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

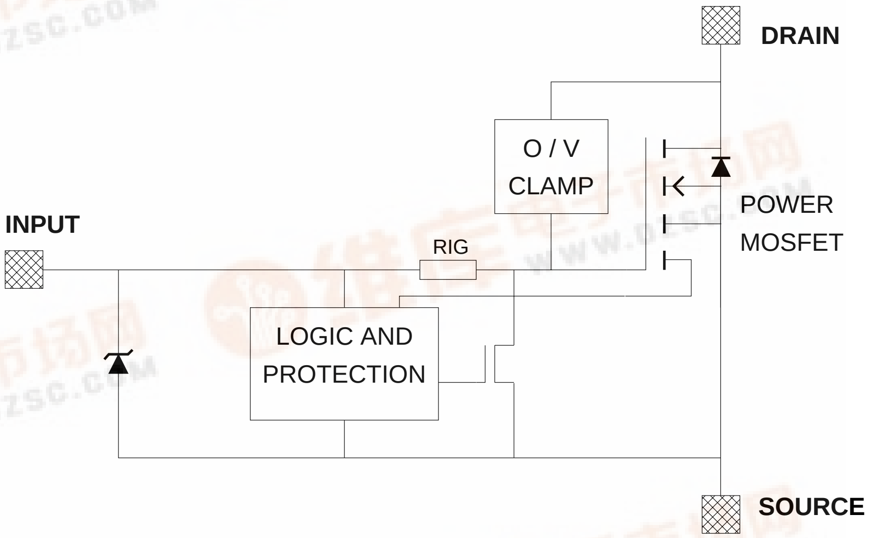
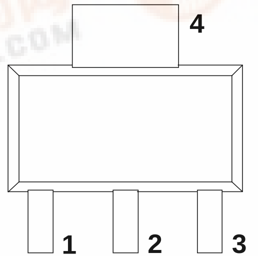


Fig.1. Elements of the TOPFET.

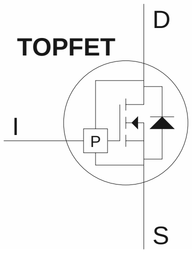
PINNING - SOT223

PIN	DESCRIPTION
1	input
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}	Continuous drain source voltage[1]	-	-	50	V
I_D	Drain current[2]	-	-	current trip	A
I_D	Continuous drain current	$T_a = 25˚C$	-	2.1	A
I_I	Continuous input current	clamping	-	3	mA
I_{IRM}	Non-repetitive peak input current	$t_p \leq 1$ ms	-	10	mA
P_D	Total power dissipation	$T_a = 25$ ˚C	-	1.8	W
T_{stg}	Storage temperature	-	-55	150	˚C
T_j	Continuous junction temperature	normal operation[3]	-	150	˚C

ESD LIMITING VALUE

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_C	Electrostatic discharge capacitor voltage	Human body model; C = 250 pF; R = 1.5 kΩ	-	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	$T_a \leq 25$ ˚C; $I_{DM} \leq I_{D(TO)}$; inductive load	-	100	mJ
E_{DRM}	Repetitive clamping energy	$T_{sp} \leq 125$ ˚C; $I_{DM} = 1$ A; f = 250 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	$V_{IS} \geq 4$ V	-	35	V

THERMAL CHARACTERISTICS

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

---

[1] Prior to the onset of overvoltage clamping. For voltages above this value, safe operation is limited by the overvoltage clamping energy.

[2] Refer to OVERLOAD PROTECTION CHARACTERISTICS.

[3] **Not** in an overload condition with drain current limiting.

[4] Temperature measured 1.3 mm from tab.

OUTPUT CHARACTERISTICS

Limits are for -40˚C ≤ T_{mb} ≤ 150˚C; typicals are for T_{mb} = 25 ˚C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
	Off-state	V_{IS} = 0 V				
$V_{(CL)DSS}$	Drain-source clamping voltage	I_D = 10 mA	50	-	-	V
		I_D = 200 mA; t_p ≤ 300 µs; δ ≤ 0.01	50	60	70	V
I_{DSS}	Drain source leakage current	V_{DS} = 40 V	-	-	100	µA
		T_{mb} = 25 ˚C	-	0.1	10	µA
	On-state	V_{IS} ≥ 4 V; t_p ≤ 300 µs; δ ≤ 0.01				
$R_{DS(ON)}$	Drain-source resistance	I_D = 100 mA	-	-	380	mΩ
		T_{mb} = 25 ˚C	-	150	200	mΩ

INPUT CHARACTERISTICS

The supply for the logic and overload protection is taken from the input.
Limits are for -40˚C ≤ T_{mb} ≤ 150˚C; typicals are for T_{mb} = 25˚C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{IS(TO)}$	Input threshold voltage	V_{DS} = 5 V; I_D = 1 mA	0.6	-	2.4	V
		T_{mb} = 25˚C	1.1	1.6	2.1	V
I_{IS}	Input supply current	normal operation; V_{IS} = 5 V	100	220	400	µA
		V_{IS} = 4 V	80	195	330	µA
I_{ISL}	Input supply current	protection latched; V_{IS} = 5 V	1.4	2	2.5	mA
		V_{IS} = 3 V	0.7	1.1	1.5	mA
V_{ISR}	Protection reset voltage[1]	reset time t_r ≥ 100 µs	1.5	2	2.5	V
t_{lr}	Latch reset time	V_{IS1} = 5 V, V_{IS2} < 1 V	10	40	100	µs
$V_{(CL)IS}$	Input clamping voltage	I_I = 1.5 mA	5.5	-	8.5	V
R_{IG}	Input series resistance[2] to gate of power MOSFET	T_{mb} = 25˚C	-	2.5	-	kΩ

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
	Overload protection	V_{IS} = 4 V to 5.5 V				
$I_{D(TO)}$	Drain current trip threshold	T_j = 25˚C	4	-	8	A
		-40˚C ≤ T_j ≤ 150˚C	3	-	9	A
	Overtemperature protection					
$T_{j(TO)}$	Threshold junction temperature	V_{IS} = 4 V to 5.5 V	150	170	-	˚C

---

[1] The input voltage below which the overload protection circuits will be reset.

[2] Not directly measureable from device terminals.

SWITCHING CHARACTERISTICS

T_a = 25 ˚C; resistive load R_L = 50 Ω; adjust V_{DD} to obtain I_D = 250 mA; refer to test circuit and waveforms

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

REVERSE DIODE LIMITING VALUE

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_S	Continuous forward current	T_{mb} ≤ 25 ˚C; V_{IS} = 0 V	-	2	A

REVERSE DIODE CHARACTERISTICS

Limits are for -40˚C ≤ T_{mb} ≤ 150˚C; typicals are for T_{mb} = 25˚C unless otherwise specified

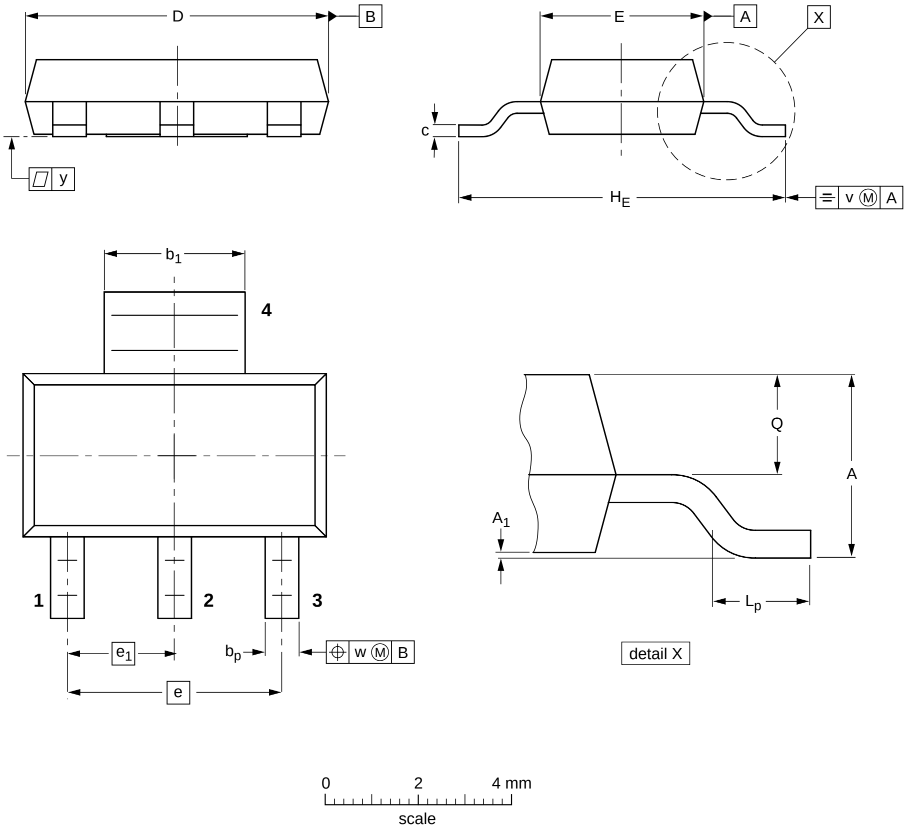
SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{SDO}	Forward voltage	I_S = 2 A; V_{IS} = 0 V; t_p = 300 µs	-	0.83	1.1	V
t_{rr}	Reverse recovery time	not applicable[1]	-	-	-	-

---

[1] The reverse diode of this type is not intended for applications requiring fast reverse recovery.

MECHANICAL DATA

Plastic surface mounted package; collector pad for good heat transfer; 4 leads **SOT223**



DIMENSIONS (mm are the original dimensions)

UNIT	A	A_1	b_p	b_1	c	D	E	e	e_1	H_E	L_p	Q	v	w	y
mm	1.8 1.5	0.10 0.01	0.80 0.60	3.1 2.9	0.32 0.22	6.7 6.3	3.7 3.3	4.6	2.3	7.3 6.7	1.1 0.7	0.95 0.85	0.2	0.1	0.1

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT223			SC-73			~~97-02-28~~ 99-09-13

Fig.2. SOT223 surface mounting package[1].

---

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

MOUNTING INSTRUCTIONS

Dimensions in mm.

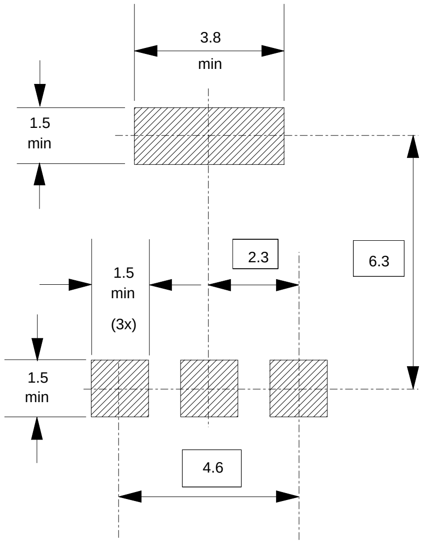


Fig.3. Soldering pattern for surface mounting.

PRINTED CIRCUIT BOARD

Dimensions in mm.

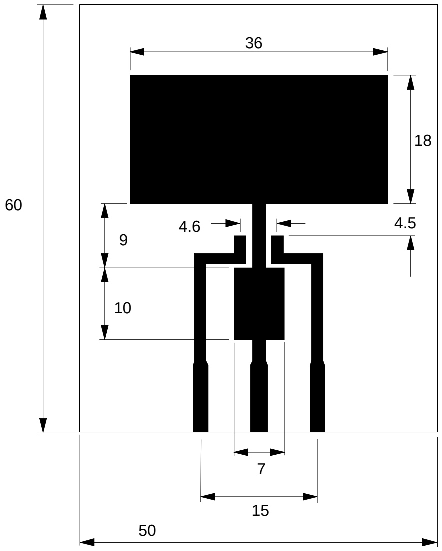


Fig.4. PCB for thermal resistance and power rating.
PCB: FR4 epoxy glass (1.6 mm thick),
copper laminate (35 µm thick).

DEFINITIONS

DATA SHEET STATUS		
DATA SHEET STATUS[1]	**PRODUCT STATUS**[2]	**DEFINITIONS**
Objective data	Development	This data sheet contains data from the objective specification for product development. Philips Semiconductors reserves the right to change the specification in any manner without notice
Preliminary data	Qualification	This data sheet contains data from the preliminary specification. Supplementary data will be published at a later date. Philips Semiconductors reserves the right to change the specification without notice, in order to improve the design and supply the best possible product
Product data	Production	This data sheet contains data from the product specification. Philips Semiconductors reserves the right to make changes at any time in order to improve the design, manufacturing and supply. Changes will be communicated according to the Customer Product/Process Change Notification (CPCN) procedure SNW-SQ-650A

Limiting values

Limiting values are given in accordance with the Absolute Maximum Rating System (IEC 134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of this specification is not implied. Exposure to limiting values for extended periods may affect device reliability.

Application information

Where application information is given, it is advisory and does not form part of the specification.

LIFE SUPPORT APPLICATIONS

These products are not designed for use in life support appliances, devices or systems where malfunction of these products can be reasonably expected to result in personal injury. Philips customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Philips for any damages resulting from such improper use or sale.

---

[1] Please consult the most recently issued datasheet before initiating or completing a design.

[2] The product status of the device(s) described in this datasheet may have changed since this datasheet was published. The latest information is available on the Internet at URL http://www.semiconductors.philips.com.