PowerMOS transistor

BUK445-50A
BUK445-50B

T-39-09

GENERAL DESCRIPTION

N-channel enhancement mode field-effect power transistor in a plastic full-pack 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
	BUK445	**-50A**	**-50B**	
V_{DS}	Drain-source voltage	50	50	V
I_D	Drain current (DC)	21	20	A
P_{tot}	Total power dissipation	30	30	W
T_j	Junction temperature	150	150	°C
$R_{DS(ON)}$	Drain-source on-state resistance	0.038	0.045	Ω

MECHANICAL DATA

Dimensions in mm

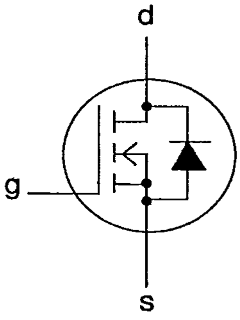
Net Mass: 2g

Pinning:

1 = Gate

2 = Drain

3 = Source



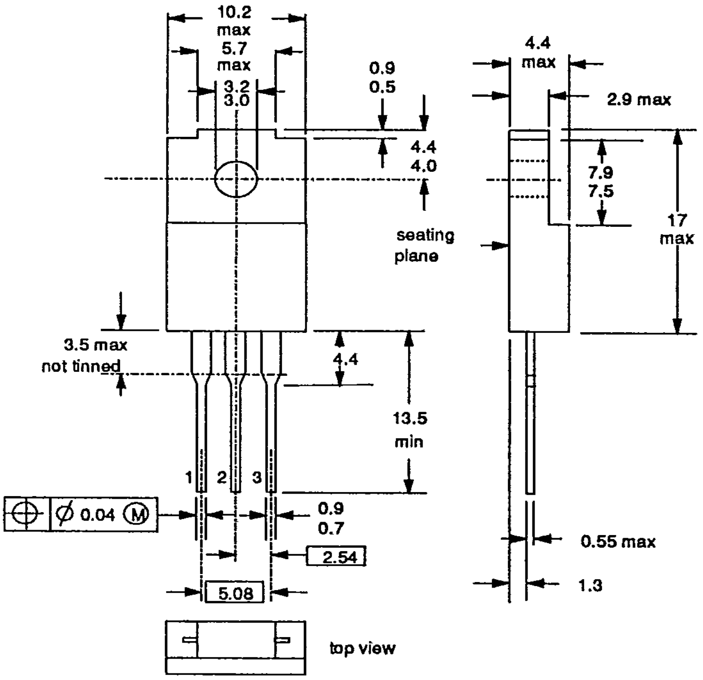


Fig.1 SOT-186; The seating plane is electrically isolated from all terminals.

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 F-pack envelopes.

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RATINGS

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.		UNIT
V_{DS}	Drain-source voltage	-	-	50		V
V_{DGR}	Drain-gate voltage	R_{GS} = 20 kΩ	-	50		V
$\pm V_{GS}$	Gate-source voltage	-	-	30		V
				-50A	-50B	
I_D	Drain current (DC)	T_{hs} = 25 °C	-	21	20	A
I_D	Drain current (DC)	T_{hs} = 100 °C	-	13	12.6	A
I_{DM}	Drain current (pulse peak value)	T_{hs} = 25 °C	-	84	80	A
P_{tot}	Total power dissipation	T_{hs} = 25 °C	-	30		W
T_{stg}	Storage temperature	-	- 55	150		°C
T_j	Junction Temperature	-	-	150		°C

THERMAL RESISTANCES

From junction to heatsink	with heatsink compound	$R_{th\,j\text{-}hs}$ = 4.17 K/W
From junction to ambient		$R_{th\,j\text{-}a}$ = 55 K/W

STATIC CHARACTERISTICS

T_{hs} = 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		50	-	-	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} = 50 V; V_{GS} = 0 V; T_j = 25 °C		-	1	10	µA
I_{DSS}	Zero gate voltage drain current	V_{DS} = 50 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; I_D = 20 A	BUK445-50A BUK445-50B	- -	0.03 0.04	0.038 0.045	Ω Ω

DYNAMIC CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
g_{fs}	Forward transconductance	V_{DS} = 25 V; I_D = 20 A	8	13.5	-	S
C_{iss}	Input capacitance	V_{GS} = 0 V; V_{DS} = 25 V; f = 1 MHz	-	1650	2000	pF
C_{oss}	Output capacitance		-	560	750	pF
C_{rss}	Feedback capacitance		-	300	400	pF
$t_{d\,on}$	Turn-on delay time	V_{DD} = 30 V; I_D = 3 A;	-	25	40	ns
t_r	Turn-on rise time	V_{GS} = 10 V; R_{GS} = 50 Ω;	-	60	90	ns
$t_{d\,off}$	Turn-off delay time	R_{gen} = 50 Ω	-	125	160	ns
t_f	Turn-off fall time		-	100	130	ns
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

ISOLATION

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	Repetitive peak voltage from all three terminals to external heatsink	R.H. ≤ 65% ; clean and dustfree	-	-	1500	V
C_{isol}	Capacitance from T2 to external heatsink	f = 1 MHz	-	12	-	pF

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REVERSE DIODE RATINGS AND CHARACTERISTICS

T_{hs} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{DR}	Continuous reverse drain current	-	-	-	21	A
I_{DRM}	Pulsed reverse drain current	-	-	-	84	A
V_{SD}	Diode forward voltage	I_F = 21 A ; V_{GS} = 0 V	-	1.4	1.8	V
t_{rr}	Reverse recovery time	I_F = 21 A; $-dI_F/dt$ = 100 A/µs;	-	250	-	ns
Q_{rr}	Reverse recovery charge	V_{GS} = 0 V; V_R = 30 V	-	0.30	-	µC

AVALANCHE RATING

T_{hs} = 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 = 41 A ; $V_{DD} \leq$ 25 V ; V_{GS} = 10 V ; R_{GS} = 50 Ω	-	-	100	mJ

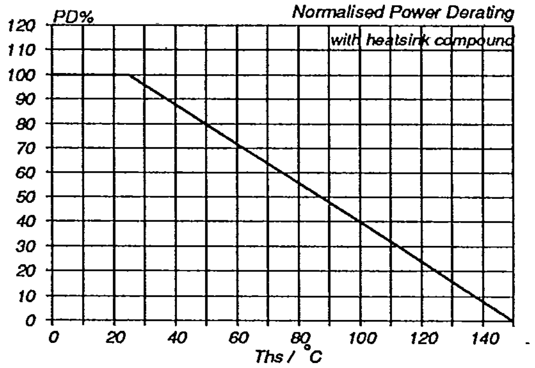

Fig.2. Normalised power dissipation.
$PD\% = 100 \cdot P_D/P_{D\,25\,°C} = f(T_{hs})$

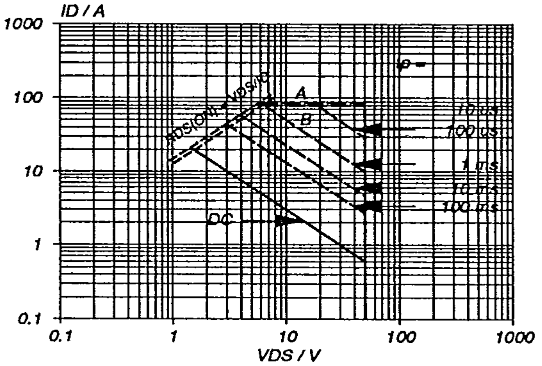

Fig.4. Safe operating area. T_{hs} = 25 °C
I_D & $I_{DM} = f(V_{DS})$; I_{DM} single pulse; parameter t_p

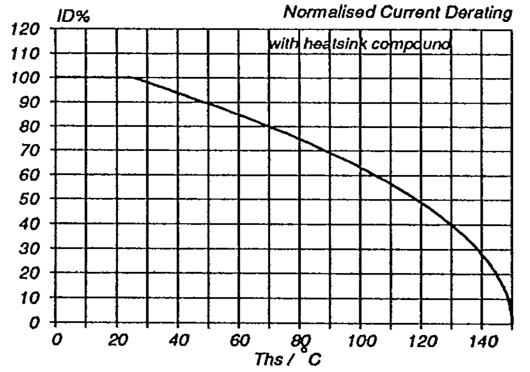

Fig.3. Normalised continuous drain current.
$ID\% = 100 \cdot I_D/I_{D\,25\,°C} = f(T_{hs})$; conditions: $V_{GS} \geq 10$ V

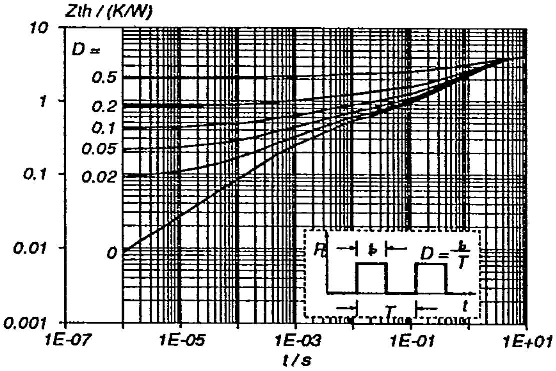

Fig.5. Transient thermal impedance.
$Z_{th\,j\text{-}hs} = f(t)$; parameter $D = t_p/T$

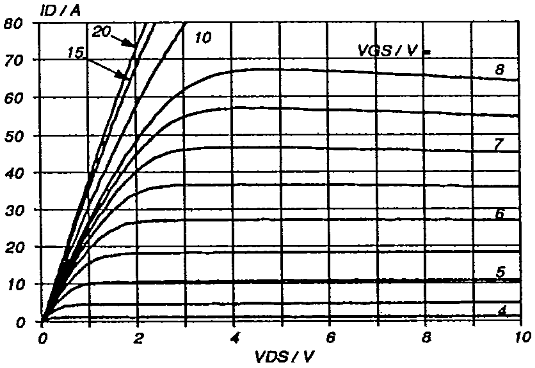

Fig.6.[1] Typical output characteristics, $T_j = 25$ °C.
$I_D = f(V_{DS})$; parameter V_{GS}

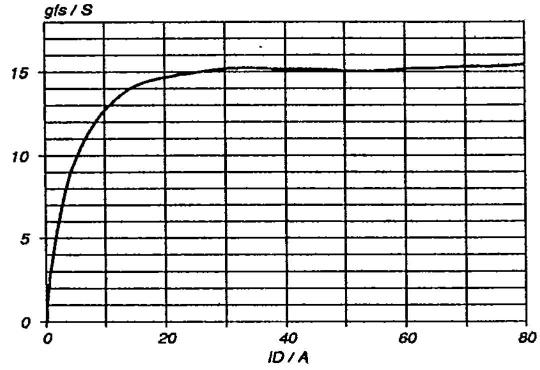

Fig.9. Typical transconductance, $T_j = 25$ °C.
$g_{fs} = f(I_D)$; conditions: $V_{DS} = 25$ V

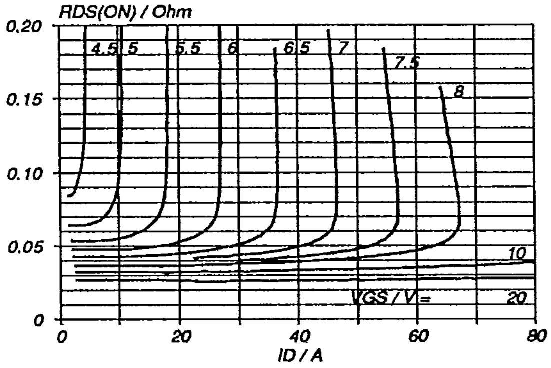

Fig.7. Typical on-state resistance, $T_j = 25$ °C.
$R_{DS(ON)} = f(I_D)$; parameter V_{GS}

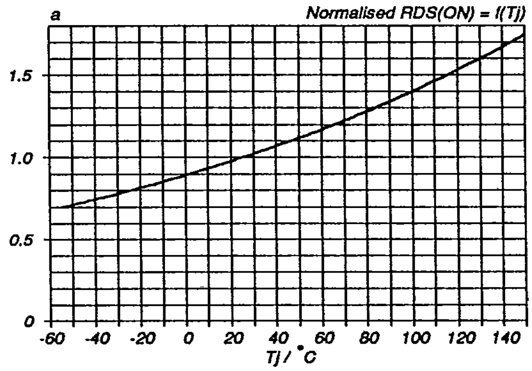

Fig.10. Normalised drain-source on-state resistance.
$a = R_{DS(ON)}/R_{DS(ON)25\,°C} = f(T_j)$; $I_D = 20$ A; $V_{GS} = 10$ V

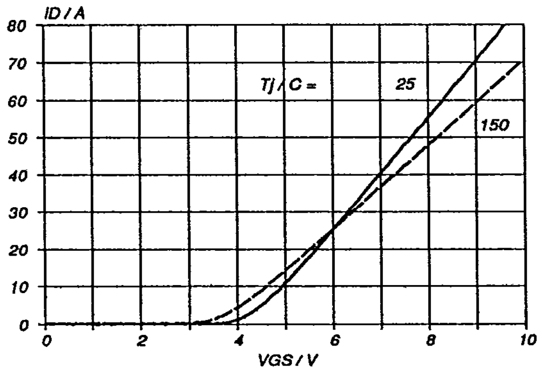

Fig.8. Typical transfer characteristics.
$I_D = f(V_{GS})$; conditions: $V_{DS} = 25$ V; parameter T_j

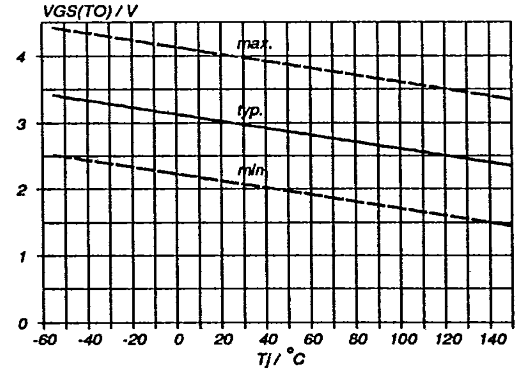

Fig.11. Gate threshold voltage.
$V_{GS(TO)} = f(T_j)$; conditions: $I_D = 1$ mA; $V_{DS} = V_{GS}$

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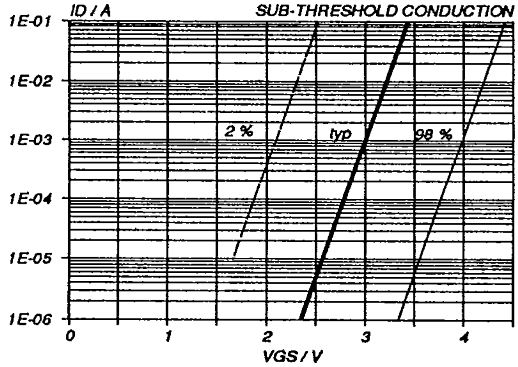

Fig.12. Sub-threshold drain current.
$I_D = f(V_{GS})$; conditions: $T_j = 25$ °C; $V_{DS} = V_{GS}$

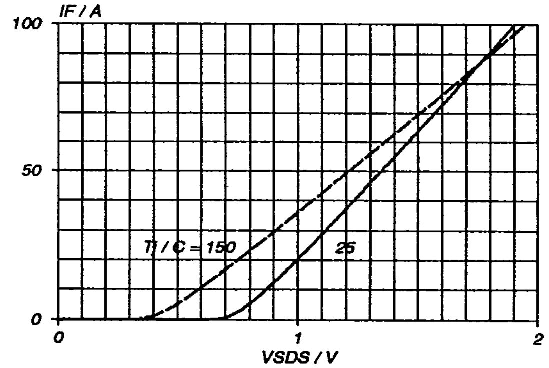

Fig.15. Typical reverse diode current.
$I_F = f(V_{SDS})$; conditions: $V_{GS} = 0$ V; parameter T_j

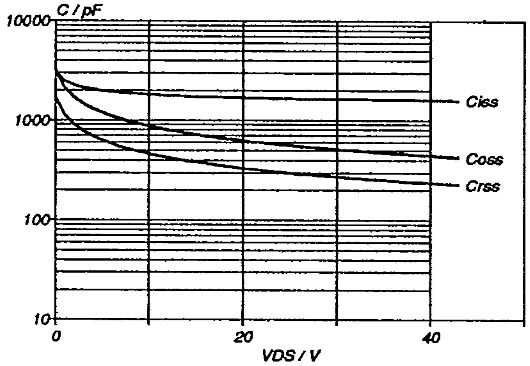

Fig.13. Typical capacitances, C_{iss}, C_{oss}, C_{rss}.
$C = f(V_{DS})$; conditions: $V_{GS} = 0$ V; $f = 1$ MHz

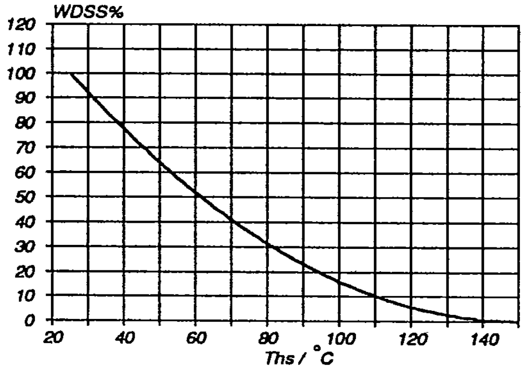

Fig.16. Normalised avalanche energy rating.
$W_{DSS}\% = f(T_{hs})$; conditions: $I_D = 41$ A

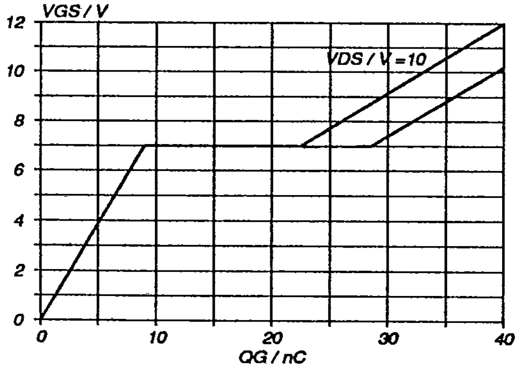

Fig.14. Typical turn-on gate-charge characteristics.
$V_{GS} = f(Q_G)$; conditions: $I_D = 41$ A; parameter V_{DS}

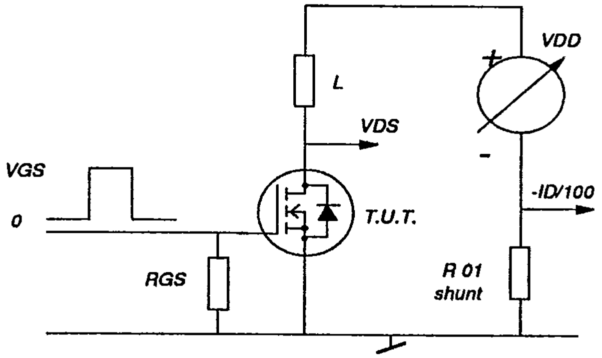

Fig.17. Avalanche energy test circuit.
$W_{DSS} = 0.5 \cdot L I_D^2 \cdot BV_{DSS}/(BV_{DSS} - V_{DD})$