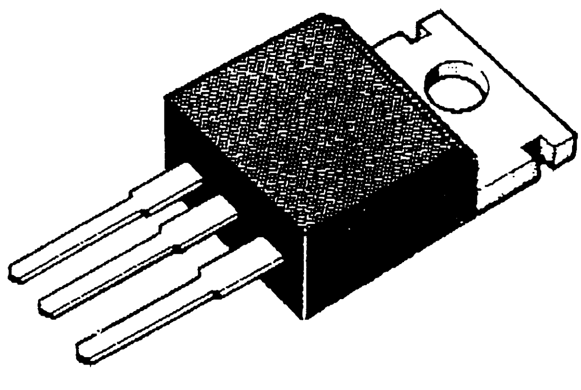
BDT63; 63A
BDT63B; 63C

# SILICON DARLINGTON POWER TRANSISTORS

N-P-N epitaxial base transistors in monolithic Darlington circuit for audio output stages and general amplifier and switching applications; TO-220 plastic envelope. P-N-P complements are BDT62, BDT62A; BDT62B and BDT62C.

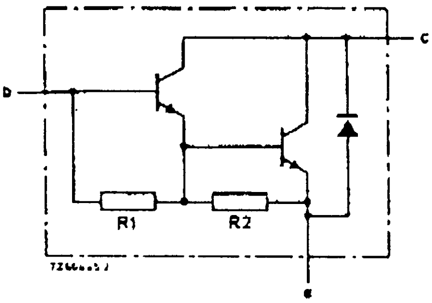
## QUICK REFERENCE DATA

| | | | BDT63 | A | B | C | |
|---|---|---|---|---|---|---|---|
| Collector-base voltage (open emitter) | $V_{CBO}$ | max. | 60 | 80 | 100 | 120 | V |
| Collector-emitter voltage (open base) | $V_{CEO}$ | max. | 60 | 80 | 100 | 120 | V |
| Collector current (d.c.) | $I_C$ | max. | | 10 | | | A |
| Collector current (peak value) $t_p$ = 0,3 ms; $\delta$ = 10% | $I_{CM}$ | max. | | 15 | | | A |
| Total power dissipation up to $T_{mb}$ = 25 °C | $P_{tot}$ | max. | | 90 | | | W |
| Junction temperature | $T_j$ | max. | | 150 | | | °C |
| D.C. current gain $I_C$ = 3 A; $V_{CE}$ = 3 V | $h_{FE}$ | > | | 1000 | | | |



TO-220

# BDT63; 63A
# BDT63B; 63C




R1 typ. 8 kΩ
R2 typ. 100 Ω

Fig. 2 Circuit diagram.

## RATINGS

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

| | | | BDT63 | A | B | C | |
|---|---|---|---|---|---|---|---|
| Collector-base voltage (open emitter) | $V_{CBO}$ | max. | 60 | 80 | 100 | 120 | V |
| Collector-emitter voltage (open base) | $V_{CEO}$ | max. | 60 | 80 | 100 | 120 | V |
| Emitter base voltage (open collector) | $V_{EBO}$ | max. | 5 | | | | V |
| Collector current (d.c.) | $I_C$ | max. | 10 | | | | A |
| Collector current (peak value) $t_p$ = 0,3 ms; δ = 10% | $I_{CM}$ | max. | 15 | | | | A |
| Base current (d.c.) | $I_B$ | max. | 250 | | | | mA |
| Total power dissipation up to $T_{mb}$ = 25 °C | $P_{tot}$ | max. | 90 | | | | W |
| Storage temperature | $T_{stg}$ | | −65 to + 150 | | | | °C |
| Junction temperature* | $T_j$ | max. | 150 | | | | °C |

## THERMAL RESISTANCE *

| | | | | |
|---|---|---|---|---|
| From junction to mounting base | $R_{th\ j\text{-}mb}$ | = | 1,39 | K/W |
| From junction to ambient (in free air) | $R_{th\ j\text{-}a}$ | = | 70 | K/W |

* Based on maximum average junction temperature in line with common industrial practice. The resulting higher junction temperature of the output transistor part is taken into account

## CHARACTERISTICS

$T_j$ = 25 °C unless otherwise specified.

| | | | |
|---|---|---|---|
| **Collector cut-off current** | | | |
| $I_E = 0$; $V_{CB} = V_{CBOmax}$ | $I_{CBO}$ | < | 0,2 mA |
| $I_E = 0$; $V_{CB} = ½V_{CBOmax}$; $T_j$ = 150 °C | $I_{CBO}$ | < | 2 mA |
| $I_B = 0$; $V_{CE} = ½V_{CEOmax}$ | $I_{CEO}$ | < | 0,5 mA |
| **Emitter cut-off current** | | | |
| $I_C = 0$; $V_{EB}$ = 5 V | $I_{EBO}$ | < | 5 mA |
| **Forward bias second-breakdown collector current** | | | |
| $V_{CE}$ = 60 V; t = 0,1 s; non-repetitive (without heatsink) | $I_{(SB)}$ | > | 1,5 A |
| **D.C. current gain*** | | | |
| $I_C$ = 3 A; $V_{CE}$ = 3 V | $h_{FE}$ | > | 1000 |
| $I_C$ = 10 A; $V_{CE}$ = 3 V | $h_{FE}$ | typ. | 3000 |
| **Base-emitter voltage*** | | | |
| $I_C$ = 3 A; $V_{CE}$ = 3 V | $V_{BE}$ | < | 2,5 V |
| **Collector-emitter saturation voltage*** | | | |
| $I_C$ = 3 A; $I_B$ = 12 mA | $V_{CEsat}$ | < | 2 V |
| $I_C$ = 8 A; $I_B$ = 80 mA | $V_{CEsat}$ | < | 2,5 V |
| **Diode, forward voltage** | | | |
| $I_F$ = 3 A | $V_F$ | < | 2 V |
| **Turn-off breakdown energy with inductive load (Fig. 6)** | | | |
| $-I_{Boff}$ = 0, L = 5 mH | $E_{(BR)}$ | > | 100 mJ |
| **Small-signal current gain at f = 1 MHz** | | | |
| $I_C$ = 3 A; $V_{CE}$ = 3 V | $h_{fe}$ | > | 25 |
| **Cut-off frequency** | | | |
| $I_C$ = 3 A; $V_{CE}$ = 3 V | $f_{hfe}$ | typ. | 50 kHz |
| **Collector capacitance** | | | |
| $V_{CB}$ = 10 V; f = 1 MHz | $C_{ob}$ | typ. | 100 pF |
| **D.C. current gain ratio of matched complementary pairs** | | | |
| $I_C$ = 3 A, $V_{CE}$ = 3 V | $h_{FE1}/h_{FE2}$ | < | 2,5 |

* Measured under pulse conditions; $t_p$ ≤ 300 μs; δ ≤ 2%.

**CHARACTERISTICS** (continued)

Switching times
(between 10% and 90% levels)
$I_{Con}$ = 3 A, $I_{Bon}$ = $-I_{Boff}$ = 12 mA

| | | | |
|---|---|---|---|
| turn-on time | $t_{on}$ | typ. | 1 μs |
| | | < | 2,5 μs |
| turn off time | $t_{off}$ | typ. | 5 μs |
| | | < | 10 μs |

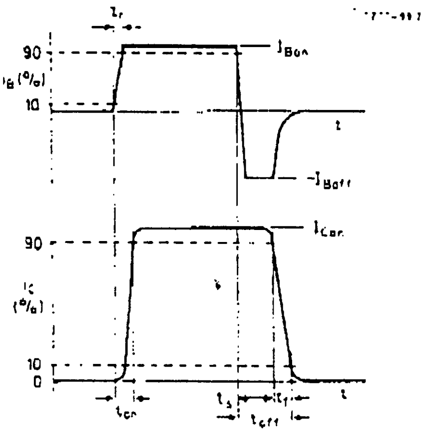
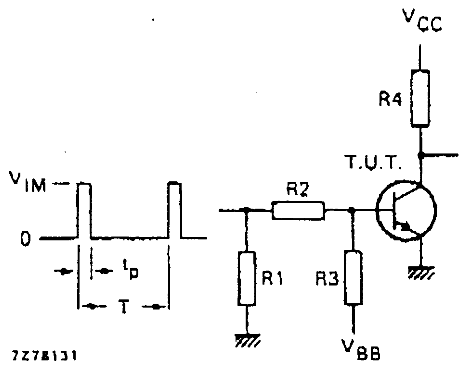



Fig. 3 Switching times waveforms.




| | | |
|---|---|---|
| $V_{IM}$ | = | 10 V |
| $V_{CC}$ | = | 10 V |
| $-V_{BB}$ | = | 4 V |
| R1 | = | 56 Ω |
| R2 | = | 410 Ω |
| R3 | = | 560 Ω |
| R4 | = | 3 Ω |
| $t_r = t_f$ | = | 15 ns |
| $t_p$ | = | 10 μs |
| T | = | 500 μs |

Fig. 4 Switching times test circuit.

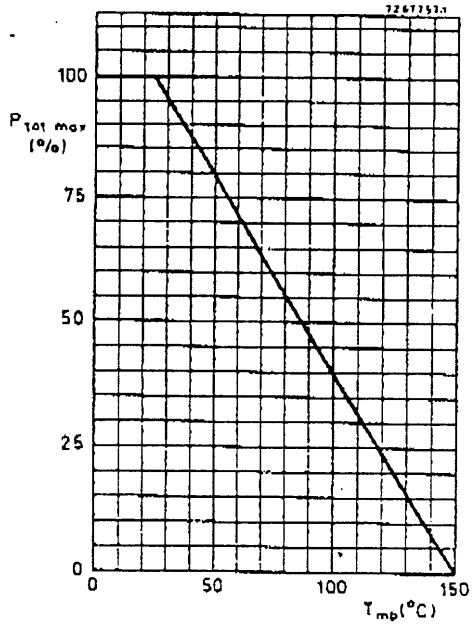



Fig. 5 Power derating curve.

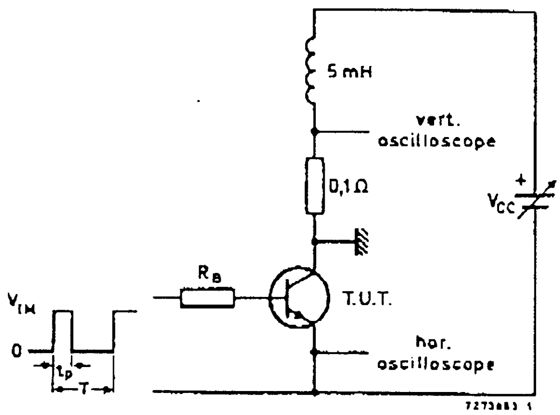



Fig. 6 Turn-off breakdown energy with inductive load.
$V_{IM}$ = 12 V; $R_B$ = 270 Ω, $\delta = \frac{t_p}{T} \times 100\% = 1\%$; $I_{CC}$ = 6,3 A.

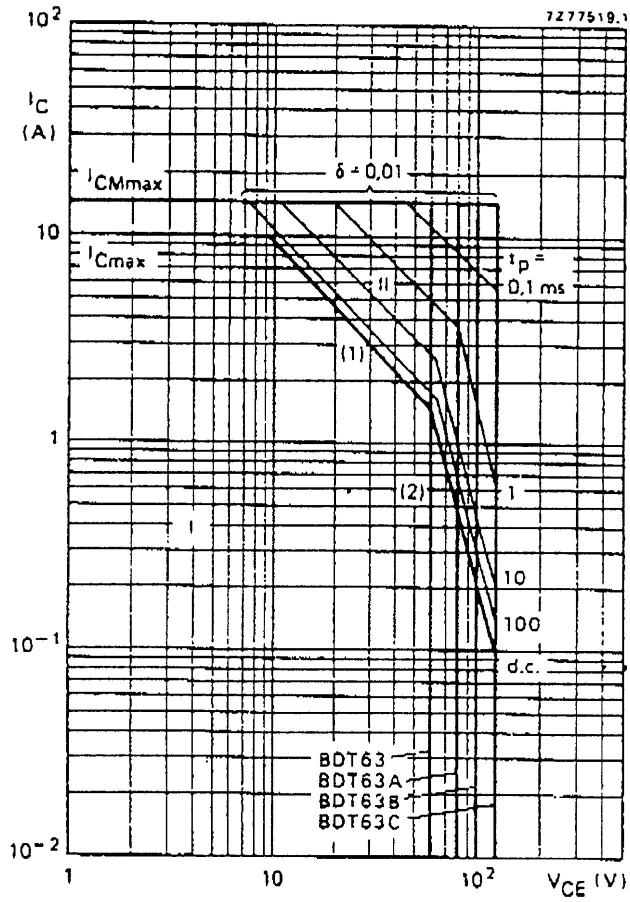



Fig. 7 Safe Operating ARea; $T_{mb}$ = 25 °C.

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).

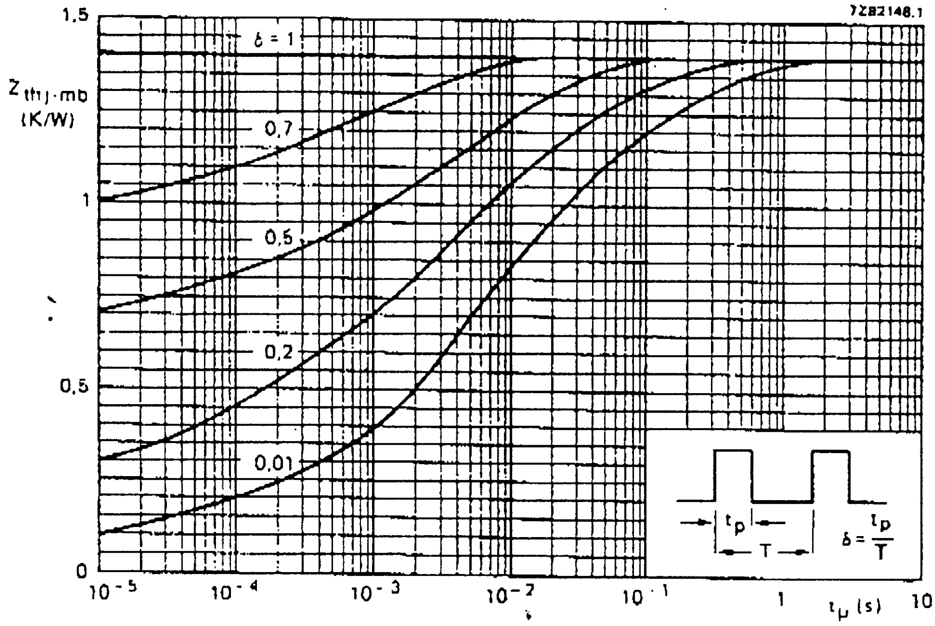



Fig. 8 Pulse power rating chart.

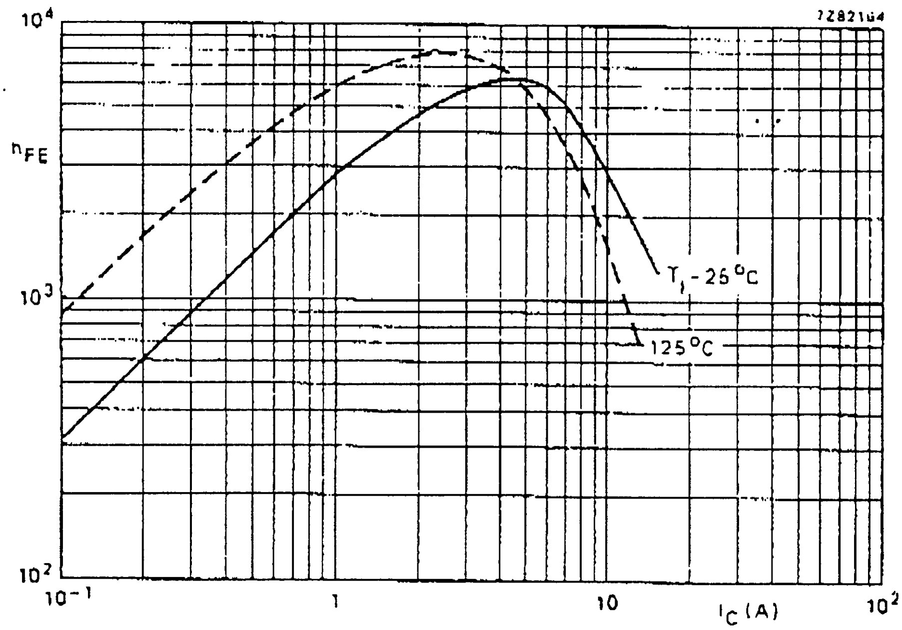



Fig. 9 Typical d.c. current gain at $V_{CE}$ = 3 V.

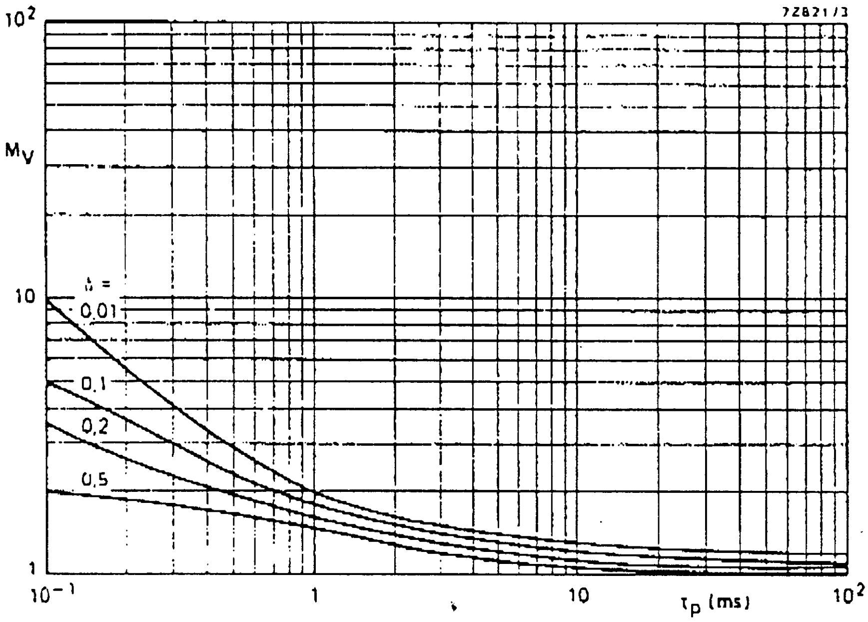



Fig. 10 S.B. voltage multiplying factor at the $I_{C\,max}$ level.

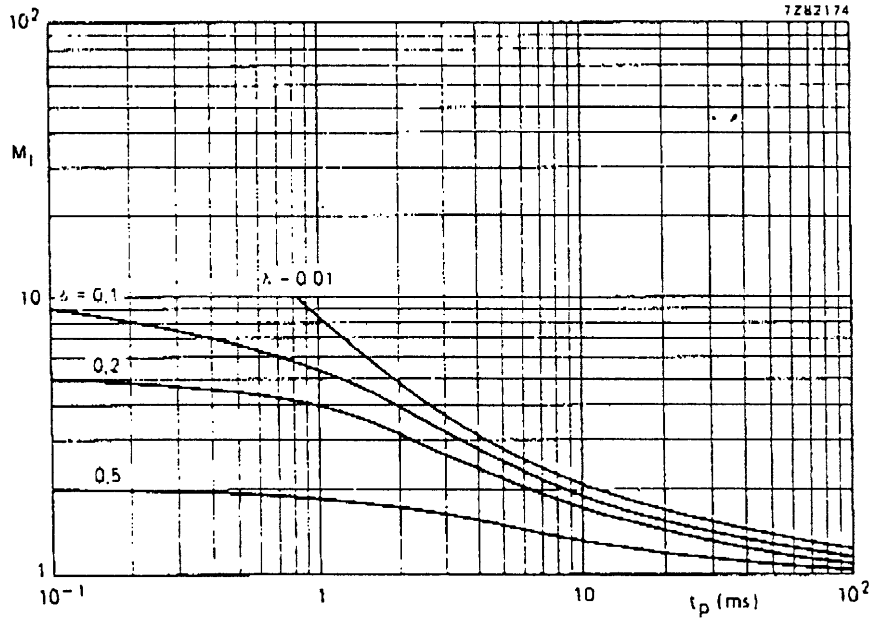



Fig. 11 S.B. current multiplying factor at $V_{CEO}$ level = 60 V and 100 V.

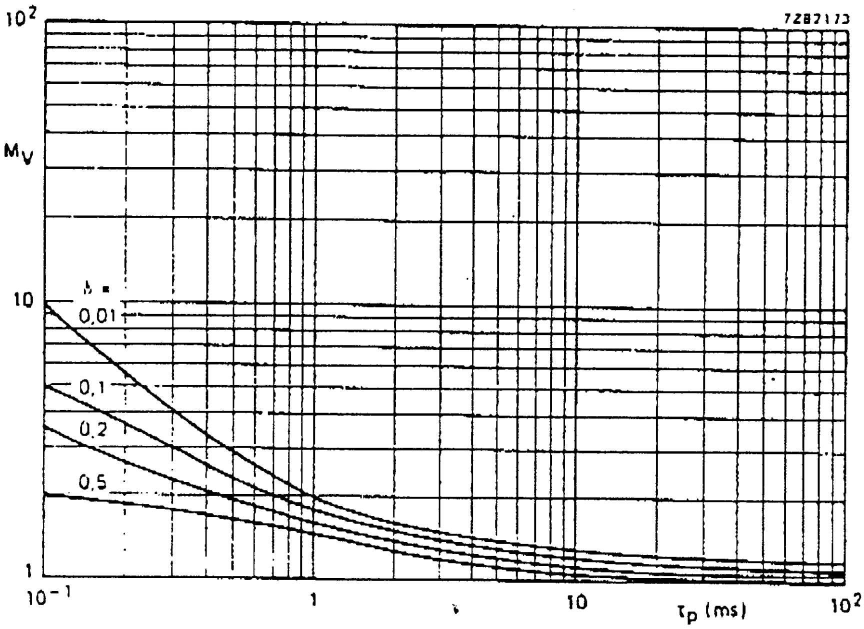



Fig. 10 S.B. voltage multiplying factor at the $I_{C\,max}$ level.

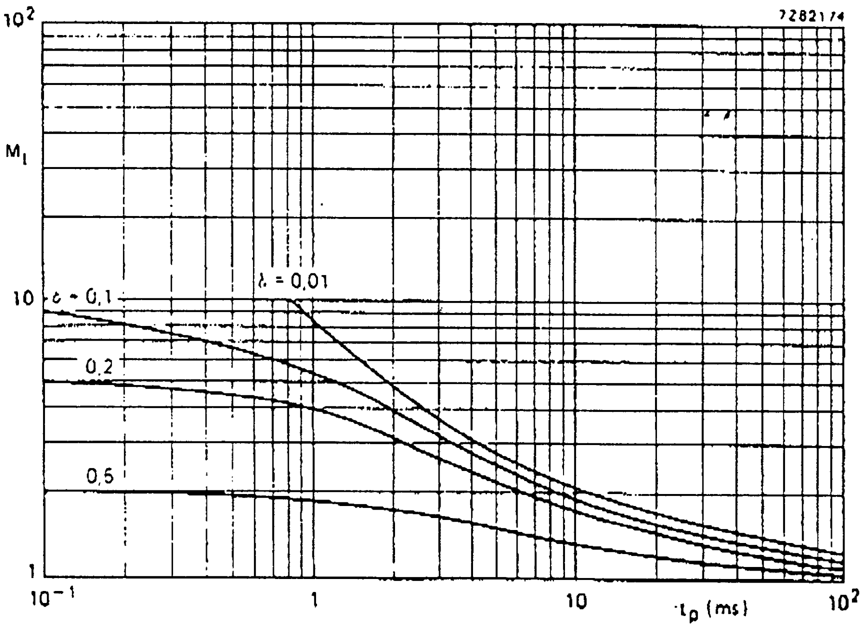



Fig. 11 S.B. current multiplying factor at $V_{CEO}$ level = 60 V and 100 V.