

**PowerMOS transistor**  
**Voltage clamped logic level FET**  
**with temperature sensing diodes**

**BUK9120-48TC**

**GENERAL DESCRIPTION**

Protected N-channel enhancement mode logic level field-effect power transistor in a plastic envelope suitable for surface mounting. Using 'trench' technology the device features very low on-state resistance and has integral zener diodes giving ESD protection up to 2kV and active drain voltage clamping. Temperature sensitive diodes are incorporated for monitoring chip temperature. The device is intended for use in automotive and general purpose switching applications.

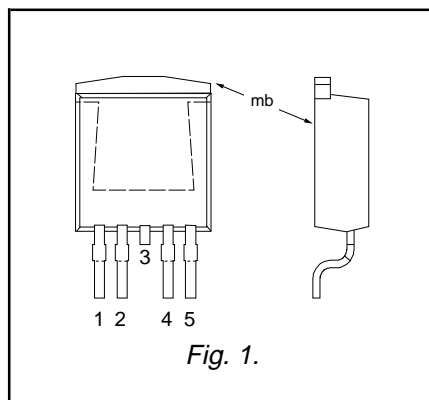
**QUICK REFERENCE DATA**

| SYMBOL        | PARAMETER  | MIN. | TYP. | MAX. | UNIT |
|---------------|--|------|------|------|------|
| $V_{(CL)DSR}$ | Drain-source clamp voltage                                 | 40   | 45   | 55   | V    |
| $I_D$         | Drain current (DC)   |      |      | 52   | A    |
| $P_{tot}$     | Total power dissipation                                    |      |      | 116  | W    |
| $T_j$         | Junction temperature                                       |      |      | 175  | °C   |
| $R_{DS(ON)}$  | Drain-source on-state resistance; $V_{GS} = 5\text{ V}$    |      |      | 20   | mΩ   |
| $V_F$         | Forward voltage, temperature sense diodes                  | 685  | 710  | 735  | mV   |
| $-S_F$        | Negative temperature coefficient, temperature sense diodes | 1.26 | 1.4  | 1.54 | mV/K |

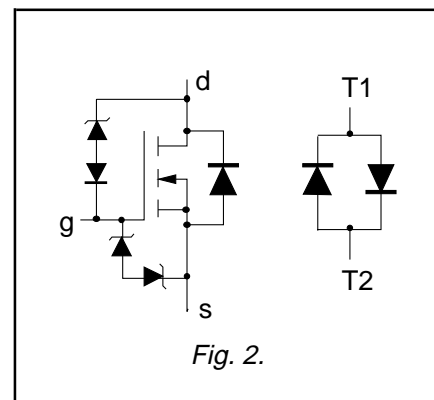
**PINNING - SOT426**

| PIN | DESCRIPTION       |
|-----|-------------------|
| 1   | gate              |
| 2   | T1                |
| 3   | (connected to mb) |
| 4   | T2                |
| 5   | source            |
| 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             | continuous                 | -    | 40        | V    |
| $V_{DG}$     | Drain-gate voltage               | continuous                 | -    | 38        | V    |
| $\pm V_{GS}$ | Gate-source voltage              | -                          | -    | 10        | V    |
| $I_D$        | Drain current (DC)               | $T_{mb} = 25\text{ °C}$    | -    | 52        | A    |
| $I_D$        | Drain current (DC)               | $T_{mb} = 100\text{ °C}$   | -    | 37        | A    |
| $I_D$        | Drain current (DC)               | $T_{mb} = 140\text{ °C}$   | -    | 25        | A    |
| $I_{DM}$     | Drain current (pulse peak value) | $T_{mb} = 25\text{ °C}$    | -    | 208       | A    |
| $P_{tot}$    | Total power dissipation          | $T_{mb} = 25\text{ °C}$    | -    | 116       | W    |
| $I_{GD}$     | Drain-gate clamp current         | 5ms pulse; $\Delta = 0.01$ | -    | 50        | mA   |
| $I_{GS}$     | Gate-source clamp current        | 5ms pulse; $\Delta = 0.01$ | -    | 50        | mA   |
| $V_{TS}$     | Source T1/T2 voltage             | -                          | -    | $\pm 100$ | V    |
| $T_{stg}$    | Storage temperature              | -                          | - 55 | 175       | °C   |
| $T_j$        | Junction temperature             | -                          | - 55 | 175       | °C   |

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## ESD LIMITING VALUE

| SYMBOL | PARAMETER                                   | CONDITIONS                              | MIN. | MAX. | UNIT |
|--------|---|---|------|------|------|
| $V_C$  | Electrostatic discharge voltage, pins 1,3,5 | Human body model (100pF,1.5K $\Omega$ ) | -    | 2    | kV   |

## THERMAL RESISTANCES

| SYMBOL         | PARAMETER                                    | CONDITIONS                   | MIN. | TYP. | MAX. | UNIT |
|----------------|--|------------------------------|------|------|------|------|
| $R_{th\ j-mb}$ | Thermal resistance junction to mounting base |                              | -    | -    | 1.29 | K/W  |
| $R_{th\ j-a}$  | Thermal resistance junction to ambient       | minimum footprint, FR4 board | -    | 50   | -    | K/W  |

## STATIC CHARACTERISTICS

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

| SYMBOL            | PARAMETER   | CONDITIONS   | MIN. | TYP.  | MAX. | UNIT       |
|-------------------|---|--|------|-------|------|------------|
| $V_{(BR)DG}$      | Drain-gate zener voltage  | 250 $\mu$ A; $-55\text{ }^\circ\text{C} \leq T_j \leq 175\text{ }^\circ\text{C}$         | 38   | 43    |      | V          |
| $V_{GS(TO)}$      | Gate threshold voltage  | $V_{DS} = V_{GS}$ ; $I_D = 1\text{ mA}$ ;<br>$T_j = 175\text{ }^\circ\text{C}$           | 1.0  | 1.5   | 2.0  | V          |
|                   |   | $T_j = -55\text{ }^\circ\text{C}$  | 0.5  | -     | -    | V          |
| $I_{DSS}$         | Zero gate voltage drain current   | $V_{DS} = +35\text{ V}$ ; $V_{GS} = 0\text{ V}$ ;<br>$T_j = 175\text{ }^\circ\text{C}$   | -    | 0.1   | 100  | $\mu$ A    |
|                   |   |  | -    | -     | 250  | $\mu$ A    |
| $I_{DSS}$         | Zero gate voltage drain current   | $V_{DS} = +15\text{ V}$ ; $V_{GS} = 0\text{ V}$ ;<br>$T_j = 175\text{ }^\circ\text{C}$   | -    | 0.004 | 2    | $\mu$ A    |
|                   |   |  | -    | -     | 250  | $\mu$ A    |
| $I_{GSS}$         | Gate source leakage current   | $V_{GS} = \pm 5\text{ V}$ ; $V_{DS} = 0\text{ V}$ ;<br>$T_j = 175\text{ }^\circ\text{C}$ | -    | 0.02  | 1    | $\mu$ A    |
|                   |   |  | -    | -     | 10   | $\mu$ A    |
| $\pm V_{(BR)GSS}$ | Gate source breakdown voltage   | $\pm 1\text{ mA}$ ;  | 10   | -     | -    | V          |
| $R_{DS(ON)}$      | Drain-source on-state resistance  | $V_{GS} = 5\text{ V}$ ; $I_D = 20\text{ A}$ ;<br>$T_j = 175\text{ }^\circ\text{C}$       | -    | 16    | 20   | m $\Omega$ |
|                   |   |  | -    | -     | 42   | m $\Omega$ |
| $V_F$             | Forward voltage, temperature sense diodes   | $I_F = 250\text{ }\mu\text{A}$ ;   | 685  | 710   | 735  | V          |
|                   |   |  |      |       |      | mV         |
| $-S_F$            | Negative temperature coefficient, temperature sense diodes from $25\text{ }^\circ\text{C}$ to $140\text{ }^\circ\text{C}$ | $I_F = 250\text{ }\mu\text{A}$   | 1.26 | 1.4   | 1.54 | mV/K       |
| $V_{HYS}$         | Forward voltage hysteresis; temperature sense diodes  | $I_F = 125\text{ }\mu\text{A}$ to $250\text{ }\mu\text{A}$                               | 25   |       | 50   | mV         |

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

| SYMBOL        | PARAMETER                               | CONDITIONS  | MIN. | TYP. | MAX. | UNIT          |
|---------------|---|---|------|------|------|---------------|
| $V_{(CL)DSR}$ | Drain source clamp voltage (peak value) | $R_G = 10\text{ k}\Omega$ ; $I_D = 10\text{ A}$ ;<br>$-55 \leq T_j \leq 175\text{ }^\circ\text{C}$    | 40   | 45   | 55   | V             |
| $g_{fs}$      | Forward transconductance                | $V_{DS} = 25\text{ V}$ ; $I_D = 10\text{ A}$  | 20   | 53   | -    | S             |
| $C_{iss}$     | Input capacitance                       | $V_{GS} = 0\text{ V}$ ; $V_{DS} = 25\text{ V}$ ; $f = 1\text{ MHz}$                                   | -    | 2200 | 2900 | pF            |
| $C_{oss}$     | Output capacitance                      |   | -    | 400  | 500  | pF            |
| $C_{rss}$     | Feedback capacitance                    |   | -    | 215  | 300  | pF            |
| $t_{don}$     | Turn-on delay time                      | $V_{DD} = 30\text{ V}$ ; $I_D = 25\text{ A}$ ;<br>$V_{GS} = 5\text{ V}$ ; $R_G = 10\text{ k}\Omega$ ; | -    | 12   | 18   | $\mu\text{s}$ |
| $t_r$         | Turn-on rise time                       |   | -    | 55   | 80   | $\mu\text{s}$ |
| $t_{doff}$    | Turn-off delay time                     |   | -    | 60   | 85   | $\mu\text{s}$ |
| $t_f$         | Turn-off fall time                      |   | -    | 45   | 60   | $\mu\text{s}$ |
| $L_d$         | Internal drain inductance               | Measured from upper edge of drain tab to centre of die  | -    | 2.5  | -    | nH            |
| $L_s$         | Internal source inductance              | Measured from source lead soldering point to source bond pad  | -    | 7.5  | -    | nH            |

**REVERSE DIODE LIMITING VALUES AND CHARACTERISTICS** $T_j = 25\text{ }^\circ\text{C}$  unless otherwise specified

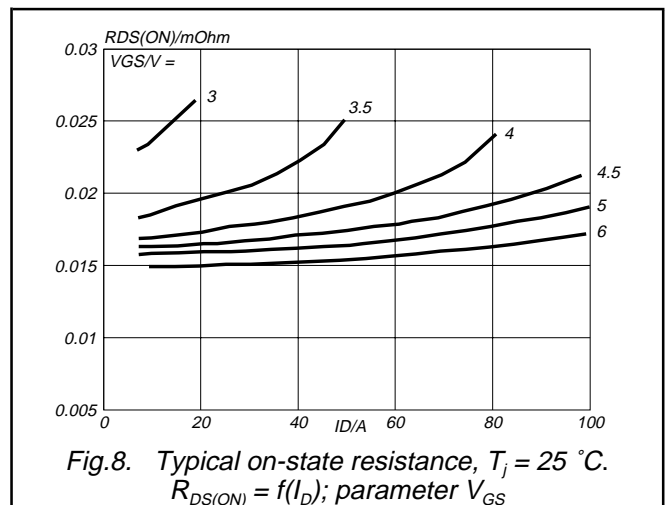
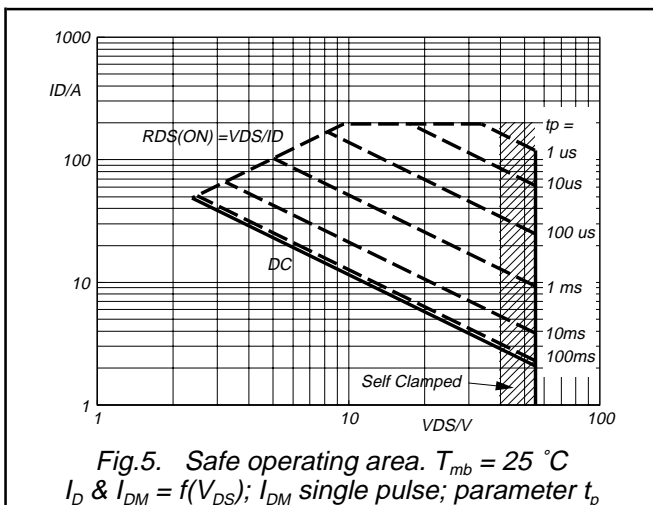
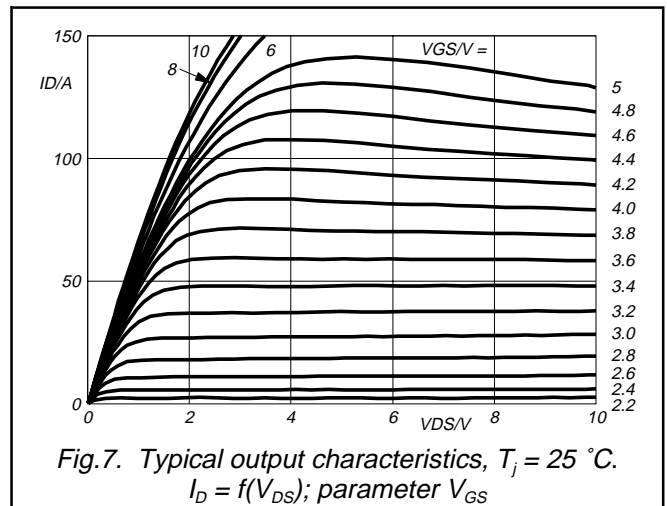
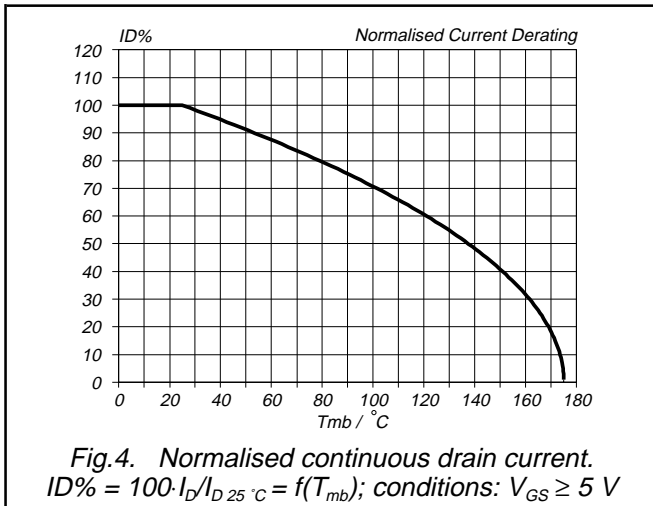
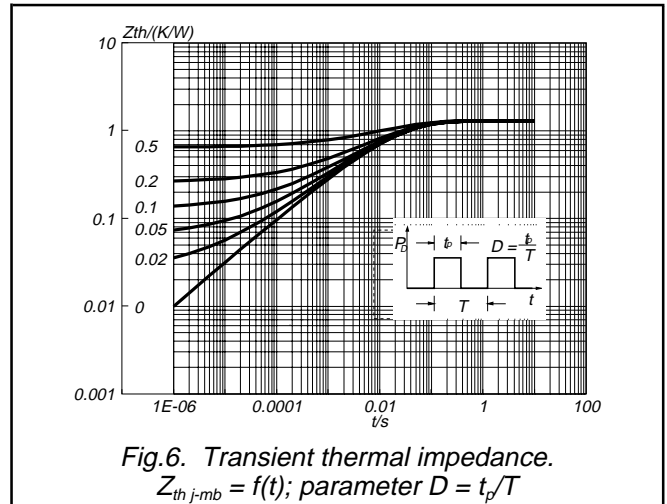
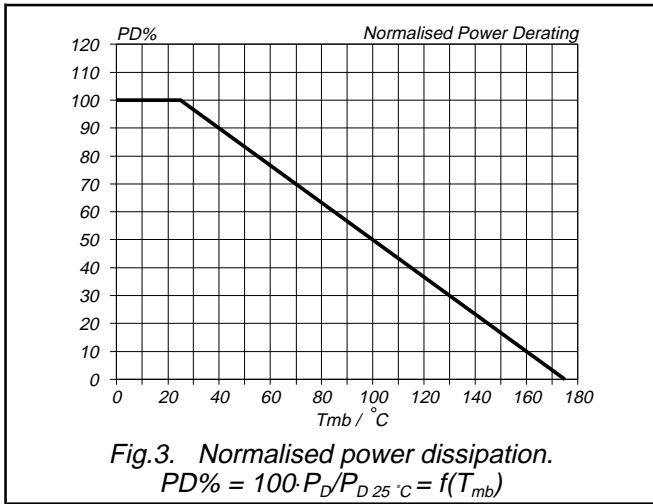
| SYMBOL    | PARAMETER                        | CONDITIONS                                  | MIN. | TYP. | MAX. | UNIT |
|-----------|----------------------------------|---|------|------|------|------|
| $I_{DR}$  | Continuous reverse drain current | -   | -    | -    | 52   | A    |
| $I_{DRM}$ | Pulsed reverse drain current     | -   | -    | -    | 208  | A    |
| $V_{SD}$  | Diode forward voltage            | $I_F = 20\text{ A}$ ; $V_{GS} = 0\text{ V}$ | -    | 0.95 | 1.2  | V    |
|           |                                  | $I_F = 40\text{ A}$ ; $V_{GS} = 0\text{ V}$ | -    | 1    | -    | V    |

**CLAMPED ENERGY LIMITING VALUE**

| SYMBOL     | PARAMETER   | CONDITIONS   | MIN. | MAX. | UNIT |
|------------|---|--|------|------|------|
| $W_{DSRS}$ | Non-repetitive drain-source clamped inductive turn off energy | $T_j = 25\text{ }^\circ\text{C}$ prior to clamping;<br>$I_D = 20\text{ A}$ ; $V_{DD} \leq 16\text{ V}$ ; $V_{GS} = 5\text{ V}$ ;<br>$R_G = 10\text{ k}\Omega$ ; inductive load | -    | 450  | mJ   |

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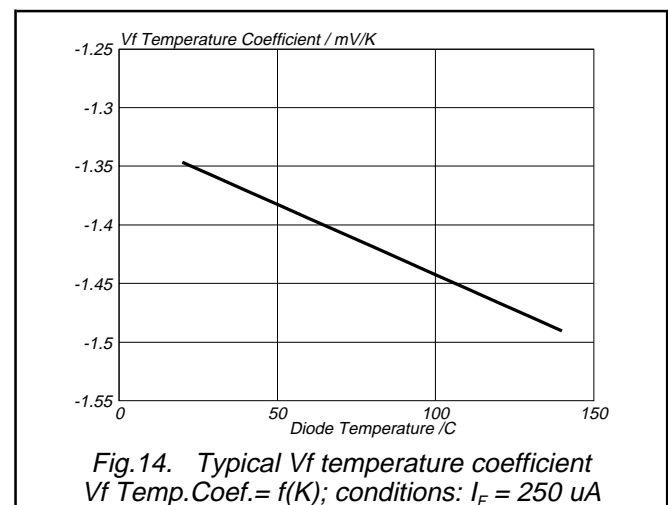
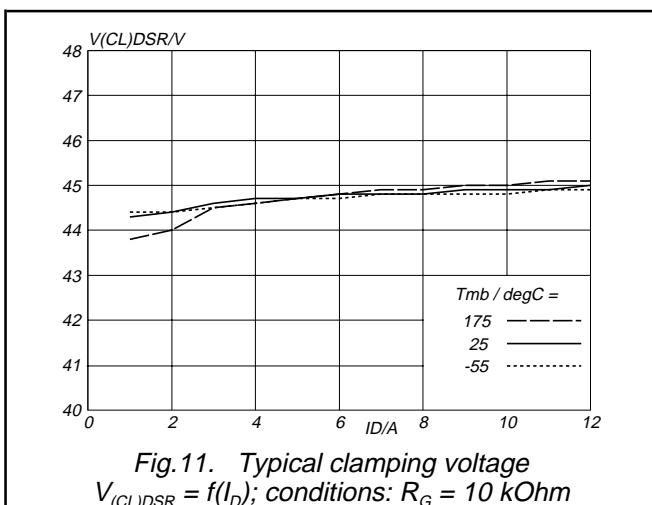
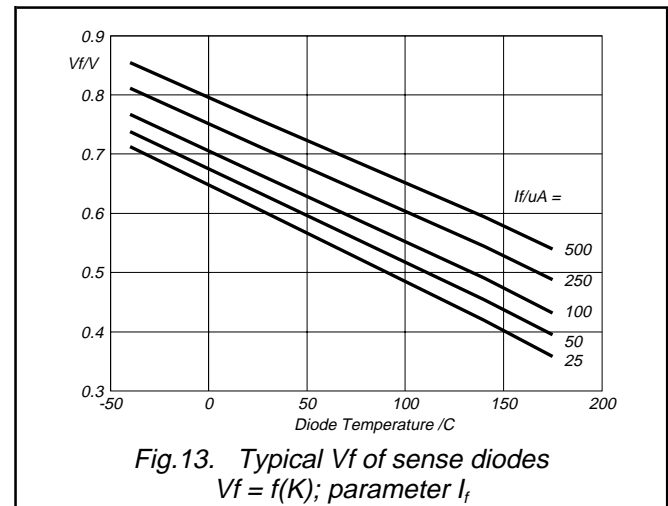
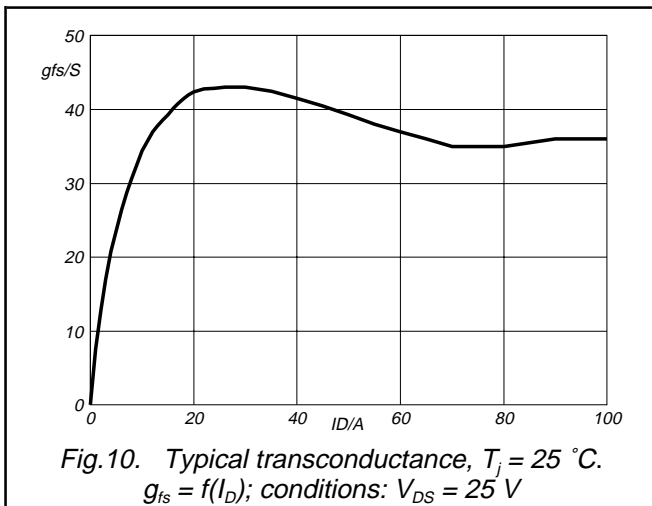
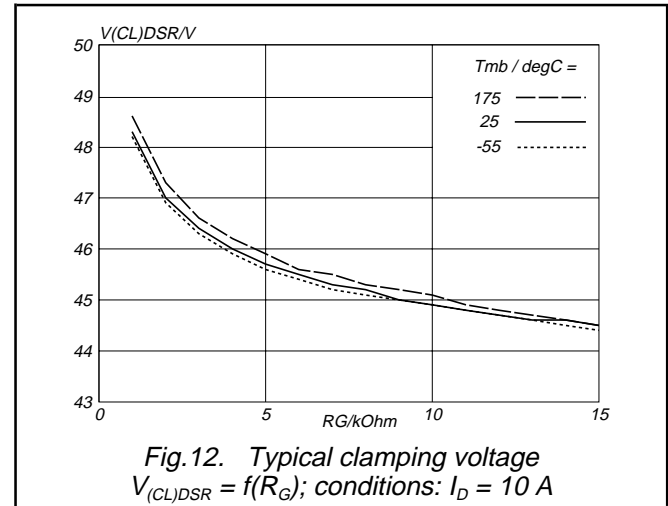
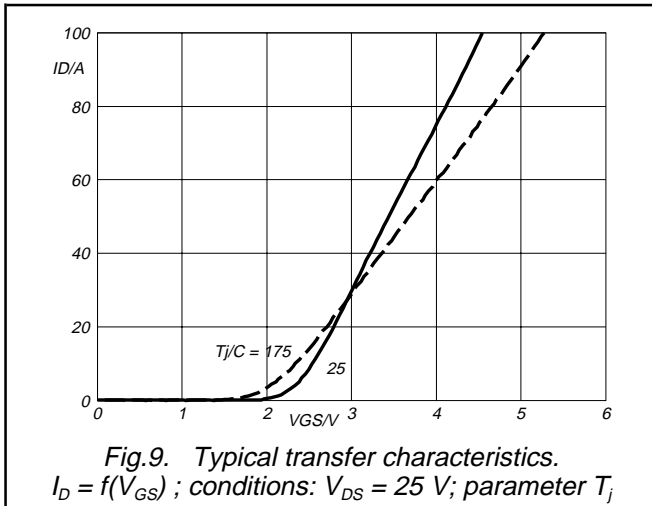
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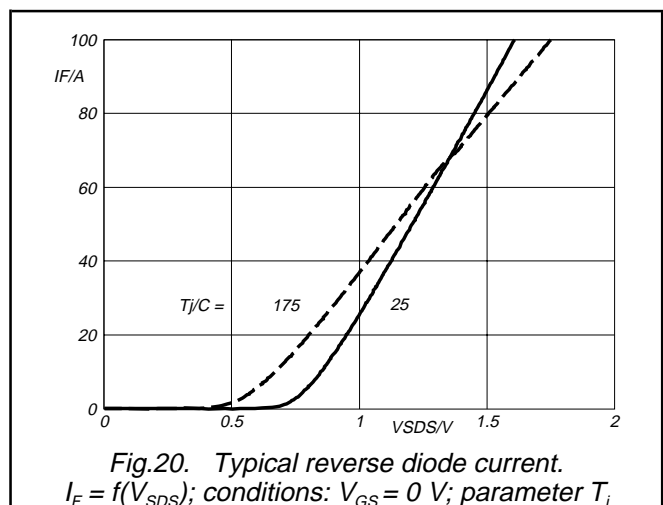
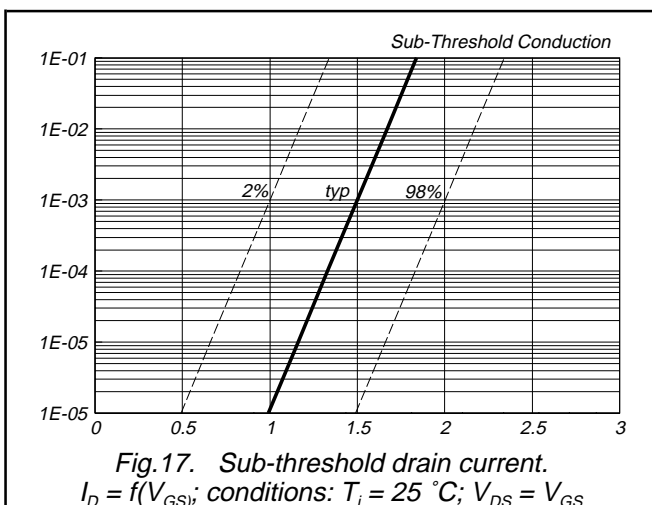
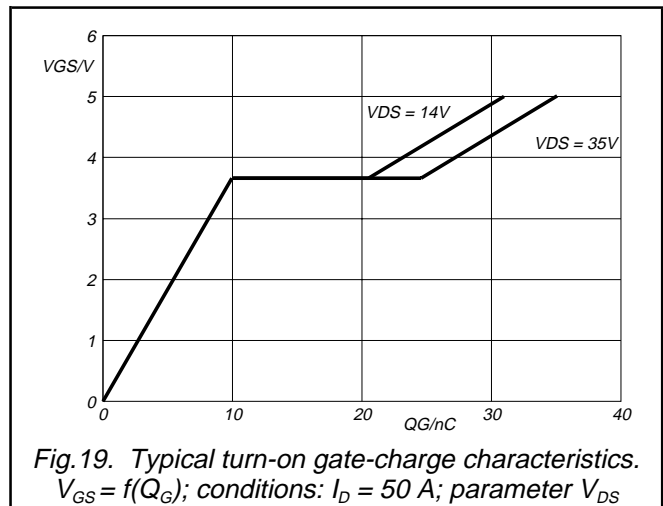
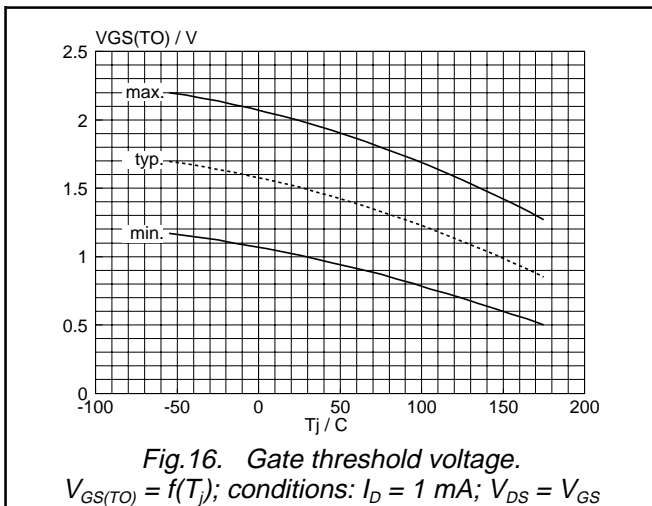
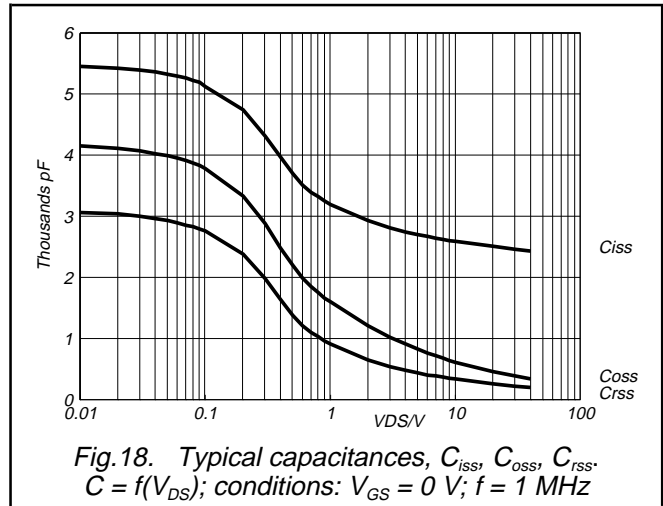
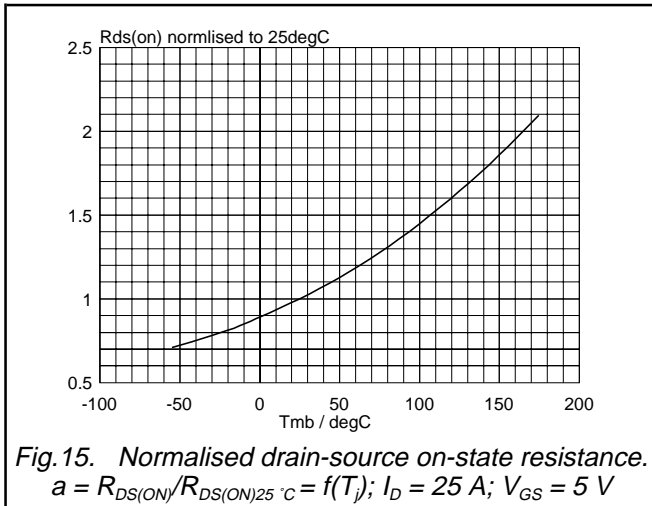
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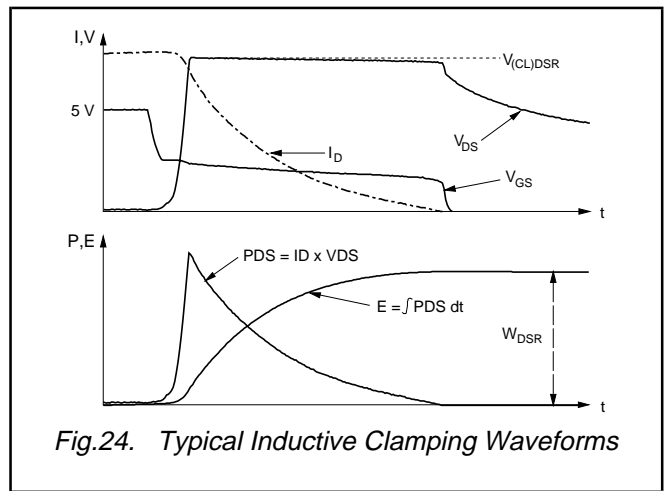
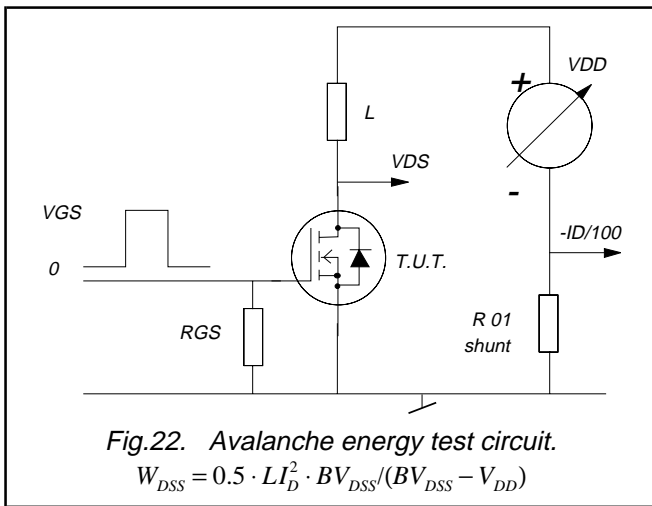
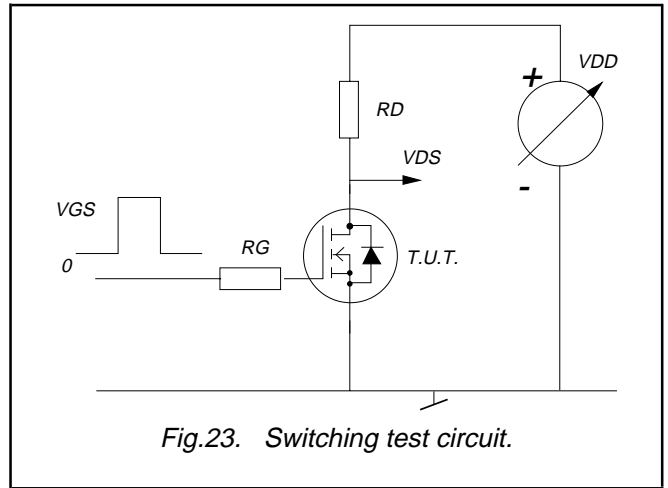
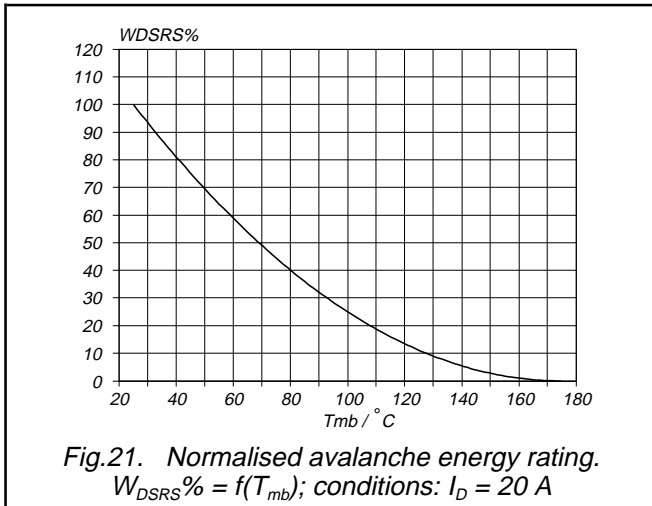
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PowerMOS transistor

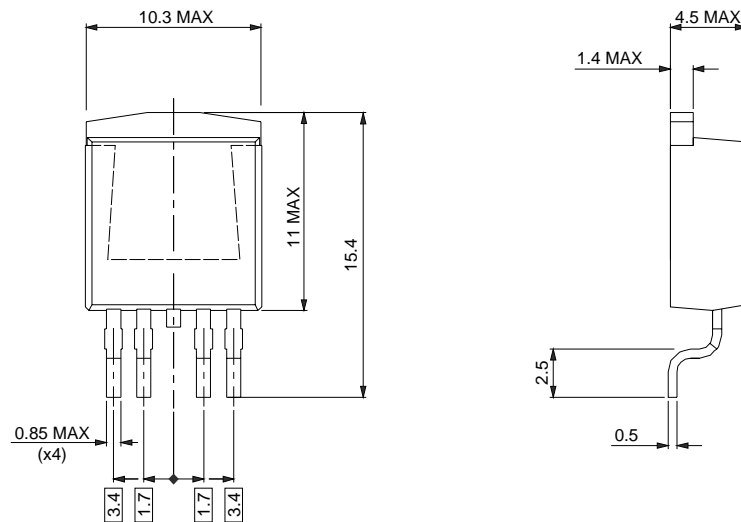
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**MECHANICAL DATA**

*Dimensions in mm*

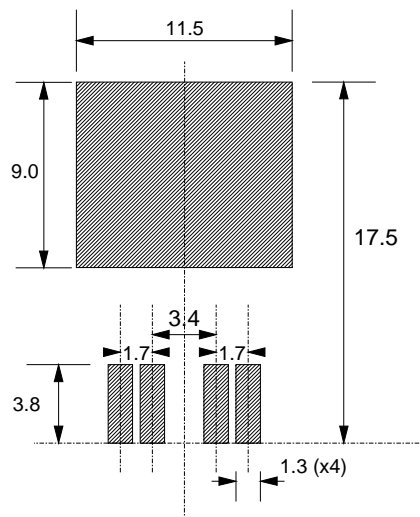
*Net Mass: 1.4 g*



*Fig.25. SOT426 : centre pin connected to mounting base.*

**MOUNTING INSTRUCTIONS**

*Dimensions in mm*



*Fig.26. SOT426 : soldering pattern for surface mounting.*

**Notes**

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



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**BUK9120-48TC****DEFINITIONS**

|  |   |
|--|---|
| <b>Data sheet status</b>   |   |
| 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.                                |
| <b>Limiting values</b>   |   |
| 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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