

PowerMOS transistor

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	BUK455	MAX. -600A	MAX. -600B	UNIT
V_{DS}	Drain-source voltage	600	600	600	V
I_D	Drain current (DC)	4.5	4.0	4.0	A
P_{tot}	Total power dissipation	100	100	100	W
$R_{DS(ON)}$	Drain-source on-state resistance	2.0	2.5	2.5	Ω

MECHANICAL DATA

Dimensions in mm

Net Mass: 2g

Pinning:

1 = Gate

2 = Drain

3 = Source

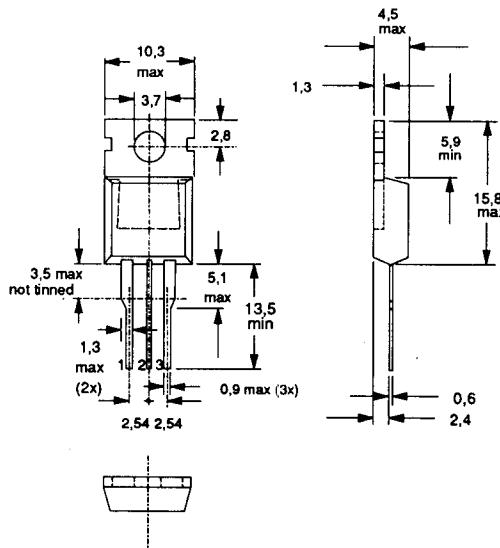
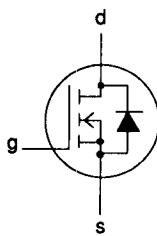


Fig.1 TO220AB; drain connected to mounting base.

blue binder, tab 4

Notes

1. Observe the general handling precautions for electrostatic-discharge sensitive devices (ESDs) to prevent damage to MOS gate oxide.
2. Accessories supplied on request: refer to Mounting instructions for TO220 envelopes.

January 1989



PHILIPS

RATINGS

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{DS}	Drain-source voltage	$R_{GS} = 20 \text{ k}\Omega$	-	600	V
V_{DGR}	Drain-gate voltage		-	600	V
$\pm V_{GS}$	Gate-source voltage		-	30	V
I_D	Drain current (DC)	$T_{mb} = 25^\circ\text{C}$	-	-600A	A
I_D	Drain current (DC)		-	4.5	A
I_{DM}	Drain current (pulse peak value)		-	2.8	A
I_D	Drain current (DC)	$T_{mb} = 100^\circ\text{C}$	-	4.0	A
I_D	Drain current (DC)		-	2.5	A
I_D	Drain current (pulse peak value)		-	16	A
P_{tot}	Total power dissipation	$T_{mb} = 25^\circ\text{C}$	-	100	W
T_{stg}	Storage temperature		-	150	°C
T_j	Junction Temperature		-	150	°C

THERMAL RESISTANCES

From junction to mounting base	$R_{th,j-mb} = 1.25 \text{ K/W}$
From junction to ambient	$R_{th,j-a} = 60 \text{ K/W}$

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT	
$V_{(BR)DSS}$	Drain-source breakdown voltage	$V_{GS} = 0 \text{ V}; I_D = 0.25 \text{ mA}$	600	-	-	V	
$V_{GS(TO)}$	Gate threshold voltage	$V_{DS} = V_{GS}; I_D = 1 \text{ mA}$	2.1	3.0	4.0	V	
I_{DSS}	Zero gate voltage drain current	$V_{DS} = 600 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 25^\circ\text{C}$	-	2	20	μA	
I_{DSS}	Zero gate voltage drain current	$V_{DS} = 600 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 125^\circ\text{C}$	-	0.1	1.0	mA	
I_{GSS}	Gate source leakage current	$V_{GS} = \pm 30 \text{ V}; V_{DS} = 0 \text{ V}$	-	10	100	nA	
$R_{DS(ON)}$	Drain-source on-state resistance	$V_{GS} = 10 \text{ V}; V_{DS} = 0 \text{ V}$ $I_D = 2.5 \text{ A}$	BUK455-600A BUK455-600B	-	1.7	2.0	Ω
				-	2.1	2.5	Ω

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
g_{fs}	Forward transconductance	$V_{DS} = 25 \text{ V}; I_D = 2.5 \text{ A}$	3.5	4.5	-	S
C_{iss}	Input capacitance	$V_{GS} = 0 \text{ V}; V_{DS} = 25 \text{ V}; f = 1 \text{ MHz}$	-	750	1000	pF
C_{oss}	Output capacitance		-	90	140	pF
C_{rss}	Feedback capacitance		-	40	70	pF
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 30 \text{ V}; I_D = 2.6 \text{ A}; V_{GS} = 10 \text{ V}; R_{GS} = 50 \Omega; R_{gen} = 50 \Omega$	-	10	45	ns
t_r	Turn-on rise time		-	45	60	ns
$t_{d(off)}$	Turn-off delay time		-	100	140	ns
t_f	Turn-off fall time		-	40	65	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 RATINGS AND CHARACTERISTICS

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{DR}	Continuous reverse drain current	-	-	-	4.5	A
I_{DPM}	Pulsed reverse drain current	$I_F = 4.5 \text{ A}; V_{GS} = 0 \text{ V}$	-	1.1	18	A
V_{SD}	Diode forward voltage		-	1.5	-	V
t_{rr}	Reverse recovery time	$I_F = 4.5 \text{ A}; -dI_F/dt = 100 \text{ A}/\mu\text{s}$	-	1200	-	ns
Q_r	Reverse recovery charge	$V_{GS} = 0 \text{ V}; V_R = 100 \text{ V}$	-	6.0	-	μC

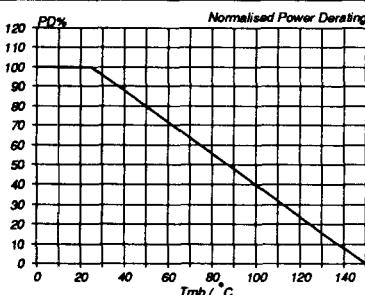


Fig.2. Normalised power dissipation.
 $PD\% = 100 P_D / P_{D,25^\circ\text{C}} = f(T_{mb})$

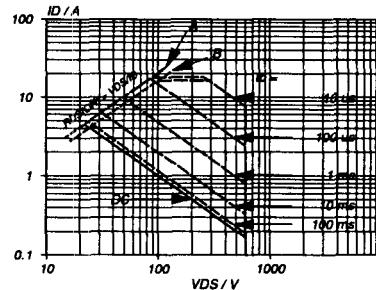


Fig.4. Safe operating area. $T_{mb} = 25^\circ\text{C}$
 $ID \& I_{DM} = f(V_{DS}); I_{DM}$ single pulse; parameter t_r

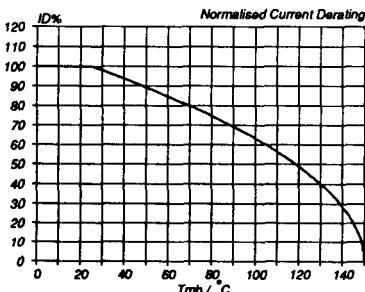


Fig.3. Normalised continuous drain current.
 $ID\% = 100 I_D / I_{D,25^\circ\text{C}} = f(T_{mb})$; conditions: $V_{GS} \geq 10 \text{ V}$

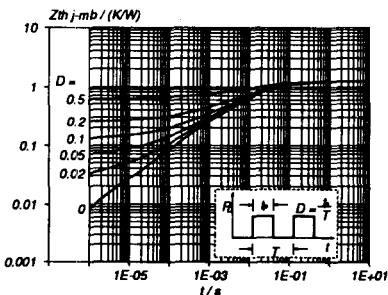


Fig.5. Transient thermal impedance.
 $Z_{th,j-mb} = f(t);$ parameter $D = t_r/T$

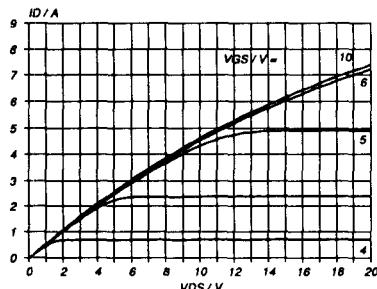


Fig.6.1 Typical output characteristics, $T_j = 25^\circ\text{C}$.
 $I_D = f(V_{DS})$; parameter V_{GS}

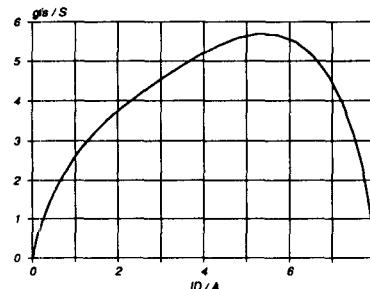


Fig.9. Typical transconductance, $T_j = 25^\circ\text{C}$.
 $g_{ds} = f(I_D)$; conditions: $V_{DS} = 25\text{V}$

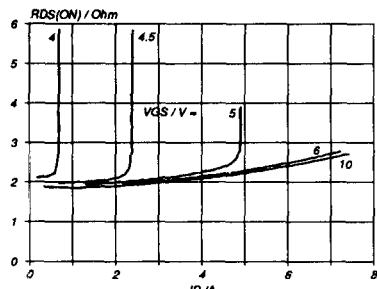


Fig.7. Typical on-state resistance, $T_j = 25^\circ\text{C}$.
 $R_{DS(ON)} = f(I_D)$; parameter V_{GS}

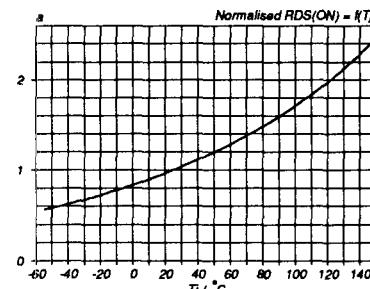


Fig.10. Normalised drain-source on-state resistance.
 $a = R_{DS(ON)}/R_{DS(ON)25^\circ\text{C}} = f(T_j)$; $I_D = 2.5\text{A}$, $V_{GS} = 10\text{V}$

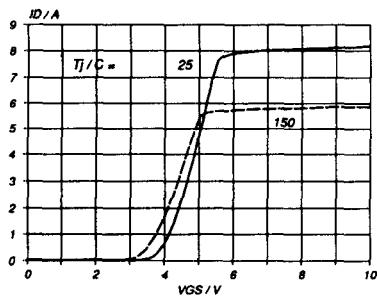


Fig.8. Typical transfer characteristics.
 $I_D = f(V_{GS})$; conditions: $V_{DS} = 25\text{V}$; parameter T_j

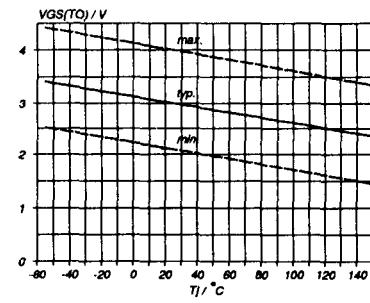


Fig.11. Gate threshold voltage.
 $V_{GS(TO)} = f(T_j)$; conditions: $I_D = 1\text{mA}$; $V_{DS} = V_{GS}$

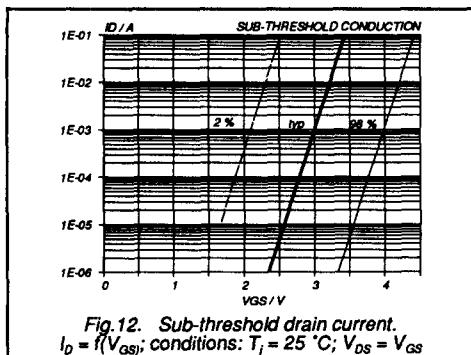


Fig.12. Sub-threshold drain current.
 $I_D = f(V_{GS})$; conditions: $T_j = 25^\circ\text{C}$; $V_{DS} = V_{GS}$

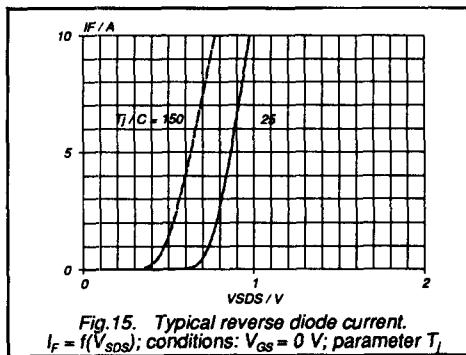


Fig.15. Typical reverse diode current.
 $I_F = f(V_{DS})$; conditions: $V_{GS} = 0\text{ V}$; parameter T_j

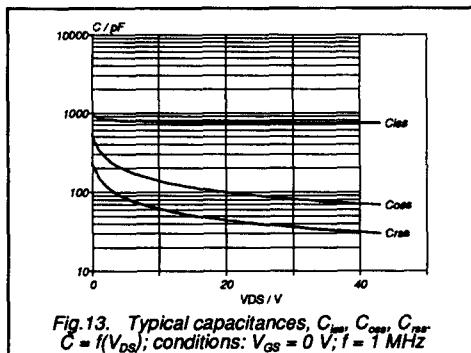


Fig.13. Typical capacitances, C_{iss} , C_{oss} , C_{res} .
 $C = f(V_{DS})$; conditions: $V_{GS} = 0\text{ V}$; $f = 1\text{ MHz}$

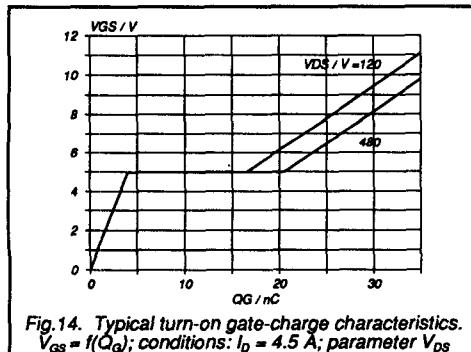


Fig.14. Typical turn-on gate-charge characteristics.
 $V_{GS} = f(Q_G)$; conditions: $I_D = 4.5\text{ A}$; parameter V_{DS}