290-452

MAGNA TEC

# BD202
# BD204 SILICON EPITAXIAL-BASE POWER TRANSISTORS

P-N-P transistors in a plastic envelope. With their n-p-n complements BD201 and BD203 they are primarily intended for use in hi-fi equipment delivering an output of 15 to 25 W into a 4 Ω or 8 Ω load.

## QUICK REFERENCE DATA

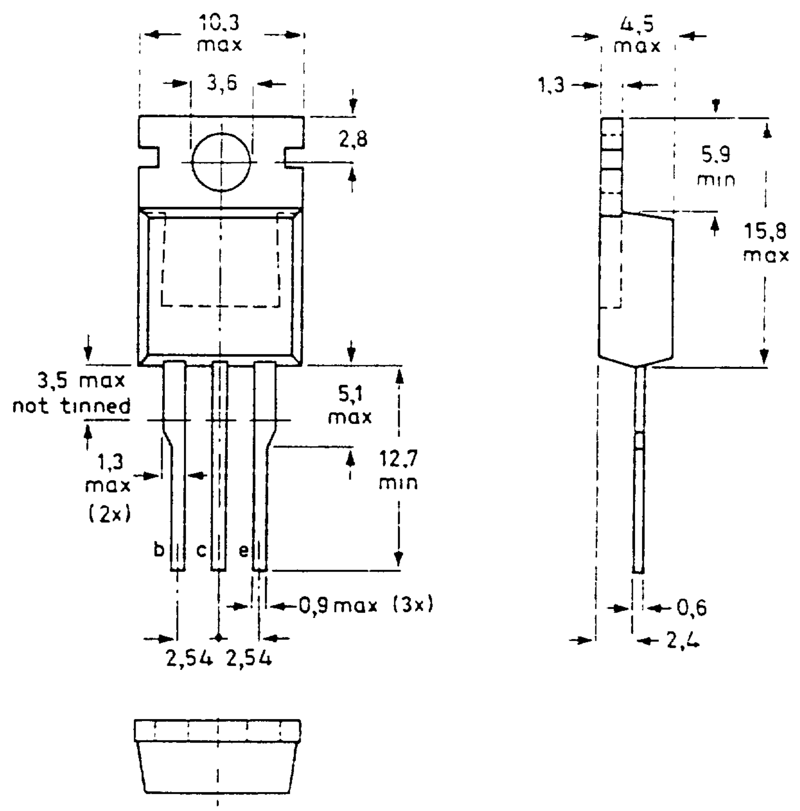
| | | | BD202 | BD204 | |
|---|---|---|---|---|---|
| Collector-emitter voltage (open base) | $-V_{CEO}$ | max. | 45 | 60 | V |
| Collector current (d.c.) | $-I_C$ | max. | 8 | 8 | A |
| Total power dissipation up to $T_{mb}$ = 25 °C | $P_{tot}$ | max. | 60 | 60 | W |
| Cut-off frequency | | | | | |
| $-I_C$ = 0,3 A; $-V_{CE}$ = 3 V | $f_{hfe}$ | > | 25 | 25 | kHz |

## MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-220.

Collector connected to mounting base.



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# BD202
# BD204

## RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

| | | | BD202 | BD204 | |
|---|---|---|---|---|---|
| Collector-base voltage (open emitter) | $-V_{CBO}$ | max. | 60 | 60 | V |
| Collector-emitter voltage (open base) | $-V_{CEO}$ | max. | 45 | 60 | V |
| Emitter-base voltage (open collector) | $-V_{EBO}$ | max. | 5 | 5 | V |

| | | | | |
|---|---|---|---|---|
| Collector current (d.c.) | $-I_C$ | max. | 8 | A |
| Collector current (peak value, $t_p \leqslant 10$ ms) | $-I_{CM}$ | max. | 12 | A |
| Collector current (non-repetitive peak value, $t_p \leqslant 2$ ms) | $-I_{CSM}$ | max. | 25 | A |
| Base current (d.c.) | $-I_B$ | max. | 3 | A |
| Total power dissipation up to $T_{mb} = 25\ ^oC$ | $P_{tot}$ | max. | 60 | W |
| Storage temperature | $T_{stg}$ | | −65 to + 150 | $^oC$ |
| Junction temperature | $T_j$ | max. | 150 | $^oC$ |

## THERMAL RESISTANCE

| | | | | |
|---|---|---|---|---|
| From junction to mounting base | $R_{th\ j\text{-}mb}$ | = | 2,08 | K/W |
| From junction to ambient in free air | $R_{th\ j\text{-}a}$ | = | 70 | K/W |

## CHARACTERISTICS

$T_j = 25\ ^oC$ unless otherwise specified

| | | | | |
|---|---|---|---|---|
| Collector cut-off current | | | | |
| $I_B = 0$; $-V_{CE} = 30$ V | $-I_{CEO}$ | < | 1 | mA |
| $I_E = 0$; $-V_{CB} = 40$ V; $T_j = 150\ ^oC$ | $-I_{CBO}$ | < | 1 | mA |
| Emitter cut-off current | | | | |
| $I_C = 0$; $-V_{EB} = 5$ V | $-I_{EBO}$ | < | 5 | mA |
| Collector-emitter breakdown voltage | | | | |
| $I_C = 0{,}2$ A; $I_B = 0$ BD202 | $-V_{(BR)CEO}$ | > | 45 | V |
| $I_C = 0{,}2$ A; $I_B = 0$ BD204 | $-V_{(BR)CEO}$ | > | 60 | V |
| Base-emitter voltage * | | | | |
| $-I_C = 3$ A; $-V_{CE} = 2$ V | $-V_{BE}$ | < | 1,5 | V |
| Knee voltage * | | | | |
| $-I_C = 3$ A; $-I_B$ = value at which $-I_C = 3{,}3$ A at $-V_{CE} = 2$ V | $-V_{CEK}$ | typ. | 1 | V |
| Saturation voltages* | | | | |
| $-I_C = 3$ A; $-I_B = 0{,}3$ A | $-V_{CEsat}$ | < | 1 | V |
| $-I_C = 6$ A; $-I_B = 0{,}6$ A | $-V_{CEsat}$ | < | 1,5 | V |
| | $-V_{BEsat}$ | < | 2 | V |
| D.C. current gain* | | | | |
| $-I_C = 3$ A; $-V_{CE} = 2$ V BD202 | $h_{FE}$ | > | 30 | |
| $-I_C = 2$ A; $-V_{CE} = 2$ V BD204 | $h_{FE}$ | > | 30 | |
| $-I_C = 1$ A, $-V_{CE} = 2$ V | $h_{FE}$ | > | 30 | |

* Measured under pulse conditions: $t_p < 300\ \mu s$, $\delta < 2\%$.

# BD202
# BD204

| | | | |
|---|---|---|---|
| Cut-off frequency<br>$-I_C = 0{,}3$ A; $-V_{CE} = 3$ V | $f_{hfe}$ | > | 25 kHz |
| Transition frequency at f = 1 MHz<br>$-I_C = 0{,}3$ A; $-V_{CE} = 3$ V | $f_T$ | > | 7 MHz |
| D.C. current gain ratio of matched complementary pairs<br>$-I_C = 1$ A; $-V_{CE} = 2$ V | $h_{FE1}/h_{FE2}$ | < | 2,5 |
| Forward bias second breakdown collector current<br>$V_{CE} = 40$ V; $t_p = 0{,}1$ s | $I_{SB}$ | > | 1,5 A |
| Switching times<br>$-I_{Con} = 2$ A; $-I_{Bon} = I_{Boff} = 0{,}2$ A<br>turn-on time | $t_{on}$ | < | 1 μs |
| turn-off time | $t_{off}$ | < | 2 μs |

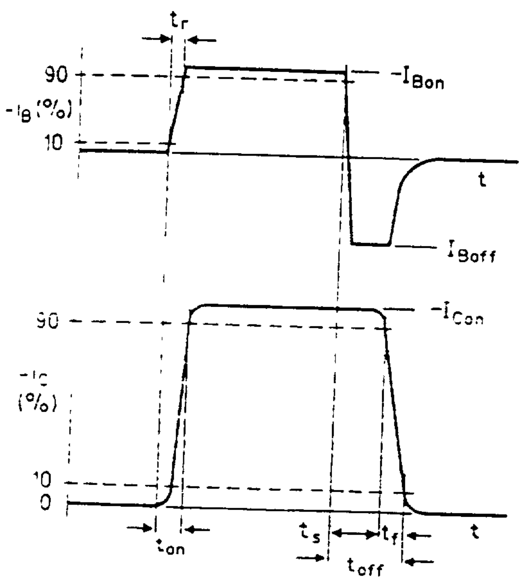


Fig. 2 Switching times waveforms.

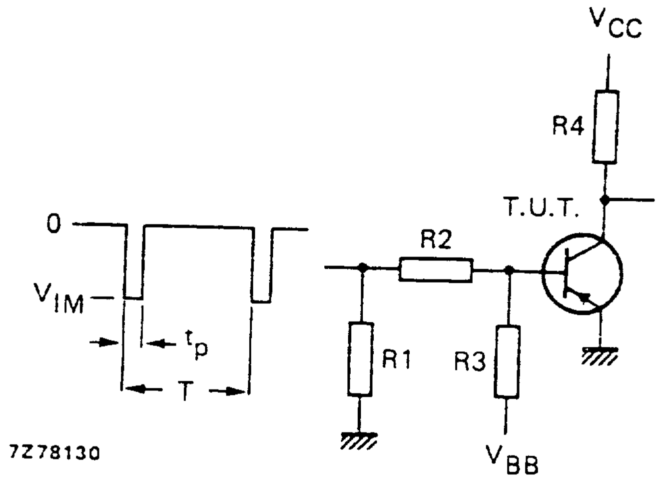


Fig. 3 Switching times test circuit.

| | | | |
|---|---|---|---|
| $-V_{IM}$ | = 15 V | R3 | = 22 Ω |
| $-V_{CC}$ | = 20 V | R4 | = 10 Ω |
| $+V_{BB}$ | = 4 V | $t_r = t_f$ | = 15 ns |
| R1 | = 56 Ω | $t_p$ | = 10 μs |
| R2 | = 33 Ω | T | = 500 μs |

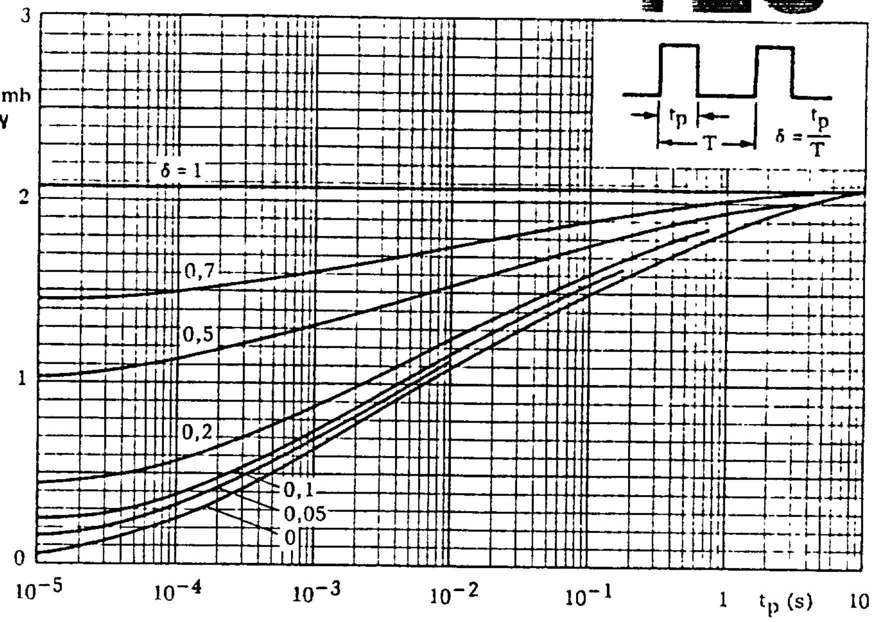


Fig 5 Pulse power rating chart.

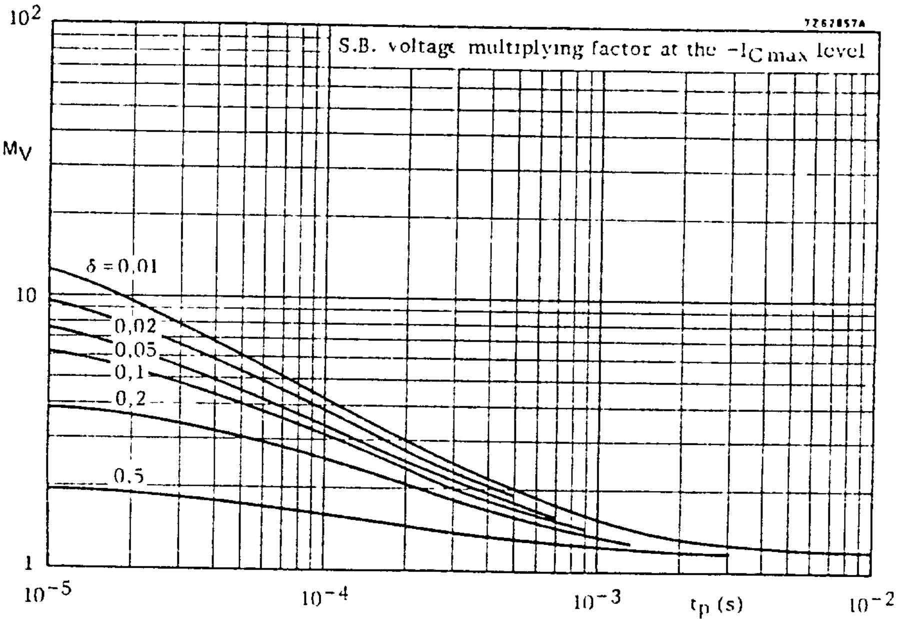


Fig. 6 S.B. voltage multiplying factor at the $-I_{Cmax}$ level.

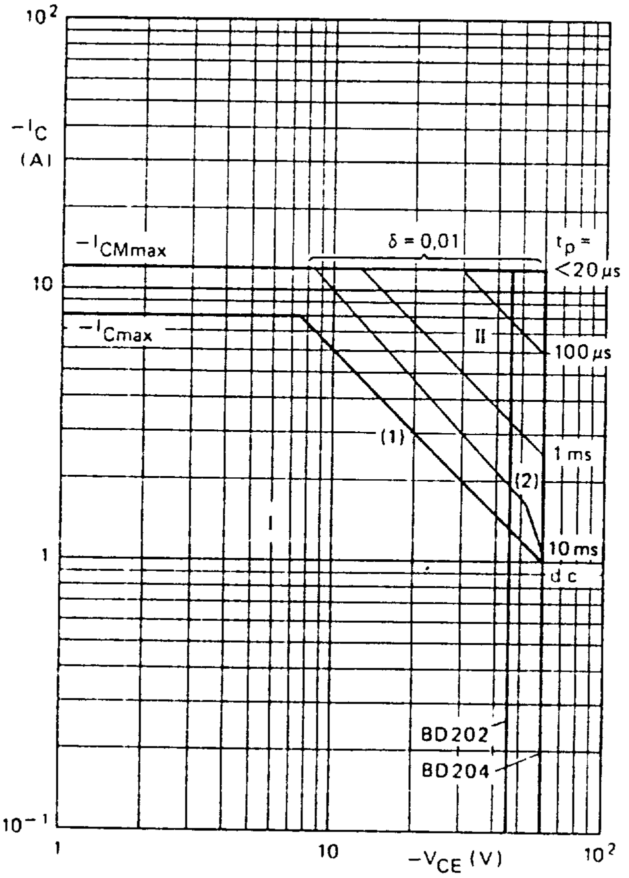


Fig 4 Safe Operating ARea, $T_{mb}$ = 25 °C

I Region of permissible d c operation
II Permissible extension for repetitive pulse operation
(1) $P_{tot\ max}$ and $P_{peak\ max}$ lines
(2) Second breakdown limits (independent of temperature)

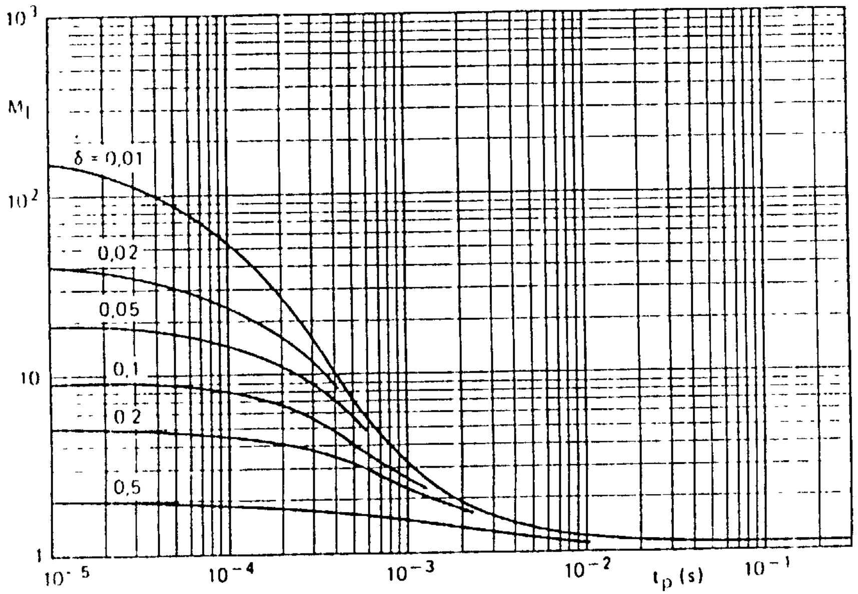


Fig 7 S.B current multiplying factor at the $-V_{CEOmax}$ level

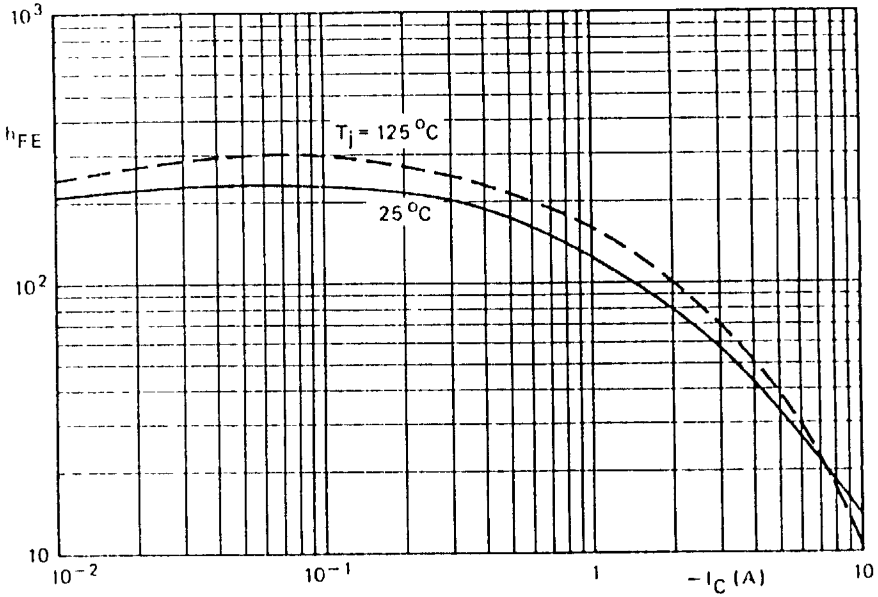


Fig 9 Typical forward current transfer ratio at $-V_{CE}$ = 2 V.

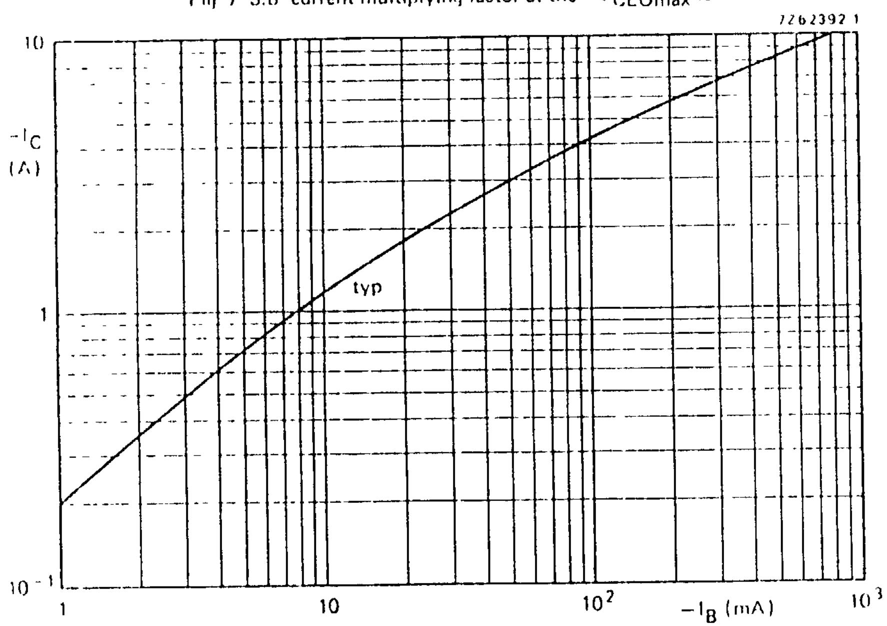


Fig 8 Typical collector current as a function of base current $-V_{CE}$ = 2 V, $T_j$ = 25 °C

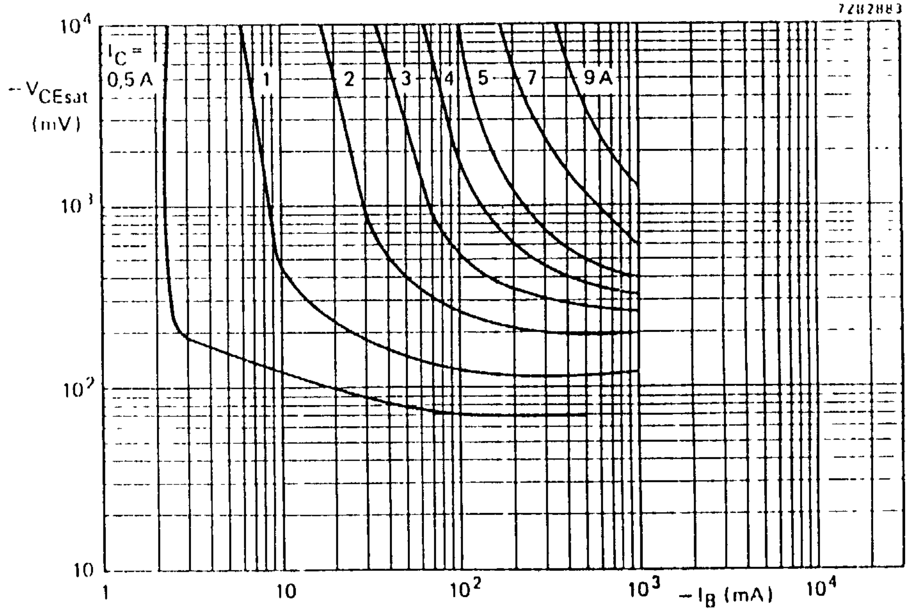


Fig 10 Typical collector-emitter saturation voltage $T_j$ = 25 °C

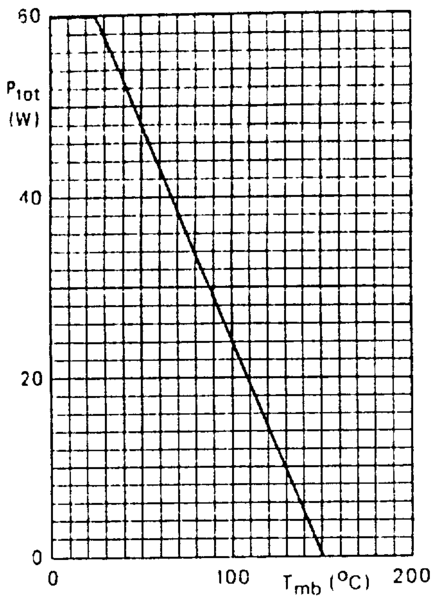


Fig. 14 Total power dissipation

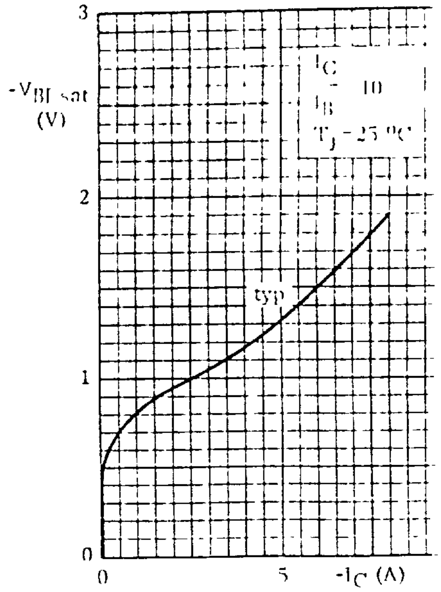


Fig. 15 Base emitter saturation volt...

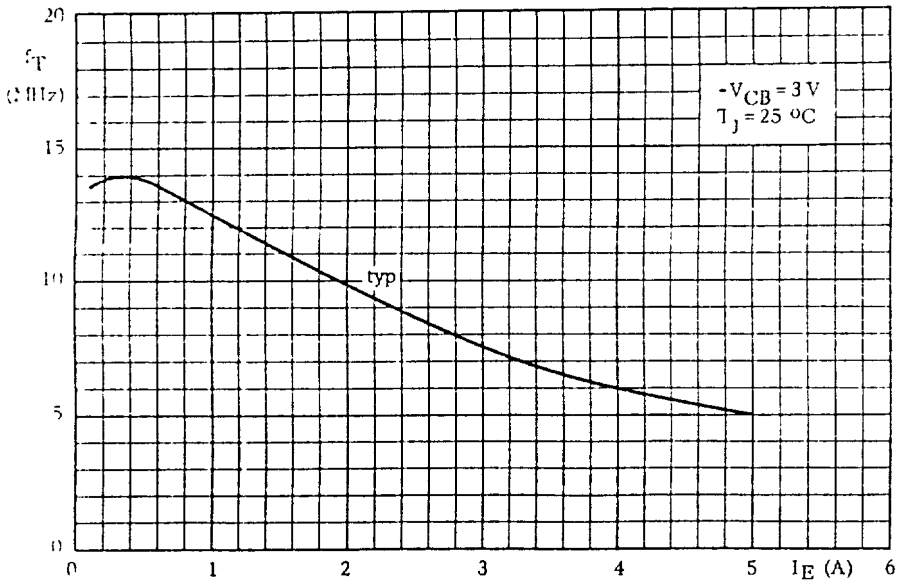


Fig. 11 Typical transition frequency.

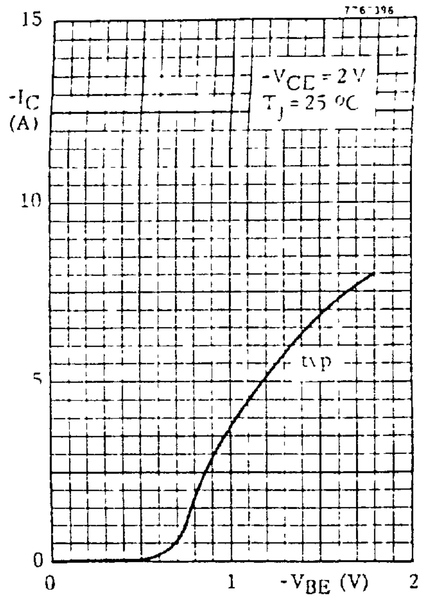


Fig. 16 Typical collector current