# **BUK149-50DL**

#### **DESCRIPTION**

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

#### **APPLICATIONS**

General purpose switch for driving

- lamps
- motors
- solenoids
- heaters

in automotive systems and other applications.

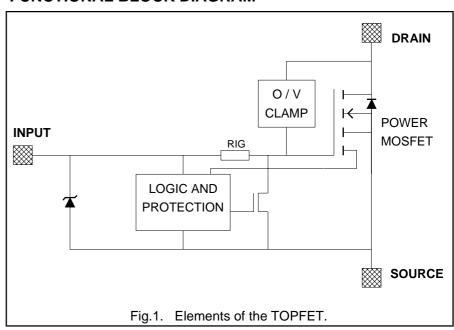
#### **FEATURES**

- TrenchMOS output stage
- **Current limiting**
- 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
$V_{DS} \\ I_{D} \\ P_{D} \\ T_{j} \\ R_{DS(ON)}$	Continuous drain source voltage Continuous drain current Total power dissipation Continuous junction temperature Drain-source on-state resistance	50 16 65 150 50	V A W °C mΩ
I <sub>ISL</sub>	Input supply current V <sub>IS</sub> = 5 V	650	μА

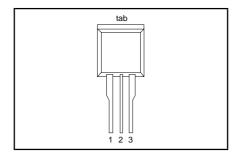
# **FUNCTIONAL BLOCK DIAGRAM**



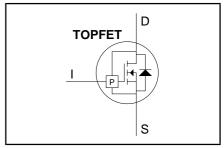
#### **PINNING - SOT226**

PIN	DESCRIPTION
1	input
2	drain
3	source
tab	drain

# PIN CONFIGURATION



#### **SYMBOL**



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#### LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V <sub>DS</sub>	Continuous drain source voltage <sup>1</sup>	-	-	50	V
I <sub>D</sub>	Continuous drain current	$V_{IS} = 5 \text{ V}; T_{mb} = 25 \text{ °C}$	-	self -	Α
				limited	
I <sub>D</sub>	Continuous drain current	$V_{IS} = 5 \text{ V}; T_{mb} \le 125 \text{ °C}$	-	16	Α
I <sub>1</sub>	Continuous input current	-	-5	5	mA
I <sub>IRM</sub>	Non-repetitive peak input current	$t_p \le 1 \text{ ms}$ $T_{mb} \le 25 \text{ °C}$	-10	10	mA
P <sub>D</sub>	Total power dissipation	T <sub>mb</sub> ≤ 25 °C	-	65	W
T <sub>stg</sub>	Storage temperature	-	-55	175	°C
T <sub>j</sub>	Continuous junction temperature <sup>2</sup>	normal operation	-	150	°C
T <sub>sold</sub>	Case temperature	during soldering	-	260	°C

#### **ESD LIMITING VALUE**

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V <sub>c</sub>	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 <sub>DSM</sub>	Inductive load turn-off Non-repetitive clamping energy Repetitive clamping energy	$I_{DM} = 16 \text{ A}; V_{DD} \le 20 \text{ V}$ $T_{mb} \le 25 \text{ °C}$ $T_{mb} \le 95 \text{ °C}; f = 250 \text{ Hz}$		200 32	mJ mJ

### **OVERLOAD PROTECTION LIMITING VALUE**

With an adequate protection supply provided via the input pin, TOPFET can protect itself from two types of overload - overtemperature and short circuit load.

SYMBOL	PARAMETER	REQUIRED CONDITION	MIN.	MAX.	UNIT
V <sub>DS</sub>	Drain source voltage <sup>3</sup>	$4 \text{ V} \leq \text{V}_{\text{IS}} \leq 5.5 \text{ V}$	0	35	V

## THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
R <sub>th j-mb</sub>	Thermal resistance Junction to mounting base	-	-	1.75	1.92	K/W
R <sub>th j-a</sub>	Junction to ambient		-	50	-	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.

 $<sup>\</sup>textbf{2} \text{ A higher } T_j \text{ is allowed as an overload condition but at the threshold } T_{j(TO)} \text{ the over temperature trip operates to protect the switch.}$ 

<sup>3</sup> All control logic and protection functions are disabled during conduction of the source drain diode.

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# **OUTPUT CHARACTERISTICS**

Limits are for -40°C  $\leq$  T<sub>mb</sub>  $\leq$  150°C; typicals are for T<sub>mb</sub> = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
	Off-state	V <sub>IS</sub> = 0 V				
$V_{(CL)DSS}$	Drain-source clamping voltage	I <sub>D</sub> = 10 mA	50	-	-	V
		$I_{DM} = 2 \text{ A}; t_p \le 300  \mu\text{s}; \delta \le 0.01$	50	60	70	V
I <sub>DSS</sub>	Drain source leakage current	V <sub>DS</sub> = 40 V	-	-	100	μΑ
		$T_{mb} = 25 ^{\circ}\text{C}$	-	0.1	10	μΑ
	On-state	$I_{DM} = 6 \text{ A}; t_p \le 300  \mu\text{s}; \delta \le 0.01$				
R <sub>DS(ON)</sub>	Drain-source resistance	V <sub>IS</sub> ≥ 4.4 V	-	-	95	mΩ
		$T_{mb} = 25  ^{\circ}C$	-	36	50	mΩ
		$V_{IS} \ge 4 V$	-	-	100	mΩ
		$T_{mb} = 25  ^{\circ}C$	-	39	55	mΩ

# **OVERLOAD CHARACTERISTICS**

-40°C  $\leq T_{mb} \leq 150^{\circ}C$  unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
	Short circuit load	V <sub>DS</sub> = 13 V				
I <sub>D</sub>	Drain current limiting	$V_{IS} = 5 \text{ V};$ $T_{mb} = 25^{\circ}\text{C}$ $4.4 \text{ V} \leq V_{IS} \leq 5.5 \text{ V}$	16 12	24 -	32 36	A A
		$4 \text{ V} \leq \text{V}_{IS} \leq 5.5 \text{ V}$	8	-	36	Α
	Overload protection	$V_{IS} = 5 \text{ V;} T_{mb} = 25^{\circ} \text{C}$				
P <sub>D(TO)</sub>	Overload power threshold	device trips if $P_D > P_{D(TO)}$	40	120	160	W
T <sub>DSC</sub>	Characteristic time	which determines trip time <sup>1</sup>	200	350	600	μs
	Overtemperature protection					
$T_{j(TO)}$	Threshold junction temperature <sup>2</sup>		150	170	-	°C

 $<sup>\</sup>textbf{1} \; \text{Trip time } \; t_{d \, \text{sc}} \; \text{varies with overload dissipation } \; P_D \; \text{according to the formula} \; t_{d \, \text{sc}} \approx T_{DSC} \, / \; \text{In[} \; P_D \, / \; P_{D(TO)} \; ].$ 

 $<sup>\</sup>boldsymbol{2}$  This is independent of the dV/dt of input voltage  $V_{\text{IS}}.$ 

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#### INPUT CHARACTERISTICS

The supply for the logic and overload protection is taken from the input. Limits are for  $-40^{\circ}\text{C} \le T_{mb} \le 150^{\circ}\text{C}$ ; typicals are for  $T_{mb} = 25^{\circ}\text{C}$  unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS		MIN.	TYP.	MAX.	UNIT
$V_{IS(TO)}$	Input threshold voltage	$V_{DS} = 5 \text{ V}; I_{D} = 1 \text{ mA}$	F 05°0	0.6	-	2.4	<b>&gt;</b>
			$T_{mb} = 25^{\circ}C$	1.1	1.6	2.1	V
I <sub>IS</sub>	Input supply current	normal operation;	$V_{IS} = 5 V$	100	220	400	μΑ
			$V_{IS} = 4 V$	80	195	330	μΑ
I <sub>ISL</sub>	Input supply current	protection latched;	$V_{IS} = 5 V$	200	400	650	μΑ
			$V_{IS} = 3 V$	130	250	430	μΑ
V <sub>ISR</sub>	Protection reset voltage <sup>1</sup>	reset time t <sub>r</sub> ≥ 100 μs		1.5	2	2.9	V
t <sub>ir</sub>	Latch reset time	$V_{IS1} = 5 \text{ V}, V_{IS2} < 1 \text{ V}$		10	40	100	μs
$V_{(CL)IS}$	Input clamping voltage	I <sub>I</sub> = 1.5 mA		5.5	-	8.5	V
R <sub>IG</sub>	Input series resistance <sup>2</sup> to gate of power MOSFET		$T_{mb} = 25^{\circ}C$	-	33	-	kΩ

#### **SWITCHING CHARACTERISTICS**

 $T_{mb}$  = 25 °C;  $V_{DD}$  = 13 V; resistive load  $R_L$  = 4  $\Omega$ . Refer to waveform figure and test circuit.

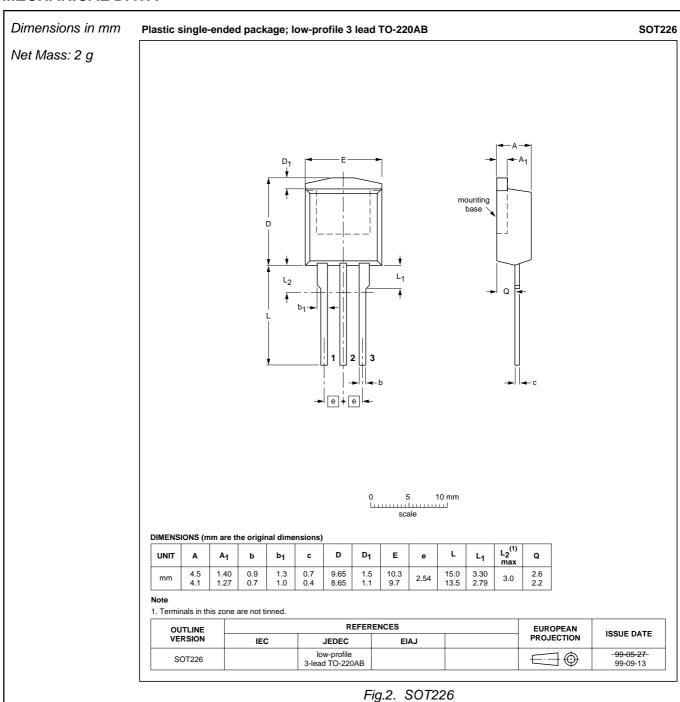
SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
t <sub>d on</sub>	Turn-on delay time	V <sub>IS</sub> = 5 V	-	15	30	μs
t <sub>r</sub>	Rise time		-	30	60	μs
t <sub>d off</sub>	Turn-off delay time	$V_{IS} = 0 V$	-	70	140	μs
t <sub>f</sub>	Fall time		-	35	70	μs

 $<sup>{\</sup>bf 1} \ {\hbox{The input voltage below which the overload protection circuits will be reset.} \\$ 

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

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# **MECHANICAL DATA**



- Refer to mounting instructions for SOT226 package.
   Epoxy meets UL94 V0 at 1/8".

Philips Semiconductors Product specification

# Logic level TOPFET

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#### **DEFINITIONS**

DATA SHEET STAT	rus	
DATA SHEET STATUS <sup>1</sup>	PRODUCT STATUS <sup>2</sup>	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 ordere 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.

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