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

Product Summary

- Continuos Drain Source Voltage 60V
- On-State Resistance 200mΩ
- Nominal Load Current (V_{IN} = 5V) 1.8A
- Clamping Energy 210mJ

Description

The ZXMS6005DT8 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 ZXMS6005DT8 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

- Lamp Driver
- Motor Driver
- Relay Driver
- Solenoid Driver

Features and Benefits

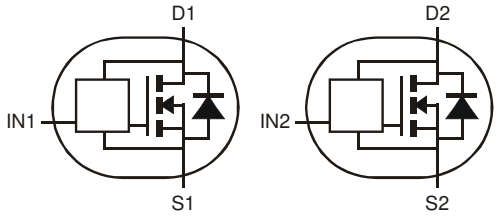
- Compact Dual Package
- Low Input Current
- Logic Level Input (3.3V and 5V)
- Short Circuit Protection with Auto Restart
- Over Voltage Protection (active clamp)
- Thermal Shutdown with Auto Restart
- Over-Current Protection
- Input Protection (ESD)
- High Continuous Current Rating
- **Lead-Free Finish; RoHS compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **Qualified to AEC-Q101 Standards for High Reliability**
- **AEC-Q101-006 Short Circuit Reliability Characterized**
- **PPAP Capable (Note 4)**

Mechanical Data

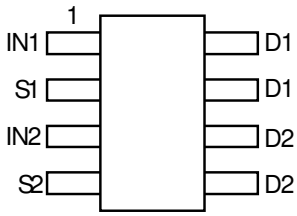
- Case: SM-8
- Case Material: Molded Plastic, "Green" Molding Compound UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Matte Tin Finish e3
- Weight: 0.117 grams (approximate)

SM-8

Top View



Device Symbol



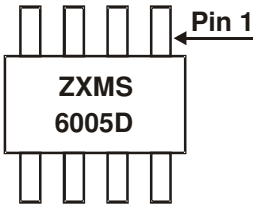
Top View
Pin-Out

Ordering Information (Note 4)

Product	Marking	Reel size (inches)	Tape width (mm)	Quantity per reel
ZXMS6005DT8TA	ZXMS6005D	7	12	1,000

Notes:
1. EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant. All applicable RoHS exemptions applied.
2. 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.

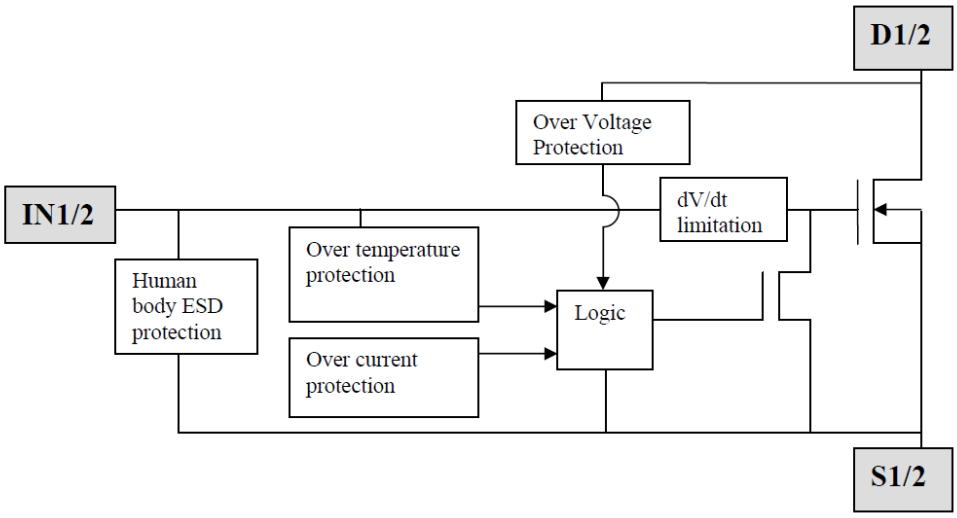
Marking Information



ZXMS6005D = Product Type Marking Code

Top View

Functional Block Diagram



Application 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 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}

Maximum Ratings (@T_A = +25°C, unless otherwise specified.)

Characteristic	Symbol	Value	Units
Continuous Drain-Source Voltage	V_{DS}	60	V
Drain-Source Voltage For Short Circuit Protection	$V_{DS(SC)}$	24	V
Continuous Input Voltage	V_{IN}	-0.5 to +6	V
Continuous Input Current @ -0.2V ≤ V_{IN} ≤ 6V Continuous Input Current @V_{IN} < -0.2V or V_{IN} > 6V	I_{IN}	No limit $\lvert I_{IN} \rvert \leq 2$	mA
Pulsed Drain Current @V_{IN} = 3.3V (Note 7)	I_{DM}	5	A
Pulsed Drain Current @V_{IN} = 5V (Note 7)	I_{DM}	6	A
Continuous Source Current (Body Diode) (Note 5)	I_S	2.5	A
Pulsed Source Current (Body Diode)	I_{SM}	10	A
Unclamped Single Pulse Inductive Energy, T_J = +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 Characteristics (@T_A = +25°C, unless otherwise specified.)

Characteristic	Symbol	Value	Units
Power Dissipation at T_A = +25°C (Notes 5 & 8) Linear Derating Factor	P_D	1.16 9.28	W mW/°C
Power Dissipation at T_A = +25°C (Notes 5 & 9) Linear Derating Factor	P_D	1.67 13.3	W mW/°C
Power Dissipation at T_A = +25°C (Notes 6 & 8) Linear Derating Factor	P_D	2.13 17	W mW/°C
Thermal Resistance, Junction to Ambient (Notes 5 & 8)	$R_{\theta JA}$	108	°C/W
Thermal Resistance, Junction to Ambient (Notes 5 & 9)	$R_{\theta JA}$	75	°C/W
Thermal Resistance, Junction to Case (Notes 6 & 8)	$R_{\theta JC}$	58.7	°C/W
Thermal Resistance, Junction to Case (Note 10)	$R_{\theta JC}$	26.5	°C/W
Operating Temperature Range	T_J	-40 to +150	°C
Storage Temperature Range	T_{STG}	-55 to +150	°C

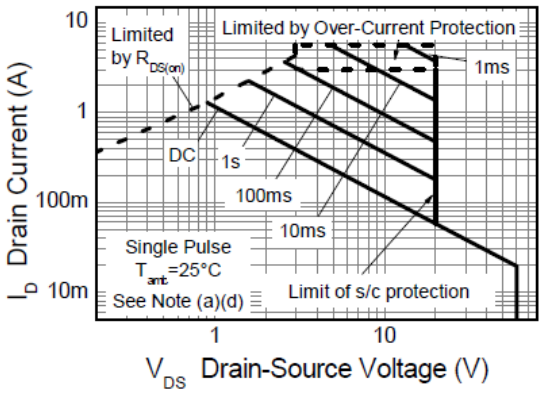
Notes:
5. For a dual device surface mounted on a 25mm x 25mm single sided 1oz weight copper split down the middle on 1.6mm FR4 board, in still air conditions.
6. For a dual device surface mounted on FR4 PCB measured at t ≤ 10sec.
7. Repetitive rating25mm x 25mm FR4 PCB, D = 0.02, Pulse width = 300µs – pulse width limited by junction temperature. Refer to transient thermal impedance graph.
8. For a dual device with one active die.
9. For a dual device with 2 active die running at equal power.
10. Thermal resistance from junction to the mounting surface of the drain pin.

Recommended Operating Conditions

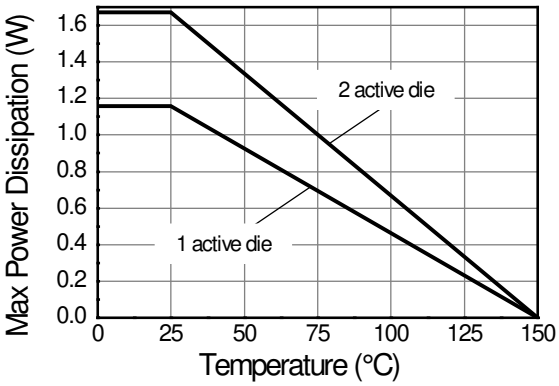
The ZXMS6005DT8 is optimized for use with µC operating from 3.3V and 5V supplies.

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	24	V

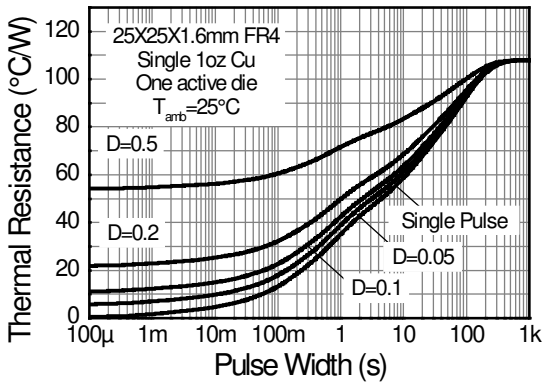
Thermal Characteristics



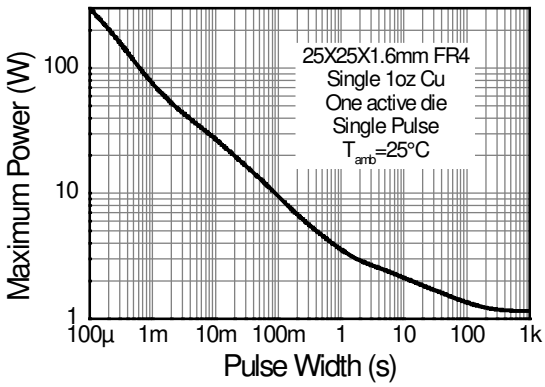
Safe Operating Area



Derating Curve



Transient Thermal Impedance



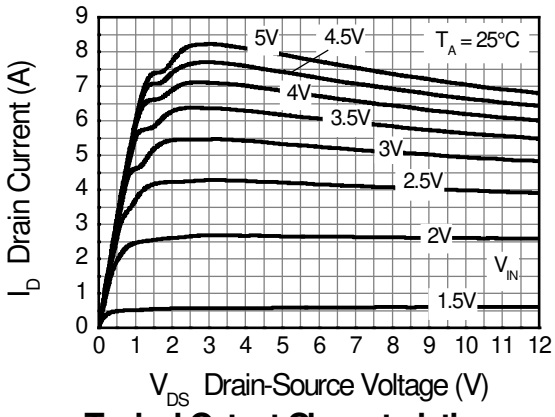
Pulse Power Dissipation

Electrical Characteristics (@T_A = +25°C, unless otherwise specified.)

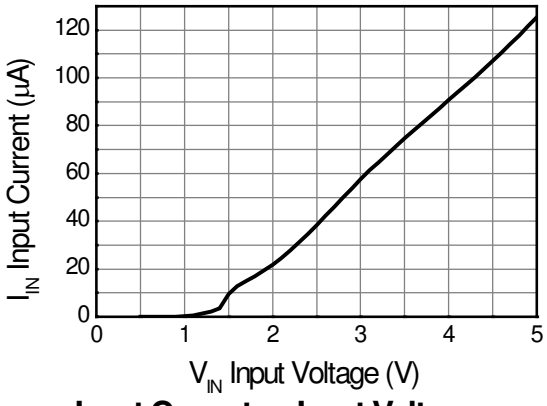
Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
Static Characteristics						
Drain-Source Clamp Voltage	$V_{DS(AZ)}$	60	65	70	V	I_D = 10mA
Off State Drain Current	I_{DSS}	—	—	1	µA	V_{DS} = 12V, V_{IN} = 0V
		—	—	2		V_{DS} = 36V, V_{IN} = 0V
Input Threshold Voltage	$V_{IN(th)}$	0.7	1	1.5	V	V_{DS} = V_{GS}, I_D = 1mA
Input Current	I_{IN}	—	60	100	µA	V_{IN} = +3V
		—	120	200		V_{IN} = +5V
Input Current while Over Temperature Active	—	—	—	300	µA	V_{IN} = +5V
Static Drain-Source On-State Resistance	$R_{DS(on)}$	—	170	250	mΩ	V_{IN} = +3V, I_D = 1A
		—	150	200		V_{IN} = +5V, I_D = 1A
Continuous Drain Current (Notes 5 & 9)	I_D	1.4	—	—	A	V_{IN} = 3V; T_A = +25°C
		1.6	—	—		V_{IN} = 5V; T_A = +25°C
Continuous Drain Current (Notes 5 & 8)		1.7	—	—		V_{IN} = 3V; T_A = +25°C
		1.8	—	—		V_{IN} = 5V; T_A = +25°C
Current Limit (Note 11)	$I_{D(LIM)}$	2.2	5	—	A	V_{IN} = +3V
		3.3	7	—		V_{IN} = +5V
Dynamic Characteristics						
Turn On Delay Time	$t_{d(on)}$	—	6	—	µs	V_{DD} = 12V, I_D = 1A, V_{GS} = 5V
Rise Time	t_r	—	14	—	µs	
Turn Off Delay Time	$t_{d(off)}$	—	34	—	µs	
Fall Time	f_f	—	19	—	µs	
Over-Temperature Protection						
Thermal Overload Trip Temperature (Note 12)	T_{JT}	150	175	—	°C	—
Thermal Hysteresis (Note 12)	f_f	—	10	—	°C	—

Notes:
11. 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.
12. 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.

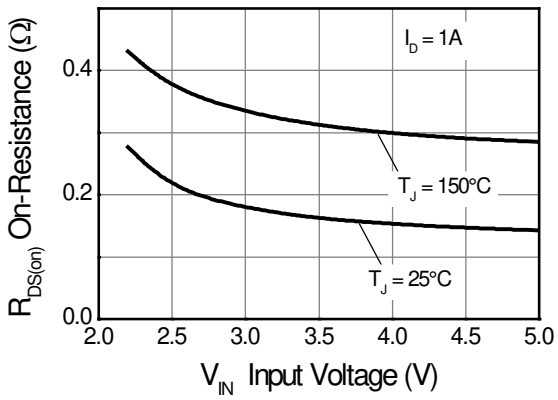
Typical Characteristics



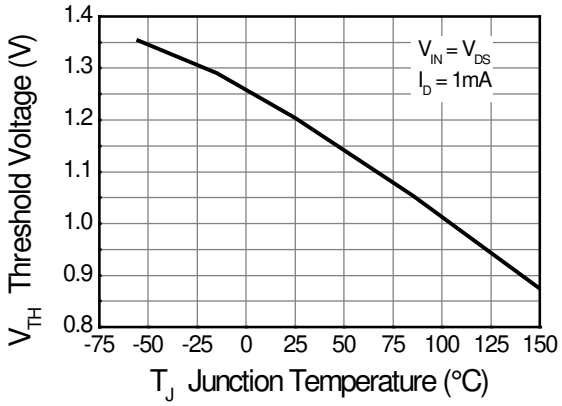
Typical Output Characteristic



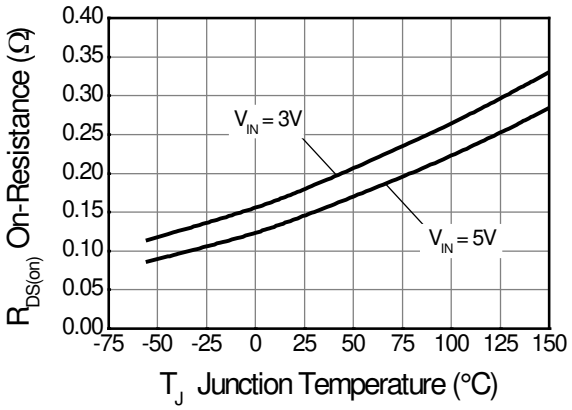
Input Current vs Input Voltage



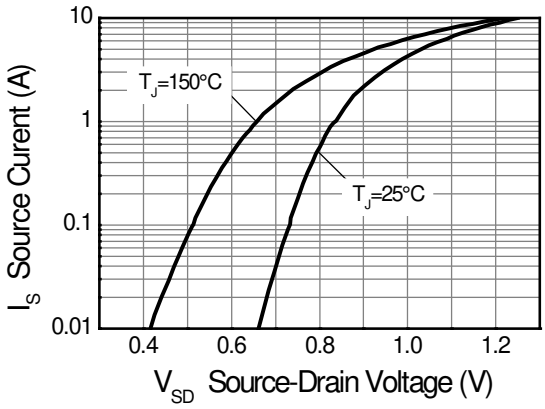
On-Resistance vs Input Voltage



Threshold Voltage vs Temperature

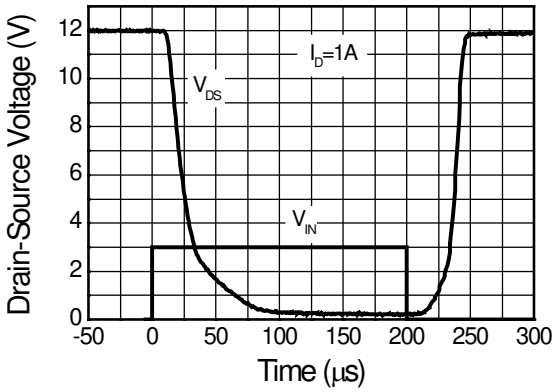


On-Resistance vs Temperature

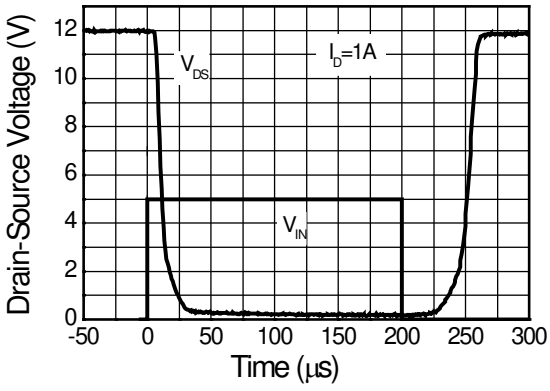


Reverse Diode Characteristic

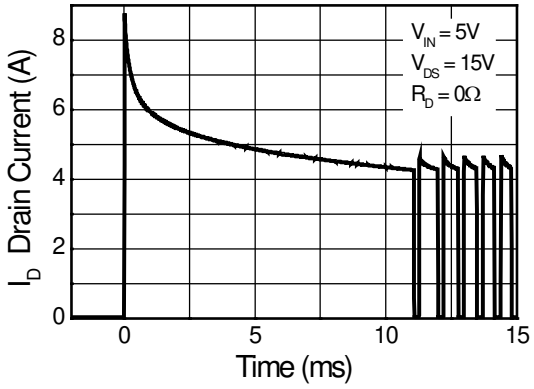
Typical Characteristics (cont.)



Switching Speed



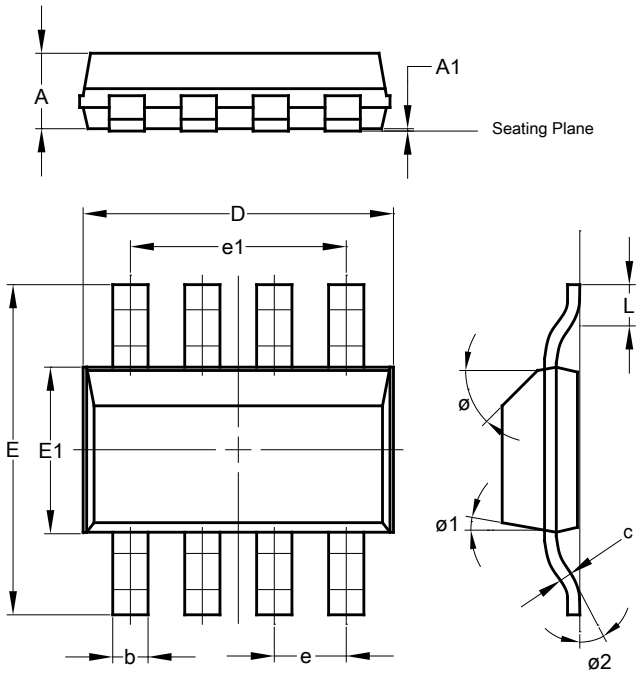
Switching Speed



Typical Short Circuit Protection

Package Outline Dimensions

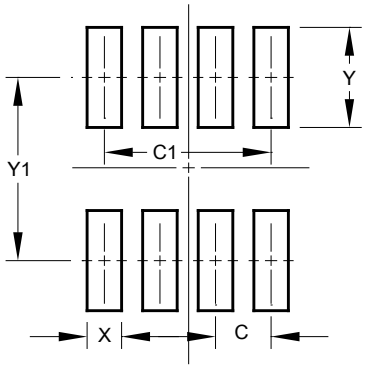
Please see AP02002 at http://www.diodes.com/datasheets/ap02002.pdf for latest version.



SM-8			
Dim	**Min**	**Max**	**Typ**
A	--	1.70	1.60
A1	0.02	0.10	0.04
b	0.70	0.90	0.80
c	0.24	0.32	0.28
D	6.30	6.70	6.60
e	1.53 REF		
e1	4.59 REF		
E	6.70	7.30	7.00
E1	3.30	3.70	3.50
L	0.75	1.00	0.90
Ø	--	--	45°
Ø1	--	15°	--
Ø2	--	--	10°
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)
C	1.52
C1	4.60
X	0.95
Y	2.80
Y1	6.80

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