TrenchMOS™ transistor Logic level FET

BUK9840-55

GENERAL DESCRIPTION

N-channel enhancement mode logic level field-effect power transistor in a plastic envelope suitable for surface mounting. The device features very low on-state resistance and has integral zener diodes giving ESD protection. It is intended for use in automotive and general purpose switching applications.

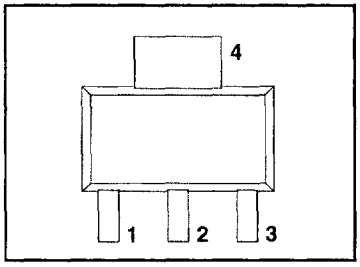
QUICK REFERENCE DATA

SYMBOL	PARAMETER	MAX.	UNIT
V_{DS}	Drain-source voltage	55	V
I_D	Drain current	10.7	A
P_{tot}	Total power dissipation	1.8	W
T_j	Junction temperature	150	°C
$R_{DS(ON)}$	Drain-source on-state resistance V_{GS} = 5 V	40	mΩ

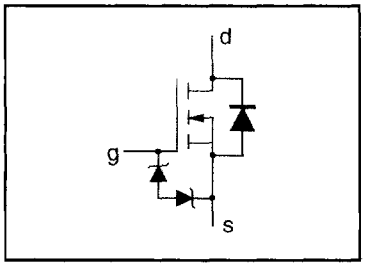
PINNING - SOT223

PIN	DESCRIPTION
1	gate
2	drain
3	source
4	drain (tab)

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	-	-	55	V
V_{DGR}	Drain-gate voltage	R_{GS} = 20 kΩ	-	55	V
$\pm V_{GS}$	Gate-source voltage	-	-	10	V
I_D	Drain current (DC)	T_{sp} = 25 °C	-	10.7	A
I_D	Drain current (DC)	On PCB in Fig.19 T_{amb} = 25 °C	-	5	A
I_D	Drain current (DC)	On PCB in Fig.19 T_{amb} = 100 °C	-	3.1	A
I_{DM}	Drain current (pulse peak value)	T_{sp} = 25 °C	-	40	A
P_{tot}	Total power dissipation	T_{sp} = 25 °C	-	8.3	W
P_{tot}	Total power dissipation	On PCB in Fig.19 T_{amb} = 25 °C	-	1.8	W
T_{stg}, T_j	Storage & operating temperature	-	- 55	150	°C

ESD LIMITING VALUE

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_C	Electrostatic discharge capacitor voltage	Human body model (100 pF, 1.5 kΩ)	-	2	kV

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j\text{-}sp}$	From junction to solder point	Mounted on any PCB	12	15	K/W
$R_{th\ j\text{-}amb}$	From junction to ambient	Mounted on PCB of Fig.18	-	70	K/W

STATIC CHARACTERISTICS

T_j= 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	55	-	-	V
		T_j = -55˚C	50	-	-	V
$V_{GS(TO)}$	Gate threshold voltage	V_{DS} = V_{GS}; I_D = 1 mA	1.0	1.5	2.0	V
		T_j = 150˚C	0.6	-	-	V
		T_j = -55˚C	-	-	2.3	V
I_{DSS}	Zero gate voltage drain current	V_{DS} = 55 V; V_{GS} = 0 V;	-	0.05	10	µA
		T_j = 150˚C	-	-	100	µA
I_{GSS}	Gate source leakage current	V_{GS} = ±5 V	-	0.02	1	µA
		T_j = 150˚C	-	-	5	µA
$\pm V_{(BR)GSS}$	Gate source breakdown voltage	I_G = ±1 mA	10	-	-	V
$R_{DS(ON)}$	Drain-source on-state resistance	V_{GS} = 5 V; I_D = 5 A	-	30	40	mΩ
		T_j = 150˚C	-	-	74	mΩ

DYNAMIC CHARACTERISTICS

T_{mb} = 25˚C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
g_{fs}	Forward transconductance	V_{DS} = 25 V; I_D = 5 A; T_j = 25˚C	11	19	-	S
C_{iss}	Input capacitance	V_{GS} = 0 V; V_{DS} = 25 V; f = 1 MHz	-	1050	1400	pF
C_{oss}	Output capacitance		-	205	245	pF
C_{rss}	Feedback capacitance		-	110	150	pF
$t_{d\ on}$	Turn-on delay time	V_{DD} = 30 V; I_D = 9 A;	-	17	25	ns
t_r	Turn-on rise time	V_{GS} = 5 V; R_G = 10 Ω;	-	65	100	ns
$t_{d\ off}$	Turn-off delay time		-	70	105	ns
t_f	Turn-off fall time	T_j = 25˚C	-	70	105	ns

REVERSE DIODE LIMITING VALUES AND CHARACTERISTICS

T_j = -55 to 175˚C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{DR}	Continuous reverse drain current	T_{sp} = 25˚C	-	-	10.7	A
I_{DRM}	Pulsed reverse drain current	T_{sp} = 25˚C	-	-	40	A
V_{SD}	Diode forward voltage	I_F = 5 A; V_{GS} = 0 V	-	0.85	1.1	V
t_{rr}	Reverse recovery time	I_F = 5 A; -dI_F/dt = 100 A/µs;	-	45	-	ns
Q_{rr}	Reverse recovery charge	V_{GS} = -10 V; V_R = 30 V	-	.3	-	µC

AVALANCHE LIMITING VALUE

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
W_{DSS}	Drain-source non-repetitive unclamped inductive turn-off energy	I_D = 3.6 A; $V_{DD} \leq$ 25 V; V_{GS} = 5 V; R_{GS} = 50 Ω; T_{sp} = 25 °C	-	-	60	mJ

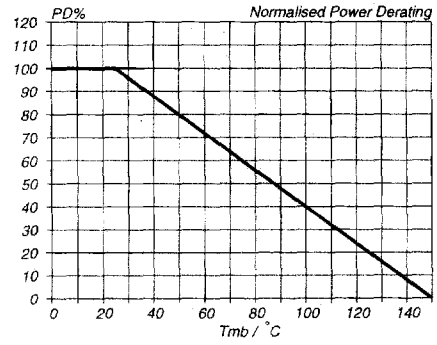


Fig.1. Normalised power dissipation.
PD% = 100·P_D/$P_{D\ 25\ °C}$ = f(T_{sp})

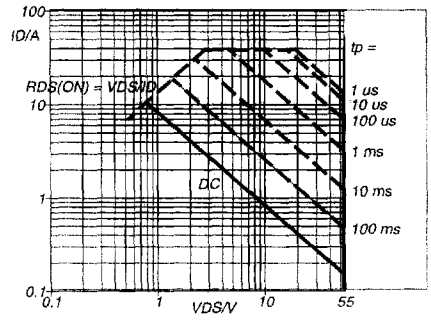


Fig.3. Safe operating area. T_{sp} = 25 °C
I_D & I_{DM} = f(V_{DS}); I_{DM} single pulse; parameter t_p

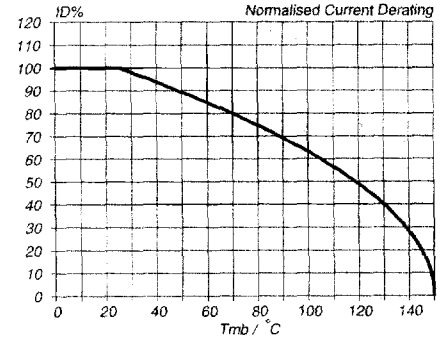


Fig.2. Normalised continuous drain current.
ID% = 100·I_D/$I_{D\ 25\ °C}$ = f(T_{sp}); conditions: $V_{GS} \geq$ 5 V

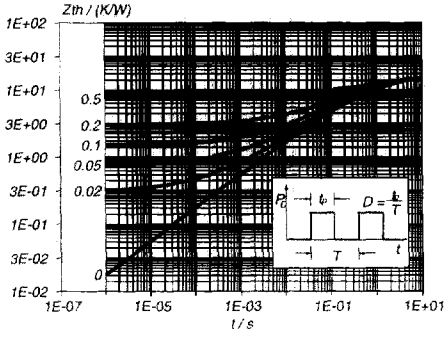


Fig.4. Transient thermal impedance.
$Z_{th\ j\text{-}sp}$ = f(t); parameter D = t_p/T

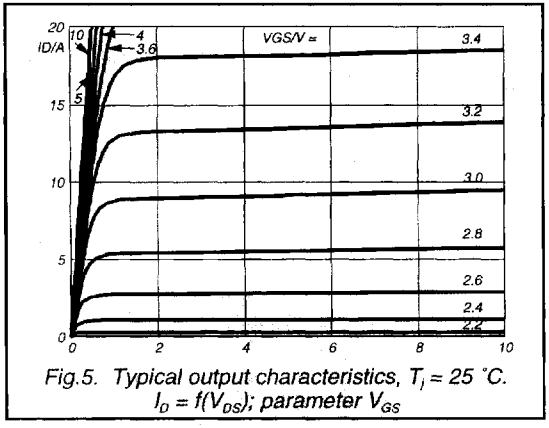


Fig.5. Typical output characteristics, T_j = 25 °C. $I_D = f(V_{DS})$; parameter V_{GS}

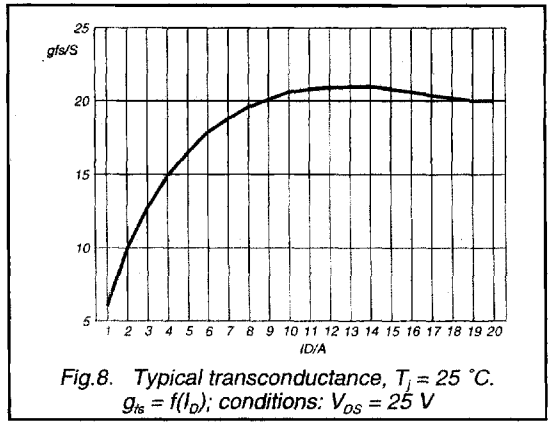


Fig.8. Typical transconductance, T_j = 25 °C. $g_{fs} = f(I_D)$; conditions: V_{DS} = 25 V

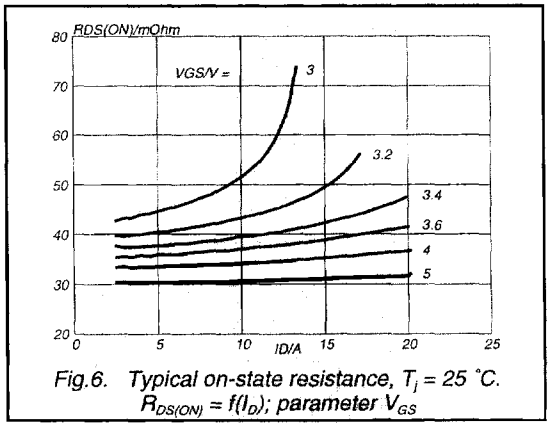


Fig.6. Typical on-state resistance, T_j = 25 °C. $R_{DS(ON)} = f(I_D)$; parameter V_{GS}

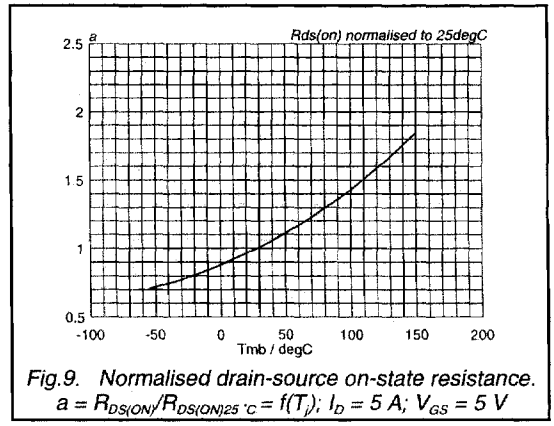


Fig.9. Normalised drain-source on-state resistance. $a = R_{DS(ON)}/R_{DS(ON)25\,°C} = f(T_j)$; I_D = 5 A; V_{GS} = 5 V

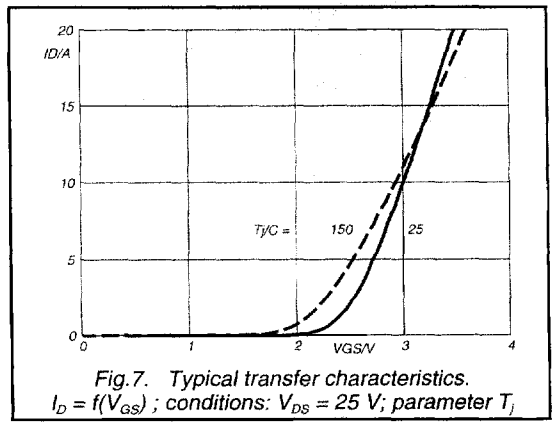


Fig.7. Typical transfer characteristics. $I_D = f(V_{GS})$; conditions: V_{DS} = 25 V; parameter T_j

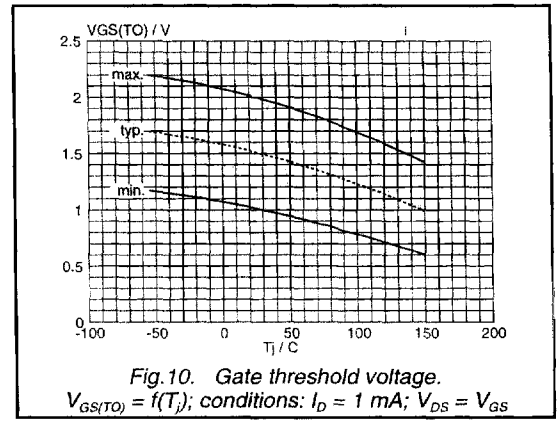


Fig.10. Gate threshold voltage. $V_{GS(TO)} = f(T_j)$; conditions: I_D = 1 mA; $V_{DS} = V_{GS}$

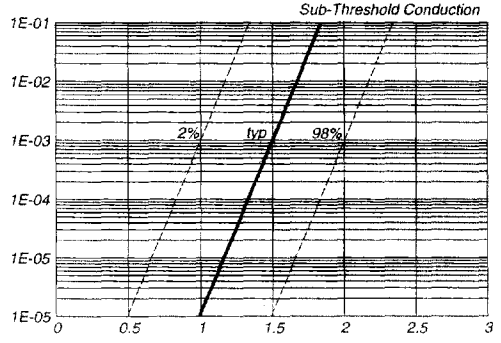


Fig.11. Sub-threshold drain current.
$I_D = f(V_{GS})$; conditions: $T_j = 25$ °C; $V_{DS} = V_{GS}$

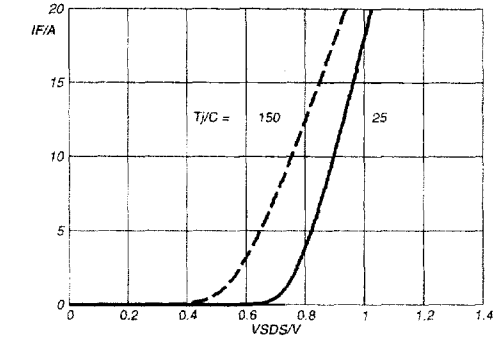


Fig.14. Typical reverse diode current.
$I_F = f(V_{SDS})$; conditions: $V_{GS} = 0$ V; parameter T_j

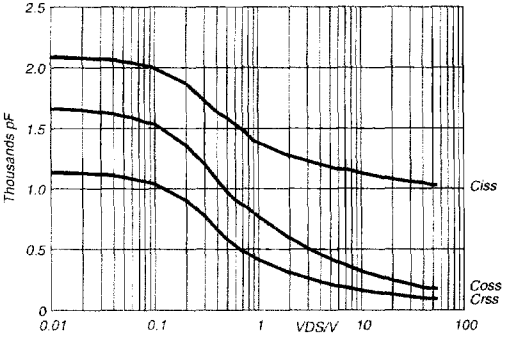


Fig.12. Typical capacitances, C_{iss}, C_{oss}, C_{rss}.
$C = f(V_{DS})$; conditions: $V_{GS} = 0$ V; $f = 1$ MHz

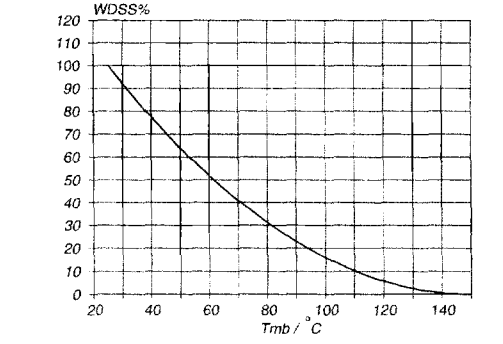


Fig.15. Normalised avalanche energy rating.
$W_{DSS}\% = f(T_{sp})$; conditions: $I_D = 3.6$ A

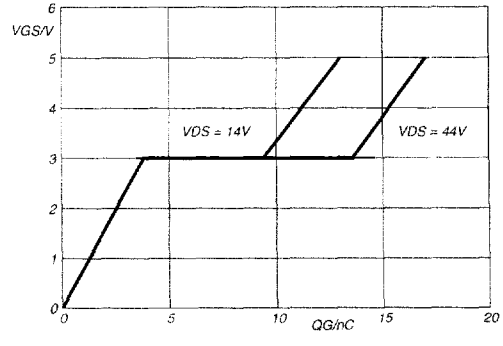


Fig.13. Typical turn-on gate-charge characteristics.
$V_{GS} = f(Q_G)$; conditions: $I_D = 9$ A; parameter V_{DS}

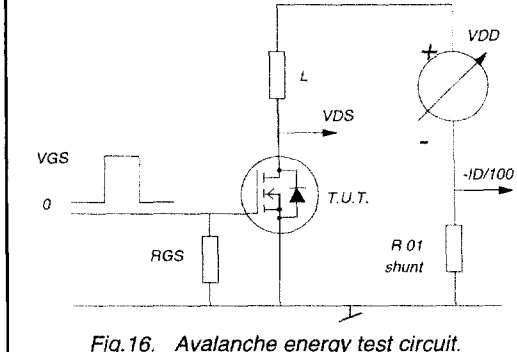


Fig.16. Avalanche energy test circuit.
$W_{DSS} = 0.5 \cdot LI_D^2 \cdot BV_{DSS}/(BV_{DSS} - V_{DD})$

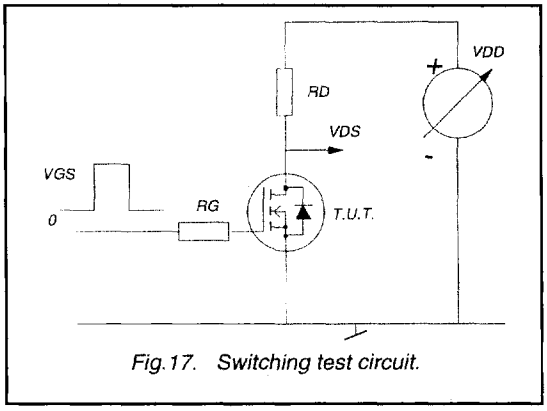


Fig.17. Switching test circuit.

PRINTED CIRCUIT BOARD

Dimensions in mm.

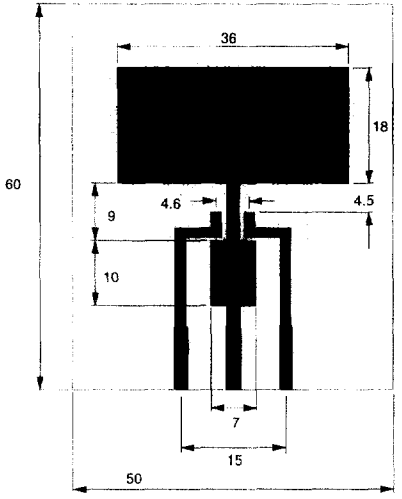


Fig.18. PCB for thermal resistance and power rating for SOT223.
PCB: FR4 epoxy glass (1.6 mm thick), copper laminate (35 μm thick).