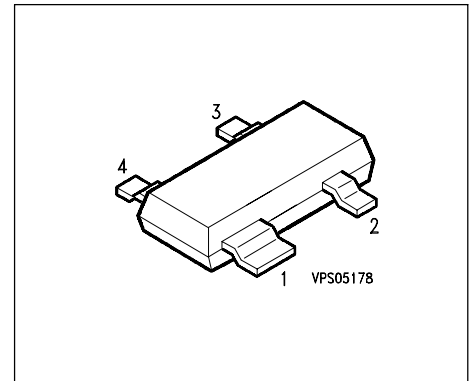


### NPN Silicon RF Transistor

- For low distortion broadband amplifiers and oscillators up to 2GHz at collector currents from 5 mA to 30 mA



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

| Type    | Marking | Ordering Code | Pin Configuration |       |       |       | Package |
|---------|---------|---------------|-------------------|-------|-------|-------|---------|
| BFP 93A | FES     | Q62702-F1144  | 1 = C             | 2 = E | 3 = B | 4 = E | SOT-143 |

### Maximum Ratings

| Parameter                                              | Symbol    | Values         | Unit             |
|--------------------------------------------------------|-----------|----------------|------------------|
| Collector-emitter voltage                              | $V_{CEO}$ | 12             | V                |
| Collector-emitter voltage                              | $V_{CES}$ | 20             |                  |
| Collector-base voltage                                 | $V_{CBO}$ | 20             |                  |
| Emitter-base voltage                                   | $V_{EBO}$ | 2              |                  |
| Collector current                                      | $I_C$     | 50             | mA               |
| Base current                                           | $I_B$     | 6              |                  |
| Total power dissipation<br>$T_S \leq 78^\circ\text{C}$ | $P_{tot}$ | 300            | mW               |
| Junction temperature                                   | $T_j$     | 150            | $^\circ\text{C}$ |
| Ambient temperature                                    | $T_A$     | - 65 ... + 150 |                  |
| Storage temperature                                    | $T_{stg}$ | - 65 ... + 150 |                  |

### Thermal Resistance

|                                          |            |            |     |
|------------------------------------------|------------|------------|-----|
| Junction - soldering point <sup>1)</sup> | $R_{thJS}$ | $\leq 240$ | 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. |               |
| DC Characteristics                                                        |               |        |      |      |               |
| Collector-emitter breakdown voltage<br>$I_C = 1\text{ mA}$ , $I_B = 0$    | $V_{(BR)CEO}$ | 12     | -    | -    | V             |
| Collector-emitter cutoff current<br>$V_{CE} = 20\text{ V}$ , $V_{BE} = 0$ | $I_{CES}$     | -      | -    | 100  | $\mu\text{A}$ |
| Collector-base cutoff current<br>$V_{CB} = 10\text{ V}$ , $I_E = 0$       | $I_{CBO}$     | -      | -    | 100  | nA            |
| Emitter-base cutoff current<br>$V_{EB} = 2\text{ V}$ , $I_C = 0$          | $I_{EBO}$     | -      | -    | 10   | $\mu\text{A}$ |
| DC current gain<br>$I_C = 30\text{ mA}$ , $V_{CE} = 8\text{ V}$           | $h_{FE}$      | 50     | 100  | 200  | -             |

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

| Parameter                                                                                                                                            | Symbol         | Values |             |        | Unit |
|------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|--------|-------------|--------|------|
|                                                                                                                                                      |                | min.   | typ.        | max.   |      |
| AC Characteristics                                                                                                                                   |                |        |             |        |      |
| Transition frequency<br>$I_C = 30\text{ mA}$ , $V_{CE} = 8\text{ V}$ , $f = 500\text{ MHz}$                                                          | $f_T$          | 4.5    | 6           | -      | GHz  |
| Collector-base capacitance<br>$V_{CB} = 10\text{ V}$ , $f = 1\text{ MHz}$                                                                            | $C_{cb}$       | -      | 0.5         | 0.8    | pF   |
| Collector-emitter capacitance<br>$V_{CE} = 10\text{ V}$ , $f = 1\text{ MHz}$                                                                         | $C_{ce}$       | -      | 0.33        | -      |      |
| Emitter-base capacitance<br>$V_{EB} = 0.5\text{ V}$ , $f = 1\text{ MHz}$                                                                             | $C_{eb}$       | -      | 1.7         | -      |      |
| Noise figure<br>$I_C = 5\text{ mA}$ , $V_{CE} = 8\text{ V}$ , $Z_S = Z_{Sopt}$<br>$f = 900\text{ MHz}$<br>$f = 1.8\text{ GHz}$                       | $F$            | -<br>- | 2<br>3.3    | -<br>- | dB   |
| Power gain 2)<br>$I_C = 30\text{ mA}$ , $V_{CE} = 8\text{ V}$ , $Z_S = Z_{Sopt}$<br>$Z_L = Z_{Lopt}$<br>$f = 900\text{ MHz}$<br>$f = 1.8\text{ GHz}$ | $G_{ma}$       | -<br>- | 18<br>12    | -<br>- |      |
| Transducer gain<br>$I_C = 30\text{ mA}$ , $V_{CE} = 8\text{ V}$ , $Z_S = Z_L = 50\text{ }\Omega$<br>$f = 900\text{ MHz}$<br>$f = 1.8\text{ GHz}$     | $ S_{21el} ^2$ | -<br>- | 14.5<br>8.5 | -<br>- |      |

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

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

### Transistor Chip Data

|       |         |          |       |          |          |        |          |          |
|-------|---------|----------|-------|----------|----------|--------|----------|----------|
| IS =  | 8.6752  | fA       | BF =  | 137.63   | -        | NF =   | 0.93633  | -        |
| VAF = | 20.011  | V        | IKF = | 0.33395  | A        | ISE =  | 2619.3   | fA       |
| NE =  | 1.5466  | -        | BR =  | 59       | -        | NR =   | 0.88761  | -        |
| VAR = | 26.834  | V        | IKR = | 0.015129 | A        | ISC =  | 0.70823  | fA       |
| NC =  | 1.95    | -        | RB =  | 7.2326   | $\Omega$ | IRB =  | 0.043806 | mA       |
| RBM = | 3.4649  | $\Omega$ | RE =  | 1.0075   | $\Omega$ | RC =   | 0.13193  | $\Omega$ |
| CJE = | 3.1538  | fF       | VJE = | 0.70393  | V        | MJE =  | 0.5071   | -        |
| TF =  | 33.388  | ps       | XTF = | 0.28319  | -        | VTF =  | 0.17765  | V        |
| ITF = | 2.5184  | mA       | PTF = | 0        | deg      | CJC =  | 1039.5   | fF       |
| VJC = | 0.72744 | V        | MJC = | 0.34565  | -        | XCJC = | 0.21422  | -        |
| TR =  | 1.1061  | ns       | CJS = | 0        | fF       | VJS =  | 0.75     | V        |
| MJS = | 0       | -        | XTB = | 0        | -        | EG =   | 1.11     | eV       |
| XTI = | 3       | -        | FC =  | 0.75935  | -        | TNOM   | 300      | K        |

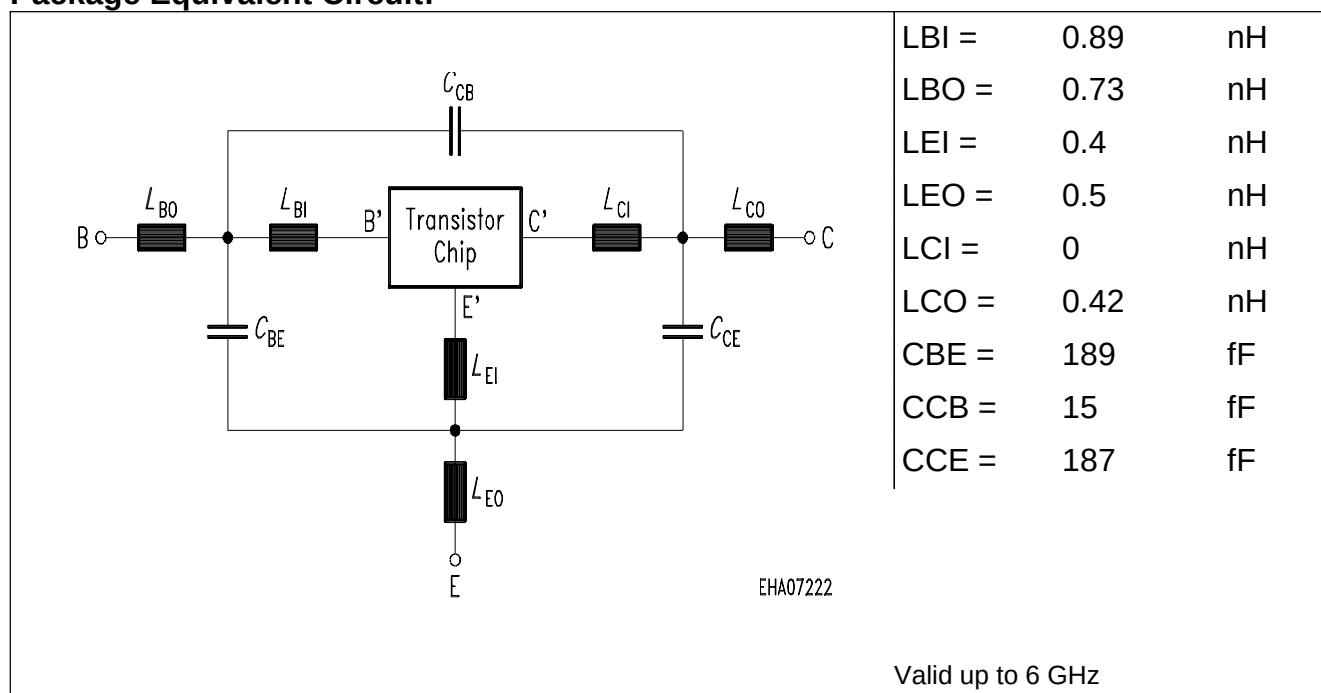
All parameters are ready to use, no scaling is necessary.

Extracted on behalf of SIEMENS Small Signal Semiconductors by:

Institut für Mobil-und Satellitenfunktechnik (IMST)

© 1996 SIEMENS AG

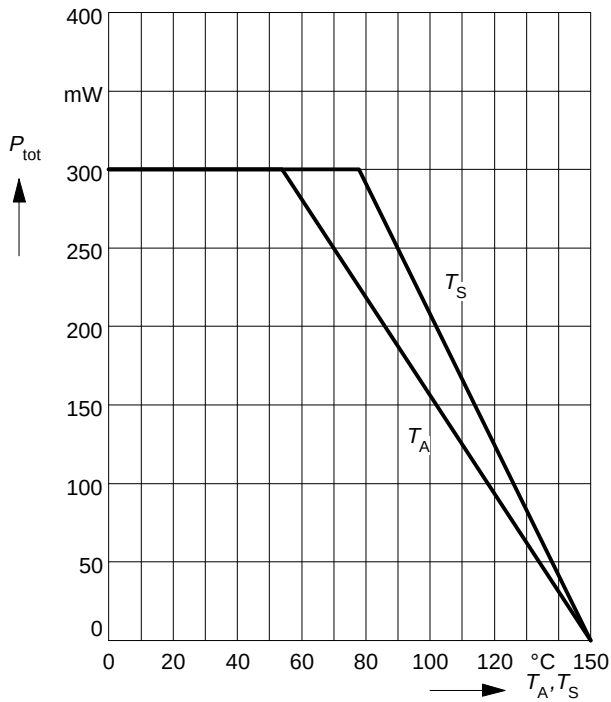
### Package Equivalent Circuit:



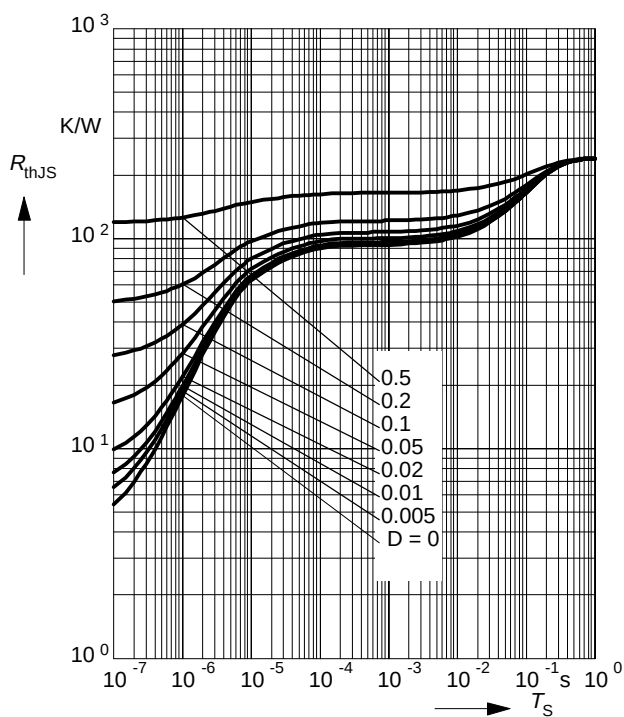
For examples and ready to use parameters please contact your local Siemens distributor or sales office to obtain a Siemens CD-ROM or see Internet: <http://www.siemens.de/Semiconductor/products/35/35.htm>

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

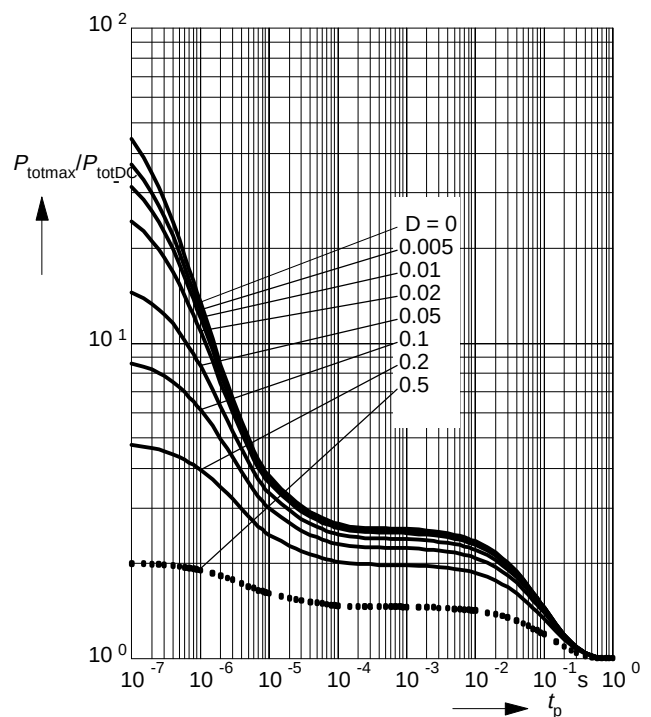
\* Package mounted on epoxy



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

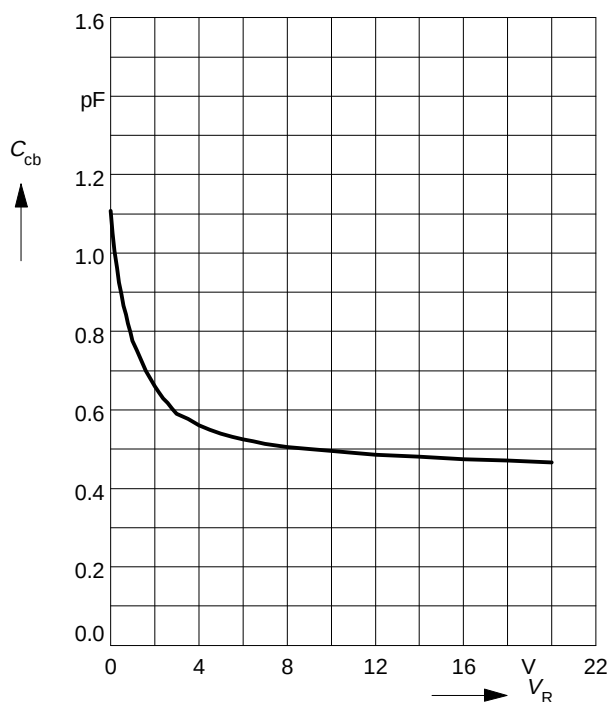


**Permissible Pulse Load**  $P_{\text{totmax}}/P_{\text{totDC}} = f(t_p)$



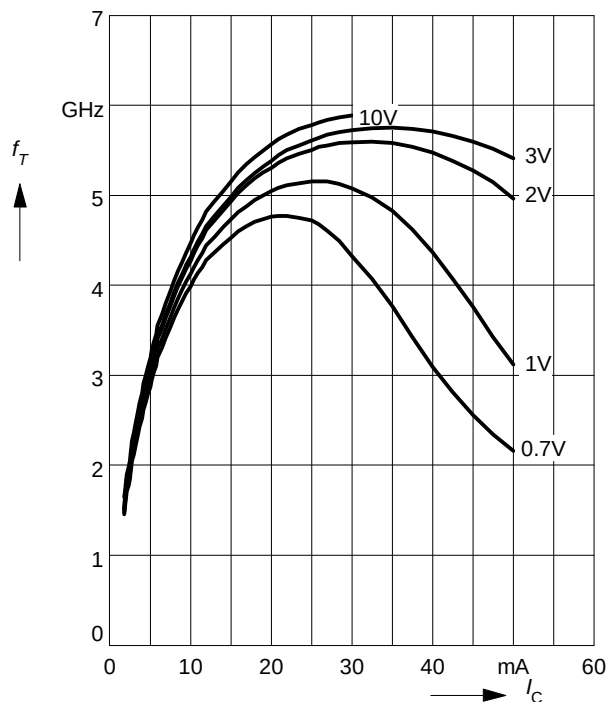
**Collector-base capacitance**  $C_{cb} = f(V_{CB})$

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



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

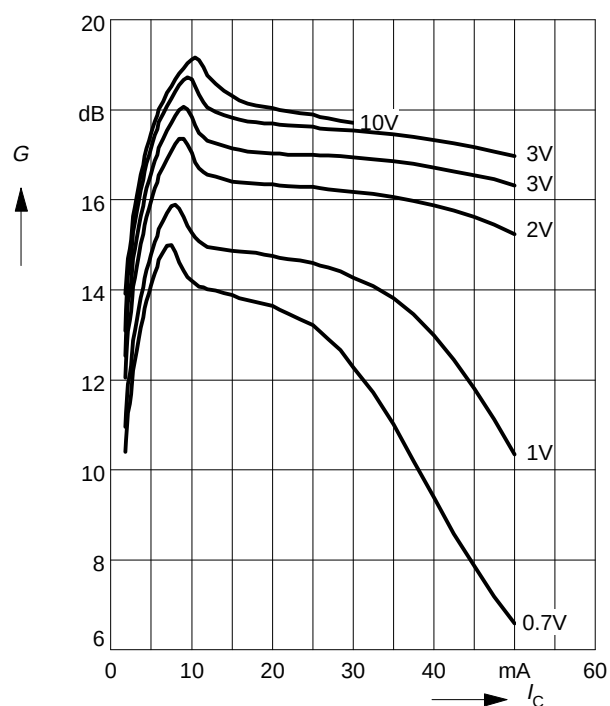
$V_{CE} = \text{Parameter}$



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

$f = 0.9\text{GHz}$

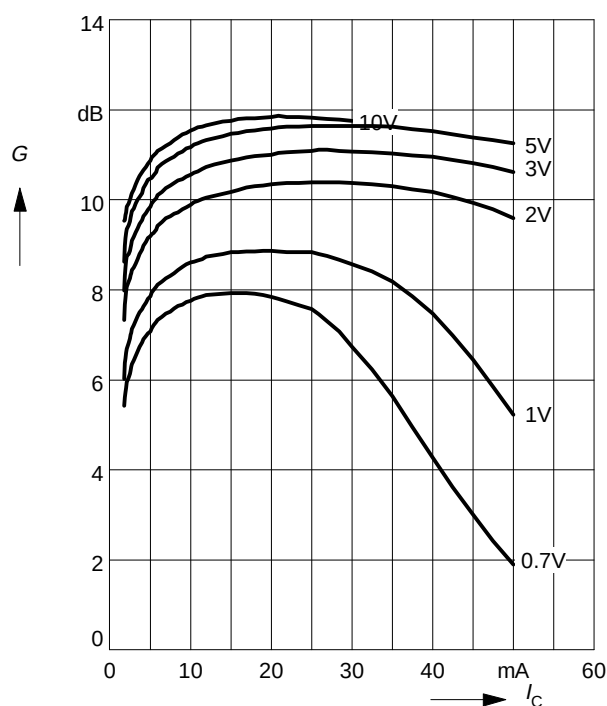
$V_{CE} = \text{Parameter}$



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

$f = 1.8\text{GHz}$

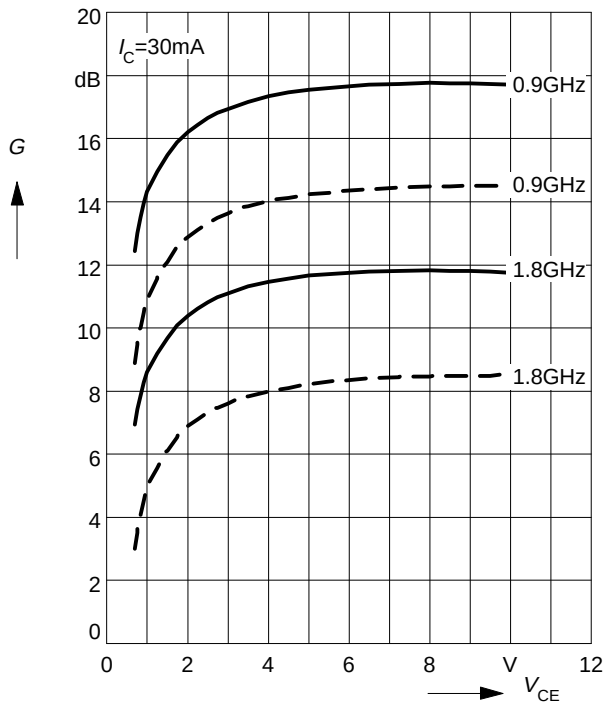
$V_{CE} = \text{Parameter}$



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

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

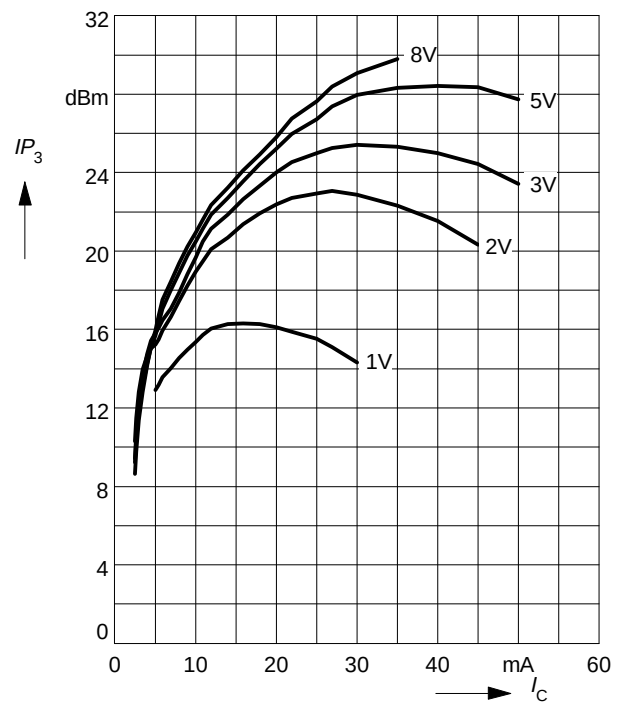
$f$  = Parameter



**Intermodulation Intercept Point**  $IP_3 = f(I_C)$

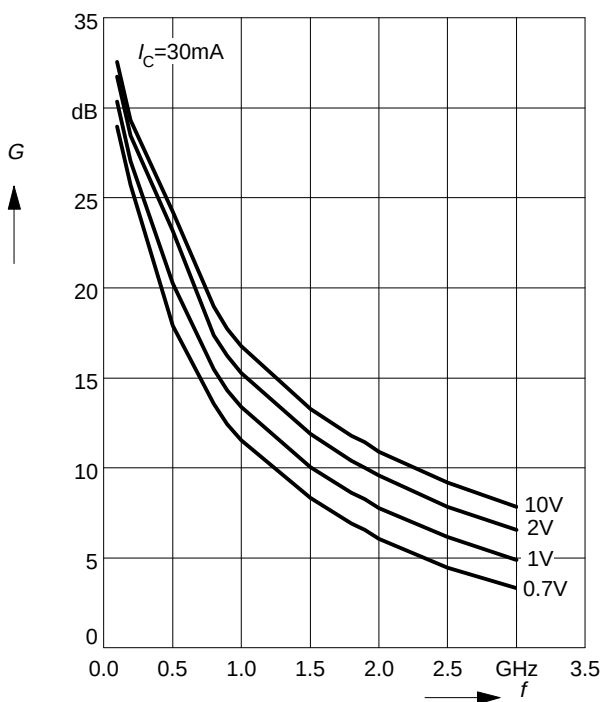
(3rd order, Output,  $Z_S = Z_L = 50\Omega$ )

$V_{CE}$  = 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

