

# ZXMS6002G 60V N-Channel self protected enhancement mode IntelliFET™ MOSFET with status indication

## Summary

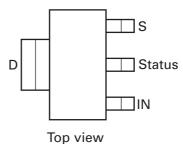
Continuous drain source voltage $V_{DS} = 60V$ On-state resistance $500m\Omega$ Nominal load current ( $V_{IN} = 5V$ )1.4AClamping energy550mJ

## Description

Self protected low side MOSFET. Monolithic over temperature, over current, over voltage (active clamp) and ESD protected logic level functionality. Intended as a general purpose switch, with status indication.

### Features

- Status pin (analog status indication)
- Short circuit protection with auto restart
- Over voltage protection (active clamp)
- Thermal shutdown with auto restart
- Over-current protection
- Input protection (ESD)
- Load dump protection (actively protects load)
- · Logic level input
- · High continuous current rating

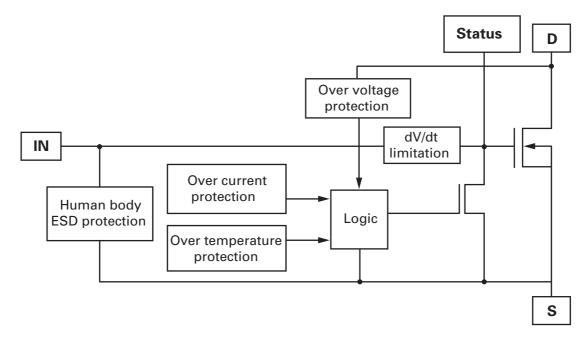


**Note:** The tab is connected to the drain pin and must be electrically isolated from the source pin. Connection of significant copper to the tab is recommended for best thermal performance.

### **Ordering information**

Device	Part mark	Reel size (inches)	Tape width (mm)	Quantity per reel
ZXMS6002GTA	ZXMS6002	7 12 embossed		1000

## Functional block diagram



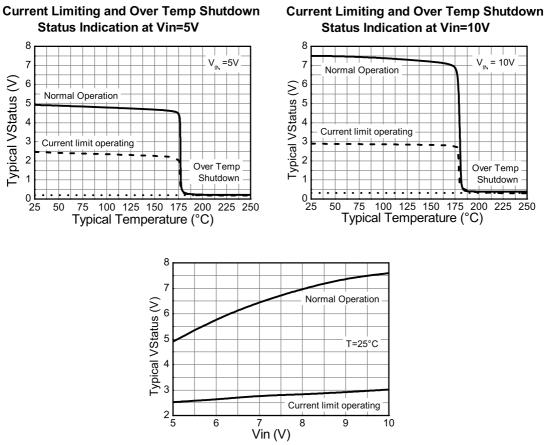
## **Applications and information**

- · Especially suited for loads with a high in-rush current such as lamps and motors
- All types of resistive, inductive and capacitive loads in switching applications
- $\mu$ C compatible power switch for 12V and 24V DC applications
- Automotive rated
- Replaces electromechanical relays and discrete circuits
- Linear mode capability the current-limiting protection circuitry is designed to de-activate at low V<sub>DS</sub>, in order not to compromise the load current during normal operation. The design max. DC operating current is therefore determined by the thermal capability of the package/ board combination, rather than by the protection circuitry Note: This does not compromise the product's ability to self-protect during short-circuit load conditions.
- Status pin voltage reflects the gate drive being applied internally to the power MOSFET. With  $V_{IN} = 5V$ :

Status voltage ~ 5V indicates normal operation.

Status voltage ~ (2-3)V indicates that the device is in current-limiting mode.

Status voltage < 1V indicates that the device is in thermal shutdown.



VStatus vs Vin

## Absolute maximum ratings

Parameter	Symbol	Limit	Unit
Continuous drain-source voltage	V <sub>DS</sub>	60	V
Drain-source voltage for short circuit protection $V_{IN}$ =5V	V <sub>DS(SC)</sub>	36	V
Drain-source voltage for short circuit protection V <sub>IN</sub> =10V	V <sub>DS(SC)</sub>	20	V
Continuous input voltage	V <sub>IN</sub>	-0.2 +10	V
Peak input voltage	V <sub>IN</sub>	-0.2 +20	V
Operating temperature range	Т <sub>ј</sub> ,	-40 to +150	°C
Storage temperature range	T <sub>stg</sub>	-55 to +150	°C
Power dissipation @ $T_{amb} = 25^{\circ}C^{(a)}$	P <sub>D</sub>	2.5	W
Continuous drain current @ V <sub>IN</sub> =10V; T <sub>amb</sub> =25°C <sup>(a)</sup>	I <sub>D</sub>	1.6	А
Continuous drain current @ V <sub>IN</sub> =5V; T <sub>amb</sub> =25°C <sup>(a)</sup>	I <sub>D</sub>	1.4	А
Continuous source current (body diode) <sup>(a)</sup>	ا <sub>S</sub>	3	А
Pulsed source current (body diode) <sup>(b)</sup>	۱ <sub>S</sub>	4.7	А
Unclamped single pulse inductive energy	E <sub>AS</sub>	550	mJ
Load dump protection	V <sub>LoadDump</sub>	80	V
Electrostatic discharge (human body model)	V <sub>ESD</sub>	4000	V
DIN humidity category, DIN 40 040		E	
IEC climatic category, DIN IEC 68-1		40/150/56	

### **Thermal resistance**

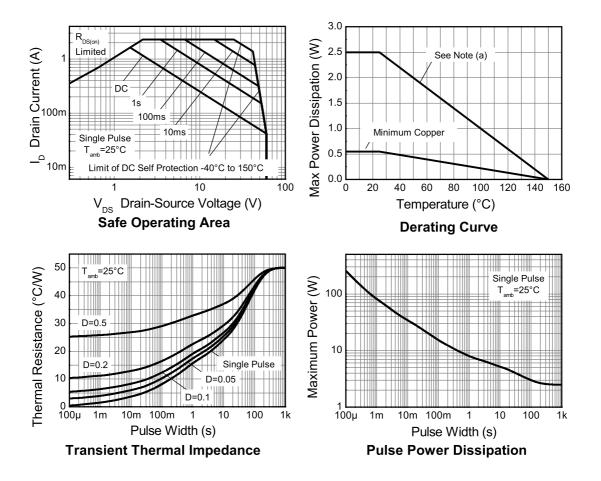
Parameter	Symbol	Limit	Unit
Junction to ambient <sup>(a)</sup>	$R_{\ThetaJA}$	50	°C/W
Junction to ambient <sup>(b)</sup>	$R_{\ThetaJA}$	28	°C/W

NOTES:

(a) For a device surface mounted on 50mm x 50mm x 1.6mm FR4 board with a high coverage of single sided 2oz weight copper.

(b) For a device surface mounted on FR4 board as (a) and measured at t<=10s.

## Characteristics



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Parameter	Symbol	Min.	Тур.	Max.	Unit	Conditions
Static characteristics						
Drain-source clamp voltage	V <sub>DS(AZ)</sub>	60	70	75	V	I <sub>D</sub> =10mA
Off state drain current	I <sub>DSS</sub>		0.1	3	μA	V <sub>DS</sub> =12V, V <sub>IN</sub> =0V
Off state drain current	I <sub>DSS</sub>		3	15	μA	V <sub>DS</sub> =32V, V <sub>IN</sub> =0V
Input threshold voltage <sup>(*)</sup>	V <sub>IN(th)</sub>	1	2.1		V	$V_{DS}=V_{GS}$ , $I_{D}=1mA$
Input current	I <sub>IN</sub>		0.7	1.2	mA	V <sub>IN</sub> =+5V
Input current	I <sub>IN</sub>		1.5	2.7	mA	V <sub>IN</sub> =+7V
Input current	I <sub>IN</sub>		4	7	mA	V <sub>IN</sub> =+10V
Static drain-source on-state resistance	R <sub>DS(on)</sub>		520	675	mΩ	V <sub>IN</sub> =5V, I <sub>D</sub> =0.7A
Static drain-source on-state resistance	R <sub>DS(on)</sub>		385	500	mΩ	V <sub>IN</sub> =10V, I <sub>D</sub> =0.7A
Current limit <sup>(†)</sup>	I <sub>D(LIM)</sub>	0.7	1.0	1.5	А	V <sub>IN</sub> =5V, V <sub>DS</sub> >5V
Current limit <sup>(†)</sup>	I <sub>D(LIM)</sub>	1.0	1.8	2.3	А	V <sub>IN</sub> =10V, V <sub>DS</sub> >5V
Dynamic characteristics						
Turn-off time (V <sub>IN</sub> to 90% $I_D$ )	t <sub>off</sub>		13	20	μS	$R_L=22\Omega$ , $V_{IN}=10V$ to 0V, $V_{DD}=12V$
Slew rate on (70 to 50% $V_{DD}$ )	-dV <sub>DS</sub> /dt <sub>on</sub>		8	20	V/µs	R <sub>L</sub> =22Ω, V <sub>IN</sub> =0 to 10V, V <sub>DD</sub> =12V
Slew rate off (50 to 70% $V_{DD}$ )	DV <sub>DS</sub> /dt <sub>on</sub>		3.2	10	V/µs	$R_L=22\Omega$ , $V_{IN}=10V$ to 0V, $V_{DD}=12V$
Protection functions (‡)				•		
Required input voltage for over temperature protection	V <sub>PROT</sub>	4.5			V	
Thermal overload trip temperature	T <sub>JT</sub>	150	175		°C	
Thermal hysteresis			1		°C	
Unclamped single pulse inductive energy T <sub>j</sub> =25°C	E <sub>AS</sub>	550			mJ	I <sub>D(ISO</sub> )=0.7A, V <sub>DD</sub> =32V
Unclamped single pulse inductive energy T <sub>j</sub> =150°C	E <sub>AS</sub>	200			mJ	I <sub>D(ISO</sub> )=0.7A, V <sub>DD</sub> =32V
						•

## Electrical characteristics (at $T_{amb} = 25^{\circ}C$ unless otherwise stated)

Parameter	Symbol	Min.	Тур.	Max.	Unit	Conditions
Status flag						
Normal operation	V <sub>STATUS</sub>		4.95		V	$V_{IN} = 5V$
Current limit operating	V <sub>STATUS</sub>		2.5		V	$V_{IN} = 5V$
Thermal shutdown activated	V <sub>STATUS</sub>		0.2	1	V	$V_{IN} = 5V$
Normal operation	V <sub>STATUS</sub>		8.0		V	V <sub>IN</sub> = 10V
Current limit operation	V <sub>STATUS</sub>		3.0		V	V <sub>IN</sub> = 10V
Thermal shutdown activated	V <sub>STATUS</sub>		0.35	1	V	V <sub>IN</sub> = 10V
Inverse diode	•	•	•	•	•	-
Source drain voltage	V <sub>SD</sub>			1	V	V <sub>IN</sub> =0V, -I <sub>D</sub> =1.4A,

## Electrical characteristics (at $T_{amb}$ = 25°C unless otherwise stated)

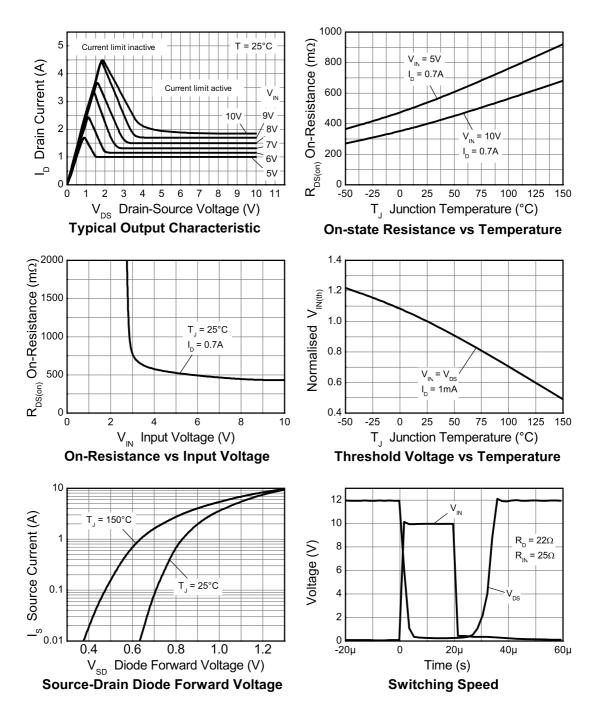
NOTES:

(\*) Protection features may operate outside spec for  $V_{IN}$ <4.5V.

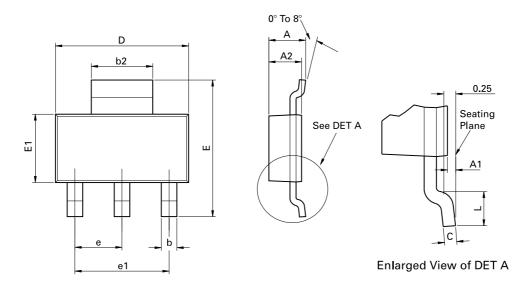
(†) The drain current is limited to a reduced value when Vds exceeds a safe level

(‡) Integrated protection functions are designed to prevent IC destruction under fault conditions described in the datasheet. Fault conditions are considered as "outside" normal operating range. Protection functions are not designed for continuous, repetitive operation.

## **Typical characteristics**



## Package outline - SOT223



Conforms to JEDEC TO-261 AA Issue B

DIM	Millin	neters	Inc	hes	DIM	Millimeters		Inches	
	Min	Мах	Min	Max		Min	Мах	Min	Max
А	-	1.80	-	0.071	е	2.30	BSC	0.090	5 BSC
A1	0.02	0.10	0.0008	0.004	e1	4.60	BSC	0.181	BSC
b	0.66	0.84	0.026	0.033	E	6.70	7.30	0.264	0.287
b2	2.90	3.10	0.114	0.122	E1	3.30	3.70	0.130	0.146
С	0.23	0.33	0.009	0.013	L	0.90	-	0.355	-
D	6.30	6.70	0.248	0.264	-	-	-	-	-

Note: Controlling dimensions are in millimeters. Approximate dimensions are provided in inches

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