

PowerMOS transistor Fast recovery diode FET

BUK638-500B

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.

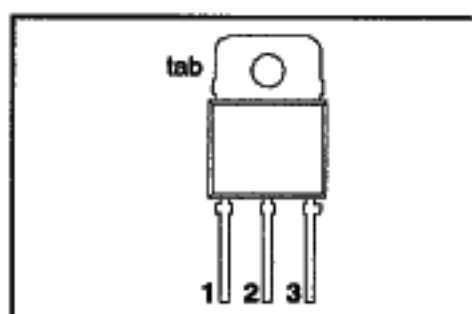
QUICK REFERENCE DATA

SYMBOL	PARAMETER	MAX.	UNIT
V_{DS}	Drain-source voltage	500	V
I_D	Drain current (DC)	13	A
P_{tot}	Total power dissipation	220	W
$R_{DS(on)}$	Drain-source on-state resistance	0.6	Ω
t_{rr}	Diode reverse recovery time	250	ns

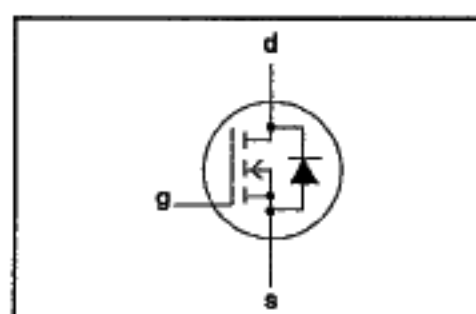
PINNING - SOT93

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	-	-	500	V
V_{DGR}	Drain-gate voltage	$R_{GS} = 20 \text{ k}\Omega$	-	500	V
$\pm V_{GS}$	Gate-source voltage	-	-	30	V
I_D	Drain current (DC)	$T_{mb} = 25 \text{ }^\circ\text{C}$	-	13	A
I_{DM}	Drain current (DC)	$T_{mb} = 100 \text{ }^\circ\text{C}$	-	8.2	A
I_{DM}	Drain current (pulse peak value)	$T_{mb} = 25 \text{ }^\circ\text{C}$	-	52	A
P_{tot}	Total power dissipation	$T_{mb} = 25 \text{ }^\circ\text{C}$	-	220	W
T_{stg}	Storage temperature	-	-55	150	$^\circ\text{C}$
T_J	Junction Temperature	-	-	150	$^\circ\text{C}$

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$R_{th(j-mb)}$	Thermal resistance junction to mounting base		-	-	0.57	K/W
$R_{th(j-a)}$	Thermal resistance junction to ambient		-	45	-	K/W

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR),DSS}$	Drain-source breakdown voltage	$V_{GS} = 0\text{ V}; I_D = 0.25\text{ mA}$	500	-	-	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	$V_{DS} = 500\text{ V}; V_{GS} = 0\text{ V}; T_J = 25\text{ }^{\circ}\text{C}$	-	5	50	μA
I_{DSS}	Zero gate voltage drain current	$V_{DS} = 500\text{ V}; V_{GS} = 0\text{ V}; T_J = 125\text{ }^{\circ}\text{C}$	-	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	$V_{GS} = 10\text{ V}; I_D = 8\text{ A}$	-	0.5	0.6	Ω

DYNAMIC CHARACTERISTICS
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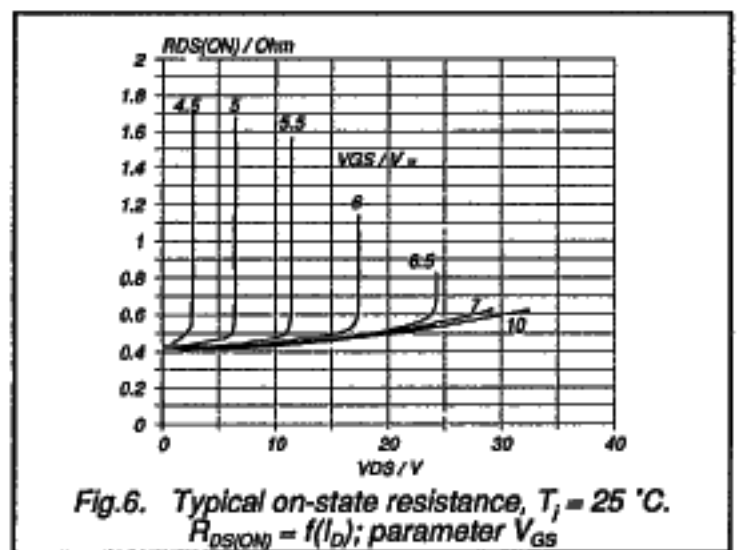
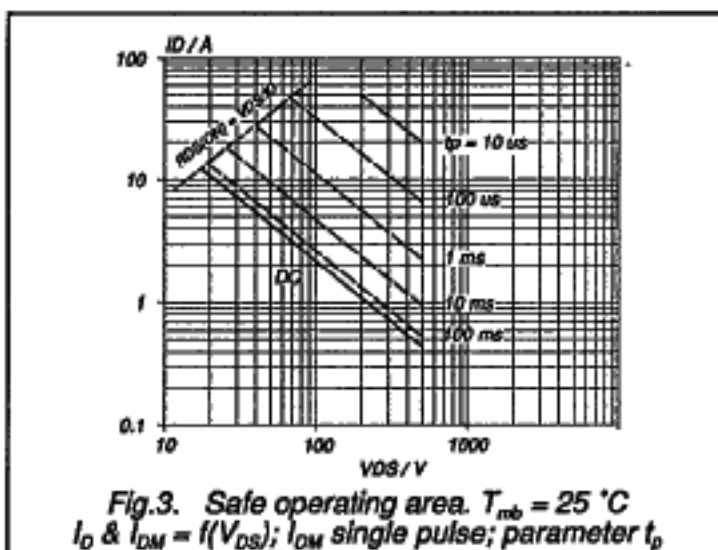
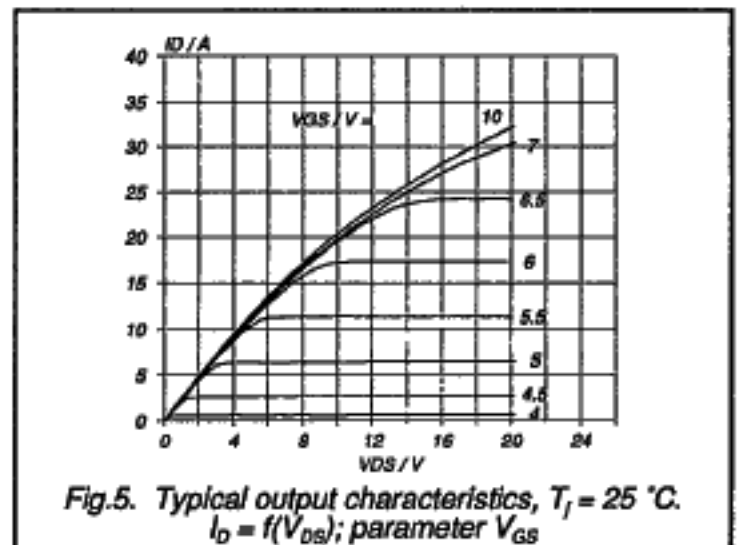
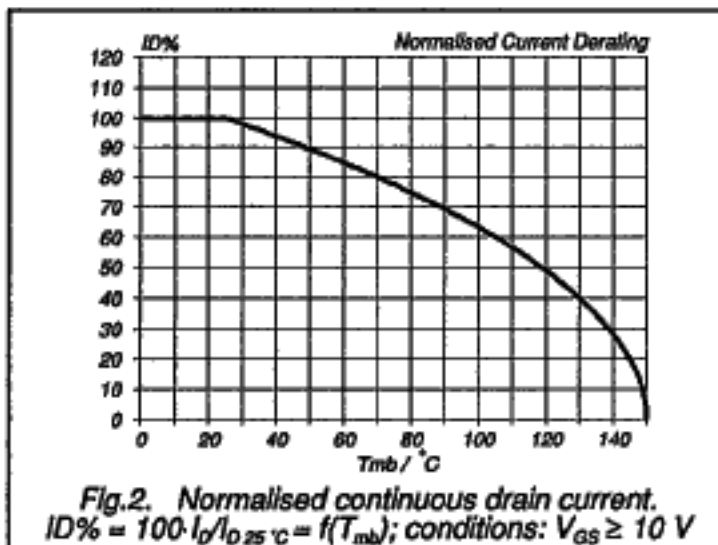
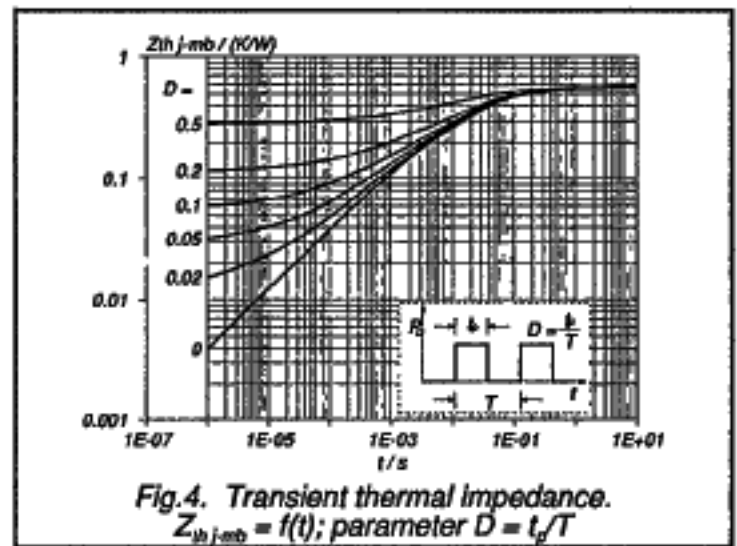
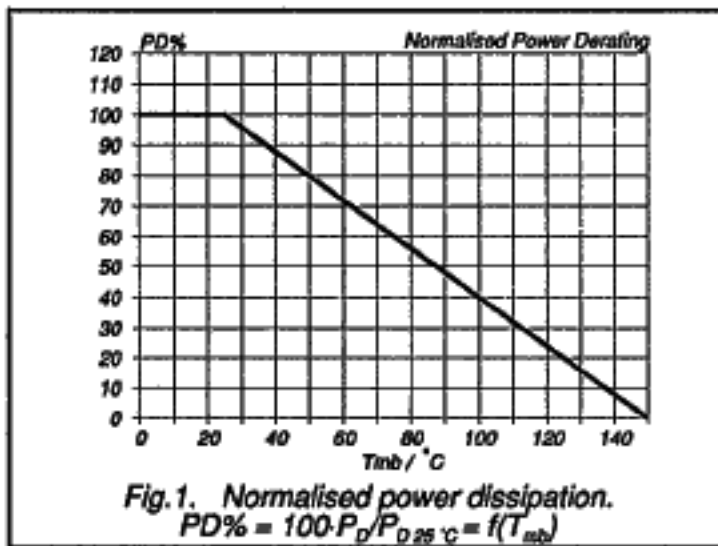
SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
g_{fs}	Forward transconductance	$V_{GS} = 25\text{ V}; I_D = 8\text{ A}$	5.0	10.0	-	S
C_{iss}	Input capacitance	$V_{GS} = 0\text{ V}; V_{DS} = 25\text{ V}; f = 1\text{ MHz}$	-	2400	2800	pF
C_{oss}	Output capacitance		-	270	420	pF
C_{rss}	Feedback capacitance		-	110	200	pF
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 30\text{ V}; I_D = 2.8\text{ A};$ $V_{GS} = 10\text{ V}; R_{GS} = 50\text{ }\Omega;$ $R_{gen} = 50\text{ }\Omega$	-	30	60	ns
t_r	Turn-on rise time		-	90	130	ns
$t_{d(off)}$	Turn-off delay time		-	300	400	ns
t_f	Turn-off fall time		-	110	140	ns
L_D	Internal drain inductance	Measured from contact screw on tab to centre of die	-	5	-	nH
L_D	Internal drain inductance	Measured from drain lead 6 mm from package to centre of die	-	5	-	nH
L_S	Internal source inductance	Measured from source lead 6 mm from package to source bond pad	-	12.5	-	nH

REVERSE DIODE LIMITING VALUES AND CHARACTERISTICS
 $T_{mb} = 25\text{ }^{\circ}\text{C}$ unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{DR}	Continuous reverse drain current	-	-	-	14.6	A
I_{DRM}	Pulsed reverse drain current	-	-	-	58	A
V_{SD}	Diode forward voltage	$I_F = 14.6\text{ A}; V_{GS} = 0\text{ V}$	-	1.1	1.5	V
t_{rr}	Reverse recovery time	$I_F = 14.6\text{ A};$ $-di_F/dt =$ $100\text{ A}/\mu\text{s};$ $V_{GS} = 0\text{ V};$ $V_R = 100\text{ V}$	-	200	250	ns
Q_{rr}	Reverse recovery charge		$T_J = 25\text{ }^{\circ}\text{C}$ $T_J = 125\text{ }^{\circ}\text{C}$	-	250	350
I_{rrm}	Reverse recovery current	$T_J = 25\text{ }^{\circ}\text{C}$ $T_J = 125\text{ }^{\circ}\text{C}$	-	1.3	2.0	μC
			-	3.5	5.0	μC
			-	15	-	A

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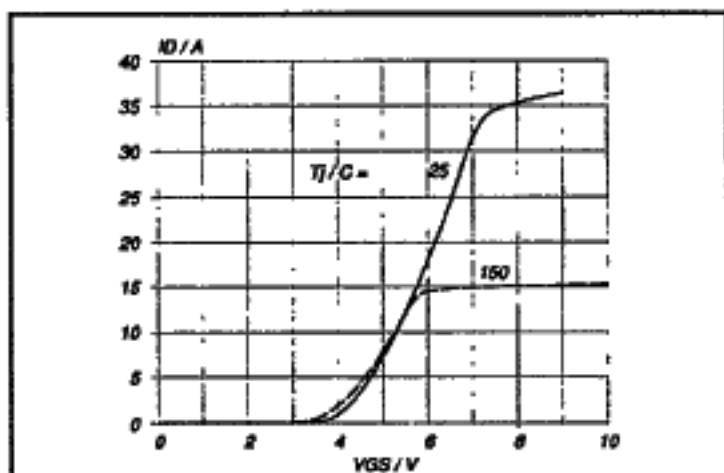


Fig. 7. Typical transfer characteristics.
 $I_D = f(V_{GS})$; conditions: $V_{DS} = 25\text{ V}$; parameter T_j

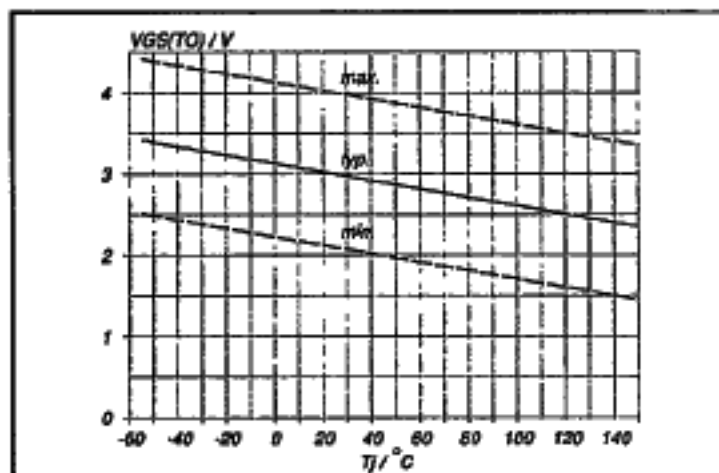


Fig. 10. Gate threshold voltage.
 $V_{GS(T0)} = f(T_j)$; conditions: $I_D = 1\text{ mA}$; $V_{DS} = V_{GS}$

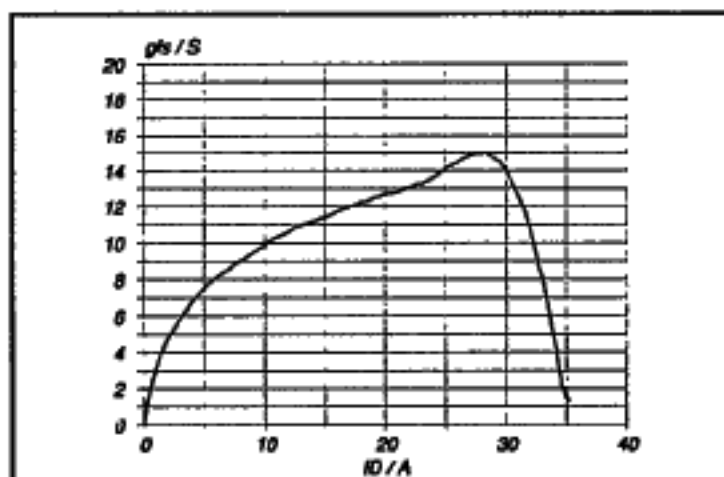


Fig. 8. Typical transconductance, $T_j = 25\text{ °C}$.
 $g_m = f(I_D)$; conditions: $V_{DS} = 25\text{ V}$

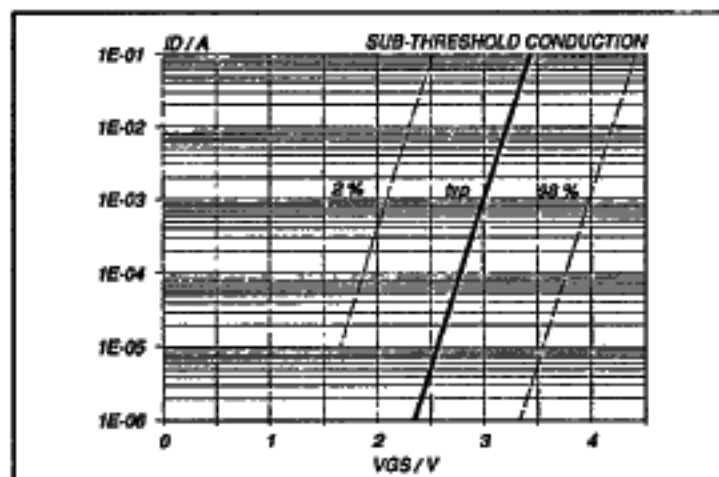


Fig. 11. Sub-threshold drain current.
 $I_D = f(V_{GS})$; conditions: $T_j = 25\text{ °C}$; $V_{DS} = V_{GS}$

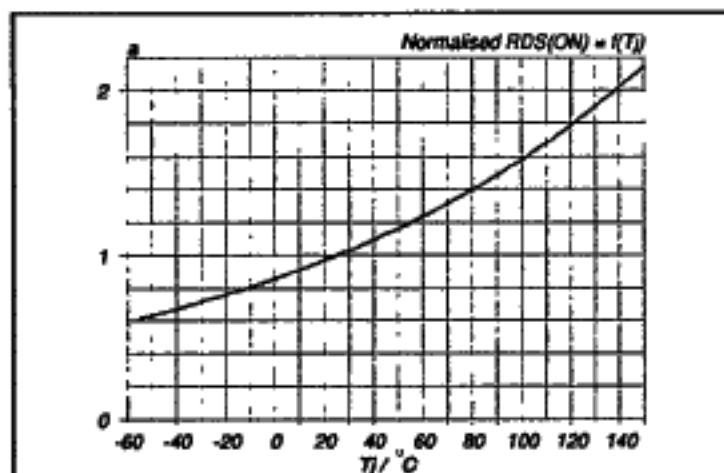


Fig. 9. Normalised drain-source on-state resistance.
 $a = R_{DS(ON)}/R_{DS(ON)25\text{ °C}} = f(T_j)$; $I_D = 8\text{ A}$; $V_{GS} = 10\text{ V}$

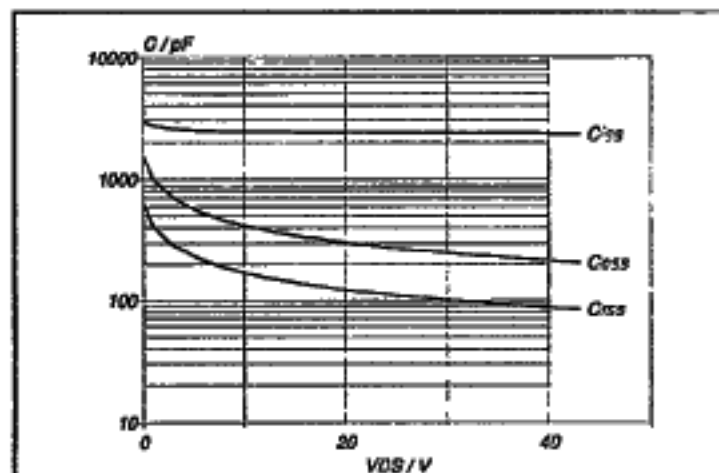


Fig. 12. Typical capacitances, C_{iss} , C_{oss} , C_{rss} .
 $C = f(V_{DS})$; conditions: $V_{GS} = 0\text{ V}$; $f = 1\text{ MHz}$

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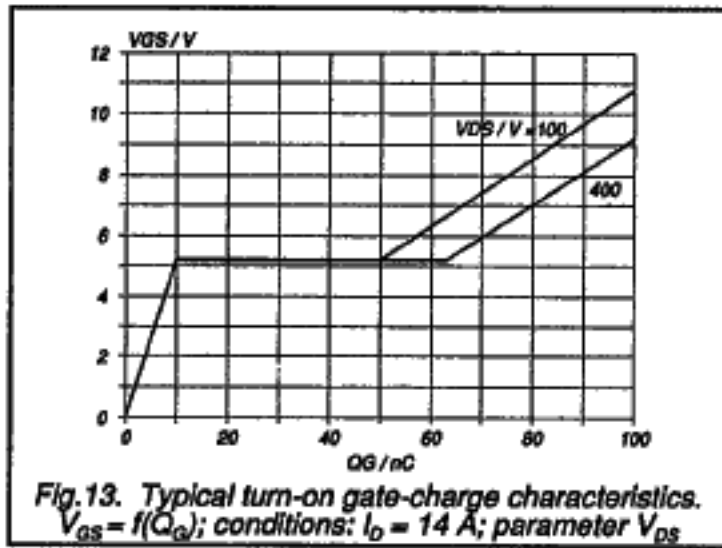


Fig. 13. Typical turn-on gate-charge characteristics.
 $V_{GS} = f(Q_G)$; conditions: $I_D = 14$ A; parameter V_{DS}

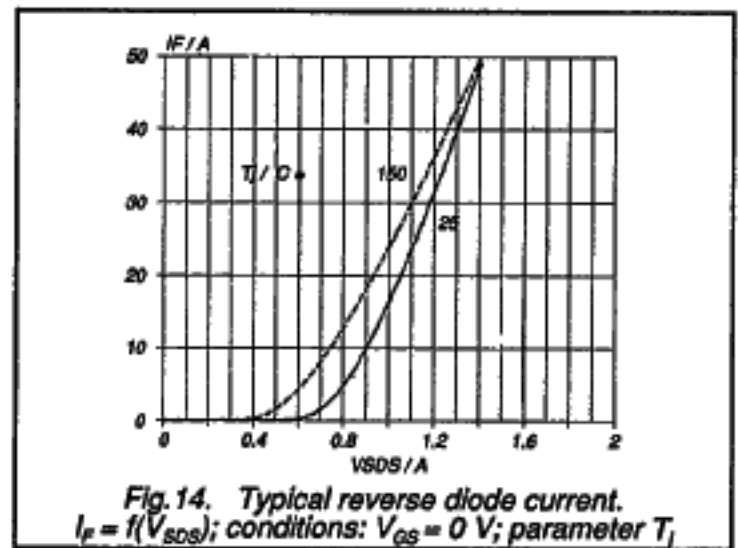


Fig. 14. Typical reverse diode current.
 $I_F = f(V_{SDS})$; conditions: $V_{GS} = 0$ V; parameter T_J