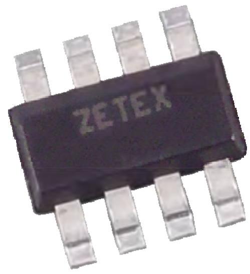
ZXMS6004DT8
60V N-CHANNEL SELF PROTECTED ENHANCEMENT MODE *INTELLIFET™* MOSFET

SUMMARY

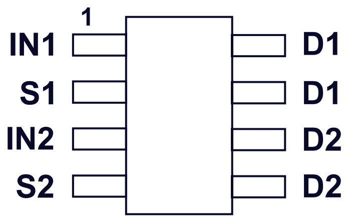
Continuous drain source voltage	**60 V**
On-state resistance	**500 mΩ**
Nominal load current (V_{IN} = 5V)	**1.2 A**
Clamping Energy	**210 mJ**



SM8 Package

DESCRIPTION

The ZXMS6004DT8 is a dual self protected low side MOSFET with logic level input. It integrates over-temperature, over-current, over-voltage (active clamp) and ESD protected logic level functionality independently per channel. The ZXMS6004DT8 is ideal as a general purpose switch driven from 3.3V or 5V microcontrollers in harsh environments where standard MOSFETs are not rugged enough.



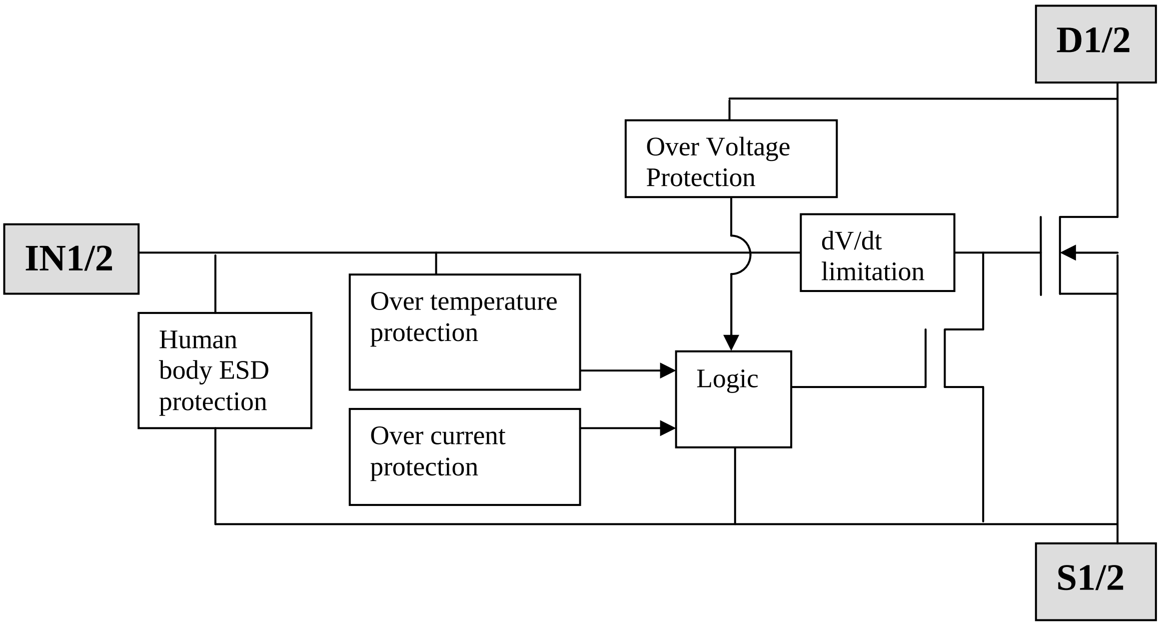
FEATURES

- Compact dual package
- Low input current
- Logic Level Input (3.3V and 5V)
- Short circuit protection with auto restart
- Over voltage protection (active clamp)
- Thermal shutdown with auto restart
- Over-current protection
- Input Protection (ESD)
- High continuous current rating

ORDERING INFORMATION

DEVICE	PART MARK	REEL SIZE (inches)	TAPE WIDTH (mm)	QUANTITY PER REEL
ZXMS6004DT8TA	ZXMS 6004D	7	12 embossed	1,000 units

FUNCTIONAL BLOCK DIAGRAM



APPLICATIONS AND INFORMATION

- Two completely isolated independent channels
- 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.
- µC 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_{DS} to minimise on state power dissipation. The maximum DC operating current is therefore determined by the thermal capability of the package/board combination, rather than by the protection circuitry. This does not compromise the product's ability to self-protect at low V_{DS}.

ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	LIMIT	UNIT
Continuous Drain-Source Voltage	V_{DS}	60	V
Drain-Source Voltage for short circuit protection	$V_{DS(SC)}$	36	V
Continuous Input Voltage	V_{IN}	-0.5 ... +6	V
Continuous Input Current $-0.2V \le V_{IN} \le 6V$ $V_{IN} < -0.2V$ or $V_{IN} > 6V$	I_{IN}	 No limit $\vert I_{IN} \vert \le 2$	mA
Operating Temperature Range	T_j,	-40 to +150	°C
Storage Temperature Range	T_{stg}	-55 to +150	°C
Power Dissipation at T_A =25°C (a)(d) Linear Derating Factor	P_D	1.16 9.28	W mW/°C
Power Dissipation at T_A =25°C (a)(e) Linear Derating Factor	P_D	1.67 13.3	W mW/°C
Power Dissipation at T_A =25°C (b)(d) Linear Derating Factor	P_D	2.13 17	W mW/°C
Pulsed Drain Current @ V_{IN}=3.3V (c)	I_{DM}	2	A
Pulsed Drain Current @ V_{IN}=5V (c)	I_{DM}	2.5	A
Continuous Source Current (Body Diode) (a)	I_S	1	A
Pulsed Source Current (Body Diode) (c)	I_{SM}	5	A
Unclamped single pulse inductive energy, Tj=25°C, I_D=0.5A, V_{DD}=24V	E_{AS}	210	mJ
Electrostatic Discharge (Human Body Model)	V_{ESD}	4000	V
Charged Device Model	V_{CDM}	1000	V

THERMAL RESISTANCE

PARAMETER	SYMBOL	VALUE	UNIT
Junction to Ambient (a)(d)	$R_{\theta JA}$	108	°C/W
Junction to Ambient (a)(e)	$R_{\theta JA}$	75	°C/W
Junction to Ambient (b)(d)	$R_{\theta JA}$	58.7	°C/W
Junction to Case (f)	$R_{\theta JC}$	26.5	°C/W

NOTES

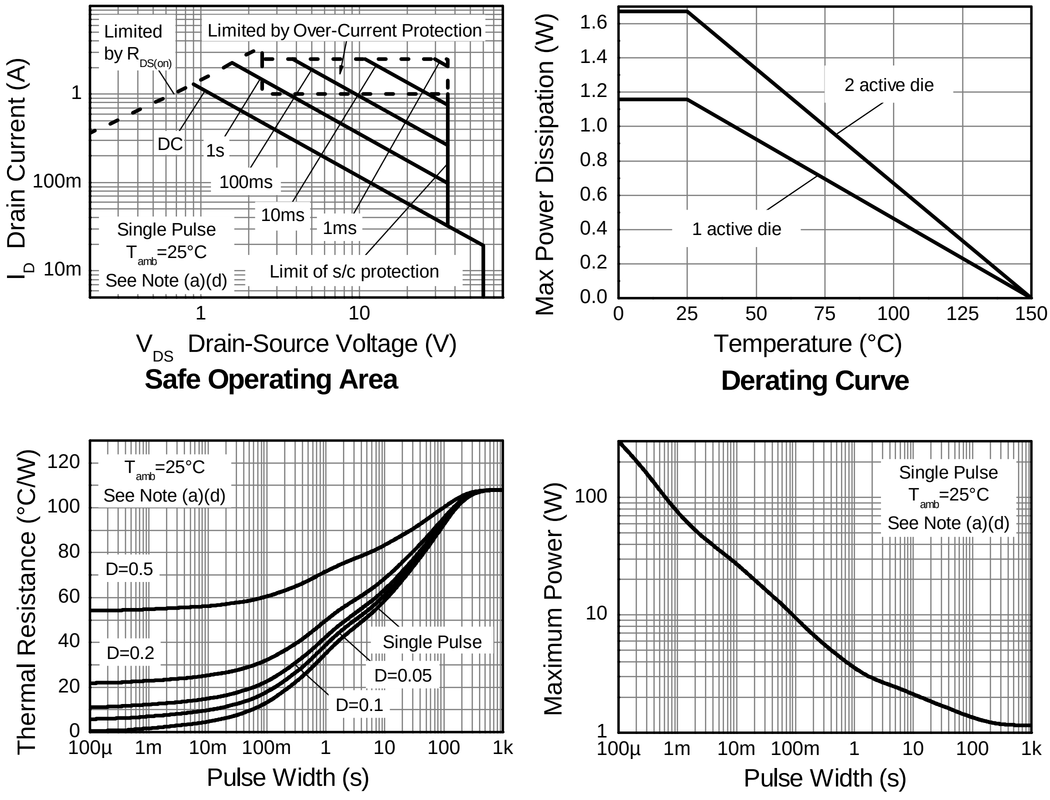
(a) For a dual device surface mounted on a 25mm x 25mm FR4 PCB single sided 1oz weight copper split down the middle on 1.6mm FR4 board, in still air conditions.
(b) For a dual device surface mounted on FR4 PCB measured at t ≤ 10sec
(c) Repetitive rating 25mm x 25mm FR4 PCB, D=0.02 pulse width=300µs – pulse width limited by junction temperature. Refer to transient Thermal Impedance Graph.
(d) For a dual device with one active die.
(e) For dual device with 2 active die running at equal power.
(f) Thermal resistance from junction to solder-point (at the end of the drain lead)

RECOMMENDED OPERATING CONDITIONS

The ZXMS6004DT8 is optimised for use with µC operating from 3.3V and 5V supplies.

Symbol	Description	Min	Max	Units
V_{IN}	Input voltage range	0	5.5	V
T_A	Ambient temperature range	-40	125	°C
V_{IH}	High level input voltage for MOSFET to be on	3	5.5	V
V_{IL}	Low level input voltage for MOSFET to be off	0	0.7	V
V_P	Peripheral supply voltage (voltage to which load is referred)	0	36	V

CHARACTERISTICS



Safe Operating Area

Derating Curve

Transient Thermal Impedance

Pulse Power Dissipation

ELECTRICAL CHARACTERISTICS (at T_{amb} = 25°C unless otherwise stated).

PARAMETER	SYMBOL	MIN	TYP	MAX	UNIT	CONDITIONS
Static Characteristics						
Drain-Source Clamp Voltage	$V_{DS(AZ)}$	60	65	70	V	I_D=10mA
Off state Drain Current	I_{DSS}			500	nA	V_{DS}=12V, V_{IN}=0V
Off state Drain Current	I_{DSS}			1	uA	V_{DS}=36V, V_{IN}=0V
Input Threshold Voltage	$V_{IN(th)}$	0.7	1	1.5	V	V_{DS}=V_{GS}, I_D=1mA
Input Current	I_{IN}		60	100	µA	V_{IN}=+3V
Input Current	I_{IN}		120	200	µA	V_{IN}=+5V
Input Current while over temperature active				220	µA	V_{IN}=+5V
Static Drain-Source On-State Resistance	$R_{DS(on)}$		400	600	mΩ	V_{IN}=+3V, I_D=0.5A
Static Drain-Source On-State Resistance	$R_{DS(on)}$		350	500	mΩ	V_{IN}=+5V, I_D=0.5A
Continuous Drain Current (a)(e)	I_D	0.9			A	V_{IN}=3V; T_A=25°C
Continuous Drain Current (a)(e)	I_D	1.0			A	V_{IN}=5V; T_A=25°C
Continuous Drain Current (a)(d)	I_D	1.1			A	V_{IN}=3V; T_A=25°C
Continuous Drain Current (a)(d)	I_D	1.2			A	V_{IN}=5V; T_A=25°C
Current Limit (g)	$I_{D(LIM)}$	0.7	1.7		A	V_{IN}=+3V,
Current Limit (g)	$I_{D(LIM)}$	1	2.2		A	V_{IN}=+5V
Dynamic Characteristics						
Turn On Delay Time	$t_{d(on)}$		5		µs	V_{DD}=12V, I_D=0.5A, V_{GS}=5V
Rise time	t_r		10		µs	
Turn Off Delay Time	$t_{d(off)}$		45		µs	
Fall Time	f_f		15		µs	

Notes:

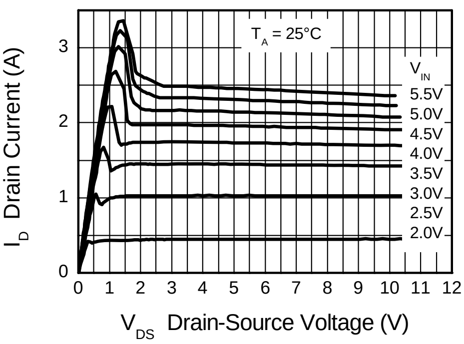
(g) The drain current is restricted only when the device is in saturation (see graph 'typical output characteristic'). This allows the device to be used in the fully on state without interference from the current limit. The device is fully protected at all drain currents, as the low power dissipation generated outside saturation makes current limit unnecessary.

PARAMETER	SYMBOL	MIN	TYP	MAX	UNIT	CONDITIONS
Over-temperature Protection						
Thermal Overload Trip Temperature (h)	T_{JT}	150	175		°C	
Thermal hysteresis (h)			10		°C	

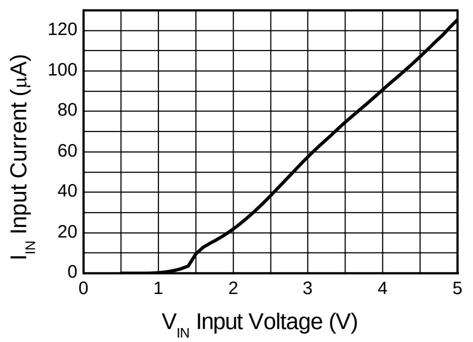
Note:

(h) Over-temperature protection is designed to prevent device destruction under fault conditions. Fault conditions are considered as “outside” normal operating range, so this part is not designed to withstand over-temperature for extended periods..

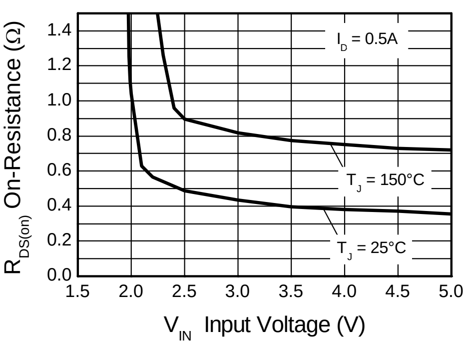
TYPICAL CHARACTERISTICS



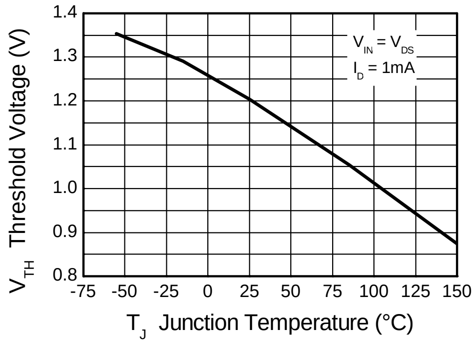
Typical Output Characteristic



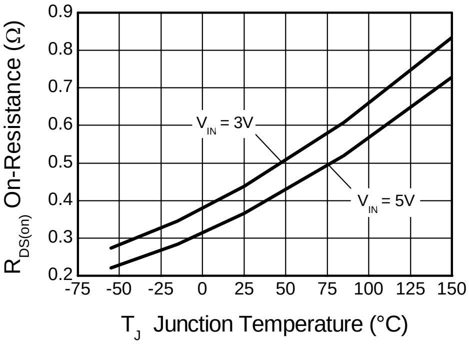
Input Current vs Input Voltage



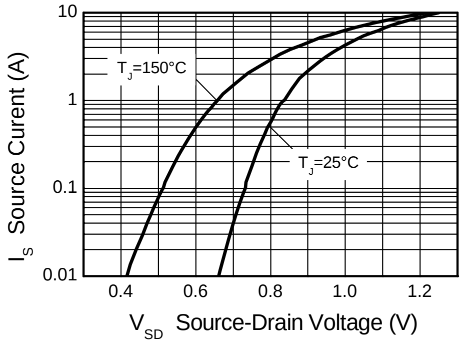
On-Resistance vs Input Voltage



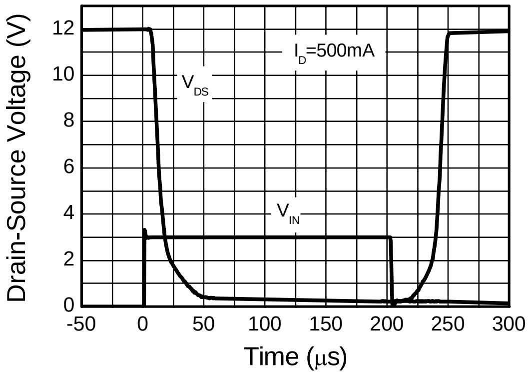
Threshold Voltage vs Temperature



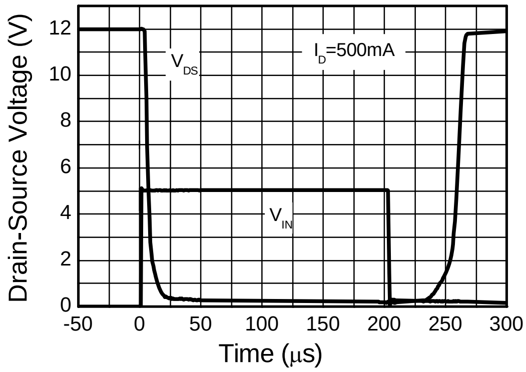
On-Resistance vs Temperature



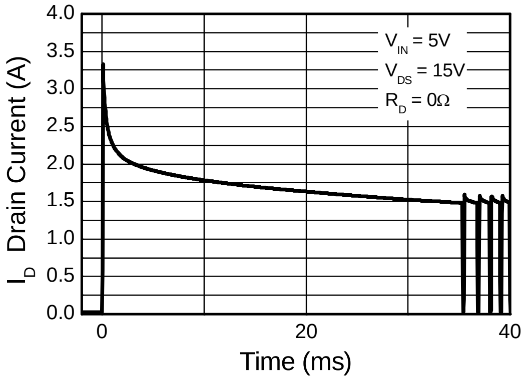
Reverse Diode Characteristic



Switching Speed



Switching Speed



Typical Short Circuit Protection

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