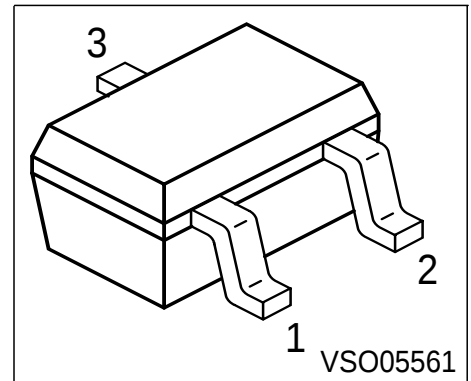


**NPN Silicon AF Transistors**

- 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:  
     BC856W, BC857W, BC858W  
     BC859W, BC860W (PNP)



| Type    | Marking | Pin Configuration |       |       | Package |
|---------|---------|-------------------|-------|-------|---------|
| BC846AW | 1As     | 1 = B             | 2 = E | 3 = C | SOT323  |
| BC846BW | 1Bs     | 1 = B             | 2 = E | 3 = C | SOT323  |
| BC847AW | 1Es     | 1 = B             | 2 = E | 3 = C | SOT323  |
| BC847BW | 1Fs     | 1 = B             | 2 = E | 3 = C | SOT323  |
| BC847CW | 1Gs     | 1 = B             | 2 = E | 3 = C | SOT323  |
| BC848AW | 1Js     | 1 = B             | 2 = E | 3 = C | SOT323  |
| BC848BW | 1Ks     | 1 = B             | 2 = E | 3 = C | SOT323  |
| BC848CW | 1Ls     | 1 = B             | 2 = E | 3 = C | SOT323  |
| BC849BW | 2Bs     | 1 = B             | 2 = E | 3 = C | SOT323  |
| BC849CW | 2Cs     | 1 = B             | 2 = E | 3 = C | SOT323  |
| BC850BW | 2Fs     | 1 = B             | 2 = E | 3 = C | SOT323  |
| BC850CW | 4Gs     | 1 = B             | 2 = E | 3 = C | SOT323  |

**Maximum Ratings**

| Parameter                                      | Symbol    | BC846W      | BC847W<br>BC850W | BC848W<br>BC849W | 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                           | $V_{EBO}$ | 6           | 6                | 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, $T_S = 124\text{ °C}$ | $P_{tot}$ | 250         |                  |                  | mW   |
| Junction temperature                           | $T_j$     | 150         |                  |                  | °C   |
| Storage temperature                            | $T_{stg}$ | -65 ... 150 |                  |                  |      |

**Thermal Resistance**

|                                          |            |      |     |
|------------------------------------------|------------|------|-----|
| Junction - soldering point <sup>1)</sup> | $R_{thJS}$ | ≤105 | 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>$I_C = 10\text{ mA}$ , $I_B = 0$       | BC846W     | $V_{(BR)CEO}$ | 65 | - | - | V |
|                                                                               | BC847/850W |               | 45 | - | - |   |
|                                                                               | BC848/849W |               | 30 | - | - |   |
|                                                                               |            |               |    |   |   |   |
| Collector-base breakdown voltage<br>$I_C = 10\text{ }\mu\text{A}$ , $I_B = 0$ | BC846W     | $V_{(BR)CBO}$ | 80 | - | - |   |
|                                                                               | BC847/850W |               | 50 | - | - |   |
|                                                                               | BC848/849W |               | 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.

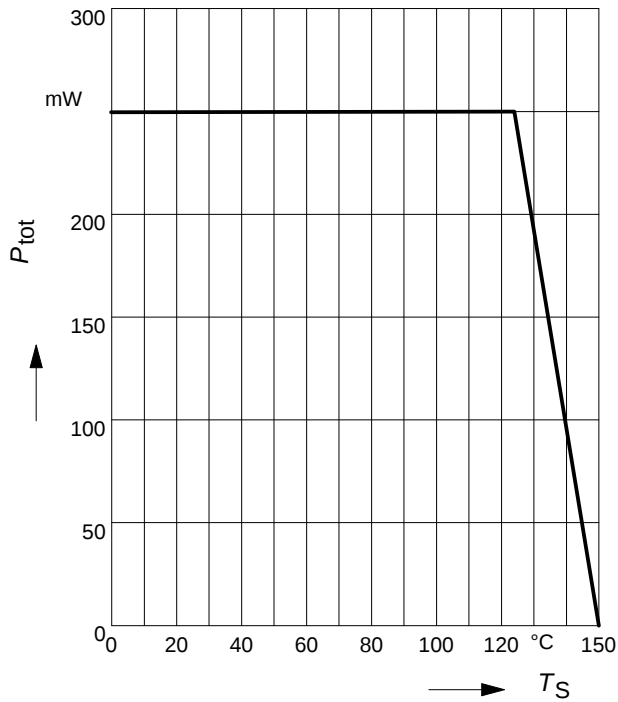
| Parameter                                                                                                                                 | Symbol        | Values |      |      | Unit          |
|-------------------------------------------------------------------------------------------------------------------------------------------|---------------|--------|------|------|---------------|
|                                                                                                                                           |               | min.   | typ. | max. |               |
| DC Characteristics                                                                                                                        |               |        |      |      |               |
| Collector-emitter breakdown voltage<br>$I_C = 10\ \mu\text{A}$ , $V_{BE} = 0$                                                             | $V_{(BR)CES}$ |        |      |      | V             |
| BC846W                                                                                                                                    |               | 80     | -    | -    |               |
| BC847/850W                                                                                                                                |               | 50     | -    | -    |               |
| BC848/849W                                                                                                                                |               | 30     | -    | -    |               |
| Emitter-base breakdown voltage<br>$I_E = 1\ \mu\text{A}$ , $I_C = 0$                                                                      | $V_{(BR)EBO}$ |        |      |      |               |
| BC846/847W                                                                                                                                |               | 6      | -    | -    |               |
| BC848-850W                                                                                                                                |               | 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>$I_C = 10\ \mu\text{A}$ , $V_{CE} = 5\ \text{V}$                                                                    | $h_{FE}$      |        |      |      | -             |
| $h_{FE}$ -group A                                                                                                                         |               | -      | 140  | -    |               |
| $h_{FE}$ -group B                                                                                                                         |               | -      | 250  | -    |               |
| $h_{FE}$ -group C                                                                                                                         |               | -      | 480  | -    |               |
| DC current gain 1)<br>$I_C = 2\ \text{mA}$ , $V_{CE} = 5\ \text{V}$                                                                       | $h_{FE}$      |        |      |      |               |
| $h_{FE}$ -group A                                                                                                                         |               | 110    | 180  | 220  |               |
| $h_{FE}$ -group B                                                                                                                         |               | 200    | 290  | 450  |               |
| $h_{FE}$ -group C                                                                                                                         |               | 420    | 520  | 800  |               |
| Collector-emitter saturation voltage1)<br>$I_C = 10\ \text{mA}$ , $I_B = 0.5\ \text{mA}$<br>$I_C = 100\ \text{mA}$ , $I_B = 5\ \text{mA}$ | $V_{CEsat}$   |        |      |      | mV            |
|                                                                                                                                           |               | -      | 90   | 250  |               |
|                                                                                                                                           |               | -      | 200  | 600  |               |
| Base-emitter saturation voltage 1)<br>$I_C = 10\ \text{mA}$ , $I_B = 0.5\ \text{mA}$<br>$I_C = 100\ \text{mA}$ , $I_B = 5\ \text{mA}$     | $V_{BEsat}$   |        |      |      |               |
|                                                                                                                                           |               | -      | 700  | -    |               |
|                                                                                                                                           |               | -      | 900  | -    |               |
| Base-emitter voltage 1)<br>$I_C = 2\ \text{mA}$ , $V_{CE} = 5\ \text{V}$<br>$I_C = 10\ \text{mA}$ , $V_{CE} = 5\ \text{V}$                | $V_{BE(ON)}$  |        |      |      |               |
|                                                                                                                                           |               | 580    | 660  | 700  |               |
|                                                                                                                                           |               | -      | -    | 770  |               |

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

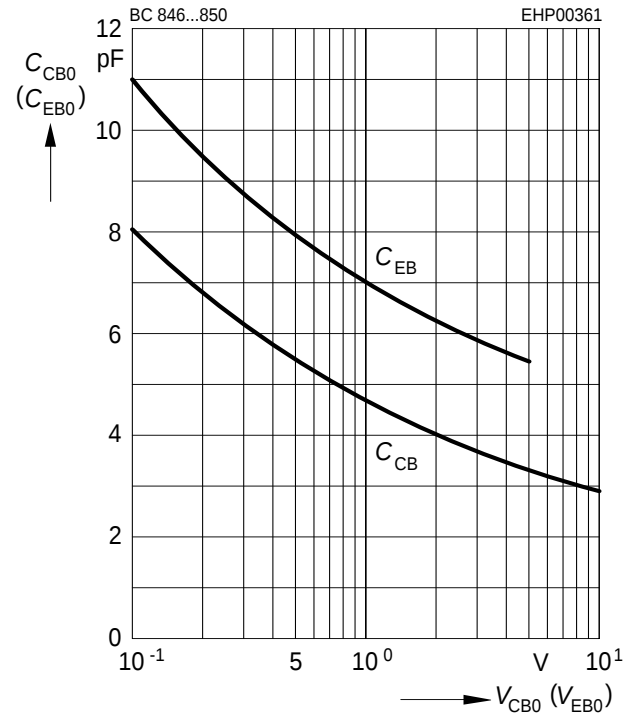
**Electrical Characteristics** at  $T_A = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified.

| 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>$V_{CB} = 10\text{ V}$ , $f = 1\text{ MHz}$                                                                              | $C_{cb}$  | -      | 2    | 3     | pF               |
| Emitter-base capacitance<br>$V_{EB} = 0.5\text{ V}$ , $f = 1\text{ MHz}$                                                                               | $C_{eb}$  | -      | 10   | 15    |                  |
| Short-circuit input impedance<br>$I_C = 2\text{ mA}$ , $V_{CE} = 5\text{ V}$ , $f = 1\text{ kHz}$                                                      | $h_{11e}$ | -      | 2.7  | -     | kΩ               |
| $h_{FE-gr.A}$                                                                                                                                          |           | -      | 4.5  | -     |                  |
| $h_{FE-gr.B}$                                                                                                                                          |           | -      | 8.7  | -     |                  |
| Open-circuit reverse voltage transf.ratio<br>$I_C = 2\text{ mA}$ , $V_{CE} = 5\text{ V}$ , $f = 1\text{ kHz}$                                          | $h_{12e}$ | -      | 1.5  | -     | 10 <sup>-4</sup> |
| $h_{FE-gr.A}$                                                                                                                                          |           | -      | 2    | -     |                  |
| $h_{FE-gr.B}$                                                                                                                                          |           | -      | 3    | -     |                  |
| Short-circuit forward current transf.ratio<br>$I_C = 2\text{ mA}$ , $V_{CE} = 5\text{ V}$ , $f = 1\text{ kHz}$                                         | $h_{21e}$ | -      | 200  | -     | -                |
| $h_{FE-gr.A}$                                                                                                                                          |           | -      | 330  | -     |                  |
| $h_{FE-gr.B}$                                                                                                                                          |           | -      | 600  | -     |                  |
| Open-circuit output admittance<br>$I_C = 2\text{ mA}$ , $V_{CE} = 5\text{ V}$ , $f = 1\text{ kHz}$                                                     | $h_{22e}$ | -      | 18   | -     | μS               |
| $h_{FE-gr.A}$                                                                                                                                          |           | -      | 30   | -     |                  |
| $h_{FE-gr.B}$                                                                                                                                          |           | -      | 60   | -     |                  |
| Noise figure<br>$I_C = 200\text{ }\mu\text{A}$ , $V_{CE} = 5\text{ V}$ , $R_S = 2\text{ k}\Omega$ ,<br>$f = 1\text{ kHz}$ , $\Delta f = 200\text{ Hz}$ | $F$       | -      | -    | 10    | dB               |
| BC846W                                                                                                                                                 |           |        |      |       |                  |
| BC847W                                                                                                                                                 |           |        |      |       |                  |
| Noise figure<br>$I_C = 200\text{ }\mu\text{A}$ , $V_{CE} = 5\text{ V}$ , $R_S = 2\text{ k}\Omega$ ,<br>$f = 1\text{ kHz}$ , $\Delta f = 200\text{ Hz}$ | $F$       | -      | 1.2  | 4     |                  |
| BC849W                                                                                                                                                 |           | -      | 1    | 4     |                  |
| Equivalent noise voltage<br>$I_C = 200\text{ }\mu\text{A}$ , $V_{CE} = 5\text{ V}$ , $R_S = 2\text{ k}\Omega$ ,<br>$f = 10 \dots 50\text{ Hz}$         | $V_n$     | -      | -    | 0.135 | μV               |

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

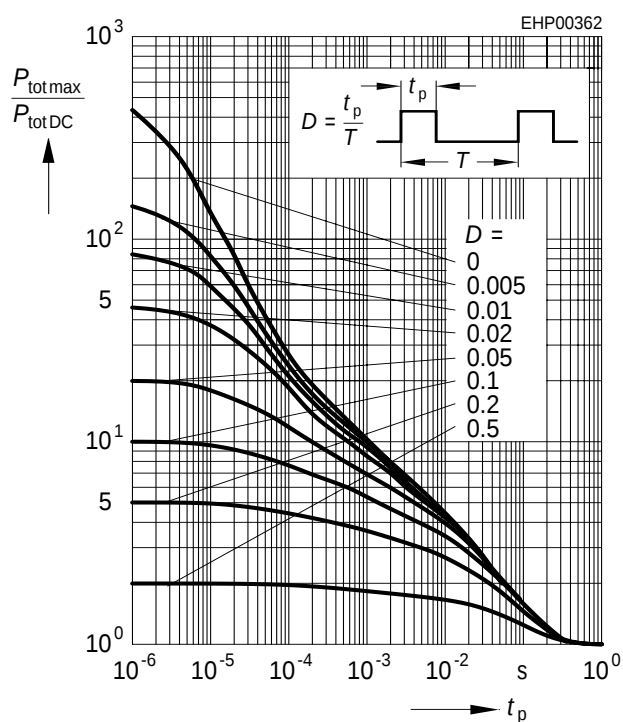


**Collector-base capacitance**  $C_{\text{CB}} = f(V_{\text{CB0}})$   
**Emitter-base capacitance**  $C_{\text{EB}} = f(V_{\text{EB0}})$



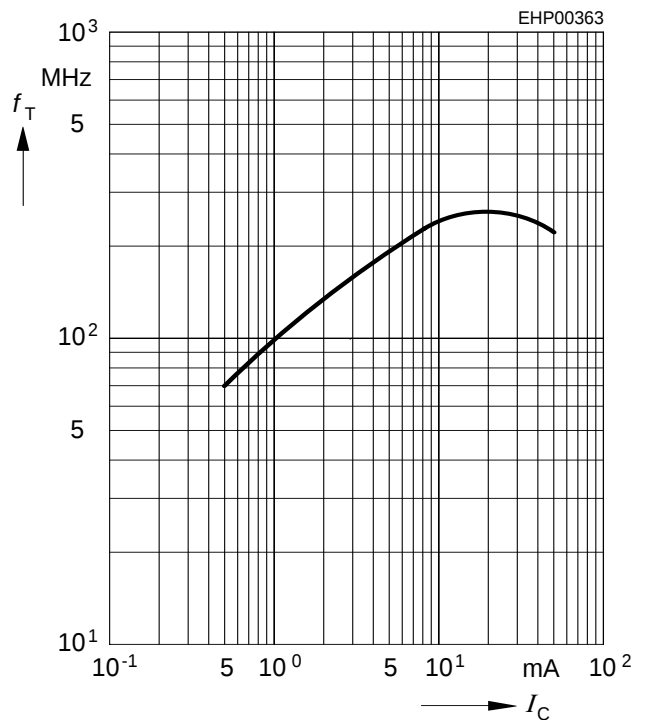
**Permissible pulse load**

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



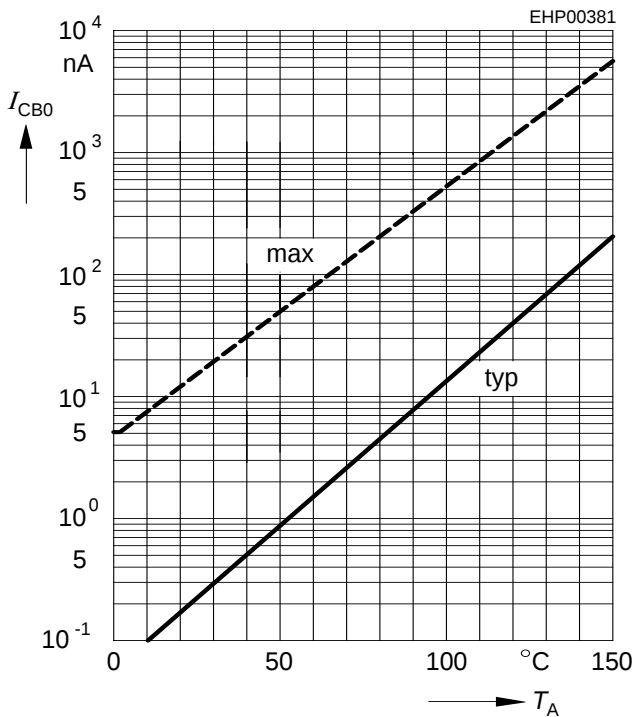
**Transition frequency**  $f_T = f(I_C)$

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



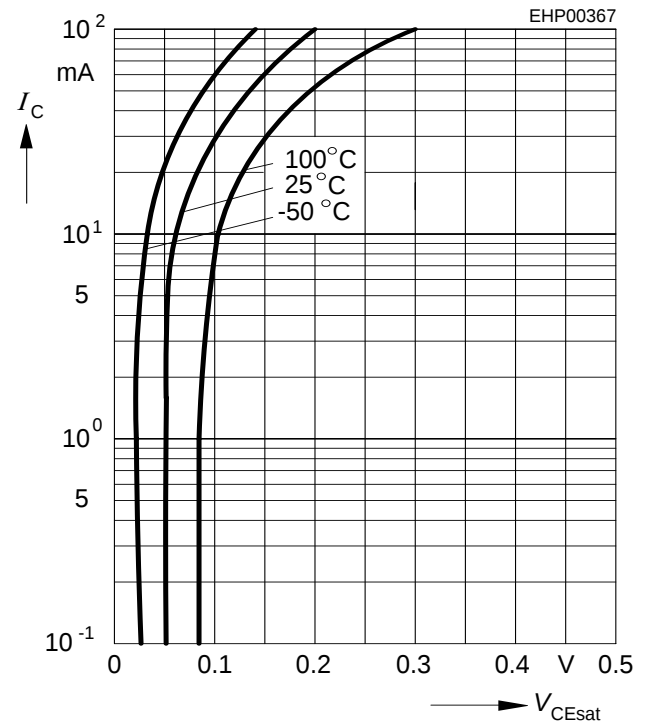
**Collector cutoff current  $I_{CBO} = f(T_A)$**

$V_{CB} = 30V$



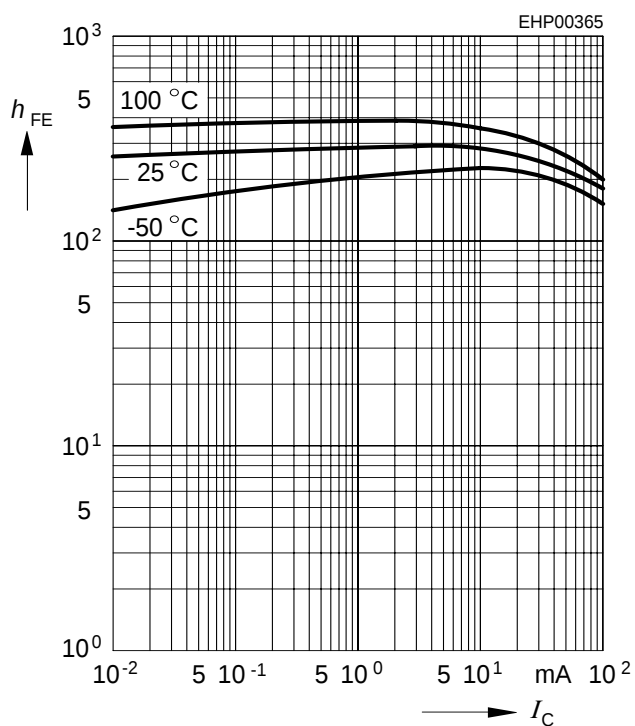
**Collector-emitter saturation voltage**

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



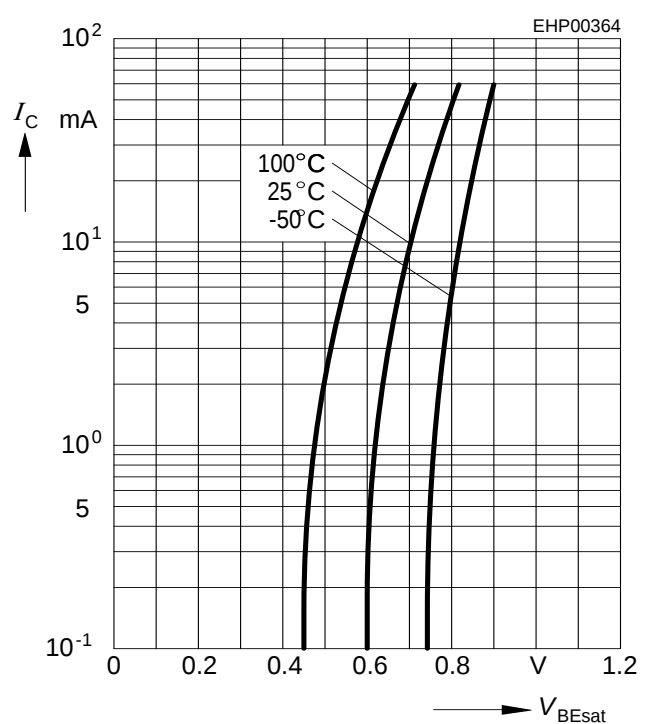
**DC current gain  $h_{FE} = f(I_C)$**

$V_{CE} = 5V$



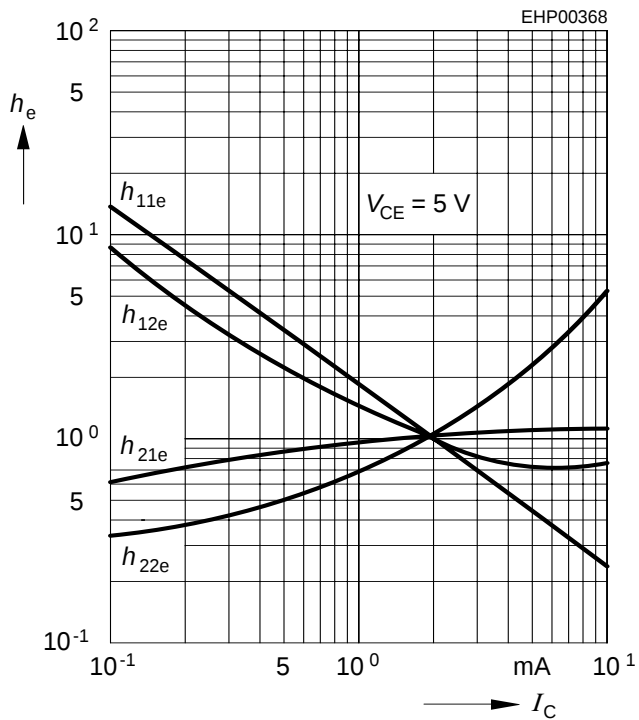
**Base-emitter saturation voltage**

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



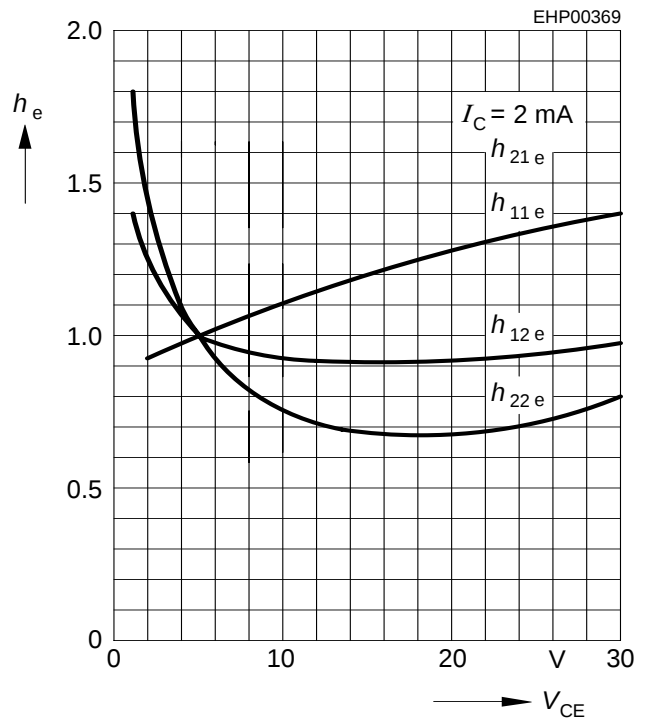
**h parameter  $h_e = f(I_C)$  normalized**

$V_{CE} = 5V$



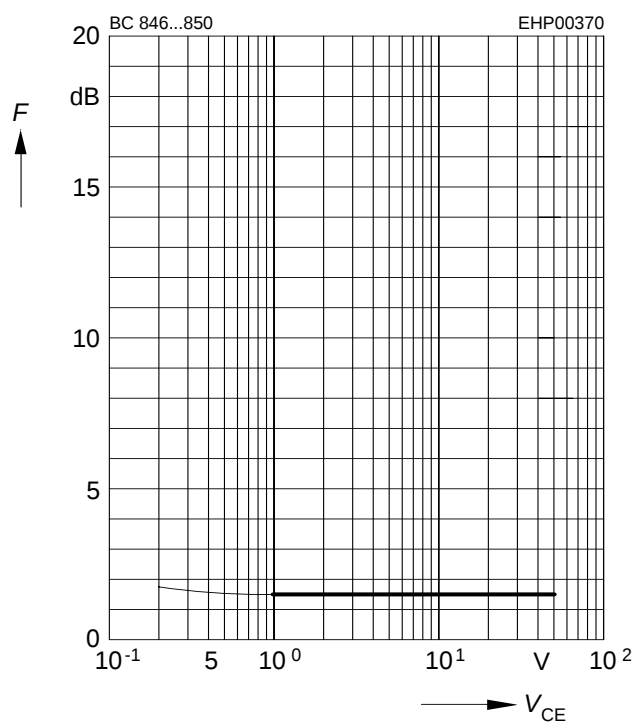
**h parameter  $h_e = f(V_{CE})$  normalized**

$I_C = 2mA$



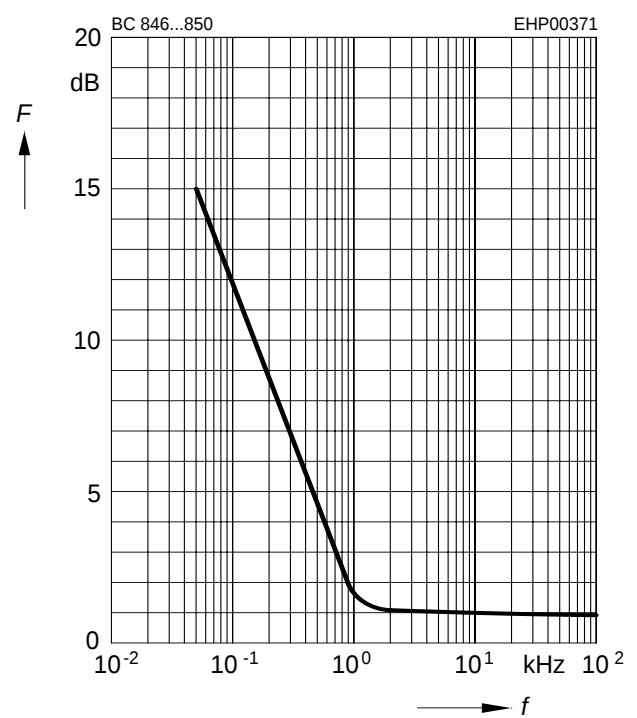
**Noise figure  $F = f(V_{CE})$**

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



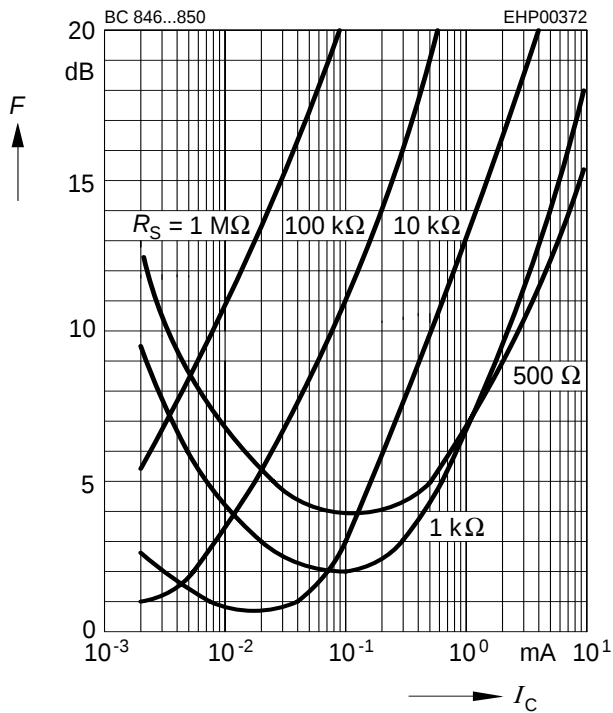
**Noise figure  $F = f(f)$**

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



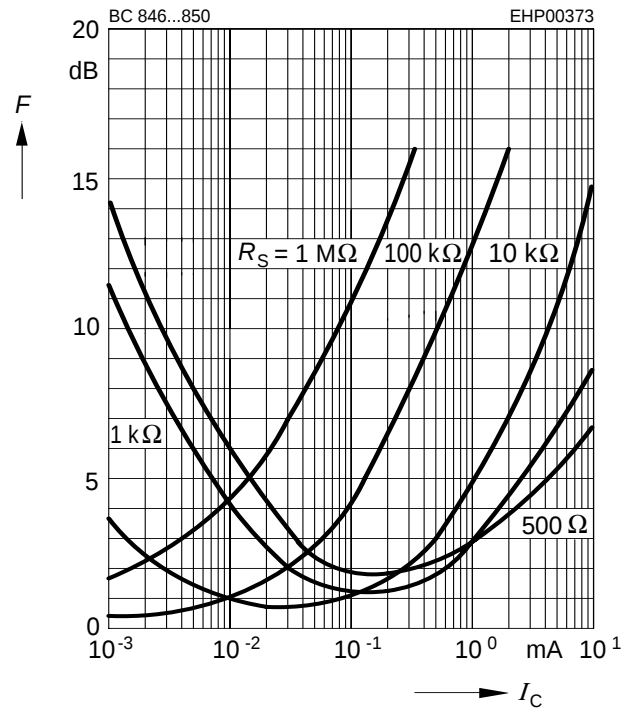
**Noise figure  $F = f(I_C)$**

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



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

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



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

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

