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

Product Summary

V_{DS}	$R_{DS(ON)}$	I_D V_{IN} = 5V	E_{AS}
60V	100mΩ	2.8A	490mJ

Description and Applications

The ZXMS6006DGQ is a self-protected low-side IntelliFET MOSFET with logic level input. It integrates overtemperature, overcurrent, overvoltage (active clamp) and ESD protected logic level functionality. The ZXMS6006DGQ is ideal as a general-purpose switch driven from 3.3V or 5V microcontrollers in harsh environments where standard MOSFETs are not rugged enough.

- Lamp drivers
- Motor drivers
- Relay drivers
- Solenoid drivers

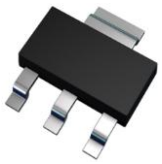
Features and Benefits

- Compact High-Power Dissipation Package
- Low Input Current
- Logic Level Input (3.3V and 5V)
- Short-Circuit Protection with Auto Restart
- Overvoltage Protection (Active Clamp)
- Thermal Shutdown with Auto Restart
- Overcurrent Protection
- Input Protection (ESD)
- High Continuous Current Rating
- **Lead-Free Finish; RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **The ZXMS6006DGQ is suitable for automotive applications requiring specific change control; this part is AEC-Q101 qualified, PPAP capable, and manufactured in IATF 16949 certified facilities.**
  https://www.diodes.com/quality/product-definitions/

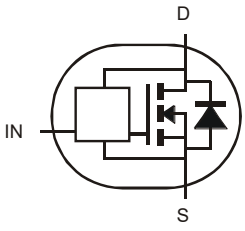
Mechanical Data

- Package: SOT223
- Package 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: 0.112 grams (Approximate)

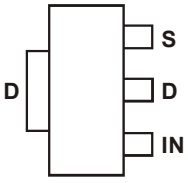
SOT223 (Type DN)



Top View



Device Symbol



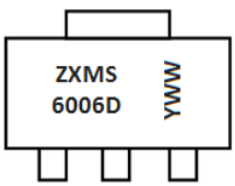
Top View
Pin Out

Ordering Information (Note 4)

Orderable Part Number	Package	Marking	Reel Size (inches)	Tape Width (mm)	Packing	
					Qty.	Carrier
ZXMS6006DGQTA	SOT223 (Type DN)	ZXMS6006D	7	12	1,000	Reel
ZXMS6006DGQ-13	SOT223 (Type DN)	ZXMS6006D	13	12	2,500	Reel

Notes:
1. EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant. All applicable RoHS exemptions applied.
2. See https://www.diodes.com/quality/lead-free/ 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. For packaging details, go to our website at https://www.diodes.com/design/support/packaging/diodes-packaging/.

Marking Information

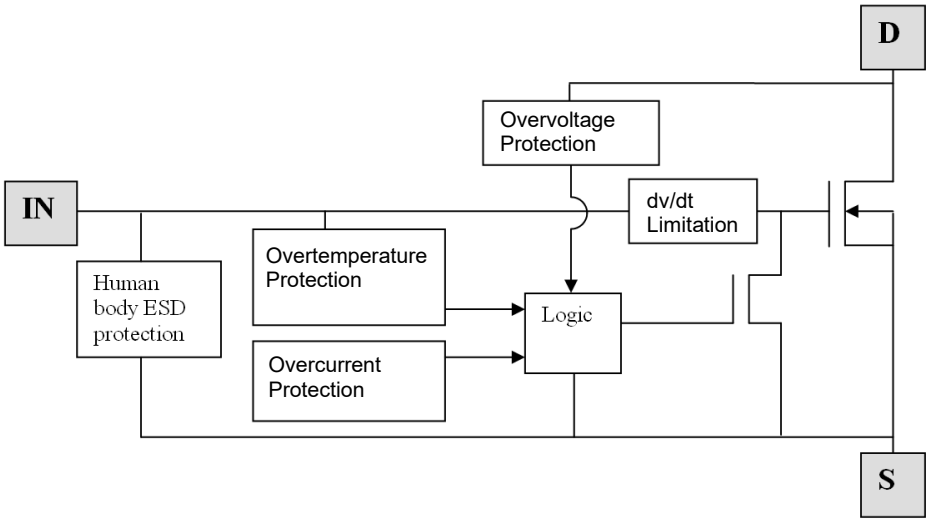


ZXMS6006D = Product Type Marking Code
YWW = Date Code Marking
Y or $\overline{Y}$ = Last Digit of Year (ex: 6 = 2026)
WW or $\overline{WW}$ = Week Code (01 to 53)

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Functional Block Diagram



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

Characteristic	Symbol	Value	Unit
Continuous Drain-Source Voltage	V_{DS}	60	V
Drain-Source Voltage for Short-Circuit Protection	$V_{DS(SC)}$	16	V
Continuous Input Voltage	V_{IN}	-0.5 to +6.0	V
Continuous Input Current @-0.2V ≤ V_{IN} ≤ 6V Continuous Input Current @V_{IN} < -0.2V or V_{IN} > 6V	I_{IN}	No Limit $\lvert I_{IN} \rvert \le 2$	mA
Pulsed Drain Current @V_{IN} = 3.3V	I_{DM}	11	A
Pulsed Drain Current @V_{IN} = 5V	I_{DM}	13	A
Continuous Source Current (Body Diode) (Note 5)	I_S	2	A
Pulsed Source Current (Body Diode)	I_{SM}	12	A
Unclamped Single Pulse Inductive Energy, T_J = 25°C, I_D = 0.5A, V_{DD} = 24V	E_{AS}	490	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	Unit
Power Dissipation at T_A = 25°C (Note 5) Linear Derating Factor	P_D	1.27 10.1	W mW/°C
Power Dissipation at T_A = 25°C (Note 6) Linear Derating Factor	P_D	1.82 14.5	W mW/°C
Thermal Resistance, Junction to Ambient (Note 5)	$R_{\theta JA}$	99	°C/W
Thermal Resistance, Junction to Ambient (Note 6)	$R_{\theta JA}$	69	°C/W
Thermal Resistance, Junction to Case (Note 7)	$R_{\theta JC}$	6.98	°C/W
Operating Temperature Range	T_J	-40 to 150	°C
Storage Temperature Range	T_{STG}	-55 to 150	°C

Notes: 5. Device mounted on FR-4 substrate PC board, 2oz copper, with minimum recommended pad layout.
6. Device mounted on FR-4 substrate PC board, 2oz copper, with 1inch square copper plate.
7. Thermal resistance between junction and the mounting surfaces of drain and source pins.

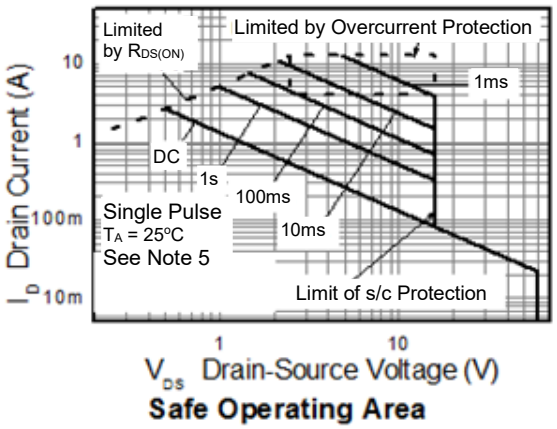
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Recommended Operating Conditions

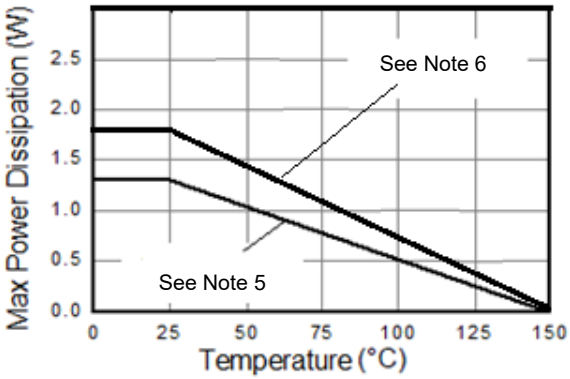
The ZXMS6006DGQ is optimized for use with µC operating from 3.3V and 5V supplies.

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	16	V

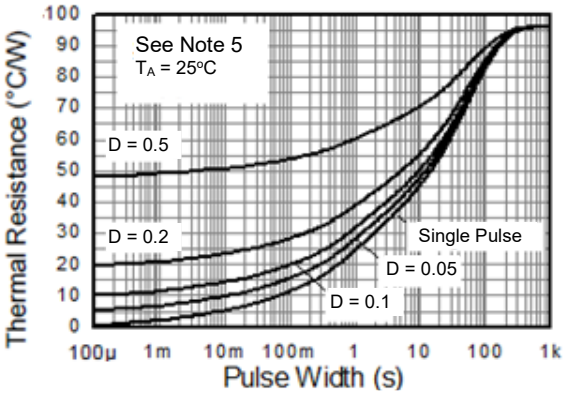
Thermal Characteristics



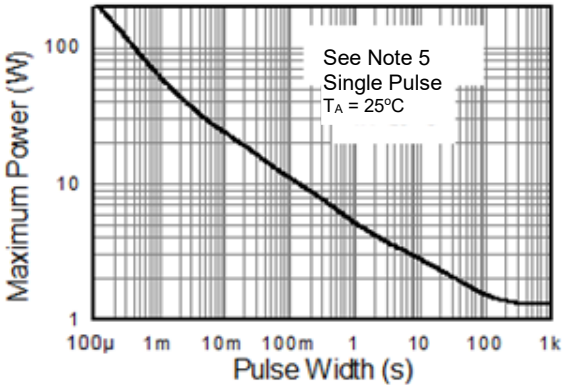
Safe Operating Area



Derating Curve



Transient Thermal Impedance



Pulse Power Dissipation

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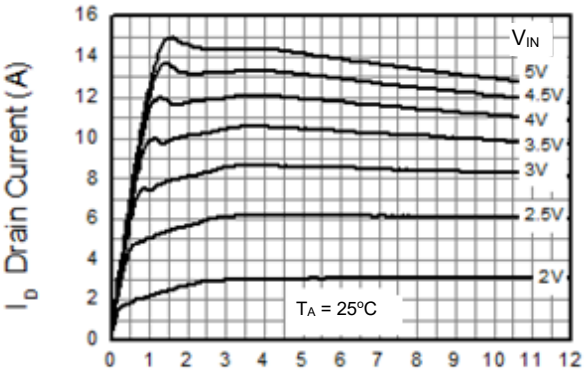
Electrical Characteristics (@T_A = +25°C, unless otherwise specified.)

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	1.15	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 Overtemperature Active	—	—	—	400	μA	V_{IN} = 5V
Static Drain-Source On-State Resistance	$R_{DS(ON)}$	—	85	125	mΩ	V_{IN} = 3V, I_D = 1A
		—	75	100		V_{IN} = 5V, I_D = 1A
Continuous Drain Current (Note 5)	I_D	2.0	—	—	A	V_{IN} = 3V, T_A = 25°C
		2.2	—	—		V_{IN} = 5V, T_A = 25°C
Continuous Drain Current (Note 6)		2.6	—	—		V_{IN} = 3V, T_A = 25°C
		2.8	—	—		V_{IN} = 5V, T_A = 25°C
Current Limit (Note 8)	$I_{D(LIM)}$	4	8	—	A	V_{IN} = 3V
		6	13	—		V_{IN} = 5V
Dynamic Characteristics						
Turn-On Delay Time	$t_{D(ON)}$	—	8.6	—	μs	V_{DD} = 12V, I_D = 1A, V_{GS} = 5V
Rise Time	t_R	—	18	—		
Turn-Off Delay Time	$t_{D(OFF)}$	—	34	—		
Fall Time	t_F	—	15	—		
Overtemperature Protection						
Thermal Overload Trip Temperature (Note 9)	T_{JT}	150	175	—	°C	—
Thermal Hysteresis (Note 9)	—	—	10	—	°C	—

Notes:
5. Device mounted on FR-4 substrate PC board, 2oz copper, with minimum recommended pad layout.
6. Device mounted on FR-4 substrate PC board, 2oz copper, with 1inch square copper plate.
7. Thermal resistance between junction and the mounting surfaces of drain and source pins.
8. 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.
9. Overtemperature 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 overtemperature for extended periods.

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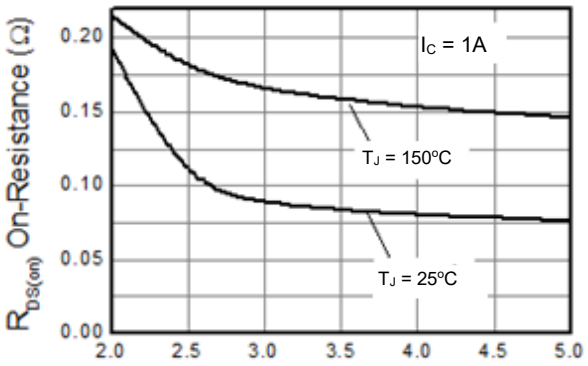
Typical Characteristics



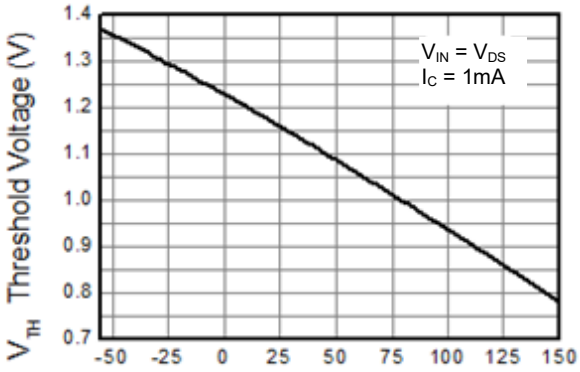
Typical Output Characteristic



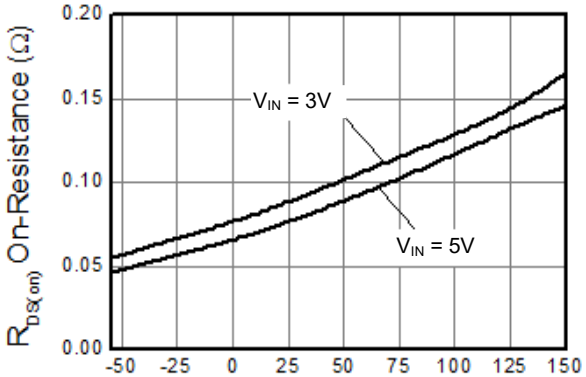
Input Current vs Input Voltage



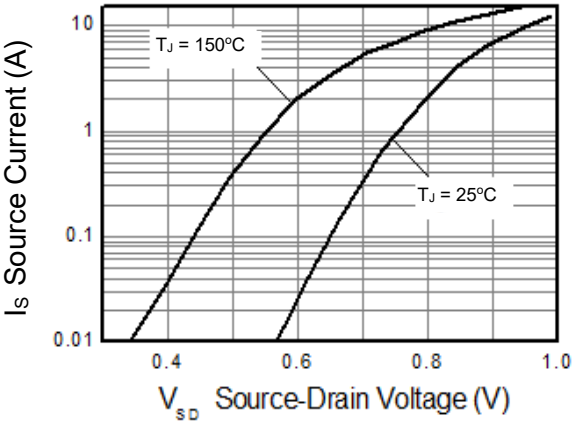
On-Resistance vs Input Voltage



Threshold Voltage vs Temperature



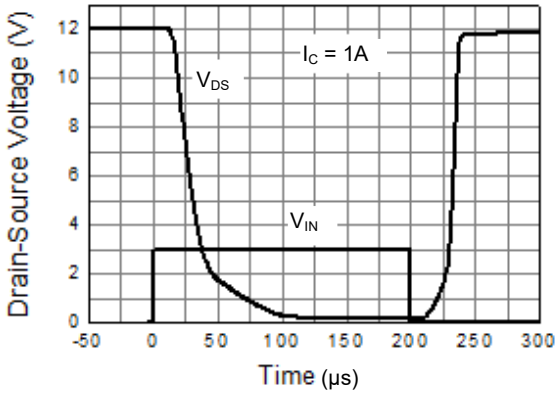
On-Resistance vs Temperature



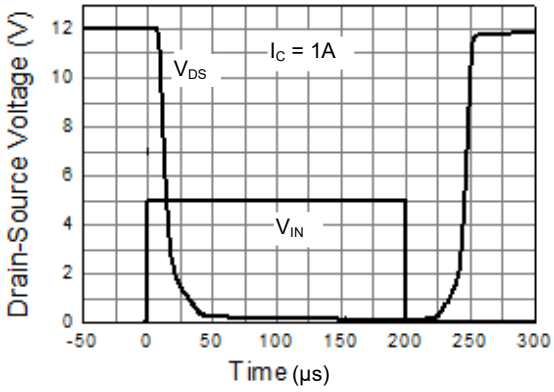
Reverse Diode Characteristic

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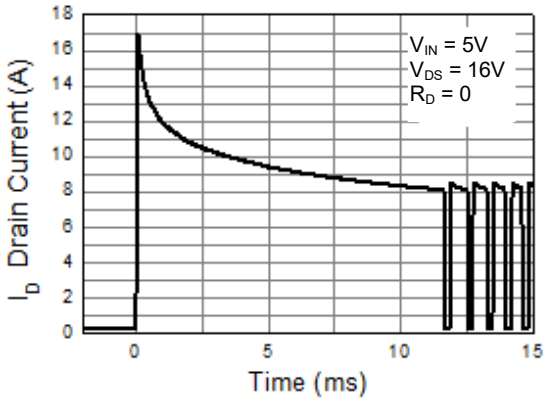
Typical Characteristics (continued)



Switching Speed



Switching Speed



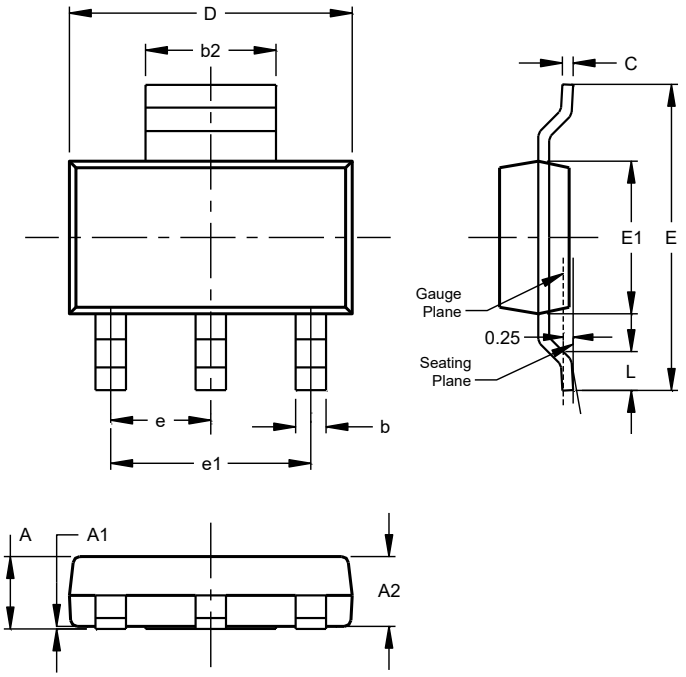
Typical Short-Circuit Protection

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Package Outline Dimensions

Please see http://www.diodes.com/package-outlines.html for the latest version.

SOT223 (Type DN)

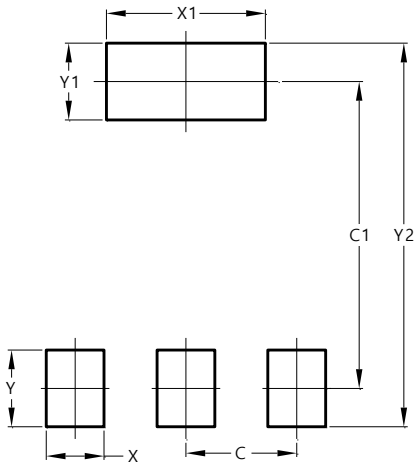


SOT223 (Type DN)			
Dim	**Min**	**Max**	**Typ**
A	--	1.70	--
A1	0.01	0.15	--
A2	1.50	1.68	1.60
b	0.60	0.80	0.70
b2	2.90	3.10	--
c	0.20	0.32	--
D	6.30	6.70	--
E	6.70	7.30	--
E1	3.30	3.70	--
e	--	--	2.30
e1	--	--	4.60
L	0.85	--	--
All Dimensions in mm			

Suggested Pad Layout

Please see http://www.diodes.com/package-outlines.html for the latest version.

SOT223 (Type DN)



Dimensions	Value (in mm)
C	2.30
C1	6.40
X	1.20
X1	3.30
Y	1.60
Y1	1.60
Y2	8.00

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