

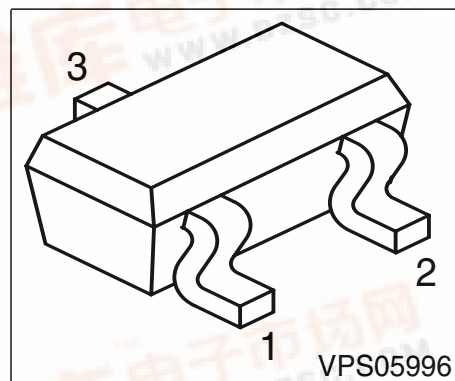


## BC846T...BC850T

### 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:

BC856T, BC857T,  
BC858T, BC859T, BC860T



| Type    | Marking | Pin Configuration |       |       | Package |
|---------|---------|-------------------|-------|-------|---------|
| BC846AT | 1As     | 1 = B             | 2 = E | 3 = C | SC75    |
| BC846BT | 1Bs     | 1 = B             | 2 = E | 3 = C | SC75    |
| BC847AT | 1Es     | 1 = B             | 2 = E | 3 = C | SC75    |
| BC847BT | 1Fs     | 1 = B             | 2 = E | 3 = C | SC75    |
| BC847CT | 1Gs     | 1 = B             | 2 = E | 3 = C | SC75    |
| BC848AT | 1Js     | 1 = B             | 2 = E | 3 = C | SC75    |
| BC848BT | 1Ks     | 1 = B             | 2 = E | 3 = C | SC75    |
| BC848CT | 1Ls     | 1 = B             | 2 = E | 3 = C | SC75    |
| BC849BT | 2Bs     | 1 = B             | 2 = E | 3 = C | SC75    |
| BC849CT | 2cs     | 1 = B             | 2 = E | 3 = C | SC75    |
| BC850BT | 2Fs     | 1 = B             | 2 = E | 3 = C | SC75    |
| BC850CT | 2Gs     | 1 = B             | 2 = E | 3 = C | SC75    |

**Maximum Ratings**

| Parameter                                      | Symbol    | BC846T      | BC847T<br>BC850T | BC848T<br>BC849T | 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, $T_S = 109\text{ °C}$ | $P_{tot}$ | 250         |                  |                  | mW   |
| Junction temperature                           | $T_j$     | 150         |                  |                  | °C   |
| Storage temperature                            | $T_{stg}$ | -65 ... 150 |                  |                  |      |

**Thermal Resistance**

|                                          |            |      |     |
|------------------------------------------|------------|------|-----|
| Junction - soldering point <sup>1)</sup> | $R_{thJS}$ | ≤165 | 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                   | $V_{(BR)CEO}$ |    |   |   | V |
| $I_C = 10\text{ mA}$ , $I_B = 0$ BC846T               |               | 65 | - | - |   |
| $I_C = 10\text{ mA}$ , $I_B = 0$ BC847T/BC850T        |               | 45 | - | - |   |
| $I_C = 10\text{ mA}$ , $I_B = 0$ BC848T/BC849T        |               | 30 | - | - |   |
| Collector-base breakdown voltage                      | $V_{(BR)CBO}$ |    |   |   |   |
| $I_C = 10\text{ }\mu\text{A}$ , $I_E = 0$ BC846T      |               | 80 | - | - |   |
| $I_C = 10\text{ }\mu\text{A}$ , $I_E = 0$ BC847T/850T |               | 50 | - | - |   |
| $I_C = 10\text{ }\mu\text{A}$ , $I_E = 0$ BC848T/849T |               | 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>$I_C = 10\ \mu\text{A}$ , $V_{BE} = 0$ BC846T<br>$I_C = 10\ \mu\text{A}$ , $V_{BE} = 0$ BC847T/850T<br>$I_C = 10\ \mu\text{A}$ , $V_{BE} = 0$ BC848T/849T                                                          | $V_{(\text{BR})\text{CES}}$ | 65<br>50<br>30    | -<br>-<br>-       | -<br>-<br>-       | V    |               |
| Emitter-base breakdown voltage<br>$I_E = 1\ \mu\text{A}$ , $I_C = 0$ BC846T<br>$I_E = 1\ \mu\text{A}$ , $I_C = 0$ BC847T/BC850T<br>$I_E = 1\ \mu\text{A}$ , $I_C = 0$ BC848T/BC849T                                                                       | $V_{(\text{BR})\text{EBO}}$ | 6<br>6<br>5       | -<br>-<br>-       | -<br>-<br>-       |      |               |
| Collector cutoff current<br>$V_{CB} = 30\ \text{V}$ , $I_E = 0$                                                                                                                                                                                           | $I_{\text{CBO}}$            | -                 | -                 | 15                |      | nA            |
| Collector cutoff current<br>$V_{CB} = 30\ \text{V}$ , $I_E = 0$ , $T_A = 150\ ^\circ\text{C}$                                                                                                                                                             | $I_{\text{CBO}}$            | -                 | -                 | 5                 |      | $\mu\text{A}$ |
| DC current gain 1)<br>$I_C = 10\ \mu\text{A}$ , $V_{CE} = 5\ \text{V}$ $h_{\text{FE}}$ -group A<br>$I_C = 10\ \mu\text{A}$ , $V_{CE} = 5\ \text{V}$ $h_{\text{FE}}$ -group B<br>$I_C = 10\ \mu\text{A}$ , $V_{CE} = 5\ \text{V}$ $h_{\text{FE}}$ -group C | $h_{\text{FE}}$             | -<br>-<br>-       | 140<br>250<br>480 | -<br>-<br>-       | -    |               |
| DC current gain 1)<br>$I_C = 2\ \text{mA}$ , $V_{CE} = 5\ \text{V}$ $h_{\text{FE}}$ -group A<br>$I_C = 2\ \text{mA}$ , $V_{CE} = 5\ \text{V}$ $h_{\text{FE}}$ -group B<br>$I_C = 2\ \text{mA}$ , $V_{CE} = 5\ \text{V}$ $h_{\text{FE}}$ -group C          | $h_{\text{FE}}$             | 110<br>200<br>420 | 180<br>290<br>520 | 220<br>450<br>800 |      |               |
| Collector-emitter saturation voltage1)<br>$I_C = 10\ \text{mA}$ , $I_B = 0.5\ \text{mA}$<br>$I_C = 100\ \text{mA}$ , $I_B = 5\ \text{mA}$                                                                                                                 | $V_{\text{CEsat}}$          | -<br>-            | 90<br>200         | 250<br>600        |      | mV            |
| Base-emitter saturation voltage 1)<br>$I_C = 10\ \text{mA}$ , $I_B = 0.5\ \text{mA}$<br>$I_C = 100\ \text{mA}$ , $I_B = 5\ \text{mA}$                                                                                                                     | $V_{\text{BEsat}}$          | -<br>-            | 700<br>900        | -<br>-            |      |               |
| Base-emitter voltage 1)<br>$I_C = 2\ \text{mA}$ , $V_{CE} = 5\ \text{V}$<br>$I_C = 10\ \text{mA}$ , $V_{CE} = 5\ \text{V}$                                                                                                                                | $V_{\text{BE(ON)}}$         | 580<br>-          | 660<br>-          | 700<br>770        |      |               |

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

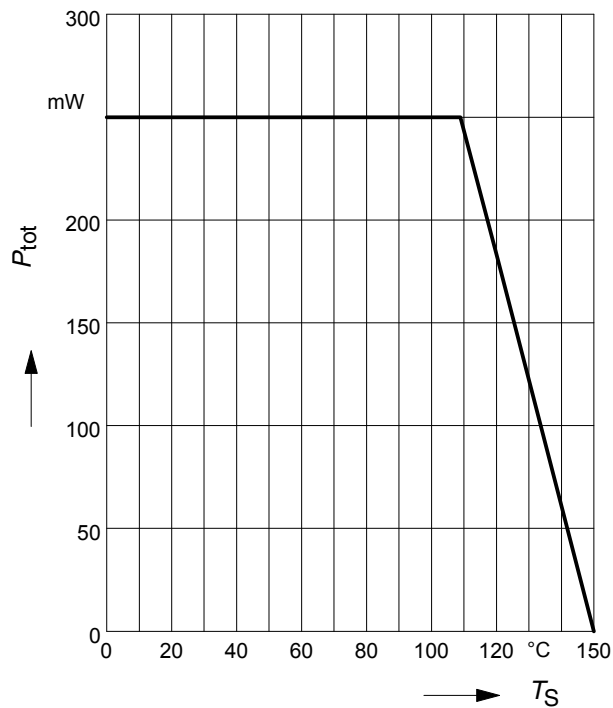
**Electrical Characteristics** at  $T_A = 25^\circ\text{C}$ , unless otherwise specified.

| 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>$I_C = 2\text{ mA}$ , $V_{CE} = 5\text{ V}$ , $f = 1\text{ kHz}$ hFE-group A<br>$I_C = 2\text{ mA}$ , $V_{CE} = 5\text{ V}$ , $f = 1\text{ kHz}$ hFE-group B<br>$I_C = 2\text{ mA}$ , $V_{CE} = 5\text{ V}$ , $f = 1\text{ kHz}$ hFE-group C              | $h_{11e}$ | -<br>-<br>- | 2.7<br>4.7<br>8.7 | -<br>-<br>- | kΩ               |
| Open-circuit reverse voltage transf.ratio<br>$I_C = 2\text{ mA}$ , $V_{CE} = 5\text{ V}$ , $f = 1\text{ kHz}$ hFE-group A<br>$I_C = 2\text{ mA}$ , $V_{CE} = 5\text{ V}$ , $f = 1\text{ kHz}$ hFE-group B<br>$I_C = 2\text{ mA}$ , $V_{CE} = 5\text{ V}$ , $f = 1\text{ kHz}$ hFE-group C  | $h_{12e}$ | -<br>-<br>- | 1.5<br>2<br>3     | -<br>-<br>- | 10 <sup>-4</sup> |
| Short-circuit forward current transf.ratio<br>$I_C = 2\text{ mA}$ , $V_{CE} = 5\text{ V}$ , $f = 1\text{ kHz}$ hFE-group A<br>$I_C = 2\text{ mA}$ , $V_{CE} = 5\text{ V}$ , $f = 1\text{ kHz}$ hFE-group B<br>$I_C = 2\text{ mA}$ , $V_{CE} = 5\text{ V}$ , $f = 1\text{ kHz}$ hFE-group C | $h_{21e}$ | -<br>-<br>- | 200<br>330<br>600 | -<br>-<br>- | -                |
| Open-circuit output admittance<br>$I_C = 2\text{ mA}$ , $V_{CE} = 5\text{ V}$ , $f = 1\text{ kHz}$ hFE-group A<br>$I_C = 2\text{ mA}$ , $V_{CE} = 5\text{ V}$ , $f = 1\text{ kHz}$ hFE-group B<br>$I_C = 2\text{ mA}$ , $V_{CE} = 5\text{ V}$ , $f = 1\text{ kHz}$ hFE-group C             | $h_{22e}$ | -<br>-<br>- | 18<br>30<br>60    | -<br>-<br>- | μS               |

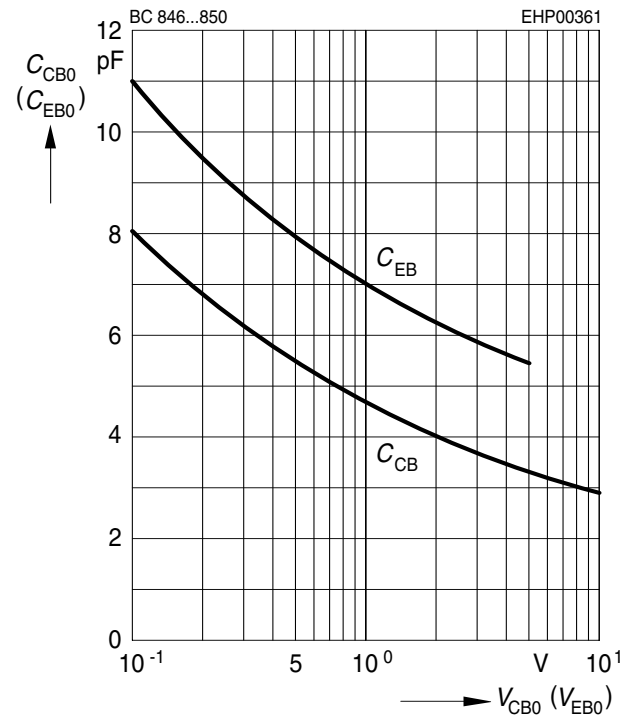
**Electrical Characteristics** at  $T_A = 25^\circ\text{C}$ , unless otherwise specified.

| Parameter                                                                                                                                                                                                                                                                                                  | Symbol | Values      |          |        | Unit |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-------------|----------|--------|------|
|                                                                                                                                                                                                                                                                                                            |        | min.        | typ.     | max.   |      |
| AC Characteristics                                                                                                                                                                                                                                                                                         |        |             |          |        |      |
| Noise figure<br>$I_C = 200\ \mu\text{A}$ , $V_{CE} = 5\ \text{V}$ , $R_S = 2\ \text{k}\Omega$ ,<br>$f = 1\ \text{kHz}$ , $\Delta f = 200\ \text{Hz}$ BC849T<br>$I_C = 200\ \mu\text{A}$ , $V_{CE} = 5\ \text{V}$ , $R_S = 2\ \text{k}\Omega$ ,<br>$f = 1\ \text{kHz}$ , $\Delta f = 200\ \text{Hz}$ BC850T | $F$    | -<br>-<br>- | 1.2<br>1 | 4<br>4 | dB   |
| Equivalent noise voltage<br>$I_C = 200\ \mu\text{A}$ , $V_{CE} = 5\ \text{V}$ , $R_S = 2\ \text{k}\Omega$ ,<br>$f = 10 \dots 50\ \text{Hz}$ BC850T                                                                                                                                                         | $V_n$  | -           | -        | 0.135  |      |

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

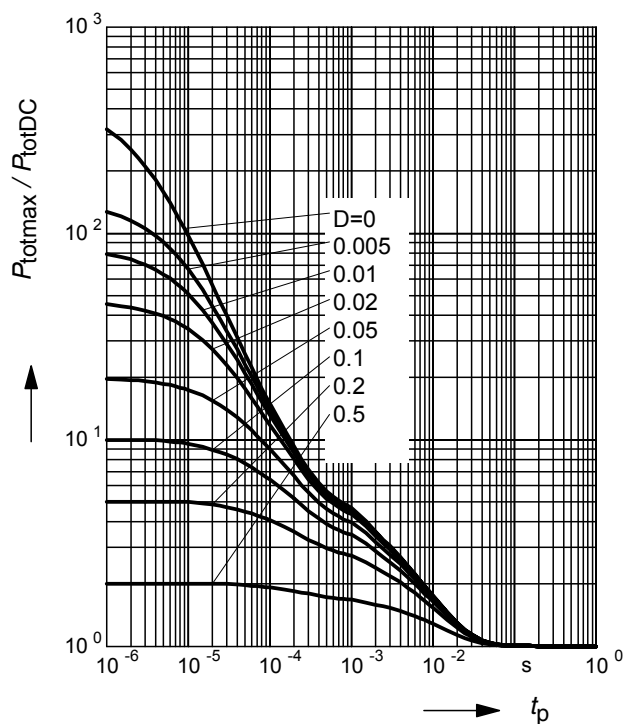


**Collector-base capacitance  $C_{\text{CB}} = f(V_{\text{CBO}})$   
Emitter-base capacitance  $C_{\text{EB}} = f(V_{\text{EBO}})$**



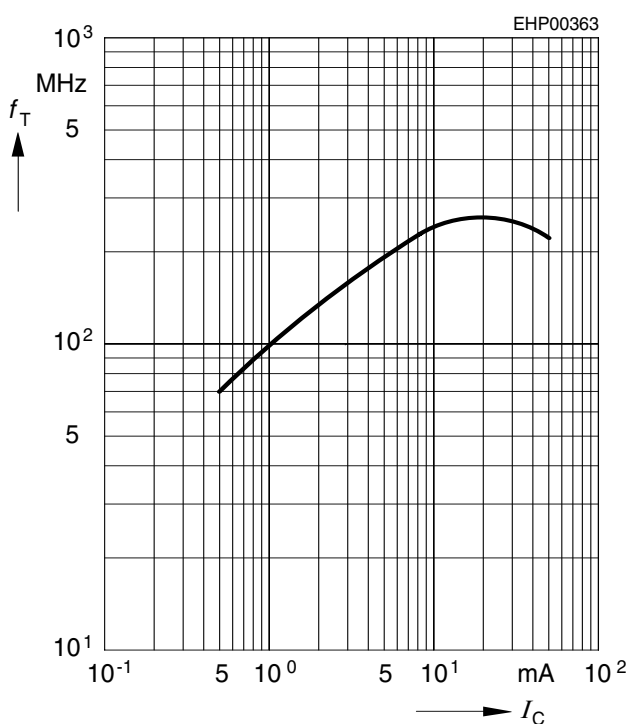
**Permissible Pulse Load**

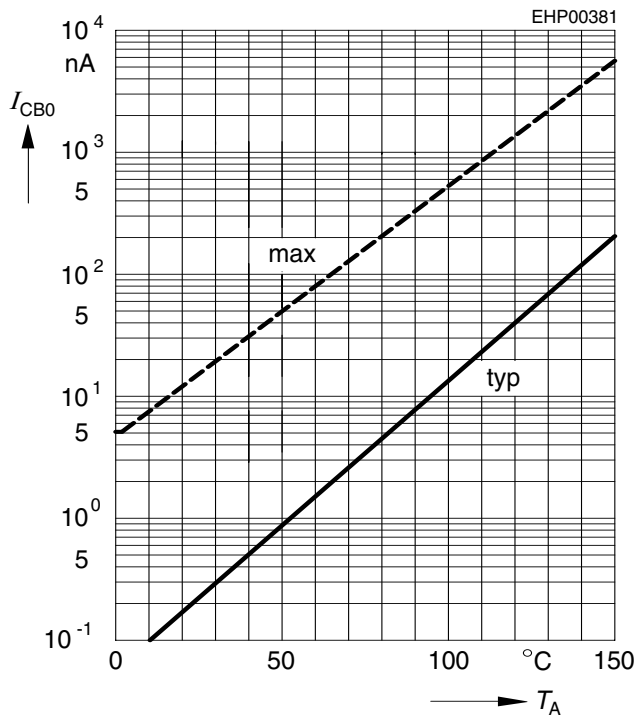
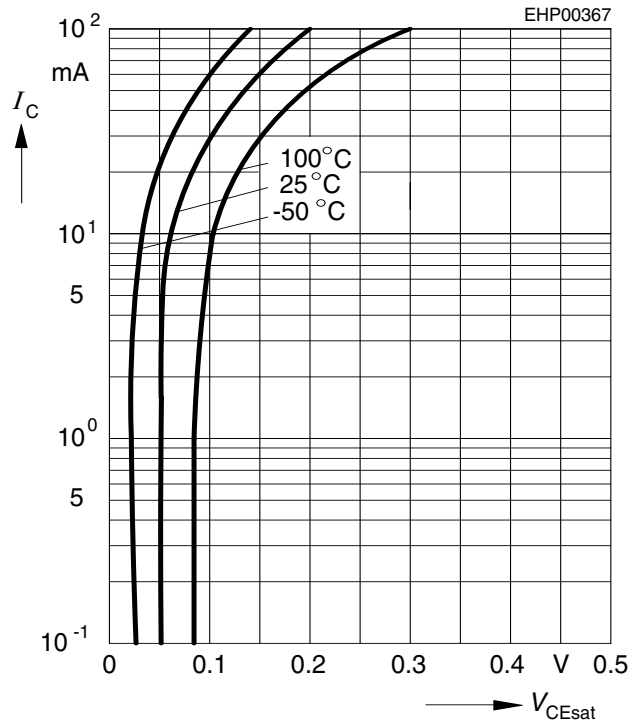
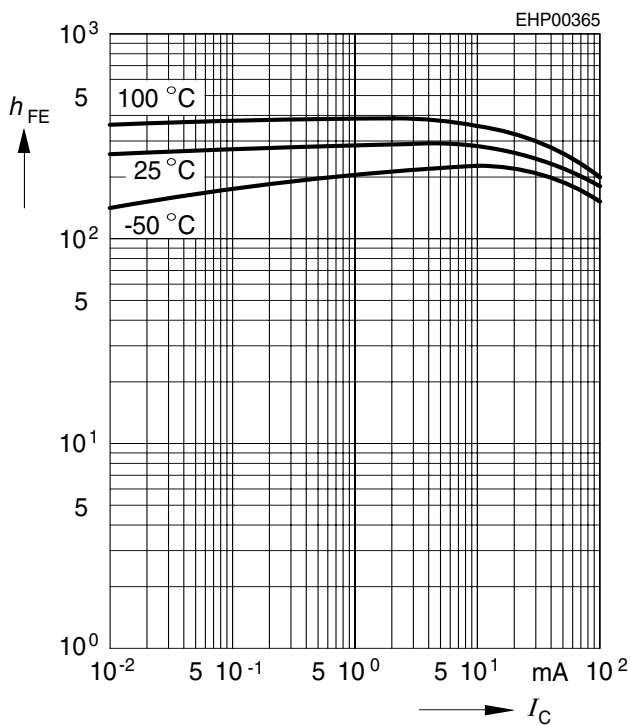
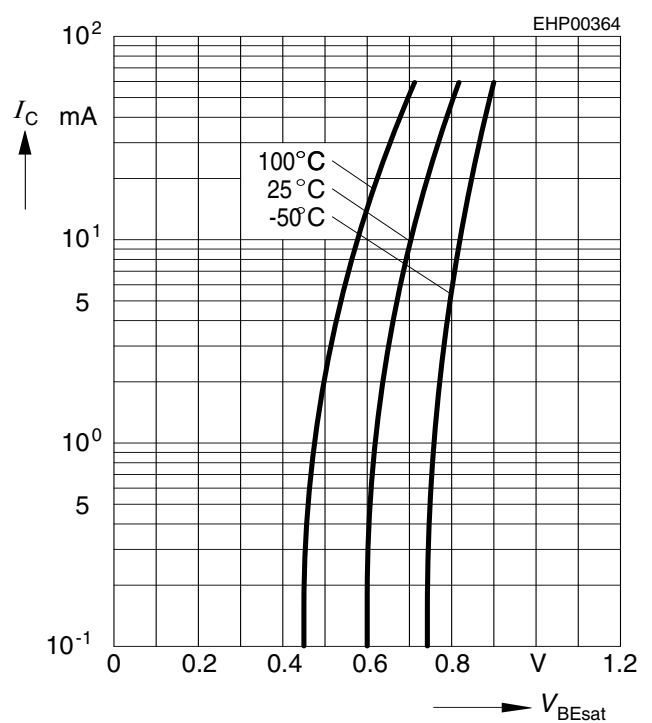
$P_{\text{totmax}} / P_{\text{totDC}} = f(t_p)$



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

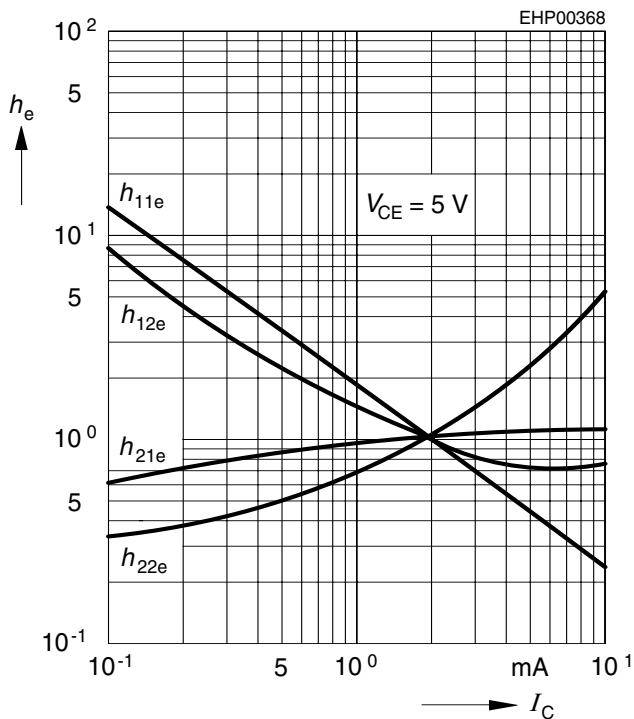
$V_{\text{CE}} = 5\text{V}$



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


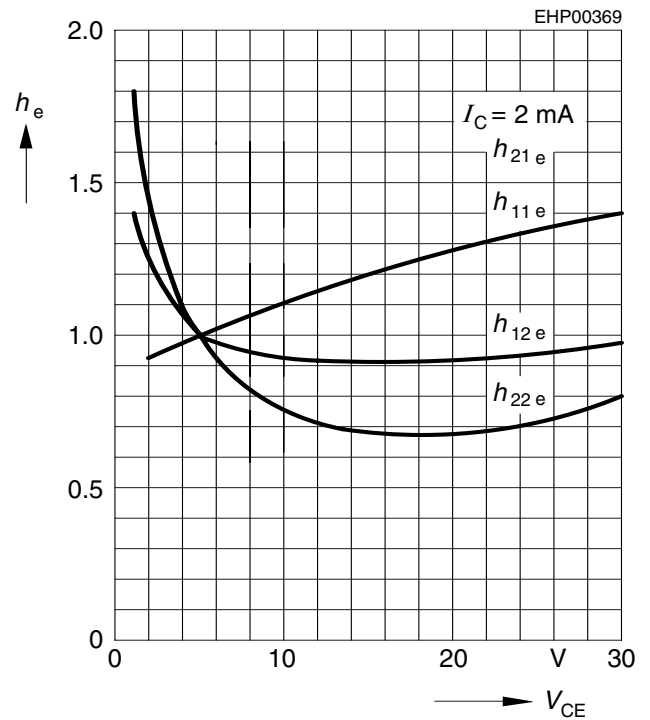
**h parameter  $h_e = f(I_C)$  normalized**

$V_{CE} = 5V$



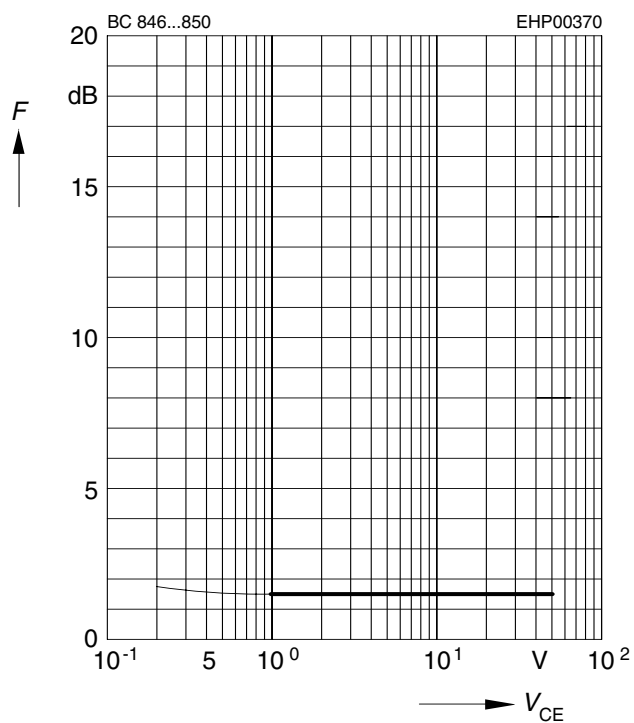
**h parameter  $h_e = f(V_{CE})$  normalized**

$I_C = 2mA$



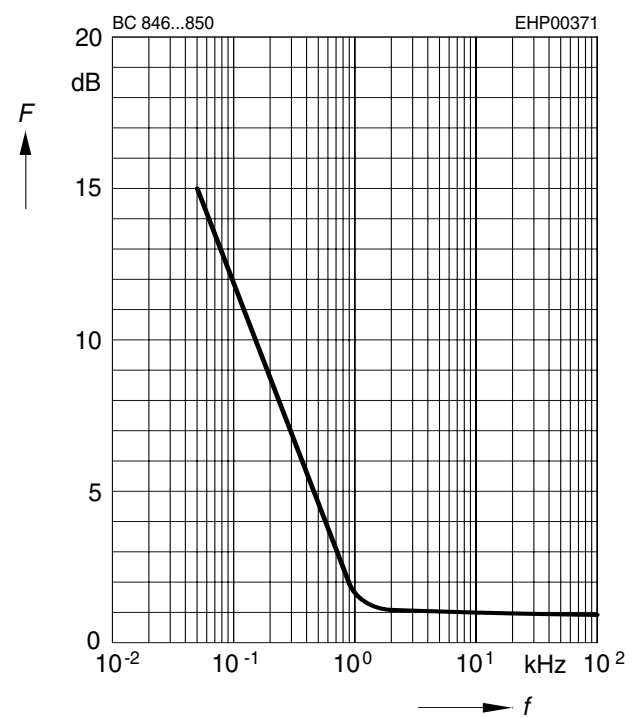
**Noise figure  $F = f(V_{CE})$**

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



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

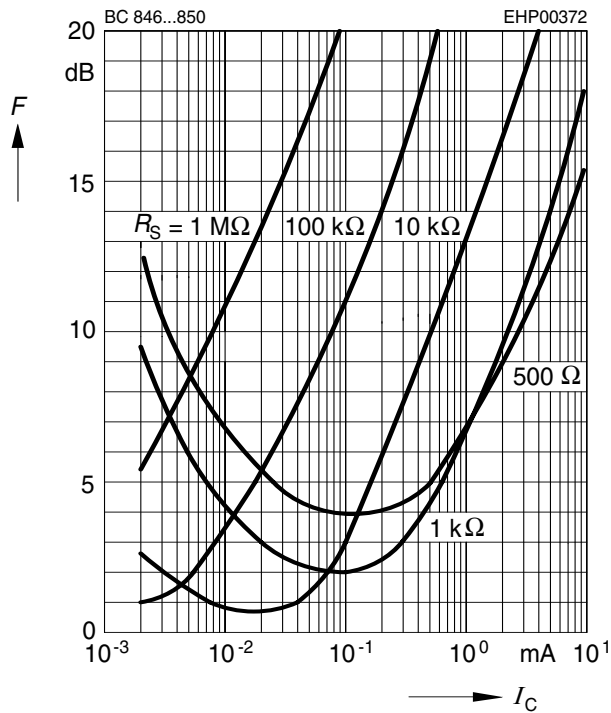
$I_C = 0.2mA$ ,  $V_{CE} = 5V$ ,  $R_S = 2k\Omega$





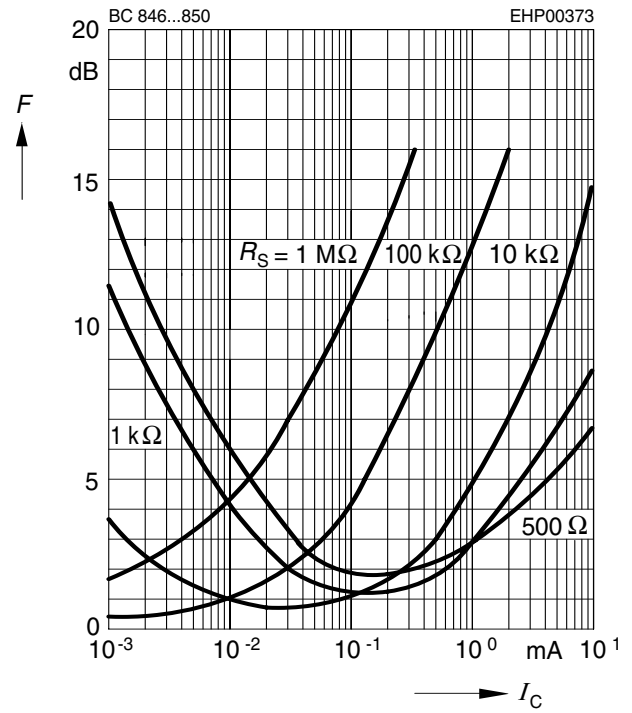
**Noise figure  $F = f(I_C)$**

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



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

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



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

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

