

**60V N-CHANNEL ENHANCEMENT MODE MOSFET IN SOT89 PACKAGE**

**Product Summary**

$V_{(BR)DSS}$	$R_{DS(on)}$ Max	$I_D$ max $T_A = 25^\circ C$ (Note 5)
60V	120m $\Omega$ @ $V_{GS} = 10V$	3.6A
	180m $\Omega$ @ $V_{GS} = 4.5V$	2.9A

**Features and Benefits**

- Low On-Resistance
- Low Threshold
- Fast Switching Speed
- Low Gate Drive
- **Lead Free/RoHS Compliant (Note 1)**
- **"Green" Device (Note 2)**
- **Qualified to AEC-Q101 Standards for High Reliability**

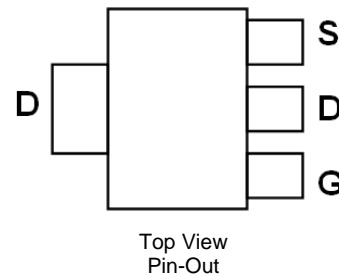
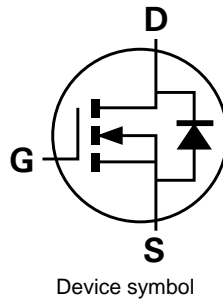
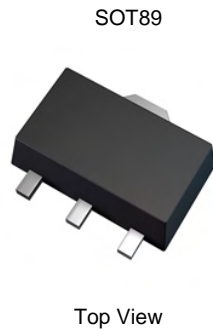
**Description and Applications**

This MOSFET has been designed to minimize the on-state resistance ( $R_{DS(on)}$ ) and yet maintain superior switching performance, making it ideal for high efficiency power management applications.

- DC-DC Converters
- Power Management functions
- Motor control
- Disconnect switches

**Mechanical Data**

- Case: SOT89
- Case Material: Molded Plastic, "Green" Molding Compound. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Matte Tin Finish
- Weight: 0.052 grams (approximate)

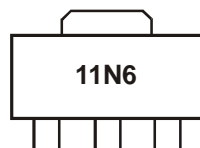


**Ordering Information** (Note 3)

Product	Marking	Reel size (inches)	Tape width (mm)	Quantity per reel
ZXMN6A11ZTA	11N6	7	12	1,000

- Notes:
1. No purposefully added lead.
  2. Diodes Inc's "Green" Policy can be found on our website at <http://www.diodes.com>
  3. For packaging details, go to our website at <http://www.diodes.com>

**Marking Information**



11N6 = Product type Marking Code

**Maximum Ratings** @ $T_A = 25^\circ\text{C}$  unless otherwise specified

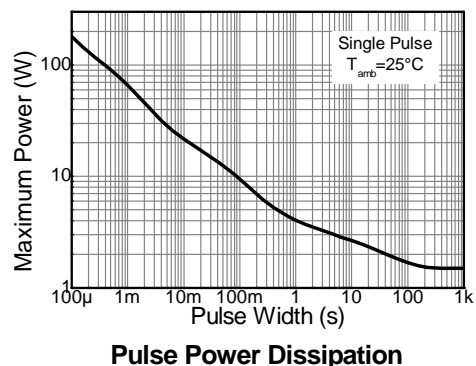
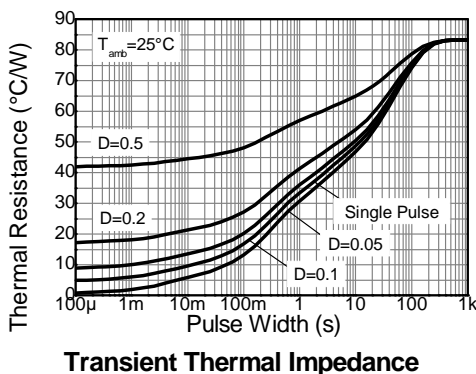
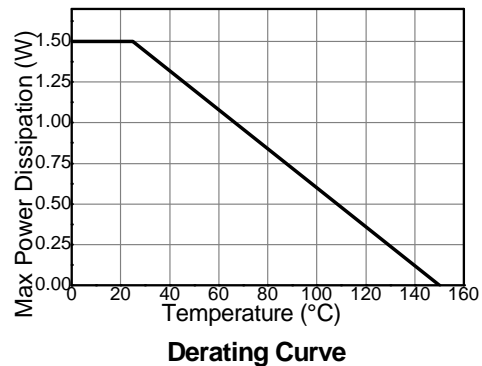
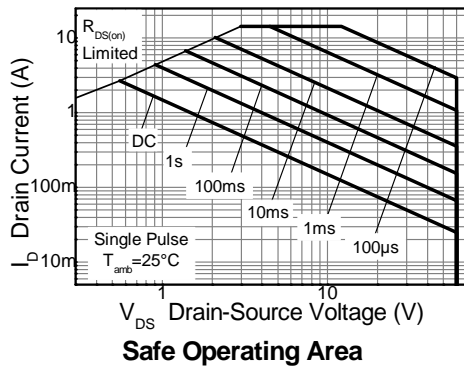
Characteristic		Symbol	Value	Unit
Drain-Source Voltage		$V_{DS}$	60	V
Gate-Source Voltage		$V_{GS}$	$\pm 20$	V
Continuous Drain Current	Steady State	@ $V_{GS} = 10\text{V}$ ; $T_A = 25^\circ\text{C}$ (Note 5)	3.6	A
		@ $V_{GS} = 10\text{V}$ ; $T_A = 75^\circ\text{C}$ (Note 5)	2.9	
		@ $V_{GS} = 10\text{V}$ ; $T_A = 25^\circ\text{C}$ (Note 4)	2.7	
Pulsed Drain Current (Note 6)		$I_{DM}$	14.5	A
Continuous Source Current (Body Diode) (Note 5)		$I_S$	3.7	A
Pulsed Source Current (Body Diode) (Note 6)		$I_{SM}$	14.5	A

**Thermal Characteristics** @ $T_A = 25^\circ\text{C}$  unless otherwise specified

Characteristic		Symbol	Value	Unit
Power Dissipation (Note 4)		$P_D$	1.5	W
Linear Derating Factor			12	
Power Dissipation (Note 5)		$P_D$	2.6	W
Linear Derating Factor			21	
Thermal Resistance, Junction to Ambient (Note 4)		$R_{\theta JA}$	83.3	$^\circ\text{C}/\text{W}$
Thermal Resistance, Junction to Ambient (Note 5)		$R_{\theta JA}$	47.4	$^\circ\text{C}/\text{W}$
Operating and Storage Temperature Range		$T_J, T_{STG}$	-55 to +150	$^\circ\text{C}$

- Notes:
4. For a device surface mounted on 25mm x 25mm FR4 PCB with high coverage of single sided 1oz copper, in still air conditions.
  5. For a device surface mounted on FR4 PCB measured at  $t \leq 10$  sec.
  6. Repetitive rating - 25mm x 25mm FR4 PCB,  $D = 0.02$ , pulse width 300 $\mu\text{s}$  – pulse width limited by maximum junction temperature.

**Thermal Characteristics**

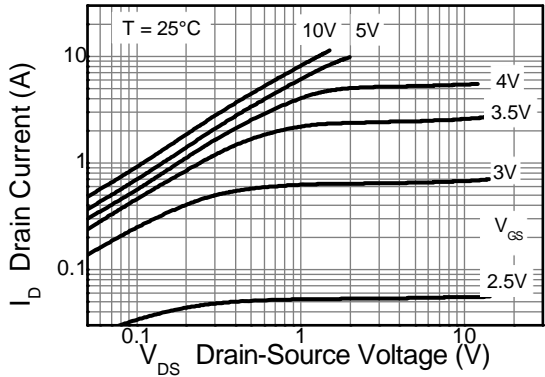


**Electrical Characteristics** @T<sub>A</sub> = 25°C unless otherwise specified

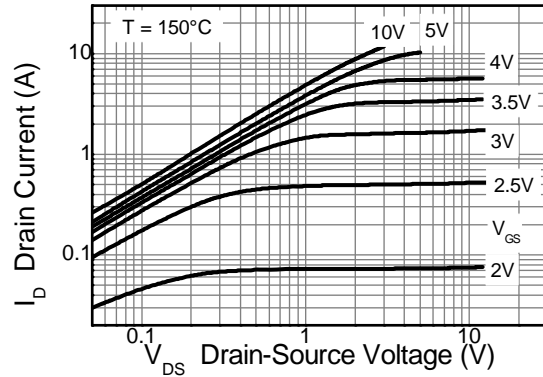
Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
<b>OFF CHARACTERISTICS</b>						
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	60	-	-	V	V <sub>GS</sub> = 0V, I <sub>D</sub> = 250μA
Zero Gate Voltage Drain Current T <sub>J</sub> = 25°C	I <sub>DSS</sub>	-	-	1.0	μA	V <sub>DS</sub> = 60V, V <sub>GS</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	-	2.2	V	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA
Static Drain-Source On-Resistance (Note 7)	R <sub>DS(on)</sub>	-	-	120	mΩ	V <sub>GS</sub> = 10V, I <sub>D</sub> = 2.5A
			-	180		V <sub>GS</sub> = 4.5V, I <sub>D</sub> = 2A
Forward Transconductance (Note 7 & 9)	g <sub>FS</sub>	-	4.9	-	S	V <sub>DS</sub> = 15V, I <sub>D</sub> = 2.5A
Diodes Forward Voltage (Note 7)	V <sub>SD</sub>	-	0.85	0.95	V	T <sub>J</sub> = 25°C, I <sub>S</sub> = 2.8A, V <sub>GS</sub> = 10V
<b>DYNAMIC CHARACTERISTICS</b>						
Input Capacitance (Note 8 & 9)	C <sub>iss</sub>	-	330	-	pF	V <sub>DS</sub> = 40V, V <sub>GS</sub> = 0V, f = 1.0MHz
Output Capacitance (Note 8 & 9)	C <sub>oss</sub>	-	35.2	-	pF	
Reverse Transfer Capacitance (Note 8 & 9)	C <sub>rss</sub>	-	17.1	-	pF	
Gate Charge (Note 8 & 9)	Q <sub>g</sub>	-	3	-	nC	V <sub>GS</sub> = 5V, V <sub>DS</sub> = 15V, I <sub>D</sub> = 2.5A
Total Gate Charge (Note 8 & 9)	Q <sub>g</sub>	-	5.7	-	nC	V <sub>GS</sub> = 10V, V <sub>DS</sub> = 15V, I <sub>D</sub> = 2.5A
Gate-Source Charge (Note 8 & 9)	Q <sub>gs</sub>	-	1.25	-	nC	
Gate-Drain Charge (Note 8 & 9)	Q <sub>gd</sub>	-	0.86	-	nC	
Reverse Recovery Time (Note 9)	t <sub>rr</sub>		21.5		ns	T <sub>J</sub> = 25°C, I <sub>S</sub> = 2.5A,
Reverse Recovery Charge (Note 9)	Q <sub>rr</sub>		20.5		nC	di/dt = 100A/μs
Turn-On Delay Time (Note 8 & 9)	t <sub>D(on)</sub>	-	1.95	-	ns	V <sub>GS</sub> = 10V, V <sub>DD</sub> = 30V, R <sub>G</sub> = 6Ω, I <sub>D</sub> = 2.5A
Turn-On Rise Time (Note 8 & 9)	t <sub>r</sub>	-	3.5	-	ns	
Turn-Off Delay Time (Note 8 & 9)	t <sub>D(off)</sub>	-	8.2	-	ns	
Turn-Off Fall Time (Note 8 & 9)	t <sub>f</sub>	-	4.6	-	ns	

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

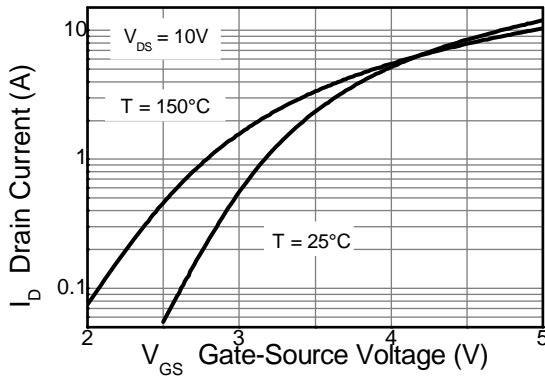
**Typical Characteristics**



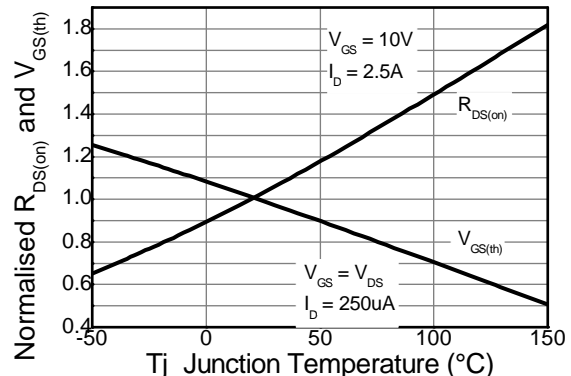
**Output Characteristics**



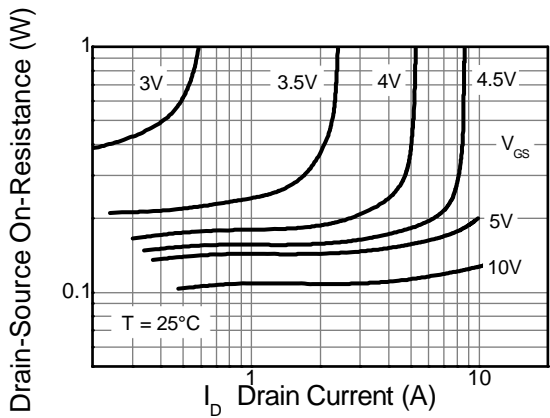
**Output Characteristics**



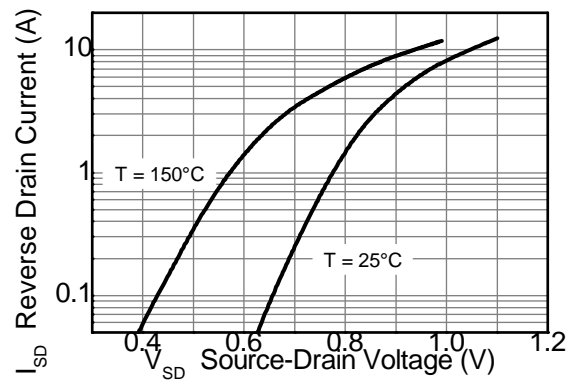
**Typical Transfer Characteristics**



**Normalised Curves v Temperature**

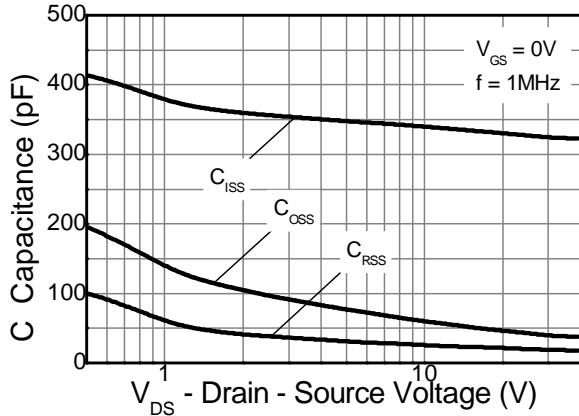


**On-Resistance v Drain Current**

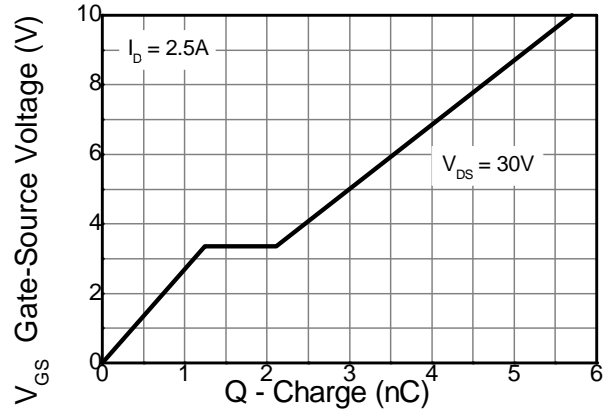


**Source-Drain Diode Forward Voltage**

**Typical Characteristics - Continued**

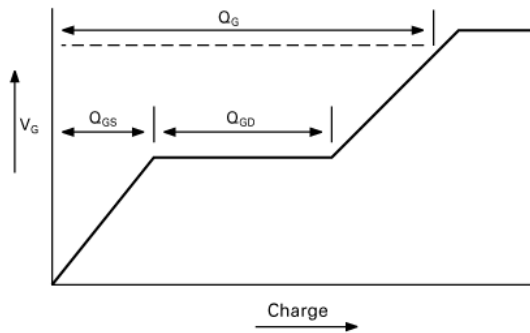


**Capacitance v Drain-Source Voltage**

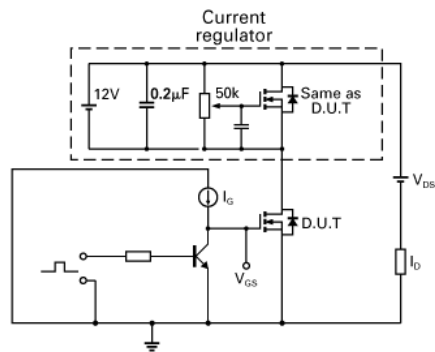


**Gate-Source Voltage v Gate Charge**

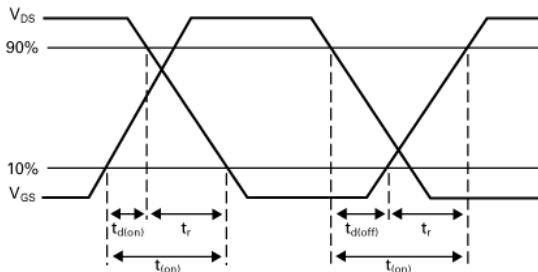
**Test Circuits**



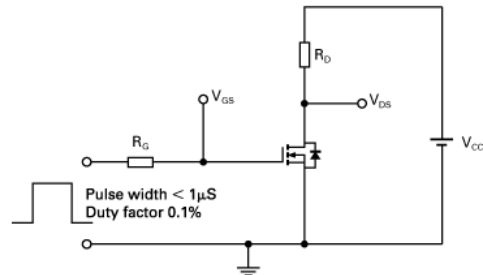
**Basic gate charge waveform**



**Gate charge test circuit**

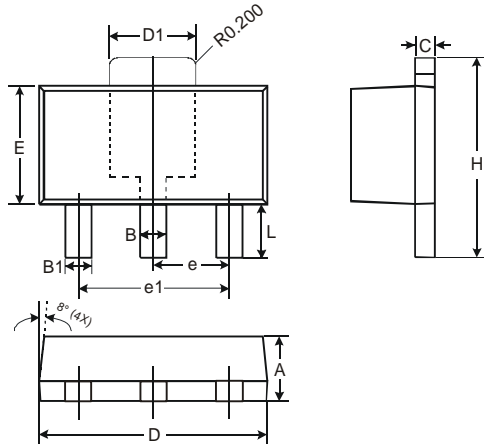


**Switching time waveforms**



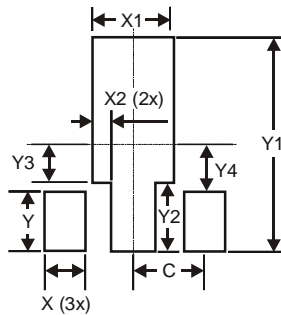
**Switching time test circuit**

**Package Outline Dimensions**



SOT89		
Dim	Min	Max
A	1.40	1.60
B	0.44	0.62
B1	0.35	0.54
C	0.35	0.43
D	4.40	4.60
D1	1.52	1.83
E	2.29	2.60
e	1.50 Typ	
e1	3.00 Typ	
H	3.94	4.25
L	0.89	1.20
All Dimensions in mm		

**Suggested Pad Layout**



Dimensions	Value (in mm)
X	0.900
X1	1.733
X2	0.416
Y	1.300
Y1	4.600
Y2	1.475
Y3	0.950
Y4	1.125
C	1.500

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