

## Silicon Diffused Power Transistor

BU2508DF

## GENERAL DESCRIPTION

Enhanced performance, new generation, high-voltage, high-speed switching npn transistor with an integrated damper diode in a plastic full-pack envelope intended for use in horizontal deflection circuits of colour television receivers. Features exceptional tolerance to base drive and collector current load variations resulting in a very low worst case dissipation.

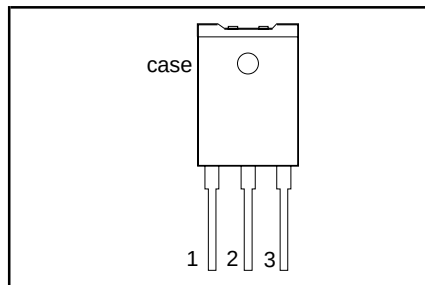
## QUICK REFERENCE DATA

| SYMBOL      | PARAMETER                             | CONDITIONS                                           | TYP. | MAX. | UNIT          |
|-------------|---------------------------------------|------------------------------------------------------|------|------|---------------|
| $V_{CESM}$  | Collector-emitter voltage peak value  | $V_{BE} = 0\text{ V}$                                | -    | 1500 | V             |
| $V_{CEO}$   | Collector-emitter voltage (open base) |                                                      | -    | 700  | V             |
| $I_C$       | Collector current (DC)                |                                                      | -    | 8    | A             |
| $I_{CM}$    | Collector current peak value          |                                                      | -    | 15   | A             |
| $P_{tot}$   | Total power dissipation               | $T_{hs} \leq 25\text{ }^{\circ}\text{C}$             | -    | 45   | W             |
| $V_{CESat}$ | Collector-emitter saturation voltage  | $I_C = 4.5\text{ A}; I_B = 1.12\text{ A}$            | -    | 1.0  | V             |
| $I_{Csat}$  | Collector saturation current          |                                                      | 4.5  | -    | A             |
| $V_F$       | Diode forward voltage                 | $I_F = 4.5\text{ A}$                                 | 1.6  | 2.0  | V             |
| $t_f$       | Fall time                             | $I_{Csat} = 4.5\text{ A}; I_{B(end)} = 1.1\text{ A}$ | 0.4  | 0.6  | $\mu\text{s}$ |

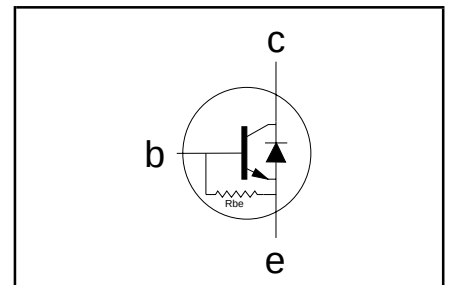
## PINNING - SOT199

| PIN  | DESCRIPTION |
|------|-------------|
| 1    | base        |
| 2    | collector   |
| 3    | emitter     |
| case | isolated    |

## PIN CONFIGURATION



## SYMBOL



## LIMITING VALUES

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

| SYMBOL       | PARAMETER                                    | CONDITIONS                               | MIN. | MAX. | UNIT               |
|--------------|----------------------------------------------|------------------------------------------|------|------|--------------------|
| $V_{CESM}$   | Collector-emitter voltage peak value         | $V_{BE} = 0\text{ V}$                    | -    | 1500 | V                  |
| $V_{CEO}$    | Collector-emitter voltage (open base)        |                                          | -    | 700  | V                  |
| $I_C$        | Collector current (DC)                       |                                          | -    | 8    | A                  |
| $I_{CM}$     | Collector current peak value                 |                                          | -    | 15   | A                  |
| $I_B$        | Base current (DC)                            |                                          | -    | 4    | A                  |
| $I_{BM}$     | Base current peak value                      |                                          | -    | 6    | A                  |
| $-I_{B(AV)}$ | Reverse base current                         | average over any 20 ms period            | -    | 100  | mA                 |
| $-I_{BM}$    | Reverse base current peak value <sup>1</sup> |                                          | -    | 5    | A                  |
| $P_{tot}$    | Total power dissipation                      | $T_{hs} \leq 25\text{ }^{\circ}\text{C}$ | -    | 45   | W                  |
| $T_{stg}$    | Storage temperature                          |                                          | -65  | 150  | $^{\circ}\text{C}$ |
| $T_j$        | Junction temperature                         |                                          | -    | 150  | $^{\circ}\text{C}$ |

<sup>1</sup> Turn-off current.

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## THERMAL RESISTANCES

| SYMBOL         | PARAMETER            | CONDITIONS                | TYP. | MAX. | UNIT |
|----------------|----------------------|---------------------------|------|------|------|
| $R_{th\ j-hs}$ | Junction to heatsink | without heatsink compound | -    | 3.7  | K/W  |
| $R_{th\ j-hs}$ | Junction to heatsink | with heatsink compound    | -    | 2.8  | K/W  |
| $R_{th\ j-a}$  | Junction to ambient  | in free air               | 35   | -    | K/W  |

## ISOLATION LIMITING VALUE &amp; CHARACTERISTIC

 $T_{hs} = 25\text{ }^{\circ}\text{C}$  unless otherwise specified

| SYMBOL     | PARAMETER                                                             | CONDITIONS                            | MIN. | TYP. | MAX. | UNIT |
|------------|-----------------------------------------------------------------------|---------------------------------------|------|------|------|------|
| $V_{isol}$ | Repetitive peak voltage from all three terminals to external heatsink | R.H. $\leq 65\%$ ; clean and dustfree | -    |      | 2500 | V    |
| $C_{isol}$ | Capacitance from T2 to external heatsink                              | $f = 1\text{ MHz}$                    | -    | 22   | -    | pF   |

## STATIC CHARACTERISTICS

 $T_{hs} = 25\text{ }^{\circ}\text{C}$  unless otherwise specified

| SYMBOL        | PARAMETER                              | CONDITIONS                                                                           | MIN. | TYP. | MAX. | UNIT     |
|---------------|----------------------------------------|--------------------------------------------------------------------------------------|------|------|------|----------|
| $I_{CES}$     | Collector cut-off current <sup>2</sup> | $V_{BE} = 0\text{ V}$ ; $V_{CE} = V_{CESMmax}$                                       | -    | -    | 1.0  | mA       |
| $I_{CES}$     |                                        | $V_{BE} = 0\text{ V}$ ; $V_{CE} = V_{CESMmax}$ ; $T_j = 125\text{ }^{\circ}\text{C}$ | -    | -    | 2.0  | mA       |
| $I_{EBO}$     | Emitter cut-off current                | $V_{EB} = 7.5\text{ V}$ ; $I_C = 0\text{ A}$                                         | -    | 227  | -    | mA       |
| $BV_{EBO}$    | Emitter-base breakdown voltage         | $I_B = 600\text{ mA}$                                                                | 7.5  | 13.5 | -    | V        |
| $R_{be}$      | Base-emitter resistance                | $V_{EB} = 7.5\text{ V}$                                                              | -    | 33   | -    | $\Omega$ |
| $V_{CEOsust}$ | Collector-emitter sustaining voltage   | $I_B = 0\text{ A}$ ; $I_C = 100\text{ mA}$ ; $L = 25\text{ mH}$                      | 700  | -    | -    | V        |
| $V_{CEsat}$   | Collector-emitter saturation voltage   | $I_C = 4.5\text{ A}$ ; $I_B = 1.12\text{ A}$                                         | -    | -    | 1.0  | V        |
| $V_{BEsat}$   | Base-emitter saturation voltage        | $I_C = 4.5\text{ A}$ ; $I_B = 1.7\text{ A}$                                          | -    | -    | 1.1  | V        |
| $h_{FE}$      | DC current gain                        | $I_C = 1\text{ A}$ ; $V_{CE} = 5\text{ V}$                                           | -    | 13   | -    |          |
| $h_{FE}$      |                                        | $I_C = 4.5\text{ A}$ ; $V_{CE} = 1\text{ V}$                                         | 4    | 5.5  | 7.0  |          |
| $V_F$         | Diode forward voltage                  | $I_F = 4.5\text{ A}$                                                                 | -    | 1.6  | 2.0  | V        |

## DYNAMIC CHARACTERISTICS

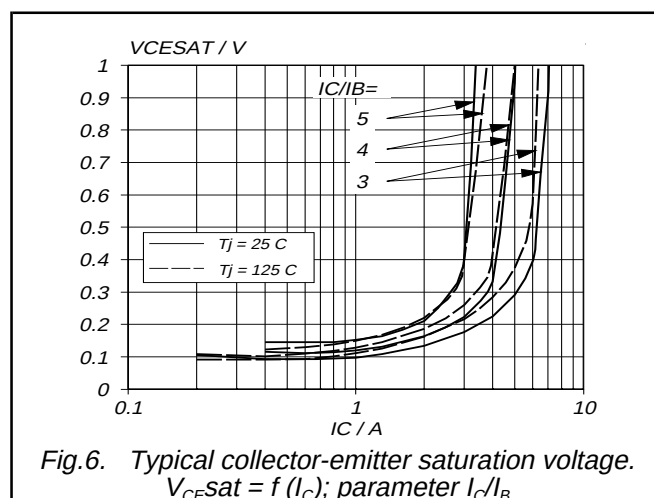
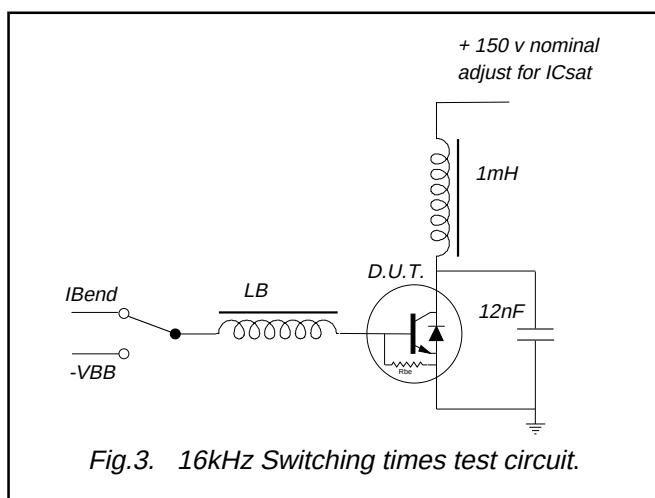
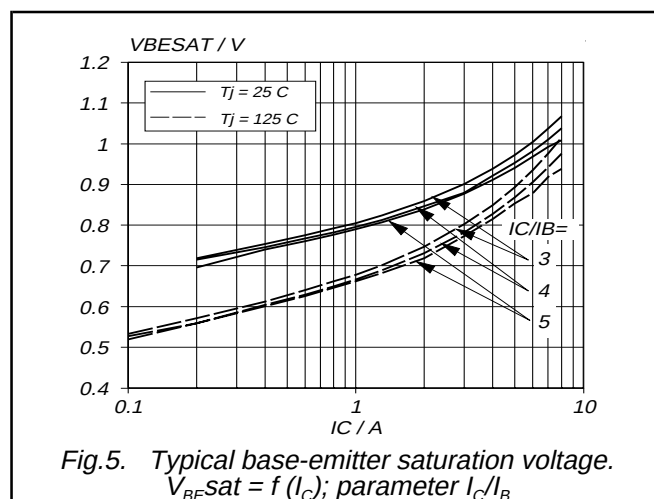
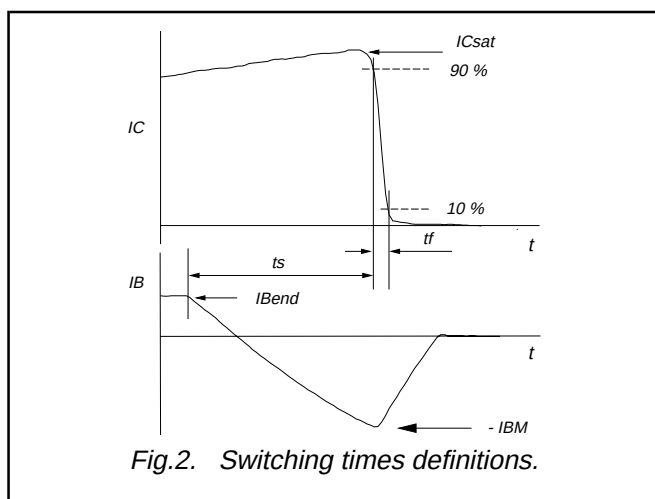
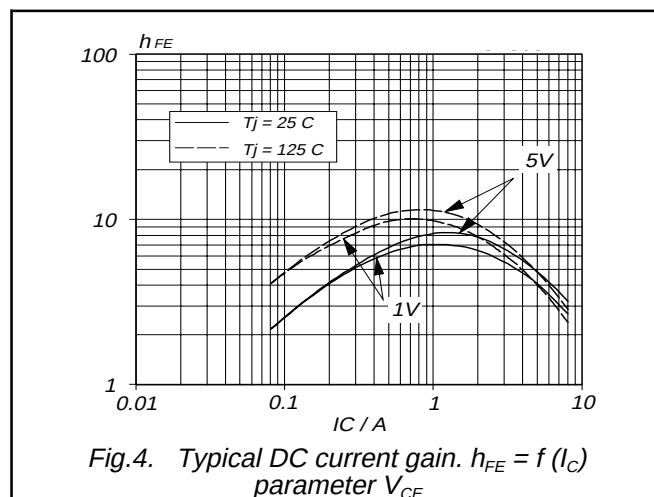
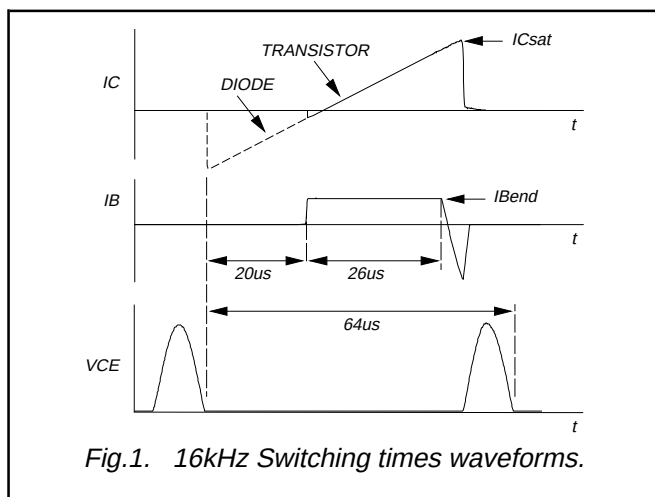
 $T_{hs} = 25\text{ }^{\circ}\text{C}$  unless otherwise specified

| SYMBOL | PARAMETER                                        | CONDITIONS                                                                                                                                                | TYP. | MAX. | UNIT          |
|--------|--------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|---------------|
| $C_c$  | Collector capacitance                            | $I_E = 0\text{ A}$ ; $V_{CB} = 10\text{ V}$ ; $f = 1\text{ MHz}$                                                                                          | 80   | -    | pF            |
| $t_s$  | Switching times (16 kHz line deflection circuit) | $I_{Csat} = 4.5\text{ A}$ ; $I_{B(end)} = 1.1\text{ A}$ ; $L_B = 6\text{ }\mu\text{H}$ ; $-V_{BB} = 4\text{ V}$ ; $(-di_B/dt = 0.6\text{ A}/\mu\text{s})$ | 5.0  | 6.0  | $\mu\text{s}$ |
| $t_f$  | Turn-off storage time                            |                                                                                                                                                           | 0.4  | 0.6  | $\mu\text{s}$ |
| $t_f$  | Turn-off fall time                               |                                                                                                                                                           |      |      |               |
| $t_s$  | Switching times (38 kHz line deflection circuit) | $I_{Csat} = 4.0\text{ A}$ ; $I_{B(end)} = 0.9\text{ A}$ ; $L_B = 6\text{ }\mu\text{H}$ ; $-V_{BB} = 4\text{ V}$ ; $(-di_B/dt = 0.6\text{ A}/\mu\text{s})$ | 4.7  | 5.7  | $\mu\text{s}$ |
| $t_f$  | Turn-off storage time                            |                                                                                                                                                           | 0.25 | 0.35 | $\mu\text{s}$ |
| $t_f$  | Turn-off fall time                               |                                                                                                                                                           |      |      |               |

<sup>2</sup> Measured with half sine-wave voltage (curve tracer).

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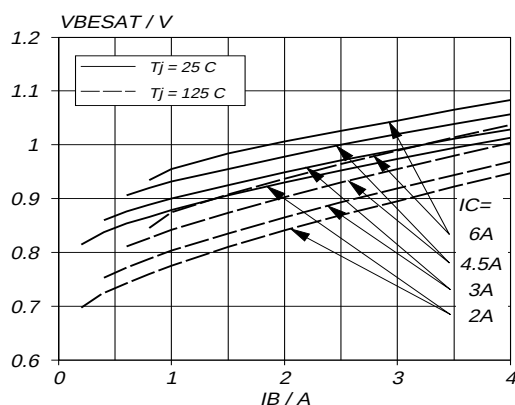


Fig. 7. Typical base-emitter saturation voltage.  
 $V_{BEsat} = f(I_B)$ ; parameter  $I_C$

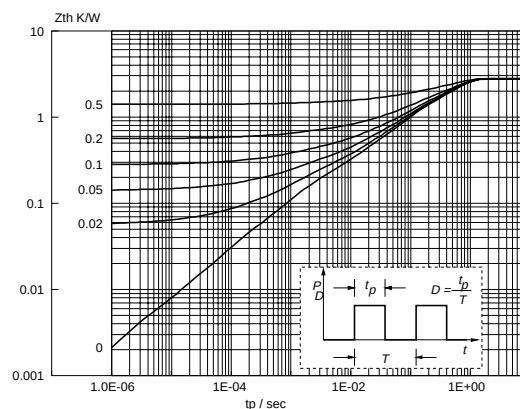


Fig. 10. Transient thermal impedance.  
 $Z_{thj-hs} = f(t)$ ; parameter  $D = t_p/T$

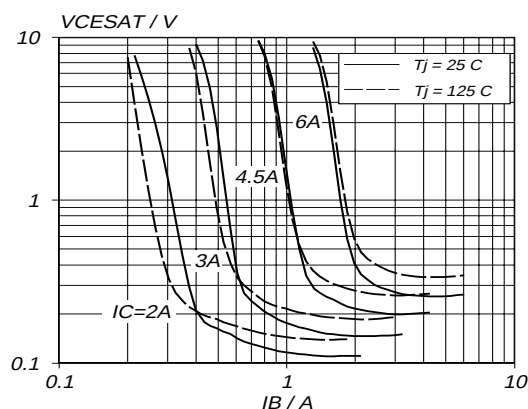


Fig. 8. Typical collector-emitter saturation voltage.  
 $V_{CEsat} = f(I_B)$ ; parameter  $I_C$

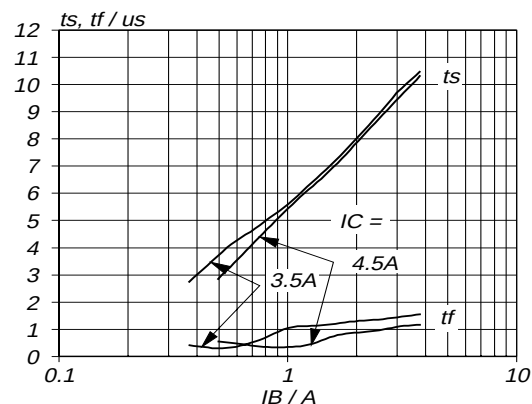


Fig. 11. Typical collector storage and fall time.  
 $t_s = f(I_B)$ ;  $t_f = f(I_B)$ ; parameter  $I_C$ ;  $T_J = 85^\circ\text{C}$ ;  $f = 16\text{ kHz}$

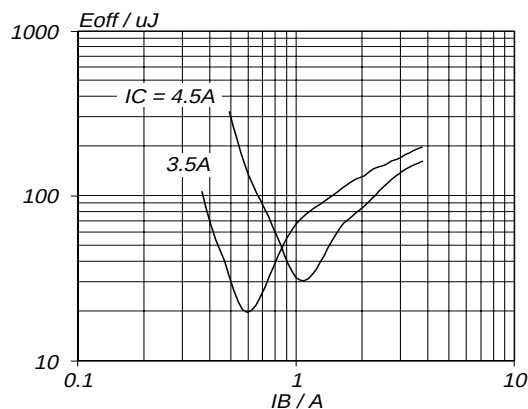


Fig. 9. Typical turn-off losses.  $T_J = 85^\circ\text{C}$   
 $E_{off} = f(I_B)$ ; parameter  $I_C$ ;  $f = 16\text{ kHz}$

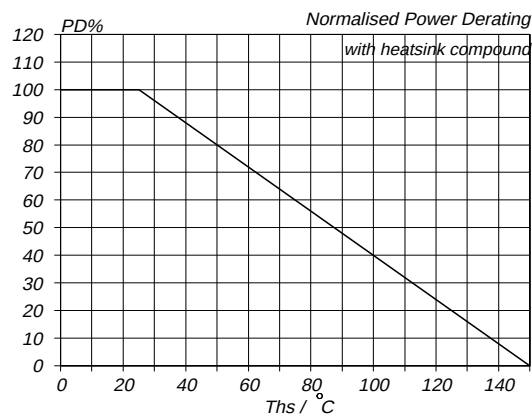


Fig. 12. Normalised power dissipation.  
 $PD\% = 100 \cdot P_D / P_{D\ 25^\circ\text{C}} = f(T_{hs})$

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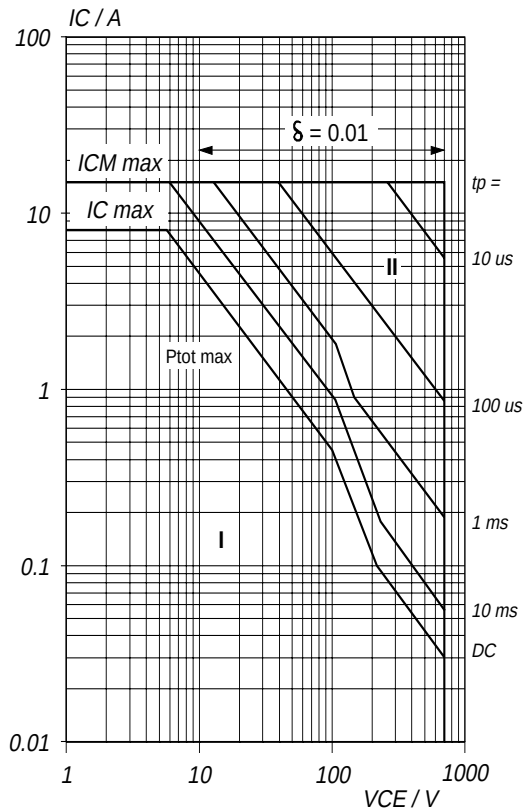


Fig.13. Forward bias safe operating area.  $T_{hs} = 25^{\circ}\text{C}$

- I Region of permissible DC operation.
- II Extension for repetitive pulse operation.

NB: Mounted with heatsink compound and  $30 \pm 5$  newton force on the centre of the envelope.

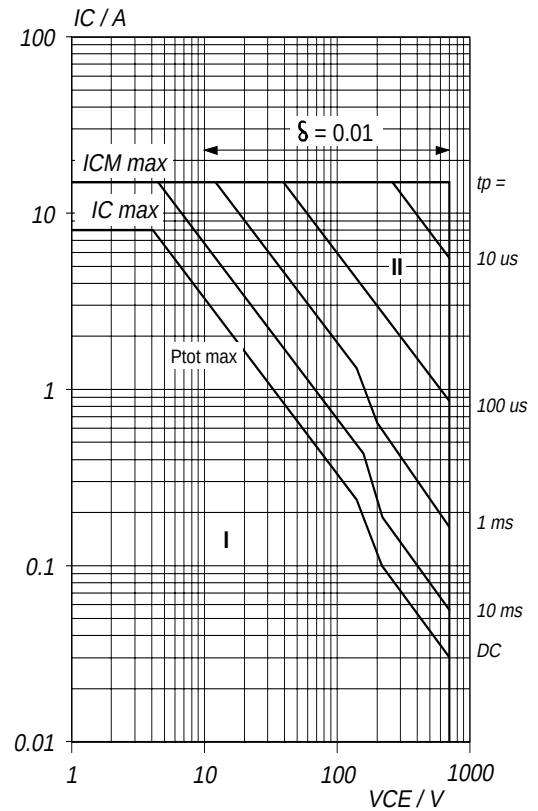


Fig.14. Forward bias safe operating area.  $T_{hs} = 25^{\circ}\text{C}$

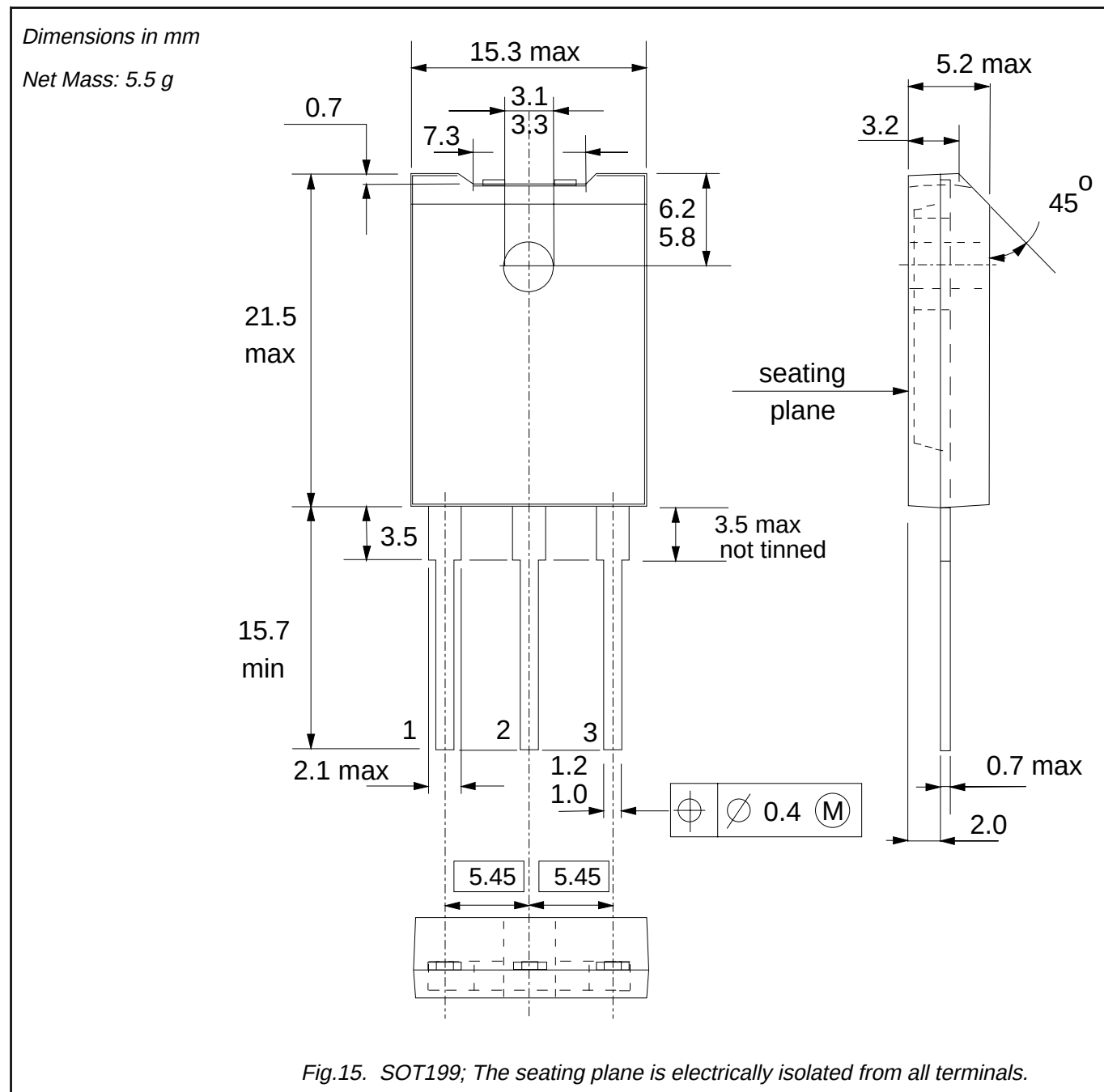
- I Region of permissible DC operation.
- II Extension for repetitive pulse operation.

NB: Mounted without heatsink compound and  $30 \pm 5$  newton force on the centre of the envelope.

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## MECHANICAL DATA



## Notes

1. Refer to mounting instructions for F-pack envelopes.
2. Epoxy meets UL94 V0 at 1/8".