

Product Summary

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

Description and Applications

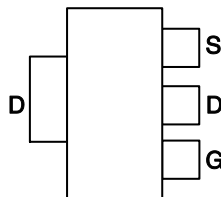
This MOSFET is designed to minimize the on-state resistance and yet maintain superior switching performance, making it ideal for high efficiency power management applications.

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

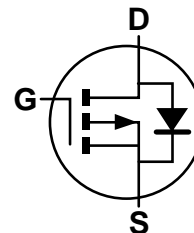
SOT223



Top View



Pin Out - Top View



Equivalent Circuit

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**

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)

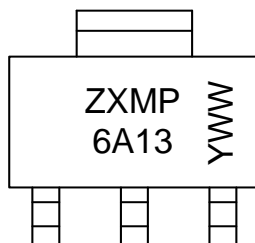
Ordering Information (Note 4)

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 \bar{Y} = Last Digit of Year (ex: 5= 2015)
 WW or $\bar{W}W$ = Week Code (01-53)

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

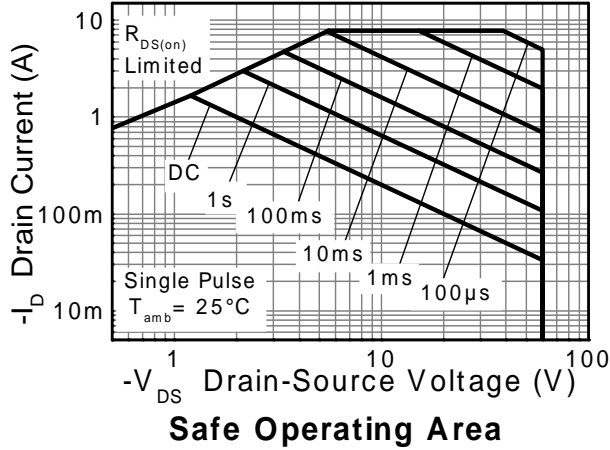
Characteristic			Symbol	Value	Unit	
Drain-Source Voltage			V _{DSS}	-60	V	
Gate-Source Voltage			V _{GS}	±20	V	
Continuous Drain Current	V _{GS} = 10V	(Note 6)	I _D	-2.3	A	
		T _A = +70°C (Note 6)		-1.9		
		(Note 5)		-1.7		
Pulsed Drain Current	V _{GS} = 10V	(Note 7)	I _{DM}	-7.8	A	
Continuous Source 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.)

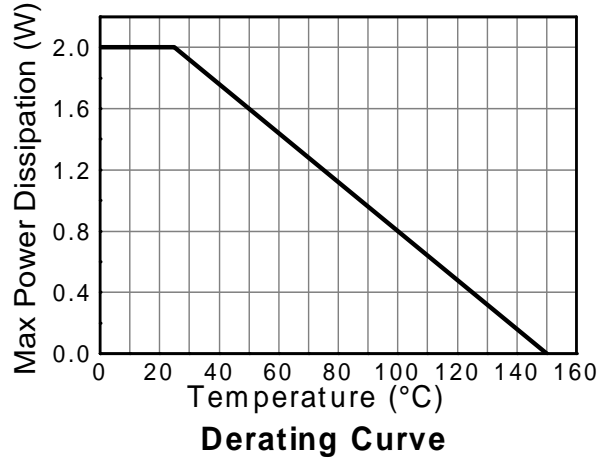
Characteristic		Symbol	Value	Unit
Power Dissipation Linear Derating Factor	(Note 5)	P _D	2.0	W mW/°C
	(Note 6)		16	
Thermal Resistance, Junction to Ambient	(Note 5)	R _{θJA}	3.9	°C/W
	(Note 6)		31	
Thermal Resistance, Junction to Lead	(Note 8)	R _{θJL}	62.5	°C/W
Operating and Storage Temperature Range		T _J , T _{STG}	32.0	
			9.8	°C
			-55 to 150	

- 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).

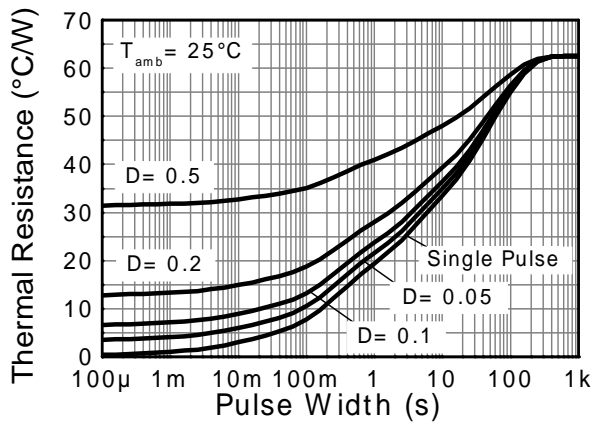
Thermal Characteristics



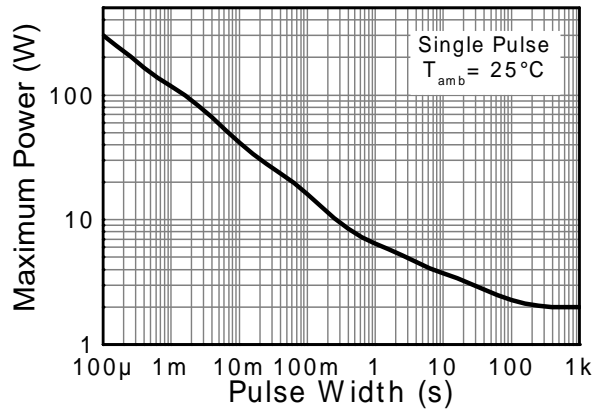
Safe Operating Area



Derating Curve



Transient Thermal Impedance



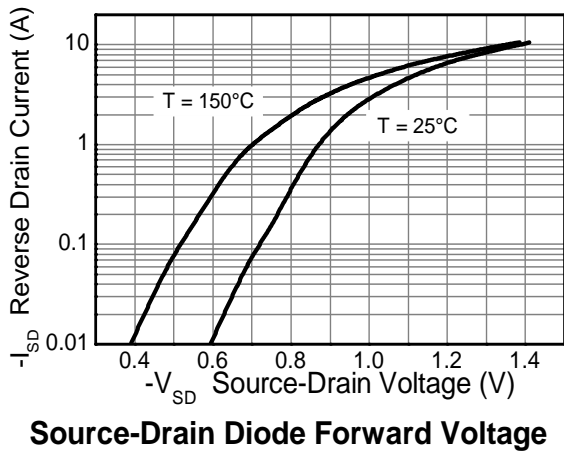
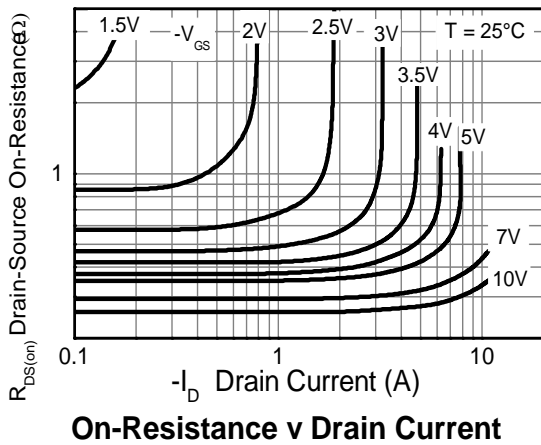
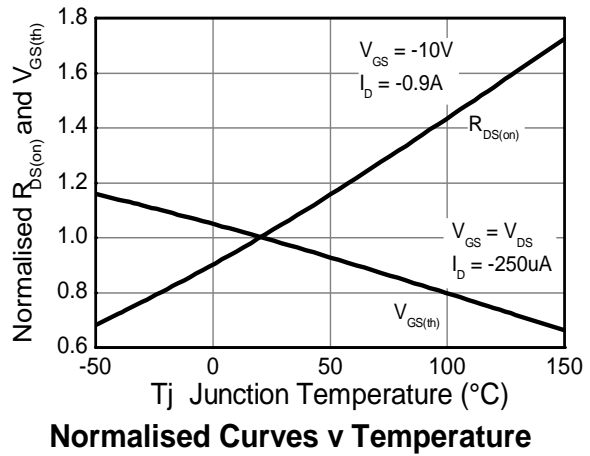
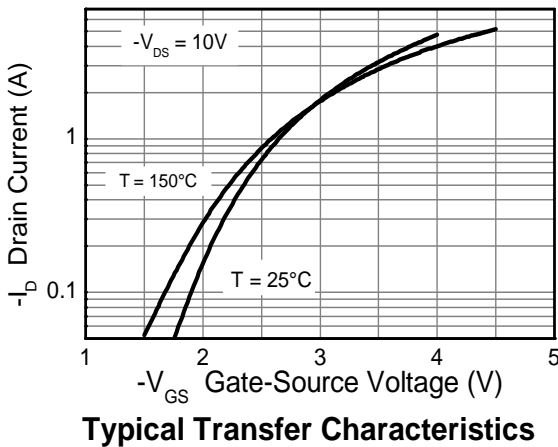
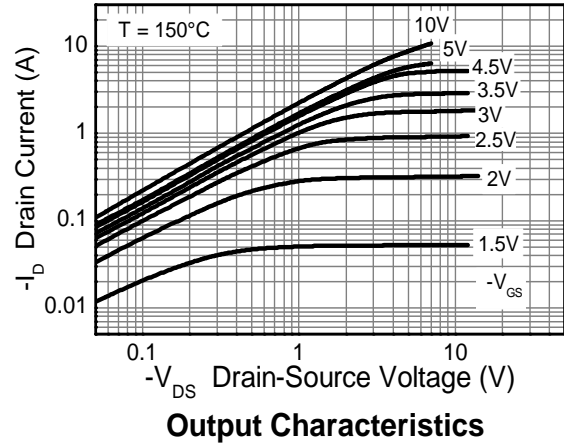
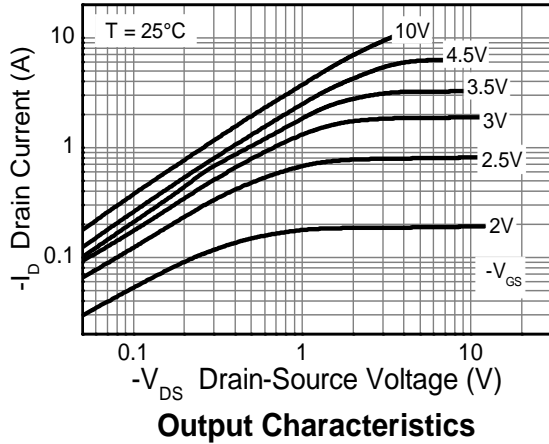
Pulse Power Dissipation

Electrical Characteristics (@ $T_A = +25^\circ\text{C}$ unless otherwise specified.)

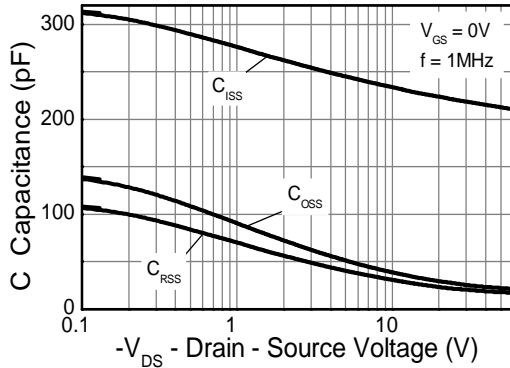
Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
OFF CHARACTERISTICS						
Drain-Source Breakdown Voltage	BV_{DSS}	-60	—	—	V	$I_D = -250\mu\text{A}$, $V_{GS} = 0\text{V}$
Zero Gate Voltage Drain Current	I_{DSS}	—	—	-0.5	μA	$V_{DS} = -60\text{V}$, $V_{GS} = 0\text{V}$
Gate-Source Leakage	I_{GSS}	—	—	± 100	nA	$V_{GS} = \pm 20\text{V}$, $V_{DS} = 0\text{V}$
ON CHARACTERISTICS						
Gate Threshold Voltage	$V_{GS(th)}$	-1.0	—	-3.0	V	$I_D = -250\mu\text{A}$, $V_{DS} = V_{GS}$
Static Drain-Source On-Resistance (Note 9)	$R_{DS(on)}$	—	—	0.390	Ω	$V_{GS} = -10\text{V}$, $I_D = -0.9\text{A}$
				0.595		$V_{GS} = -4.5\text{V}$, $I_D = -0.8\text{A}$
Forward Transconductance (Notes 9 & 10)	g_{fs}	—	1.8	—	S	$V_{DS} = -15\text{V}$, $I_D = -0.9\text{A}$
Diode Forward Voltage (Note 9)	V_{SD}	—	-0.85	-0.95	V	$I_S = -0.8\text{A}$, $V_{GS} = 0\text{V}$, $T_J = +25^\circ\text{C}$
Reverse Recovery Time (Note 10)	t_{rr}	—	21.1	—	ns	$I_S = -0.9\text{A}$, $di/dt = 100\text{A}/\mu\text{s}$,
Reverse Recovery Charge (Note 10)	Q_{rr}	—	19.3	—	nC	$T_J = +25^\circ\text{C}$
DYNAMIC CHARACTERISTICS (Note 10)						
Input Capacitance	C_{iss}	—	219	—	pF	$V_{DS} = -30\text{V}$, $V_{GS} = 0\text{V}$ $f = 1\text{MHz}$
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	$V_{GS} = -4.5\text{V}$
Total Gate Charge (Note 11)	Q_g	—	5.9	—	nC	$V_{GS} = -10\text{V}$ $V_{DS} = -30\text{V}$ $I_D = -0.9\text{A}$
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	$V_{DD} = -30\text{V}$, $V_{GS} = -10\text{V}$ $I_D = -1\text{A}$, $R_G \cong 6.0\Omega$
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 $\leq 300\mu\text{s}$; duty cycle $\leq 2\%$
 10. For design aid only, not subject to production testing.
 11. Switching characteristics are independent of operating junction temperatures.

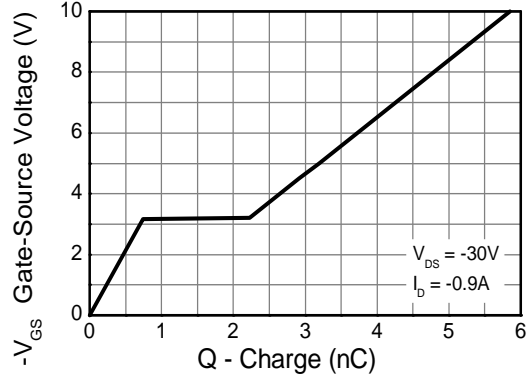
Typical Characteristics



Typical Characteristics (cont.)

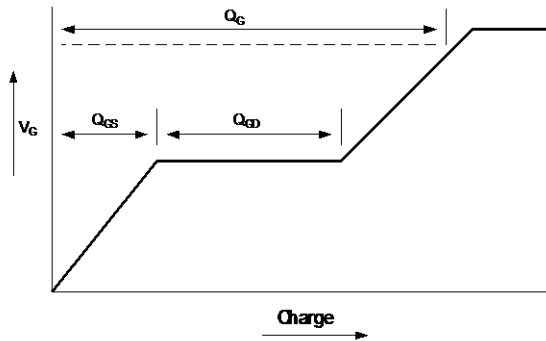


Capacitance v Drain-Source Voltage

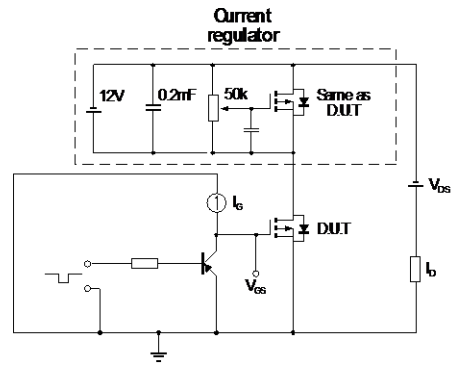


Gate-Source Voltage v Gate Charge

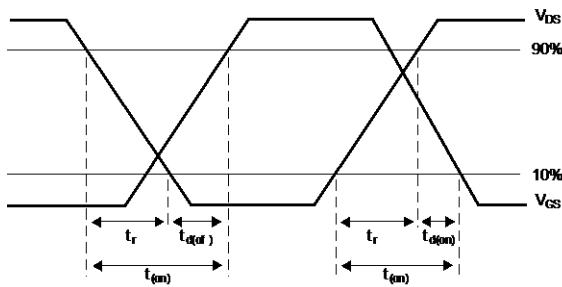
Test Circuits



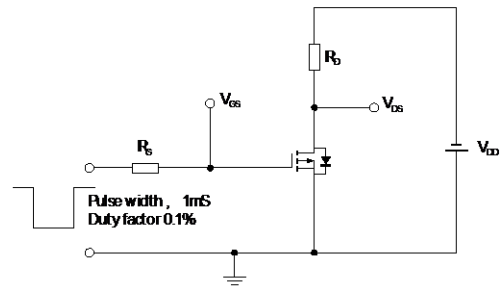
Basic gate charge waveform



Gate charge test circuit



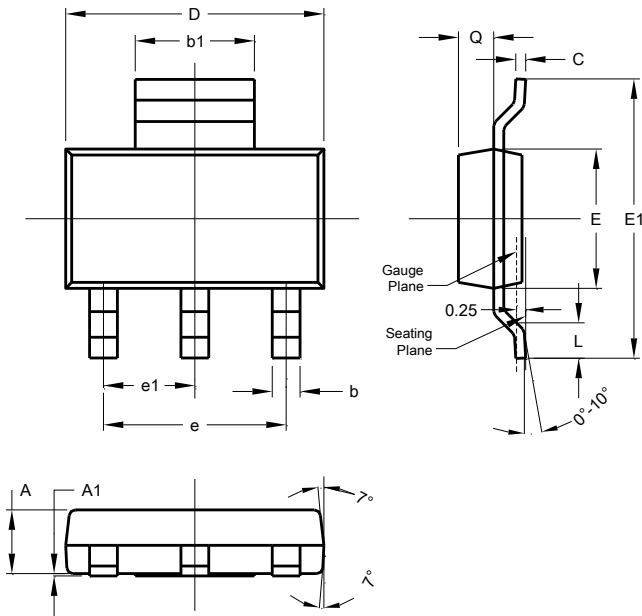
Switching time waveforms



Switching time test circuit

Package Outline Dimensions

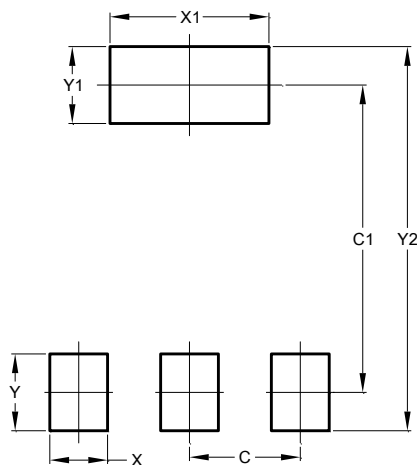
Please see AP02002 at <http://www.diodes.com/datasheets/ap02002.pdf> for the latest version.



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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