

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

**Product Summary**

$V_{(BR)DSS}$	Max $R_{DS(on)}$	Max $I_D$ $T_A = 25^\circ C$
-60V	400m $\Omega$ @ $V_{GS} = -10V$	-1.1A
	600m $\Omega$ @ $V_{GS} = -4.5V$	-0.9A

**Description**

This MOSFET utilizes a unique structure that combines the benefits of low on-resistance with fast switching speed, making it ideal for high-efficiency power management applications.

**Applications**

- DC - DC converters
- Power management functions
- Relay and solenoid driving
- Motor control

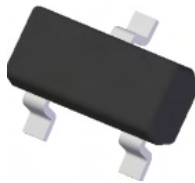
**Features**

- Fast switching speed
- Low input capacitance
- Low gate charge
- **Totally Lead-Free & Fully RoHS compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **Qualified to AEC-Q101 Standards for High Reliability**
- **PPAP capable (Note 4)**

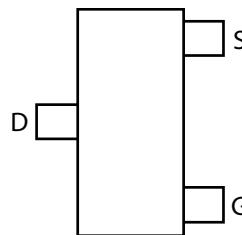
**Mechanical Data**

- Case: SOT23
- Case Material: Molded Plastic, UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Finish – Matte Tin Plated Leads, Solderable per MIL-STD-202, Method 208
- Weight: 0.008 grams (approximate)

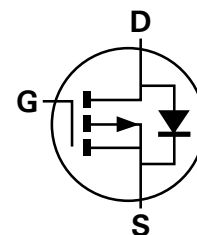
SOT23



Top View



Top View  
Pin Out



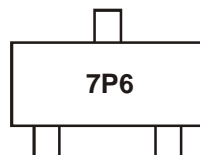
Equivalent Circuit

**Ordering Information** (Notes 4 & 5)

Product	Compliance	Marking	Reel size (inches)	Tape width (mm)	Quantity per reel
ZXMP6A13FTA	AEC-Q101	7P6	7	8	3000 Units
ZXMP6A13FQTA	Automotive	7P6	7	8	3000 Units

- Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant.
  2. See <http://www.diodes.com> 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. Automotive products are AEC-Q101 qualified and are PPAP capable. Automotive, AEC-Q101 and standard products are electrically and thermally the same, except where specified.
  5. For packaging details, go to our website at <http://www.diodes.com>

**Marking Information**



7P6 = Product Type Marking Code

**Maximum Ratings** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

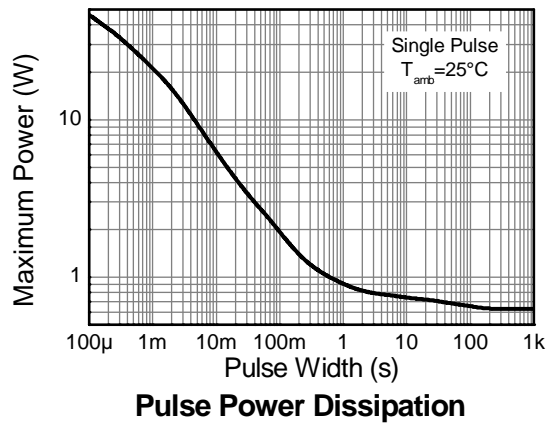
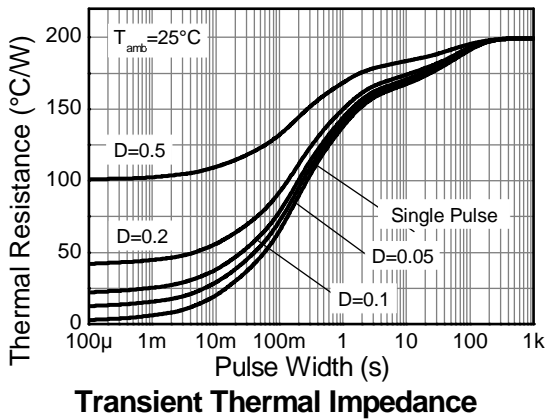
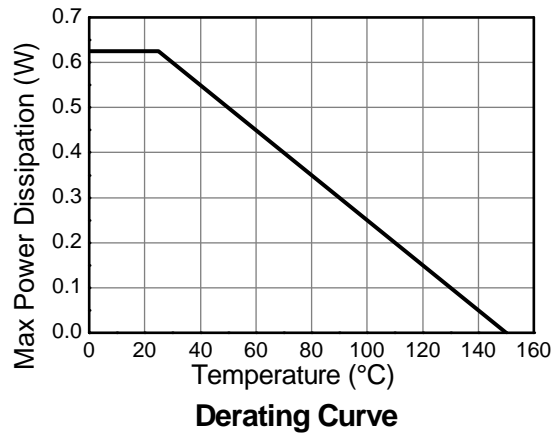
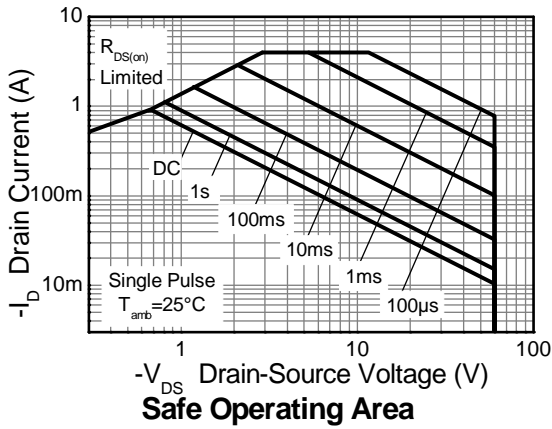
Characteristic			Symbol	Value	Units
Drain-Source Voltage			V <sub>DSS</sub>	-60	V
Gate-Source Voltage			V <sub>GS</sub>	±20	V
Continuous Drain Current	V <sub>GS</sub> = 10V	(Note 7)	I <sub>D</sub>	-1.1	A
		(Note 7)		-0.8	
		(Note 6)		-0.9	
Pulsed Drain Current (Note 8)			I <sub>DM</sub>	-4.0	A
Continuous Source Current (Body Diode) (Note 7)			I <sub>S</sub>	-1.2	A
Pulsed Source Current (Body Diode) (Note 8)			I <sub>SM</sub>	-4.0	A

**Thermal Characteristics** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

Characteristic		Symbol	Value	Unit
Power Dissipation (Note 6)		P <sub>D</sub>	625	mW
Linear Derating Factor			5	mW/°C
Power Dissipation (Note 7)		P <sub>D</sub>	806	mW
Linear Derating Factor			6.5	mW/°C
Thermal Resistance, Junction to Ambient (Note 6)		R <sub>θJA</sub>	200	°C/W
Thermal Resistance, Junction to Ambient (Note 7)		R <sub>θJA</sub>	155	°C/W
Thermal Resistance, Junction to Leads (Note 9)		R <sub>θJL</sub>	194	°C/W
Operating and Storage Temperature Range		T <sub>J</sub> , T <sub>STG</sub>	-55 to +150	°C

- Notes:
6. For a device surface mounted on 25mm x 25mm FR4 PCB with high coverage of single sided 1oz copper, in still air conditions
  7. For a device surface mounted on FR4 PCB measured at t ≤ 5 secs.
  8. Repetitive rating 25mm x 25mm FR4 PCB, D = 0.05 pulse width = 10µs - pulse current limited by maximum junction temperature.
  9. Thermal resistance from junction to solder-point (at the end of the collector lead).

**Thermal Characteristics**

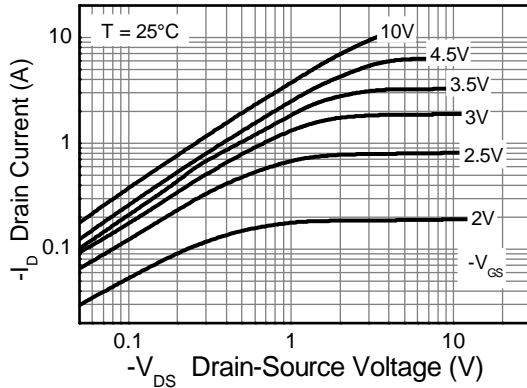


**Electrical Characteristics** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

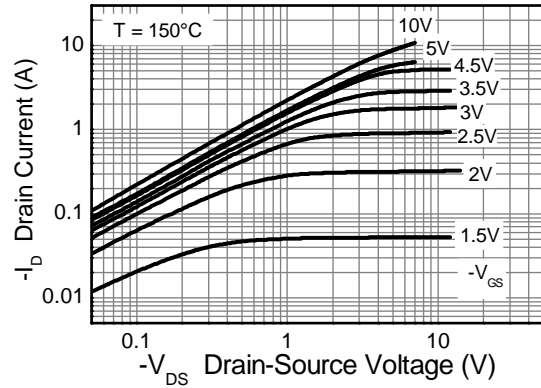
Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
<b>OFF CHARACTERISTICS</b>						
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	-60	—	—	V	I <sub>D</sub> = -250μA, V <sub>GS</sub> = 0V
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	—	—	-0.5	μA	V <sub>DS</sub> = -60V, V <sub>GS</sub> = 0V
Gate-Source 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 10)	R <sub>DS(on)</sub>	—	—	0.400	Ω	V <sub>GS</sub> = -10V, I <sub>D</sub> = -0.9A
				0.600		V <sub>GS</sub> = -4.5V, I <sub>D</sub> = -0.8A
Forward Transconductance (Notes 10 and 12)	g <sub>fs</sub>	—	1.8	—	S	V <sub>DS</sub> = -15V, I <sub>D</sub> = -0.9A
Diode Forward Voltage (Note 10)	V <sub>SD</sub>	—	-0.85	-0.95	V	T <sub>J</sub> = 25°C, I <sub>S</sub> = -0.8A, V <sub>GS</sub> = 0V
Reverse Recovery Time (Note 12)	t <sub>rr</sub>	—	21.1	—	ns	T <sub>J</sub> = 25°C, I <sub>F</sub> = -0.9A,
Reverse Recovery Charge (Note 12)	Q <sub>rr</sub>	—	19.3	—	nC	di/dt = 100A/μs
<b>DYNAMIC CHARACTERISTICS (Note 12)</b>						
Input Capacitance	C <sub>iss</sub>	—	219	—	pF	V <sub>DS</sub> = -30V, V <sub>GS</sub> = 0V f = 1.0MHz
Output Capacitance	C <sub>oss</sub>	—	25.7	—		
Reverse Transfer Capacitance	C <sub>rss</sub>	—	20.5	—		
Turn-On Delay Time (Note 11)	t <sub>D(on)</sub>	—	1.6	—	ns	V <sub>DD</sub> = -30V, I <sub>D</sub> = -1A, R <sub>G</sub> ≅ 6.0Ω, V <sub>GS</sub> = -10V
Turn-On Rise Time (Note 11)	t <sub>r</sub>	—	2.2	—		
Turn-Off Delay Time (Note 11)	t <sub>D(off)</sub>	—	11.2	—		
Turn-Off Fall Time (Note 11)	t <sub>f</sub>	—	5.7	—		
Total Gate Charge (Note 11)	Q <sub>g</sub>	—	2.9	—	nC	V <sub>DS</sub> = -30V, V <sub>GS</sub> = -4.5V, I <sub>D</sub> = -0.9A
Total Gate Charge (Note 11)	Q <sub>g</sub>	—	5.9	—	nC	V <sub>DS</sub> = -30V, V <sub>GS</sub> = -10V, I <sub>D</sub> = -0.9A
Gate-Source Charge (Note 11)	Q <sub>gs</sub>	—	0.74	—		
Gate-Drain Charge (Note 11)	Q <sub>gd</sub>	—	1.5	—		

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

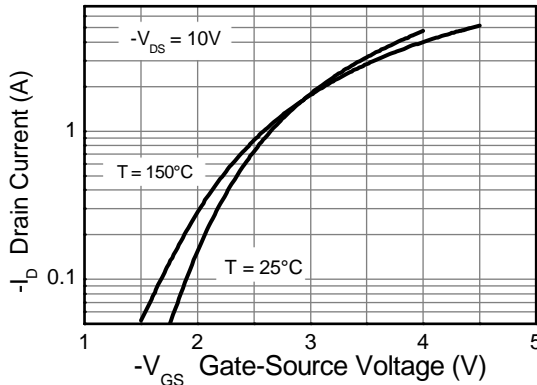
**Typical Characteristics**



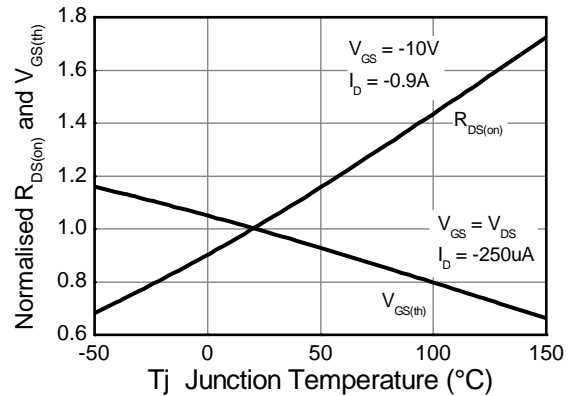
**Output Characteristics**



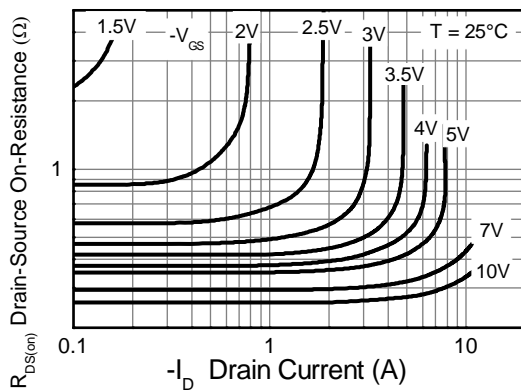
**Output Characteristics**



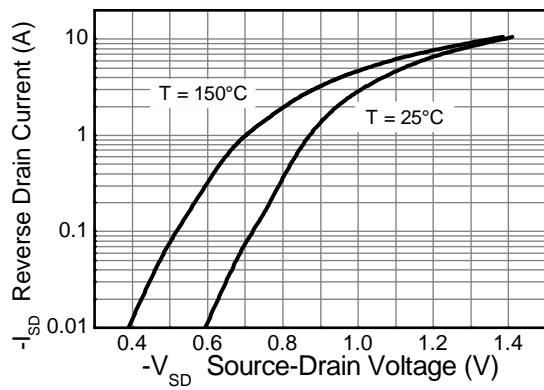
**Typical Transfer Characteristics**



**Normalised Curves v Temperature**

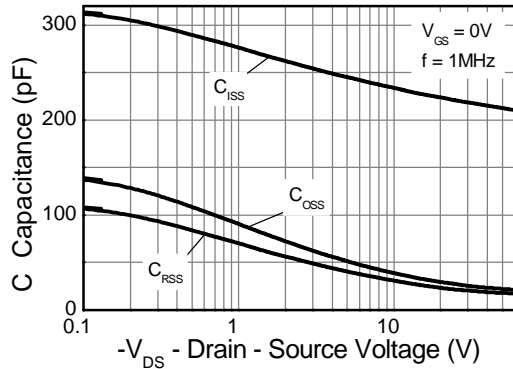


**On-Resistance v Drain Current**

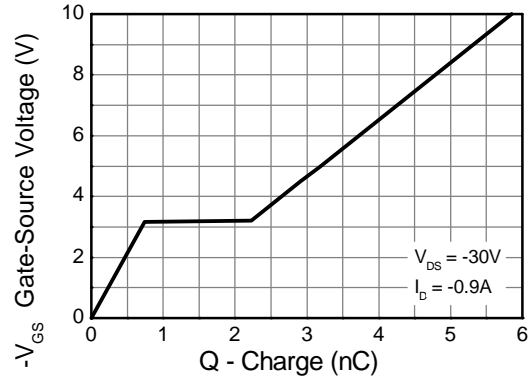


**Source-Drain Diode Forward Voltage**

**Typical Characteristics - continued**

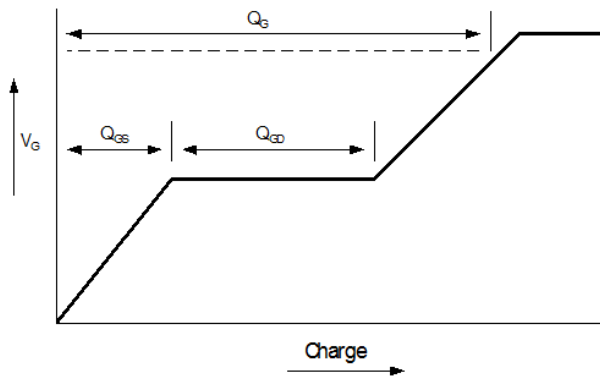


**Capacitance v Drain-Source Voltage**

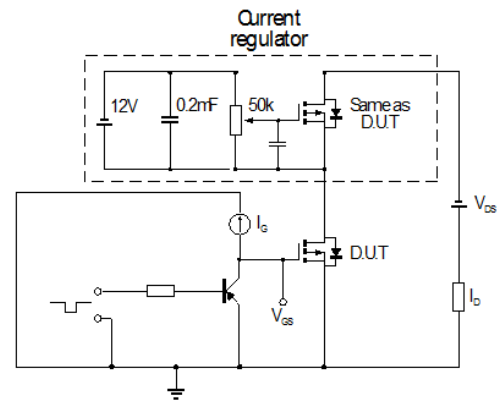


**Gate-Source Voltage v Gate Charge**

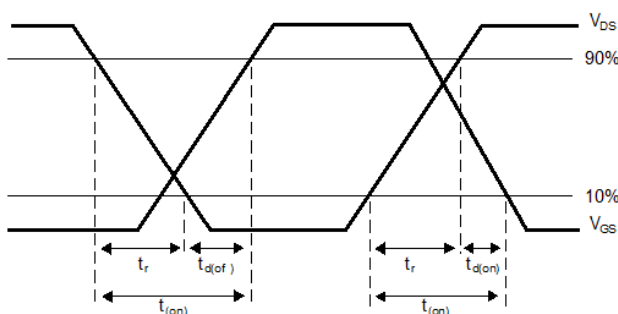
**Test Circuits**



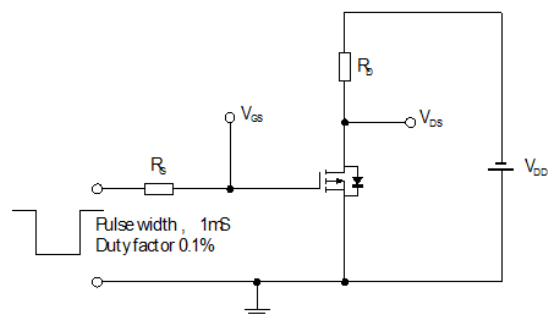
**Basic gate charge waveform**



**Gate charge test circuit**



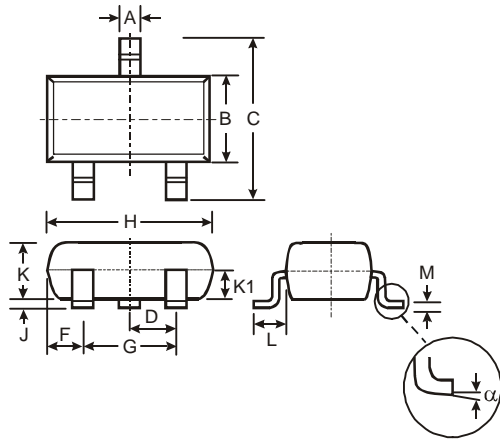
**Switching time waveforms**



**Switching time test circuit**

## Package Outline Dimensions

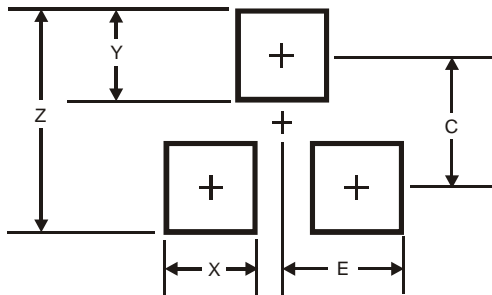
Please see AP02002 at <http://www.diodes.com/datasheets/ap02002.pdf> for latest version.



SOT23			
Dim	Min	Max	Typ
A	0.37	0.51	0.40
B	1.20	1.40	1.30
C	2.30	2.50	2.40
D	0.89	1.03	0.915
F	0.45	0.60	0.535
G	1.78	2.05	1.83
H	2.80	3.00	2.90
J	0.013	0.10	0.05
K	0.903	1.10	1.00
K1	-	-	0.400
L	0.45	0.61	0.55
M	0.085	0.18	0.11
α	0°	8°	-
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)
Z	2.9
X	0.8
Y	0.9
C	2.0
E	1.35

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