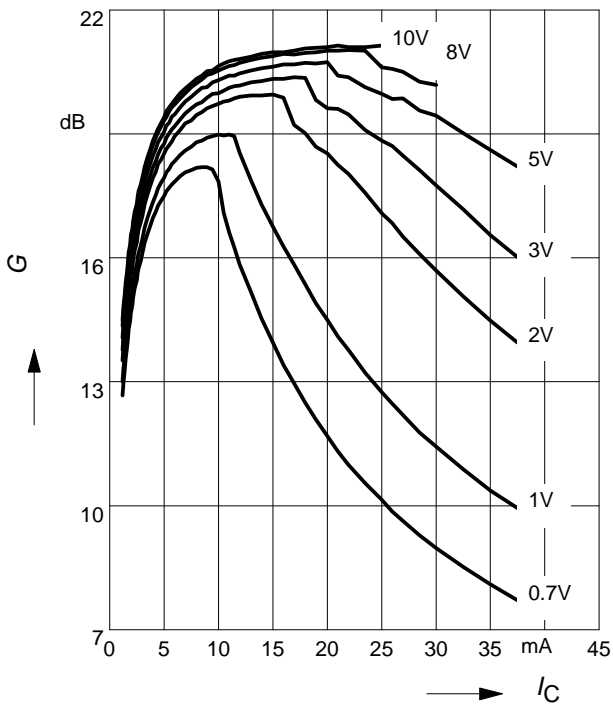
$V_{CE} = \text{Parameter}$



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

$f = 0.9\text{GHz}$

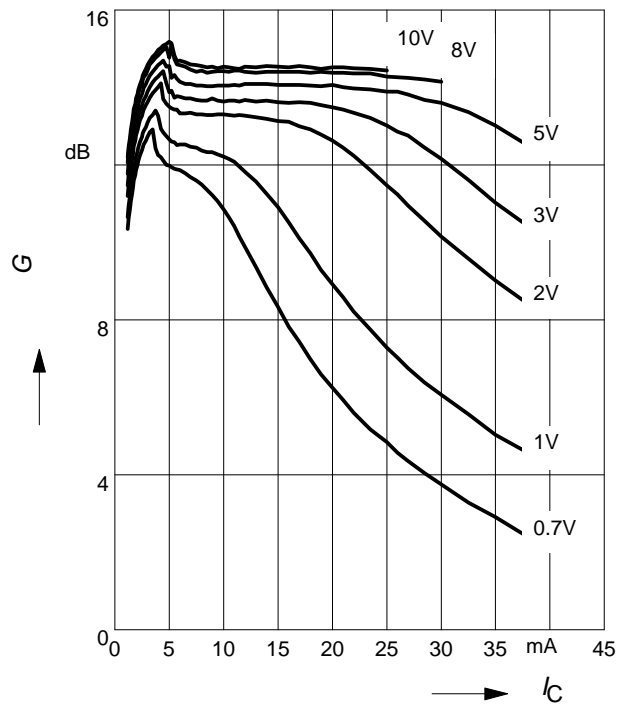
$V_{CE} = \text{Parameter}$



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

$f = 1.8\text{GHz}$

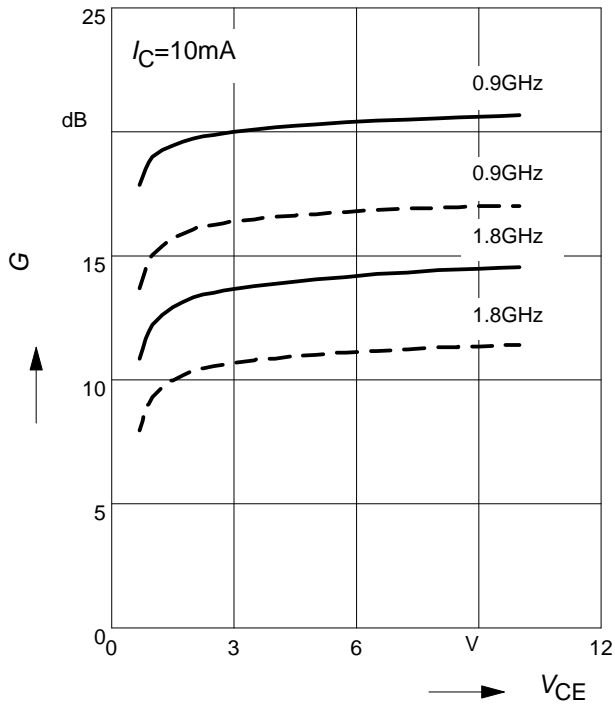
$V_{CE} = \text{Parameter}$



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

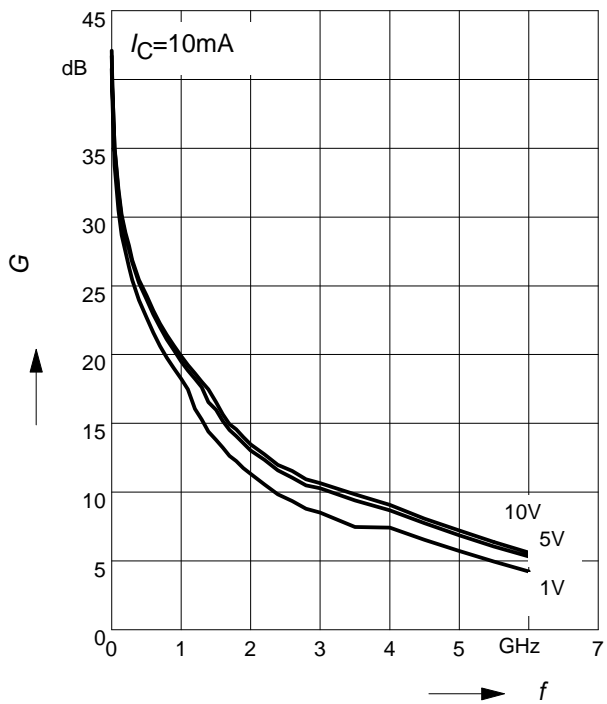
$|S_{21}|^2 = f(V_{CE})$ :-----

$f$  = Parameter



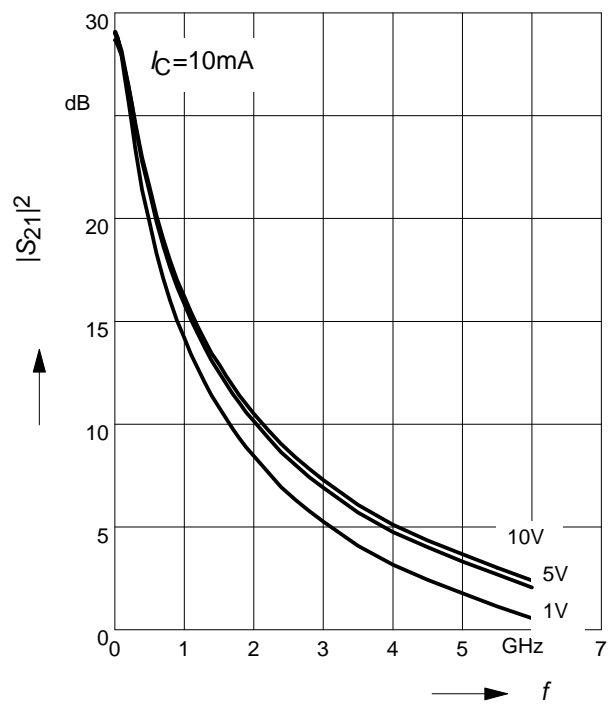
**Power Gain**  $G_{ma}$ ,  $G_{ms} = f(f)$

$V_{CE}$  = Parameter



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

$V_{CE}$  = Parameter



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