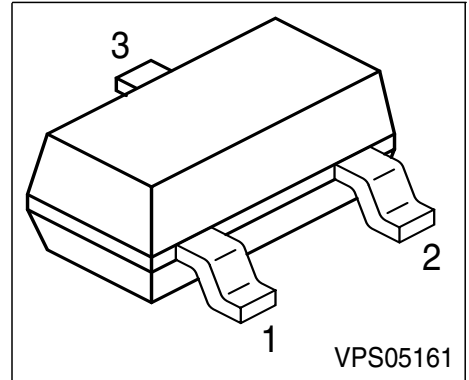


NPN Silicon AF Transistors

- 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: BCW61, BCX71 (PNP)



| Type | Marking | Pin Configuration | | | Package |
|---------|---------|-------------------|-------|-------|---------|
| | | 1 = B | 2 = E | 3 = C | |
| BCW60A | AAs | 1 = B | 2 = E | 3 = C | SOT23 |
| BCW60B | ABs | 1 = B | 2 = E | 3 = C | SOT23 |
| BCW60C | ACs | 1 = B | 2 = E | 3 = C | SOT23 |
| BCW60D | ADs | 1 = B | 2 = E | 3 = C | SOT23 |
| BCW60FF | AFs | 1 = B | 2 = E | 3 = C | SOT23 |
| BCW60FN | ANs | 1 = B | 2 = E | 3 = C | SOT23 |
| BCX70G | AGs | 1 = B | 2 = E | 3 = C | SOT23 |
| BCX70H | AHs | 1 = B | 2 = E | 3 = C | SOT23 |
| BCX70J | AJs | 1 = B | 2 = E | 3 = C | SOT23 |
| BCX70K | AKs | 1 = B | 2 = E | 3 = C | SOT23 |

Maximum Ratings

| Parameter | Symbol | BCW60 | BCW60FF | BCX70 | Unit |
|---|-----------|-------------|---------|-------|------|
| Collector-emitter voltage | V_{CEO} | 32 | 32 | 45 | V |
| Collector-base voltage | V_{CBO} | 32 | 32 | 45 | |
| Emitter-base voltage | V_{EBO} | 5 | 5 | 5 | |
| DC 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 | T_{stg} | -65 ... 150 | | | |

Thermal Resistance

| | | | |
|--|------------|------|-----|
| Junction - soldering point ¹⁾ | 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 $I_C = 10\text{ mA}$, $I_B = 0$ | $V_{(BR)CEO}$ | | | | V |
| BCW60/60FF | | 32 | - | - | |
| BCX70 | | 45 | - | - | |
| Collector-base breakdown voltage $I_C = 10\text{ }\mu\text{A}$, $I_B = 0$ | $V_{(BR)CBO}$ | | | | |
| BCW60/60FF | | 32 | - | - | |
| BCX70 | | 45 | - | - | |
| Emitter-base breakdown voltage $I_E = 1\text{ }\mu\text{A}$, $I_C = 0$ | $V_{(BR)EBO}$ | 5 | - | - | |

¹For 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. | |
| AC Characteristics | | | | | |
| Collector cutoff current $V_{CB} = 32\text{ V}, I_E = 0$ $V_{CB} = 45\text{ V}, I_E = 0$ | I_{CBO} | - | - | 20 | nA |
| | BCW60 /60FF | - | - | 20 | |
| | BCX70 | - | - | 20 | |
| Collector cutoff current $V_{CB} = 32\text{ V}, I_E = 0, T_A = 150^\circ\text{C}$ $V_{CB} = 45\text{ V}, I_E = 0, T_A = 150^\circ\text{C}$ | I_{CBO} | - | - | 20 | μA |
| | BCW60 / 60FF | - | - | 20 | |
| | BCX70 | - | - | 20 | |
| Emitter cutoff current $V_{EB} = 4\text{ V}, I_C = 0$ | I_{EBO} | - | - | 20 | nA |
| DC current gain 1) $I_C = 10\ \mu\text{A}, V_{CE} = 5\text{ V}$ | h_{FE} | 20 | 140 | - | - |
| | h_{FE} -grp. A/ G | 20 | 140 | - | |
| | h_{FE} -grp. B/ H | 20 | 200 | - | |
| | h_{FE} -grp. C/ J/ FF | 40 | 300 | - | |
| | h_{FE} -grp. D/ K/ FN | 100 | 460 | - | |
| DC current gain 1) $I_C = 2\text{ mA}, V_{CE} = 5\text{ V}$ | h_{FE} | 120 | 170 | 220 | |
| | h_{FE} -grp. A/ G | 120 | 170 | 220 | |
| | h_{FE} -grp. B/ H | 180 | 250 | 310 | |
| | h_{FE} -grp. C/ J/ FF | 250 | 350 | 460 | |
| | h_{FE} -grp. D/ K/ FN | 380 | 500 | 630 | |
| DC current gain 1) $I_C = 50\text{ mA}, V_{CE} = 1\text{ V}$ | h_{FE} | 50 | - | - | |
| | h_{FE} -grp. A/ G | 50 | - | - | |
| | h_{FE} -grp. B/ H | 70 | - | - | |
| | h_{FE} -grp. C/ J/ FF | 90 | - | - | |
| | h_{FE} -grp. D/ K/ FN | 100 | - | - | |

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

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

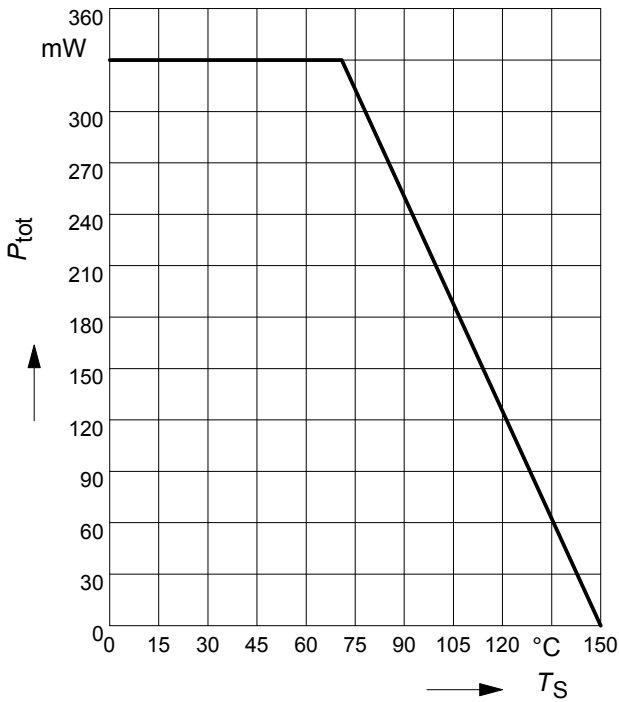
| Parameter | Symbol | Values | | | Unit |
|--|---|----------------|-------------------------------|------------------|------------|
| | | min. | typ. | max. | |
| DC Characteristics | | | | | |
| Collector-emitter saturation voltage ¹⁾ $I_C = 10\text{ mA}, I_B = 0.25\text{ mA}$ $I_C = 50\text{ mA}, I_B = 1.25\text{ mA}$ | V_{CEsat} | - | 0.12 0.2 | 0.25 0.55 | V |
| Base-emitter saturation voltage 1) $I_C = 10\text{ mA}, I_B = 0.25\text{ mA}$ $I_C = 50\text{ mA}, I_B = 1.25\text{ mA}$ | V_{BEsat} | - | 0.7 0.83 | 0.85 1.05 | |
| Base-emitter voltage 1) $I_C = 10\text{ }\mu\text{A}, V_{CE} = 5\text{ V}$ $I_C = 2\text{ mA}, V_{CE} = 5\text{ V}$ $I_C = 50\text{ mA}, V_{CE} = 1\text{ V}$ | $V_{BE(ON)}$ | - 0.55 - | 0.52 0.65 0.78 | - 0.75 - | |
| AC Characteristics | | | | | |
| Transition frequency $I_C = 20\text{ mA}, V_{CE} = 5\text{ V}, f = 100\text{ MHz}$ | f_T | - | 250 | - | MHz |
| Collector-base capacitance $V_{CB} = 10\text{ V}, f = 1\text{ MHz}$ | C_{cb} | - | 3 | - | pF |
| Emitter-base capacitance $V_{EB} = 0.5\text{ V}, f = 1\text{ MHz}$ | C_{eb} | - | 8 | - | |
| Short-circuit input impedance $I_C = 2\text{ mA}, V_{CE} = 5\text{ V}, f = 1\text{ kHz}$ | $h_{FE-grp.}$ A / G B / H C / J / FF D / K / FN | h_{11e} | - 2.7 3.6 4.5 7.5 | - - - - | k Ω |
| Open-circuit reverse voltage transf.ratio $I_C = 2\text{ mA}, V_{CE} = 5\text{ V}, f = 1\text{ kHz}$ | $h_{FE-grp.}$ A / G B / H C / J/FF D / K / FN | h_{12e} | - 1.5 2 2 3 | - - - - | 10^{-4} |

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

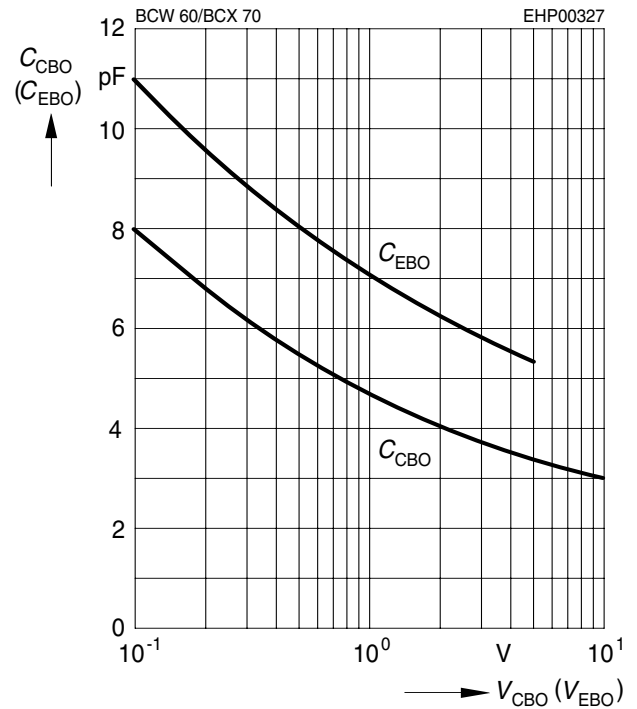
Electrical Characteristics at $T_A = 25^\circ\text{C}$, unless otherwise specified.

| Parameter | Symbol | Values | | | Unit |
|--|----------------------------|--------|------|-------|---------------|
| | | min. | typ. | max. | |
| AC Characteristics | | | | | |
| Short-circuit forward current transf.ratio $h_{FE-grp.}$ $I_C = 2\text{ mA}, V_{CE} = 5\text{ V}, f = 1\text{ kHz}$ | h_{21e} | | | | - |
| A / G | | - | 200 | - | |
| B / H | | - | 260 | - | |
| C / J / FF | | - | 330 | - | |
| D / K / FN | | - | 520 | - | |
| Open-circuit output admittance $I_C = 2\text{ mA}, V_{CE} = 5\text{ V}, f = 1\text{ kHz}$ | $h_{FE-grp.}$ h_{22e} | | | | μS |
| A / G | | - | 18 | - | |
| B / H | | - | 24 | - | |
| C / J / FF | | - | 30 | - | |
| D / K / FN | | - | 50 | - | |
| Noise figure $I_C = 200\text{ }\mu\text{A}, V_{CE} = 5\text{ V}, R_S = 2\text{ k}\Omega,$ $f = 1\text{ kHz}, \Delta f = 200\text{ Hz}$ | $h_{FE-grp.}$ F | | | | dB |
| A - K | | - | 2 | - | |
| FF - FN | | - | 1 | 2 | |
| Equivalent noise voltage $I_C = 200\text{ }\mu\text{A}, V_{CE} = 5\text{ V}, R_S = 2\text{ k}\Omega,$ $f = 10 \dots 50\text{ Hz}$ | $h_{FE-grp.}$ V_n | - | - | 0.135 | μV |
| FF / FN | | | | | |

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

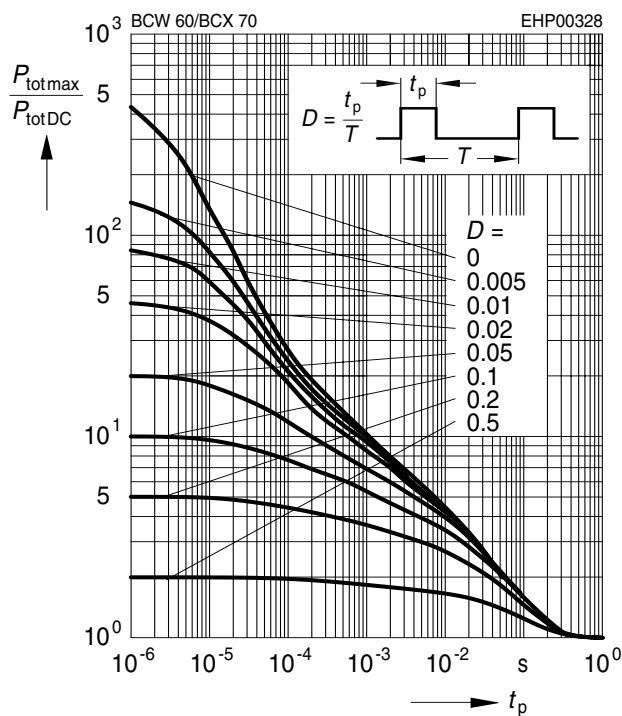


**Collector-base capacitance $C_{CB} = f(V_{CBO})$
Emitter-base capacitance $C_{EB} = f(V_{EBO})$**



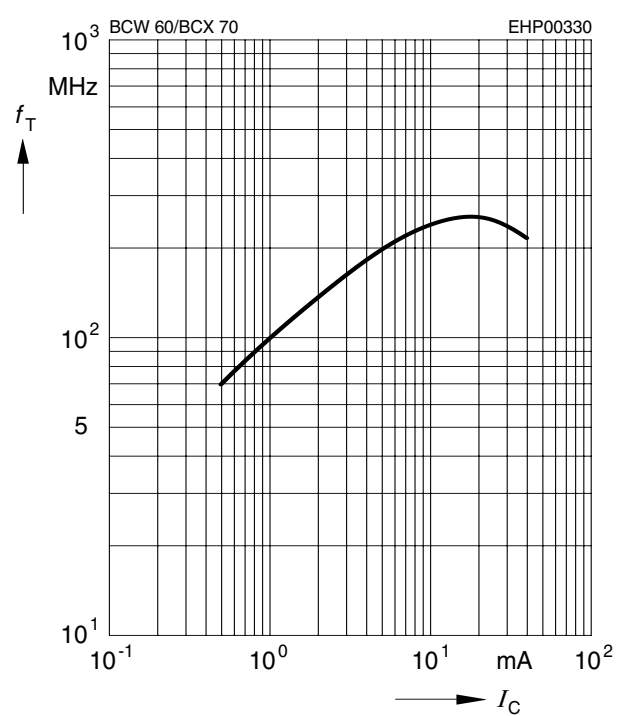
Permissible pulse load

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



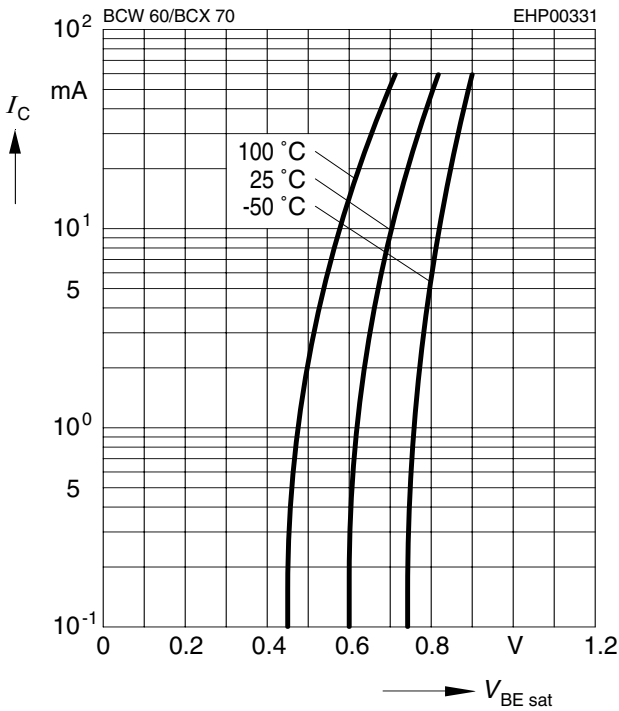
Transition frequency $f_T = f(I_C)$

$V_{CE} = 5V$



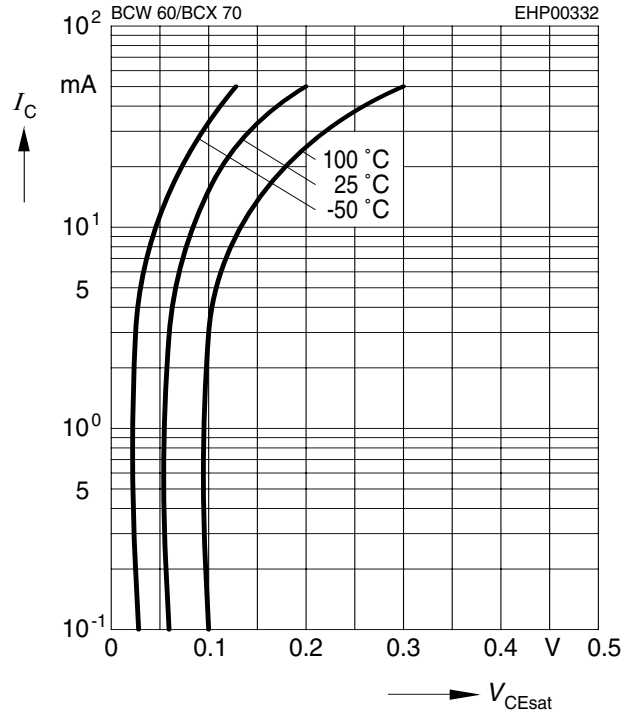
Base-emitter saturation voltage

$I_C = f(V_{BEsat}), h_{FE} = 40$



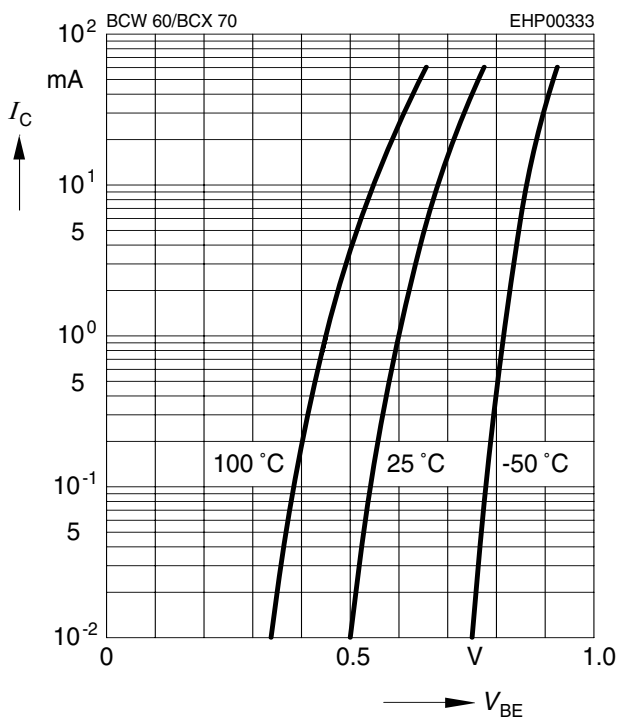
Collector-emitter saturation voltage

$I_C = f(V_{CEsat}), h_{FE} = 40$



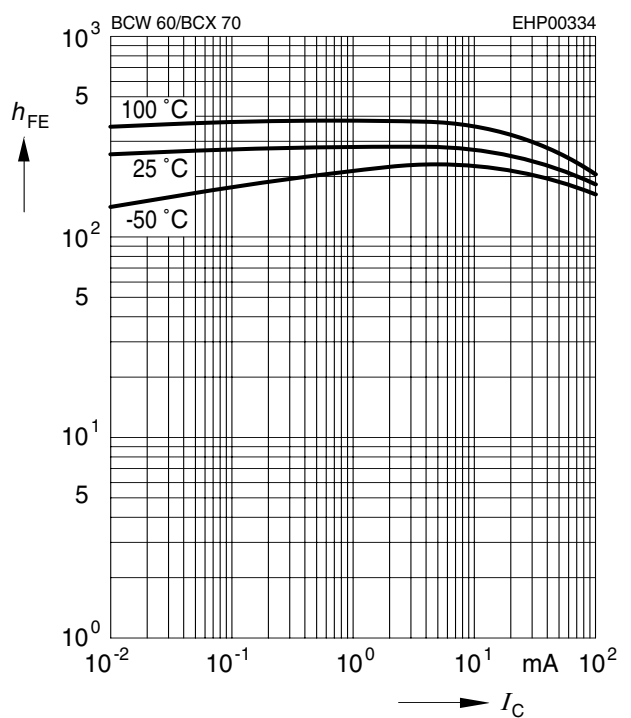
Collector current $I_C = f(V_{BE})$

$V_{CE} = 5V$



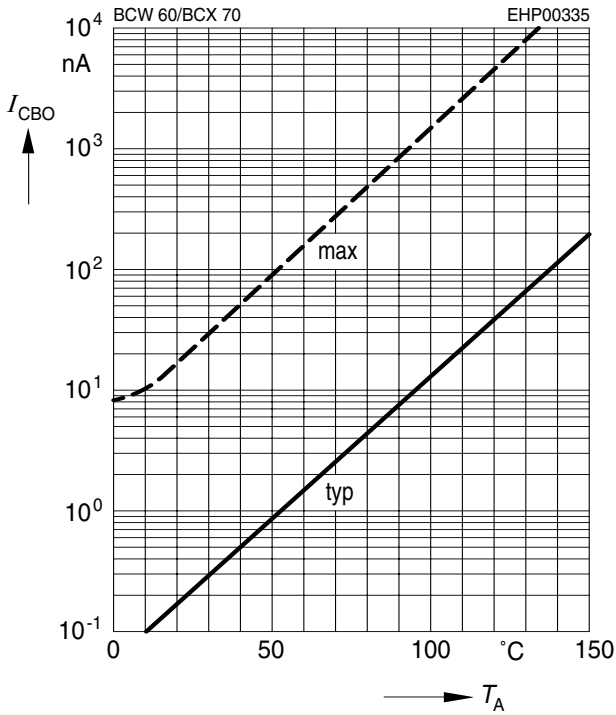
DC current gain $h_{FE} = f(I_C)$

$V_{CE} = 5V$



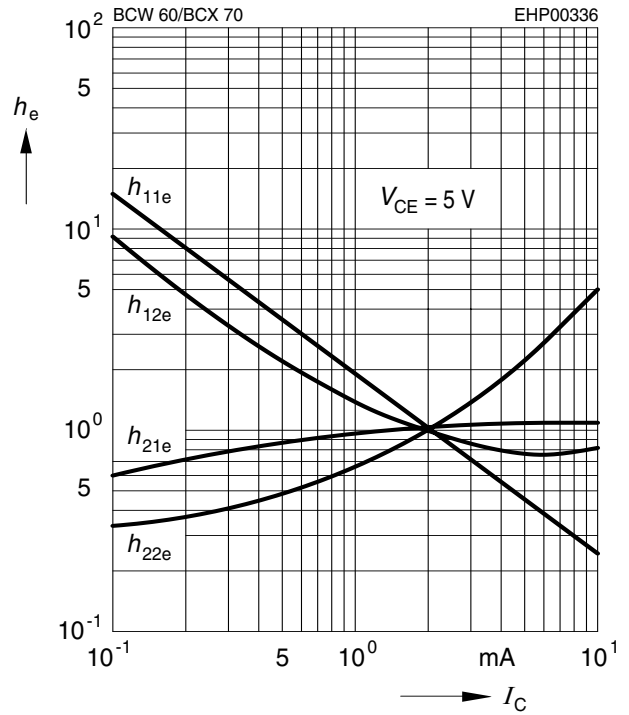
Collector cutoff current $I_{CBO} = f(T_A)$

$V_{CB} = V_{CEmax}$



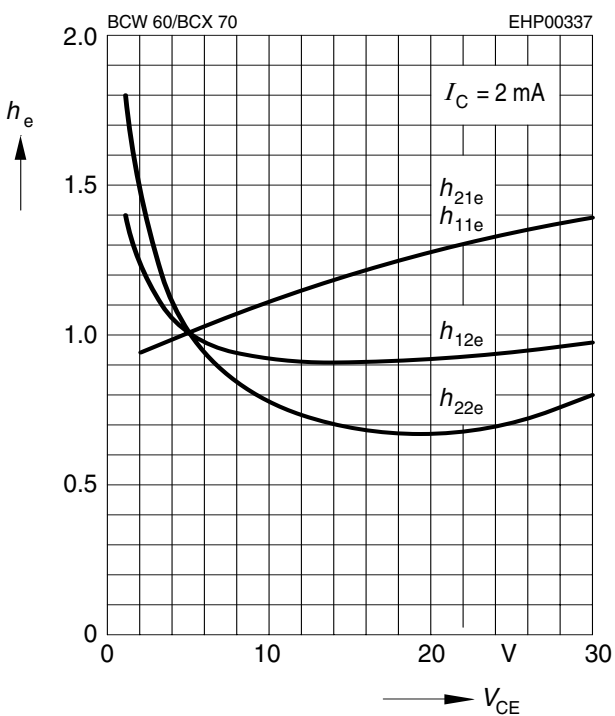
h parameter $h_e = f(I_C)$ normalized

$V_{CE} = 5V$



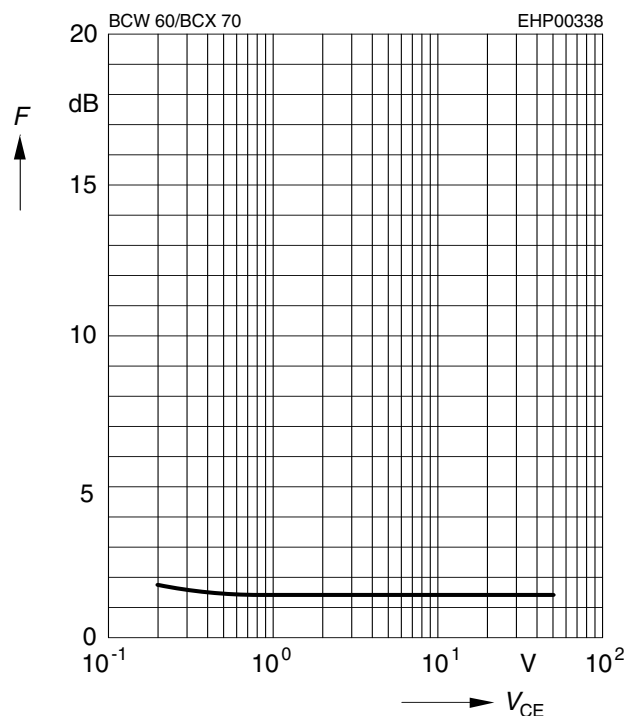
h parameter $h_e = f(V_{CE})$ normalized

$I_C = 2mA$



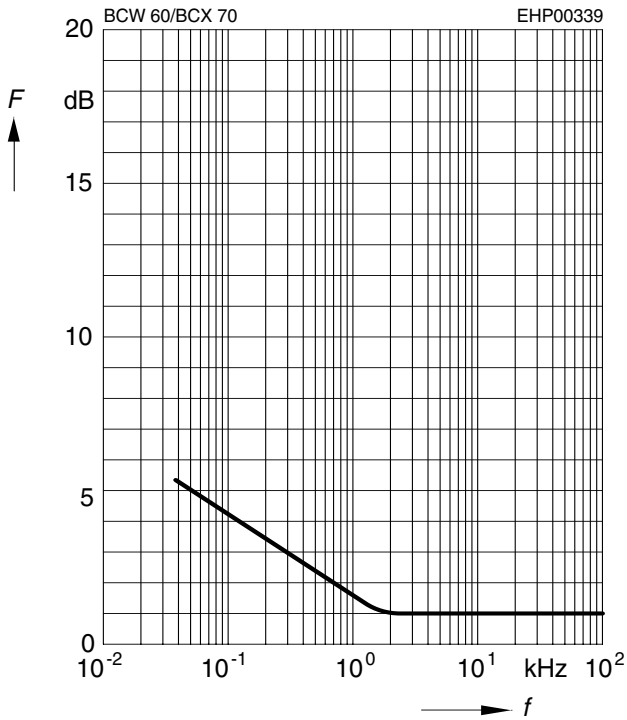
Noise figure $F = f(V_{CE})$

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



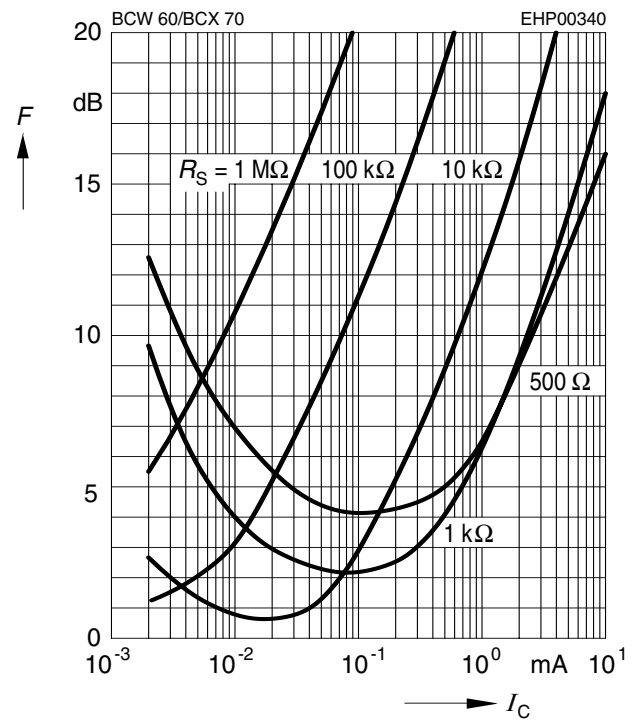
Noise figure $F = f(f)$

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



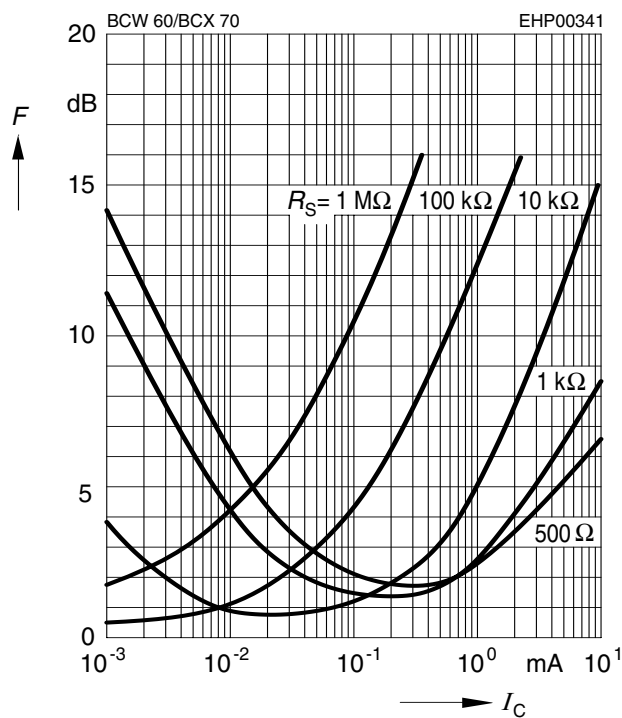
Noise figure $F = f(I_C)$

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



Noise figure $F = f(I_C)$

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



Noise figure $F = f(I_C)$

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

