

PowerMOS transistor Fast Recovery Diode FET

BUK657-400A
BUK657-400B

T-39-13

GENERAL DESCRIPTION

N-channel enhancement mode field-effect power transistor in a plastic envelope. FREDFET with fast recovery reverse diode, particularly suitable for motor control applications, eg. in full bridge configurations for which faster recovery characteristics simplify design for inductive loads.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	MAX.	MAX.	UNIT
	BUK657	-400A	-400B	
V_{DS}	Drain-source voltage	400	400	V
I_D	Drain current (DC)	13	11	A
P_{tot}	Total power dissipation	150	150	W
$R_{DS(ON)}$	Drain-source on-state resistance	0.5	0.6	Ω
t_{rr}	Diode reverse recovery time	250	250	ns

MECHANICAL DATA

Dimensions in mm

Net Mass: 2g

Pinning:

1 = Gate

2 = Drain

3 = Source

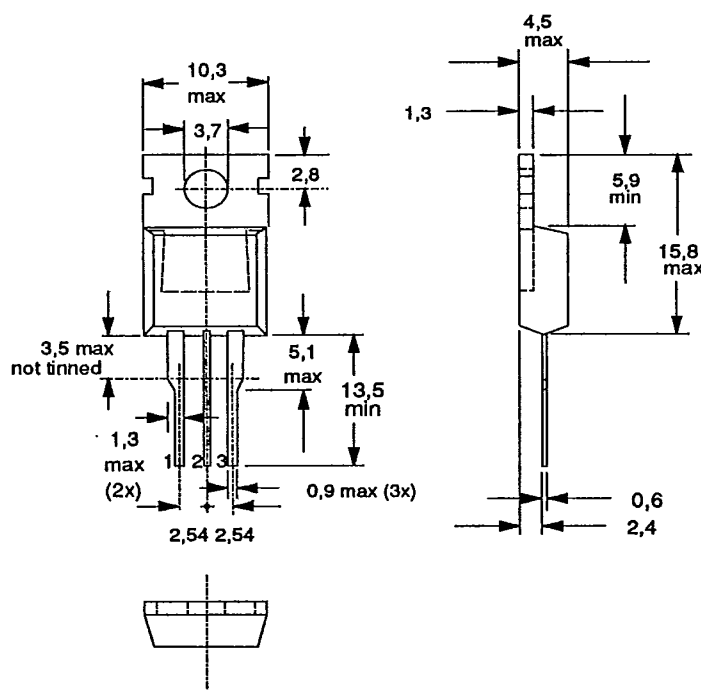
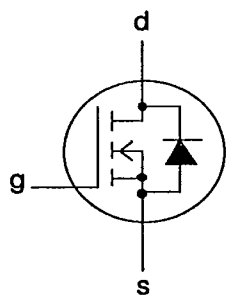


Fig.1 TO220AB; drain connected to mounting base.

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.

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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	-	-	400	V
V_{DGR}	Drain-gate voltage	$R_{GS} = 20 \text{ k}\Omega$	-	400	V
$\pm V_{GS}$	Gate-source voltage	-	-	30	V
I_D	Drain current (DC)	$T_{mb} = 25^\circ\text{C}$	-	-400A 13	A
I_D	Drain current (DC)	$T_{mb} = 100^\circ\text{C}$	-	-400B 11	A
I_{DM}	Drain current (pulse peak value)	$T_{mb} = 25^\circ\text{C}$	-	8.2 52	A
P_{tot}	Total power dissipation	$T_{mb} = 25^\circ\text{C}$	-	150	W
T_{stg}	Storage temperature	-	-55	150	$^\circ\text{C}$
T_j	Junction Temperature	-	-	150	$^\circ\text{C}$

THERMAL RESISTANCES

From junction to mounting base	$R_{th\ j-mb} = 0.83 \text{ K/W}$
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	$V_{GS} = 0 \text{ V}; I_D = 0.25 \text{ mA}$	400	-	-	V
$V_{GS(TH)}$	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	$V_{DS} = 400 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 25^\circ\text{C}$	-	2	20	μA
I_{DSS}	Zero gate voltage drain current	$V_{DS} = 400 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 125^\circ\text{C}$	-	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	$V_{GS} = 10 \text{ V}; I_D = 6.5 \text{ A}$	-	0.4	0.5	Ω
		BUK657-400A	-	0.5	0.6	Ω
		BUK657-400B	-	0.5	0.6	Ω

DYNAMIC CHARACTERISTICS

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
g_{fs}	Forward transconductance	$V_{DS} = 25 \text{ V}; I_D = 6.5 \text{ A}$	5.0	8.0	-	S
C_{iss}	Input capacitance	$V_{GS} = 0 \text{ V}; V_{DS} = 25 \text{ V}; f = 1 \text{ MHz}$	-	1500	1800	pF
C_{oss}	Output capacitance		-	170	270	pF
C_{rss}	Feedback capacitance		-	70	120	pF
t_{don}	Turn-on delay time	$V_{DD} = 30 \text{ V}; I_D = 2.8 \text{ A};$	-	20	40	ns
t_r	Turn-on rise time	$V_{GS} = 10 \text{ V}; R_{GS} = 50 \Omega;$	-	60	90	ns
t_{doff}	Turn-off delay time	$R_{gen} = 50 \Omega$	-	200	250	ns
t_f	Turn-off fall time		-	75	90	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

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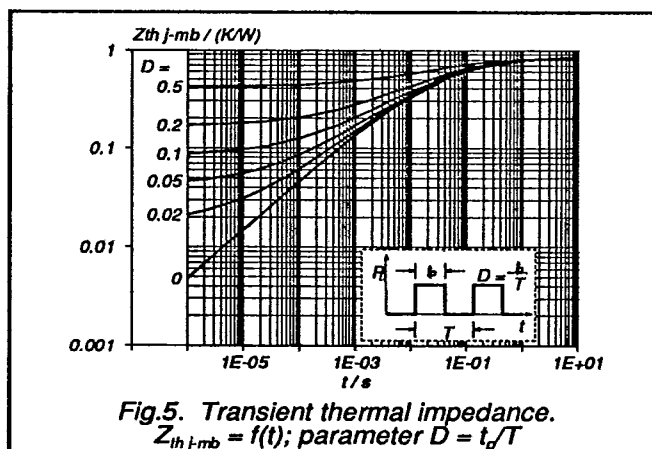
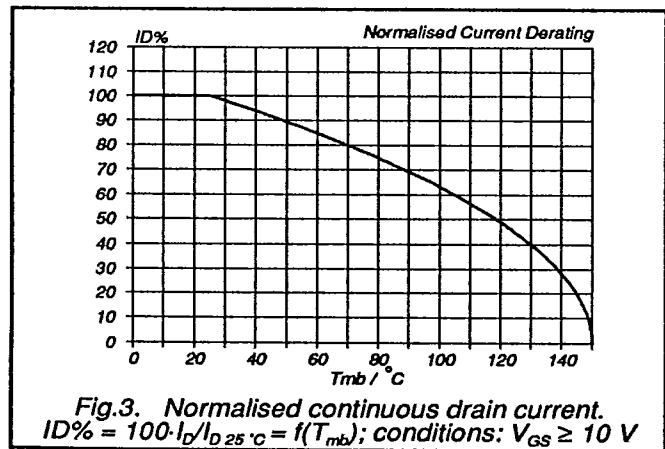
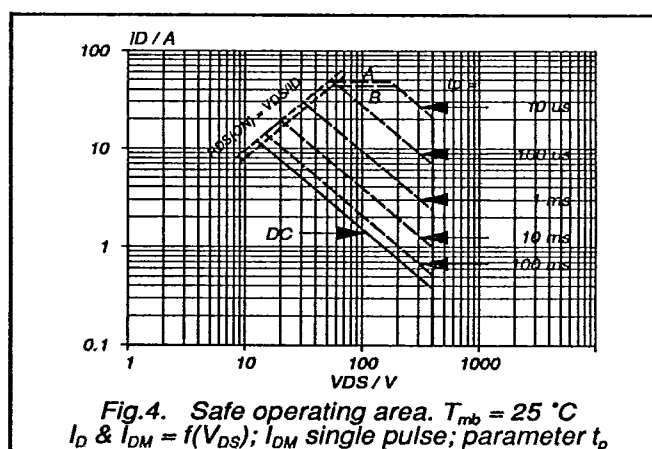
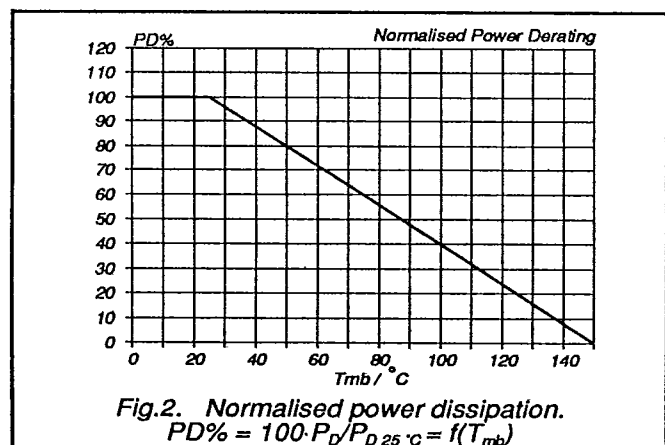
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REVERSE DIODE RATINGS AND CHARACTERISTICS

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{DR}	Continuous reverse drain current	-	-	-	13	A
I_{DRM}	Pulsed reverse drain current	-	-	-	52	A
V_{SD}	Diode forward voltage	$I_F = 13\text{ A}; V_{GS} = 0\text{ V}$	-	1.1	1.5	V
t_{rr}	Reverse recovery time	$I_F = 13\text{ A}; -di_F/dt = 100\text{ A}/\mu\text{s}; V_{GS} = 0\text{ V}; V_R = 100\text{ V}$	-	180	250	ns
Q_{rr}	Reverse recovery charge	$T_J = 25^\circ\text{C}; T_J = 125^\circ\text{C}$	-	220	300	ns
I_{rrm}	Reverse recovery current	$T_J = 25^\circ\text{C}; T_J = 125^\circ\text{C}$	-	0.65	1.2	μC
			-	2.6	5.0	μC
			-	15	-	A



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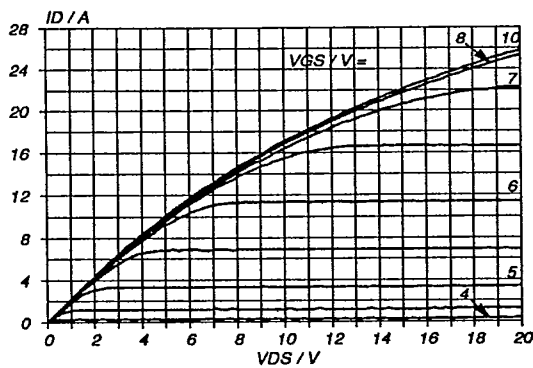


Fig. 6. Typical output characteristics, $T_j = 25\text{ }^{\circ}\text{C}$.
 $I_D = f(V_{DS})$; parameter V_{GS}

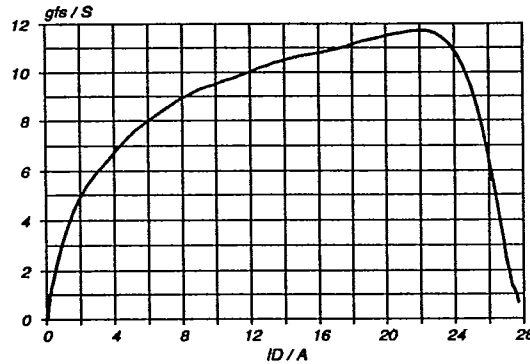


Fig. 9. Typical transconductance, $T_j = 25\text{ }^{\circ}\text{C}$.
 $g_{fs} = f(I_D)$; conditions: $V_{DS} = 25\text{ V}$

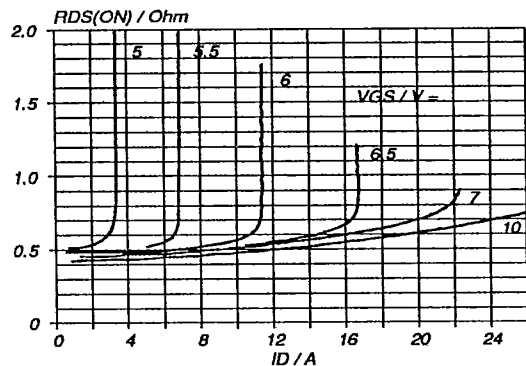


Fig. 7. Typical on-state resistance, $T_j = 25\text{ }^{\circ}\text{C}$.
 $R_{DS(ON)} = f(I_D)$; parameter V_{GS}

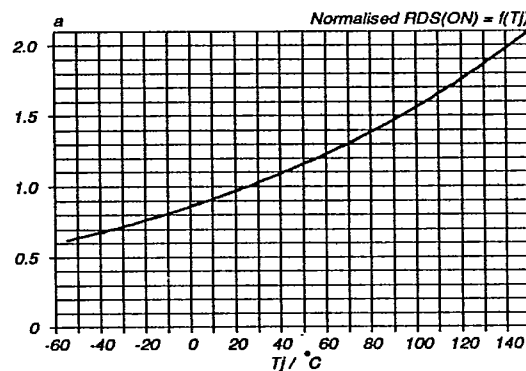


Fig. 10. Normalised drain-source on-state resistance.
 $a = R_{DS(ON)}/R_{DS(ON)25\text{ }^{\circ}\text{C}} = f(T_j)$; $I_D = 6.5\text{ A}$; $V_{GS} = 10\text{ V}$

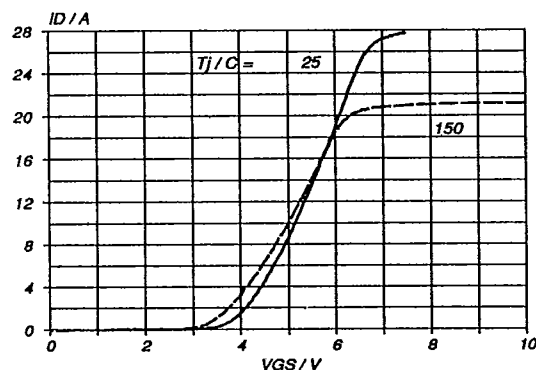


Fig. 8. Typical transfer characteristics.
 $I_D = f(V_{GS})$; conditions: $V_{DS} = 25\text{ V}$; parameter T_j

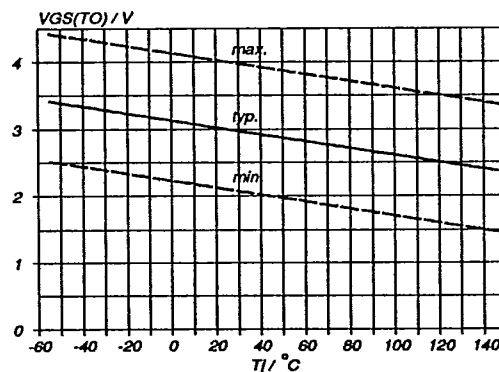


Fig. 11. Gate threshold voltage.
 $V_{GS(TO)} = f(T_j)$; conditions: $I_D = 1\text{ mA}$; $V_{DS} = V_{GS}$

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