# NPN Silicon Planar Transistors

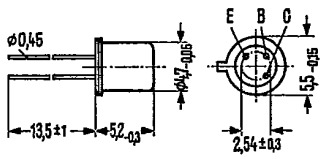
**BCY 58**
**BCY 59**
**BCY 65 E**



BCY 58, BCY 59, and BCY 65 E are epitaxial NPN silicon planar transistors in TO 18 cases (18 A 3 DIN 41876). The collector is electrically connected to the case. The transistors are particularly suitable for AF input and driver stages as well as for switching applications.

SIEMENS AKTIENGESELLSCHAF

| Type | Ordering code |
|---|---|
| BCY 58 | Q60203-Y58 |
| BCY 58 VII | Q60203-Y58-G |
| BCY 58 VIII | Q60203-Y58-H |
| BCY 58 IX | Q60203-Y58-J |
| BCY 58 X | Q60203-Y58-K |
| BCY 59 | Q60203-Y59 |
| BCY 59 VII | Q60203-Y59-G |
| BCY 59 VIII | Q60203-Y59-H |
| BCY 59 IX | Q60203-Y59-J |
| BCY 59 X | Q60203-Y59-K |
| BCY 65 E | Q60203-Y65-S2 |
| BCY 65 E VII | Q60203-Y65-E7 |
| BCY 65 E VIII | Q60203-Y65-E8 |
| BCY 65 E IX | Q60203-Y65-E9 |




Approx. weight 0.3 g  Dimensions in mm

| Maximum ratings | | BCY 58 | BCY 59 | BCY 65 E | |
|---|---|---|---|---|---|
| Collector-emitter voltage | $V_{CES}$ | 32 | 45 | 60 | V |
| Collector-emitter voltage | $V_{CEO}$ | 32 | 45 | 60 | V |
| Emitter-base voltage | $V_{EBO}$ | 7 | 7 | 7 | V |
| Collector current | $I_C$ | 200 | 200 | 100 | mA |
| Base current | $I_B$ | 50 | 50 | 50 | mA |
| Junction temperature | $T_j$ | 200 | 200 | 200 | °C |
| Storage temperature range | $T_{stg}$ | −65 to +200 | | | °C |
| Total power dissipation ($T_{case} \leq 45$ °C) | $P_{tot}$ | 1 | 1 | 1 | W |

| Thermal resistance | | | | | |
|---|---|---|---|---|---|
| Junction to ambient air | $R_{thJA}$ | ≤450 | ≤450 | ≤450 | K/W |
| Junction to case | $R_{thJC}$ | ≤150 | ≤150 | ≤150 | K/W |

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

The transistors are grouped according to the DC current gain $h_{FE}$ and marked by Roman numerals.

**BCY 58**
**BCY 59**
**BCY 65E**

T-29-23

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

| Type | | BCY 65 E | BCY 65 E | BCY 65 E | – | BCY 58 |
|---|---|---|---|---|---|---|
| | | BCY 58/59 | BCY 58/59 | BCY 58/59 | BCY 58/59 | BCY 59 |
| $h_{FE}$ group | | VII | VIII | IX | X | BCY 65E |
| $V_{CE}$ V | $I_C$ mA | $h_{FE}$ $I_C/I_B$ | $h_{FE}$ $I_C/I_B$ | $h_{FE}$ $I_C/I_B$ | $h_{FE}$ $I_C/I_B$ | $V_{BE}$ V |
| 5 | 0.01 | 78 | 145 (>20) | 220 (>40) | 300 (>100) | 0.5 |
| 5 | 2 | 170 (120 to 220) | 250 (180 to 310) | 350 (250 to 460) | 500 (380 to 630) | 0.62 (0.55 to 0.7)* |
| 1 | 10 | 190 (>80) | 260 (120 to 400) | 380 (160 to 630) | 550 (240 to 1000) | 0.7 |
| 1 | 50[1)] | >40 | >45 | >60 | – | 0.76 |
| 1 | 100[2)] | >40 | >45 | >60 | >60 | 0.76 |

| **Saturation voltages:** | $V_{CEsat}$ | $V_{BEsat}$ | |
|---|---|---|---|
| ($I_C$ = 10 mA; $I_B$ = 0.25 mA) | 0.12 (<0.35) | 0.7 (<0.85) | V |
| ($I_C$ = 10 mA; $I_B$ = 2.5 mA)[2)] | 0.3 (<0.7) | 0.9 (<1.2) | V |
| ($I_C$ = 50 mA; $I_B$ = 1.25 mA)[1)] | 0.1 (<0.7) | 0.9 (<1.2) | V |

| | | BCY 58 | BCY 59 | BCY 65E | |
|---|---|---|---|---|---|
| Collector cutoff current ($V_{CES}$ = 32 V) | $I_{CES}$ | 0.2 (<10) | – | – | nA* |
| ($V_{CES}$ = 45 V) | $I_{CES}$ | – | 0.2 (<10) | – | nA* |
| ($V_{CES}$ = 60 V) | $I_{CES}$ | – | – | 0.2 (<10) | nA* |
| Collector cutoff current ($V_{CES}$ = 32 V, $T_{amb}$ = 150°C) | $I_{CES}$ | 0.2 (<10) | – | – | µA |
| ($V_{CES}$ = 45 V; $T_{amb}$ = 150°C) | $I_{CES}$ | – | 0.2 (<10) | – | µA |
| ($V_{CES}$ = 60 V; $T_{amb}$ = 150°C) | $I_{CES}$ | – | – | 0.2 (<10) | µA |
| Collector cutoff current ($V_{CE}$ = 32 V; $V_{BE}$ = 0.2 V; $T_{amb}$ = 100°C) | $I_{CEX}$ | <20 | – | – | µA |
| ($V_{CE}$ = 45 V; $V_{BE}$ = 0.2 V; $T_{amb}$ = 100°C) | $I_{CEX}$ | – | <20 | – | µA |
| ($V_{CE}$ = 60 V; $V_{BE}$ = 0.2 V; $T_{amb}$ = 100°C) | $I_{CEX}$ | – | – | <20 | µA |
| Emitter cutoff current ($V_{EBO}$ = 5 V) | $I_{EBO}$ | <10 | <10 | <10 | nA* |
| Collector-emitter breakdown voltage ($I_{CEO}$ = 2 mA) | $V_{(BR)CEO}$ | >32 | >45 | >60 | V* |
| Emitter-base breakdown voltage ($I_{EBO}$ = 1 µA) | $V_{(BR)EBO}$ | >7 | >7 | >7 | V* |

1) applies only to BCY 65 E
2) applies only to BCY 58, BCY 59
*) AQL = 0.65%

| Dynamic characteristics ($T_{amb}$ = 25 °C) | | BCY 58 | BCY 59 | BCY 65 E | |
|---|---|---|---|---|---|
| Transition frequency ($I_C$ = 10 mA; $V_{CE}$ = 5 V; $f$ = 100 MHz) | $f_T$ | 250 (>125) | 250 (>125) | 250 (>125) | MHz |
| Collector-base capacitance ($V_{CBO}$ = 10 V; $f$ = 1 MHz) | $C_{CBO}$ | 3.5 (<6) | 3.5 (<6) | 3.5 (<6) | pF |
| Emitter-base capacitance ($V_{EBO}$ = 0.5 V; $f$ = 1 MHz) | $C_{EBO}$ | 8 (<15) | 8 (<15) | 8 (<15) | pF |
| Noise figure ($I_C$ = 0.2 mA; $V_{CE}$ = 5 V; $R_g$ = 2 kΩ; $f$ = 1 kHz; $\Delta f$ = 200 Hz) | $NF$ | 2 (<6) | 2 (<6) | 2 (<6) | dB |

**Four-pole characteristics** ($I_C$ = 2 mA; $V_{CE}$ = 5 V; $f$ = 1 kHz)

| $h_{FE}$ group | VII | VIII | IX | X | |
|---|---|---|---|---|---|
| $h_{11e}$ | 2.7 (1.6 to 4.5) | 3.6 (2.5 to 6) | 4.5 (3.2 to 8.5) | 7.5 (4.5 to 12) | kΩ |
| $h_{12e}$ | 1.5 | 2 | 2 | 3 | $10^{-4}$ |
| $h_{21e}$ | 200 | 260 | 330 | 520 | – |
| $h_{22e}$ | 18 (<30) | 24 (<50) | 30 (<60) | 50 (<100) | µS |

**Switching times:**
Operating point: BCY 58; BCY 59; BCY 65 E
$I_C : I_{B1} : -I_{B2}$ approx. 10:1:1 mA; $R_1$ = 5 kΩ; $R_2$ = 5 kΩ; $V_{BB}$ = 3.6 V; $R_L$ = 990 Ω

| | | | | | |
|---|---|---|---|---|---|
| $t_d$ | 35 | ns | $t_s$ | 400 | ns |
| $t_r$ | 50 | ns | $t_f$ | 80 | ns |
| $t_{on}$ | 85 (<150) | ns | $t_{off}$ | 480 (<800) | ns |

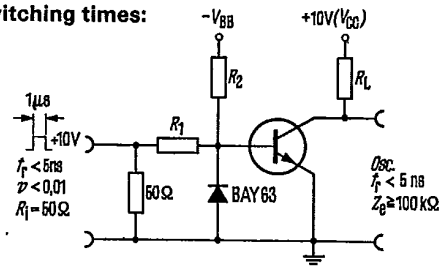
**Switching times:**
Operating point: BCY 58; BCY 59
$I_C : I_{B1} : -I_{B2}$ approx. 100:10:10 mA; $R_1$ = 500 Ω; $R_2$ = 700 Ω; $V_{BB}$ = 5 V; $R_L$ = 98 Ω

| | | | | | |
|---|---|---|---|---|---|
| $t_d$ | 5 | ns | $t_s$ | 250 | ns |
| $t_r$ | 50 | ns | $t_f$ | 200 | ns |
| $t_{on}$ | 55 (<150) | ns | $t_{off}$ | 450 (<800) | ns |

**Switching times:**
Operating point: BCY 65 E
$I_C : I_{B1} : -I_{B2}$ approx. 50:5:5 mA; $R_1$ = 1 kΩ; $R_2$ = 1.3 kΩ; $V_{BB}$ = 4.7 V; $R_L$ = 195 Ω

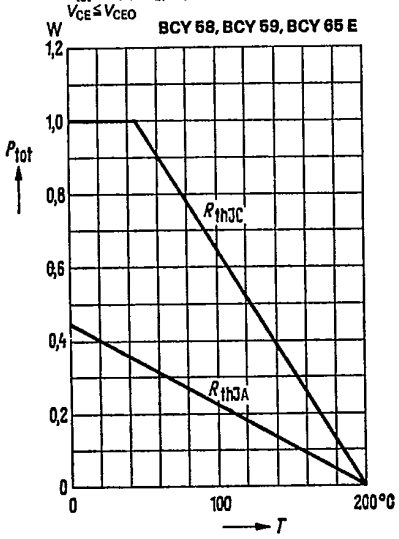
| | | | | | |
|---|---|---|---|---|---|
| $t_d$ | 15 | ns | $t_s$ | 300 | ns |
| $t_r$ | 50 | ns | $t_f$ | 150 | ns |
| $t_{on}$ | 65 (<150) | ns | $t_{off}$ | 450 (<800) | ns |

**Test circuit for switching times:**

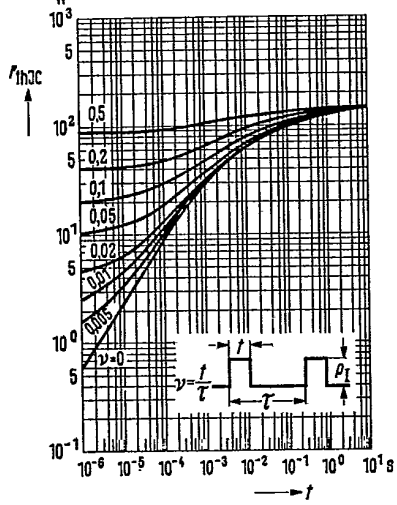


# BCY 58
# BCY 59
# BCY 65 E

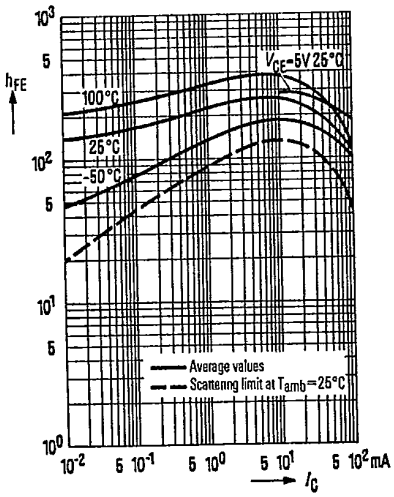
**Total perm. power dissipation versus temperature**
$P_{tot} = f(T)$; $R_{th}$ = parameter;
$V_{CE} \leq V_{CEO}$
**BCY 58, BCY 59, BCY 65 E**

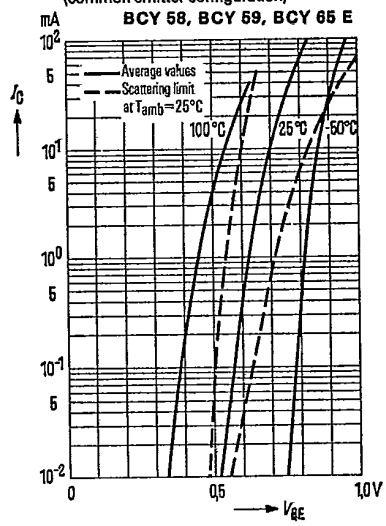



**Permissible pulse load**
$r_{thJC} = f(t)$; v = parameter
**BCY 58, BCY 59, BCY 65 E**




**DC current gain $h_{FE} = f(I_C)$**
$V_{CE} = 1$ V; $T_{amb}$ = parameter
(common emitter configuration)




**Collector current $I_C = f(V_{BE})$**
$V_{CE} = 1$ V
(common emitter configuration)
**BCY 58, BCY 59, BCY 65 E**