TELEFUNKEN electronic
Creative Technologies

# BUT 56 · BUT 56 A

T-33-13

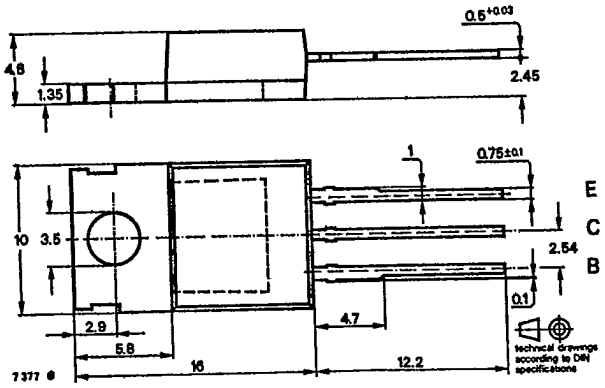
## Silicon NPN Power Transistors

**Applications:** Switching mode power supply

**Features:**

- In multi diffusion technique
- Glass passivation
- High reverse voltage
- Short switching times
- Power dissipation 100 W

**Dimensions in mm**




Collector connected with metalic surface

Standard plastic case
14 A 3 DIN 41 869
JEDEC TO 220
Weight max. 2.5 g

**Accessories:**

Isolating washer No. 564 542

| **Absolute maximum ratings** | | **BUT 56** | **BUT 56 A** | |
|---|---|---|---|---|
| Collector-emitter voltage | $V_{CEO}$ | 400 | 450 | V |
| | $V_{CES}$ | 800 | 1000 | V |
| $R_{BE} \leq 100\ \Omega$ | $V_{CER}$ | 800 | 1000 | V |
| Collector peak curent | $I_{CM}$ | 10 | | A |
| Collector current | $I_C$ | 8 | | A |
| Base current | $I_{BM}$ | 4 | | A |
| | $-I_{BM}$ | 4 | | A |
| Total power disspation $T_{case} \leq 25\ °C$ | $P_{tot}$ | 100 | | W |
| Junction temperature | $T_j$ | 150 | | °C |
| Storage temperature range | $T_{stg}$ | −65 ...+150 | | °C |
| **Maximum thermal resistance** | | | | |
| Junction case | $R_{thJC}$ | 1.25 | | K/W |

T1.2/238.0583 E2

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# BUT 56 · BUT 56 A

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| Characteristics | | | Min. | Typ. | Max. | |
|---|---|---|---|---|---|---|
| $T_{case}$ = 25 °C, unless otherwise specified | | | | | | |
| Collector cut-off current | | | | | | |
| $V_{CE}$ = 800 V | BUT 56 | $I_{CES}$ | | | 1 | mA |
| $V_{CE}$ = 1000 V | BUT 56 A | $I_{CES}$ | | | 1 | mA |
| $T_j$ = 150 °C, $V_{CE}$ = 800 V | BUT 56 | $I_{CES}$ | | | 2 | mA |
| $T_j$ = 150 °C, $V_{CE}$ = 1000 V | BUT 56 A | $I_{CES}$ | | | 2 | mA |
| Collector-emitter breakdown voltage | | | | | | |
| $I_C$ = 100 mA, $L_C$ = 125 mH | BUT 56 | $V_{(BR)CEO}$ [2] | 400 | | | V |
| | BUT 56 | $V_{(BR)CEO}$ [2] | 450 | | | V |
| $I_C$ = 0.5 mA, $R_{BE} \leq$ 100 Ω | BUT 56 | $V_{(BR)CER}$ | 800 | | | V |
| | BUT 56 A | $V_{(BR)CER}$ | 1000 | | | V |
| Emitter-base breakdown voltage | | | | | | |
| $I_E$ = 1 mA | | $V_{(BR)EBO}$ | 6 | | | V |
| Base saturation voltage | | | | | | |
| $I_C$ = 4 A, $I_B$ = 0.8 A | | $V_{BEsat}$ [2] | | | 2 | V |
| DC forward current transfer ratio | | | | | | |
| $V_{CE}$ = 5 V, $I_C$ = 1 A | | $h_{FE}$ | 15 | | 45 | |
| $V_{CE}$ = 5 V, $I_C$ = 4 A | BUT 56 | $h_{FE}$ | 5.5 | | | |
| $V_{CE}$ = 2 V, $I_C$ = 3 A | BUT 56 A | $h_{FE}$ | 4 | | | |
| Gain bandwidth product | | | | | | |
| $V_{CE}$ = 10 V, $I_C$ = 500 mA, $f$ = 1 MHz | | $f_T$ | | 10 | | MHz |
| **Switching characteristics** | | | | | | |
| $I_C$ = 4 A, $I_{B1} = -I_{B2}$ = 1.25 A, $t_p$ = 20 µs | | | | | | |
| Turn-off time | | $t_{off}$ | | | 4 | µs |
| Fall time | | $t_f$ [1] | | | 1 | µs |
| $I_C$ = 2.5 A, $I_{B1}$ = 0.5 A, $-dI_B/dt \approx$ 0.5 A/µs, $dV_{CE}/dt$ = 500 V/µs | Fig. 6 | $t_f$ | | | 0.25 | µs |

Instruction for the calculation of storage time and turn-off base current with charging values $Q_{s(BE)}$ for inductive collector load, $I_{CE}$ = 2.5 A and $-I_{B2}$ limited due to:

$$-I_{B2} = 1.41 \sqrt{Q_{s(BE)} \cdot \left|\frac{di_i}{dt}\right|} - I_{B1}$$

$$t_s \approx \frac{I_{B1} + |I_{B2}|}{\left|\frac{di_B}{dt}\right|}$$

[1] By using retrace at switching-off inductive load

[2] $\frac{t_p}{T} \geq 0.01$, $t_p$ = 0.3 ms

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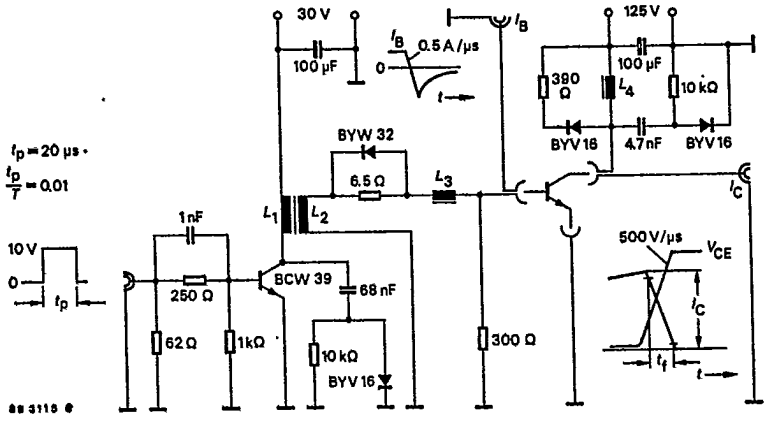
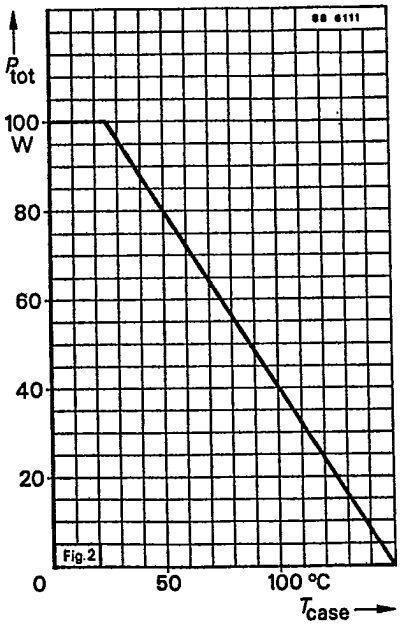
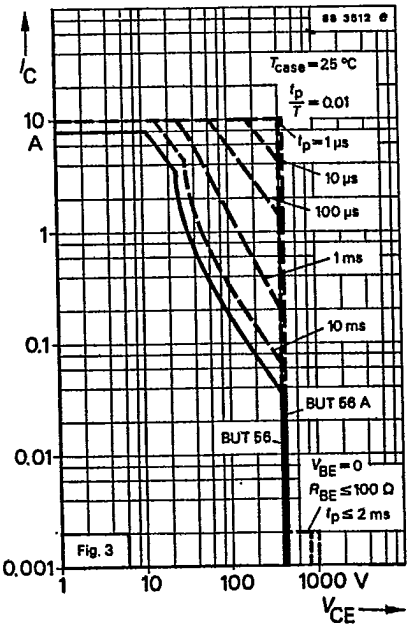
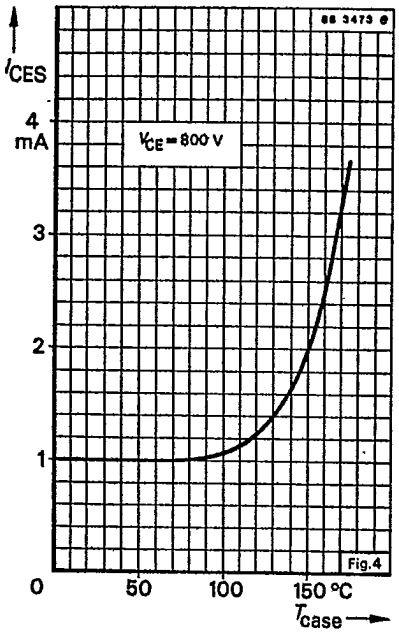
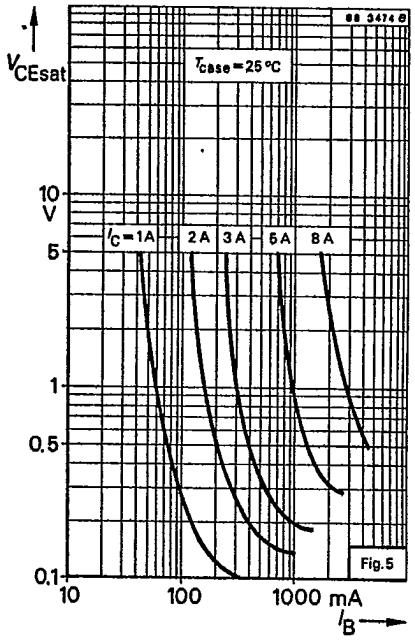


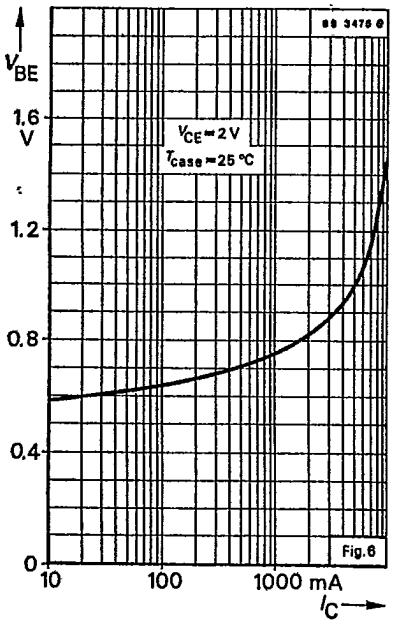

Fig. 1 Test circuit for switching characteristics

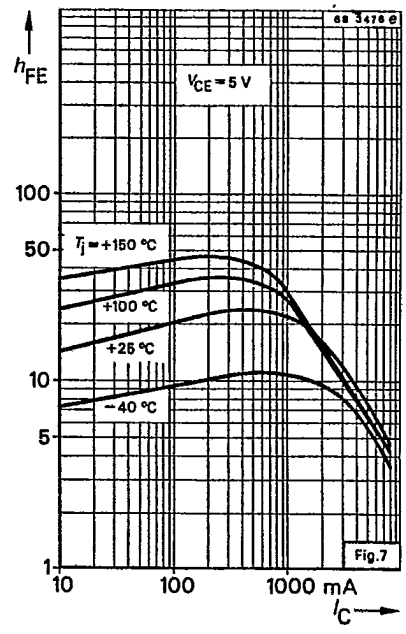




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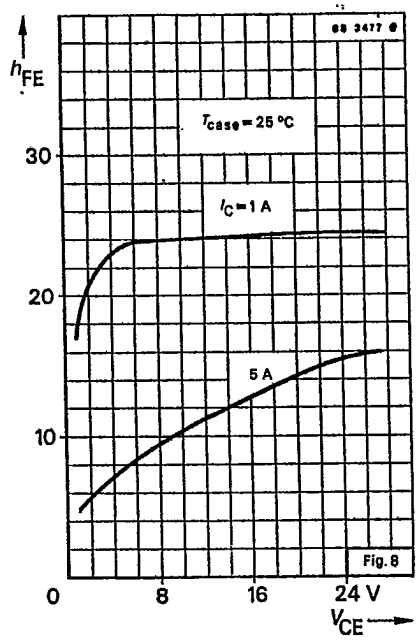

Fig. 8

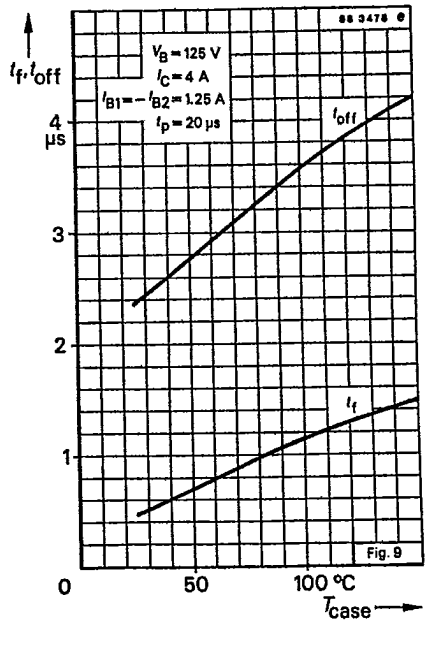

Fig. 9

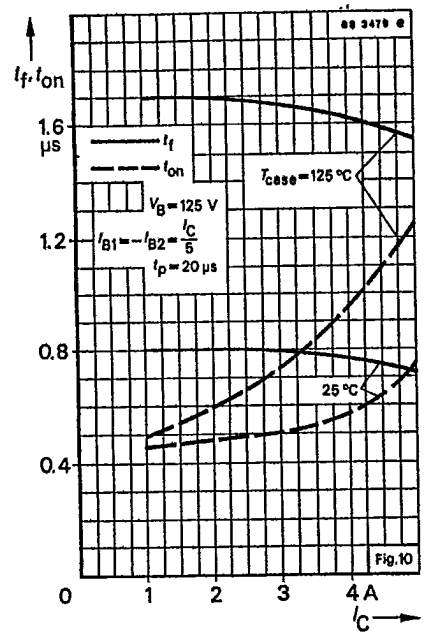

Fig. 10

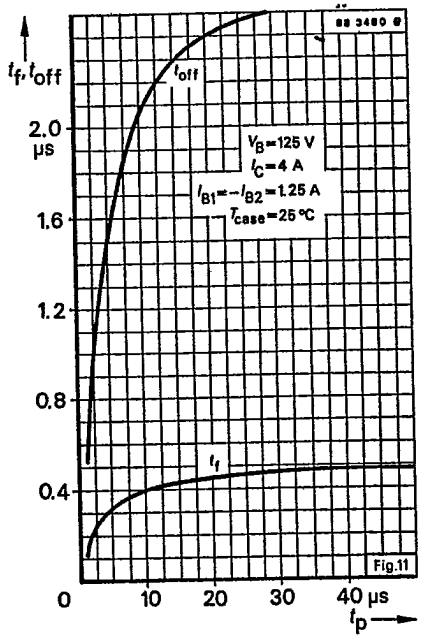

Fig. 11

T-91-20

● Family of curves

Besides the static (d. c.) and dynamic (a. c.) characteristics, family of curves are given for specified operating conditions. They show the typical interdepedence of individual characteristics. Partly are given the scattering limits. They signify that at least 95% of the delivery lies inside these tolerances.

### 6.6. Additional informations

**Preliminary specifications**

This heading indicates that some information on the device concerned may be subject to slight changes.

**Not for new developments**

This heading indicates that the device concerned should not be used in equipment under development, it is, however, available for present production.

## 7. Taping and reeling

### 7.1. Taping of TO-92 transistors

Standard reeling: Taped on reel, reeled together with a paper film.

7.1.1. Order Numbers

Add the taping-code to the order number.

**Example:**

BC 238 C DU 06 Z

- BC 238 C — Order-No. of Type
- DU — Code for TO-92 Transistors
- 06 — Orientation of transistor on tape [1]
- Z — Additional marking for specials [2]

[1] 06 = View on flat side of transistor, view on gummed tape
05 = View on round side of transistor, view on gummed tape

[2] Additional marking "0": Taping without paper film

Additional marking "Z": Zigzag folded tape inspecial box. Marking for orientation of transistor not necessary, because box can be opened on top or botton.

Example for order No.: BC 237 C DU Z

A E G CORP

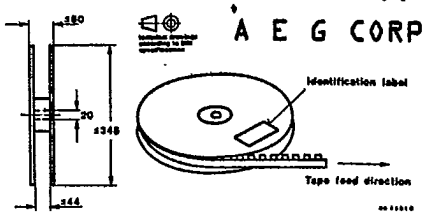


Fig. 7.1. Dimensions of reel in mm

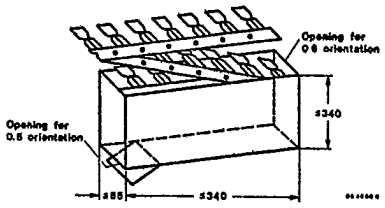


Fig. 7.2. Dimension of box for Zigzag folding in mm

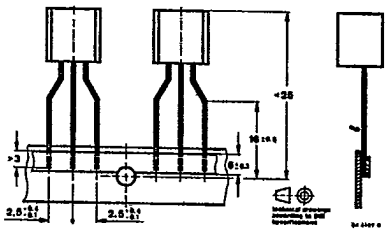

Fig. 7.3. Dimensions of tape in mm

7.1.2 Quantity of devices

1 000 devices per reel

2 000 devices per folded tape in special box.

### 7.2 Taped transistors in SOT 23 and SOT 143 case

a) Standard taping

Designation is attached with code GS 08 in case of standard taping. Example for normal version transistors as standard taped: BF 569-GS08.

Example for R-version transistors as standard taped: BF 569 R-GS 08.

In case of standard taping, the transistor orientation on the tape is shown in Fig. 7.4 and Fig. 7.5.

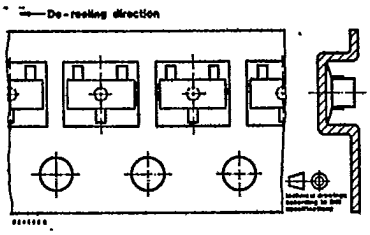


Fig. 7.4 Standard taped SOT 23

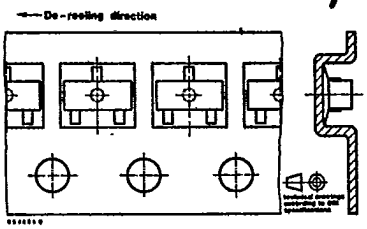


Fig. 7.6 Reverse taped SOT 23

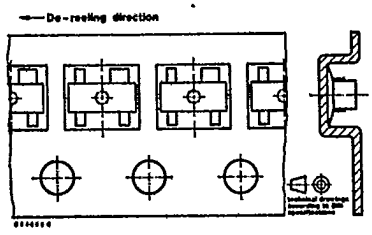


Fig. 7.5 Standard taped SOT 143

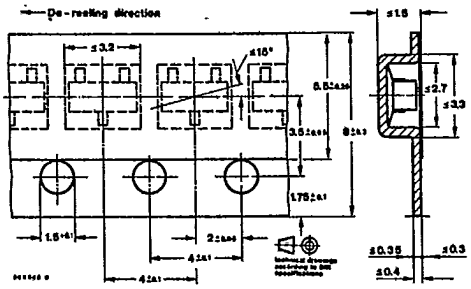


Fig. 7.7 Dimensions of tape in mm

b) Reverse taping
Desigantion is attached with code GS 07 in case of reverse taping. Example for normal version transistors as reverse taped: BF 569 R-GS 07. Example for R-version transistors as reverse taping: BF 569 R-GS 07.

In case of reverse taping, the transistor orientation on the tape is shown in Fig. 6.
Regarding MOF-FET and MES-FET devices, reverse taping is at present not available.

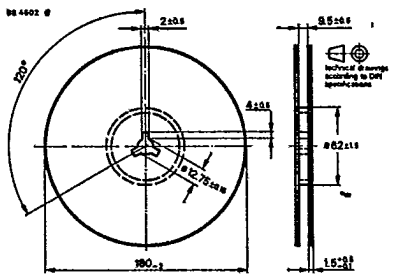

Fig. 7.8 Dimensions of reel in mm

7.2.2 Quantity of devices
3000 devices per reel

## 8. Assessories

| Number | Fig. | Designation | For case |
|---|---|---|---|
| 119880 | 8.1. | Isolating washer thickness 60 µm | 12A 3 DIN 41 869<br>JEDEC TO 126 (SOT 32) |
| 564542 | 8.2. | Isolating washer thickness 50 µm | 14A 3 DIN 41 869<br>JEDEC TO 220 (SOT 78) |
| 912884 | 8.3 | Isolating washer thickness 50 µm | 15A 3 DIN 41 869<br>(TOP3) for clip mounting |
| 191131 | 8.4 | Isolating washer thickness 50 µm | 15A 3 DIN 41 869<br>(TOP3) for screw mounting |
| 191140 | 8.5 | Mounting clip | 15A 3 DIN 41 869<br>(TOP3) |
| 569524 | 8.6 | Isolating washer thickness 100 µm + 50 µm | 3B 2 DIN 41 872<br>JEDEC TO 3<br>Devices with high reverse voltage |