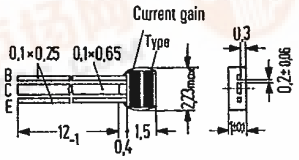
# NPN Silicon Transistors

SIEMENS AKTIENGESELLSCHAF

**C 121**
**BC 122**
**BC 123**

BC 121, BC 122, and BC 123 are miniature epitaxial NPN silicon planar transistors in U 32 plastic encapsulation. The types are marked by a color line on the case: BC 121 yellow, BC 122 white, BC 123 red. The transistors are particularly intended for use in low noise AF amplifier stages and as complementary transistors to BC 201, BC 202, and BC 203.

| Type | Ordering code |
|---|---|
| BC 121[1] | Q60203-X121 |
| BC 121 white | Q60203-X121-X9 |
| BC 121 yellow | Q60203-X121-X4 |
| BC 121 green | Q60203-X121-S6 |
| BC 121 blue | Q60203-X121-X6 |
| BC 122[1] | Q60203-X122 |
| BC 122 white | Q60203-X122-X9 |
| BC 122 yellow | Q60203-X122-X4 |
| BC 122 green | Q60203-X122-X10 |
| BC 122 blue | Q60203-X122-X6 |
| BC 123[1] | Q60203-X123 |
| BC 123 white | Q60203-X123-X9 |
| BC 123 yellow | Q60203-X123-X4 |
| BC 123 green | Q60203-X123-X5 |




Approx. weight 20 mg  Dimensions in mm

| Maximum ratings | | BC 121 | BC 122 | BC 123 | |
|---|---|---|---|---|---|
| Collector-emitter voltage | $V_{CEO}$ | 5 | 20 | 30 | V |
| Collector-base voltage | $V_{CBO}$ | 5 | 30 | 45 | V |
| Emitter-base voltage | $V_{EBO}$ | 5 | 5 | 5 | V |
| Collector current | $I_C$ | 75 | 75 | 75 | mA |
| Emitter current | $I_E$ | 85 | 85 | 85 | mA |
| Base current | $I_B$ | 10 | 10 | 10 | mA |
| Junction temperature | $T_j$ | 150 | 150 | 150 | °C |
| Storage temperature range | $T_{stg}$ | −55 to +125 | −55 to +125 | −55 to +125 | °C |
| Total power dissipation Lead length $L$ = 2 mm; see diagram[2] $R_{th} = f(L)$ | $P_{tot}$ | 250 | 250 | 250 | mW |
| **Thermal resistance** | | | | | |
| see diagram[2] $R_{th} = f(L)$ | $R_{thJA}$ | ≦1000 | ≦1000 | ≦1000 | K/W |

1) If the order does not include any exact indication of the current amplification group desired, a transistor of a current amplification group just available from stock will be delivered.

2) (page 146)

**Static characteristics ($T_{amb}$ = 25 °C)**

The transistors are grouped according to the small signal current gain $h_{fe}$ and marked by a color line. At a voltage of $V_{CE}$ = 2 V and the collector currents listed below, the following static characteristics apply:

| $h_{fe}$ groups | white | yellow | green | blue | |
|---|---|---|---|---|---|
| **Type** | **BC 121<br>BC 122<br>BC 123** | **BC 121<br>BC 122<br>BC 123** | **BC 121<br>BC 122<br>BC 123** | **BC 121<br>BC 122<br>–** | **BC 121<br>BC 122<br>BC 123** |
| $I_C$<br>mA | $h_{FE}$<br>$I_C/I_B$ | $h_{FE}$<br>$I_C/I_B$ | $h_{FE}$<br>$I_C/I_B$ | $h_{FE}$<br>$I_C/I_B$ | $V_{BE}$<br>mV |
| 0.01 | 63 | 110 | 180 | 330 | 530 |
| 0.25 | 100 | 175 | 290 | 520 | 560 (500-630) |
| 10 | 125 | 220 | 320 | 620 | 610 |

**Static characteristics ($T_{amb}$ = 25 °C)**

Saturation voltages

| | $V_{CEsat}$ | $V_{BEsat}$ | |
|---|---|---|---|
| ($I_C$ = 10 mA; $I_B$ = 0.5 mA) | 0.07 (<0.2) | 0.73 (<0.83) | V |
| ($I_C$ = 50 mA; $I_B$ = 2.5 mA) | 0.13 (<0.4) | 0.82 (>0.95) | V |

| | | BC 121 | BC 122 | BC 123 | |
|---|---|---|---|---|---|
| Collector cutoff current ($V_{CBO}$ = 25 V) | $I_{CBO}$ | – | – | <10 | nA |
| Collector cutoff current ($V_{CBO}$ = 15 V) | $I_{CBO}$ | – | <10 | – | nA |
| Collector cutoff current ($V_{CBO}$ = 2 V) | $I_{CBO}$ | <10 | – | – | nA |
| Collector-emitter breakdown voltage ($I_{CEO}$ = 100 µA) | $V_{(BR)CEO}$ | >5 | >20 | >30 | V |
| Collector-base breakdown voltage ($I_{CBO}$ = 100 µA) | $V_{(BR)CBO}$ | >5 | >30 | >45 | V |
| Emitter-base breakdown voltage ($I_{EBO}$ = 100 µA) | $V_{(BR)EBO}$ | >5 | >5 | >5 | V |

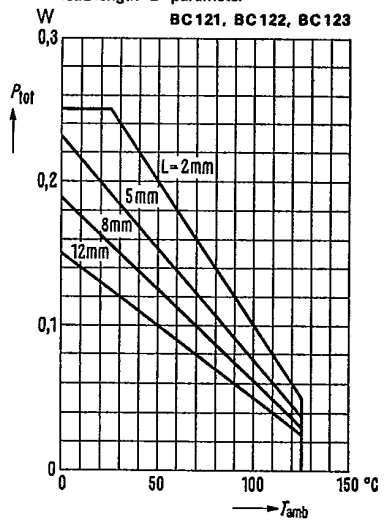
| Dynamic characteristics ($T_{amb}$ = 25 °C) | | BC 121 | BC 122 | BC 123 | |
|---|---|---|---|---|---|
| Transition frequency ($I_C$ = 250 µA; $V_{CE}$ = 0.5 V) | $f_T$ | 50 | 50 | 50 | MHz |
| Transition frequency ($I_C$ = 10 mA; $V_{CE}$ = 0.5 V) | $f_T$ | 250 | 250 | 250 | MHz |
| Collector-base capacitance ($V_{CBO}$ = 2 V; $f$ = 1 MHz) | $C_{CBO}$ | 4.4 (<11) | – | – | pF |
| Collector-base capacitance ($V_{CBO}$ = 10 V; $f$ = 1 MHz) | $C_{CBO}$ | – | 3.5 (<7) | 3.5 (<7) | pF |
| Noise figure ($I_C$ = 200 µA; $V_{CE}$ = 0.5 V; $f$ = 1 kHz; $\Delta f$ = 200 Hz; $R_g$ = 2 kΩ) | $NF$ | 2.5 (<5) | 2.5 (<5) | 2.5 (<5) | dB |

Current gain groups

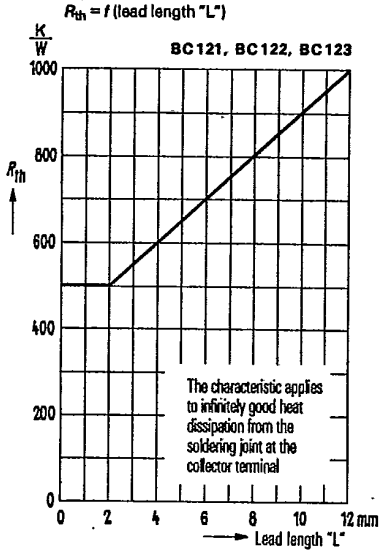
The transistors BC 121, BC 122, BC 123 are grouped according to the small signal current gain $h_{fe}$ and are marked by a color line.
Operating point: $V_{CE}$ = 0.5 V; $I_C$ = 250 µA; $f$ = 1 kHz

| Color line | white | yellow | green | blue |
|---|---|---|---|---|
| Type | BC 121<br>BC 122<br>BC 123 | BC 121<br>BC 122<br>BC 123 | BC 121<br>BC 122<br>BC 123 | BC 121<br>BC 122<br>– |
| Small signal current gain $h_{fe}$ | 75 to 150 | 125 to 260 | 240 to 500 | 450 to 900 |

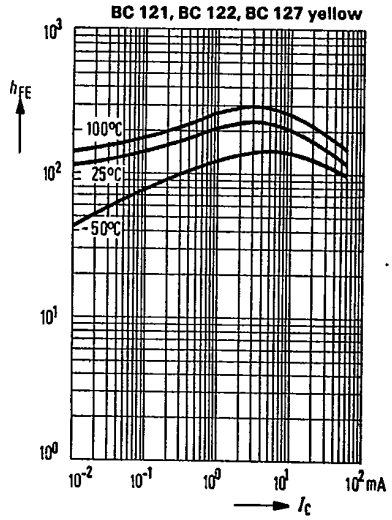
**Total perm. power dissipation versus temperature $P_{tot} = f(T_{amb})$; lead length "L"-parameter**



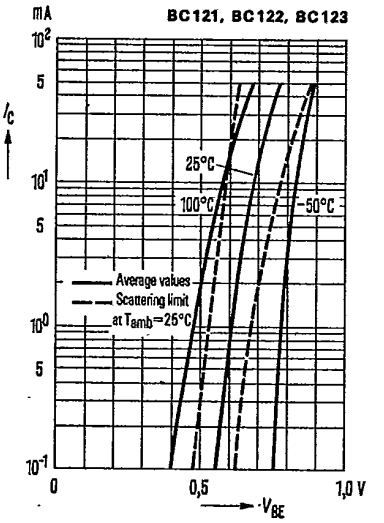

**Thermal resistance $R_{th} = f$ (lead length "L")**



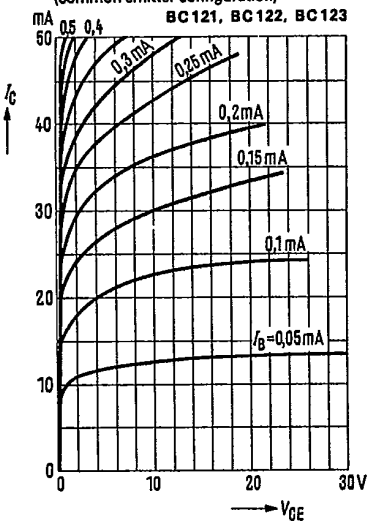

**DC current gain $h_{FE} = f(I_C)$**
**$V_{CE}$ = 2 V, $T_{amb}$ = parameter**
**(common emitter configuration)**
**BC 121 yellow, BC 122 yellow, BC 123 yellow**



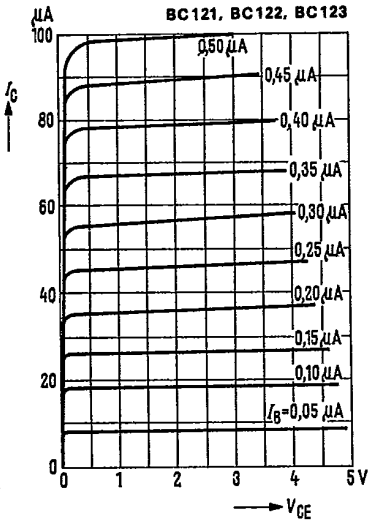

**Collector current $I_C = f(V_{BE})$**
**$T_{amb}$ = parameter; $V_{CE}$ = 2 V**
**(common emitter configuration)**



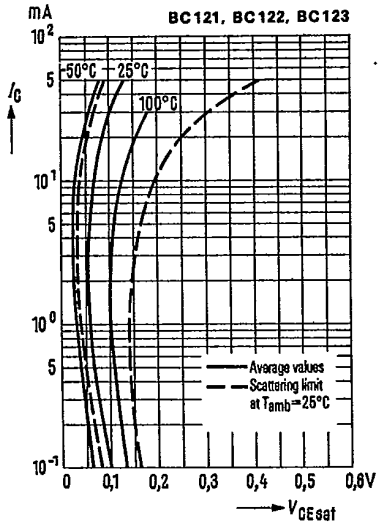
**Output characteristics $I_C = f(V_{CE})$;**
**$I_B$ = parameter, $T_{amb}$ = 25°C**
**(common emitter configuration)**



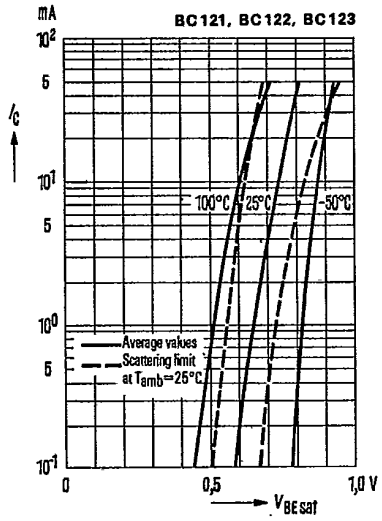

**Output characteristics $I_C = f(V_{CE})$**
**$I_B$ = parameter**
**(common emitter configuration)**




**Collector-emitter saturation voltage**
**$V_{CEsat} = f(I_C)$**
**$h_{FE}$ = 20; $T_{amb}$ = parameter**
**(common emitter configuration)**




**Base-emitter saturation voltage**
**$V_{BEsat} = f(I_C)$**
**$h_{FE}$ = 20; $T_{amb}$ = parameter**
**(common emitter configuration)**



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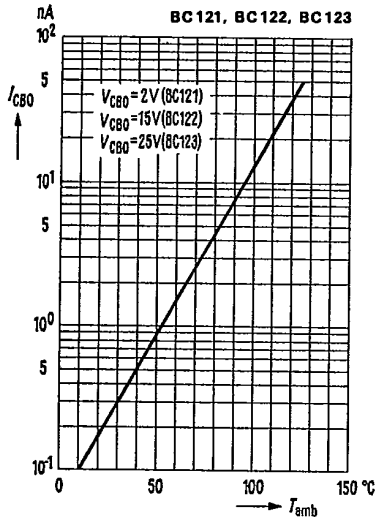
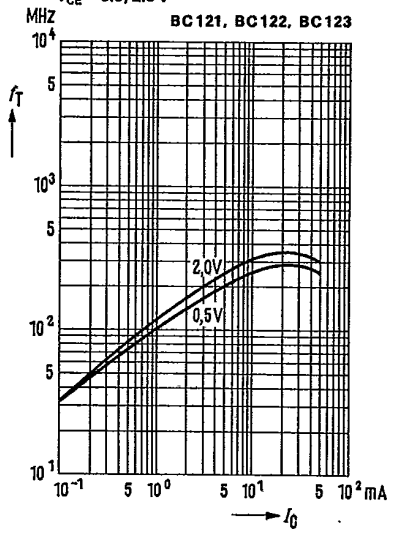
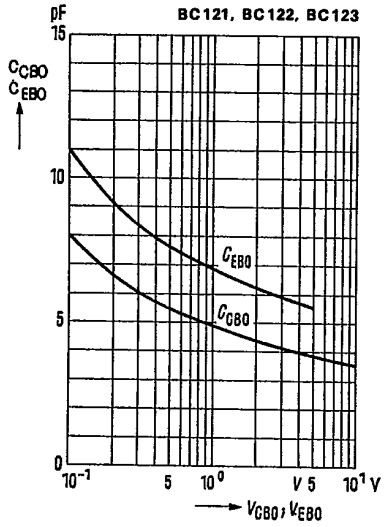
**Collector cutoff current versus temperature**
$I_{CBO} = f(T_{amb})$



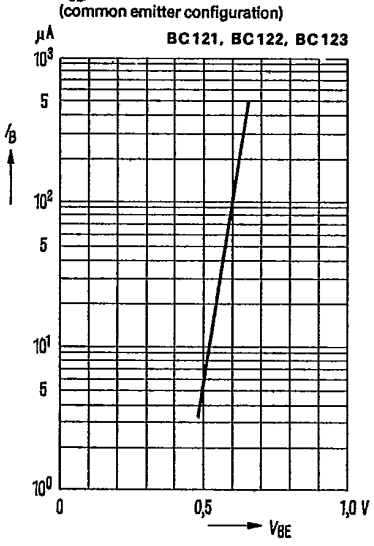

**Transition frequency $f_T = f(I_C)$;**
$V_{CE}$ = 0.5; 2.0 V



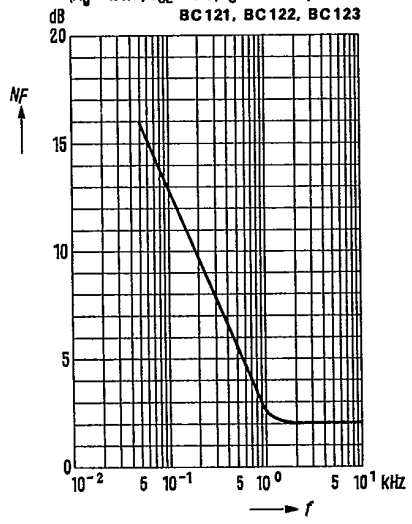

**Emitter-base capacitance $C_{EBO} = f(V_{EBO})$**
**Collector-base capacitance $C_{CBO} = f(V_{CBO})$**



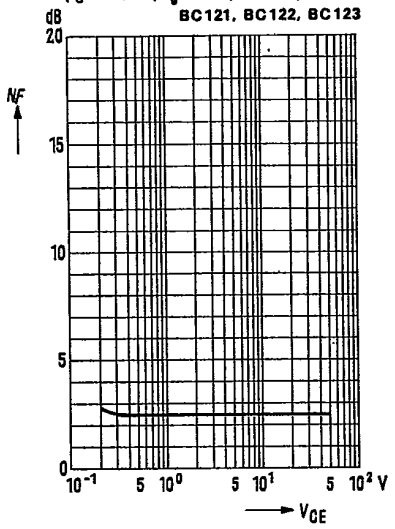

**Input characteristic $I_B = f(V_{BE})$**
$V_{CE}$ = 2 V
(common emitter configuration)



**Noise figure $NF = f(f)$**
**($R_g = 2\,k\Omega$, $V_{CE} = 5\,V$, $I_C = 0.2\,mA$)**
**BC121, BC122, BC123**




**Noise figure $NF = f(V_{CE})$**
**($I_C = 0.2\,mA$, $R_g = 2\,k\Omega$, $f = 1\,kHz$)**
**BC121, BC122, BC123**




**Noise figure $NF = f(I_C)$**
**($V_{CE} = 5\,V$; $f = 1\,kHz$, $T_{amb} = 25°C$)**
**BC121, BC122, BC123**