60V P-CHANNEL ENHANCEMENT MODE MOSFET

Product Summary

$V_{(BR)DSS}$	Max $R_{DS(on)}$	Max I_D T_A = +25°C
-60V	400mΩ @ V_{GS} = -10V	-1.1A
	600mΩ @ 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 Available**

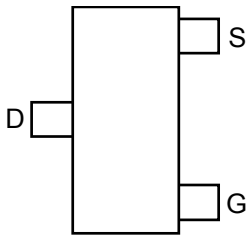
Mechanical Data

- 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 e3
- Weight: 0.008 grams (approximate)

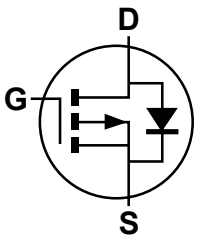
SOT23



Top View



Top View
Pin Out



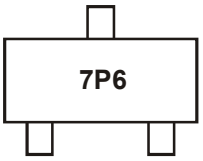
Equivalent Circuit

Ordering Information (Notes 4 & 5)

Product	Compliance	Case	Quantity per reel
ZXMP6A13FQTA	Automotive	SOT23	3,000 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/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. 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/products/packages.html

Marking Information



7P6 = Product Type Marking Code

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

Characteristic				Symbol	Value	Units
Drain-Source Voltage				V_{DSS}	-60	V
Gate-Source Voltage				V_{GS}	±20	V
Continuous Drain Current	V_{GS} = 10V	T_A = +70°C	(Note 7) (Note 7) (Note 6)	I_D	-1.1 -0.8 -0.9	A
Pulsed Drain Current (Note 8)				I_{DM}	-4.0	A
Continuous Source Current (Body Diode) (Note 7)				I_S	-1.2	A
Pulsed Source Current (Body Diode) (Note 8)				I_{SM}	-4.0	A

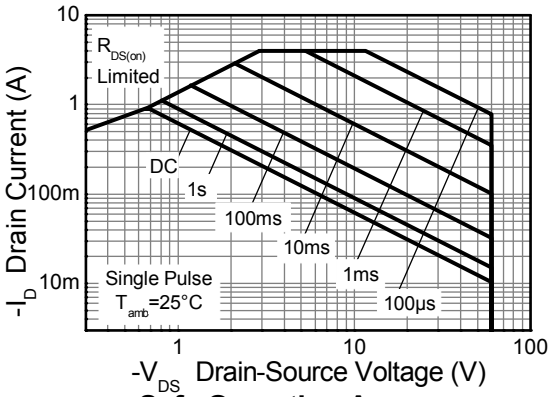
Thermal Characteristics (@T_A = +25°C, unless otherwise specified.)

Characteristic	Symbol	Value	Unit
Power Dissipation (Note 6) Linear Derating Factor	P_D	625 5	mW mW/°C
Power Dissipation (Note 7) Linear Derating Factor	P_D	806 6.5	mW mW/°C
Thermal Resistance, Junction to Ambient (Note 6)	$R_{\theta JA}$	200	°C/W
Thermal Resistance, Junction to Ambient (Note 7)	$R_{\theta JA}$	155	°C/W
Thermal Resistance, Junction to Leads (Note 9)	$R_{\theta JL}$	194	°C/W
Operating and Storage Temperature Range	T_J, T_{STG}	-55 to +150	°C

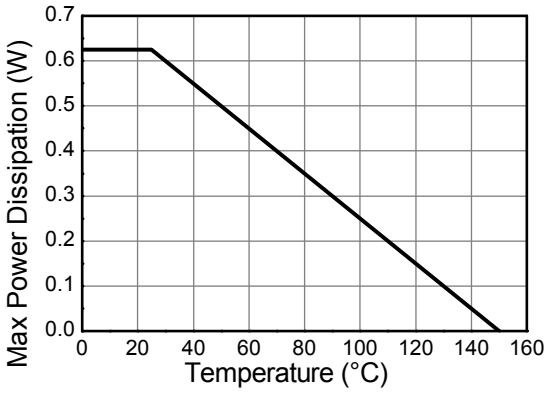
Notes:
6. For a device surface mounted on 25mm x 25mm FR4 PCB with high coverage of single sided 1oz copper, in still air conditions
7. For a device surface mounted on FR4 PCB measured at t ≤ 5 secs.
8. Repetitive rating 25mm x 25mm FR4 PCB, D = 0.05 pulse width = 10µs - pulse current limited by maximum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

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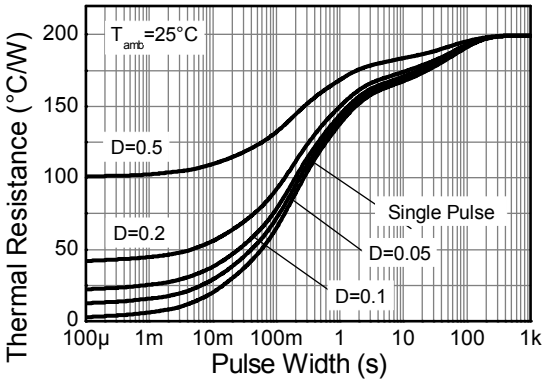
Thermal Characteristics



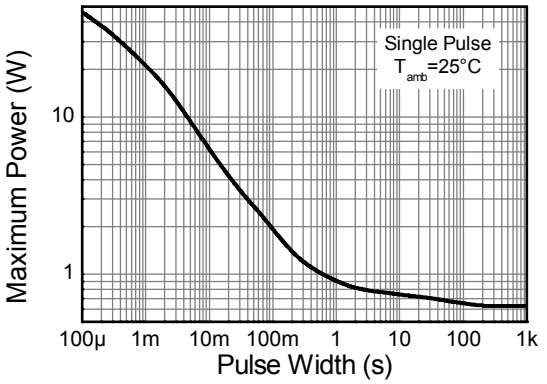
Safe Operating Area



Derating Curve



Transient Thermal Impedance



Pulse Power Dissipation

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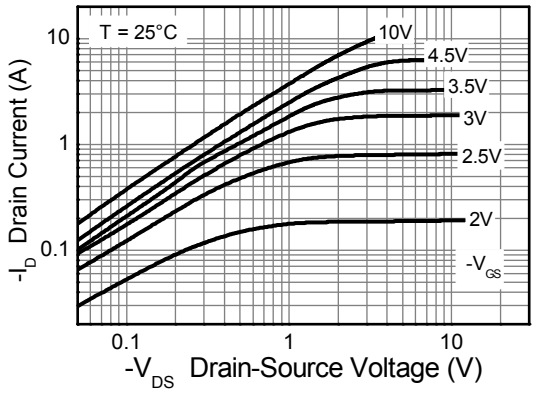
Electrical Characteristics (@T_A = +25°C, unless otherwise specified.)

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 10)	$R_{DS\ (ON)}$	—	—	0.4	Ω	V_{GS} = -10V, I_D = -0.9A
				0.6		V_{GS} = -4.5V, I_D = -0.8A
Forward Transconductance (Notes 10 and 12)	g_{fs}	—	1.8	—	S	V_{DS} = -15V, I_D = -0.9A
Diode Forward Voltage (Note 10)	V_{SD}	—	-0.85	-0.95	V	T_J = +25°C, I_S = -0.8A, V_{GS} = 0V
Reverse Recovery Time (Note 12)	t_{rr}	—	21.1	—	ns	T_J = +25°C, I_F = -0.9A, di/dt = 100A/µs
Reverse Recovery Charge (Note 12)	Q_{rr}	—	19.3	—	nC	
DYNAMIC CHARACTERISTICS (Note 12)						
Input Capacitance	C_{iss}	—	219	—	pF	V_{DS} = -30V, V_{GS} = 0V f = 1.0MHz
Output Capacitance	C_{oss}	—	25.7	—		
Reverse Transfer Capacitance	C_{rss}	—	20.5	—		
Turn-On Delay Time (Note 11)	$t_{D(on)}$	—	1.6	—	ns	V_{DD} = -30V, I_D = -1A, $R_G \cong 6.0\Omega$, V_{GS} = -10V
Turn-On Rise Time (Note 11)	t_r	—	2.2	—		
Turn-Off Delay Time (Note 11)	$t_{D(off)}$	—	11.2	—		
Turn-Off Fall Time (Note 11)	t_f	—	5.7	—		
Total Gate Charge (Note 11)	Q_g	—	2.9	—	nC	V_{DS} = -30V, V_{GS} = -4.5V, I_D = -0.9A
Total Gate Charge (Note 11)	Q_g	—	5.9	—	nC	V_{DS} = -30V, V_{GS} = -10V, I_D = -0.9A
Gate-Source Charge (Note 11)	Q_{gs}	—	0.74	—		
Gate-Drain Charge (Note 11)	Q_{gd}	—	1.5	—		

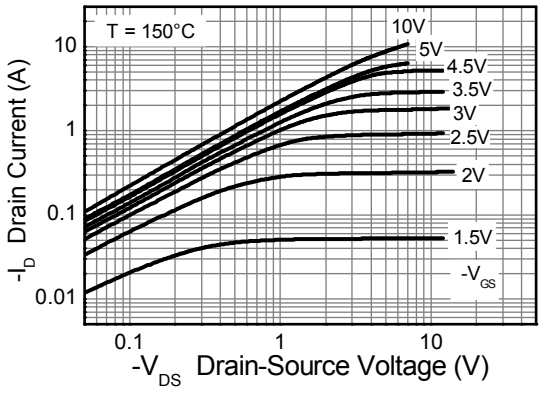
Notes: 10. Measured under pulsed conditions. Pulse width = 300µs. Duty cycle ≤ 2%.
11. Switching characteristics are independent of operating junction temperature.
12. For design aid only, not subject to production testing

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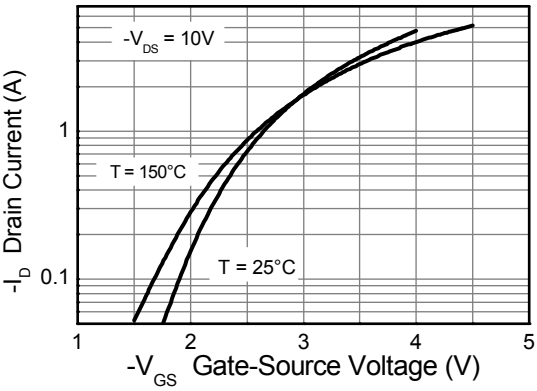
Typical Characteristics



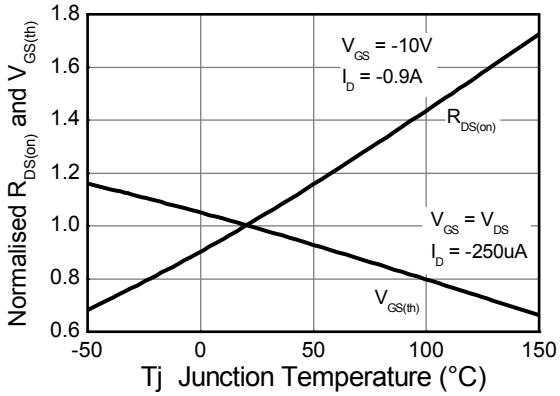
Output Characteristics



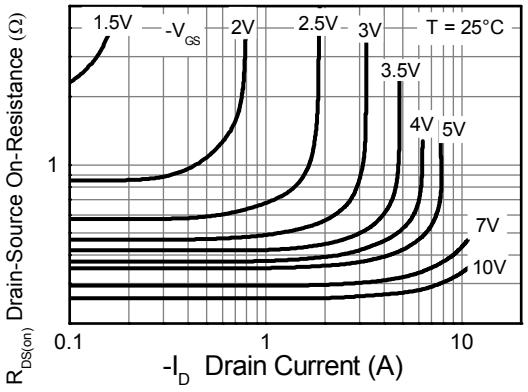
Output Characteristics



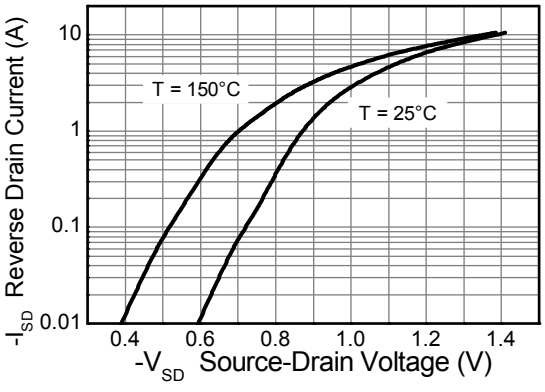
Typical Transfer Characteristics



Normalised Curves v Temperature



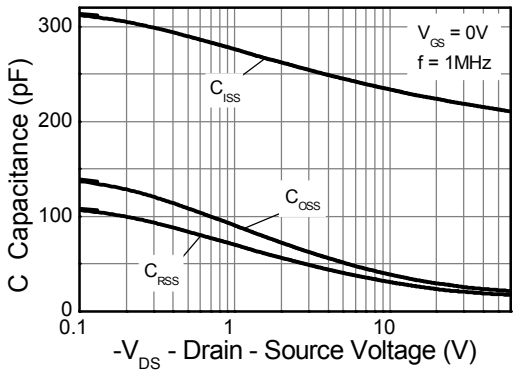
On-Resistance v Drain Current



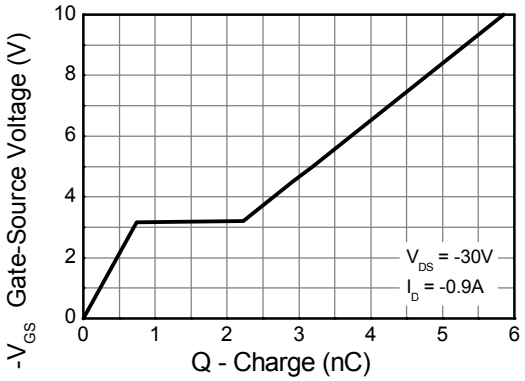
Source-Drain Diode Forward Voltage

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Typical Characteristics - continued

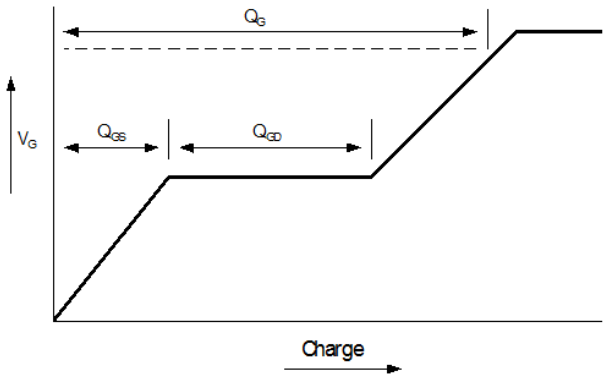


Capacitance v Drain-Source Voltage

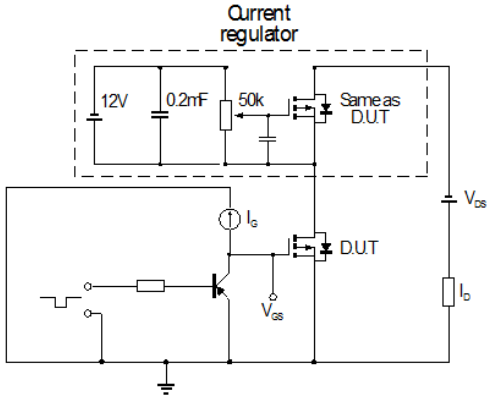


Gate-Source Voltage v Gate Charge

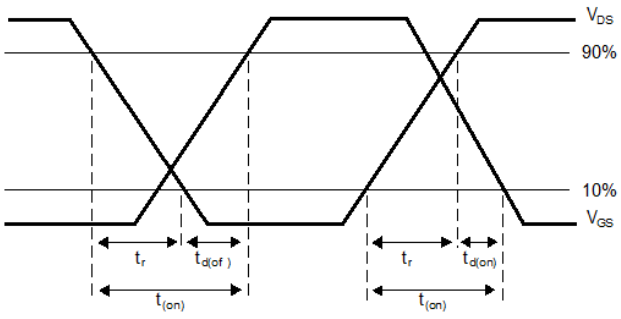
Test Circuits



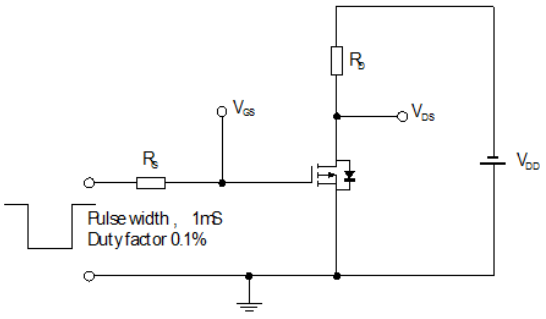
Basic gate charge waveform



Gate charge test circuit



Switching time waveforms

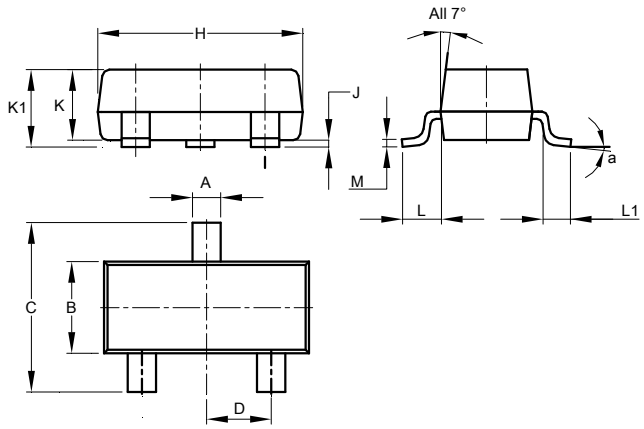


Switching time test circuit

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Package Outline Dimensions

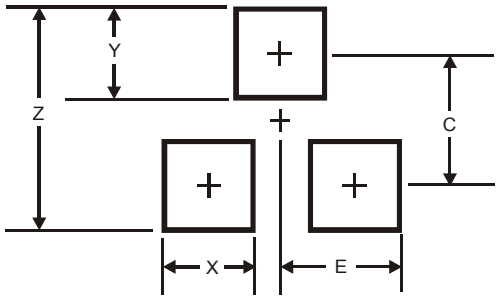
Please see AP02002 at http://www.diodes.com/datasheets/ap02002.pdf for latest version.



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	0.890	1.00	0.975
K1	0.903	1.10	1.025
L	0.45	0.61	0.55
L1	0.25	0.55	0.40
M	0.085	0.150	0.110
a	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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