



60V N-CHANNEL SELF PROTECTED ENHANCEMENT MODE INTELLIFET® MOSFET

Product Summary

 $\begin{array}{lll} \bullet & & \text{Continuous Drain Source Voltage} & V_{DS} = 60V \\ \bullet & & \text{On-State Resistance} & 500m\Omega \\ \bullet & & \text{Nominal Load Current } (V_{IN} = 5V) & 1.2A \\ \bullet & & \text{Clamping Energy} & 210mJ \\ \end{array}$

Description

The ZXMS6004DT8Q 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. The ZXMS6004DT8Q is ideal as a general purpose switch driven from 3.3V or 5V microcontrollers in harsh environments where standard MOSFETs are not rugged enough.

Applications

- 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}.





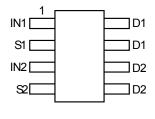
Top View

Features and Benefits

- 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
- Qualified to AEC-Q101 Standards for High Reliability
- PPAP Capable
- Lead-Free Finish; RoHS compliant (Note 1 & 2)
- Halogen and Antimony Free. "Green" Device (Note 3)

Mechanical Data

- Case: SM-8
- Case Material: Molded Plastic, "Green" Molding Compound UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Matte Tin Finish
- Weight: 0.117 grams (approximate)



Top view Pin-Out

Ordering Information

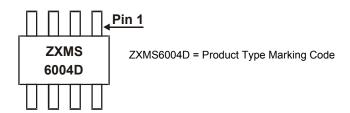
Product	Marking	Reel size (inches)	Tape width (mm)	Quantity per reel
ZXMS6004DT8QTA	ZXMS6004D	7 12		1,000 units

Notes:

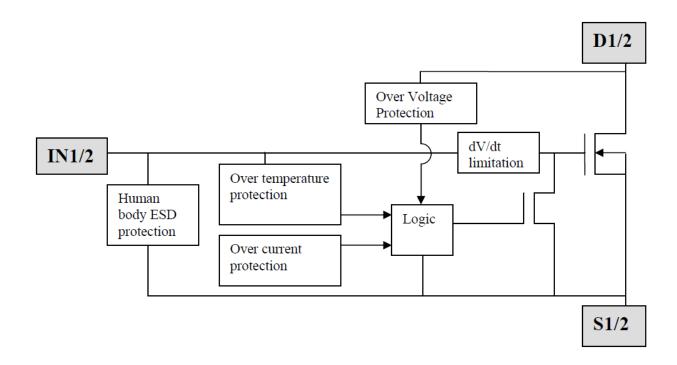
- 1. EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant. All applicable RoHS exemptions applied.
- See http://www.diodes.com/quality/lead_free.html for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
- 3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.
- 4. Automotive products are AEC-Q101 qualified and are PPAP capable. Automotive, AEC-Q101 and standard products are electrically and thermally the same, except where specified. For more information, please refer to http://www.diodes.com/quality/product_compliance_definitions/.
- 5. For packaging details, go to our website at http://www.diodes.com/products/packages.html.



Marking Information



Functional Block Diagram





Absolute Maximum Ratings (@T_{amb} = +25°C, unless otherwise stated.)

Characteristic	Symbol	Value	Units
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 @ $-0.2V \le V_{IN} \le 6V$ Continuous Input Current @ $V_{IN} < -0.2V$ or $V_{IN} > 6V$	l _{IN}	No limit I _{IN} ≤2	mA
Pulsed Drain Current @V _{IN} = 3.3V (Note 8)	I _{DM}	2	А
Pulsed Drain Current @V _{IN} = 5V (Note 8)	I _{DM}	2.5	Α
Continuous Source Current (Body Diode) (Note 6)	Is	1	А
Pulsed Source Current (Body Diode) (Note 8)	I _{SM}	5	Α
Unclamped Single Pulse Inductive Energy, $T_J = +25^{\circ}C$, $I_D = 0.5A$, $V_{DD} = 24V$	Eas	210	mJ
Electrostatic Discharge (Human Body Model)	V _{ESD}	4000	V
Charged Device Model	V_{CDM}	1000	V

Thermal Resistance

Characteristic	Symbol	Value	Units
Power Dissipation at T _{amb} = +25°C (Notes 6 & 9) Linear Derating Factor	P _D	1.16 9.28	W mW/°C
Power Dissipation at T _{amb} = +25°C (Notes 6 & 10) Linear Derating Factor	P _D	1.67 13.3	W mW/°C
Power Dissipation at T _{amb} = +25°C (Notes 7 & 9) Linear Derating Factor	P _D	2.13 17	W mW/°C
Thermal Resistance, Junction to Ambient (Notes 6 & 9)	$R_{ heta JA}$	108	°C/W
Thermal Resistance, Junction to Ambient (Notes 6 & 10)	R _{θJA}	75	°C/W
Thermal Resistance, Junction to Case (Notes 7 & 9)	R _{0JC}	58.7	°C/W
Thermal Resistance, Junction to Case (Note 11)	R _{θJC}	26.5	°C/W
Operating Temperature Range	TJ	-40 to +150	°C
Storage Temperature Range	T _{STG}	-55 to +150	°C

Notes:

- 6. 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
- 7. For a dual device surface mounted on FR4 PCB measured at t ≤ 10sec
- 8. 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
- 9. For a dual device with one active die
- 10. For dual device with 2 active die running at equal power
- 11. Thermal resistance from junction to solder-point (at the end of the drain lead)

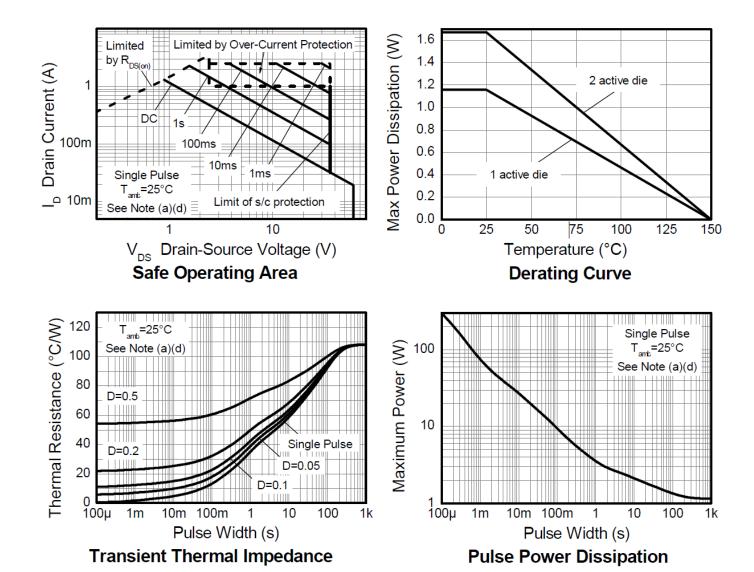
Recommended Operating Conditions

The ZXMS6004DT8Q is optimized for use with μC operating from 3.3V and 5V supplies.

Characteristic	Symbol	Min	Max	Unit
Input Voltage Range	V_{IN}	0	5.5	V
Ambient Temperature Range	T _A	-40	125	°C
High Level Input Voltage for MOSFET to be on	V _{IH}	3	5.5	V
Low Level Input Voltage for MOSFET to be off	V_{IL}	0	0.7	V
Peripheral Supply Voltage (Voltage to Which Load is Referred)	V _P	0	36	V



Thermal Characteristics





Electrical Characteristics (@T_{amb} = +25°C, unless otherwise stated.)

Characteristic	Symbol	Min	Тур	Max	Unit	Test Condition
Static Characteristics						
Drain-Source Clamp Voltage	$V_{DS(AZ)}$	60	65	70	V	I _D = 10mA
Off State Drain Current	I _{DSS}	_	_	0.5	μΑ	V _{DS} = 12V, V _{IN} = 0V
On State Drain Current		_	_	1		$V_{DS} = 36V, V_{IN} = 0V$
Input Threshold Voltage	V _{IN(th)}	0.7	1	1.5	٧	$V_{DS} = V_{GS}$, $I_D = 1mA$
Innut Current		_	60	100	μΑ	V _{IN} = +3V
Input Current	I _{IN}	_	120	200		V _{IN} = +5V
Input Current while Over Temperature Active	_	_	_	220	μΑ	V _{IN} = +5V
Static Drain-Source On-State Resistance	_	_	400	600	mΩ	$V_{IN} = +3V, I_D = 1A$
Static Dialii-Source Off-State Resistance	R _{DS(on)}	_	350	500	11122	$V_{IN} = +5V, I_D = 1A$
Continuous Drain Current (Notes 6 & 10)	I _D	0.9	_	_	А	$V_{IN} = 3V; T_A = +25^{\circ}C$
Continuous Drain Current (Notes 6 & 10)		1	_	_		$V_{IN} = 5V$; $T_A = +25$ °C
Continuous Drain Current (Notes 6 & 9)		1.1	_	_		$V_{IN} = 3V; T_A = +25^{\circ}C$
Continuous Diain Current (Notes 6 & 9)		1.2	_	_		$V_{IN} = 5V$; $T_A = +25$ °C
Current Limit (Note 12)	I _{D(LIM)}	0.7	1.7	_	Α	V _{IN} = +3V
Current Limit (Note 12)		1	2.2	_		V _{IN} = +5V
Dynamic Characteristics						
Turn On Delay Time	t _{d(on)}	_	5	_	μs	
Rise Time	t _r	_	10	_	μs	$V_{DD} = 12V, I_D = 0.5A,$
Turn Off Delay Time	t _{d(off)}	_	45	_	μs	$V_{GS} = 5V$
Fall Time	f _f	_	15	_	μs	
Over-Temperature Protection						
Thermal Overload Trip Temperature (Note 13)	T_{JT}	150	175	_	°C	_
Thermal Hysteresis (Note 13)	_	_	10	_	°C	_

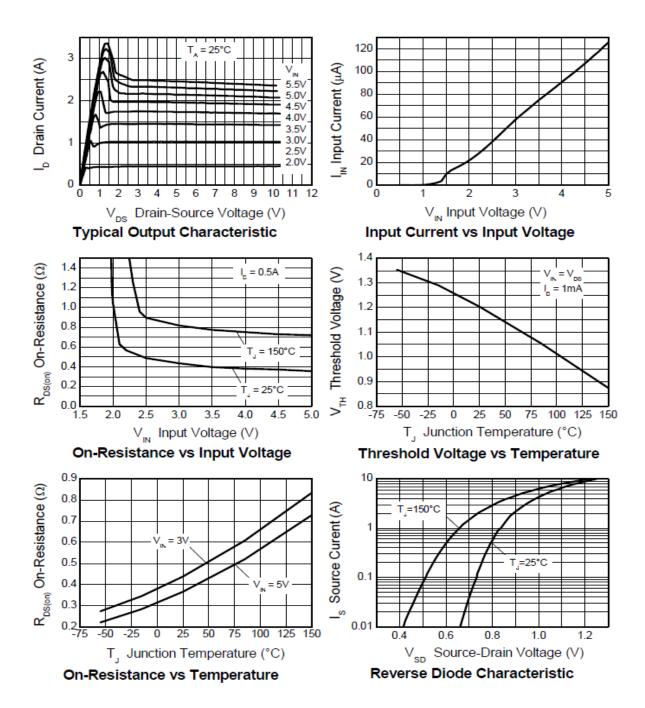
Notes: 12. The drain current is restricted only when the device is in saturation (see graph "Typical Output Characteristic"). This allows the device to be used in the fully on state without interference from the current limit. The device is fully protected at all drain currents, as the low power dissipation generated outside saturation makes current limit unnecessary.

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13. 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.

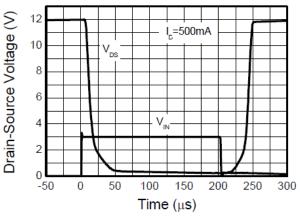


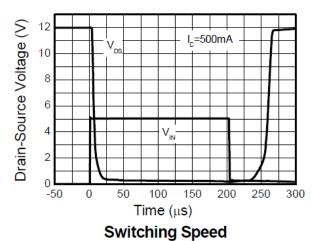
Typical Characteristics



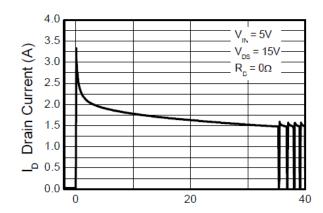


Typical Characteristics - (cont.)





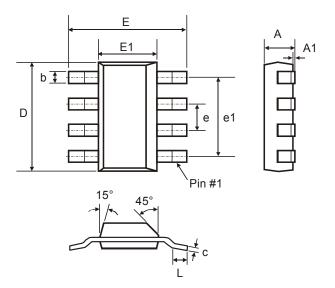
Switching Speed





Package Outline Dimensions

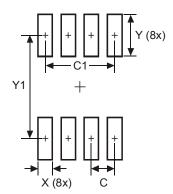
Please see AP02002 at http://www.diodes.com/datasheets/ap02002.pdf for latest version.



SM-8				
Dim	Min	Max	Тур	
Α	_	1.7	_	
A1	0.02	0.1	-	
b	_	0.7	-	
С	0.24	0.32	-	
D	6.3	6.7	-	
е	_	_	1.53	
e1	-	-	4.59	
Е	6.7	7.3	-	
E1	3.3	3.7	_	
L	0.9	_	_	
All Dimensions in mm				

Suggested Pad Layout

Please see AP02001 at http://www.diodes.com/datasheets/ap02001.pdf for the latest version.



Dimensions	Value (in mm)		
С	1.52		
C1	4.6		
Х	0.95		
Y	2.80		
Y1	6.80		



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