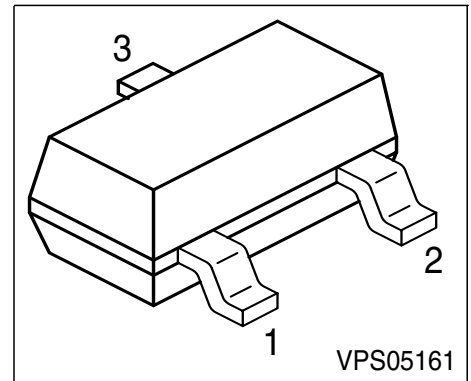


**PNP Silicon AF Transistors**

- 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: BC846, BC847, BC848  
BC849, BC850 (NPN)



| Type   | Marking | Pin Configuration |       |       | Package |
|--------|---------|-------------------|-------|-------|---------|
| BC856A | 3As     | 1 = B             | 2 = E | 3 = C | SOT23   |
| BC856B | 3Bs     | 1 = B             | 2 = E | 3 = C | SOT23   |
| BC857A | 3Es     | 1 = B             | 2 = E | 3 = C | SOT23   |
| BC857B | 3Fs     | 1 = B             | 2 = E | 3 = C | SOT23   |
| BC857C | 3Gs     | 1 = B             | 2 = E | 3 = C | SOT23   |
| BC858A | 3Js     | 1 = B             | 2 = E | 3 = C | SOT23   |
| BC858B | 3Ks     | 1 = B             | 2 = E | 3 = C | SOT23   |
| BC858C | 3Ls     | 1 = B             | 2 = E | 3 = C | SOT23   |
| BC859A | 4As     | 1 = B             | 2 = E | 3 = C | SOT23   |
| BC859B | 4Bs     | 1 = B             | 2 = E | 3 = C | SOT23   |
| BC859C | 4Cs     | 1 = B             | 2 = E | 3 = C | SOT23   |
| BC860B | 4Fs     | 1 = B             | 2 = E | 3 = C | SOT23   |
| BC860C | 4Gs     | 1 = B             | 2 = E | 3 = C | SOT23   |

**Maximum Ratings**

| Parameter                                     | Symbol    | BC856       | BC857<br>BC860 | BC858<br>BC859 | Unit |
|-----------------------------------------------|-----------|-------------|----------------|----------------|------|
| Collector-emitter voltage                     | $V_{CEO}$ | 65          | 45             | 30             | V    |
| Collector-base voltage                        | $V_{CBO}$ | 80          | 50             | 30             |      |
| Collector-emitter voltage                     | $V_{CES}$ | 80          | 50             | 30             |      |
| Emitter-base voltage                          | $V_{EBO}$ | 5           | 5              | 5              |      |
| DC collector current                          | $I_C$     | 100         |                |                | mA   |
| Peak collector current                        | $I_{CM}$  | 200         |                |                | mA   |
| Peak base current                             | $I_{BM}$  | 200         |                |                |      |
| Peak emitter current                          | $I_{EM}$  | 200         |                |                |      |
| Total power dissipation, $T_S = 71\text{ °C}$ | $P_{tot}$ | 330         |                |                | mW   |
| Junction temperature                          | $T_j$     | 150         |                |                | °C   |
| Storage temperature                           | $T_{sta}$ | -65 ... 150 |                |                |      |

**Thermal Resistance**

|                                          |            |      |     |
|------------------------------------------|------------|------|-----|
| Junction - soldering point <sup>1)</sup> | $R_{thJS}$ | ≤240 | K/W |
|------------------------------------------|------------|------|-----|

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

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

**DC Characteristics**

|                                                                               |           |               |    |   |   |   |
|-------------------------------------------------------------------------------|-----------|---------------|----|---|---|---|
| Collector-emitter breakdown voltage<br>$I_C = 10\text{ mA}$ , $I_B = 0$       | BC856     | $V_{(BR)CEO}$ | 65 | - | - | V |
|                                                                               | BC857/860 |               | 45 | - | - |   |
|                                                                               | BC858/859 |               | 30 | - | - |   |
|                                                                               |           |               |    |   |   |   |
| Collector-base breakdown voltage<br>$I_C = 10\text{ }\mu\text{A}$ , $I_E = 0$ | BC856     | $V_{(BR)CBO}$ | 80 | - | - |   |
|                                                                               | BC857/860 |               | 50 | - | - |   |
|                                                                               | BC858/859 |               | 30 | - | - |   |
|                                                                               |           |               |    |   |   |   |

<sup>1)</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.

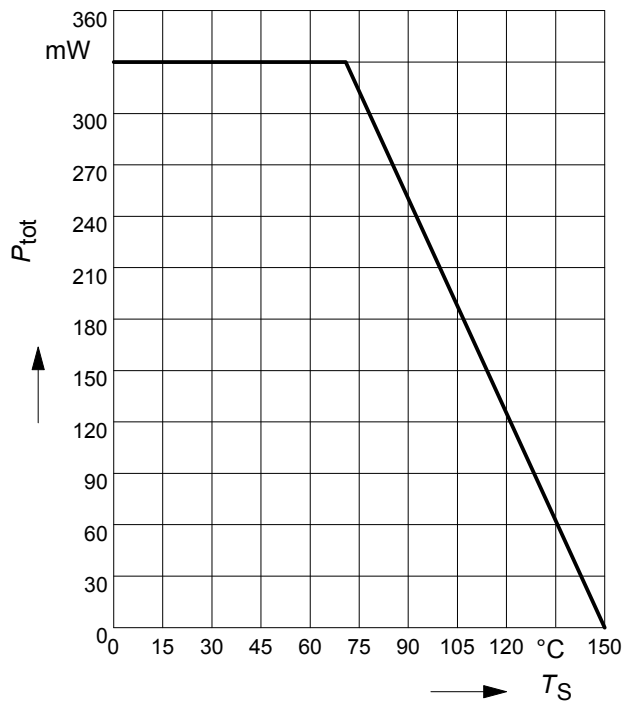
| Parameter                                                                                                                                                                                             | Symbol        | Values            |                   |                   | Unit          |    |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|-------------------|-------------------|-------------------|---------------|----|
|                                                                                                                                                                                                       |               | min.              | typ.              | max.              |               |    |
| DC Characteristics                                                                                                                                                                                    |               |                   |                   |                   |               |    |
| Collector-emitter breakdown voltage<br>$I_C = 10\ \mu\text{A}$ , $V_{BE} = 0$<br><div>BC856<br/>BC857/860<br/>BC858/859</div>                                                                         | $V_{(BR)CES}$ | 80<br>50<br>30    | -<br>-<br>-       | -<br>-<br>-       | V             |    |
| Emitter-base breakdown voltage<br>$I_E = 1\ \mu\text{A}$ , $I_C = 0$                                                                                                                                  | $V_{(BR)EBO}$ | 5                 | -                 | -                 |               |    |
| Collector cutoff current<br>$V_{CB} = 30\ \text{V}$ , $I_E = 0$                                                                                                                                       | $I_{CBO}$     | -                 | -                 | 15                | nA            |    |
| Collector cutoff current<br>$V_{CB} = 30\ \text{V}$ , $I_E = 0$ , $T_A = 150\ ^\circ\text{C}$                                                                                                         | $I_{CBO}$     | -                 | -                 | 5                 | $\mu\text{A}$ |    |
| DC current gain 1)<br>$I_C = 10\ \mu\text{A}$ , $V_{CE} = 5\ \text{V}$<br><div><math>h_{FE}</math>-group <b>A</b><br/><math>h_{FE}</math>-group <b>B</b><br/><math>h_{FE}</math>-group <b>C</b></div> | $h_{FE}$      | -<br>-<br>-       | 140<br>250<br>480 | -<br>-<br>-       | -             |    |
| DC current gain 1)<br>$I_C = 2\ \text{mA}$ , $V_{CE} = 5\ \text{V}$<br><div><math>h_{FE}</math>-group <b>A</b><br/><math>h_{FE}</math>-group <b>B</b><br/><math>h_{FE}</math>-group <b>C</b></div>    | $h_{FE}$      | 125<br>220<br>420 | 180<br>290<br>520 | 250<br>475<br>800 |               |    |
| Collector-emitter saturation voltage1)<br>$I_C = 10\ \text{mA}$ , $I_B = 0.5\ \text{mA}$<br>$I_C = 100\ \text{mA}$ , $I_B = 5\ \text{mA}$                                                             | $V_{CEsat}$   | -<br>-            | 75<br>250         | 300<br>650        |               | mV |
| Base-emitter saturation voltage 1)<br>$I_C = 10\ \text{mA}$ , $I_B = 0.5\ \text{mA}$<br>$I_C = 100\ \text{mA}$ , $I_B = 5\ \text{mA}$                                                                 | $V_{BEsat}$   | -<br>-            | 700<br>850        | -<br>-            |               |    |
| Base-emitter voltage 1)<br>$I_C = 2\ \text{mA}$ , $V_{CE} = 5\ \text{V}$<br>$I_C = 10\ \text{mA}$ , $V_{CE} = 5\ \text{V}$                                                                            | $V_{BE(ON)}$  | 600<br>-          | 650<br>-          | 750<br>820        |               |    |

1) Pulse test:  $t \leq 300\ \mu\text{s}$ ,  $D = 2\%$

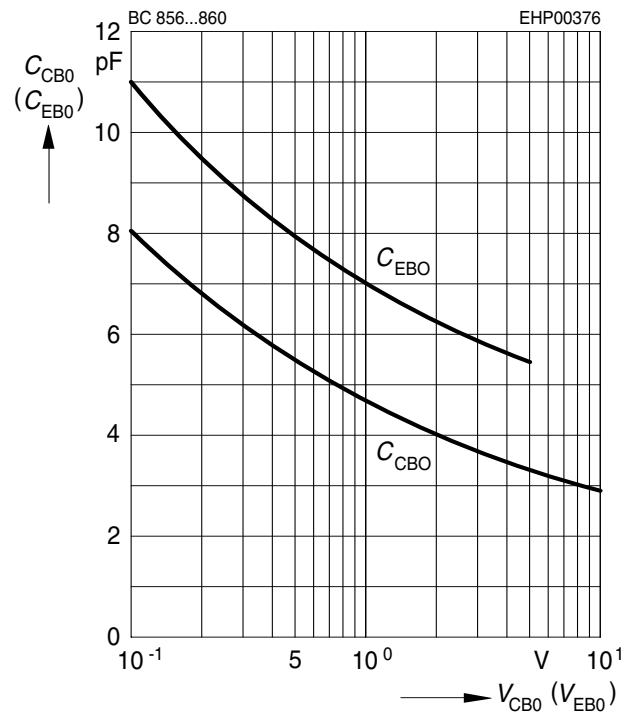
**Electrical Characteristics** at  $T_A = 25^\circ\text{C}$ , unless otherwise specified.

| Parameter                                                                                                                                      | Symbol    | Values |      |      | Unit             |
|------------------------------------------------------------------------------------------------------------------------------------------------|-----------|--------|------|------|------------------|
|                                                                                                                                                |           | min.   | typ. | max. |                  |
| AC Characteristics                                                                                                                             |           |        |      |      |                  |
| Transition frequency<br>$I_C = 20\text{ mA}$ , $V_{CE} = 5\text{ V}$ , $f = 100\text{ MHz}$                                                    | $f_T$     | -      | 250  | -    | MHz              |
| Collector-base capacitance<br>$V_{CB} = 10\text{ V}$ , $f = 1\text{ MHz}$                                                                      | $C_{cb}$  | -      | 3    | -    | pF               |
| Emitter-base capacitance<br>$V_{EB} = 0.5\text{ V}$ , $f = 1\text{ MHz}$                                                                       | $C_{eb}$  | -      | 8    | -    |                  |
| Short-circuit input impedance<br>$I_C = 2\text{ mA}$ , $V_{CE} = 5\text{ V}$ , $f = 1\text{ kHz}$                                              | $h_{11e}$ |        |      |      | kΩ               |
| $h_{FE-gr.A}$                                                                                                                                  |           | -      | 2.7  | -    |                  |
| $h_{FE-gr.B}$                                                                                                                                  |           | -      | 4.5  | -    |                  |
| $h_{FE-gr.C}$                                                                                                                                  |           | -      | 8.7  | -    |                  |
| Open-circuit reverse voltage transf.ratio<br>$I_C = 2\text{ mA}$ , $V_{CE} = 5\text{ V}$ , $f = 1\text{ kHz}$                                  | $h_{12e}$ |        |      |      | 10 <sup>-4</sup> |
| $h_{FE-gr.A}$                                                                                                                                  |           | -      | 1.5  | -    |                  |
| $h_{FE-gr.B}$                                                                                                                                  |           | -      | 2    | -    |                  |
| $h_{FE-gr.C}$                                                                                                                                  |           | -      | 3    | -    |                  |
| Short-circuit forward current transf.ratio<br>$I_C = 2\text{ mA}$ , $V_{CE} = 5\text{ V}$ , $f = 1\text{ kHz}$                                 | $h_{21e}$ |        |      |      | -                |
| $h_{FE-gr.A}$                                                                                                                                  |           | -      | 200  | -    |                  |
| $h_{FE-gr.B}$                                                                                                                                  |           | -      | 330  | -    |                  |
| $h_{FE-gr.C}$                                                                                                                                  |           | -      | 600  | -    |                  |
| Open-circuit output admittance<br>$I_C = 2\text{ mA}$ , $V_{CE} = 5\text{ V}$ , $f = 1\text{ kHz}$                                             | $h_{22e}$ |        |      |      | μS               |
| $h_{FE-gr.A}$                                                                                                                                  |           | -      | 18   | -    |                  |
| $h_{FE-gr.B}$                                                                                                                                  |           | -      | 30   | -    |                  |
| $h_{FE-gr.C}$                                                                                                                                  |           | -      | 60   | -    |                  |
| Noise figure<br>$I_C = 0.2\text{ mA}$ , $V_{CE} = 5\text{ V}$ , $R_S = 2\text{ k}\Omega$ ,<br>$f = 1\text{ kHz}$ , $\Delta f = 200\text{ Hz}$  | $F$       | -      | 1    | 4    | dB               |
| BC 859                                                                                                                                         |           |        |      |      |                  |
| BC 860                                                                                                                                         |           |        |      |      |                  |
| Equivalent noise voltage<br>$I_C = 200\text{ }\mu\text{A}$ , $V_{CE} = 5\text{ V}$ , $R_S = 2\text{ k}\Omega$ ,<br>$f = 10 \dots 50\text{ Hz}$ | $V_n$     | -      | -    | 0.11 | μV               |
| BC 860                                                                                                                                         |           |        |      |      |                  |

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

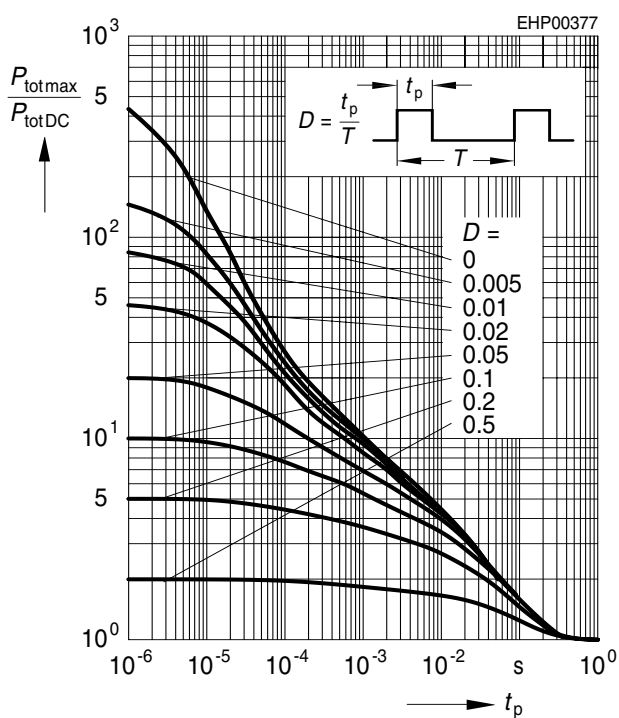


**Collector-base capacitance  $C_{CB} = f(V_{CB0})$**   
**Emitter-base capacitance  $C_{EB} = f(V_{EB0})$**



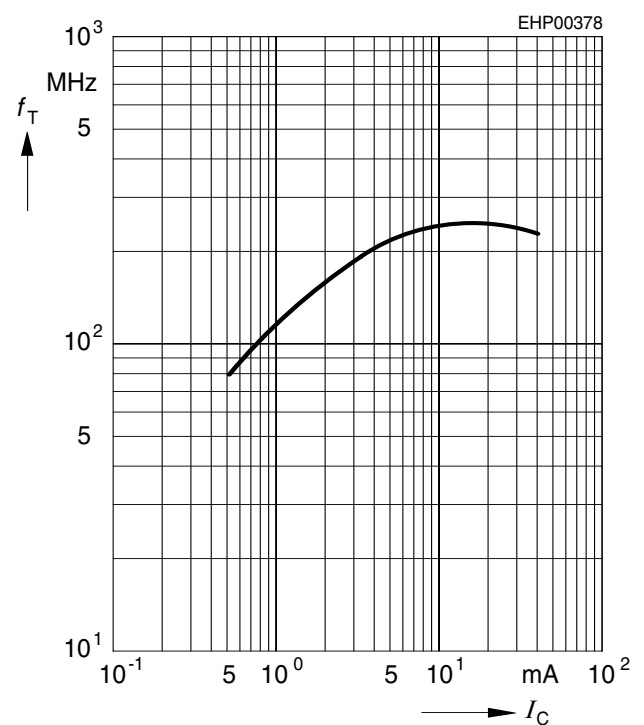
**Permissible pulse load**

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



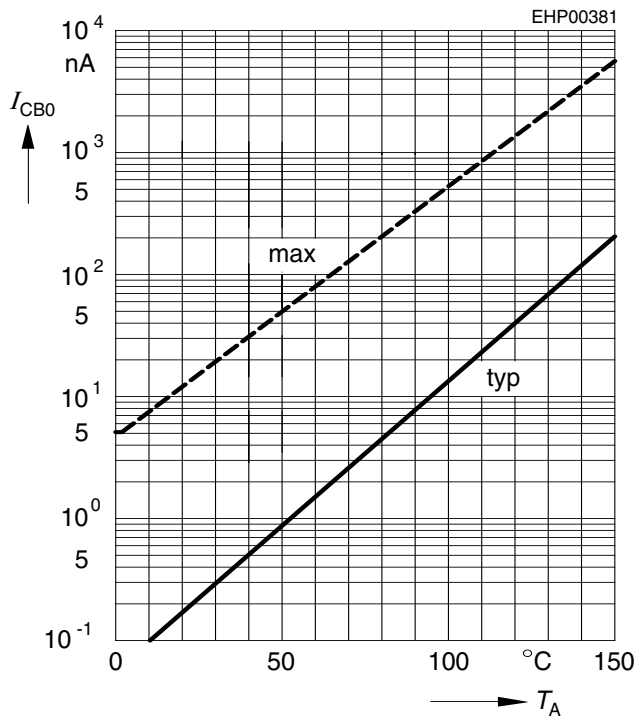
**Transition frequency  $f_T = f(I_C)$**

$V_{CE} = 5V$



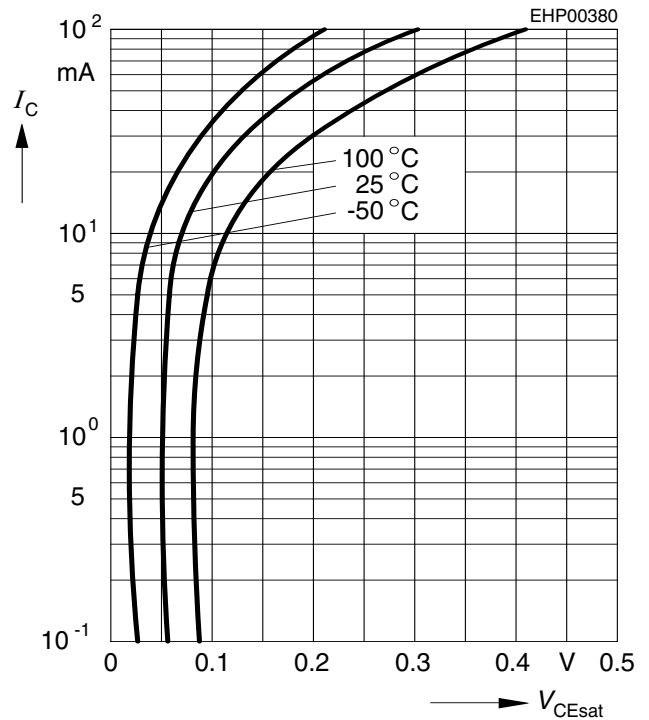
**Collector cutoff current  $I_{CBO} = f(T_A)$**

$V_{CB} = 30V$



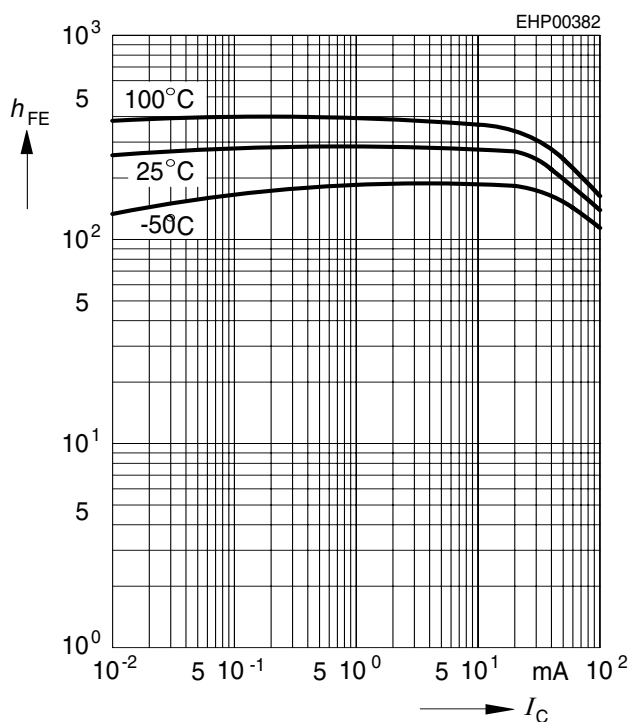
**Collector-emitter saturation voltage**

$I_C = f(V_{CEsat}), h_{FE} = 20$



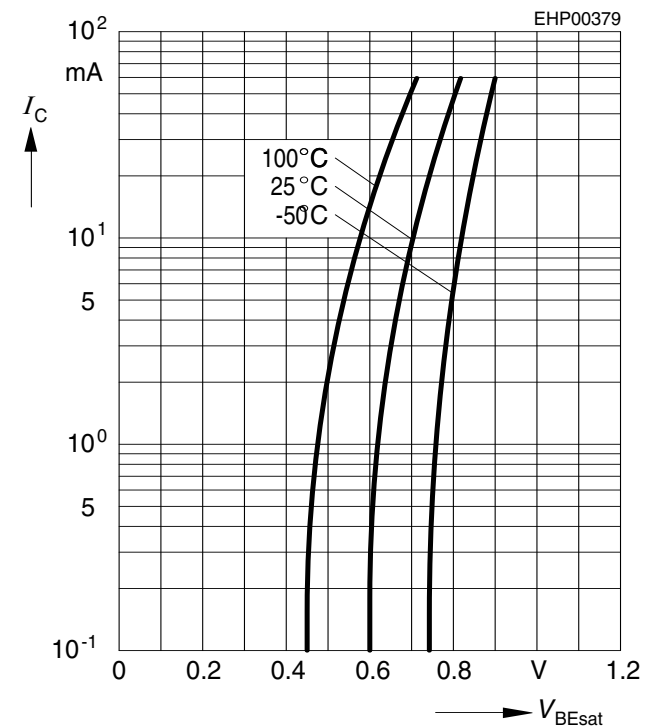
**DC current gain  $h_{FE} = f(I_C)$**

$V_{CE} = 5V$



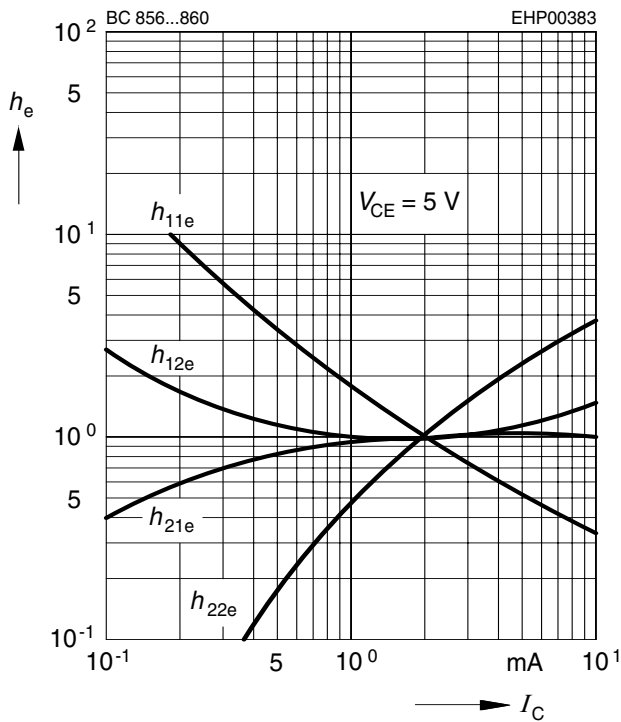
**Base-emitter saturation voltage**

$I_C = f(V_{BEsat}), h_{FE} = 20$



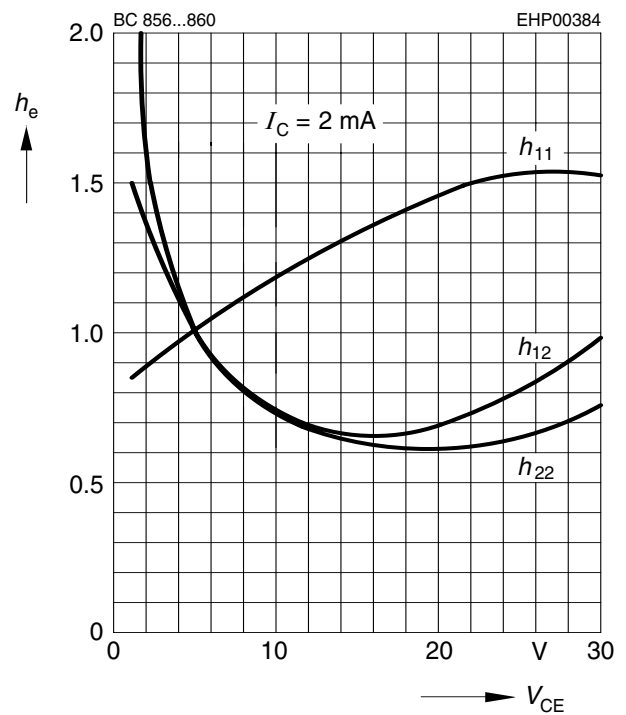
**h parameter  $h_e = f(I_C)$  normalized**

$V_{CE} = 5V$



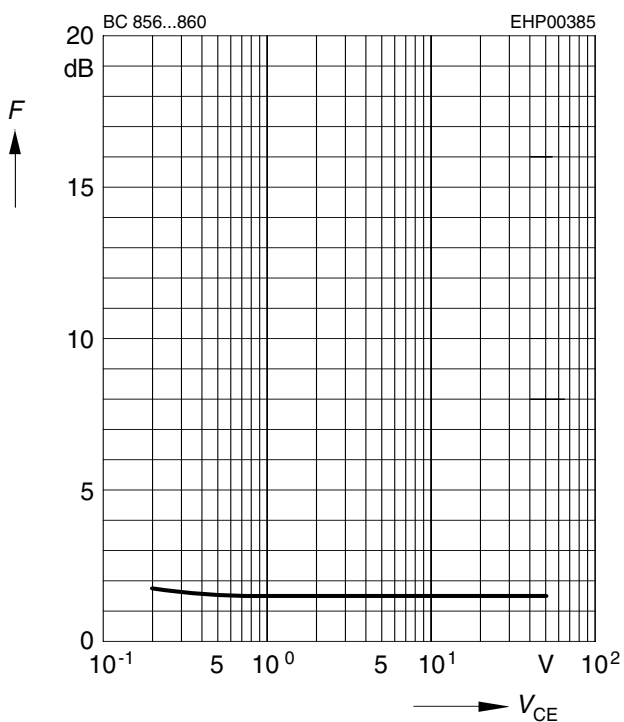
**h parameter  $h_e = f(V_{CE})$  normalized**

$I_C = 2mA$



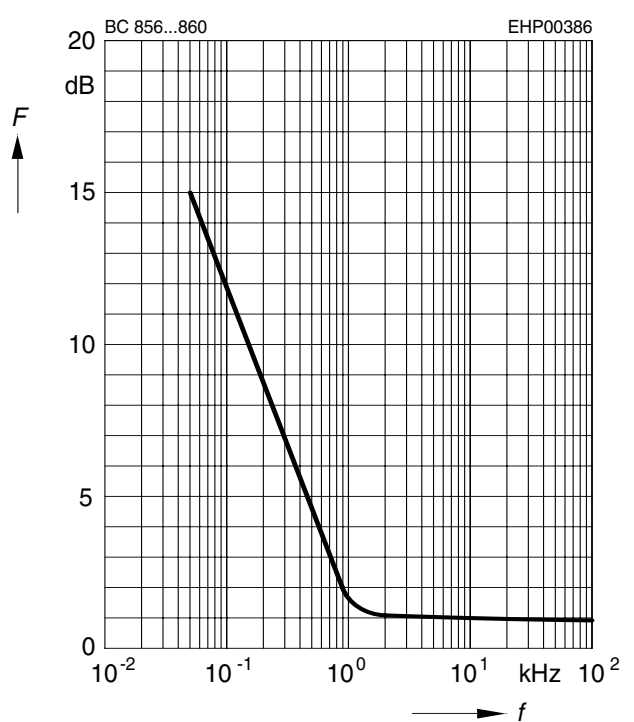
**Noise figure  $F = f(V_{CE})$**

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



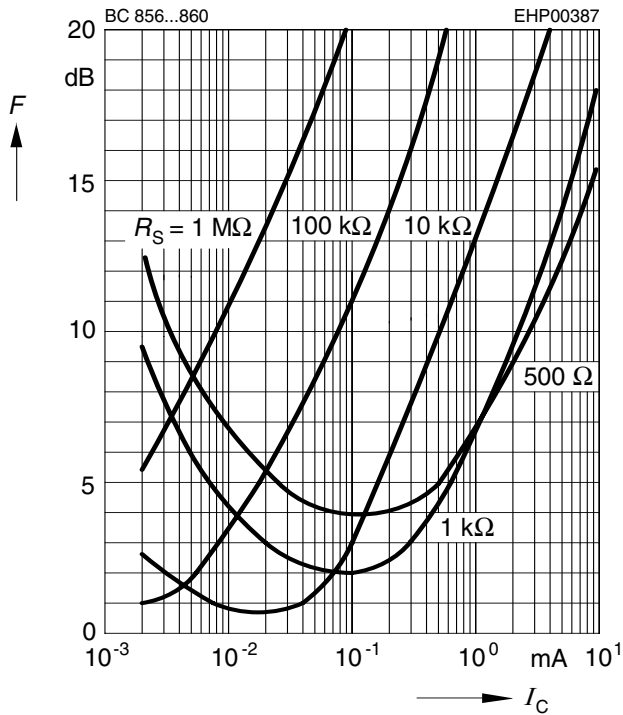
**Noise figure  $F = f(f)$**

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



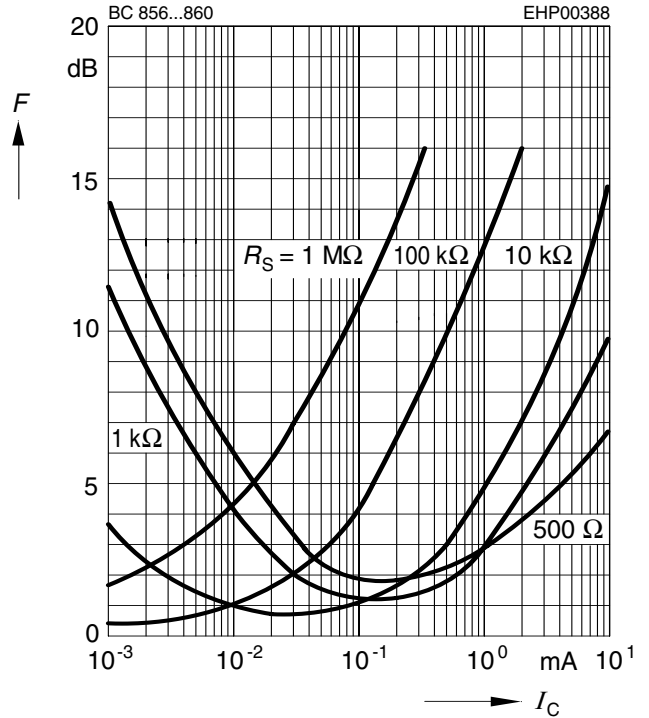
**Noise figure  $F = f(I_C)$**

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



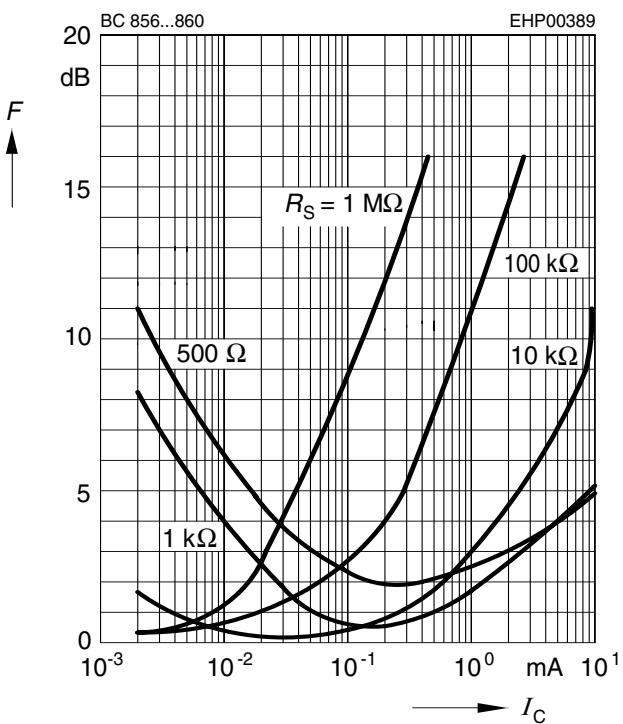
**Noise figure  $F = f(I_C)$**

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



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

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



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