TELEFUNKEN electronic
Creative Technologies

BUT 54

T-33-13

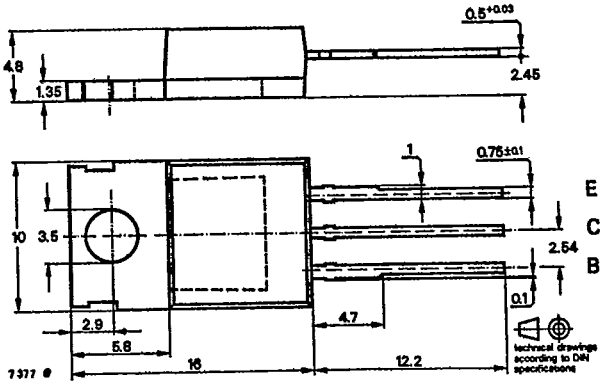
Silicon NPN Power Transistor

Application: Switching mode power supply, electronic ballast

Features:

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

Dimensions in mm



Collector connected with metallic surface

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

Accessories

Isolating washer No. 564542

Absolute maximum ratings

Collector emitter voltage	V_{CEO}	430	V
	V_{CES}	800	V
$R_{BE} \leqq 100\ \Omega$	V_{CER}	800	V
Collector peak current	I_{CM}	10	A
Collector current	I_C	8	A
Base current	I_{BM}	4	A
	$-I_{BM}$	4	A
Total power dissipation $T_{case} \leqq 25$ °C	P_{tot}	100	W
Junction temperature	T_j	150	°C
Storage temperature range	T_{stg}	−55 ...+150	°C

Maximum thermal resistance

Junction case	R_{thJC}	1.25	K/W

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Characteristics $T_{case} = 25\,°C$, unless otherwise specified		Min.	Typ.	Max.	
Collector cut-off current					
$V_{CE} = 800\,V$	I_{CES}			1	mA
$T_j = 150\,°C$, $V_{CE} = 800\,V$	I_{CES}			2	mA
Collector-emitter breakdown voltage					
$I_C = 100\,mA$; $L_C = 125\,mH$	$V_{(BR)CEO}$ [2]	430			V
$I_C = 0.5\,mA$, $R_{BE} \leq 100\,\Omega$	$V_{(BR)CER}$	800			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}	20		45	
$V_{CE} = 5\,V$, $I_C = 4\,A$	h_{FE}	5.5			
Gain bandwidth product					
$V_{CE} = 10\,V$, $I_C = 500\,mA$, $f = 1\,MHz$	f_T		10		MHz
Switching characteristics					
$I_C = 4\,A$, $I_{B1} = -I_{B2} = 1.25\,A$, $t_p = 20\,\mu s$					
Turn-off time	t_{off}			4	µs
Fall time	t_f [1]			1	µs
$I_C = 2.5\,A$, $I_{B1} = 0.5\,A$, $-dI_B/dt \approx 0.5\,A/\mu s$, $dV_{CE}/dt = 500\,V/\mu s$ 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:

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

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

[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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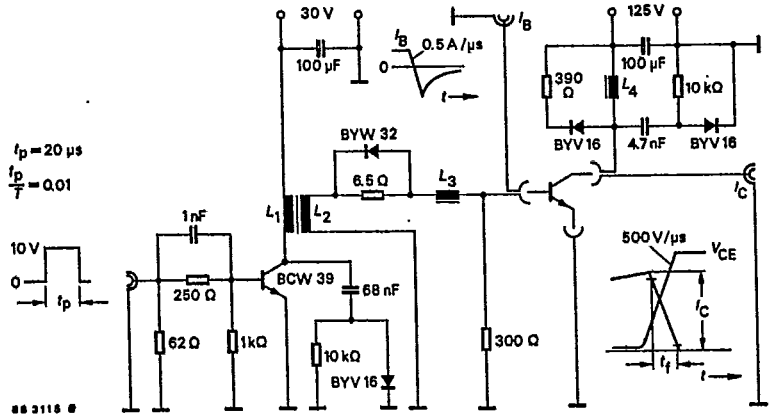
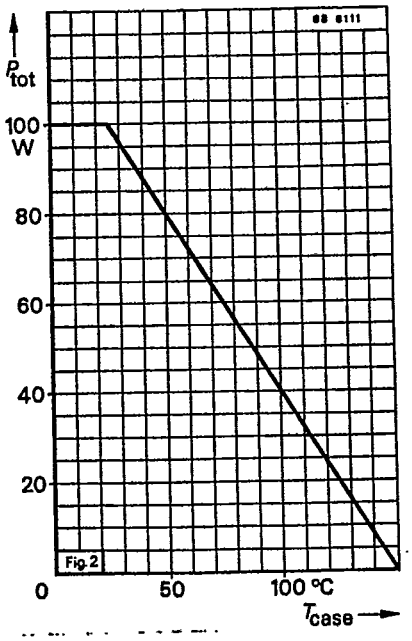
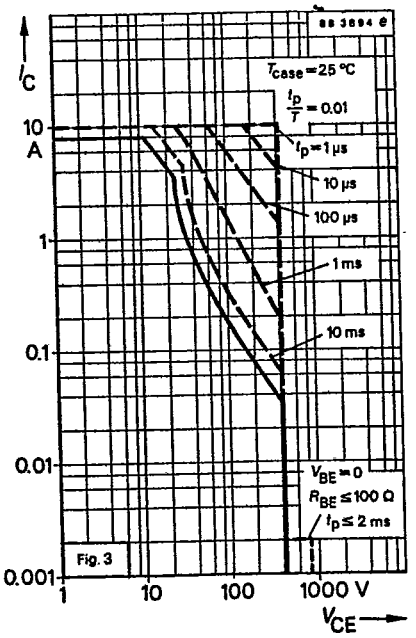
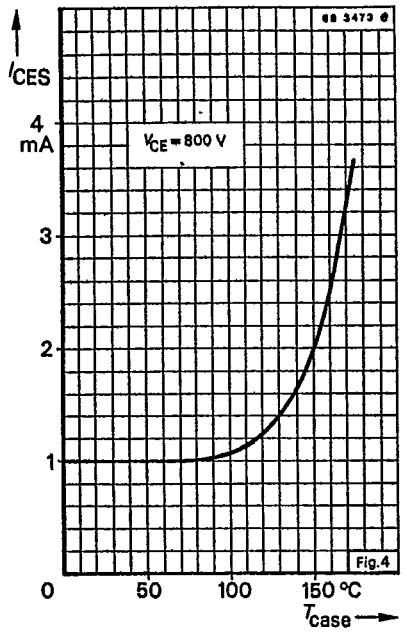
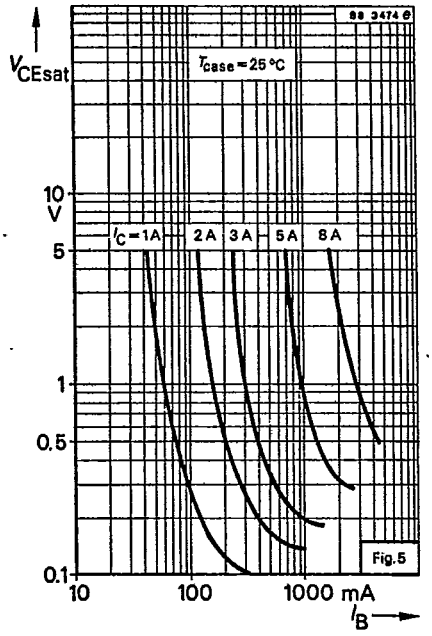


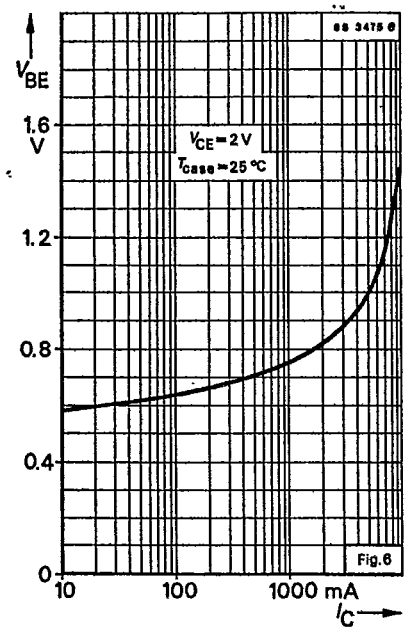
Fig. 1 Test circuit for switching characteristics

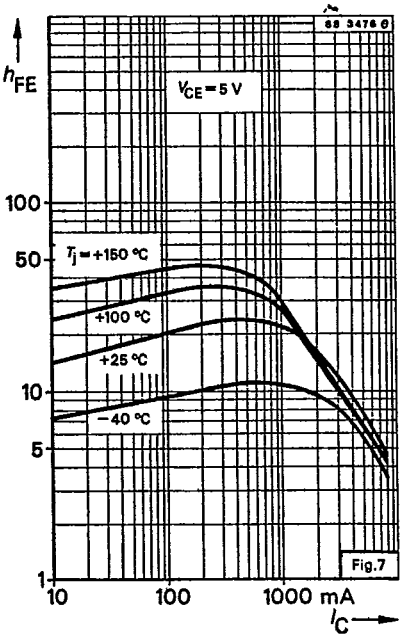





88 3473 e
I_{CES}
4 mA
3
2
1
0
V_{CE} = 800 V
50
100
150 °C
T_{case}
Fig.4


88 3474 e
V_{CEsat}
T_{case} = 25 °C
10 V
5
1
0.5
0.1
I_C = 1A
2A
3A
5A
8A
10
100
1000 mA
I_B
Fig.5


88 3475 e
V_{BE}
1.6 V
1.2
0.8
0.4
0
V_{CE} = 2 V
T_{case} = 25 °C
10
100
1000 mA
I_C
Fig.6


88 3476 e
h_{FE}
V_{CE} = 5 V
100
50
10
5
1
T_j = +150 °C
+100 °C
+25 °C
−40 °C
10
100
1000 mA
I_C
Fig.7

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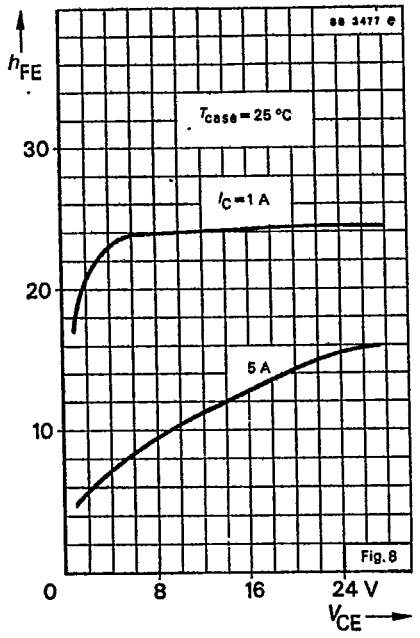
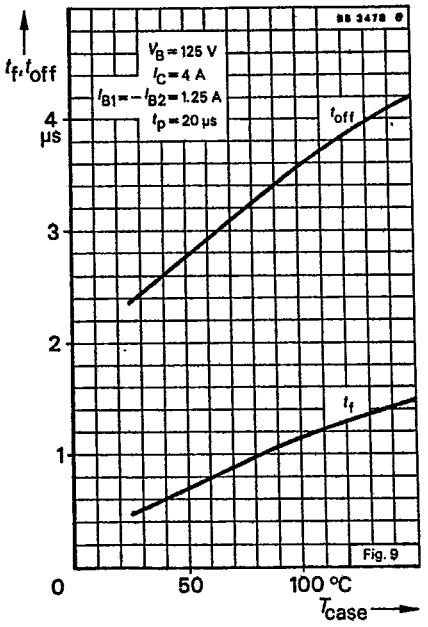
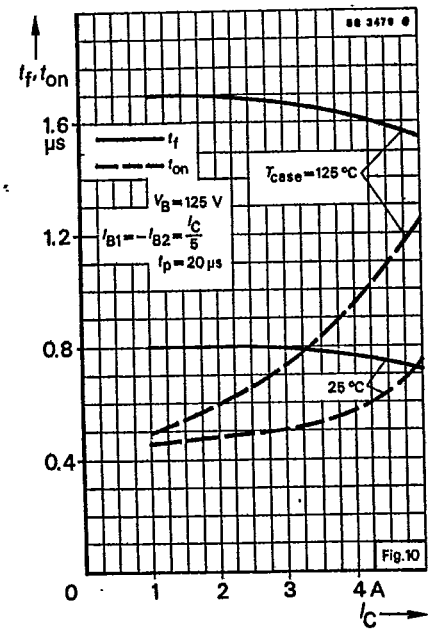
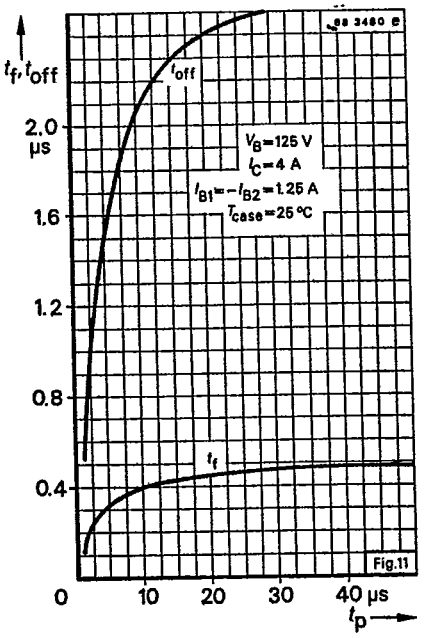

h_{FE}
T_{case}=25 °C
I_C=1 A
5 A
30
20
10
0
8
16
24 V
V_{CE}
Fig. 8


t_f, t_{off}
V_B=125 V
I_C=4 A
I_{B1}=−I_{B2}=1.25 A
t_p=20 µs
t_{off}
t_f
4 µs
3
2
1
0
50
100 °C
T_{case}
Fig. 9


t_f, t_{on}
1.6 µs
t_f
t_{on}
T_{case}=125 °C
V_B=125 V
I_{B1}=−I_{B2}=$\frac{I_C}{5}$
t_p=20 µs
25 °C
1.2
0.8
0.4
0
1
2
3
4 A
I_C
Fig.10


t_f, t_{off}
t_{off}
2.0 µs
V_B=125 V
I_C=4 A
I_{B1}=−I_{B2}=1.25 A
T_{case}=25 °C
1.6
1.2
0.8
0.4
t_f
0
10
20
30
40 µs
t_p
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

- Order-No. of Type
- Code for TO-92 Transistors
- Orientation of transistor on tape [1]
- 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

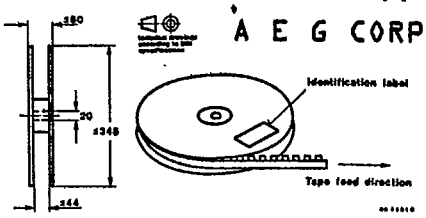


Fig. 7.1. Dimensions of reel in mm

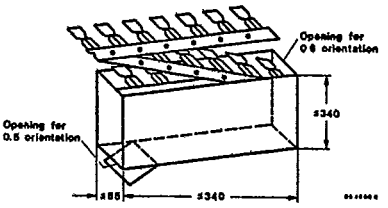


Fig. 7.2. Dimension of box for Zigzag folding in mm

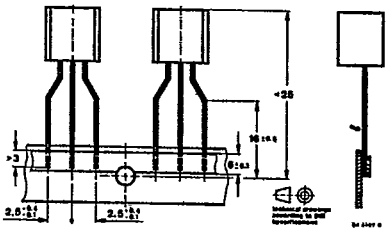


Fig. 7.3. Dimensions of tape in mm

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.

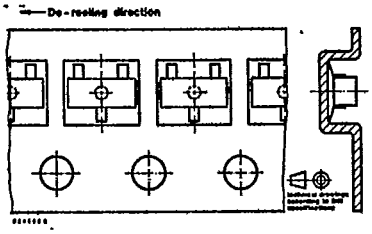


Fig. 7.4 Standard taped SOT 23

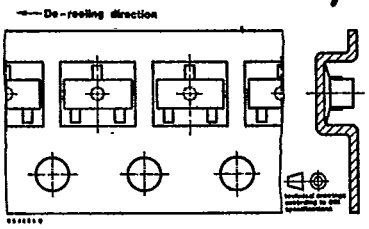


Fig. 7.6 Reverse taped SOT 23

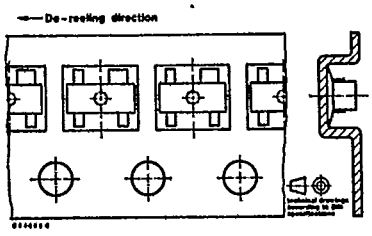


Fig. 7.5 Standard taped SOT 143

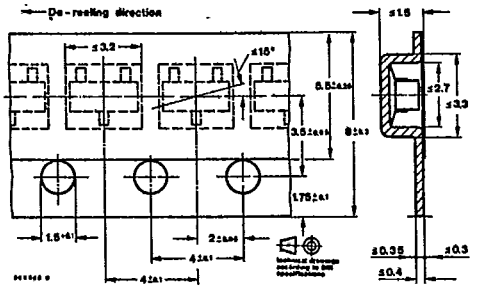


Fig. 7.7 Dimensions of tape in mm

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.

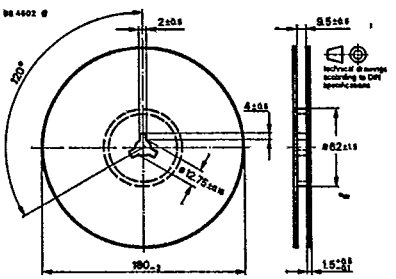


Fig. 7.8 Dimensions of reel in mm

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 41869 JEDEC TO 126 (SOT 32)
564542	8.2.	Isolating washer thickness 50 µm	14A 3 DIN 41869 JEDEC TO 220 (SOT 78)
912884	8.3	Isolating washer thickness 50 µm	15A 3 DIN 41869 (TOP3) for clip mounting
191131	8.4	Isolating washer thickness 50 µm	15A 3 DIN 41869 (TOP3) for screw mounting
191140	8.5	Mounting clip	15A 3 DIN 41869 (TOP3)
569524	8.6	Isolating washer thickness 100 µm + 50 µm	3B 2 DIN 41872 JEDEC TO 3 Devices with high reverse voltage