# SILICON EPITAXIAL BASE POWER TRANSISTORS

N-P-N silicon transistors in a plastic envelope intended for use in audio output stages, general amplifier and high-speed switching applications. P-N-P complements are BD242; 242A; 242B; and 242C.

## QUICK REFERENCE DATA

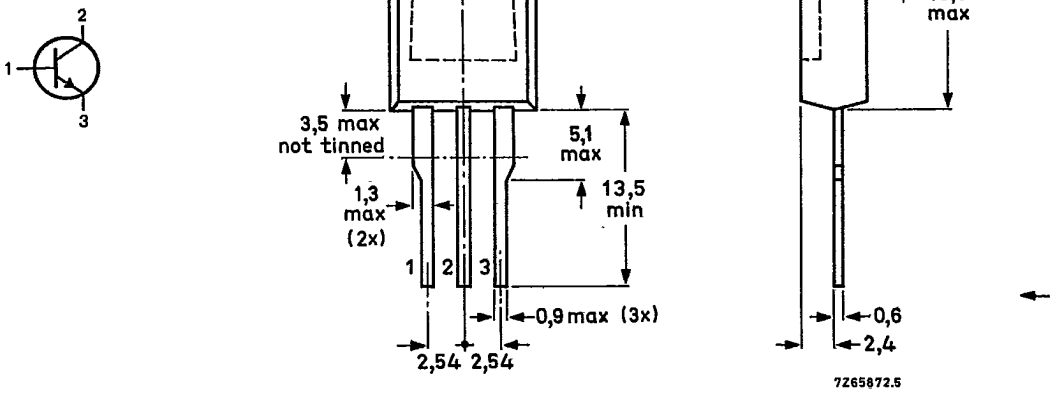
| | | | BD241 | A | B | C | |
|---|---|---|---|---|---|---|---|
| Collector-base voltage | $V_{CBO}$ | max. | 45 | 60 | 80 | 100 | V |
| Collector-emitter voltage | $V_{CEO}$ | max. | 45 | 60 | 80 | 100 | V |
| Collector current (d.c.) | $I_C$ | max. | | 5 | | | A |
| Total power dissipation up to $T_{mb}$ = 25 °C | $P_{tot}$ | max. | | 40 | | | W |
| Junction temperature | $T_j$ | max. | | 150 | | | °C |
| D.C. current gain $I_C$ = 1 A; $V_{CE}$ = 4 V | $h_{FE}$ | > | | 25 | | | |
| Transition frequency at f = 1 MHz $I_C$ = 500 mA; $V_{CE}$ = 10 V | $f_T$ | > | | 3 | | | MHz |

## MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-220AB.

Collector connected to mounting base.




See also chapters Mounting instructions and Accessories.

## RATINGS

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

| | | | BD241 | A | B | C | |
|---|---|---|---|---|---|---|---|
| Collector-base voltage (open emitter) | $V_{CBO}$ | max. | 45 | 60 | 80 | 100 | V |
| Collector-emitter voltage (open base) | $V_{CEO}$ | max. | 45 | 60 | 80 | 100 | V |
| Collector-emitter voltage ($R_{BE}$ = 100 Ω) | $V_{CER}$ | max. | 55 | 70 | 90 | 115 | V |
| Emitter-base voltage (open collector) | $V_{EBO}$ | max. | 5 | | | | V |
| Collector current (d.c.) | $I_C$ | max. | 5 | | | | A |
| Collector current (peak value) | $I_{CM}$ | max. | 8 | | | | A |
| Base current (d.c.) | $I_B$ | max. | 1 | | | | A |
| Total power dissipation up to $T_{mb}$ = 25 °C | $P_{tot}$ | max. | 40 | | | | W |
| Storage temperature | $T_{stg}$ | | −65 to +150 | | | | °C |
| Junction temperature | $T_j$ | max. | 150 | | | | °C |

## THERMAL RESISTANCE

| | | | | |
|---|---|---|---|---|
| From junction to mounting base | $R_{thj\text{-}mb}$ | = | 3, 12 | K/W |
| From junction to ambient in free air | $R_{thj\text{-}a}$ | = | 70 | K/W |

## CHARACTERISTICS

$T_j$ = 25 °C unless otherwise specified

| | | | BD241; A | BD241B; C | |
|---|---|---|---|---|---|
| Collector cut-off current | | | | | |
| $I_B$ = 0; $V_{CE}$ = 30 V | $I_{CEO}$ | < | 0,1 | – | mA |
| $I_B$ = 0; $V_{CE}$ = 60 V | $I_{CEO}$ | < | – | 0,1 | mA |
| $V_{BE}$ = 0; $V_{CE}$ = $V_{CEOmax}$ | $I_{CES}$ | < | 0,2 | | mA |
| Emitter cut-off current | | | | | |
| $I_C$ = 0; $V_{EB}$ = 5 V | $I_{EBO}$ | < | 1 | | mA |
| D.C. current gain* | | | | | |
| $I_C$ = 1 A; $V_{CE}$ = 4 V | $h_{FE}$ | > | 25 | | |
| $I_C$ = 3 A; $V_{CE}$ = 4 V | $h_{FE}$ | > | 10 | | |
| Base-emitter voltage** | | | | | |
| $I_C$ = 3 A; $V_{CE}$ = 4 V | $V_{BE}$ | < | 1,8 | | V |
| Collector-emitter saturation voltage* | | | | | |
| $I_C$ = 3 A; $I_B$ = 0,6 A | $V_{CEsat}$ | < | 1,2 | | V |
| Small-signal current gain | | | | | |
| $I_C$ = 0,5 A; $V_{CE}$ = 10 V; f = 1 kHz | $\lvert h_{fe} \rvert$ | > | 20 | | |
| Turn off breakdown energy | | | | | |
| L = 20 mH; $I_{CC}$ = 1,8 A | $E_{(BR)}$ | > | 32 | | mJ |

* Measured under pulse conditions: $t_p \leq 300\ \mu s$; $\delta < 0{,}02$.
** $V_{BE}$ decreases by about 2,3 mV/K with increasing temperature.

| | | | |
|---|---|---|---|
| Transition frequency at f = 1 MHz<br>$I_C$ = 0,5 A; $V_{CE}$ = 10 V | $f_T$ | > | 3 MHz |
| Switching times<br>(between 10% and 90% levels)<br>$I_{Con}$ = 1 A; $I_{Bon} = -I_{Boff}$ = 0,1 A | | | |
| Turn-on time | $t_{on}$ | typ. | 0,3 μs |
| Turn-off time | $t_{off}$ | typ. | 1 μs |

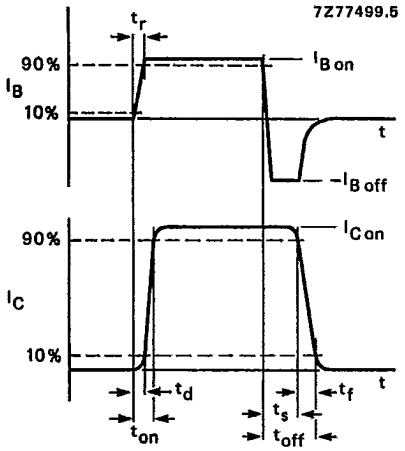
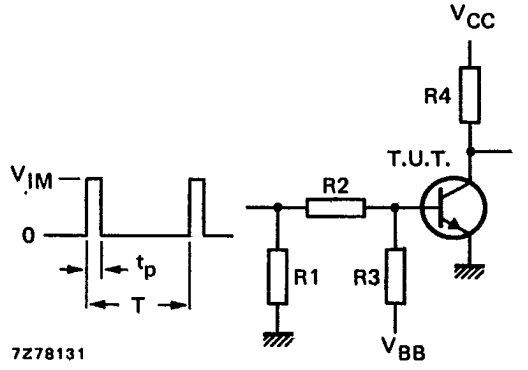



Fig. 2 Switching times waveforms.




| | | |
|---|---|---|
| $V_{IM}$ | = | 16 V |
| $V_{CC}$ | = | 20 V |
| $-V_{BB}$ | = | 6,4 V |
| R1 | = | 82 Ω |
| R2 | = | 82 Ω |
| R3 | = | 82 Ω |
| R4 | = | 20 Ω |
| $t_r = t_f$ | ⩽ | 20 ns |
| $t_p$ | = | 20 μs |
| T | = | 500 μs |

Fig. 3 Switching times test circuit.

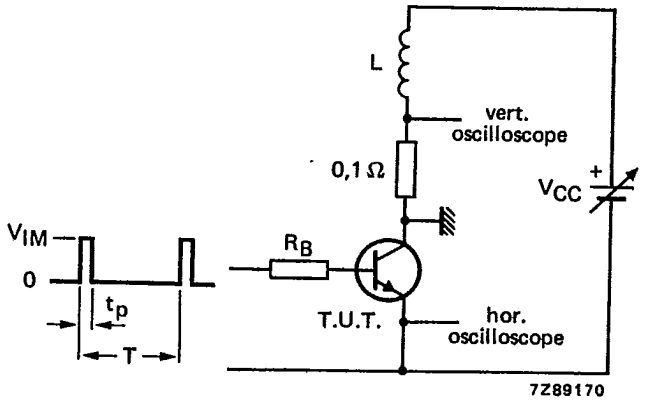



Fig. 4 Test circuit for turn-off breakdown energy.
$V_{IM}$ = 12 V; $R_B$ = 270 Ω; $I_{CC}$ = 1,8 A; $t_p$ = 1 ms; δ = 0,01.

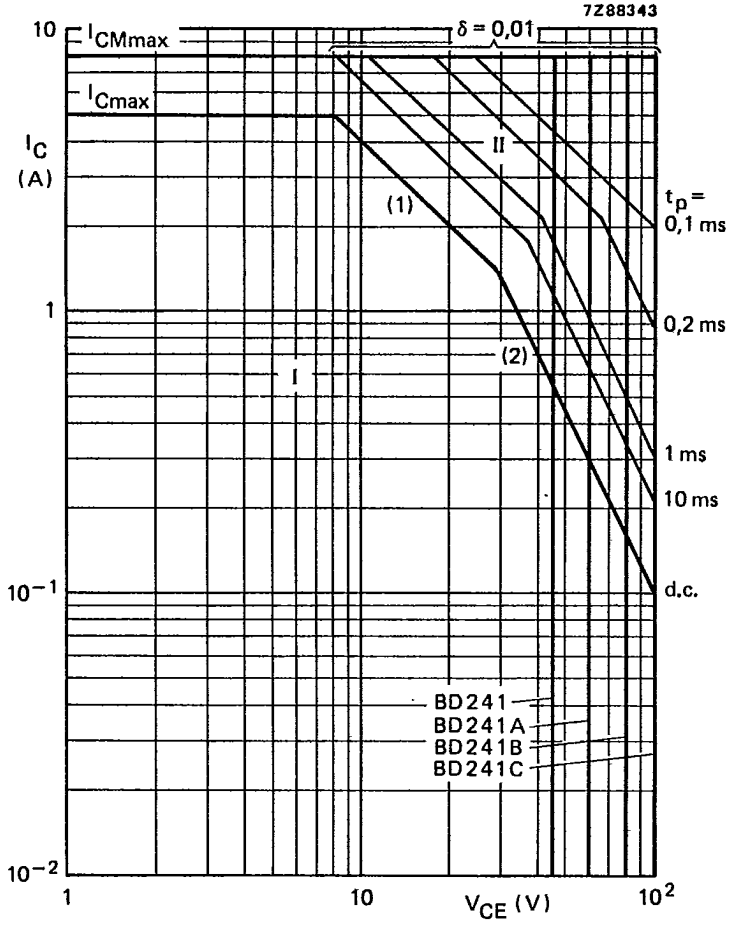



Fig. 5 Safe Operating AREa; $T_{mb}$ = 25 °C.

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.

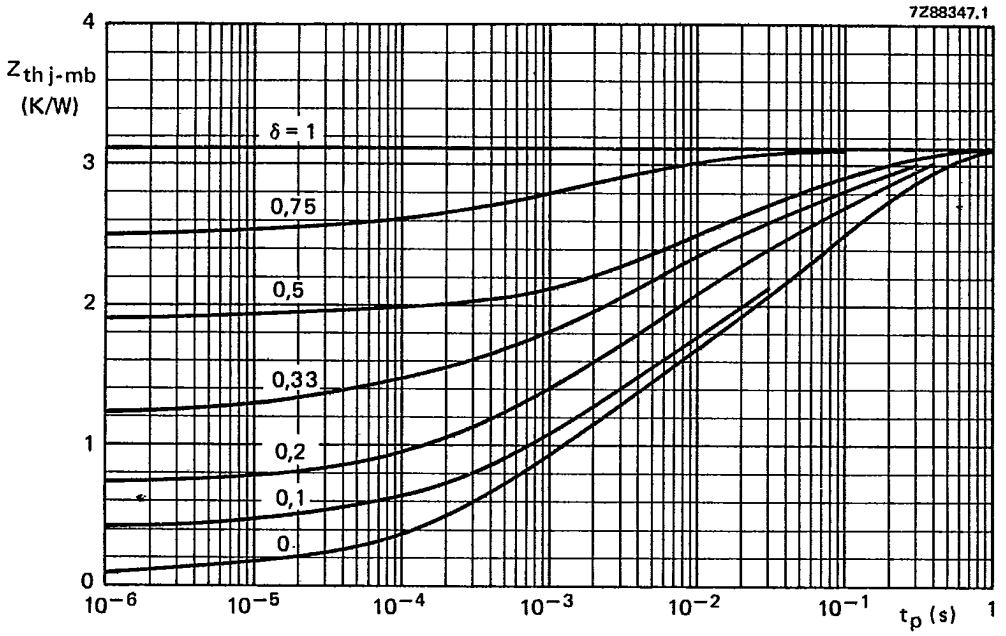



Fig. 6 Power pulse rating chart.

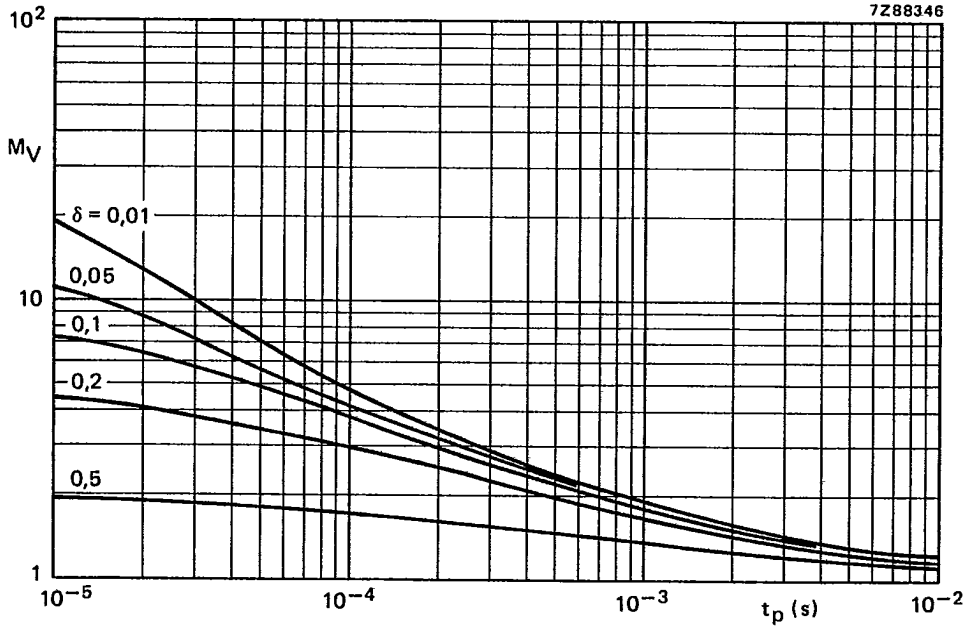



Fig. 7 S.B. voltage multiplying factor at the $I_{Cmax}$ level.

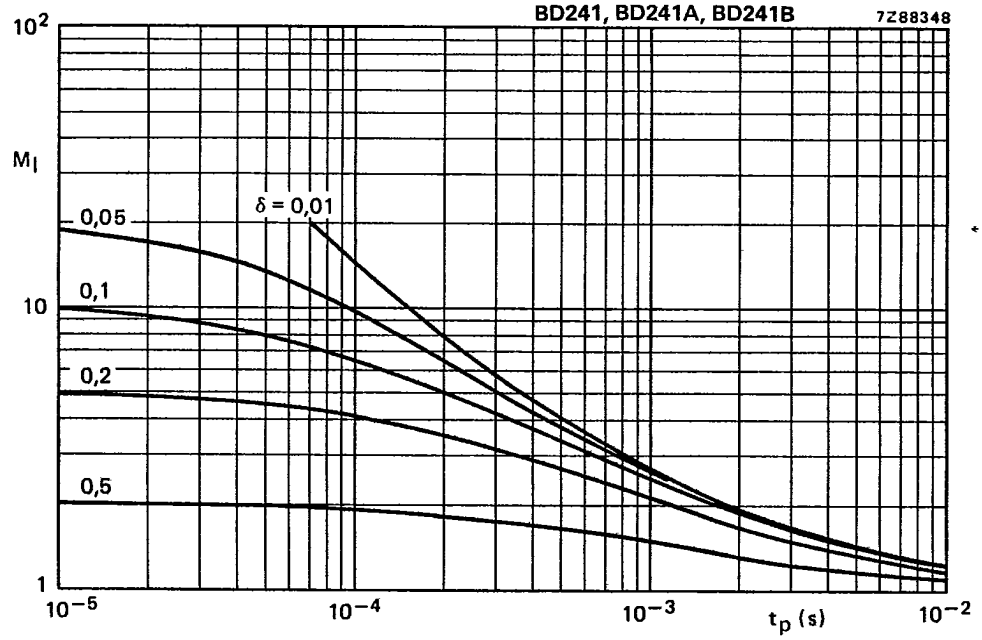



Fig. 8 S.B. current multiplying factor at the $V_{CEOmax}$ level.

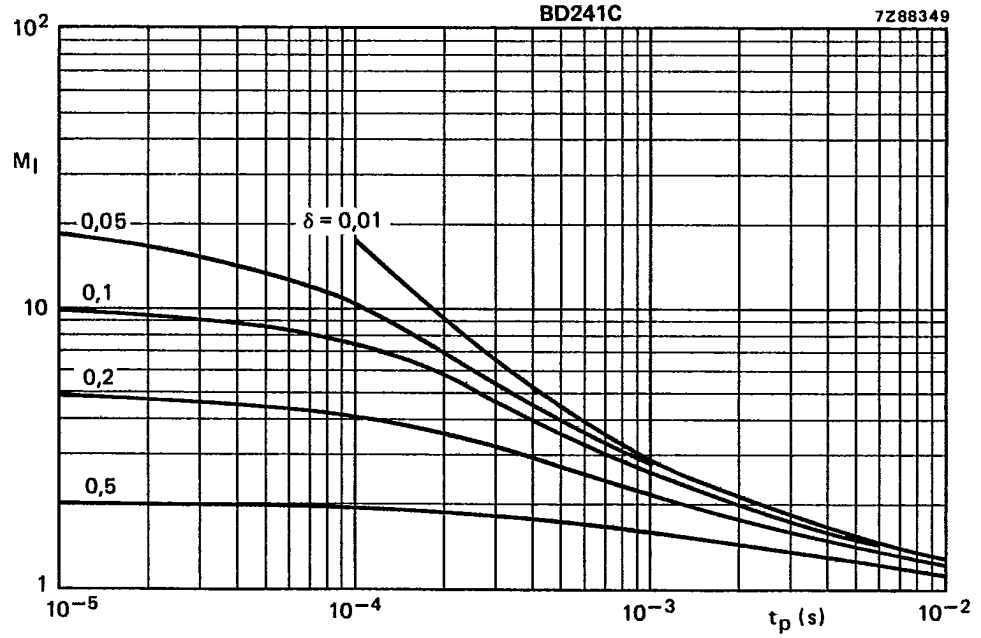



Fig. 9 S.B. current multiplying factor at the $V_{CEOmax}$ level.

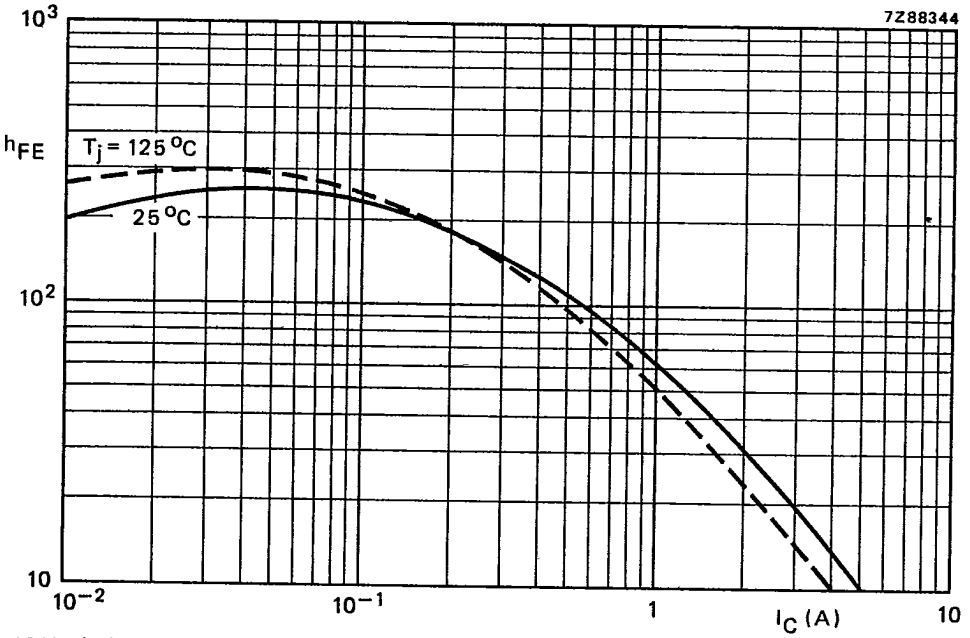



Fig. 10 Typical static forward current transfer ratio as a function of the collector current. $V_{CE}$ = 4 V.

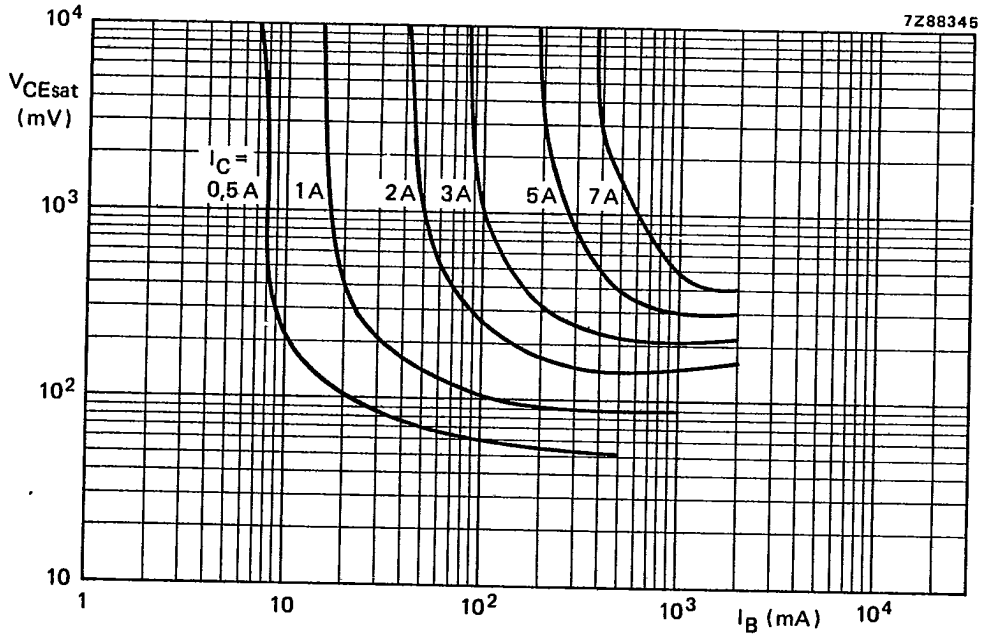



Fig. 11 Typical values collector-emitter saturation voltage at $T_j$ = 25 °C.

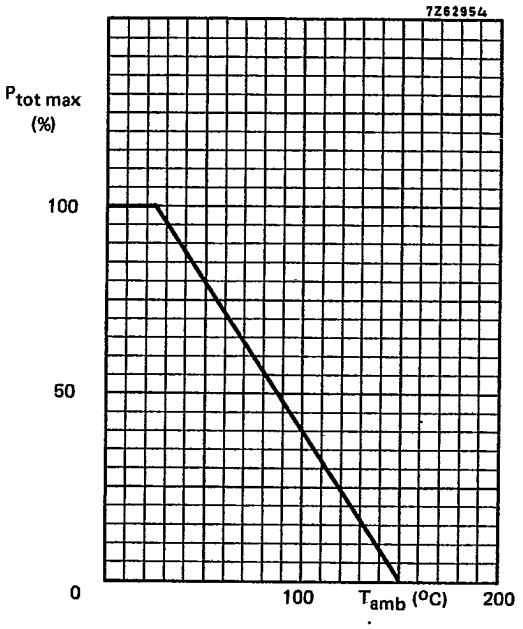



Fig. 12 Power derating curve.