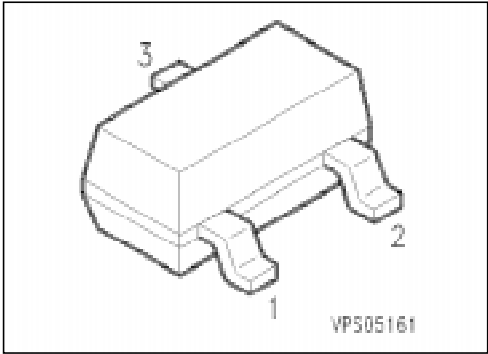


## PNP Silicon AF Transistors

**BCW 61**  
**BCX 71**

- For AF input stages and driver applications
- High current gain
- Low collector-emitter saturation voltage
- Low noise between 30 Hz and 15 kHz
- Complementary types: BCW 60, BCX 70 (NPN)



| Type      | Marking | Ordering Code<br>(tape and reel) | Pin Configuration |   |   | Package <sup>1)</sup> |
|-----------|---------|----------------------------------|-------------------|---|---|-----------------------|
|           |         |                                  | 1                 | 2 | 3 |                       |
| BCW 61 A  | BAs     | Q62702-C452                      | B                 | E | C | SOT-23                |
| BCW 61 B  | BBs     | Q62702-C1585                     |                   |   |   |                       |
| BCW 61 C  | BCs     | Q62702-C1478                     |                   |   |   |                       |
| BCW 61 D  | BDs     | Q62702-C1556                     |                   |   |   |                       |
| BCW 61 FF | BFs     | Q62702-C1890                     |                   |   |   |                       |
| BCW 61 FN | BNs     | Q62702-C1891                     |                   |   |   |                       |
| BCX 71G   | BGs     | Q62702-C1482                     |                   |   |   |                       |
| BCX 71H   | BHs     | Q62702-C1586                     |                   |   |   |                       |
| BCX 71J   | BJs     | Q62702-C1554                     |                   |   |   |                       |
| BCX 71 K  | BKs     | Q62702-C1654                     |                   |   |   |                       |

<sup>1)</sup> For detailed information see chapter Package Outlines.

## Maximum Ratings

| Parameter                                     | Symbol    | Values         |           |        | Unit |
|-----------------------------------------------|-----------|----------------|-----------|--------|------|
|                                               |           | BCW 61         | BCW 61 FF | BCX 71 |      |
| Collector-emitter voltage                     | $V_{CE0}$ | 32             | 32        | 45     | V    |
| Collector-base voltage                        | $V_{CB0}$ | 32             | 32        | 45     |      |
| Emitter-base voltage                          | $V_{EB0}$ | 5              |           |        |      |
| Collector current                             | $I_C$     | 100            |           |        | mA   |
| Peak collector current                        | $I_{CM}$  | 200            |           |        |      |
| Peak base current                             | $I_{BM}$  | 200            |           |        |      |
| Total power dissipation, $T_s = 71\text{ °C}$ | $P_{tot}$ | 330            |           |        | mW   |
| Junction temperature                          | $T_j$     | 150            |           |        | °C   |
| Storage temperature range                     | $T_{stg}$ | − 65 ... + 150 |           |        |      |

## Thermal Resistance

|                                  |             |       |     |
|----------------------------------|-------------|-------|-----|
| Junction - ambient <sup>1)</sup> | $R_{th JA}$ | ≤ 310 | K/W |
| Junction - soldering point       | $R_{th JS}$ | ≤ 240 |     |

<sup>1)</sup> Package mounted on epoxy pcb 40 mm × 40 mm × 1.5 mm/6 cm<sup>2</sup> Cu.

## 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>$I_C = 10\text{ mA}$                         | $V_{(BR)CE0}$ | 32<br>45 | —<br>— | —<br>— | V             |
| Collector-base breakdown voltage<br>$I_C = 10\text{ }\mu\text{A}$                   | $V_{(BR)CB0}$ | 32<br>45 | —<br>— | —<br>— |               |
| Emitter-base breakdown voltage<br>$I_E = 1\text{ }\mu\text{A}$                      | $V_{(BR)EB0}$ | 5        | —      | —      |               |
| Collector cutoff current<br>$V_{CB} = 32\text{ V}$                                  | $I_{CB0}$     | —        | —      | 20     | nA            |
| $V_{CB} = 45\text{ V}$                                                              |               | —        | —      | 20     | nA            |
| $V_{CB} = 32\text{ V}, T_A = 150^\circ\text{C}$                                     |               | —        | —      | 20     | $\mu\text{A}$ |
| $V_{CB} = 45\text{ V}, T_A = 150^\circ\text{C}$                                     |               | —        | —      | 20     | $\mu\text{A}$ |
| Emitter cutoff current<br>$V_{EB} = 4\text{ V}$                                     | $I_{EB0}$     | —        | —      | 20     | nA            |
| DC current gain <sup>1)</sup><br>$I_C = 10\text{ }\mu\text{A}, V_{CE} = 5\text{ V}$ | $h_{FE}$      |          |        |        | —             |
| BCW 61 A, BCX 71 G                                                                  |               | 20       | 140    | —      |               |
| BCW 61 B, BCX 71 H                                                                  |               | 30       | 200    | —      |               |
| BCW 61 FF, BCW 61 C, BCX 71 J                                                       |               | 40       | 300    | —      |               |
| BCW 61 FN, BCW 61 D, BCX 71 K                                                       |               | 100      | 460    | —      |               |
| $I_C = 2\text{ mA}, V_{CE} = 5\text{ V}$                                            |               |          |        |        |               |
| BCW 61 A, BCX 71 G                                                                  |               | 120      | 170    | 220    |               |
| BCW 61 B, BCX 71 H                                                                  |               | 180      | 250    | 310    |               |
| BCW 61 FF, BCW 61 C, BCX 71 J                                                       |               | 250      | 350    | 460    |               |
| BCW 61 FN, BCW 61 D, BCX 71 K                                                       |               | 380      | 500    | 630    |               |
| $I_C = 50\text{ mA}, V_{CE} = 1\text{ V}$                                           |               |          |        |        |               |
| BCW 61 A, BCX 71 G                                                                  |               | 60       | —      | —      |               |
| BCW 61 B, BCX 71 H                                                                  |               | 80       | —      | —      |               |
| BCW 61 FF, BCW 61 C, BCX 71 J                                                       |               | 100      | —      | —      |               |
| BCW 61 FN, BCW 61 D, BCX 71 K                                                       |               | 110      | —      | —      |               |

<sup>1)</sup> Pulse test:  $t \leq 300\text{ }\mu\text{s}$ ,  $D \leq 2\%$ .

### Electrical Characteristics

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

| Parameter | Symbol | Values |      |      | Unit |
|-----------|--------|--------|------|------|------|
|           |        | min.   | typ. | max. |      |

### DC characteristics

|                                                                                                                                                                                            |              |                |                      |                |   |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|----------------|----------------------|----------------|---|
| Collector-emitter saturation voltage <sup>1)</sup><br>$I_C = 10\text{ mA}$ , $I_B = 0.25\text{ mA}$<br>$I_C = 50\text{ mA}$ , $I_B = 1.25\text{ mA}$                                       | $V_{CEsat}$  | —<br>—         | 0.12<br>0.20         | 0.25<br>0.55   | V |
| Base-emitter saturation voltage <sup>1)</sup><br>$I_C = 10\text{ mA}$ , $I_B = 0.25\text{ mA}$<br>$I_C = 50\text{ mA}$ , $I_B = 1.25\text{ mA}$                                            | $V_{BEsat}$  | —<br>—         | 0.70<br>0.83         | 0.85<br>1.05   |   |
| Base-emitter voltage <sup>1)</sup><br>$I_C = 10\text{ }\mu\text{A}$ , $V_{CE} = 5\text{ V}$<br>$I_C = 2\text{ mA}$ , $V_{CE} = 5\text{ V}$<br>$I_C = 50\text{ mA}$ , $V_{CE} = 1\text{ V}$ | $V_{BE(on)}$ | —<br>0.55<br>— | 0.52<br>0.65<br>0.78 | —<br>0.75<br>— |   |

### AC characteristics

|                                                                                                                                                                                                                               |           |                  |                          |                  |                  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|------------------|--------------------------|------------------|------------------|
| Transition frequency<br>$I_C = 20\text{ mA}$ , $V_{CE} = 5\text{ V}$ , $f = 100\text{ MHz}$                                                                                                                                   | $f_T$     | —                | 250                      | —                | MHz              |
| Output capacitance<br>$V_{CB} = 10\text{ V}$ , $f = 1\text{ MHz}$                                                                                                                                                             | $C_{obo}$ | —                | 3                        | —                | pF               |
| Input capacitance<br>$V_{CB} = 0.5\text{ V}$ , $f = 1\text{ MHz}$                                                                                                                                                             | $C_{ibo}$ | —                | 8                        | —                |                  |
| Short-circuit input impedance<br>$I_C = 2\text{ mA}$ , $V_{CE} = 5\text{ V}$ , $f = 1\text{ kHz}$<br>BCW 61 A, BCX 71 G<br>BCW 61 B, BCX 71 H<br>BCW 61 FF, BCW 61 C, BCX 71 J<br>BCW 61 FN, BCW 61 D, BCX 71 K               | $h_{11e}$ | —<br>—<br>—<br>— | 2.7<br>3.6<br>4.5<br>7.5 | —<br>—<br>—<br>— | $\text{k}\Omega$ |
| Open-circuit reverse voltage transfer ratio<br>$I_C = 2\text{ mA}$ , $V_{CE} = 5\text{ V}$ , $f = 1\text{ kHz}$<br>BCW 61 A, BCX 71 G<br>BCW 61 B, BCX 71 H<br>BCW 61 FF, BCW 61 C, BCX 71 J<br>BCW 61 FN, BCW 61 D, BCX 71 K | $h_{12e}$ | —<br>—<br>—      | 1.5<br>2.0<br>2.0<br>3.0 | —<br>—<br>—      |                  |

<sup>1)</sup> Pulse test:  $t \leq 300\text{ }\mu\text{s}$ ,  $D \leq 2\%$ .

### Electrical Characteristics

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

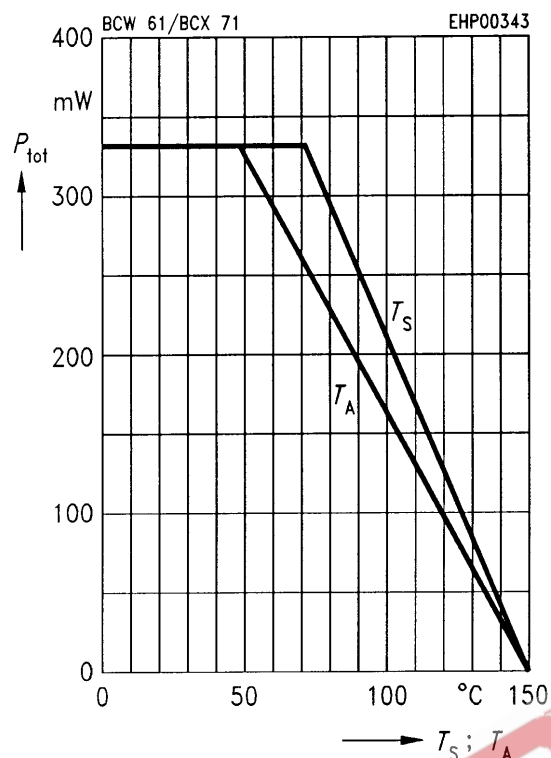
| Parameter | Symbol | Values |      |      | Unit |
|-----------|--------|--------|------|------|------|
|           |        | min.   | typ. | max. |      |

### AC characteristics

|                                                                                                                                                                                                                                       |           |   |     |      |               |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|---|-----|------|---------------|
| <b>Short-circuit forward current transfer ratio</b><br>$I_C = 2\text{ mA}$ , $V_{CE} = 5\text{ V}$ , $f = 1\text{ kHz}$<br>BCW 61 A, BCX 71 G<br>BCW 61 B, BCX 71 H<br>BCW 61 FF, BCW 61 C, BCX 71 J<br>BCW 61 FN, BCW 61 D, BCX 71 K | $h_{21e}$ | — | 200 | —    | —             |
|                                                                                                                                                                                                                                       |           | — | 260 | —    |               |
|                                                                                                                                                                                                                                       |           | — | 330 | —    |               |
|                                                                                                                                                                                                                                       |           | — | 520 | —    |               |
| <b>Open-circuit output admittance</b><br>$I_C = 2\text{ mA}$ , $V_{CE} = 5\text{ V}$ , $f = 1\text{ kHz}$<br>BCW 61 A, BCX 71 G<br>BCW 61 B, BCX 71 H<br>BCW 61 FF, BCW 61 C, BCX 71 J<br>BCW 61 FN, BCW 61 D, BCX 71 K               | $h_{22e}$ | — | 18  | —    | $\mu\text{S}$ |
|                                                                                                                                                                                                                                       |           | — | 24  | —    |               |
|                                                                                                                                                                                                                                       |           | — | 30  | —    |               |
|                                                                                                                                                                                                                                       |           | — | 50  | —    |               |
| <b>Noise figure</b><br>$I_C = 0.2\text{ mA}$ , $V_{CE} = 5\text{ V}$ , $R_S = 2\text{ k}\Omega$<br>$f = 1\text{ kHz}$ , $\Delta f = 200\text{ Hz}$<br>BCW 61 A to BCX 71 K<br>BCW 61 FF, BCW 61 FN                                    | $F$       | — | 2   | —    | dB            |
|                                                                                                                                                                                                                                       |           | — | 1   | 2    |               |
| <b>Equivalent noise voltage</b><br>$I_C = 0.2\text{ mA}$ , $V_{CE} = 5\text{ V}$ , $R_S = 2\text{ k}\Omega$<br>$f = 10\text{ Hz} \dots 50\text{ Hz}$<br>BCW 61 FF, BCW 61 FN                                                          | $V_n$     | — | —   | 0.11 | $\mu\text{V}$ |

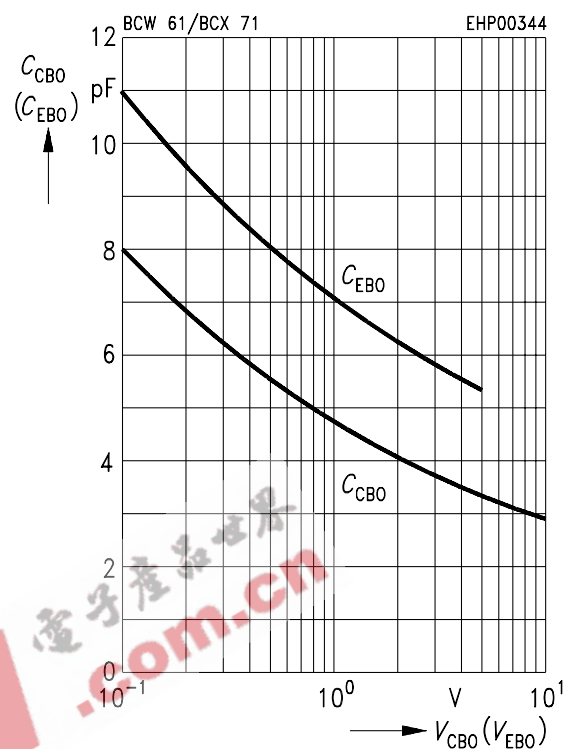
## Total power dissipation $P_{\text{tot}} = f(T_A^*; T_S)$

\* Package mounted on epoxy



## Collector-base capacitance $C_{\text{CB0}} = f(V_{\text{CB0}})$

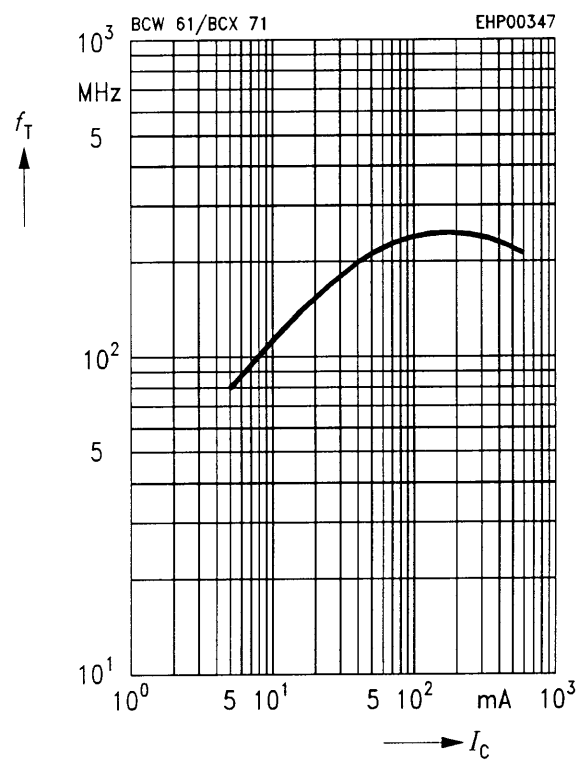
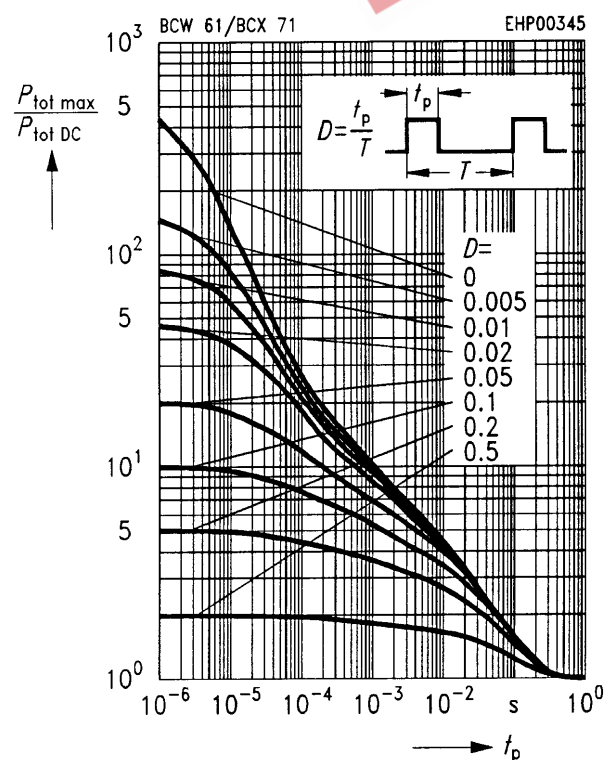
Emitter-base capacitance  $C_{\text{EB0}} = f(V_{\text{EB0}})$



## Permissible pulse load $P_{\text{tot max}}/P_{\text{tot DC}} = f(t_p)$

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

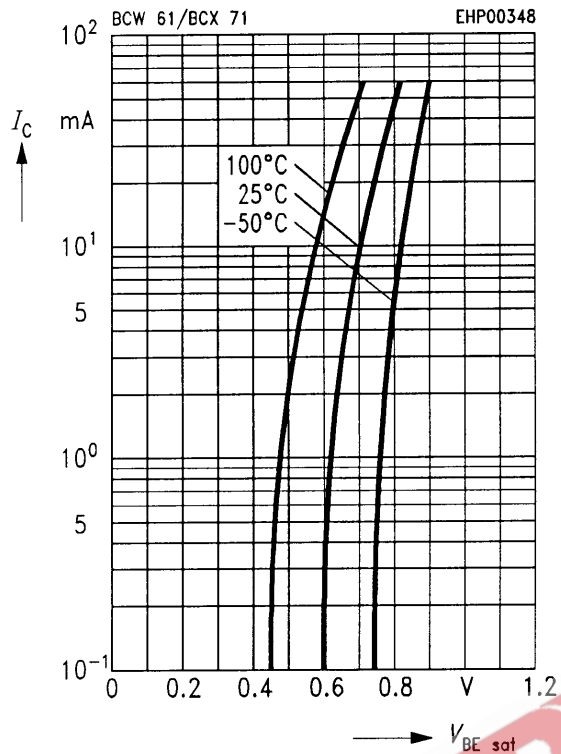
$V_{\text{CE}} = 5 \text{ V}$



### Base-emitter saturation voltage

$$I_C = f(V_{BEsat})$$

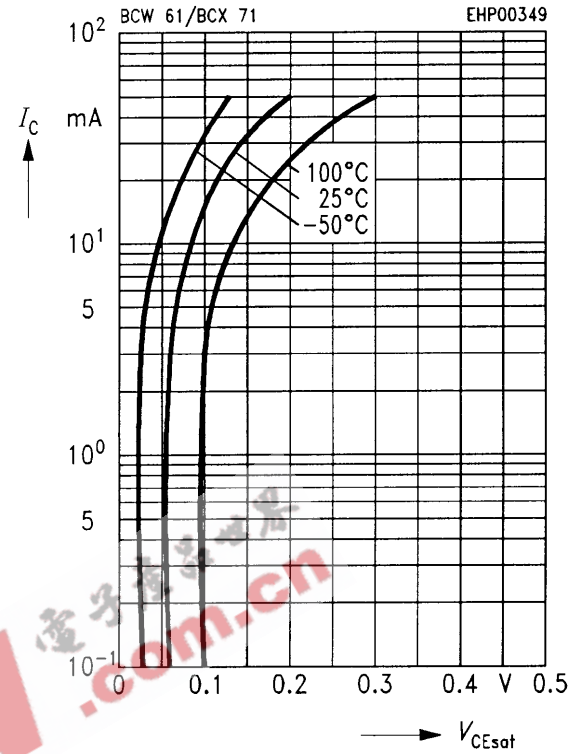
$$h_{FE} = 40$$



### Collector-emitter saturation voltage

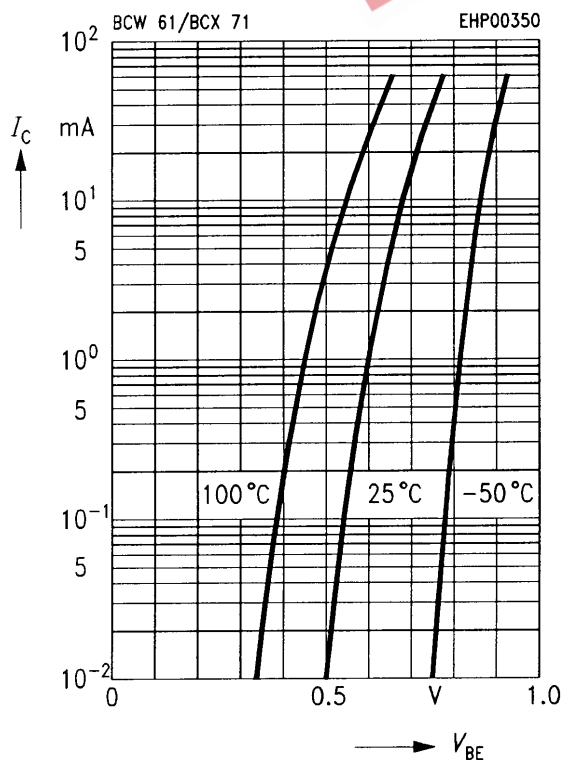
$$I_C = f(V_{CEsat})$$

$$h_{FE} = 40$$



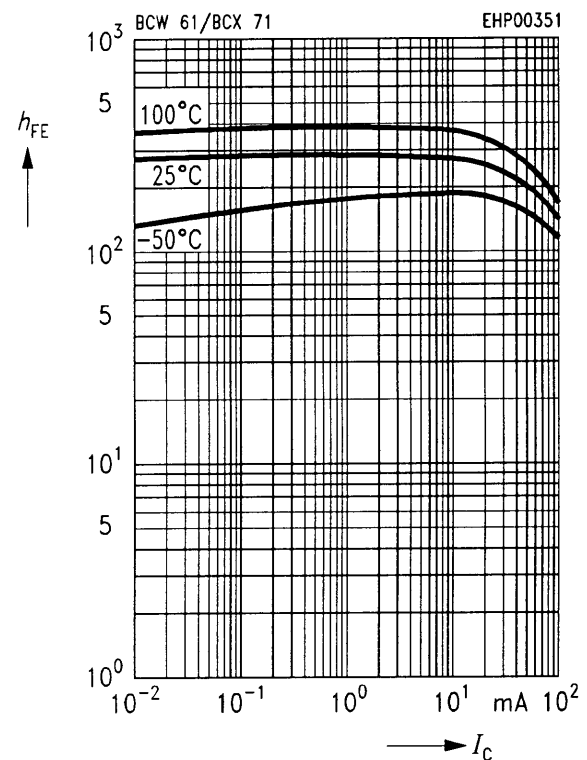
### Collector current $I_C = f(V_{BE})$

$$V_{CE} = 5 \text{ V}$$

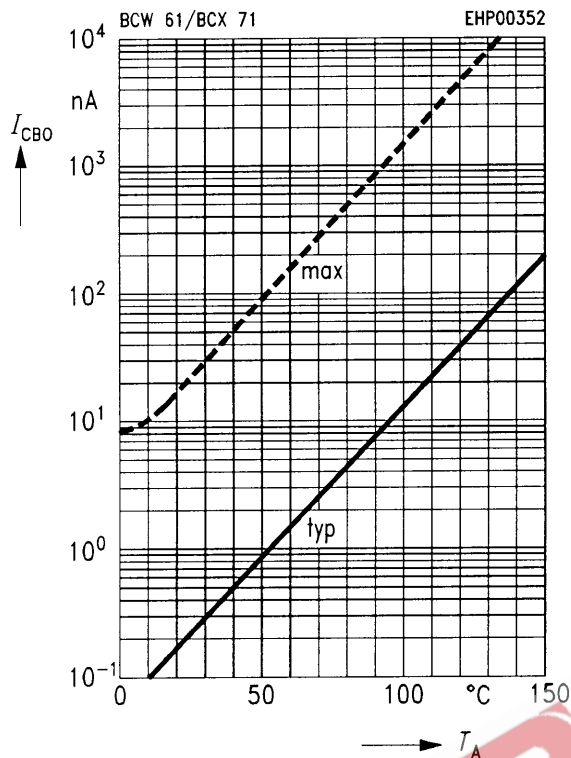


### DC current gain $h_{FE} = f(I_C)$

$$V_{CE} = 5 \text{ V}$$

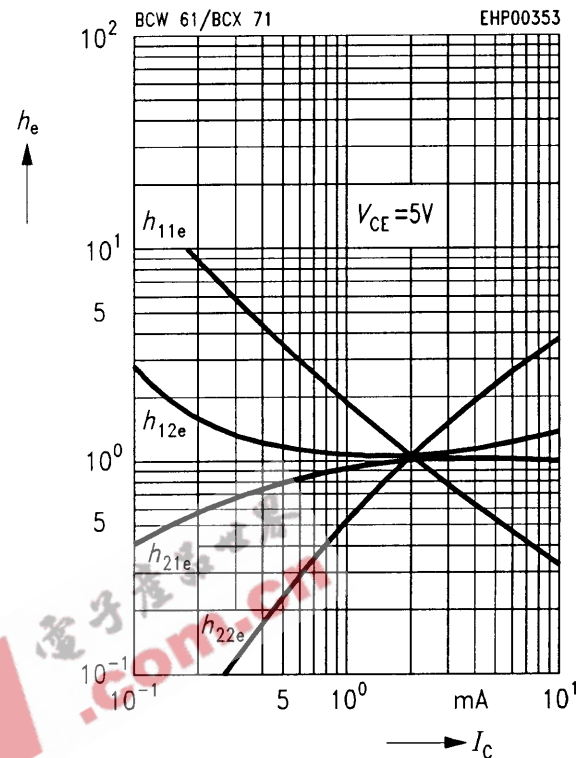


Collector cutoff current  $I_{CB0} = f(T_A)$



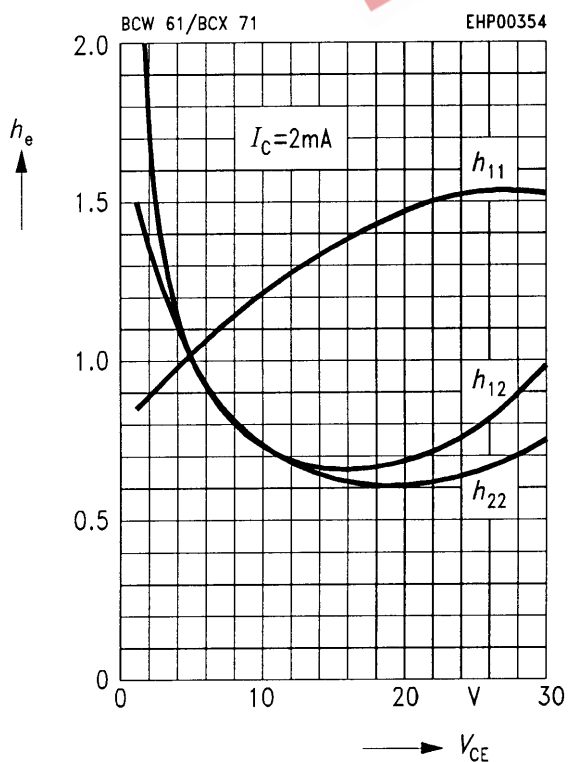
h parameter  $h_e = f(I_C)$

$V_{CE} = 5\text{ V}$



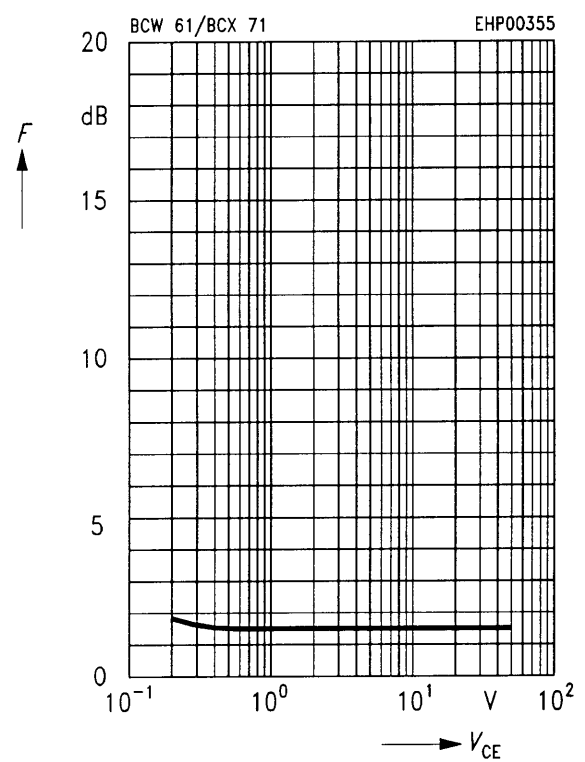
h parameter  $h_e = f(V_{CE})$

$I_C = 2\text{ mA}$



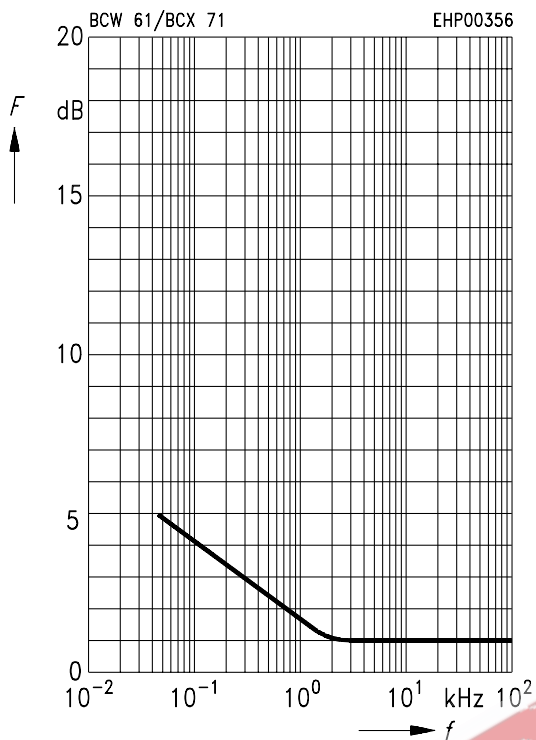
Noise figure  $F = f(V_{CE})$

$I_C = 0.2\text{ mA}$ ,  $R_S = 2\text{ k}\Omega$ ,  $f = 1\text{ kHz}$



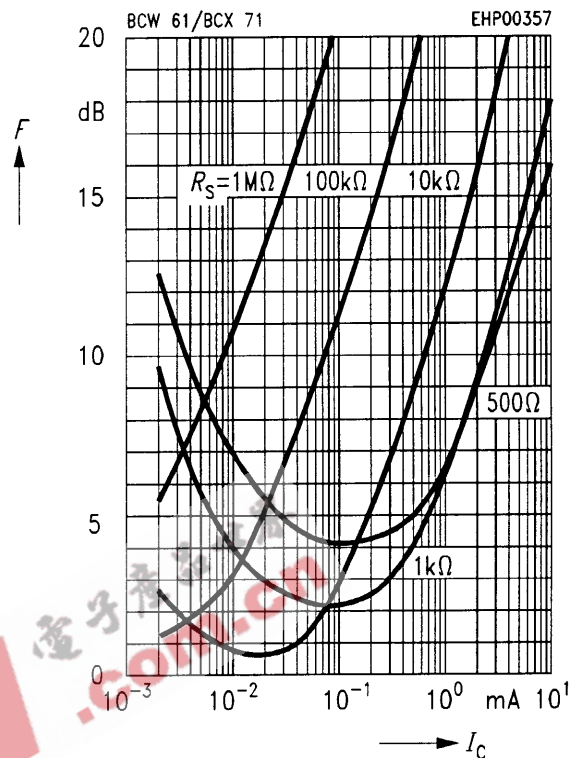
## Noise figure $F = f(f)$

$I_C = 0.2 \text{ mA}$ ,  $R_S = 2 \text{ k}\Omega$ ,  $V_{CE} = 5 \text{ V}$



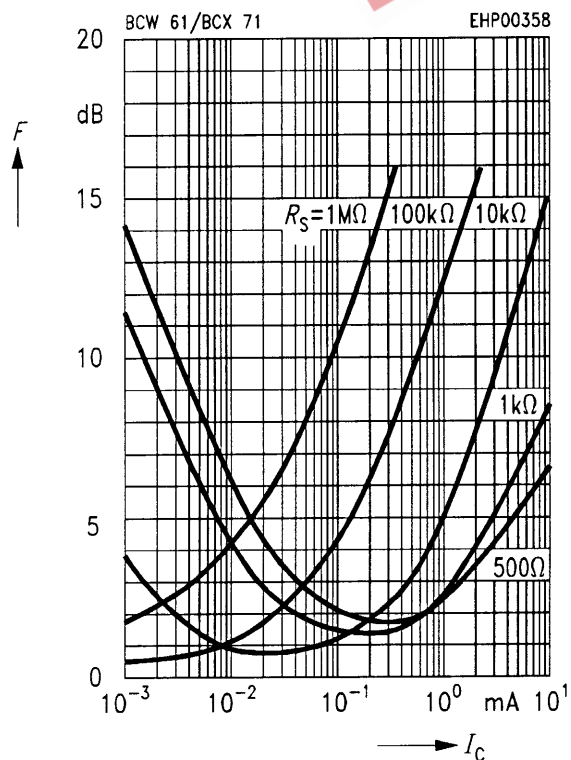
## Noise figure $F = f(I_C)$

$V_{CE} = 5 \text{ V}$ ,  $f = 120 \text{ Hz}$



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

$V_{CE} = 5 \text{ V}$ ,  $f = 1 \text{ kHz}$



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

$V_{CE} = 5 \text{ V}$ ,  $f = 10 \text{ kHz}$

