

## Thyristors

## BT151S series

## GENERAL DESCRIPTION

Passivated thyristors in a plastic envelope, suitable for surface mounting, intended for use in applications requiring high bidirectional blocking voltage capability and high thermal cycling performance. Typical applications include motor control, industrial and domestic lighting, heating and static switching.

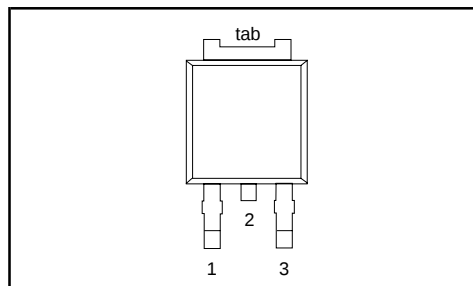
## QUICK REFERENCE DATA

| SYMBOL                   | PARAMETER                                             | MAX.               | MAX.               | MAX.               | UNIT |
|--------------------------|-------------------------------------------------------|--------------------|--------------------|--------------------|------|
| $V_{DRM}$ ,<br>$V_{RRM}$ | <b>BT151S -</b><br>Repetitive peak off-state voltages | <b>500R</b><br>500 | <b>650R</b><br>650 | <b>800R</b><br>800 | V    |
| $I_{T(AV)}$              | Average on-state current                              | 7.5                | 7.5                | 7.5                | A    |
| $I_{T(RMS)}$             | RMS on-state current                                  | 12                 | 12                 | 12                 | A    |
| $I_{TSM}$                | Non-repetitive peak on-state current                  | 100                | 100                | 100                | A    |

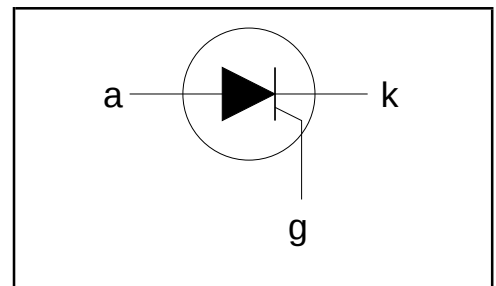
## PINNING - SOT428

| PIN NUMBER |         |
|------------|---------|
| 1          | cathode |
| 2          | anode   |
| 3          | gate    |
| tab        | anode   |

## PIN CONFIGURATION



## SYMBOL



## LIMITING VALUES

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

| SYMBOL                | PARAMETER                                                    | CONDITIONS                                                                              | MIN. | MAX.                             |                                 |                     | UNIT             |
|-----------------------|--------------------------------------------------------------|-----------------------------------------------------------------------------------------|------|----------------------------------|---------------------------------|---------------------|------------------|
| $V_{DRM}$ , $V_{RRM}$ | Repetitive peak off-state voltages                           |                                                                                         | -    | <b>-500R</b><br>500 <sup>1</sup> | <b>650R</b><br>650 <sup>1</sup> | <b>-800R</b><br>800 | V                |
| $I_{T(AV)}$           | Average on-state current                                     | half sine wave; $T_{mb} \leq 103^\circ\text{C}$<br>all conduction angles                | -    | 7.5                              |                                 |                     | A                |
| $I_{T(RMS)}$          | RMS on-state current                                         | half sine wave; $T_j = 25^\circ\text{C}$ prior to surge                                 | -    | 12                               |                                 |                     | A                |
| $I_{TSM}$             | Non-repetitive peak on-state current                         | $t = 10\text{ ms}$                                                                      | -    | 100                              |                                 |                     | A                |
|                       |                                                              | $t = 8.3\text{ ms}$                                                                     | -    | 110                              |                                 |                     | A                |
| $I^2t$                | $I^2t$ for fusing                                            | $t = 10\text{ ms}$                                                                      | -    | 50                               |                                 |                     | A <sup>2</sup> s |
| $di_T/dt$             | Repetitive rate of rise of on-state current after triggering | $I_{TM} = 20\text{ A}$ ; $I_G = 50\text{ mA}$ ;<br>$di_G/dt = 50\text{ mA}/\mu\text{s}$ | -    | 50                               |                                 |                     | A/ $\mu\text{s}$ |
| $I_{GM}$              | Peak gate current                                            |                                                                                         | -    | 2                                |                                 |                     | A                |
| $V_{RGM}$             | Peak reverse gate voltage                                    |                                                                                         | -    | 5                                |                                 |                     | V                |
| $P_{GM}$              | Peak gate power                                              |                                                                                         | -    | 5                                |                                 |                     | W                |
| $P_{G(AV)}$           | Average gate power                                           | over any 20 ms period                                                                   | -    | 0.5                              |                                 |                     | W                |
| $T_{stg}$             | Storage temperature                                          |                                                                                         | -40  | 150                              |                                 |                     | $^\circ\text{C}$ |
| $T_j$                 | Operating junction temperature                               |                                                                                         | -    | 125                              |                                 |                     | $^\circ\text{C}$ |

<sup>1</sup> Although not recommended, off-state voltages up to 800V may be applied without damage, but the thyristor may switch to the on-state. The rate of rise of current should not exceed 15 A/ $\mu\text{s}$ .

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## THERMAL RESISTANCES

| SYMBOL         | PARAMETER                                    | CONDITIONS                                | MIN. | TYP. | MAX. | UNIT |
|----------------|----------------------------------------------|-------------------------------------------|------|------|------|------|
| $R_{th\ j-mb}$ | Thermal resistance junction to mounting base | pcb (FR4) mounted; footprint as in Fig.14 | -    | -    | 1.8  | K/W  |
| $R_{th\ j-a}$  | Thermal resistance junction to ambient       |                                           | -    | 75   | -    | K/W  |

## STATIC CHARACTERISTICS

 $T_j = 25\ ^\circ\text{C}$  unless otherwise stated

| SYMBOL     | PARAMETER                 | CONDITIONS                                                                 | MIN. | TYP. | MAX. | UNIT |
|------------|---------------------------|----------------------------------------------------------------------------|------|------|------|------|
| $I_{GT}$   | Gate trigger current      | $V_D = 12\ \text{V}$ ; $I_T = 0.1\ \text{A}$                               | -    | 2    | 15   | mA   |
| $I_L$      | Latching current          | $V_D = 12\ \text{V}$ ; $I_{GT} = 0.1\ \text{A}$                            | -    | 10   | 40   | mA   |
| $I_H$      | Holding current           | $V_D = 12\ \text{V}$ ; $I_{GT} = 0.1\ \text{A}$                            | -    | 7    | 20   | mA   |
| $V_T$      | On-state voltage          | $I_T = 23\ \text{A}$                                                       | -    | 1.4  | 1.75 | V    |
| $V_{GT}$   | Gate trigger voltage      | $V_D = 12\ \text{V}$ ; $I_T = 0.1\ \text{A}$                               | -    | 0.6  | 1.5  | V    |
| $I_D, I_R$ | Off-state leakage current | $V_D = V_{DRM(max)}$ ; $I_T = 0.1\ \text{A}$ ; $T_j = 125\ ^\circ\text{C}$ | 0.25 | 0.4  | -    | V    |
|            |                           | $V_D = V_{DRM(max)}$ ; $V_R = V_{RRM(max)}$ ; $T_j = 125\ ^\circ\text{C}$  | -    | 0.1  | 0.5  | mA   |

## DYNAMIC CHARACTERISTICS

 $T_j = 25\ ^\circ\text{C}$  unless otherwise stated

| SYMBOL    | PARAMETER                                  | CONDITIONS                                                                                                                                                                                                         | MIN.      | TYP.        | MAX. | UNIT             |
|-----------|--------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|-------------|------|------------------|
| $dV_D/dt$ | Critical rate of rise of off-state voltage | $V_{DM} = 67\% V_{DRM(max)}$ ; $T_j = 125\ ^\circ\text{C}$ ; exponential waveform;                                                                                                                                 | 50<br>200 | 130<br>1000 | -    | V/ $\mu\text{s}$ |
|           |                                            | Gate open circuit<br>$R_{GK} = 100\ \Omega$                                                                                                                                                                        |           |             |      |                  |
| $t_{gt}$  | Gate controlled turn-on time               | $I_{TM} = 40\ \text{A}$ ; $V_D = V_{DRM(max)}$ ; $I_G = 0.1\ \text{A}$ ; $dI_G/dt = 5\ \text{A}/\mu\text{s}$                                                                                                       | -         | 2           | -    | $\mu\text{s}$    |
| $t_q$     | Circuit commutated turn-off time           | $V_D = 67\% V_{DRM(max)}$ ; $T_j = 125\ ^\circ\text{C}$ ; $I_{TM} = 20\ \text{A}$ ; $V_R = 25\ \text{V}$ ; $dI_{TM}/dt = 30\ \text{A}/\mu\text{s}$ ; $dV_D/dt = 50\ \text{V}/\mu\text{s}$ ; $R_{GK} = 100\ \Omega$ | -         | 70          | -    | $\mu\text{s}$    |

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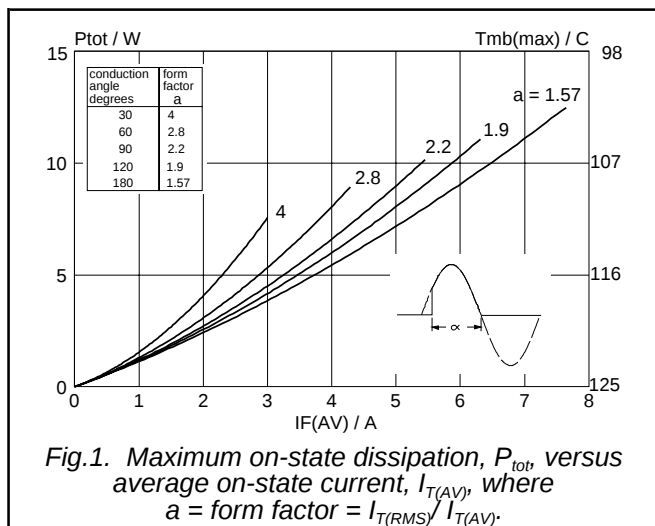


Fig.1. Maximum on-state dissipation,  $P_{tot}$ , versus average on-state current,  $I_{T(AV)}$ , where  $a = \text{form factor} = I_{T(RMS)} / I_{T(AV)}$ .

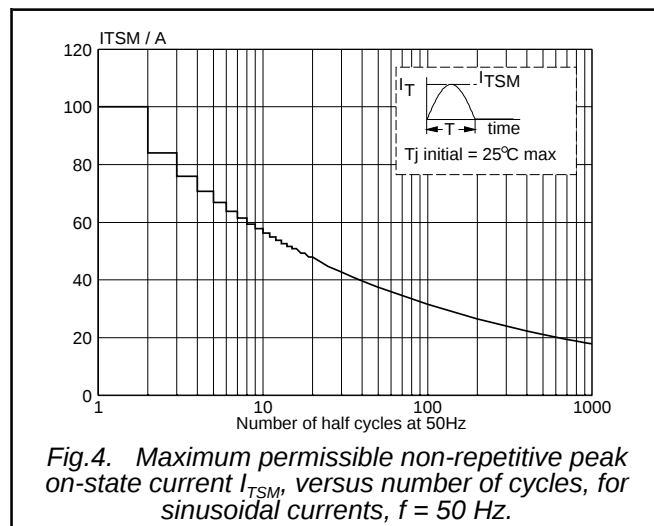


Fig.4. Maximum permissible non-repetitive peak on-state current  $I_{TSM}$ , versus number of cycles, for sinusoidal currents,  $f = 50 \text{ Hz}$ .

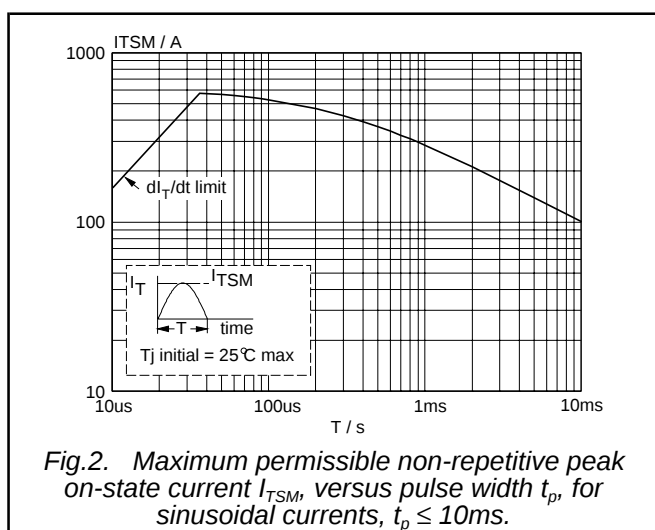


Fig.2. Maximum permissible non-repetitive peak on-state current  $I_{TSM}$ , versus pulse width  $t_p$ , for sinusoidal currents,  $t_p \leq 10\text{ms}$ .

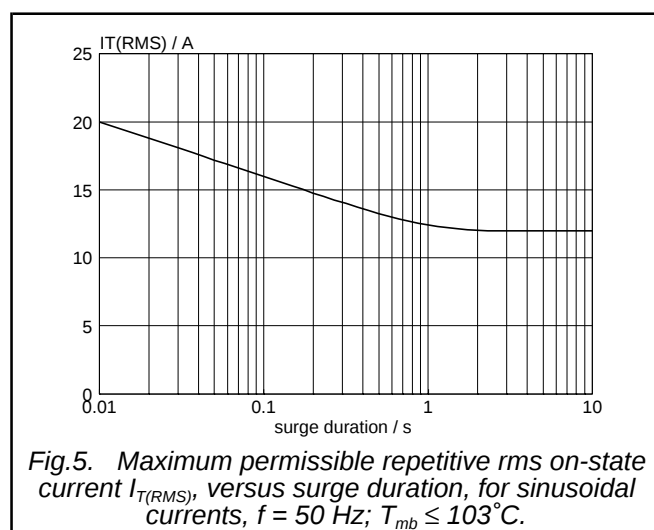


Fig.5. Maximum permissible repetitive rms on-state current  $I_{T(RMS)}$ , versus surge duration, for sinusoidal currents,  $f = 50 \text{ Hz}$ ;  $T_{mb} \leq 103^\circ\text{C}$ .

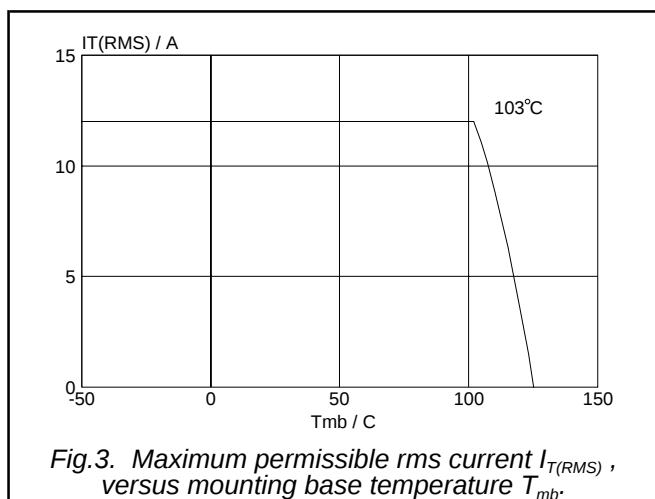


Fig.3. Maximum permissible rms current  $I_{T(RMS)}$ , versus mounting base temperature  $T_{mb}$ .

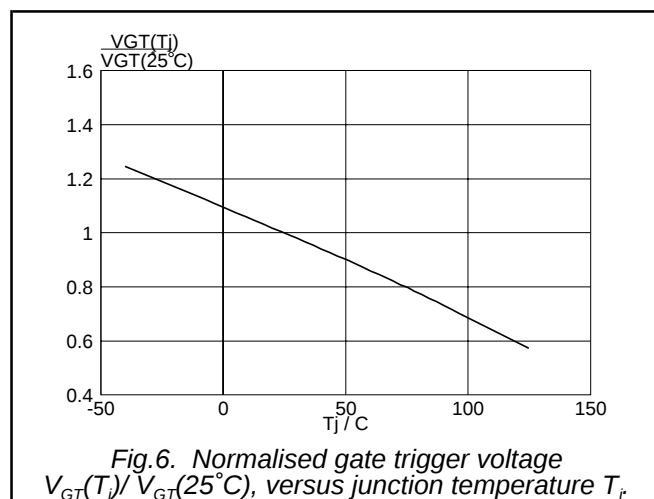
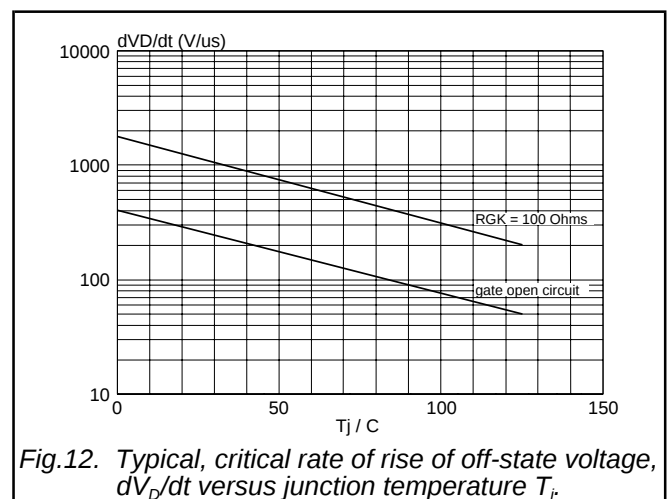
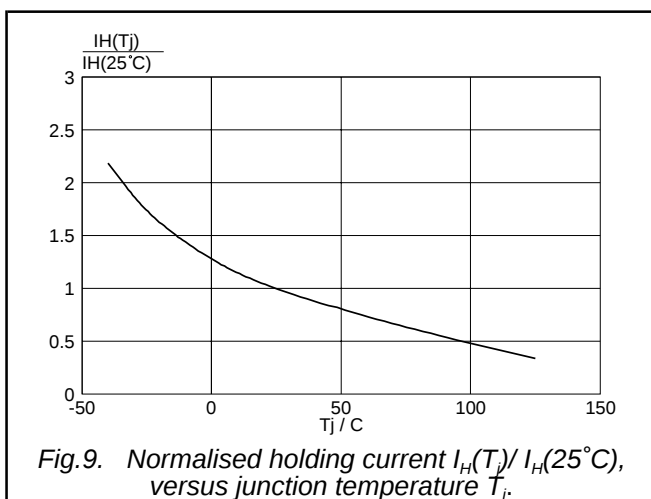
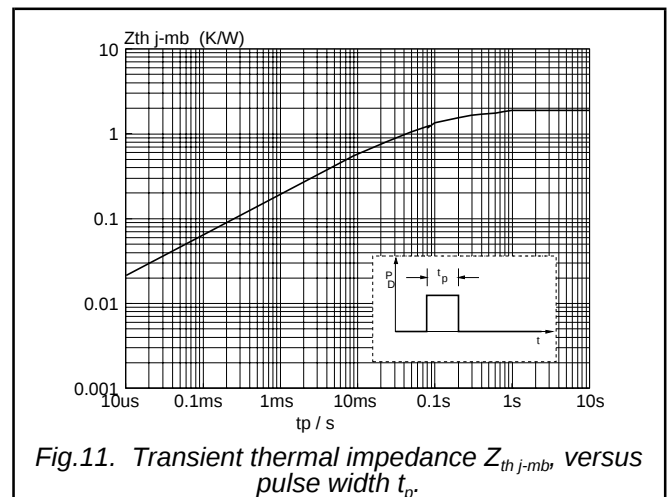
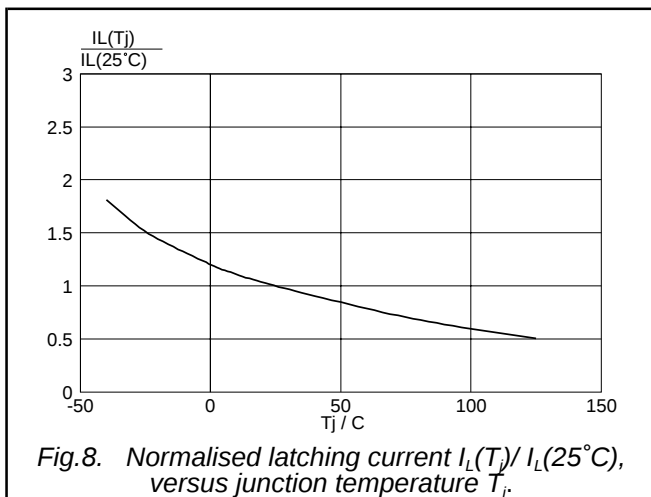
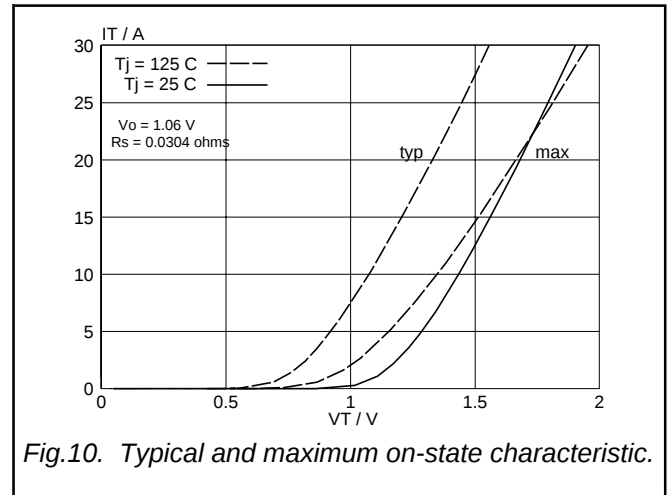
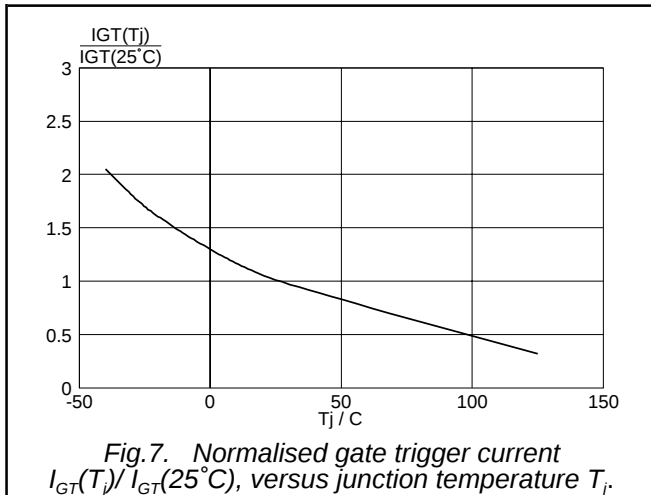


Fig.6. Normalised gate trigger voltage  $V_{GT}(T_j) / V_{GT}(25^\circ\text{C})$ , versus junction temperature  $T_j$ .

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## MECHANICAL DATA

Dimensions in mm

Net Mass: 1.1 g

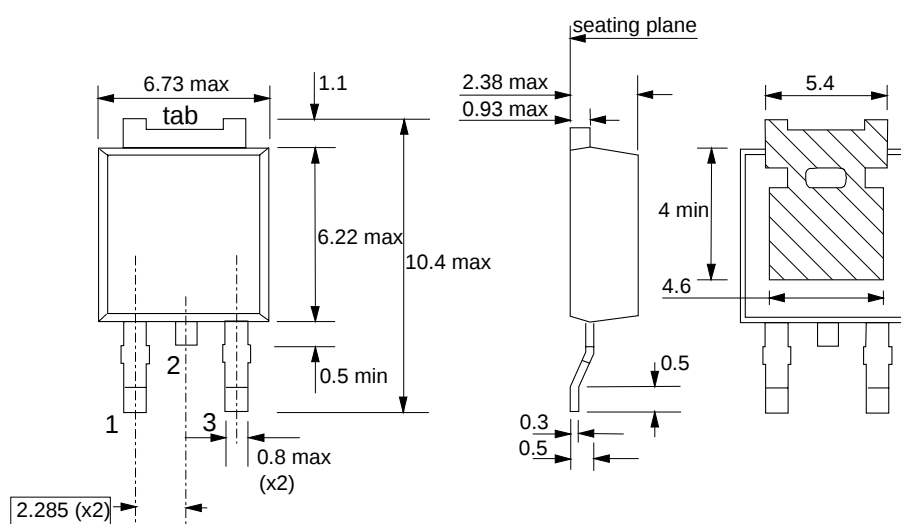


Fig.13. SOT428 : centre pin connected to tab.

## MOUNTING INSTRUCTIONS

Dimensions in mm

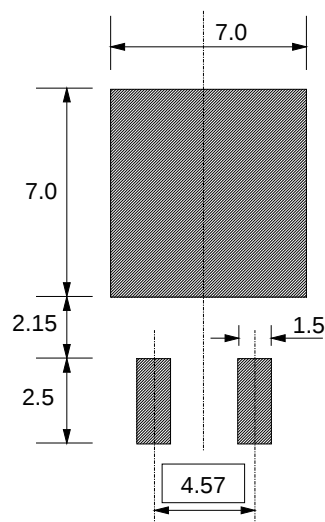


Fig.14. SOT428 : minimum pad sizes for surface mounting.

## Notes

1. Plastic meets UL94 V0 at 1/8".

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## DEFINITIONS

| DATA SHEET STATUS                                                                                                                                                                                                                                                                                                                                                                                                                                          |                             |                                                                                                                                                                                                                                                                                                                       |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| DATA SHEET STATUS <sup>2</sup>                                                                                                                                                                                                                                                                                                                                                                                                                             | PRODUCT STATUS <sup>3</sup> | DEFINITIONS                                                                                                                                                                                                                                                                                                           |
| Objective data                                                                                                                                                                                                                                                                                                                                                                                                                                             | Development                 | This data sheet contains data from the objective specification for product development. Philips Semiconductors reserves the right to change the specification in any manner without notice                                                                                                                            |
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| Limiting values are given in accordance with the Absolute Maximum Rating System (IEC 134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of this specification is not implied. Exposure to limiting values for extended periods may affect device reliability. |                             |                                                                                                                                                                                                                                                                                                                       |
| <b>Application information</b>                                                                                                                                                                                                                                                                                                                                                                                                                             |                             |                                                                                                                                                                                                                                                                                                                       |
| Where application information is given, it is advisory and does not form part of the specification.                                                                                                                                                                                                                                                                                                                                                        |                             |                                                                                                                                                                                                                                                                                                                       |
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