60V P-CHANNEL ENHANCEMENT MODE MOSFET

Product Summary

$V_{(BR)DSS}$	$R_{DS(on)}$	I_D T_A = +25°C
-60V	390mΩ @ V_{GS} = -10V	-2.3A
	595mΩ @ V_{GS} = -4.5V	-1.9A

Features and Benefits

- Fast Switching Speed
- Low Gate Drive
- Low Input Capacitance
- **Lead-Free Finish; RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **Qualified to AEC-Q101 Standards for High Reliability**

Description and Applications

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

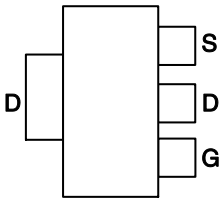
- Motor Control
- DC-DC Converters
- Power Management Functions
- Uninterrupted Power Supply

Mechanical Data

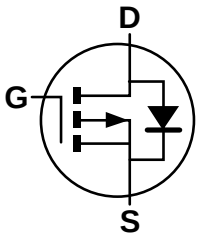
- Case: SOT223
- Case Material: Molded Plastic, “Green” Molding Compound; UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals Connections: See Diagram Below
- Terminals: Finish - Matte Tin Annealed over Copper Leadframe; Solderable per MIL-STD-202, Method 208 e3
- Weight: 0.112 grams (Approximate)

SOT223

Top View



Pin Out - Top View



Equivalent Circuit

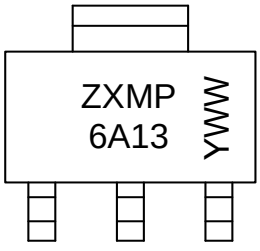
Ordering Information (Note 4)

Product	Marking	Reel size (inches)	Tape width (mm)	Quantity per reel
ZXMP6A13GTA	ZXMP6A13	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. For packaging details, go to our website at http:// www.diodes.com/products/packages.html.

Marking Information

SOT223



ZXMP 6A13 = Product Type Marking Code
YWW = Date Code Marking
Y or $\overline{Y}$ = Last Digit of Year (ex: 5= 2015)
WW or $\overline{W}W$ = Week Code (01~53)

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

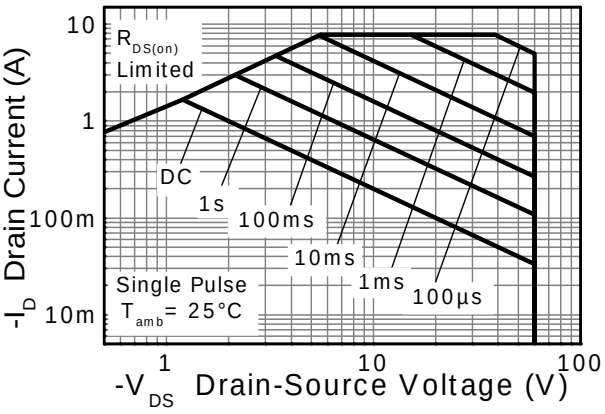
Characteristic			Symbol	Value	Unit
Drain-Source Voltage			V_{DSS}	-60	V
Gate-Source Voltage			V_{GS}	±20	V
Continuous Drain Current	V_{GS} = 10V	(Note 6)	I_D	-2.3	A
		T_A = +70°C (Note 6)		-1.9	
		(Note 5)		-1.7	
Pulsed Drain Current	V_{GS}= 10V	(Note 7)	I_{DM}	-7.8	A
Continuous Source Current (Body Diode)		(Note 6)	I_S	-4.1	A
Pulsed Source Current (Body Diode)		(Note 7)	I_{SM}	-7.8	A

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

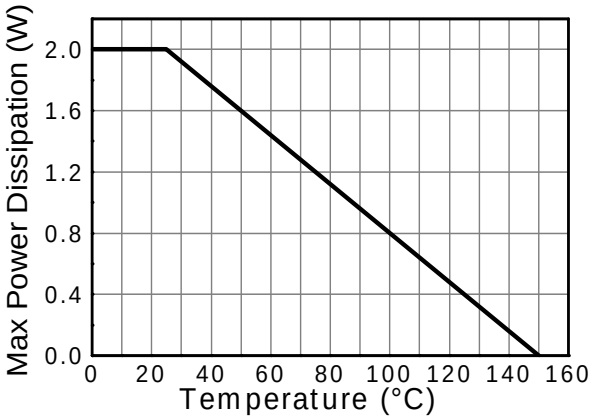
Characteristic		Symbol	Value	Unit
Power Dissipation	(Note 5)	P_D	2.0	W
Linear Derating Factor			16	mW/°C
	(Note 6)		3.9	W
			31	mW/°C
Thermal Resistance, Junction to Ambient	(Note 5)	$R_{\theta JA}$	62.5	°C/W
	(Note 6)		32.0	
Thermal Resistance, Junction to Lead	(Note 8)	$R_{\theta JL}$	9.8	
Operating and Storage Temperature Range		T_J, T_{STG}	-55 to 150	°C

Notes:
5. 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.
6. Same as Note 5, except the device is measured at t ≤ 10 sec.
7. Same as Note 5, except the device is pulsed with D = 0.02 and pulse width 300µs. The pulse current is limited by the maximum junction temperature.
8. Thermal resistance from junction to solder-point (at the end of the drain lead).

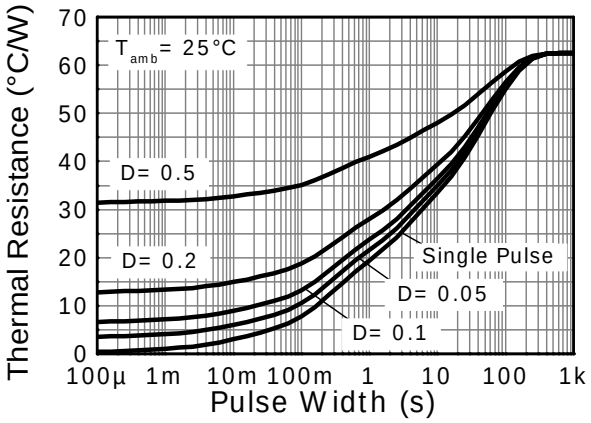
Thermal Characteristics



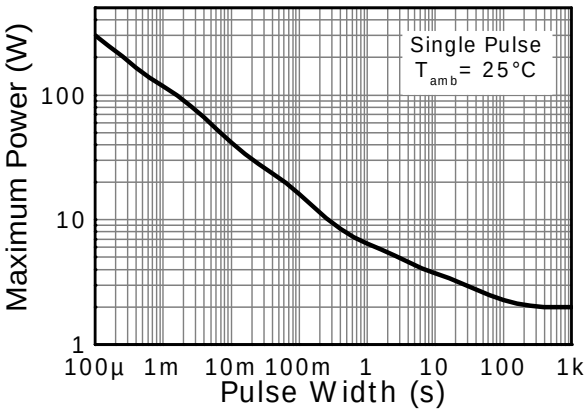
Safe Operating Area



Derating Curve



Transient Thermal Impedance



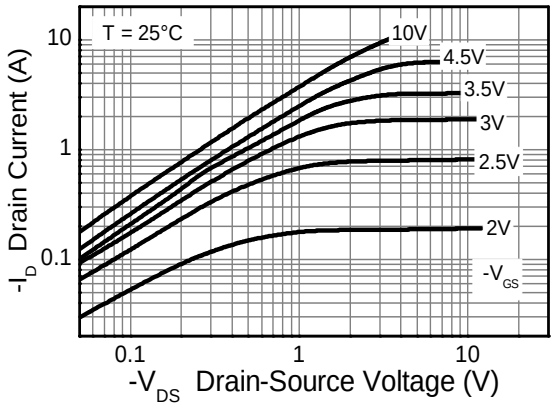
Pulse Power Dissipation

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

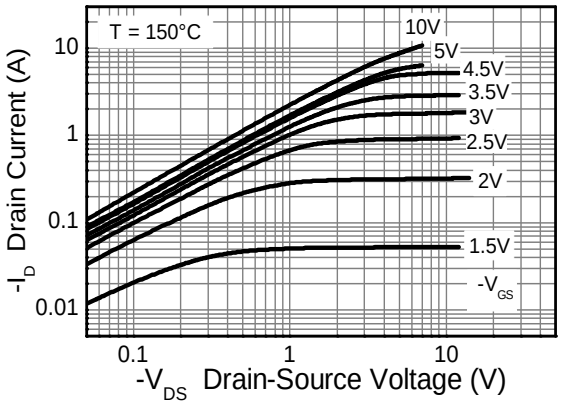
Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
OFF CHARACTERISTICS						
Drain-Source Breakdown Voltage	BV_{DSS}	-60	—	—	V	I_D = -250µA, V_{GS} = 0V
Zero Gate Voltage Drain Current	I_{DSS}	—	—	-0.5	µA	V_{DS} = -60V, V_{GS} = 0V
Gate-Source Leakage	I_{GSS}	—	—	±100	nA	V_{GS} = ±20V, V_{DS} = 0V
ON CHARACTERISTICS						
Gate Threshold Voltage	$V_{GS(th)}$	-1.0	—	-3.0	V	I_D = -250µA, V_{DS} = V_{GS}
Static Drain-Source On-Resistance (Note 9)	$R_{DS\ (ON)}$	—	—	0.390	Ω	V_{GS} = -10V, I_D = -0.9A
				0.595		V_{GS} = -4.5V, I_D = -0.8A
Forward Transconductance (Notes 9 & 10)	g_{fs}	—	1.8	—	S	V_{DS} = -15V, I_D = -0.9A
Diode Forward Voltage (Note 9)	V_{SD}	—	-0.85	-0.95	V	I_S = -0.8A, V_{GS} = 0V, T_J = +25°C
Reverse Recovery Time (Note 10)	t_{rr}		21.1	—	ns	I_S = -0.9A, di/dt = 100A/µs, T_J = +25°C
Reverse Recovery Charge (Note 10)	Q_{rr}	—	19.3	—	nC	
DYNAMIC CHARACTERISTICS (Note 10)						
Input Capacitance	C_{iss}	—	219	—	pF	V_{DS} = -30V, V_{GS} = 0V f = 1MHz
Output Capacitance	C_{oss}	—	25.7	—	pF	
Reverse Transfer Capacitance	C_{rss}	—	20.5	—	pF	
Total Gate Charge (Note 11)	Q_g	—	2.9	—	nC	V_{GS} = -4.5V; V_{DS} = -30V, I_D = -0.9A
Total Gate Charge (Note 11)	Q_g	—	5.9	—	nC	V_{GS} = -10V; V_{DS} = -30V, I_D = -0.9A
Gate-Source Charge (Note 11)	Q_{gs}	—	0.74	—	nC	
Gate-Drain Charge (Note 11)	Q_{gd}	—	1.5	—	nC	
Turn-On Delay Time (Note 11)	$t_{D(on)}$	—	1.6	—	ns	V_{DD} = -30V, V_{GS} = -10V, I_D = -1A, R_G ≅ 6.0Ω
Turn-On Rise Time (Note 11)	t_r	—	2.2	—	ns	
Turn-Off Delay Time (Note 11)	$t_{D(off)}$	—	11.2	—	ns	
Turn-Off Fall Time (Note 11)	t_f	—	5.7	—	ns	

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

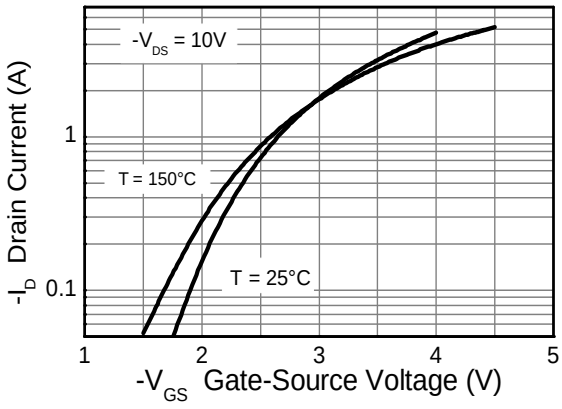
Typical Characteristics



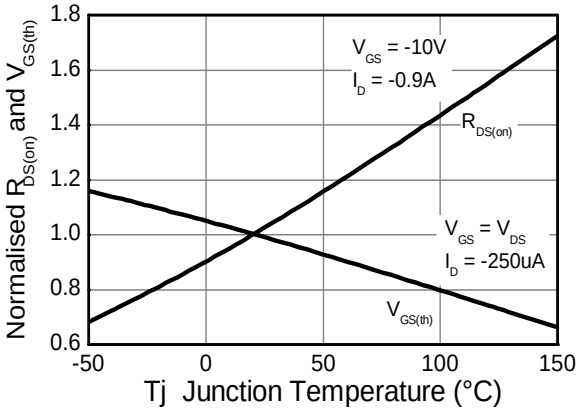
Output Characteristics



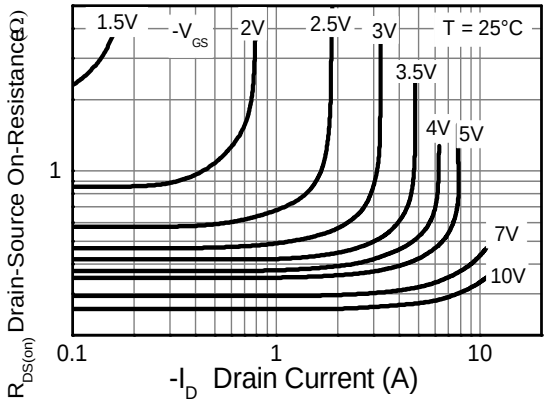
Output Characteristics



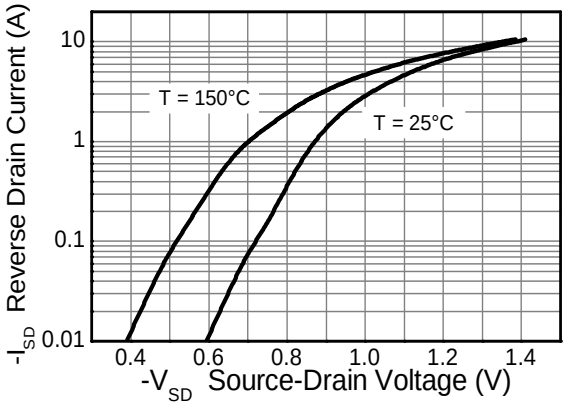
Typical Transfer Characteristics



Normalised Curves v Temperature

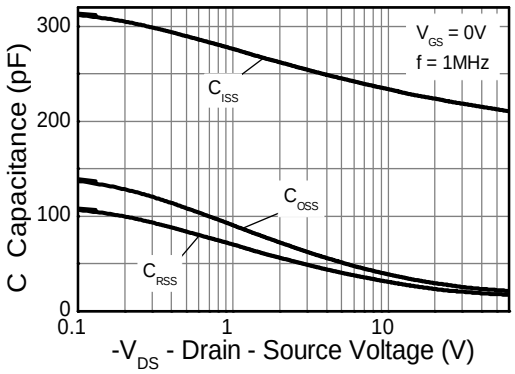


On-Resistance v Drain Current

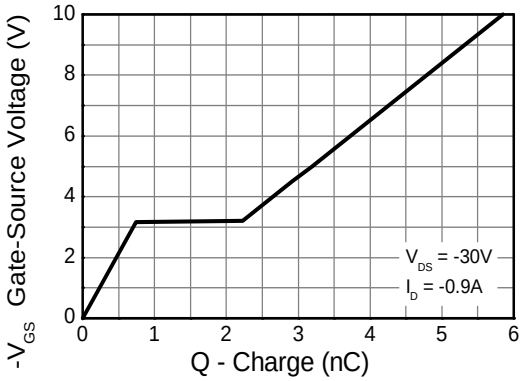


Source-Drain Diode Forward Voltage

Typical Characteristics (cont.)

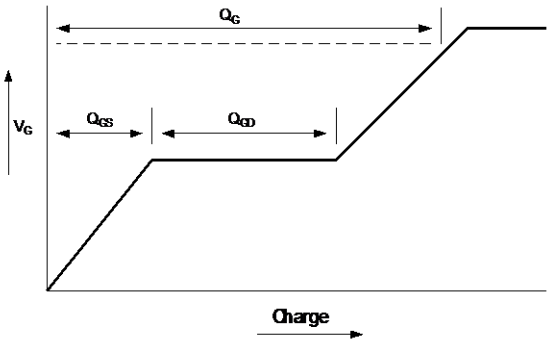


Capacitance v Drain-Source Voltage

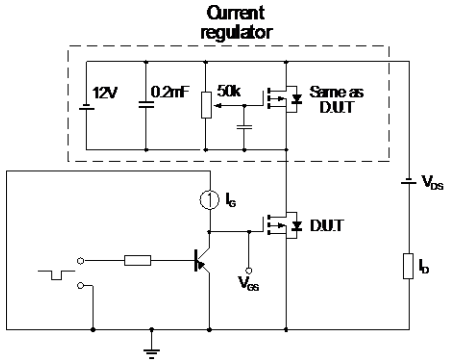


Gate-Source Voltage v Gate Charge

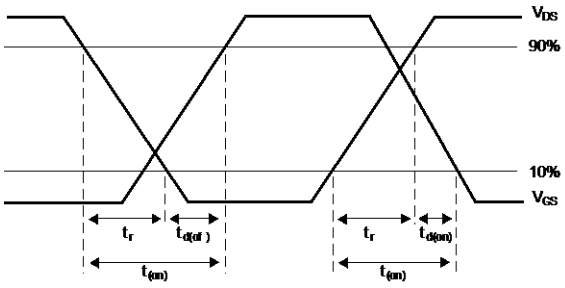
Test Circuits



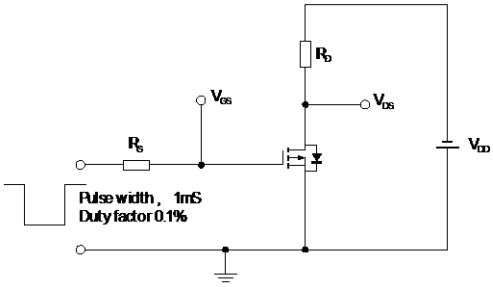
Basic gate charge waveform



Gate charge test circuit



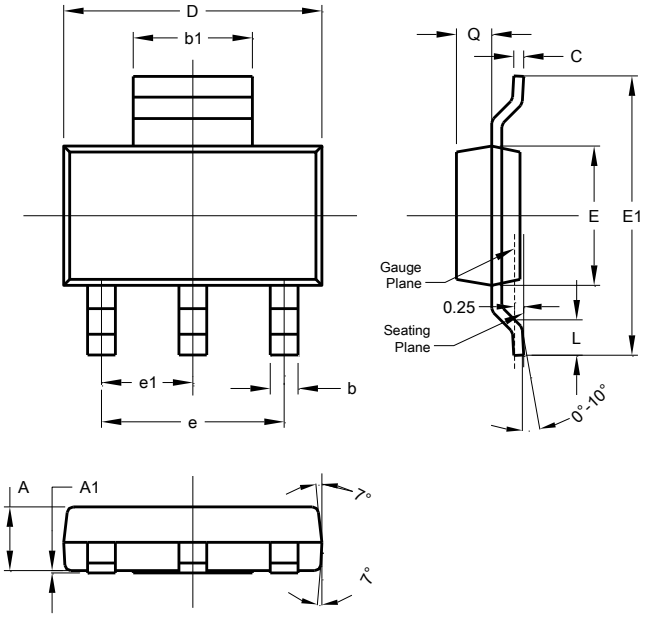
Switching time waveforms



Switching time test circuit

Package Outline Dimensions

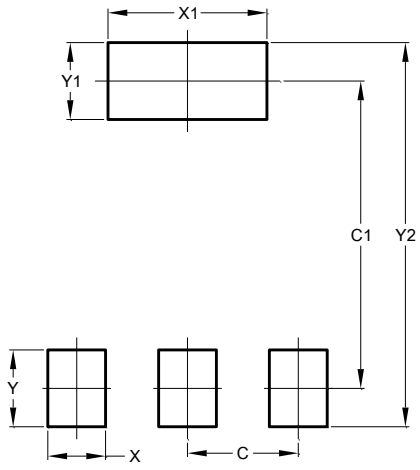
Please see AP02002 at http://www.diodes.com/datasheets/ap02002.pdf for the latest version.



SOT223			
Dim	**Min**	**Max**	**Typ**
A	1.55	1.65	1.60
A1	0.010	0.15	0.05
b	0.60	0.80	0.70
b1	2.90	3.10	3.00
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

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



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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