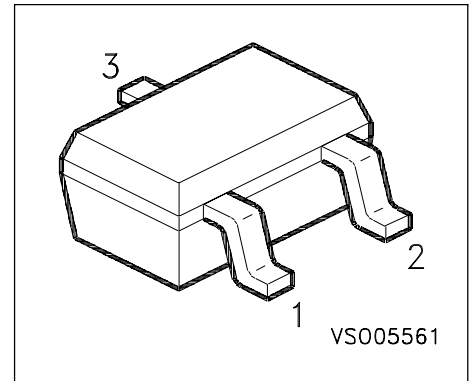


### NPN Silicon RF Transistor

- For low-power amplifiers in mobile communication systems (pager) at collector currents from 0.2mA to 2.5mA
- $f_T = 7\text{GHz}$   
F = 2.1dB at 900MHz



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

| Type     | Marking | Ordering Code | Pin Configuration |       |       | Package |
|----------|---------|---------------|-------------------|-------|-------|---------|
| BFR 180W | RDs     | Q62702-F1490  | 1 = B             | 2 = E | 3 = C | SOT-323 |

### Maximum Ratings

| Parameter   | Symbol    | Values         | Unit |
|---|-----------|----------------|------|
| Collector-emitter voltage                                       | $V_{CEO}$ | 8              | V    |
| Collector-emitter voltage                                       | $V_{CES}$ | 10             |      |
| Collector-base voltage  | $V_{CBO}$ | 10             |      |
| Emitter-base voltage  | $V_{EBO}$ | 2              |      |
| Collector current   | $I_C$     | 4              | mA   |
| Base current  | $I_B$     | 0.5            |      |
| Total power dissipation<br>$T_S \leq 126\text{ }^\circ\text{C}$ | $P_{tot}$ | 30             | mW   |
| Junction temperature  | $T_j$     | 150            |      |
| Ambient temperature   | $T_A$     | - 65 ... + 150 |      |
| Storage temperature   | $T_{stg}$ | - 65 ... + 150 |      |

### Thermal Resistance

|  |            |            |     |
|--|------------|------------|-----|
| Junction - soldering point <sup>1)</sup> | $R_{thJS}$ | $\leq 790$ | K/W |
|--|------------|------------|-----|

1)  $T_S$  is measured on the collector lead at the soldering point to the pcb.

**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>$I_C = 1 \text{ mA}, I_B = 0$    | $V_{(BR)CEO}$ | 8      | -    | -    | V             |
| Collector-emitter cutoff current<br>$V_{CE} = 10 \text{ V}, V_{BE} = 0$ | $I_{CES}$     | -      | -    | 100  | $\mu\text{A}$ |
| Collector-base cutoff current<br>$V_{CB} = 8 \text{ V}, I_E = 0$        | $I_{CBO}$     | -      | -    | 100  | nA            |
| Emitter-base cutoff current<br>$V_{EB} = 1 \text{ V}, I_C = 0$          | $I_{EBO}$     | -      | -    | 1    | $\mu\text{A}$ |
| DC current gain<br>$I_C = 1 \text{ mA}, V_{CE} = 5 \text{ V}$           | $h_{FE}$      | 30     | 100  | 200  | -             |

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

| Parameter  | Symbol        | Values |              |      | Unit |
|--|---------------|--------|--------------|------|------|
|  |               | min.   | typ.         | max. |      |
| <b>AC Characteristics</b>  |               |        |              |      |      |
| Transition frequency<br>$I_C = 3 \text{ mA}, V_{CE} = 5 \text{ V}, f = 500 \text{ MHz}$  | $f_T$         | 5      | 7            | -    | GHz  |
| Collector-base capacitance<br>$V_{CB} = 5 \text{ V}, f = 1 \text{ MHz}$  | $C_{cb}$      | -      | 0.3          | 0.45 | pF   |
| Collector-emitter capacitance<br>$V_{CE} = 5 \text{ V}, f = 1 \text{ MHz}$   | $C_{ce}$      | -      | 0.22         | -    |      |
| Emitter-base capacitance<br>$V_{EB} = 0.5 \text{ V}, f = 1 \text{ MHz}$  | $C_{eb}$      | -      | 0.1          | -    |      |
| Noise figure<br>$I_C = 1 \text{ mA}, V_{CE} = 5 \text{ V}, Z_S = Z_{Sopt}$<br>$f = 900 \text{ MHz}$<br>$f = 1.8 \text{ GHz}$                                 | $F$           | -      | 2.1<br>2.25  | -    | dB   |
| Power gain <sup>1)</sup><br>$I_C = 1 \text{ mA}, V_{CE} = 5 \text{ V}, Z_S = Z_{Sopt}$<br>$Z_L = Z_{Lopt}$<br>$f = 900 \text{ MHz}$<br>$f = 1.8 \text{ GHz}$ | $G_{ms}$      | -      | 13.5<br>10.5 | -    |      |
| Transducer gain<br>$I_C = 1 \text{ mA}, V_{CE} = 5 \text{ V}, Z_S = Z_L = 50 \Omega$<br>$f = 900 \text{ MHz}$<br>$f = 1.8 \text{ GHz}$                       | $ S_{21e} ^2$ | -      | 8.5<br>6     | -    |      |

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

## SPICE Parameters (Gummel-Poon Model, Berkeley-SPICE 2G.6 Syntax) :

### Transistor Chip Data

|       |         |          |       |          |          |        |         |          |
|-------|---------|----------|-------|----------|----------|--------|---------|----------|
| IS =  | 0.18519 | fA       | BF =  | 94.687   | -        | NF =   | 1.0236  | -        |
| VAF = | 26.867  | V        | IKF = | 0.025252 | A        | ISE =  | 130.93  | fA       |
| NE =  | 1.9818  | -        | BR =  | 20.325   | -        | NR =   | 0.93013 | -        |
| VAR = | 3.2134  | V        | IKR = | 0.012138 | A        | ISC =  | 6.1852  | fA       |
| NC =  | 1.6195  | -        | RB =  | 1.4255   | $\Omega$ | IRB =  | 0.01    | mA       |
| RBM = | 60      | $\Omega$ | RE =  | 3.7045   | $\Omega$ | RC =   | 0.56    | $\Omega$ |
| CJE = | 3.2473  | fF       | VJE = | 1.1812   | V        | MJE =  | 0.41827 | -        |
| TF =  | 14.866  | ps       | XTF = | 0.3062   | -        | VTF =  | 0.22023 | V        |
| ITF = | 1.0202  | mA       | PTF = | 0        | deg      | CJC =  | 183.69  | fF       |
| VJC = | 1.1812  | V        | MJC = | 0.30423  | -        | XCJC = | 0.08334 | -        |
| TR =  | 2.2648  | ns       | CJS = | 0        | fF       | VJS =  | 0.75    | V        |
| MJS = | 0       | -        | XTB = | 0        | -        | EG =   | 1.11    | eV       |
| XTI = | 3       | -        | FC =  | 0.87906  | -        | TNOM   | 300     | K        |

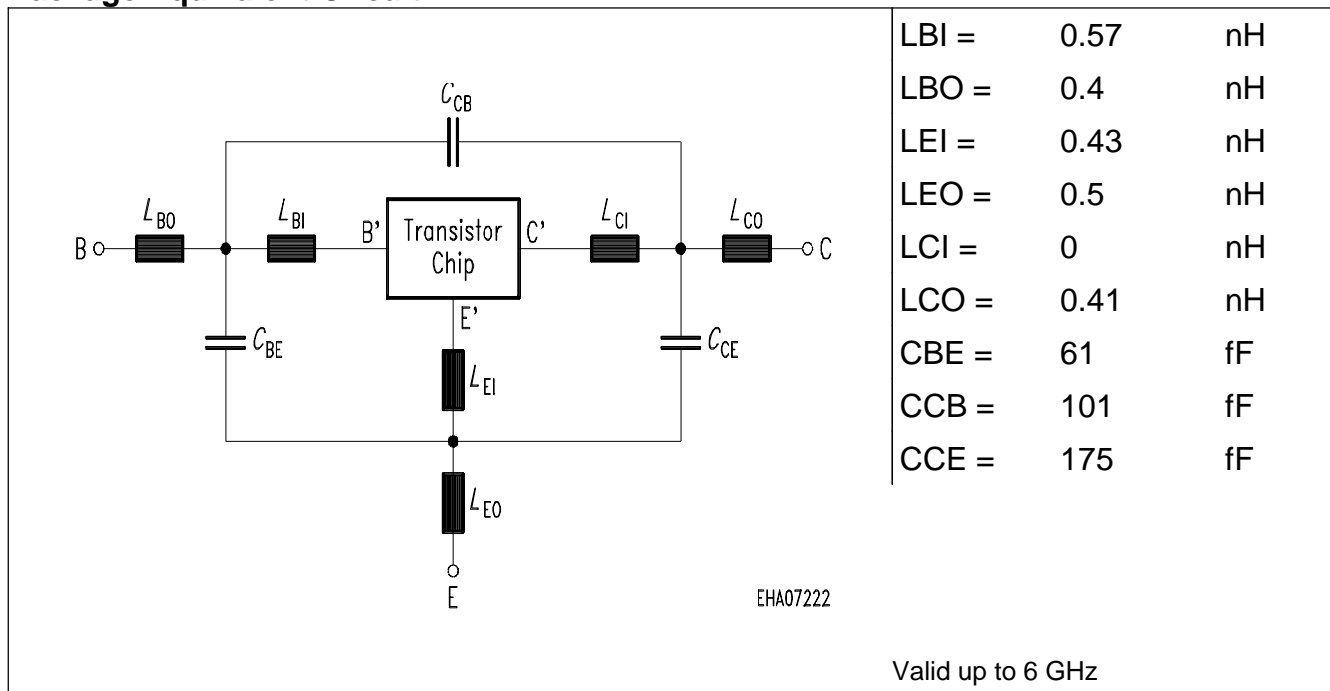
All parameters are ready to use, no scaling is necessary.

Extracted on behalf of SIEMENS Small Signal Semiconductors by:

Institut für Mobil-und Satellitenfunktechnik (IMST)

© 1996 SIEMENS AG

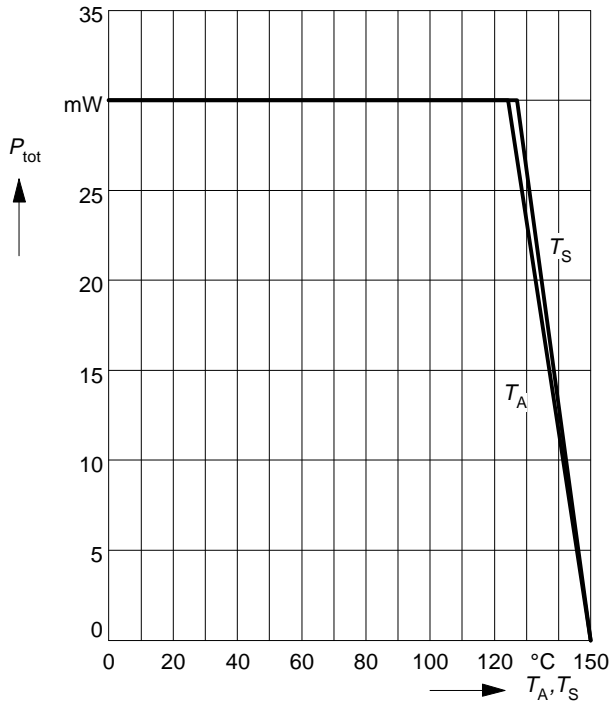
### Package Equivalent Circuit:



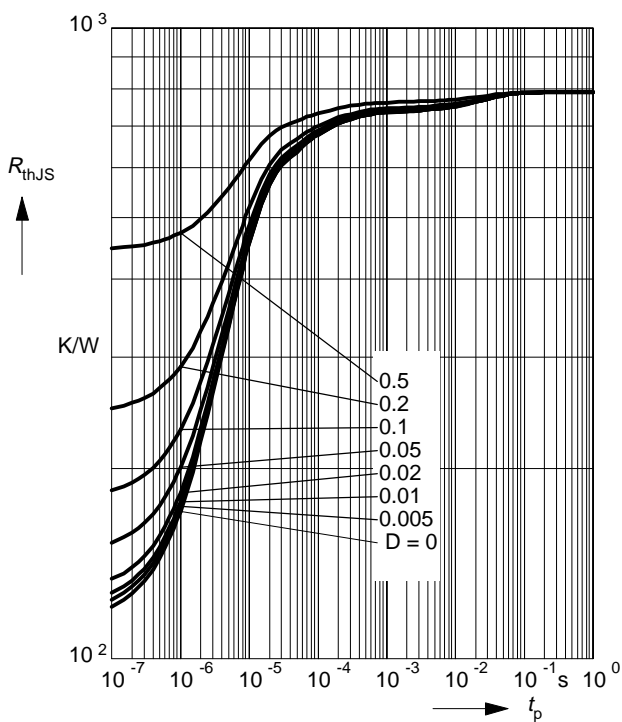
For examples and ready to use parameters please contact your local Siemens distributor or sales office to obtain a Siemens CD-ROM or see Internet: <http://www.siemens.de/Semiconductor/products/35/35.htm>

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

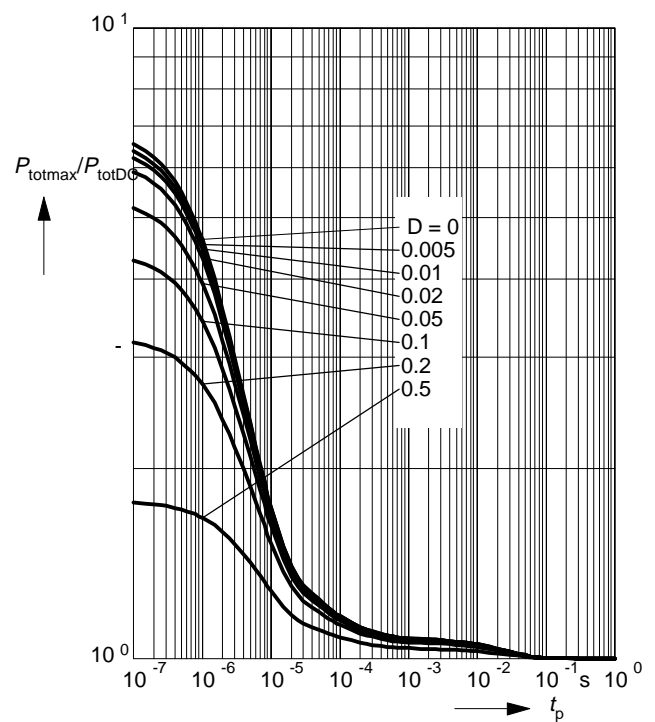
\* Package mounted on epoxy



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

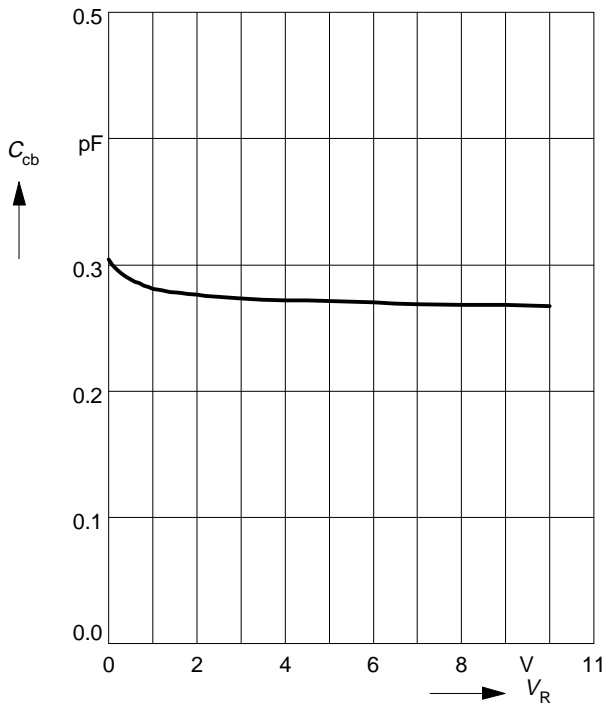


**Permissible Pulse Load**  $P_{totmax}/P_{totDC} = f(t_p)$



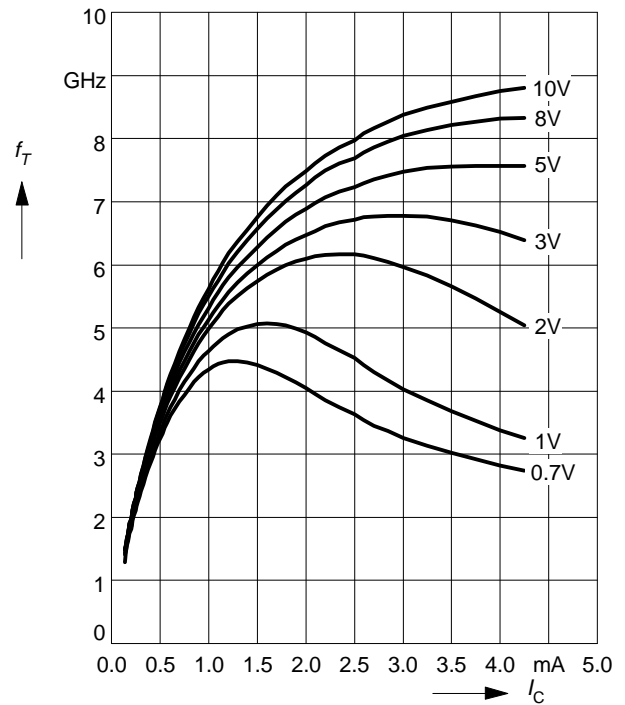
### Collector-base capacitance $C_{cb} = f(V_{CB})$

$V_{BE} = v_{be} = 0, f = 1\text{MHz}$



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

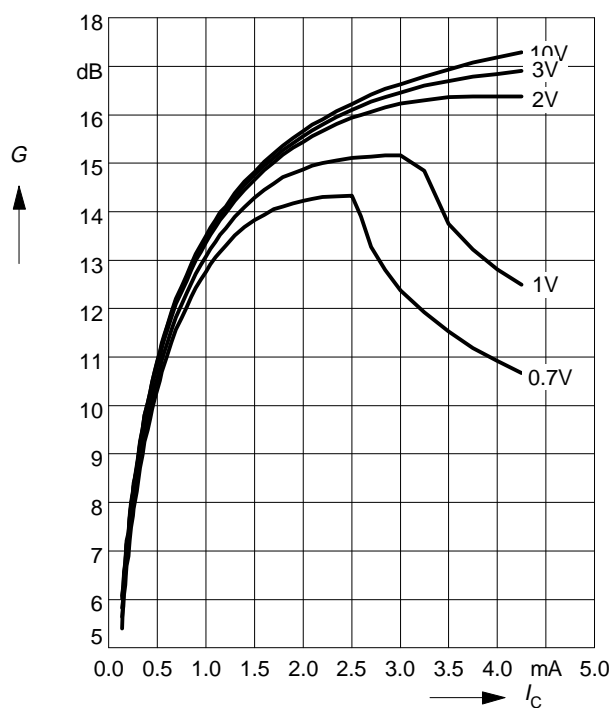
$V_{CE} = \text{Parameter}$



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

$f = 0.9\text{GHz}$

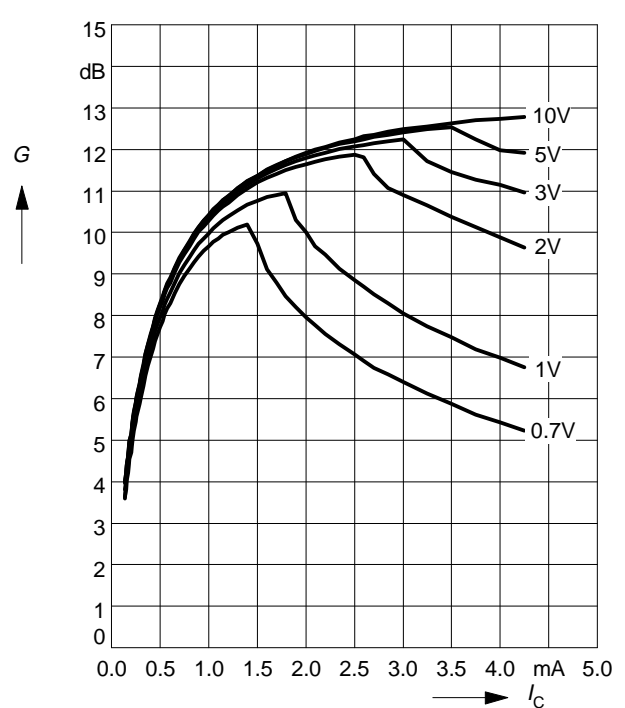
$V_{CE} = \text{Parameter}$



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

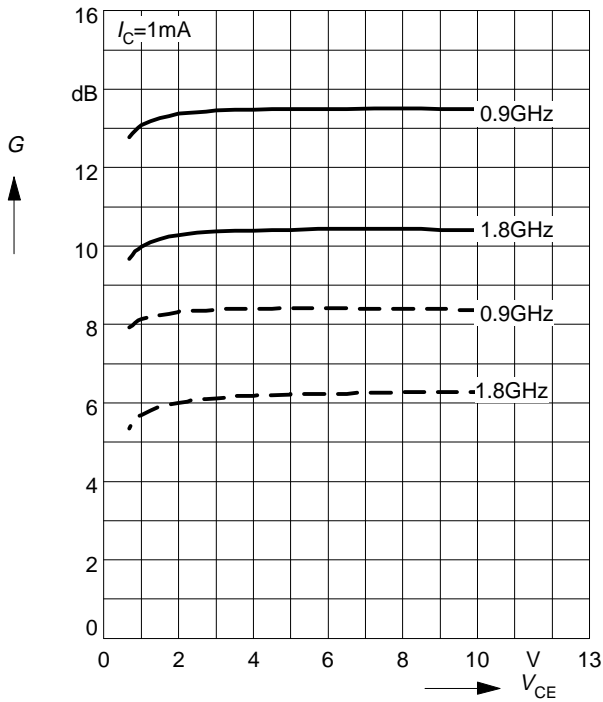
$f = 1.8\text{GHz}$

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



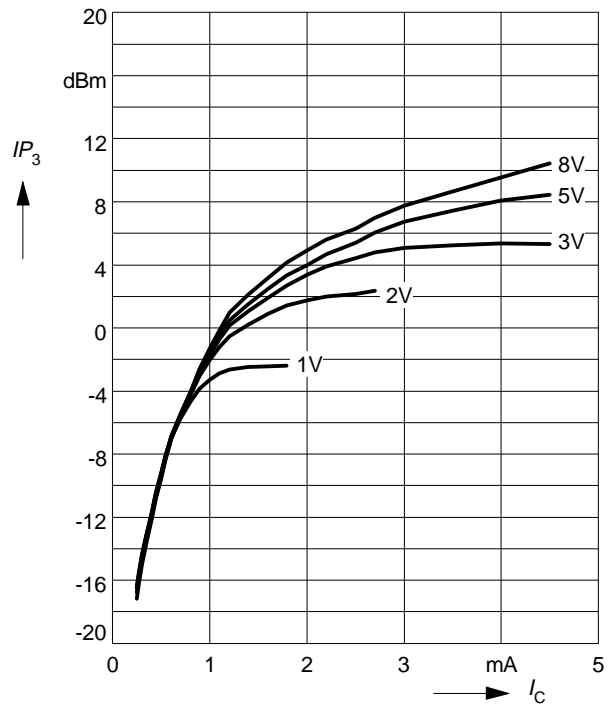
**Power Gain**  $G_{ma}, G_{ms} = f(V_{CE})$ : \_\_\_\_\_  
 $|S_{21}|^2 = f(V_{CE})$ : - - - - -

$f =$  Parameter



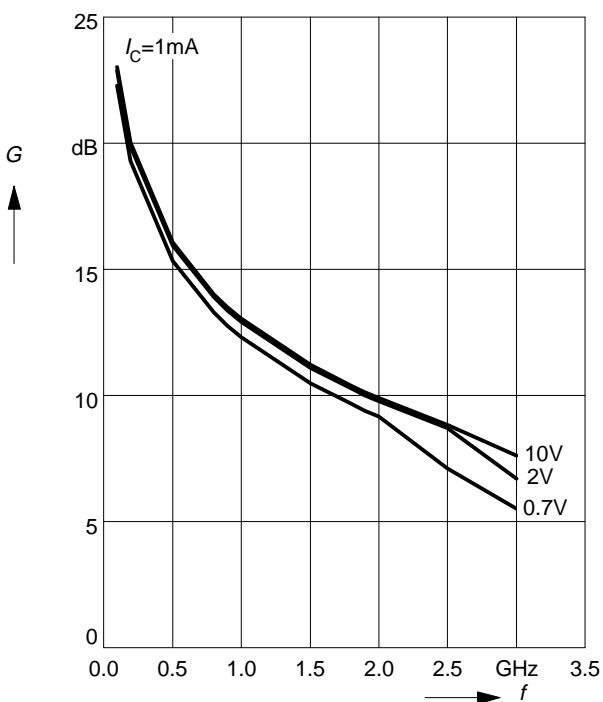
**Intermodulation Intercept Point**  $IP_3 = f(I_C)$   
 (3rd order, Output,  $Z_S = Z_L = 50\Omega$ )

$V_{CE} =$  Parameter,  $f = 900\text{MHz}$



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

$V_{CE} =$  Parameter



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

$V_{CE} =$  Parameter

