

**PowerMOS transistor  
Logic level TOPFET**

**BUK113-50DL**

**DESCRIPTION**

Monolithic overload protected logic level power MOSFET in a surface mount plastic envelope, intended as a general purpose switch for automotive systems and other applications.

**APPLICATIONS**

General controller for driving

- lamps
- small motors
- solenoids

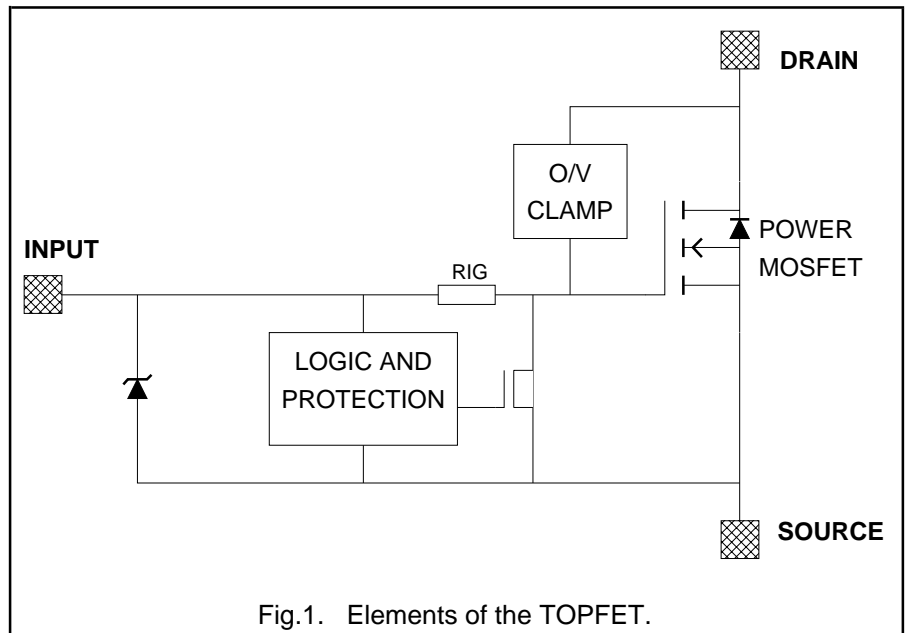
**FEATURES**

- Vertical power DMOS output stage
- Overload protected up to 125°C ambient
- Overload protection by current limiting and overtemperature sensing
- Latched overload protection reset by input
- 5 V logic compatible input level
- Control of power MOSFET 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	MIN.	MAX.	UNIT
$V_{DS}$	Continuous drain source voltage	-	50	V
$I_D$	Drain current limiting	4	8	A
$P_D$	Total power dissipation	-	4	W
$T_j$	Continuous junction temperature	-	150	°C
$R_{DS(ON)}$	Drain-source on-state resistance	-	200	mΩ

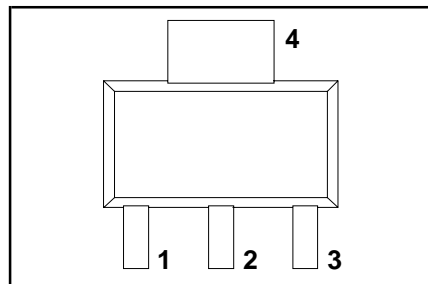
**FUNCTIONAL BLOCK DIAGRAM**



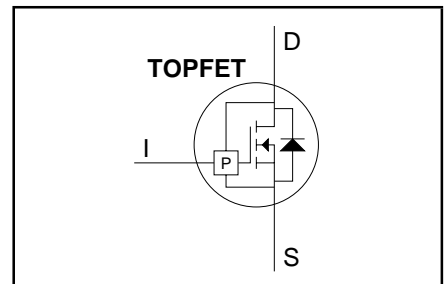
**PINNING - SOT223**

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

**PIN CONFIGURATION**



**SYMBOL**



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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
$I_D$	Continuous drain current <sup>2</sup>	-	-	self limiting	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	$T_{sp} = 90$ °C	-	4	W
$T_{stg}$	Storage temperature	-	-55	150	°C
$T_j$	Continuous junction temperature	normal operation	-	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 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	$T_b \leq 25$ °C; $I_{DM} < I_{D(lim)}$ ; inductive load	-	100	mJ
$E_{DRM}$	Repetitive clamping energy	$T_b \leq 75$ °C; $I_{DM} = 50$ mA; f = 250 Hz	-	4	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 limiting and activating the overtemperature protection.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$V_{ISP}$	Protection supply voltage <sup>3</sup>	for valid protection	4	-	V
$V_{DDP}$	Protected drain source supply voltage	$V_{IS} = 5$ V	-	35	V

## THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$R_{th\ j-sp}$	<b>Thermal resistance</b> Junction to solder point	measured to pin 4 solder point	-	12	15	K/W
$R_{th\ j-a}$	<b>Application information</b> Junction to ambient	on PCB of fig. 3 on minimum footprint PCB	-	70 100	-	K/W 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> The input voltage for which the overload protection circuits are functional.

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**OVERLOAD PROTECTION CHARACTERISTICS**

TOPFET switches off to protect itself when there is an overload fault condition. It remains latched off until reset by the input.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$I_{D(lim)}$	<b>Overload protection</b> Drain current limiting	$V_{IS} = 5\text{ V}$	4	6	8	A
$E_{DS(TO)}$	<b>Short circuit load protection</b> Overload threshold energy	$V_{DD} = 13\text{ V}; V_{IS} = 5\text{ V}$	-	<i>tbf</i>	-	J
$T_{j(TO)}$	<b>Overtemperature protection</b> Threshold junction temperature	$V_{IS} = 5\text{ V}$	150	165	-	°C

**STATIC CHARACTERISTICS**

$T_b = 25\text{ °C}$  unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(CL)DSS}$	Drain-source clamping voltage	$V_{IS} = 0\text{ V}; I_D = 10\text{ mA}$	50	55	-	V
$V_{(CL)DSS}$	Drain-source clamping voltage	$V_{IS} = 0\text{ V}; I_{DM} = 200\text{ mA};$ $t_p \leq 300\text{ }\mu\text{s}; \delta \leq 0.01$	-	56	70	V
$I_{DSS}$	Off-state drain current	$V_{DS} = 45\text{ V}; V_{IS} = 0\text{ V}$	-	0.5	2	$\mu\text{A}$
$I_{DSS}$	Off-state drain current	$V_{DS} = 50\text{ V}; V_{IS} = 0\text{ V}$	-	1	20	$\mu\text{A}$
$I_{DSS}$	Off-state drain current	$V_{DS} = 40\text{ V}; V_{IS} = 0\text{ V}; T_j = 100\text{ °C}$	-	10	100	$\mu\text{A}$
$R_{DS(ON)}$	Drain-source on-state resistance <sup>1</sup>	$V_{IS} = 5\text{ V}; I_{DM} = 1\text{ A};$ $t_p \leq 300\text{ }\mu\text{s}; \delta \leq 0.01$	-	150	200	m $\Omega$

**INPUT CHARACTERISTICS**

$T_b = 25\text{ °C}$  unless otherwise specified. The supply for the logic and overload protection is taken from the input.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{IS(TO)}$	Input threshold voltage	$V_{DS} = 5\text{ V}; I_D = 1\text{ mA}$	1.7	2.2	2.7	V
$I_{IS}$	Input supply current	normal operation;	-	330	450	$\mu\text{A}$
		$V_{IS} = 5\text{ V}$	-	170	270	$\mu\text{A}$
		$V_{IS} = 4\text{ V}$	-	500	650	$\mu\text{A}$
$I_{ISL}$	Input supply current	protection latched;	-	250	400	$\mu\text{A}$
		$V_{IS} = 5\text{ V}$	-	250	400	$\mu\text{A}$
		$V_{IS} = 3.5\text{ V}$	-	250	400	$\mu\text{A}$
$V_{ISR}$	Protection latch reset voltage <sup>2</sup>		1	2.2	3.5	V
$V_{(CL)IS}$	Input clamping voltage	$I_I = 1.5\text{ mA}$	6	7.5	-	V
$R_{IG}$	Input series resistance	to gate of power MOSFET	-	33	-	k $\Omega$

**SHADED BOXES**

Values shown within shaded boxes are estimated for the objective specification. These will not be fixed until the evaluation of prototype samples.

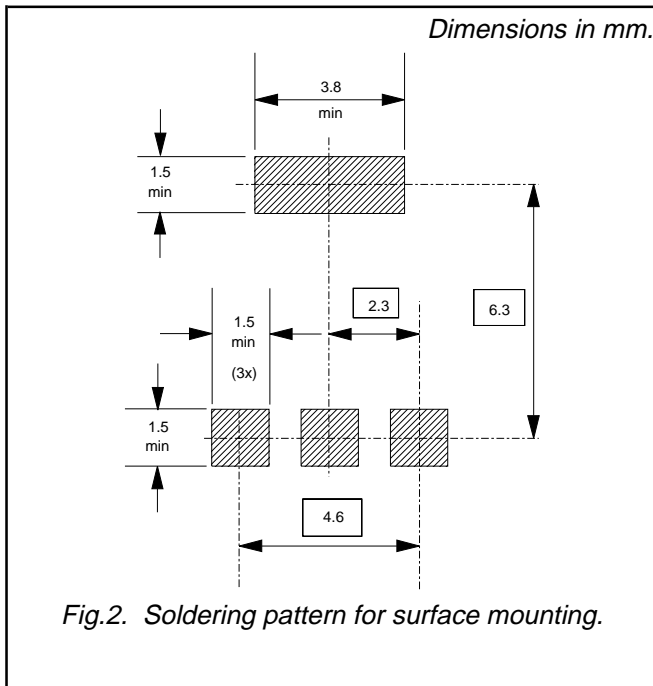
<sup>1</sup> Continuous input voltage. The specified pulse width is for the drain current.

<sup>2</sup> The input voltage below which the overload protection circuits will be reset.

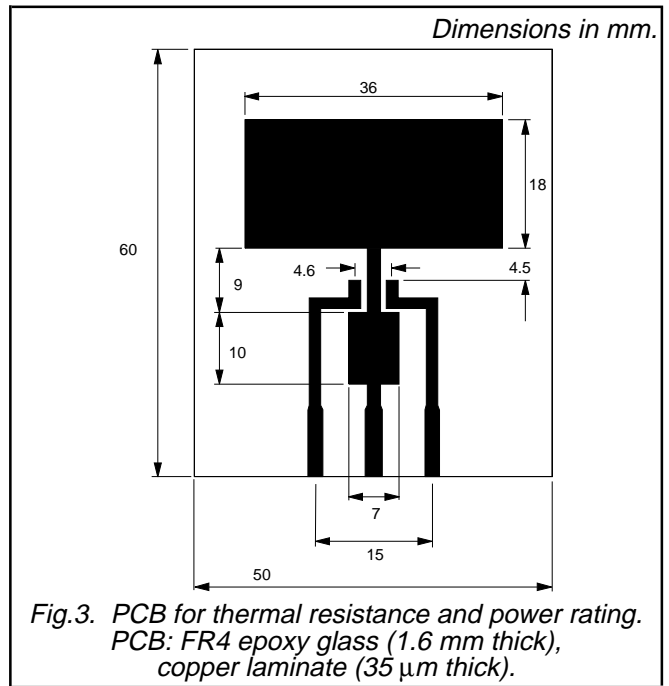
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**MOUNTING INSTRUCTIONS**



**PRINTED CIRCUIT BOARD**



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MECHANICAL DATA

Dimensions in mm

Net Mass: 0.11 g

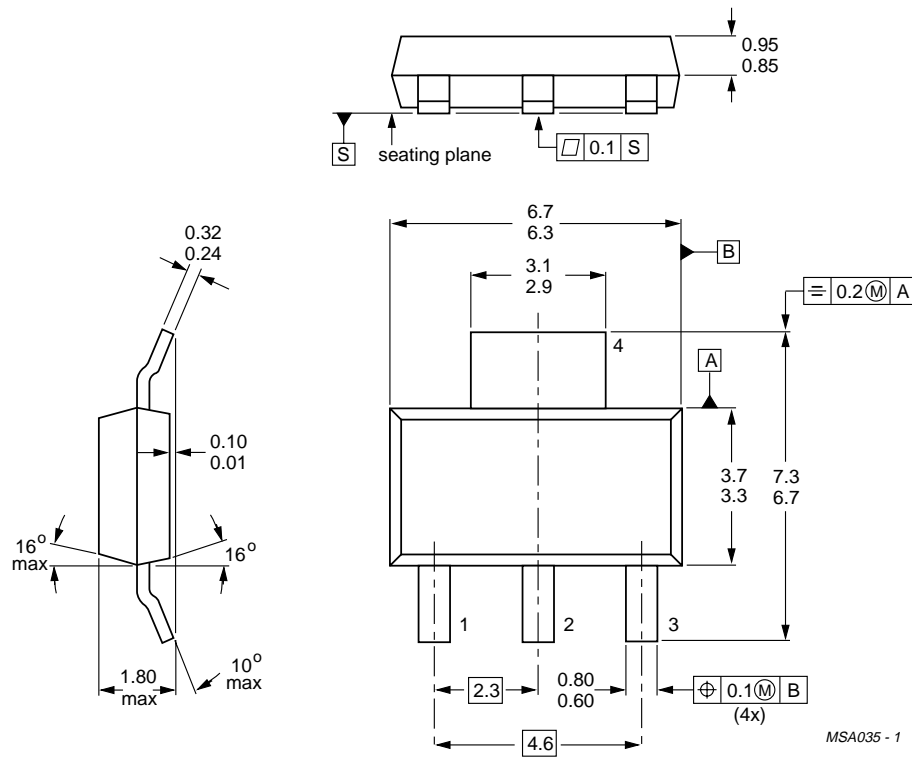


Fig.4. SOT223 surface mounting package<sup>1</sup>.

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

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**DEFINITIONS**

<b>Data sheet status</b>	
Objective specification	This data sheet contains target or goal specifications for product development.
Preliminary specification	This data sheet contains preliminary data; supplementary data may be published later.
Product specification	This data sheet contains final product specifications.
<b>Limiting values</b>	
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.	
<b>Application information</b>	
Where application information is given, it is advisory and does not form part of the specification.	
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