

# TrenchMOS™ transistor

## Logic level FET

**BUK9528-100A**  
**BUK9628-100A**

### GENERAL DESCRIPTION

N-channel enhancement mode logic level field-effect power transistor in a plastic envelope available in TO220AB and SOT404. Using 'trench' technology which features very low on-state resistance. It is intended for use in automotive and general purpose switching applications.

### QUICK REFERENCE DATA

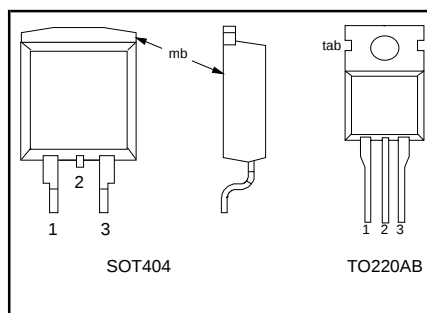
| SYMBOL       | PARAMETER                        | MAX. | UNIT |
|--------------|----------------------------------|------|------|
| $V_{DS}$     | Drain-source voltage             | 100  | V    |
| $I_D$        | Drain current (DC)               | 49   | A    |
| $P_{tot}$    | Total power dissipation          | 166  | W    |
| $T_j$        | Junction temperature             | 175  | °C   |
| $R_{DS(ON)}$ | Drain-source on-state resistance | 28   | mΩ   |
|              | $V_{GS} = 5\text{ V}$            | 27   | mΩ   |
|              | $V_{GS} = 10\text{ V}$           |      |      |

### PINNING

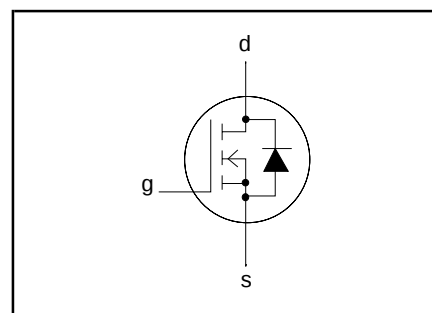
#### TO220AB & SOT404

| PIN    | DESCRIPTION |
|--------|-------------|
| 1      | gate        |
| 2      | drain       |
| 3      | source      |
| tab/mb | drain       |

#### PIN CONFIGURATION



#### SYMBOL



### LIMITING VALUES

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

| SYMBOL         | PARAMETER                          | CONDITIONS                           | MIN. | MAX. | UNIT |
|----------------|------------------------------------|--------------------------------------|------|------|------|
| $V_{DS}$       | Drain-source voltage               | -                                    | -    | 100  | V    |
| $V_{DGR}$      | Drain-gate voltage                 | $R_{GS} = 20\text{ k}\Omega$         | -    | 100  | V    |
| $\pm V_{GS}$   | Gate-source voltage                | -                                    | -    | 10   | V    |
| $\pm V_{GSM}$  | Non-repetitive gate-source voltage | $t_p \leq 50\mu\text{S}$             | -    | 15   | V    |
| $I_D$          | Drain current (DC)                 | $T_{mb} = 25\text{ }^\circ\text{C}$  | -    | 49   | A    |
| $I_D$          | Drain current (DC)                 | $T_{mb} = 100\text{ }^\circ\text{C}$ | -    | 34   | A    |
| $I_{DM}$       | Drain current (pulse peak value)   | $T_{mb} = 25\text{ }^\circ\text{C}$  | -    | 195  | A    |
| $P_{tot}$      | Total power dissipation            | $T_{mb} = 25\text{ }^\circ\text{C}$  | -    | 166  | W    |
| $T_{stg}, T_j$ | Storage & operating temperature    | -                                    | - 55 | 175  | °C   |

### THERMAL RESISTANCES

| SYMBOL         | PARAMETER                                       | CONDITIONS                   | TYP. | MAX. | UNIT |
|----------------|-------------------------------------------------|------------------------------|------|------|------|
| $R_{th\ j-mb}$ | Thermal resistance junction to mounting base    | -                            | -    | 0.9  | K/W  |
| $R_{th\ j-a}$  | Thermal resistance junction to ambient(TO220AB) | in free air                  | 60   | -    | K/W  |
| $R_{th\ j-a}$  | Thermal resistance junction to ambient(SOT404)  | Minimum footprint, FR4 board | 50   | -    | K/W  |

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### STATIC CHARACTERISTICS

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

| SYMBOL        | PARAMETER                        | CONDITIONS                                                                                          | MIN.      | TYP.     | MAX.     | UNIT          |
|---------------|----------------------------------|-----------------------------------------------------------------------------------------------------|-----------|----------|----------|---------------|
| $V_{(BR)DSS}$ | Drain-source breakdown voltage   | $V_{GS} = 0\text{ V}$ ; $I_D = 0.25\text{ mA}$ ;<br>$T_j = -55^\circ\text{C}$                       | 100<br>89 | -<br>-   | -<br>-   | V<br>V        |
| $V_{GS(TO)}$  | Gate threshold voltage           | $V_{DS} = V_{GS}$ ; $I_D = 1\text{ mA}$ ;<br>$T_j = 175^\circ\text{C}$<br>$T_j = -55^\circ\text{C}$ | 1<br>0.5  | 1.5<br>- | 2.0<br>- | V<br>V        |
| $I_{DSS}$     | Zero gate voltage drain current  | $V_{DS} = 100\text{ V}$ ; $V_{GS} = 0\text{ V}$ ;<br>$T_j = 175^\circ\text{C}$                      | -         | 0.05     | 10       | $\mu\text{A}$ |
| $I_{GSS}$     | Gate source leakage current      | $V_{GS} = \pm 10\text{ V}$ ; $V_{DS} = 0\text{ V}$                                                  | -         | 2        | 100      | nA            |
| $R_{DS(ON)}$  | Drain-source on-state resistance | $V_{GS} = 5\text{ V}$ ; $I_D = 25\text{ A}$ ;<br>$T_j = 175^\circ\text{C}$                          | -         | 18.5     | 28       | m $\Omega$    |
|               |                                  | $V_{GS} = 10\text{ V}$ ; $I_D = 25\text{ A}$                                                        | -         | 17       | 27       | m $\Omega$    |
|               |                                  | $V_{GS} = 4.5\text{ V}$ ; $I_D = 25\text{ A}$                                                       | -         | 18.8     | 31       | m $\Omega$    |

### DYNAMIC CHARACTERISTICS

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

| SYMBOL     | PARAMETER                  | CONDITIONS                                                                                    | MIN. | TYP. | MAX. | UNIT |
|------------|----------------------------|-----------------------------------------------------------------------------------------------|------|------|------|------|
| $C_{iss}$  | Input capacitance          | $V_{GS} = 0\text{ V}$ ; $V_{DS} = 25\text{ V}$ ; $f = 1\text{ MHz}$                           | -    | 3220 | 4293 | pF   |
| $C_{oss}$  | Output capacitance         |                                                                                               | -    | 315  | 378  | pF   |
| $C_{rss}$  | Feedback capacitance       |                                                                                               | -    | 187  | 256  | pF   |
| $t_{don}$  | Turn-on delay time         | $V_{DD} = 30\text{ V}$ ; $R_{load} = 1.2\Omega$ ;<br>$V_{GS} = 5\text{ V}$ ; $R_G = 10\Omega$ | -    | 11   | 16   | ns   |
| $t_r$      | Turn-on rise time          |                                                                                               | -    | 58   | 87   | ns   |
| $t_{doff}$ | Turn-off delay time        |                                                                                               | -    | 250  | 350  | ns   |
| $t_f$      | Turn-off fall time         |                                                                                               | -    | 106  | 148  | ns   |
| $L_d$      | Internal drain inductance  | Measured from drain lead 6 mm from package to centre of die                                   | -    | 4.5  | -    | nH   |
| $L_d$      | Internal drain inductance  | Measured from contact screw on tab to centre of die(TO220AB)                                  | -    | 3.5  | -    | nH   |
| $L_d$      | Internal drain inductance  | Measured from upper edge of drain tab to centre of die(SOT404)                                | -    | 2.5  | -    | nH   |
| $L_s$      | Internal source inductance | Measured from source lead to source bond pad                                                  | -    | 7.5  | -    | nH   |

### REVERSE DIODE LIMITING VALUES AND CHARACTERISTICS

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

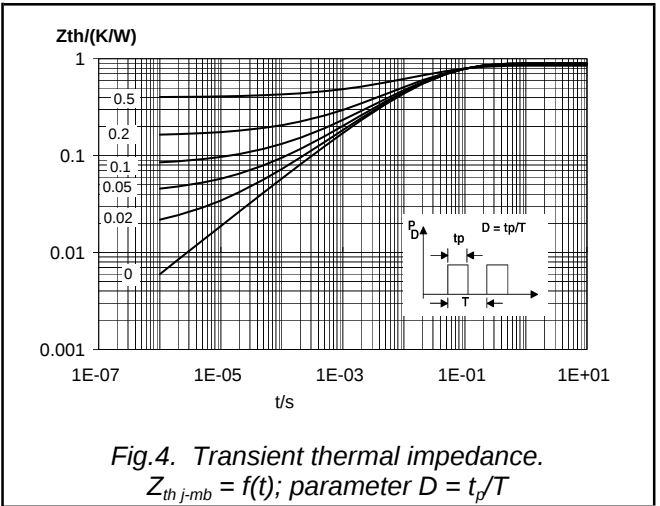
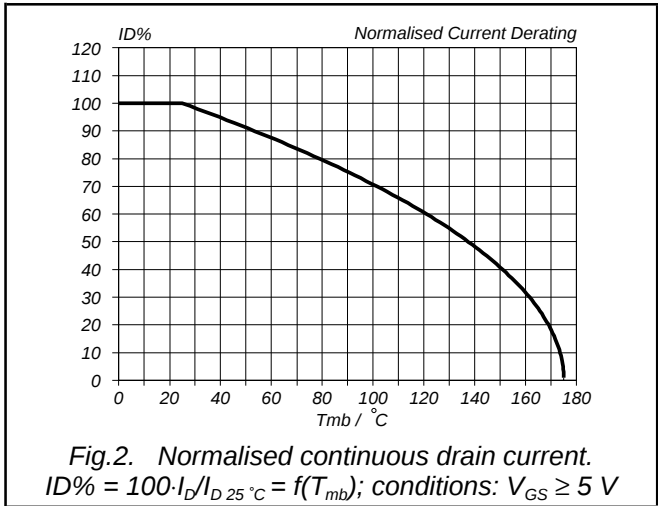
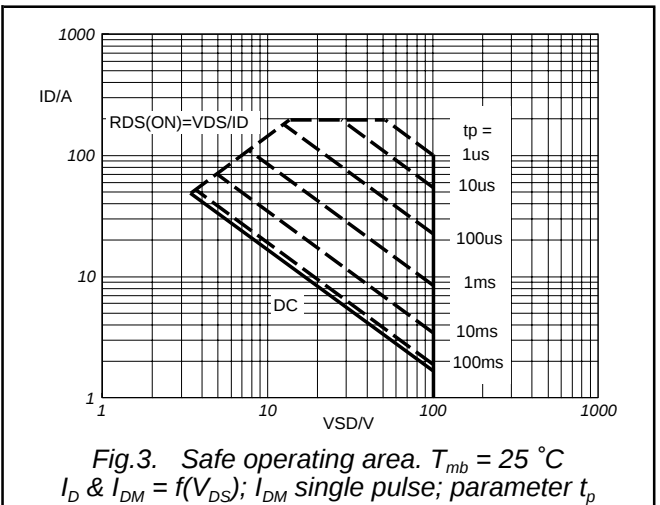
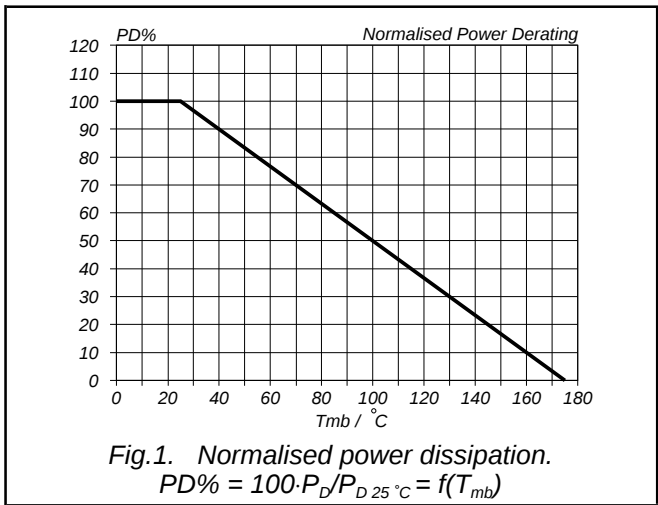
| SYMBOL    | PARAMETER                        | CONDITIONS                                                                                                     | MIN. | TYP. | MAX. | UNIT          |
|-----------|----------------------------------|----------------------------------------------------------------------------------------------------------------|------|------|------|---------------|
| $I_{DR}$  | Continuous reverse drain current |                                                                                                                | -    | -    | 49   | A             |
| $I_{DRM}$ | Pulsed reverse drain current     |                                                                                                                | -    | -    | 195  | A             |
| $V_{SD}$  | Diode forward voltage            | $I_F = 25\text{ A}$ ; $V_{GS} = 0\text{ V}$                                                                    | -    | 0.85 | 1.2  | V             |
|           |                                  | $I_F = 49\text{ A}$ ; $V_{GS} = 0\text{ V}$                                                                    | -    | 1.1  | -    | V             |
| $t_{rr}$  | Reverse recovery time            | $I_F = 49\text{ A}$ ; $-dI_F/dt = 100\text{ A}/\mu\text{s}$ ;<br>$V_{GS} = -10\text{ V}$ ; $V_R = 30\text{ V}$ | -    | 63   | -    | ns            |
| $Q_{rr}$  | Reverse recovery charge          |                                                                                                                | -    | 0.22 | -    | $\mu\text{C}$ |

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AVALANCHE LIMITING VALUE

| SYMBOL      | PARAMETER                                                       | CONDITIONS                                                                                                                               | MIN. | TYP. | MAX. | UNIT |
|-------------|-----------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|------|------|------|------|
| $W_{DSS}^1$ | Drain-source non-repetitive unclamped inductive turn-off energy | $I_D = 30\text{ A}$ ; $V_{DD} \leq 25\text{ V}$ ;<br>$V_{GS} = 5\text{ V}$ ; $R_{GS} = 50\ \Omega$ ; $T_{mb} = 25\text{ }^\circ\text{C}$ | -    | -    | 45   | mJ   |

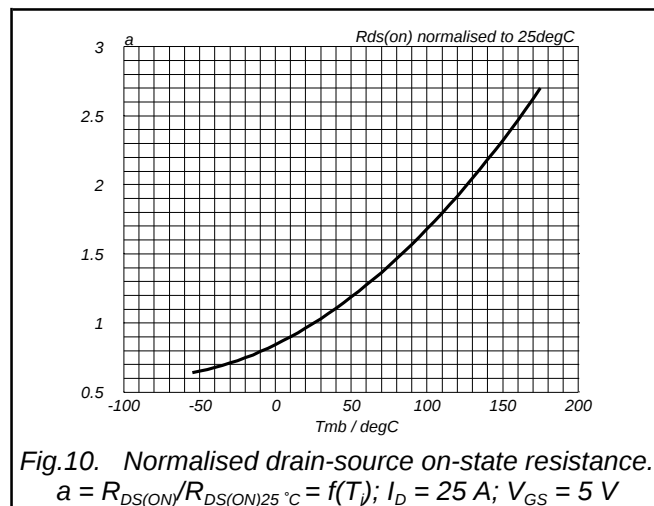
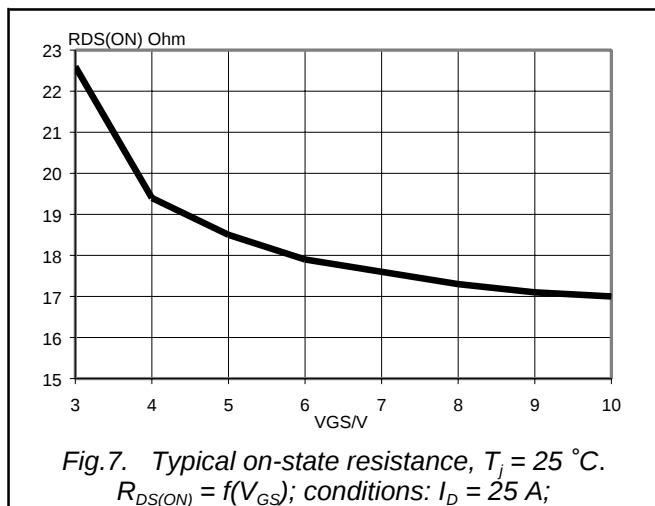
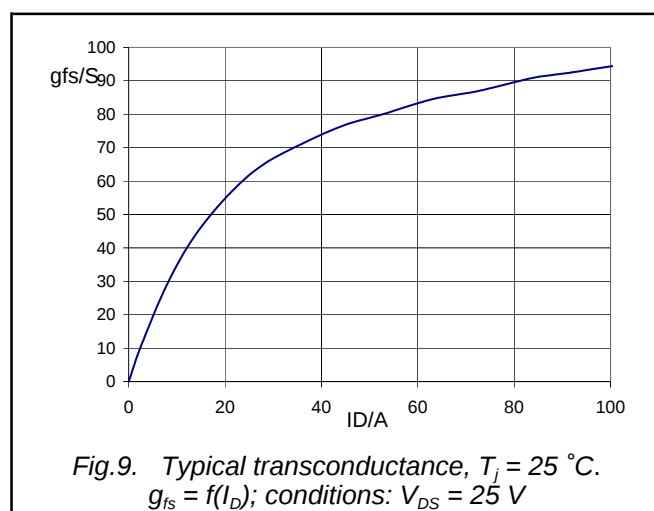
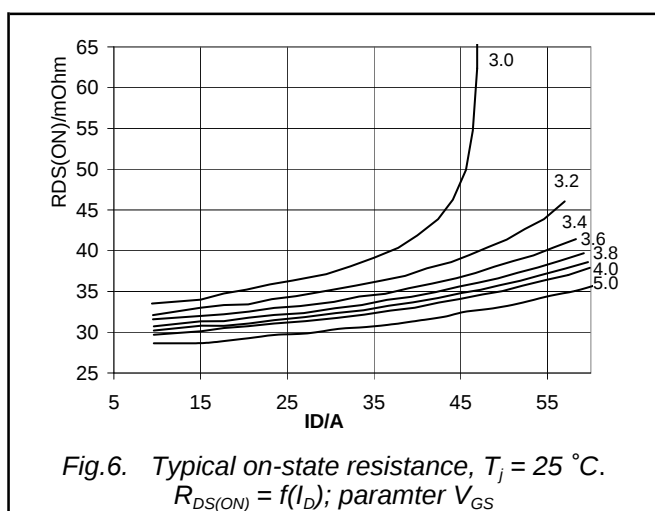
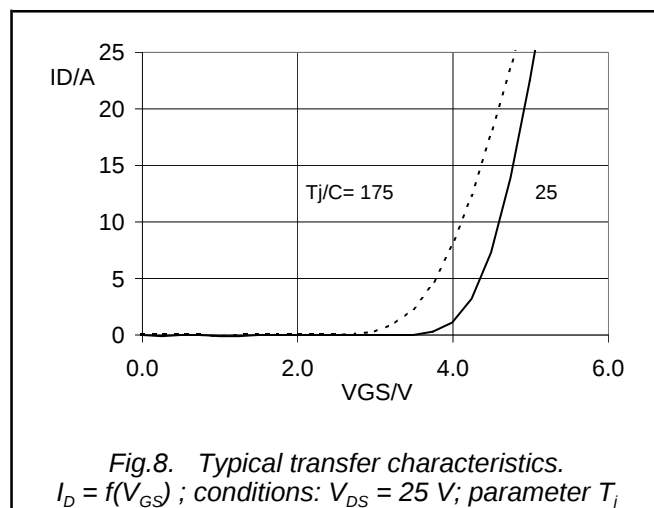
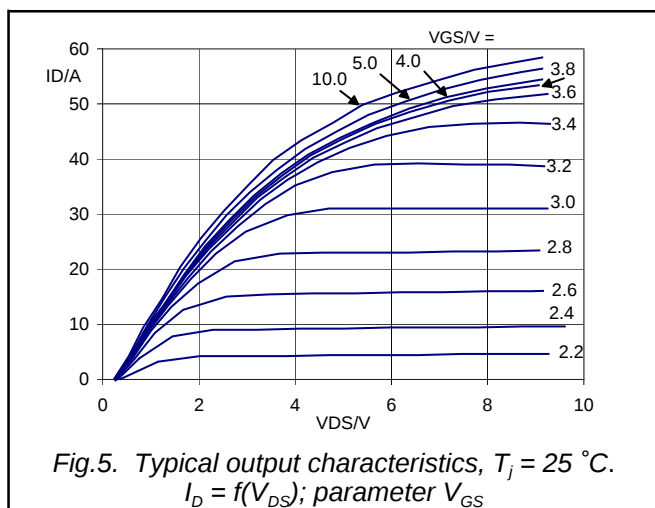


1 For maximum permissible repetitive avalanche current see fig.18.

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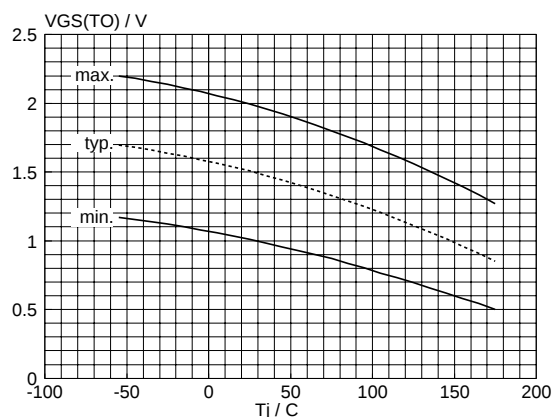


Fig.11. Gate threshold voltage.  
 $V_{GS(TO)} = f(T_J)$ ; conditions:  $I_D = 1 \text{ mA}$ ;  $V_{DS} = V_{GS}$

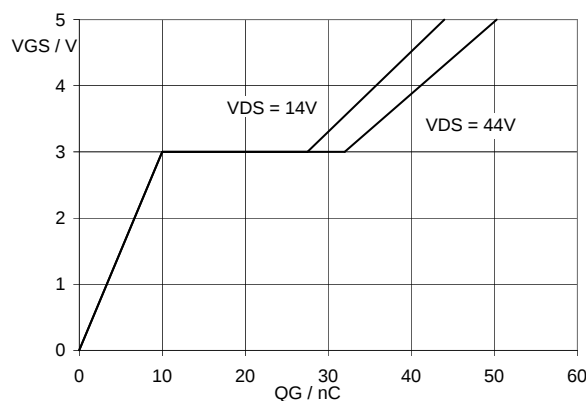


Fig.14. Typical turn-on gate-charge characteristics.  
 $V_{GS} = f(Q_G)$ ; conditions:  $I_D = 25 \text{ A}$ ; parameter  $V_{DS}$

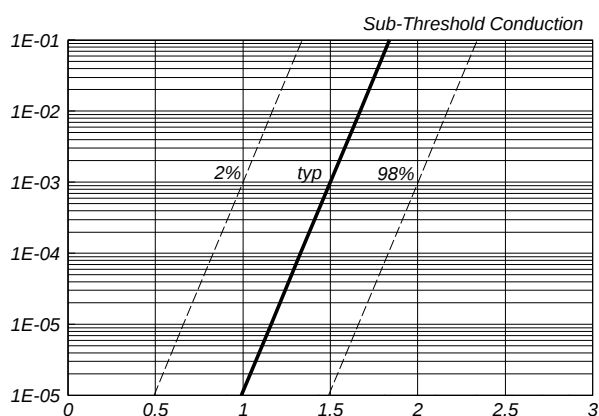


Fig.12. Sub-threshold drain current.  
 $I_D = f(V_{GS})$ ; conditions:  $T_J = 25^\circ\text{C}$ ;  $V_{DS} = V_{GS}$

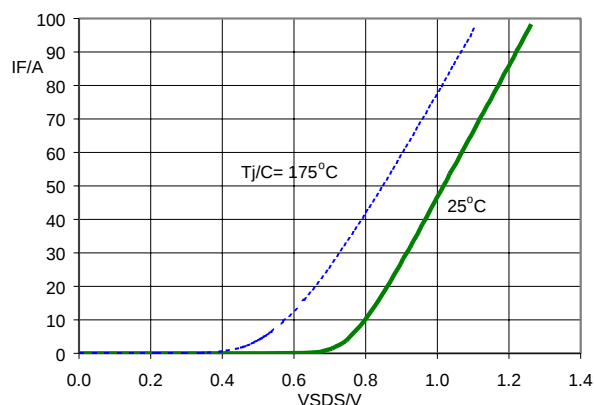


Fig.15. Typical reverse diode current.  
 $I_F = f(V_{SDS})$ ; conditions:  $V_{GS} = 0 \text{ V}$ ; parameter  $T_J$

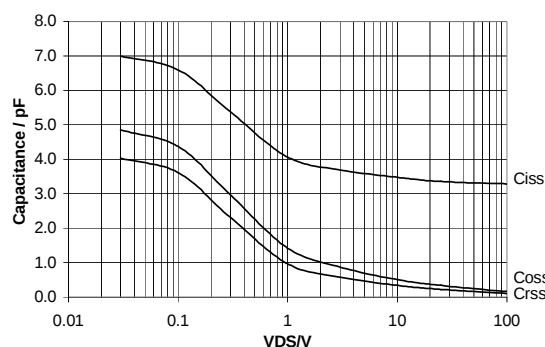


Fig.13. Typical capacitances,  $C_{iss}$ ,  $C_{oss}$ ,  $C_{rss}$ .  
 $C = f(V_{DS})$ ; conditions:  $V_{GS} = 0 \text{ V}$ ;  $f = 1 \text{ MHz}$

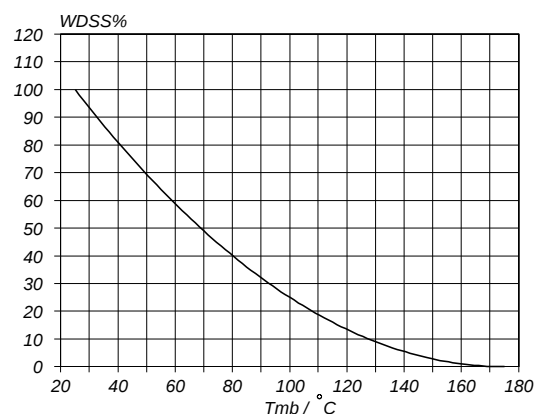
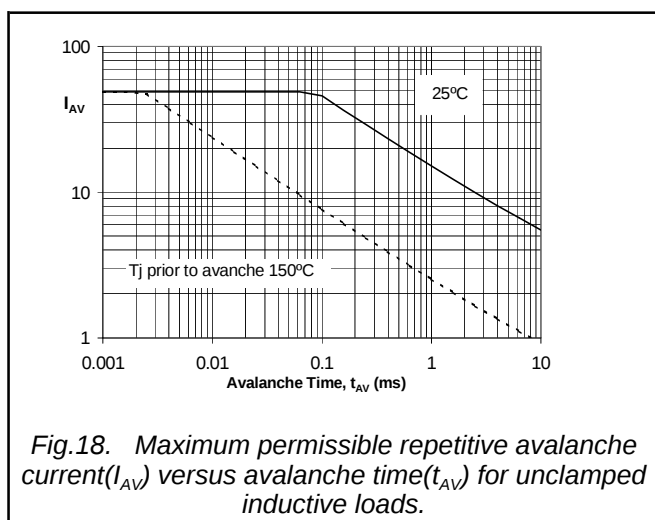
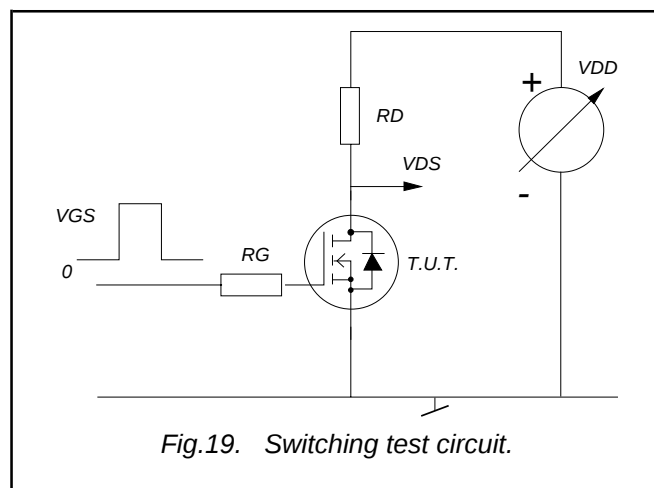
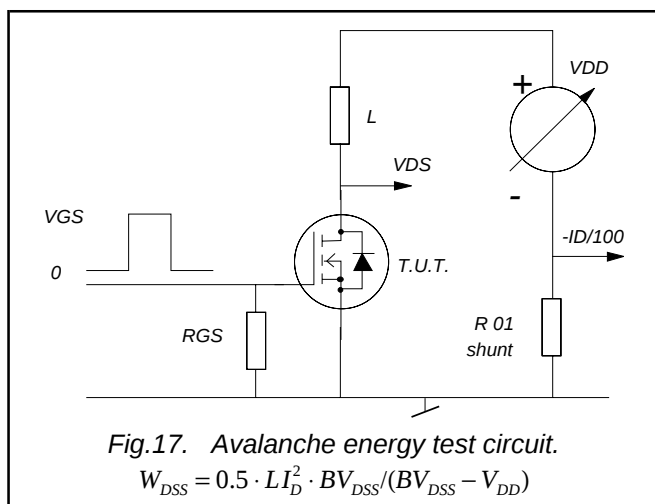


Fig.16. Normalised avalanche energy rating.  
 $W_{DSS}\% = f(T_{mb})$ ; conditions:  $I_D = 75 \text{ A}$

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## MECHANICAL DATA

Dimensions in mm

Net Mass: 2 g

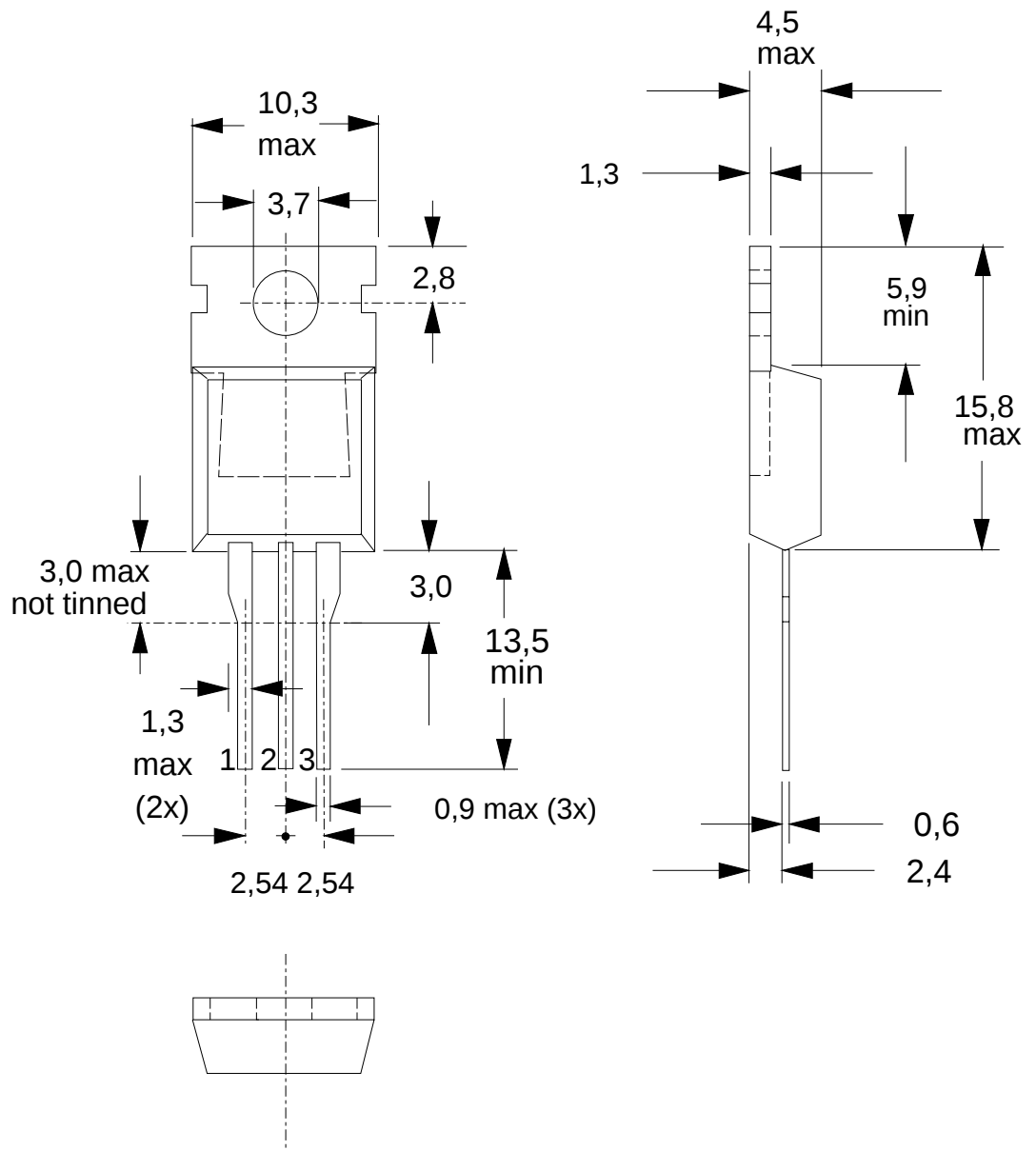


Fig.20. SOT78 (TO220AB); pin 2 connected to mounting base.

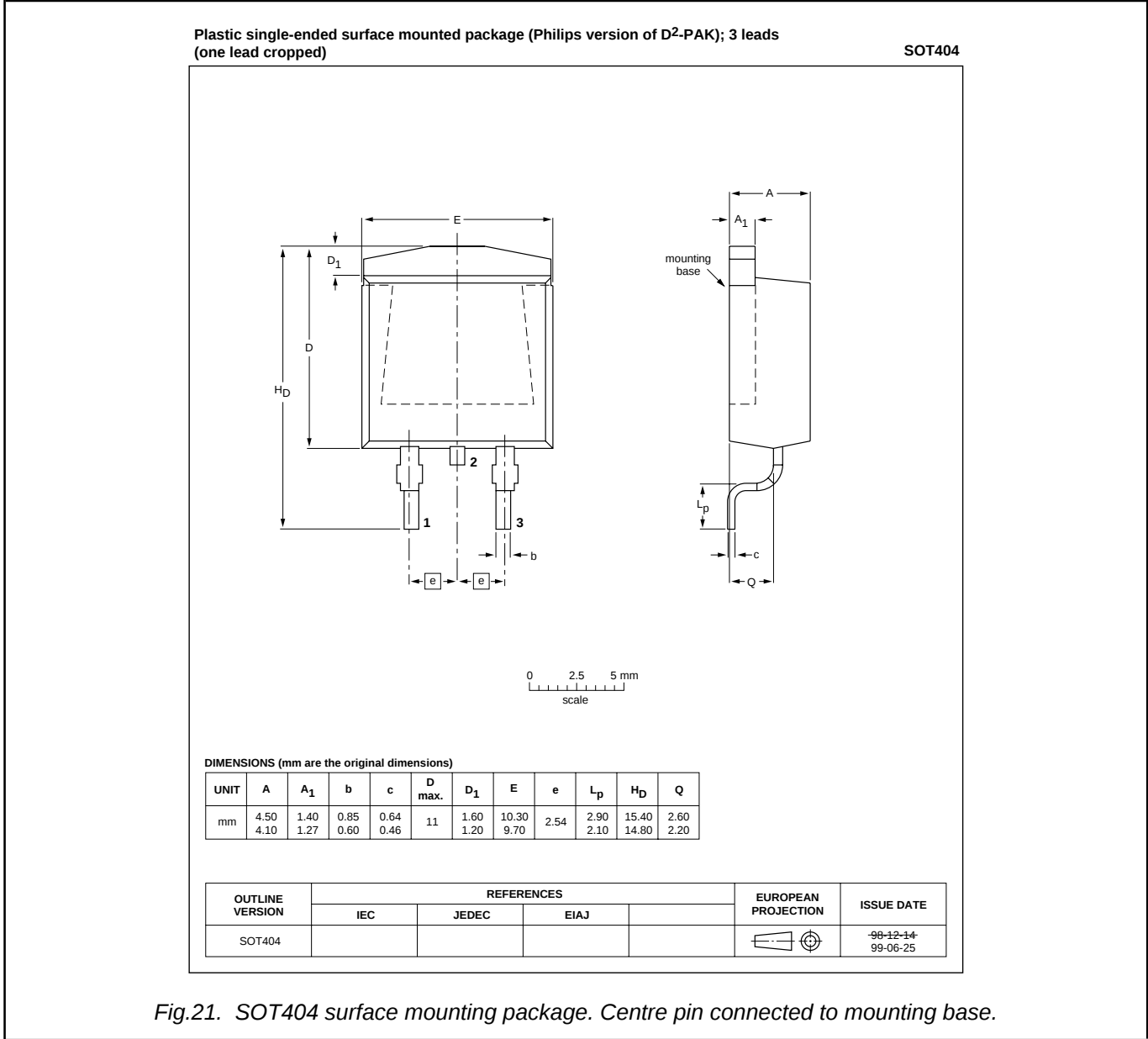
### Notes

1. Observe the general handling precautions for electrostatic-discharge sensitive devices (ESDs) to prevent damage to MOS gate oxide.
2. Refer to mounting instructions for SOT78 (TO220) envelopes.
3. Epoxy meets UL94 V0 at 1/8".

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MECHANICAL DATA



Notes

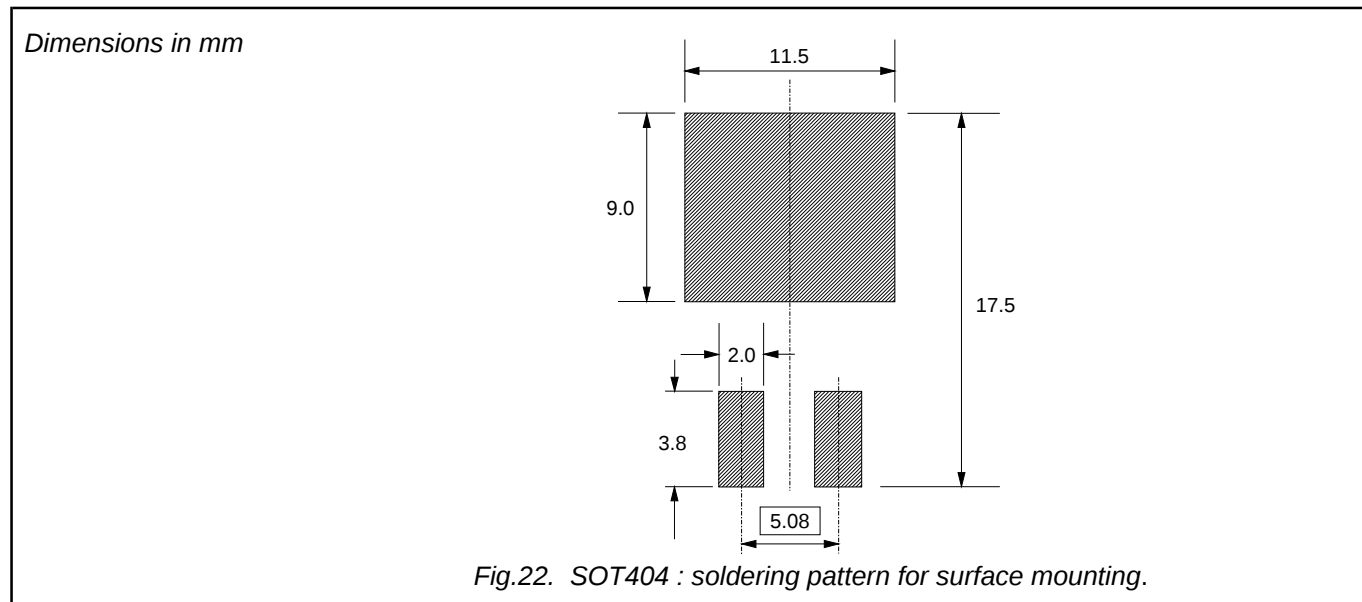
1. This product is supplied in anti-static packaging. The gate-source input must be protected against static discharge during transport or handling.
2. Refer to SMD Footprint Design and Soldering Guidelines, Data Handbook SC18.
3. Epoxy meets UL94 V0 at 1/8".

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### MOUNTING INSTRUCTIONS



### DEFINITIONS

| Data sheet status                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                       |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| Objective specification                                                                                                                                                                                                                                                                                                                                                                                                                                    | This data sheet contains target or goal specifications for product development.       |
| Preliminary specification                                                                                                                                                                                                                                                                                                                                                                                                                                  | This data sheet contains preliminary data; supplementary data may be published later. |
| Product specification                                                                                                                                                                                                                                                                                                                                                                                                                                      | This data sheet contains final product specifications.                                |
| Limiting values                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                       |
| 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. |                                                                                       |
| Application information                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                       |
| Where application information is given, it is advisory and does not form part of the specification.                                                                                                                                                                                                                                                                                                                                                        |                                                                                       |
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