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**PowerMOS transistor  
Logic level TOPFET**

**BUK127-50GT**

**DESCRIPTION**

Monolithic temperature and overload protected logic level power MOSFET in **TOPFET2** technology assembled in a 3 pin surface mount plastic package.

**APPLICATIONS**

General purpose switch for driving

- lamps
- motors
- solenoids
- heaters

in automotive systems and other applications.

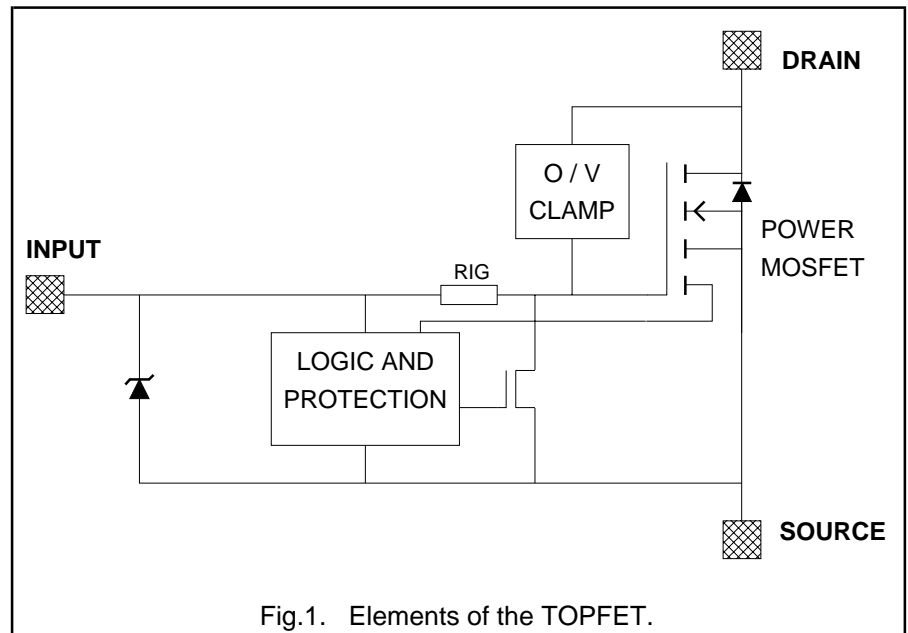
**FEATURES**

- TrenchMOS output stage
- Current trip protection
- Overload protection
- Overtemperature protection
- Protection latched reset by input
- 5 V logic compatible input level
- Control of output stage and supply of overload protection circuits derived from input
- Low operating input current permits direct drive by micro-controller
- ESD protection on all pins
- Overvoltage clamping for turn off of inductive loads

**QUICK REFERENCE DATA**

SYMBOL	PARAMETER	MAX.	UNIT
$V_{DS}$	Continuous drain source voltage	50	V
$I_D$	Continuous drain current	2.1	A
$P_D$	Total power dissipation	1.8	W
$T_j$	Continuous junction temperature	150	°C
$R_{DS(ON)}$	Drain-source on-state resistance	200	mΩ

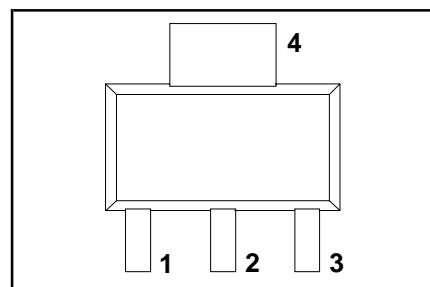
**FUNCTIONAL BLOCK DIAGRAM**



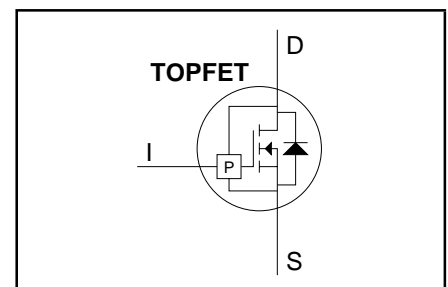
**PINNING - SOT223**

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

**PIN CONFIGURATION**



**SYMBOL**



# PowerMOS transistor

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### LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$V_{DS}$	Continuous drain source voltage <sup>1</sup>	-	-	50	V
$I_D$	Drain current <sup>2</sup>	-	-	current trip	A
$I_D$	Continuous drain current	$T_a = 25^\circ\text{C}$	-	2.1	A
$I_I$	Continuous input current	clamping	-	3	mA
$I_{IRM}$	Non-repetitive peak input current	$t_p \leq 1 \text{ ms}$	-	10	mA
$P_D$	Total power dissipation	$T_a = 25^\circ\text{C}$	-	1.8	W
$T_{stg}$	Storage temperature	-	-55	150	$^\circ\text{C}$
$T_j$	Continuous junction temperature	normal operation <sup>3</sup>	-	150	$^\circ\text{C}$

### ESD LIMITING VALUE

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$V_C$	Electrostatic discharge capacitor voltage	Human body model; $C = 250 \text{ pF}$ ; $R = 1.5 \text{ k}\Omega$	-	2	kV

### OVERVOLTAGE CLAMPING LIMITING VALUES

At a drain source voltage above 50 V the power MOSFET is actively turned on to clamp overvoltage transients.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$E_{DSM}$	Non-repetitive clamping energy	$T_a \leq 25^\circ\text{C}$ ; $I_{DM} \leq I_{D(TO)}$ ; inductive load	-	100	mJ
$E_{DRM}$	Repetitive clamping energy	$T_{sp} \leq 125^\circ\text{C}$ ; $I_{DM} = 1 \text{ A}$ ; $f = 250 \text{ Hz}$	-	5	mJ

### OVERLOAD PROTECTION LIMITING VALUES

With the protection supply provided via the input pin, TOPFET can protect itself from short circuit loads. Overload protection operates by means of drain current trip or by activating the overtemperature protection.

SYMBOL	PARAMETER	REQUIRED CONDITION	MIN.	MAX.	UNIT
$V_{DDP}$	Protected drain source supply voltage	$V_{IS} \geq 4 \text{ V}$	-	35	V

### THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$R_{th\ j-sp}$	<b>Thermal resistance</b> Junction to solder point		-	12	18	K/W
$R_{th\ j-b}$	Junction to board <sup>4</sup>	Mounted on any PCB	-	40	-	K/W
$R_{th\ j-a}$	Junction to ambient	Mounted on PCB of fig. 4	-	-	70	K/W

<sup>1</sup> Prior to the onset of overvoltage clamping. For voltages above this value, safe operation is limited by the overvoltage clamping energy.

<sup>2</sup> Refer to OVERLOAD PROTECTION CHARACTERISTICS.

<sup>3</sup> **Not** in an overload condition with drain current limiting.

<sup>4</sup> Temperature measured 1.3 mm from tab.

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### OUTPUT CHARACTERISTICS

Limits are for  $-40^{\circ}\text{C} \leq T_{\text{mb}} \leq 150^{\circ}\text{C}$ ; typicals are for  $T_{\text{mb}} = 25^{\circ}\text{C}$  unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(\text{CL})\text{DSS}}$	Off-state Drain-source clamping voltage	$V_{\text{IS}} = 0\text{ V}$	50	-	-	V
		$I_{\text{D}} = 10\text{ mA}$ $I_{\text{D}} = 200\text{ mA}; t_{\text{p}} \leq 300\text{ }\mu\text{s}; \delta \leq 0.01$	50	60	70	V
$I_{\text{DSS}}$	Drain source leakage current	$V_{\text{DS}} = 40\text{ V}$	-	-	100	$\mu\text{A}$
		$T_{\text{mb}} = 25^{\circ}\text{C}$	-	0.1	10	$\mu\text{A}$
$R_{\text{DS(ON)}}$	On-state Drain-source resistance	$V_{\text{IS}} \geq 4\text{ V}; t_{\text{p}} \leq 300\text{ }\mu\text{s}; \delta \leq 0.01$	-	-	380	$\text{m}\Omega$
		$I_{\text{D}} = 100\text{ mA}$ $T_{\text{mb}} = 25^{\circ}\text{C}$	-	150	200	$\text{m}\Omega$

### INPUT CHARACTERISTICS

The supply for the logic and overload protection is taken from the input.

Limits are for  $-40^{\circ}\text{C} \leq T_{\text{mb}} \leq 150^{\circ}\text{C}$ ; typicals are for  $T_{\text{mb}} = 25^{\circ}\text{C}$  unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT	
$V_{\text{IS(TO)}}$	Input threshold voltage	$V_{\text{DS}} = 5\text{ V}; I_{\text{D}} = 1\text{ mA}$	0.6	-	2.4	V	
		$T_{\text{mb}} = 25^{\circ}\text{C}$	1.1	1.6	2.1	V	
$I_{\text{IS}}$	Input supply current	normal operation;	$V_{\text{IS}} = 5\text{ V}$	100	220	400	$\mu\text{A}$
			$V_{\text{IS}} = 4\text{ V}$	80	195	330	$\mu\text{A}$
$I_{\text{ISL}}$	Input supply current	protection latched;	$V_{\text{IS}} = 5\text{ V}$	1.4	2	2.5	mA
			$V_{\text{IS}} = 3\text{ V}$	0.7	1.1	1.5	mA
$V_{\text{ISR}}$	Protection reset voltage <sup>1</sup>	reset time $t_{\text{r}} \geq 100\text{ }\mu\text{s}$	1.5	2	2.5	V	
$t_{\text{r}}$	Latch reset time	$V_{\text{IS1}} = 5\text{ V}, V_{\text{IS2}} < 1\text{ V}$	10	40	100	$\mu\text{s}$	
$V_{(\text{CL})\text{IS}}$	Input clamping voltage	$I_{\text{I}} = 1.5\text{ mA}$	5.5	-	8.5	V	
$R_{\text{IG}}$	Input series resistance <sup>2</sup> to gate of power MOSFET	$T_{\text{mb}} = 25^{\circ}\text{C}$	-	2.5	-	k $\Omega$	

### OVERLOAD PROTECTION CHARACTERISTICS

TOPFET switches off to protect itself when one of the overload thresholds is exceeded. It remains latched off until reset by the input.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$I_{\text{D(TO)}}$	Overload protection Drain current trip threshold	$V_{\text{IS}} = 4\text{ V to }5.5\text{ V}$	4	-	8	A
		$T_{\text{J}} = 25^{\circ}\text{C}$ $-40^{\circ}\text{C} \leq T_{\text{J}} \leq 150^{\circ}\text{C}$	3	-	9	A
$T_{\text{J(TO)}}$	Overtemperature protection Threshold junction temperature	$V_{\text{IS}} = 4\text{ V to }5.5\text{ V}$	150	170	-	$^{\circ}\text{C}$

<sup>1</sup> The input voltage below which the overload protection circuits will be reset.

<sup>2</sup> Not directly measurable from device terminals.

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**SWITCHING CHARACTERISTICS**
 $T_a = 25\text{ °C}$ ; resistive load  $R_L = 50\ \Omega$ ; adjust  $V_{DD}$  to obtain  $I_D = 250\text{ mA}$ ; refer to test circuit and waveforms

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$t_{d\ on}$	Turn-on delay time	$V_{IS} = 0\text{ V to }V_{IS} = 5\text{ V}$	-	0.5	0.9	$\mu\text{s}$
$t_r$	Rise time		-	0.7	1.5	$\mu\text{s}$
$t_{d\ off}$	Turn-off delay time	$V_{IS} = 5\text{ V to }V_{IS} = 0\text{ V}$	-	3.2	6.5	$\mu\text{s}$
$t_f$	Fall time		-	1.6	3.5	$\mu\text{s}$

**REVERSE DIODE LIMITING VALUE**

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$I_S$	Continuous forward current	$T_{mb} \leq 25\text{ °C}; V_{IS} = 0\text{ V}$	-	2	A

**REVERSE DIODE CHARACTERISTICS**

Limits are for  $-40\text{ °C} \leq T_{mb} \leq 150\text{ °C}$ ; typicals are for  $T_{mb} = 25\text{ °C}$  unless otherwise specified

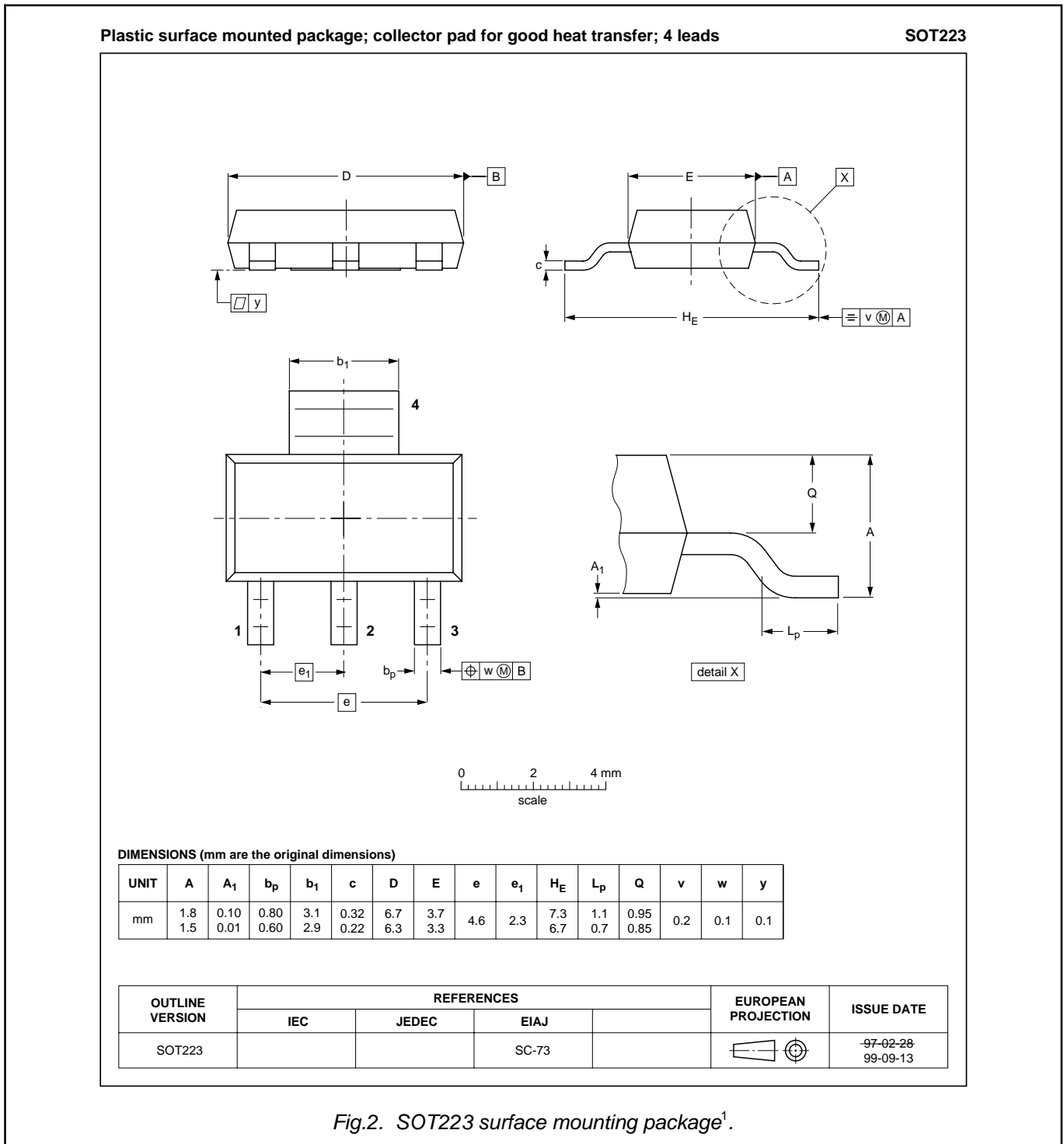
SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{SDO}$	Forward voltage	$I_S = 2\text{ A}; V_{IS} = 0\text{ V}; t_p = 300\ \mu\text{s}$	-	0.83	1.1	V
$t_{rr}$	Reverse recovery time	not applicable <sup>1</sup>	-	-	-	-

<sup>1</sup> The reverse diode of this type is not intended for applications requiring fast reverse recovery.

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MECHANICAL DATA

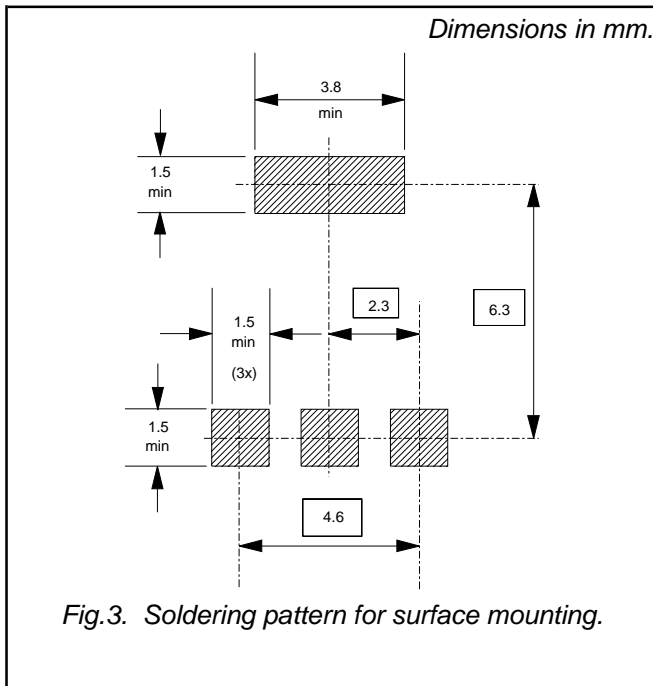


<sup>1</sup> For further information, refer to surface mounting instructions for SOT223 envelope. Epoxy meets UL94 V0 at 1/8". Net Mass: 0.11 g

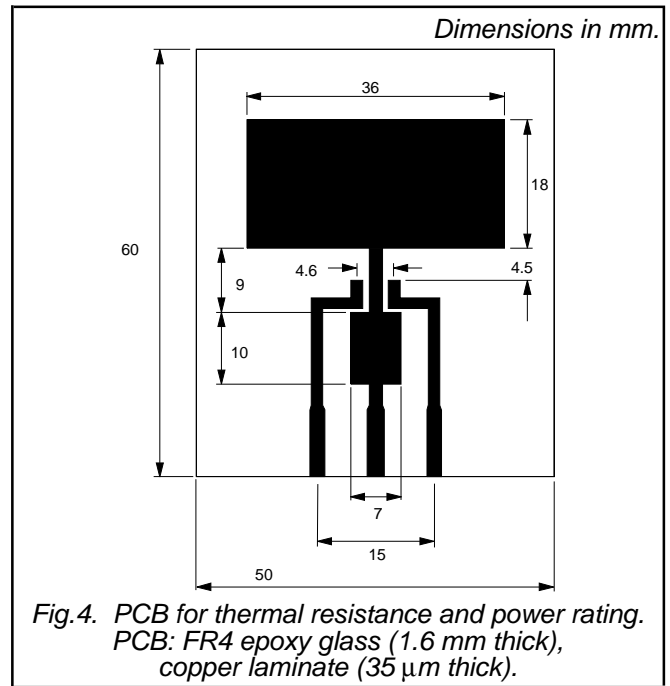
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**MOUNTING INSTRUCTIONS**



**PRINTED CIRCUIT BOARD**



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**PowerMOS transistor**  
**Logic level TOPFET**


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**BUK127-50GT****DEFINITIONS**

<b>DATA SHEET STATUS</b>		
<b>DATA SHEET STATUS<sup>1</sup></b>	<b>PRODUCT STATUS<sup>2</sup></b>	<b>DEFINITIONS</b>
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<b>Application information</b>		
Where application information is given, it is advisory and does not form part of the specification.		
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