## PowerMOS transistor

## BUK453-100A/B

### GENERAL DESCRIPTION

N-channel enhancement mode field-effect power transistor in a plastic envelope.
The device is intended for use in Switched Mode Power Supplies (SMPS), motor control, welding, DC/DC and AC/DC converters, and in general purpose switching applications.

### QUICK REFERENCE DATA

| SYMBOL | PARAMETER | MAX. | MAX. | UNIT |
|---|---|---|---|---|
| | **BUK453** | **-100A** | **-100B** | |
| $V_{DS}$ | Drain-source voltage | 100 | 100 | V |
| $I_D$ | Drain current (DC) | 14 | 13 | A |
| $P_{tot}$ | Total power dissipation | 75 | 75 | W |
| $T_j$ | Junction temperature | 175 | 175 | °C |
| $R_{DS(ON)}$ | Drain-source on-state resistance | 0.16 | 0.20 | Ω |

### PINNING - TO220AB

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

### PIN CONFIGURATION
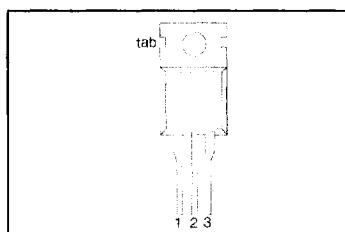


### SYMBOL
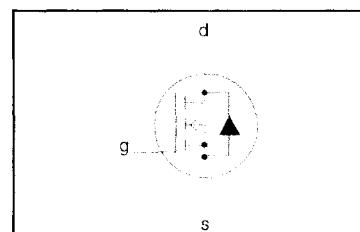


### LIMITING VALUES

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 | $R_{GS} = 20$ k$\Omega$ | - | 100 | | V |
| $\pm V_{GS}$ | Gate-source voltage | - | - | 30 | | V |
| | | | | **-100A** | **-100B** | |
| $I_D$ | Drain current (DC) | $T_{mb} = 25$ °C | - | 14 | 13 | A |
| $I_D$ | Drain current (DC) | $T_{mb} = 100$ °C | - | 10 | 9 | A |
| $I_{DM}$ | Drain current (pulse peak value) | $T_{mb} = 25$ °C | - | 56 | 52 | A |
| $P_{tot}$ | Total power dissipation | $T_{mb} = 25$ °C | - | 75 | | W |
| $T_{stg}$ | Storage temperature | - | - 55 | 175 | | °C |
| $T_j$ | Junction Temperature | - | - | 175 | | °C |

### THERMAL RESISTANCES

| SYMBOL | PARAMETER | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| $R_{th\,j-mb}$ | Thermal resistance junction to mounting base | | - | - | 2 | K/W |
| $R_{th\,j-a}$ | Thermal resistance junction to ambient | | - | 60 | - | K/W |

## STATIC CHARACTERISTICS

$T_{mb}$ = 25 °C unless otherwise specified

| SYMBOL | PARAMETER | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| $V_{(BR)DSS}$ | Drain-source breakdown voltage | $V_{GS}$ = 0 V; $I_D$ = 0.25 mA | 100 | - | - | V |
| $V_{GS(TO)}$ | Gate threshold voltage | $V_{DS}$ = $V_{GS}$; $I_D$ = 1 mA | 2.1 | 3.0 | 4.0 | V |
| $I_{DSS}$ | Zero gate voltage drain current | $V_{DS}$ = 100 V; $V_{GS}$ = 0 V; $T_j$ = 25 °C | - | 1 | 10 | µA |
| $I_{DSS}$ | Zero gate voltage drain current | $V_{DS}$ = 100 V; $V_{GS}$ = 0 V; $T_j$ = 125 °C | - | 0.1 | 1.0 | mA |
| $I_{GSS}$ | Gate source leakage current | $V_{GS}$ = ±30 V; $V_{DS}$ = 0 V | - | 10 | 100 | nA |
| $R_{DS(ON)}$ | Drain-source on-state resistance | $V_{GS}$ = 10 V;　　BUK453-100A | - | 0.15 | 0.16 | Ω |
| | | $I_D$ = 5 A　　　　BUK453-100B | - | 0.15 | 0.20 | Ω |

## DYNAMIC CHARACTERISTICS

$T_{mb}$ = 25 °C unless otherwise specified

| SYMBOL | PARAMETER | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| $g_{fs}$ | Forward transconductance | $V_{DS}$ = 25 V; $I_D$ = 5 A | 4.0 | 5.5 | - | S |
| $C_{iss}$ | Input capacitance | $V_{GS}$ = 0 V; $V_{DS}$ = 25 V; f = 1 MHz | - | 660 | 825 | pF |
| $C_{oss}$ | Output capacitance | | - | 140 | 200 | pF |
| $C_{rss}$ | Feedback capacitance | | - | 60 | 100 | pF |
| $t_{d on}$ | Turn-on delay time | $V_{DD}$ = 30 V; $I_D$ = 3 A; | - | 10 | 20 | ns |
| $t_r$ | Turn-on rise time | $V_{GS}$ = 10 V; $R_{GS}$ = 50 Ω; | - | 25 | 40 | ns |
| $t_{d off}$ | Turn-off delay time | $R_{gen}$ = 50 Ω | - | 60 | 90 | ns |
| $t_f$ | Turn-off fall time | | - | 40 | 55 | ns |
| $L_d$ | Internal drain inductance | Measured from contact screw on tab to centre of die | - | 3.5 | - | nH |
| $L_d$ | Internal drain inductance | Measured from drain lead 6 mm from package to centre of die | - | 4.5 | - | nH |
| $L_s$ | Internal source inductance | Measured from source lead 6 mm from package to source bond pad | - | 7.5 | - | nH |

## REVERSE DIODE LIMITING VALUES AND CHARACTERISTICS

$T_{mb}$ = 25 °C unless otherwise specified

| SYMBOL | PARAMETER | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| $I_{DR}$ | Continuous reverse drain current | - | - | - | 14 | A |
| $I_{DRM}$ | Pulsed reverse drain current | - | - | - | 56 | A |
| $V_{SD}$ | Diode forward voltage | $I_F$ = 14 A ; $V_{GS}$ = 0 V | - | 1.2 | 1.5 | V |
| $t_{rr}$ | Reverse recovery time | $I_F$ = 14 A; -d$I_F$/dt = 100 A/µs; | - | 90 | - | ns |
| $Q_{rr}$ | Reverse recovery charge | $V_{GS}$ = 0 V; $V_R$ = 30 V | - | 0.6 | - | µC |

## AVALANCHE LIMITING VALUE

$T_{mb}$ = 25 °C unless otherwise specified

| SYMBOL | PARAMETER | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| $W_{DSS}$ | Drain-source non-repetitive unclamped inductive turn-off energy | $I_D$ = 14 A ; $V_{DD}$ ≤ 50 V ; $V_{GS}$ = 10 V ; $R_{GS}$ = 50 Ω | - | - | 70 | mJ |
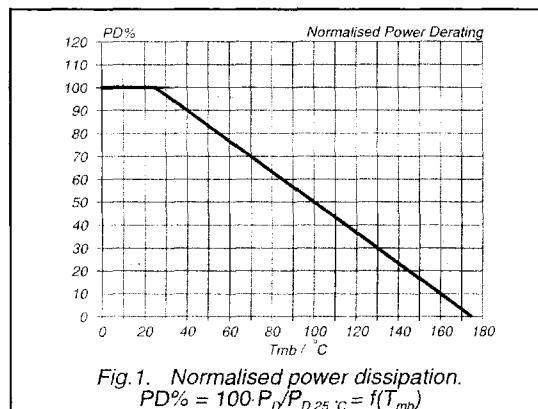
Fig. 1.   Normalised power dissipation.
$PD\% = 100 \cdot P_D/P_{D\,25\,°C} = f(T_{mb})$
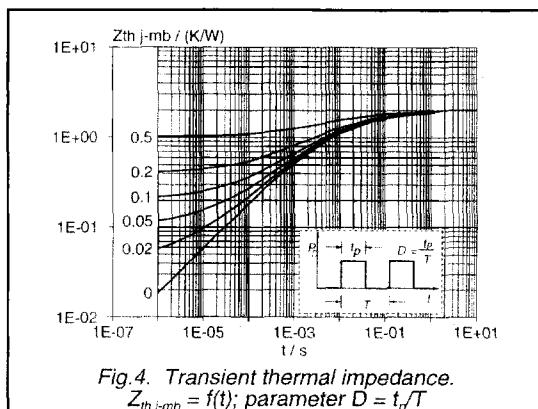


Fig. 4.   Transient thermal impedance.
$Z_{th\,j\text{-}mb} = f(t)$; parameter $D = t_p/T$
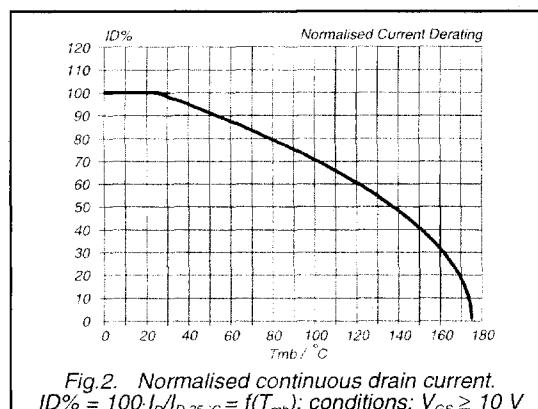


Fig. 2.   Normalised continuous drain current.
$ID\% = 100 \cdot I_D/I_{D\,25\,°C} = f(T_{mb})$; conditions: $V_{GS} \geq 10\ V$
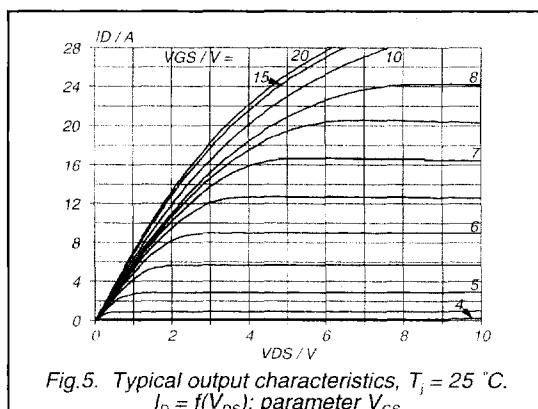


Fig. 5.   Typical output characteristics, $T_j = 25\ °C$.
$I_D = f(V_{DS})$; parameter $V_{GS}$
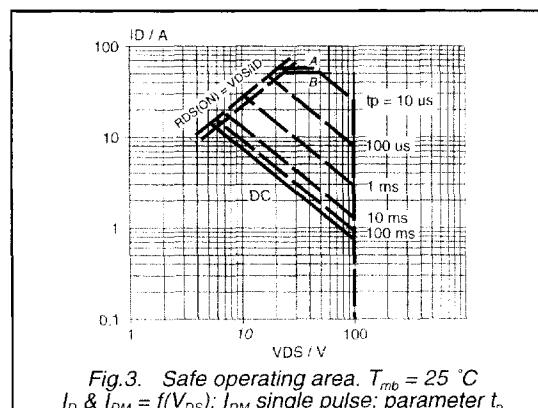


Fig. 3.   Safe operating area. $T_{mb} = 25\ °C$
$I_D$ & $I_{DM} = f(V_{DS})$; $I_{DM}$ single pulse; parameter $t_p$
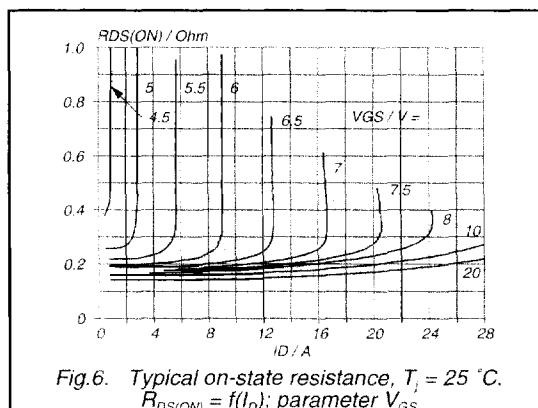


Fig. 6.   Typical on-state resistance, $T_j = 25\ °C$.
$R_{DS(ON)} = f(I_D)$; parameter $V_{GS}$

Fig.7. Typical transfer characteristics.
$I_D = f(V_{GS})$ ; conditions: $V_{DS} = 25$ V; parameter $T_j$

Fig.10. Gate threshold voltage.
$V_{GS(TO)} = f(T_j)$; conditions: $I_D = 1$ mA; $V_{DS} = V_{GS}$

Fig.8. Typical transconductance, $T_j = 25$ °C.
$g_{fs} = f(I_D)$; conditions: $V_{DS} = 25$ V

Fig.11. Sub-threshold drain current.
$I_D = f(V_{GS})$; conditions: $T_j = 25$ °C; $V_{DS} = V_{GS}$

Fig.9. Normalised drain-source on-state resistance.
$a = R_{DS(ON)}/R_{DS(ON)25 °C} = f(T_j)$; $I_D = 5$ A; $V_{GS} = 10$ V

Fig.12. Typical capacitances, $C_{iss}$, $C_{oss}$, $C_{rss}$.
$C = f(V_{DS})$; conditions: $V_{GS} = 0$ V; $f = 1$ MHz
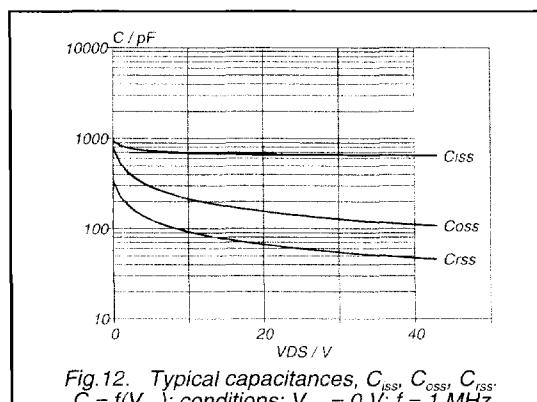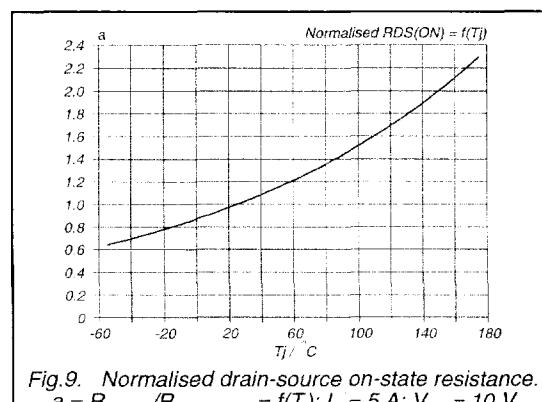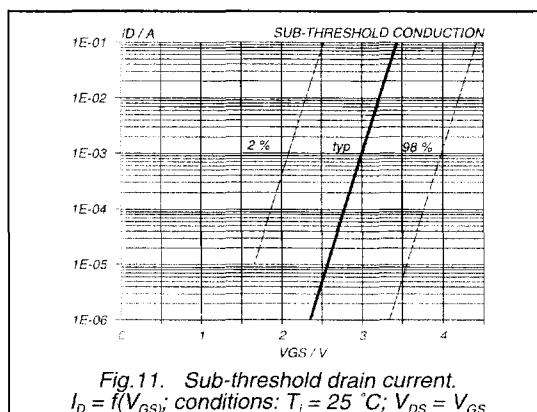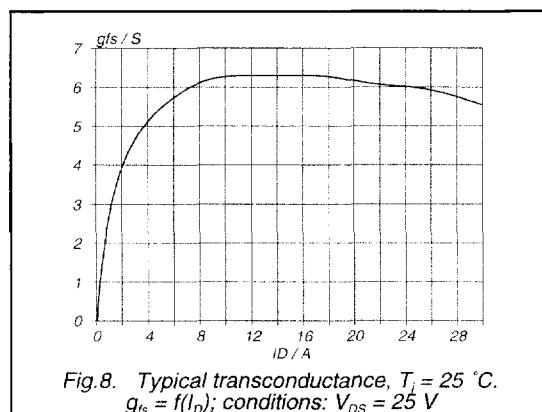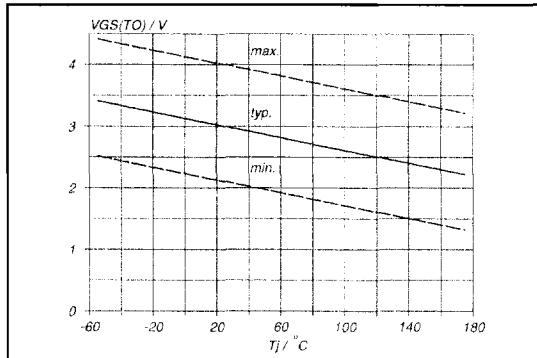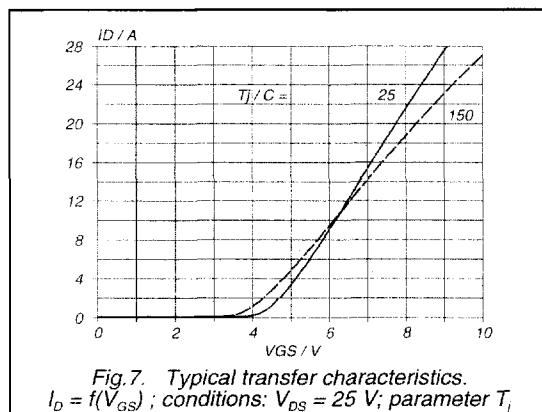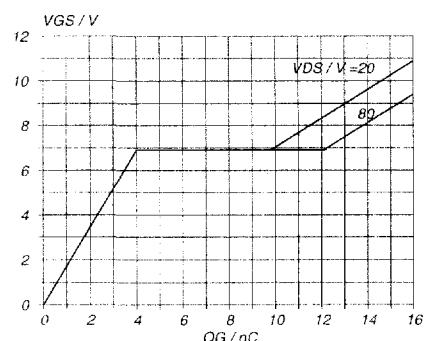
Fig.13. Typical turn-on gate-charge characteristics.
$V_{GS} = f(Q_G)$; conditions: $I_D = 14$ A; parameter $V_{DS}$
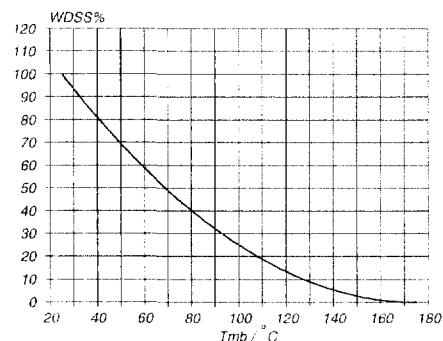


Fig.15. Normalised avalanche energy rating.
$W_{DSS}\% = f(T_{mb})$; conditions: $I_D = 14$ A
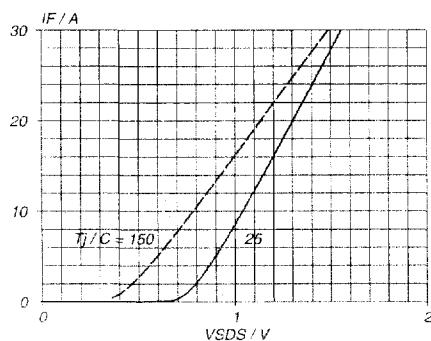


Fig.14. Typical reverse diode current.
$I_F = f(V_{SDS})$; conditions: $V_{GS} = 0$ V; parameter $T_j$
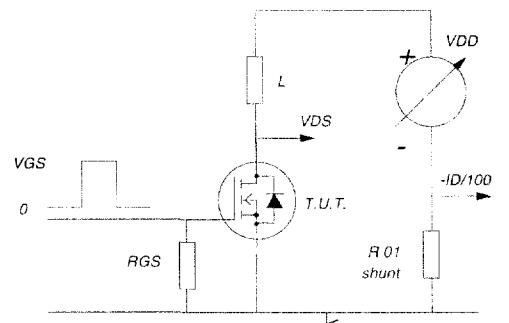


Fig.16. Avalanche energy test circuit.
$W_{DSS} = 0.5 \cdot LI_D^2 \cdot BV_{DSS}/(BV_{DSS} - V_{DD})$