

**ZXMP6A13G**

**60V P-CHANNEL ENHANCEMENT MODE MOSFET**

**Product Summary**

$V_{(BR)DSS}$	$R_{DS(on)}$	$I_D$ $T_A = 25^\circ C$
-60V	390m $\Omega$ @ $V_{GS} = -10V$	-2.3A
	595m $\Omega$ @ $V_{GS} = -4.5V$	-1.9A

**Description and Applications**

This MOSFET has been designed to minimize the on-state resistance and yet maintain superior switching performance, making it ideal for high efficiency power management applications.

- Motor control
- DC-DC Converters
- Power management functions
- Uninterrupted power supply

**Features and Benefits**

- Fast switching speed
- Low gate drive
- Low input capacitance
- "Lead Free", RoHS Compliant (Note 1)
- Halogen and Antimony Free. "Green" Device (Note 2)
- Qualified to AEC-Q101 Standards for High Reliability

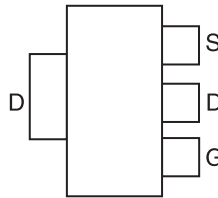
**Mechanical Data**

- Case: SOT223
- Case Material: Molded Plastic, UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Finish - Matte Tin annealed over Copper lead frame. Solderable per MIL-STD-202, Method 208
- Weight: 0.112 grams (approximate)

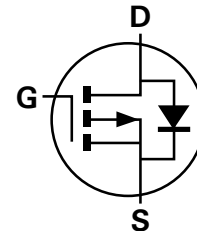
SOT223



Top View



Pin Out - Top View



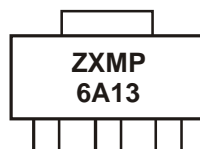
Equivalent Circuit

**Ordering Information** (Note 3)

Product	Marking	Reel size (inches)	Tape width (mm)	Quantity per reel
ZXMP6A13GTA	ZXMP6A13	7	12	1,000

- Notes:
1. No purposefully added lead
  2. Diodes Inc's "Green" policy can be found on our website at <http://www.diodes.com>.
  3. For packaging details, go to our website at <http://www.diodes.com>.

**Marking Information**



ZXMP = Product Type Marking Code, Line 1  
6A13 = Product Type Marking Code, Line 2

**Maximum Ratings** @ $T_A = 25^\circ\text{C}$  unless otherwise specified

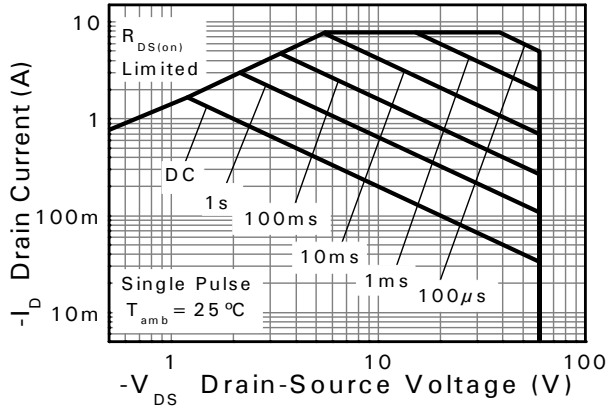
Characteristic			Symbol	Value	Unit	
Drain-Source voltage			$V_{DSS}$	-60	V	
Gate-Source voltage			$V_{GS}$	$\pm 20$	V	
Continuous Drain current	$V_{GS} = 10\text{V}$	(Note 5)	$I_D$	-2.3	A	
		$T_A = 70^\circ\text{C}$ (Note 5)		-1.9		
		(Note 4)		-1.7		
Pulsed Drain current	$V_{GS} = 10\text{V}$	(Note 6)	$I_{DM}$	-7.8	A	
Continuous Source current (Body diode)			(Note 5)	$I_S$	-4.1	A
Pulsed Source current (Body diode)			(Note 6)	$I_{SM}$	-7.8	A

**Thermal Characteristics** @ $T_A = 25^\circ\text{C}$  unless otherwise specified

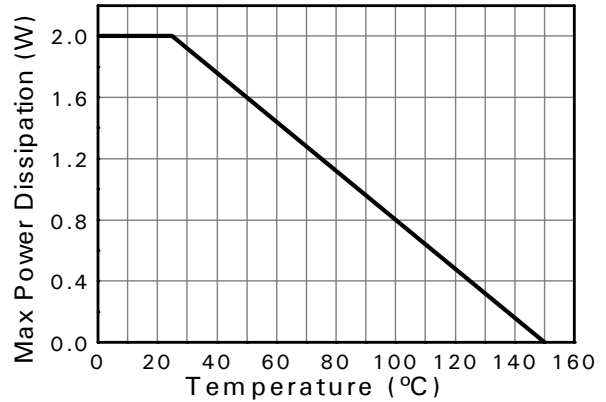
Characteristic		Symbol	Value	Unit
Power dissipation Linear derating factor	(Note 4)	$P_D$	2.0	W mW/ $^\circ\text{C}$
			16	
	(Note 5)		3.9	
Thermal Resistance, Junction to Ambient	(Note 4)	$R_{\theta JA}$	62.5	$^\circ\text{C/W}$
	(Note 5)		32.0	
Thermal Resistance, Junction to Lead	(Note 7)	$R_{\theta JL}$	9.8	
Operating and storage temperature range		$T_J, T_{STG}$	-55 to 150	$^\circ\text{C}$

- Notes:
4. For a device surface mounted on 25mm x 25mm x 1.6mm FR4 PCB with high coverage of single sided 1oz copper, in still air conditions; the device is measured when operating in a steady-state condition.
  5. Same as note (1), except the device is measured at  $t \leq 10$  sec.
  6. Same as note (1), except the device is pulsed with  $D = 0.02$  and pulse width 300 $\mu\text{s}$ . The pulse current is limited by the maximum junction temperature.
  7. Thermal resistance from junction to solder-point (at the end of the drain lead).

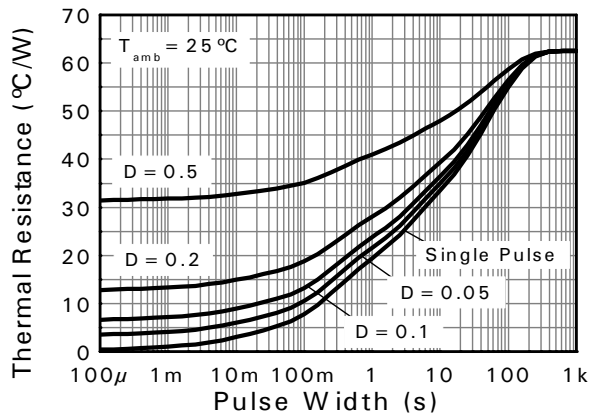
**Thermal Characteristics**



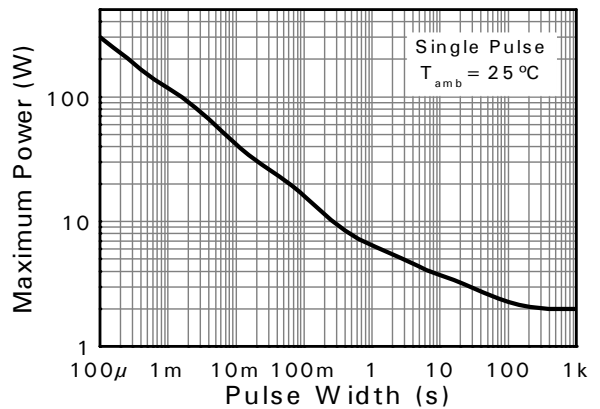
**Safe Operating Area**



**Derating Curve**



**Transient Thermal Impedance**



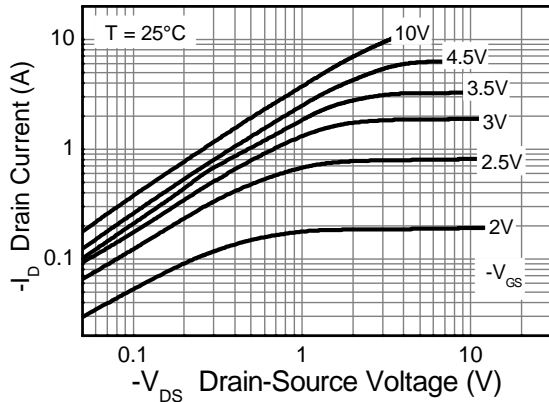
**Pulse Power Dissipation**

**Electrical Characteristics** @T<sub>A</sub> = 25°C unless otherwise specified

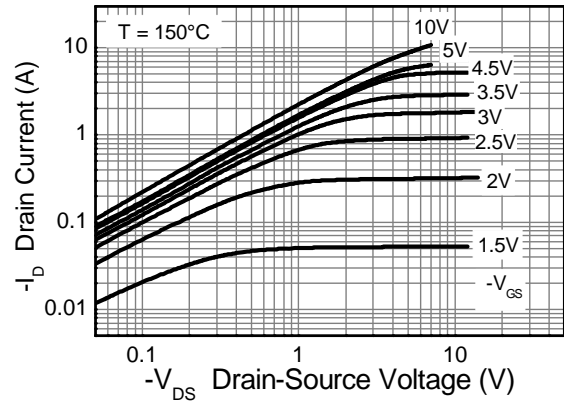
Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
<b>OFF CHARACTERISTICS</b>						
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	-60	—	—	V	I <sub>D</sub> = -250μA, V <sub>GS</sub> = 0V
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	—	—	-0.5	μA	V <sub>DS</sub> = -60V, V <sub>GS</sub> = 0V
Gate-Source Leakage	I <sub>GSS</sub>	—	—	±100	nA	V <sub>GS</sub> = ±20V, V <sub>DS</sub> = 0V
<b>ON CHARACTERISTICS</b>						
Gate Threshold Voltage	V <sub>GS(th)</sub>	-1.0	—	-3.0	V	I <sub>D</sub> = -250μA, V <sub>DS</sub> = V <sub>GS</sub>
Static Drain-Source On-Resistance (Note 8)	R <sub>DS(on)</sub>	—	—	0.390	Ω	V <sub>GS</sub> = -10V, I <sub>D</sub> = -0.9A
				0.595		V <sub>GS</sub> = -4.5V, I <sub>D</sub> = -0.8A
Forward Transconductance (Notes 8 & 9)	g <sub>fs</sub>	—	1.8	—	S	V <sub>DS</sub> = -15V, I <sub>D</sub> = -0.9A
Diode Forward Voltage (Note 8)	V <sub>SD</sub>	—	-0.85	-0.95	V	I <sub>S</sub> = -0.8A, V <sub>GS</sub> = 0V, T <sub>J</sub> = 25°C
Reverse recovery time (Note 9)	t <sub>rr</sub>	—	21.1	—	ns	I <sub>S</sub> = -0.9A, di/dt = 100A/μs, T <sub>J</sub> = 25°C
Reverse recovery charge (Note 9)	Q <sub>rr</sub>	—	19.3	—	nC	T <sub>J</sub> = 25°C
<b>DYNAMIC CHARACTERISTICS (Note 9)</b>						
Input Capacitance	C <sub>iss</sub>	—	219	—	pF	V <sub>DS</sub> = -30V, V <sub>GS</sub> = 0V f = 1MHz
Output Capacitance	C <sub>oss</sub>	—	25.7	—	pF	
Reverse Transfer Capacitance	C <sub>rss</sub>	—	20.5	—	pF	
Total Gate Charge (Note 10)	Q <sub>g</sub>	—	2.9	—	nC	V <sub>GS</sub> = -4.5V
Total Gate Charge (Note 10)	Q <sub>g</sub>	—	5.9	—	nC	V <sub>GS</sub> = -10V
Gate-Source Charge (Note 10)	Q <sub>gs</sub>	—	0.74	—	nC	
Gate-Drain Charge (Note 10)	Q <sub>gd</sub>	—	1.5	—	nC	
Turn-On Delay Time (Note 10)	t <sub>D(on)</sub>	—	1.6	—	ns	V <sub>DD</sub> = -30V, V <sub>GS</sub> = -10V I <sub>D</sub> = -1A, R <sub>θ</sub> = 6.0Ω
Turn-On Rise Time (Note 10)	t <sub>r</sub>	—	2.2	—	ns	
Turn-Off Delay Time (Note 10)	t <sub>D(off)</sub>	—	11.2	—	ns	
Turn-Off Fall Time (Note 10)	t <sub>f</sub>	—	5.7	—	ns	

- Notes:
8. Measured under pulsed conditions. Pulse width ≤ 300μs; duty cycle ≤ 2%
  9. For design aid only, not subject to production testing.
  10. Switching characteristics are independent of operating junction temperatures.

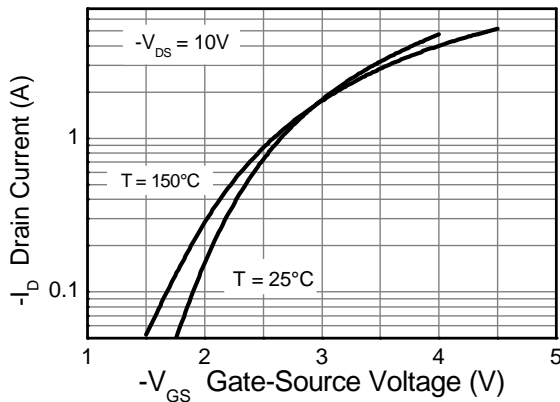
**Typical Characteristics**



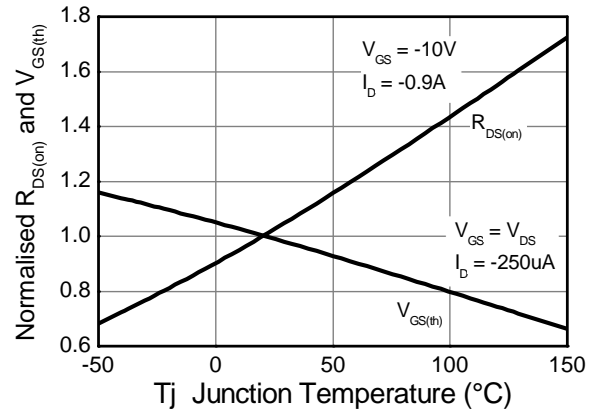
**Output Characteristics**



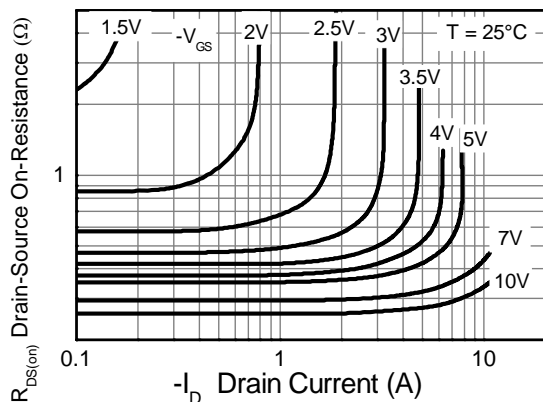
**Output Characteristics**



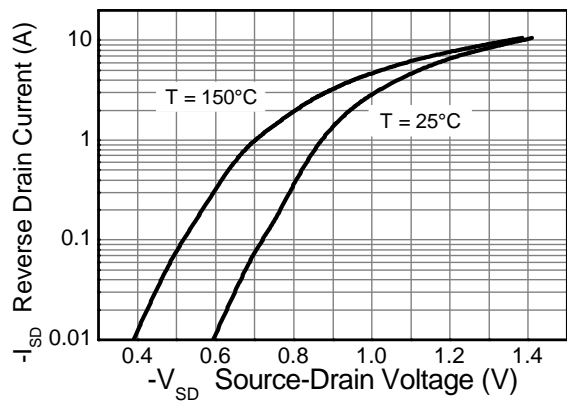
**Typical Transfer Characteristics**



**Normalised Curves v Temperature**

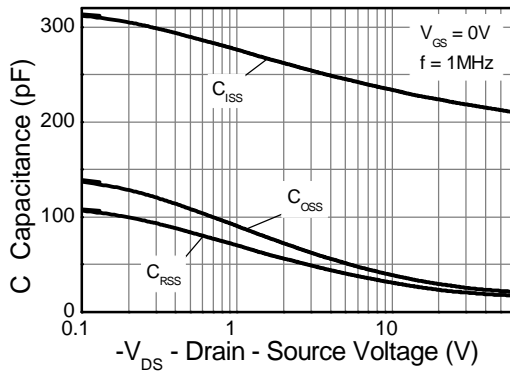


**On-Resistance v Drain Current**

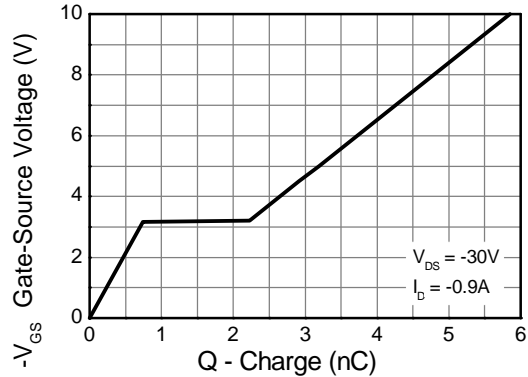


**Source-Drain Diode Forward Voltage**

**Typical Characteristics - continued**

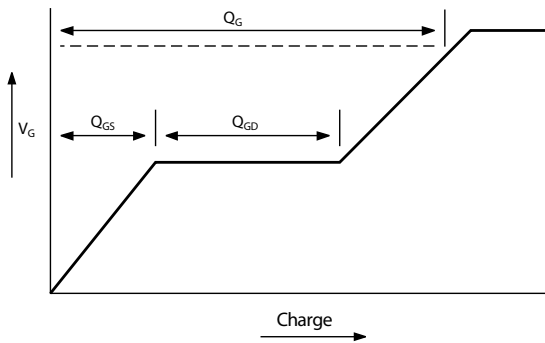


**Capacitance v Drain-Source Voltage**

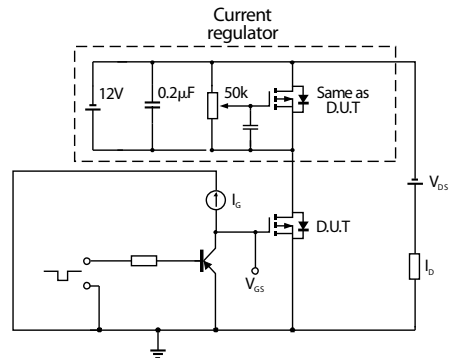


**Gate-Source Voltage v Gate Charge**

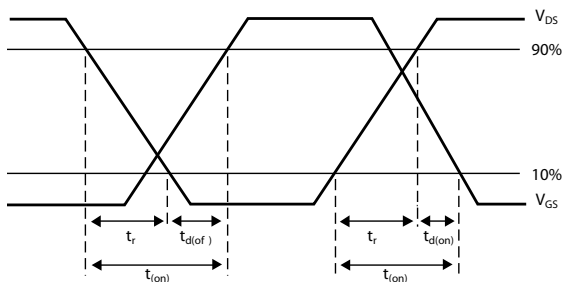
**Test Circuits**



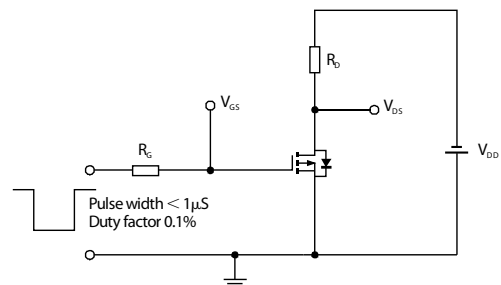
**Basic gate charge waveform**



**Gate charge test circuit**

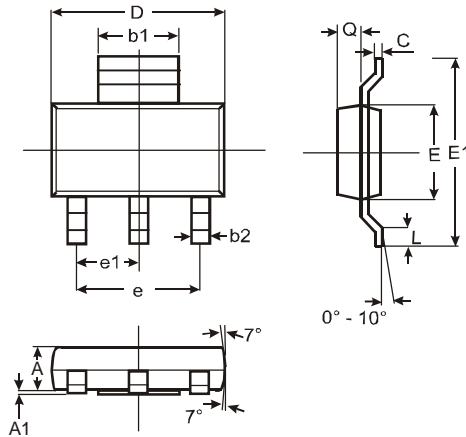


**Switching time waveforms**



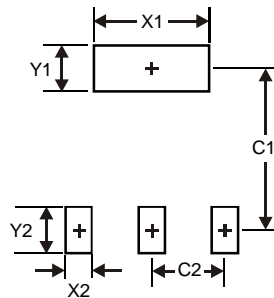
**Switching time test circuit**

**Package Outline Dimensions**



SOT223			
Dim	Min	Max	Typ
A	1.55	1.65	1.60
A1	0.010	0.15	0.05
b1	2.90	3.10	3.00
b2	0.60	0.80	0.70
C	0.20	0.30	0.25
D	6.45	6.55	6.50
E	3.45	3.55	3.50
E1	6.90	7.10	7.00
e	—	—	4.60
e1	—	—	2.30
L	0.85	1.05	0.95
Q	0.84	0.94	0.89
All Dimensions in mm			

**Suggested Pad Layout**



Dimensions	Value (in mm)
X1	3.3
X2	1.2
Y1	1.6
Y2	1.6
C1	6.4
C2	2.3

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