

60V P-CHANNEL ENHANCEMENT MODE MOSFET
Product Summary

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

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**

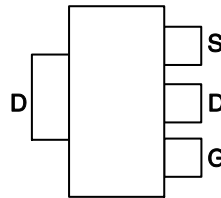
Mechanical Data

- 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)

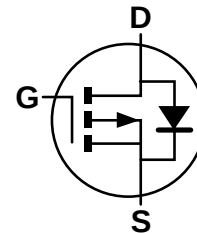
SOT223



Top View



Pin Out - Top View



Equivalent Circuit

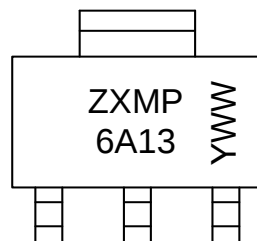
Ordering Information (Note 4)

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 $\bar{Y}$ = 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.)

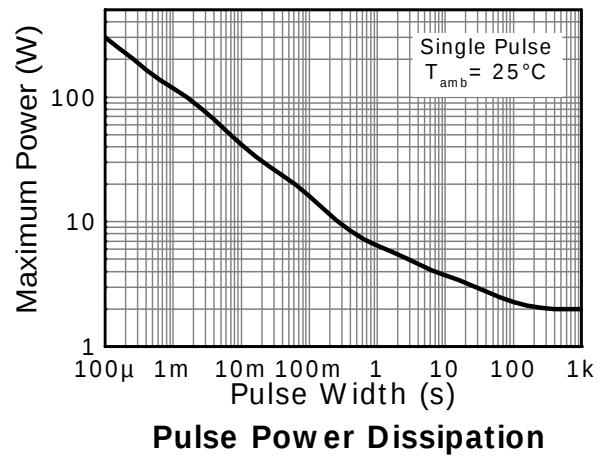
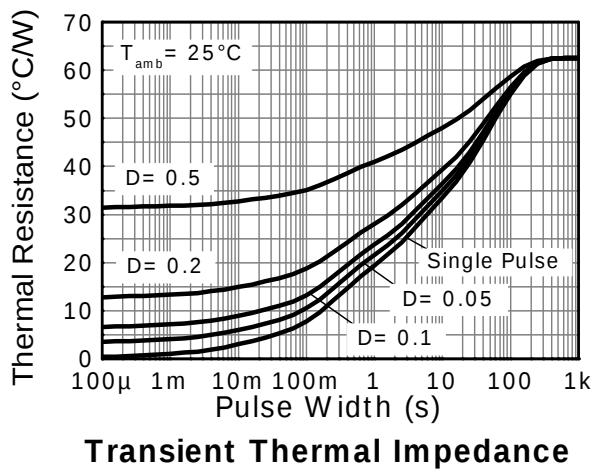
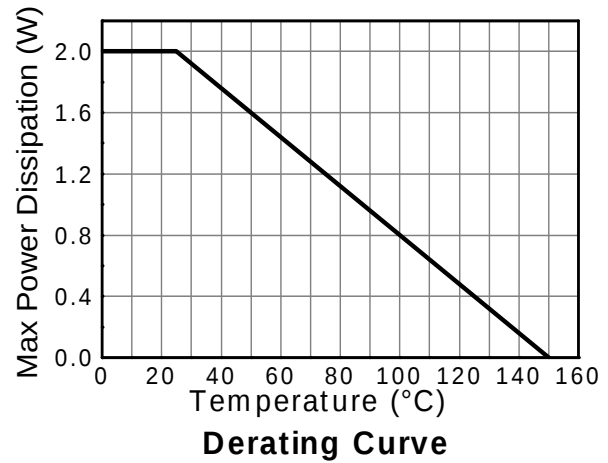
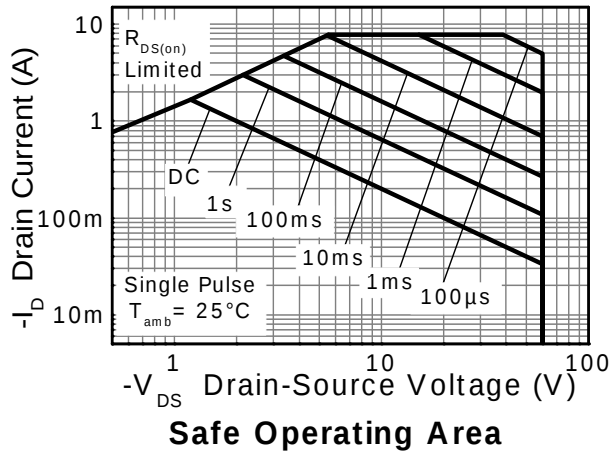
Characteristic			Symbol	Value	Unit
Drain-Source Voltage			V _{DSS}	-60	V
Gate-Source Voltage			V _{GS}	±20	V
Continuous Drain Current	V _{GS} = 10V	(Note 6)	I _D	-2.3	A
		T _A = +70°C (Note 6)		-1.9	
		(Note 5)		-1.7	
Pulsed Drain Current	V _{GS} = 10V	(Note 7)	I _{DM}	-7.8	A
Continuous Source Current (Body Diode)			I _S	-4.1	A
Pulsed Source Current (Body Diode)			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
			16	
Linear Derating Factor	(Note 6)		3.9	mW/°C
			31	
Thermal Resistance, Junction to Ambient	(Note 5)	R _{θJA}	62.5	°C/W
	(Note 6)		32.0	
Thermal Resistance, Junction to Lead	(Note 8)	R _{θJL}	9.8	
Operating and Storage Temperature Range		T _J , T _{STG}	-55 to 150	°C

- Notes:
- 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.
 - Same as Note 5, except the device is measured at t ≤ 10 sec.
 - 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.
 - Thermal resistance from junction to solder-point (at the end of the drain lead).

Thermal Characteristics

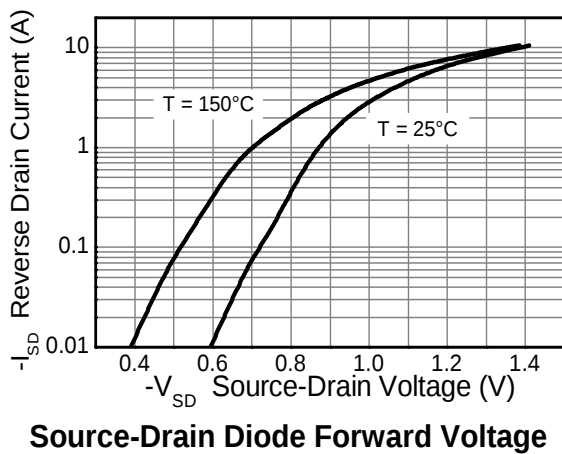
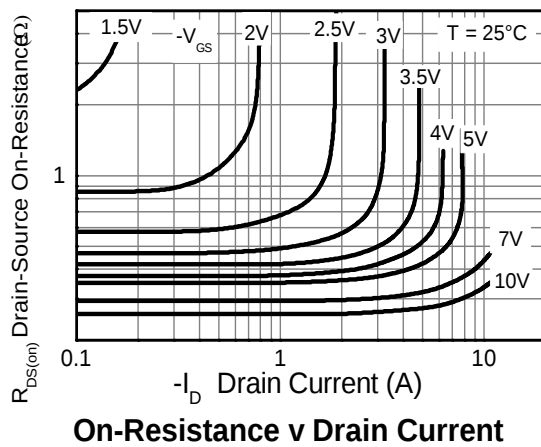
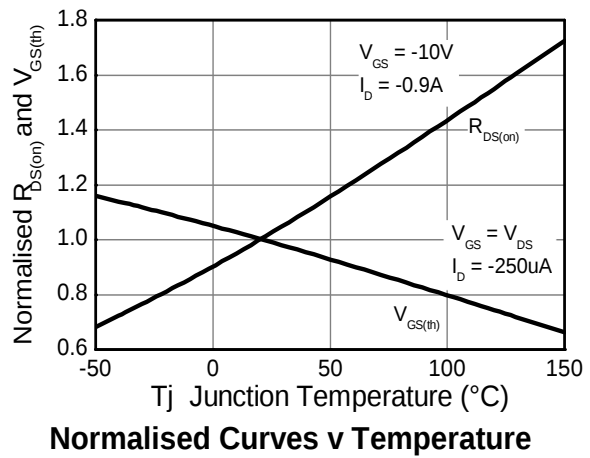
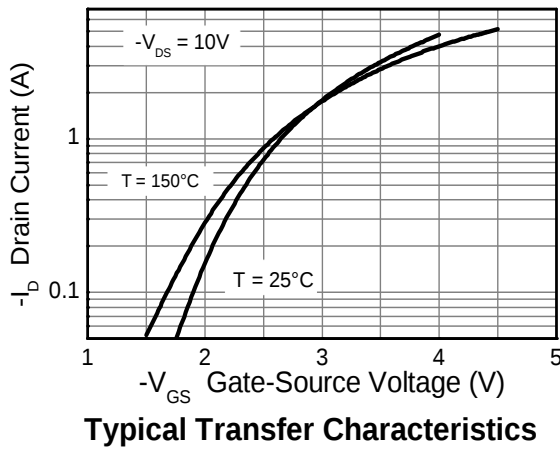
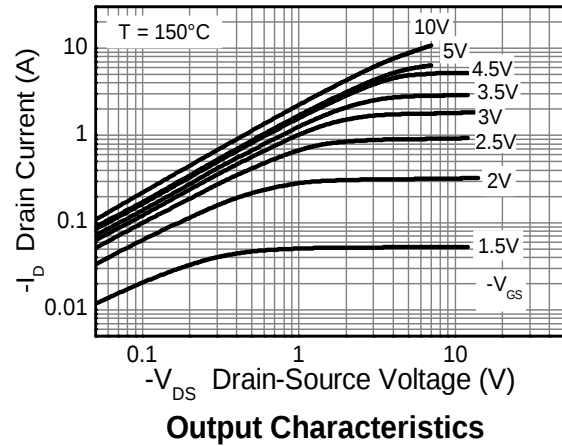
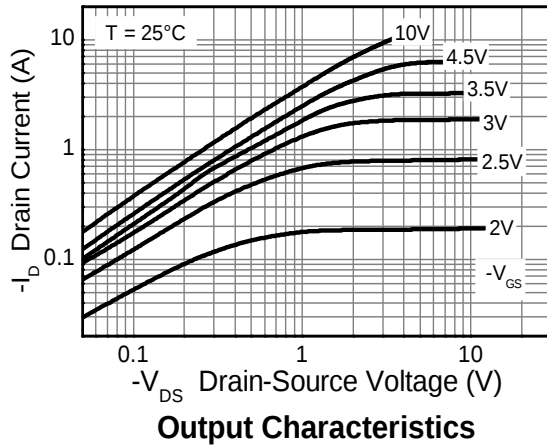


Electrical Characteristics (@T_A = +25°C unless otherwise specified.)

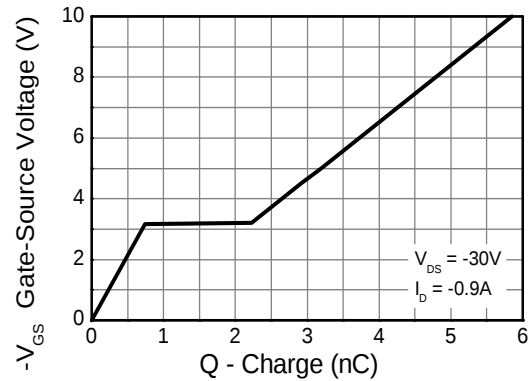
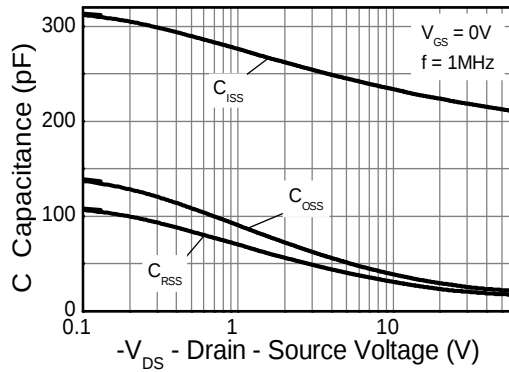
Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition	
OFF CHARACTERISTICS							
Drain-Source Breakdown Voltage	BV _{DSS}	-60	—	—	V	I _D = -250μA, V _{GS} = 0V	
Zero Gate Voltage Drain Current	I _{DSS}	—	—	-0.5	μA	V _{DS} = -60V, V _{GS} = 0V	
Gate-Source Leakage	I _{GSS}	—	—	±100	nA	V _{GS} = ±20V, 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	
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.

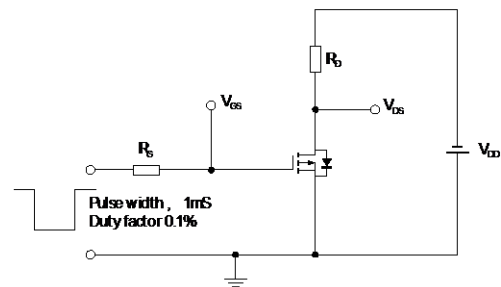
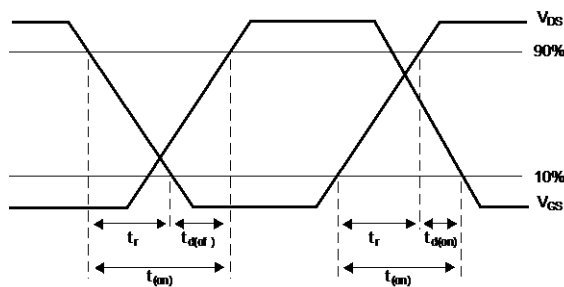
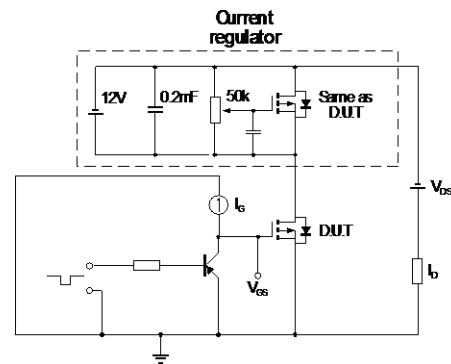
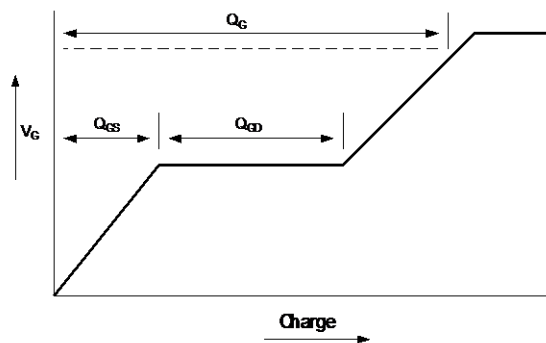
Typical Characteristics



Typical Characteristics (cont.)

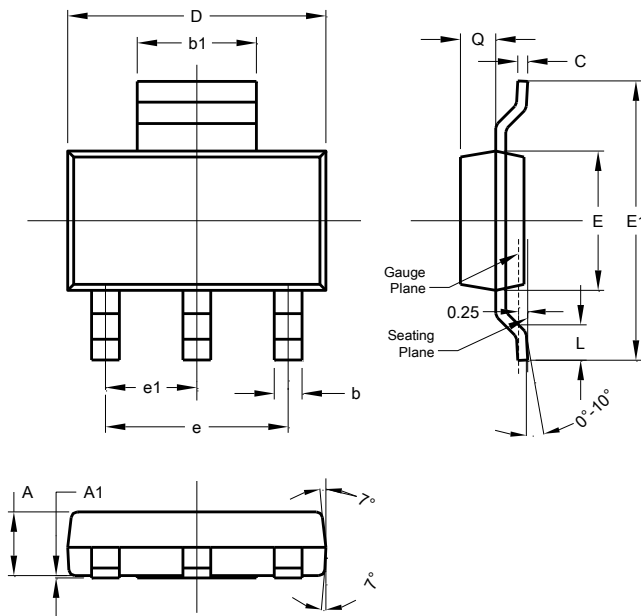


Test Circuits



Package Outline Dimensions

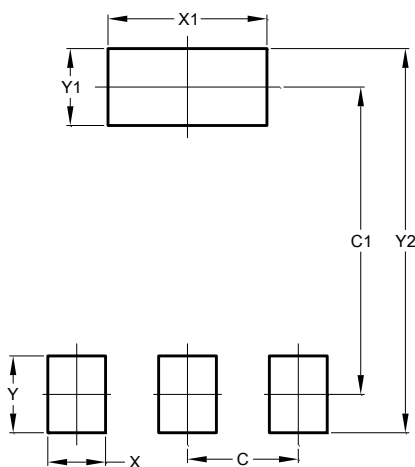
Please see AP02002 at <http://www.diodes.com/datasheets/ap02002.pdf> for the latest version.



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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