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	MAX.	MAX.	UNIT
	BUK454	**-500A**	**-500B**	
V_{DS}	Drain-source voltage	500	500	V
I_D	Drain current (DC)	3.7	3.3	A
P_{tot}	Total power dissipation	75	75	W
$R_{DS(ON)}$	Drain-source on-state resistance	2.3	2.8	Ω

MECHANICAL DATA

blue binder, tab 4

Dimensions in mm

Net Mass: 2g

Pinning:

1 = Gate

2 = Drain

3 = Source
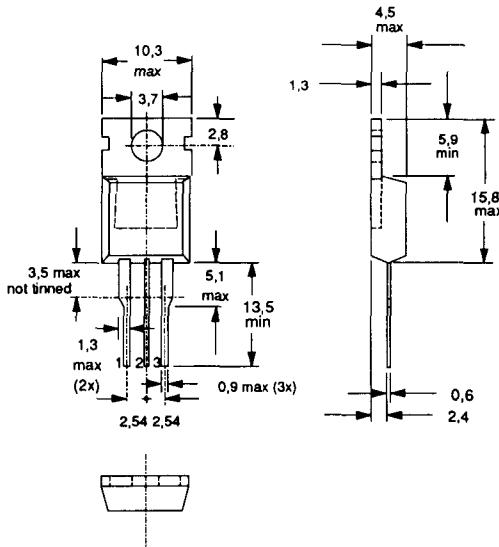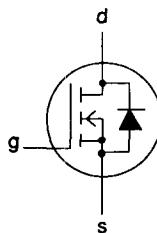
Fig.1 TO220AB; drain connected to mounting base.

Notes

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

PHILIPS

RATINGS

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.		UNIT
V_{DS}	Drain-source voltage	-	-	500		V
V_{DGR}	Drain-gate voltage	$R_{GS} = 20 \text{ k}\Omega$	-	500		V
$\pm V_{GS}$	Gate-source voltage	-	-	30		V
				-500A	**-500B**	
I_D	Drain current (DC)	$T_{mb} = 25 \text{ °C}$	-	3.7	3.3	A
I_D	Drain current (DC)	$T_{mb} = 100 \text{ °C}$	-	2.3	2.1	A
I_{DM}	Drain current (pulse peak value)	$T_{mb} = 25 \text{ °C}$	-	15	13	A
P_{tot}	Total power dissipation	$T_{mb} = 25 \text{ °C}$	-	75		W
T_{stg}	Storage temperature	-	- 55	150		°C
T_j	Junction Temperature	-	-	150		°C

THERMAL RESISTANCES

From junction to mounting base	$R_{th\ j-mb} = 1.67 \text{ K/W}$
From junction to ambient	$R_{th\ j-a} = 60 \text{ K/W}$

STATIC CHARACTERISTICS

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)DSS}$	Drain-source breakdown voltage	$V_{GS} = 0 \text{ V}; I_D = 0.25 \text{ mA}$	500	-	-	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	$V_{DS} = 500 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ °C}$	-	2	20	μA
I_{DSS}	Zero gate voltage drain current	$V_{DS} = 500 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 125 \text{ °C}$	-	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	$V_{GS} = 10 \text{ V};$ BUK454-500A	-	2.0	2.3	Ω
		$I_D = 1.5 \text{ A}$ BUK454-500B	-	2.3	2.8	Ω

DYNAMIC CHARACTERISTICS

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
g_{fs}	Forward transconductance	$V_{DS} = 25 \text{ V}; I_D = 1.5 \text{ A}$	1.9	2.5	-	S
C_{iss}	Input capacitance	$V_{GS} = 0 \text{ V}; V_{DS} = 25 \text{ V}; f = 1 \text{ MHz}$	-	400	500	pF
C_{oss}	Output capacitance		-	55	80	pF
C_{rss}	Feedback capacitance		-	20	55	pF
$t_{d\ on}$	Turn-on delay time	$V_{DD} = 30 \text{ V}; I_D = 2.5 \text{ A};$	-	15	20	ns
t_r	Turn-on rise time	$V_{GS} = 10 \text{ V}; R_{GS} = 50 \text{ }\Omega;$	-	40	60	ns
$t_{d\ off}$	Turn-off delay time	$R_{gen} = 50 \text{ }\Omega$	-	50	65	ns
t_f	Turn-off fall time		-	30	40	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

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{DR}	Continuous reverse drain current	-	-	-	3.7	A
I_{DRM}	Pulsed reverse drain current	-	-	-	15	A
V_{SD}	Diode forward voltage	$I_F = 3.7$ A ; $V_{GS} = 0$ V	-	1.0	1.3	V
t_{rr}	Reverse recovery time	$I_F = 3.7$ A; $-dI_F/dt = 100$ A/µs;	-	350	-	ns
Q_{rr}	Reverse recovery charge	$V_{GS} = 0$ V; $V_R = 100$ V	-	3.5	-	µC
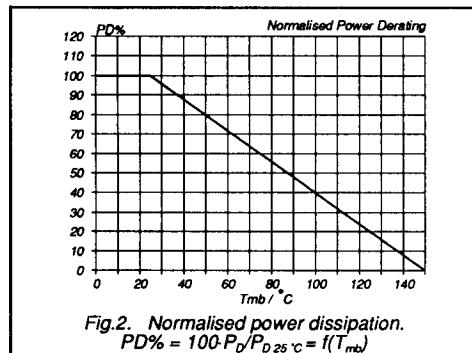
Fig.2. Normalised power dissipation.
$PD\% = 100 \cdot P_D/P_{D\,25\,°C} = f(T_{mb})$
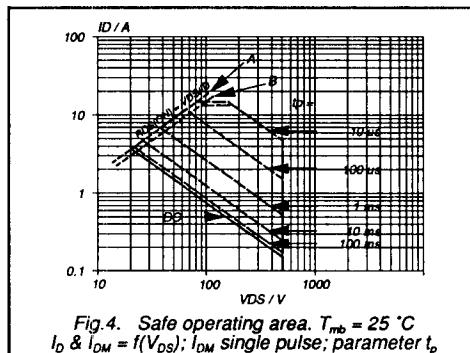
Fig.4. Safe operating area. $T_{mb} = 25$ °C
I_D & $I_{DM} = f(V_{DS})$; I_{DM} single pulse; parameter t_p
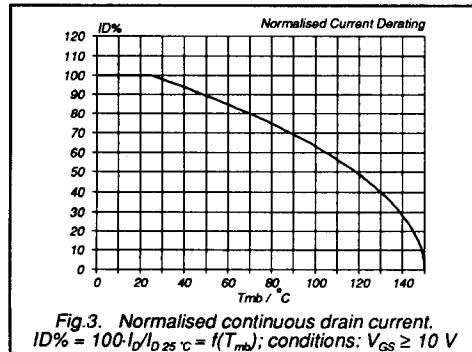
Fig.3. Normalised continuous drain current.
$ID\% = 100 \cdot I_D/I_{D\,25\,°C} = f(T_{mb})$; conditions: $V_{GS} \geq 10$ V
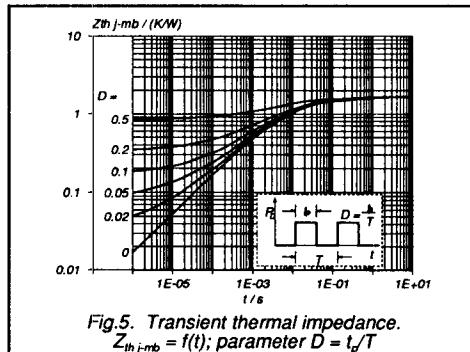
Fig.5. Transient thermal impedance.
$Z_{th\,j-mb} = f(t)$; parameter $D = t_p/T$
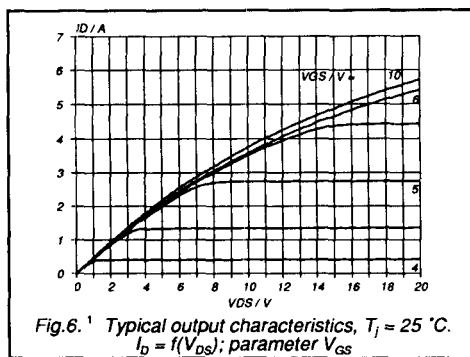
Fig.6. [1] Typical output characteristics, $T_j = 25\ ^\circ C$.
$I_D = f(V_{DS})$; parameter V_{GS}
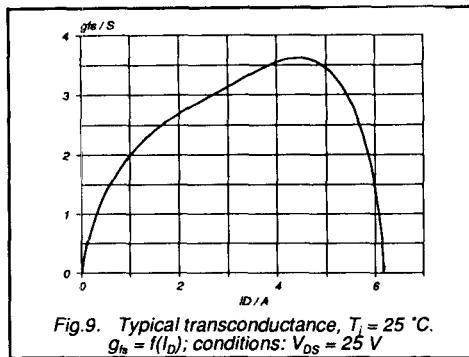
Fig.9. Typical transconductance, $T_j = 25\ ^\circ C$.
$g_{fs} = f(I_D)$; conditions: $V_{DS} = 25\ V$
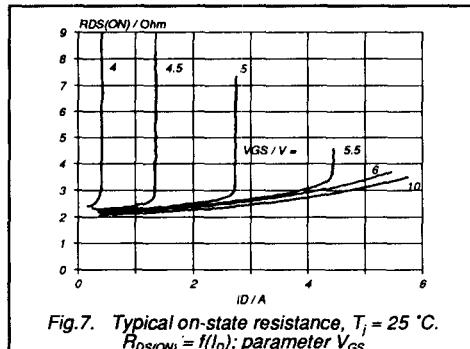
Fig.7. Typical on-state resistance, $T_j = 25\ ^\circ C$.
$R_{DS(ON)} = f(I_D)$; parameter V_{GS}
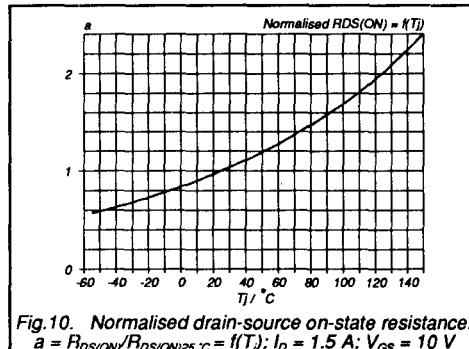
Fig.10. Normalised drain-source on-state resistance.
$a = R_{DS(ON)}/R_{DS(ON)25\ ^\circ C} = f(T_j)$; $I_D = 1.5\ A$; $V_{GS} = 10\ V$
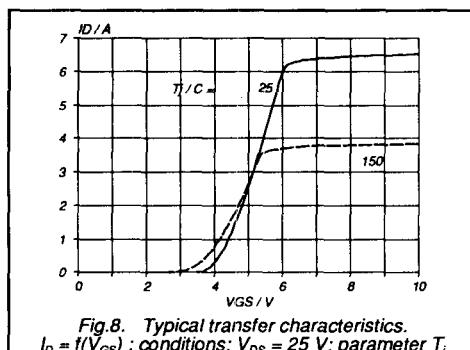
Fig.8. Typical transfer characteristics.
$I_D = f(V_{GS})$; conditions: $V_{DS} = 25\ V$; parameter T_j
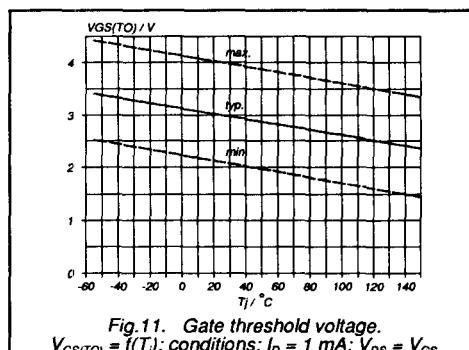
Fig.11. Gate threshold voltage.
$V_{GS(TO)} = f(T_j)$; conditions: $I_D = 1\ mA$; $V_{DS} = V_{GS}$

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

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

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

Fig.14. Typical turn-on gate-charge characteristics.
$V_{GS} = f(Q_G)$; conditions: $I_D = 3.7\,A$; parameter V_{DS}

January 1989

Philips Components