

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 Ω @ $V_{GS} = 10V$	3.6A
	180m Ω @ $V_{GS} = 4.5V$	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**

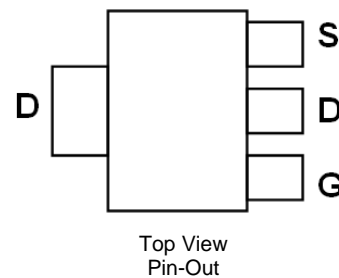
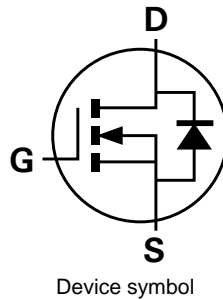
Description and Applications

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)

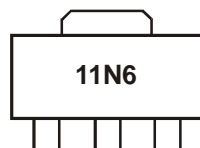


Ordering Information (Note 3)

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

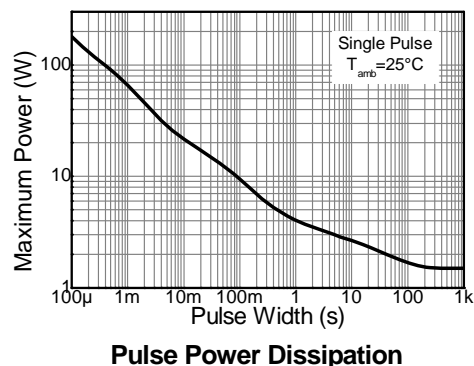
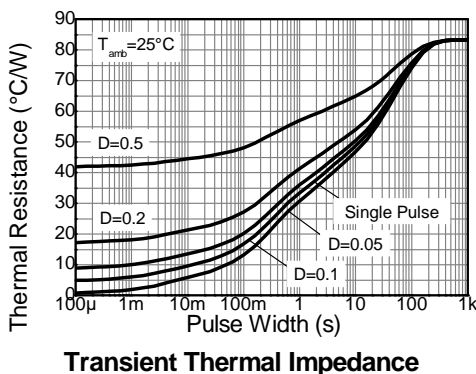
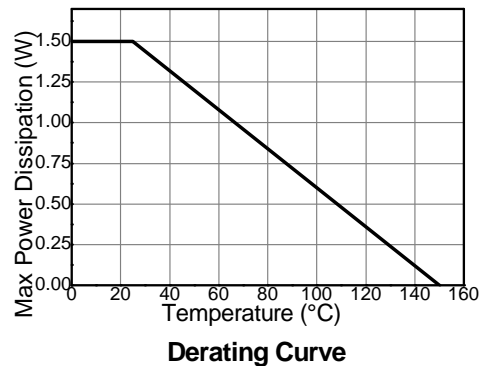
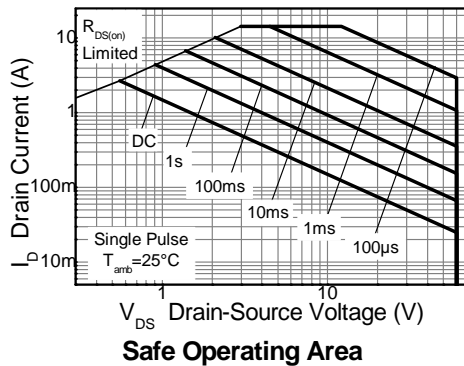
Characteristic		Symbol	Value	Unit
Drain-Source Voltage		V_{DS}	60	V
Gate-Source Voltage		V_{GS}	± 20	V
Continuous Drain Current	Steady State	@ $V_{GS} = 10\text{V}$; $T_A = 25^\circ\text{C}$ (Note 5)	3.6	A
		@ $V_{GS} = 10\text{V}$; $T_A = 75^\circ\text{C}$ (Note 5)	2.9	
		@ $V_{GS} = 10\text{V}$; $T_A = 25^\circ\text{C}$ (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	mW/ $^\circ\text{C}$
Power Dissipation (Note 5)		P_D	2.6	W
Linear Derating Factor			21	mW/ $^\circ\text{C}$
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 μs – pulse width limited by maximum junction temperature.

Thermal Characteristics

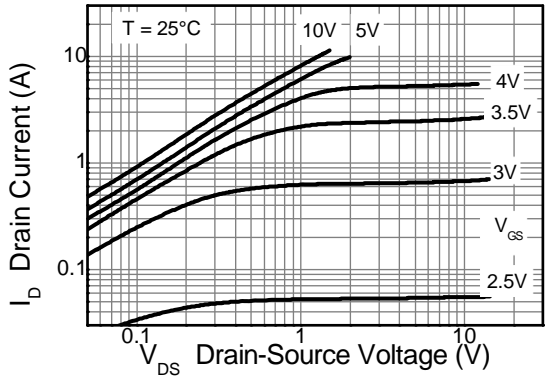


Electrical Characteristics @T_A = 25°C unless otherwise specified

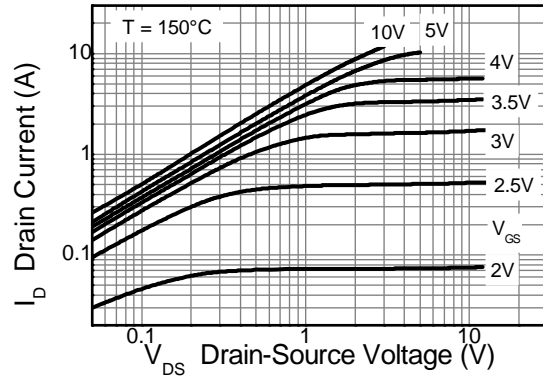
Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
OFF CHARACTERISTICS						
Drain-Source Breakdown Voltage	BV _{DSS}	60	-	-	V	V _{GS} = 0V, I _D = 250μA
Zero Gate Voltage Drain Current T _J = 25°C	I _{DSS}	-	-	1.0	μA	V _{DS} = 60V, V _{GS} = 0V
Gate-Source Leakage	I _{GSS}	-	-	100	nA	V _{GS} = ±20V, V _{DS} = 0V
ON CHARACTERISTICS						
Gate Threshold Voltage	V _{GS(th)}	1	-	2.2	V	V _{DS} = V _{GS} , I _D = 250μA
Static Drain-Source On-Resistance (Note 7)	R _{DS(on)}	-	-	120	mΩ	V _{GS} = 10V, I _D = 2.5A
			-	180		V _{GS} = 4.5V, I _D = 2A
Forward Transconductance (Note 7 & 9)	g _{FS}	-	4.9	-	S	V _{DS} = 15V, I _D = 2.5A
Diodes Forward Voltage (Note 7)	V _{SD}	-	0.85	0.95	V	T _J = 25°C, I _S = 2.8A, V _{GS} = 10V
DYNAMIC CHARACTERISTICS						
Input Capacitance (Note 8 & 9)	C _{iss}	-	330	-	pF	V _{DS} = 40V, V _{GS} = 0V, f = 1.0MHz
Output Capacitance (Note 8 & 9)	C _{oss}	-	35.2	-	pF	
Reverse Transfer Capacitance (Note 8 & 9)	C _{rss}	-	17.1	-	pF	
Gate Charge (Note 8 & 9)	Q _g	-	3	-	nC	V _{GS} = 5V, V _{DS} = 15V, I _D = 2.5A
Total Gate Charge (Note 8 & 9)	Q _g	-	5.7	-	nC	V _{GS} = 10V, V _{DS} = 15V, I _D = 2.5A
Gate-Source Charge (Note 8 & 9)	Q _{gs}	-	1.25	-	nC	
Gate-Drain Charge (Note 8 & 9)	Q _{gd}	-	0.86	-	nC	
Reverse Recovery Time (Note 9)	t _{rr}		21.5		ns	T _J = 25°C, I _S = 2.5A,
Reverse Recovery Charge (Note 9)	Q _{rr}		20.5		nC	di/dt = 100A/μs
Turn-On Delay Time (Note 8 & 9)	t _{D(on)}	-	1.95	-	ns	V _{GS} = 10V, V _{DD} = 30V, R _G = 6Ω, I _D = 2.5A
Turn-On Rise Time (Note 8 & 9)	t _r	-	3.5	-	ns	
Turn-Off Delay Time (Note 8 & 9)	t _{D(off)}	-	8.2	-	ns	
Turn-Off Fall Time (Note 8 & 9)	t _f	-	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.

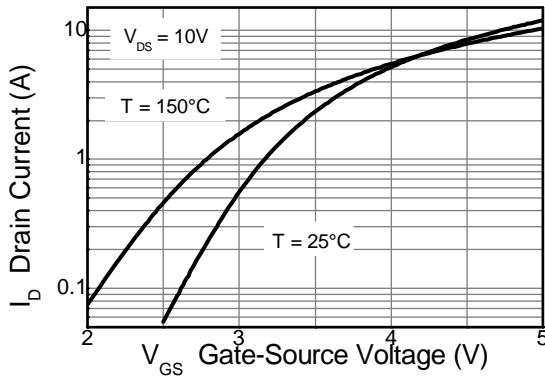
Typical Characteristics



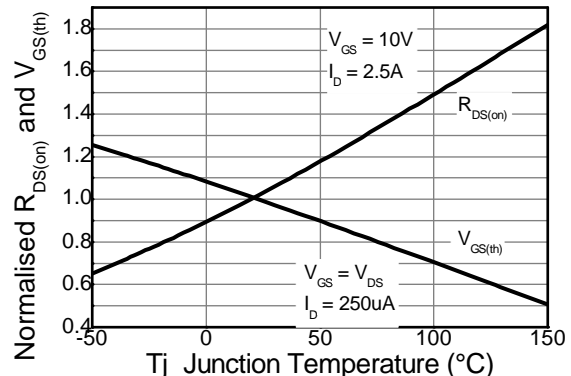
Output Characteristics



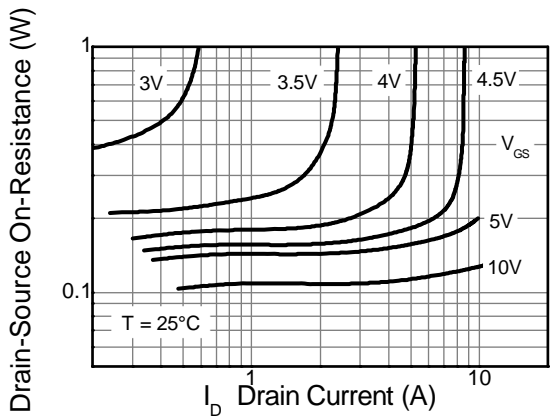
Output Characteristics



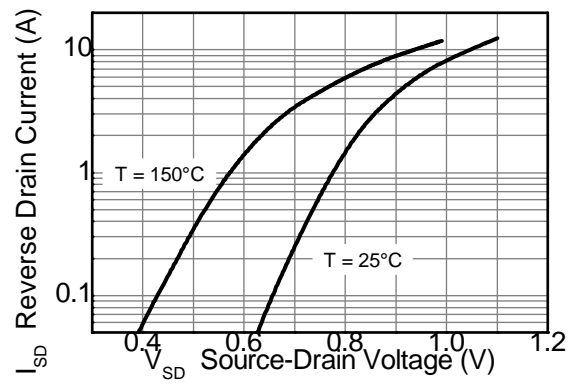
Typical Transfer Characteristics



Normalised Curves v Temperature

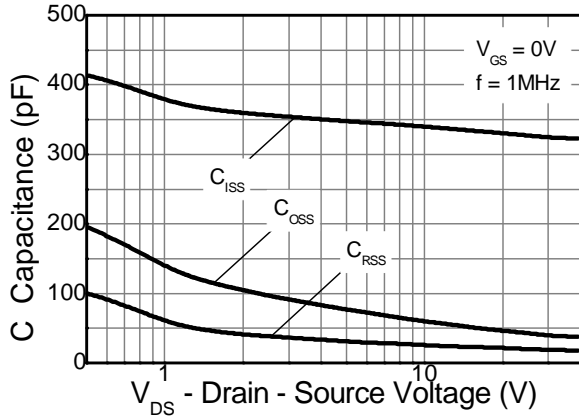


On-Resistance v Drain Current

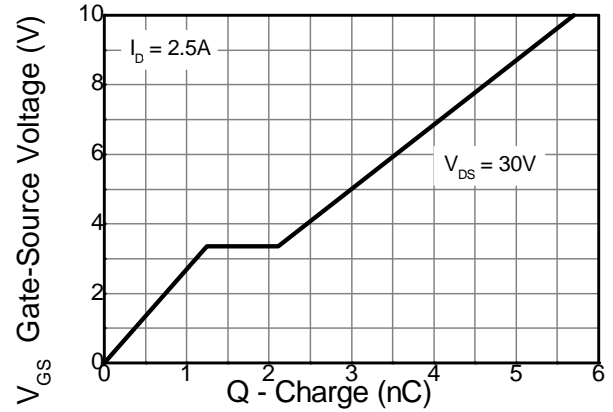


Source-Drain Diode Forward Voltage

Typical Characteristics - Continued

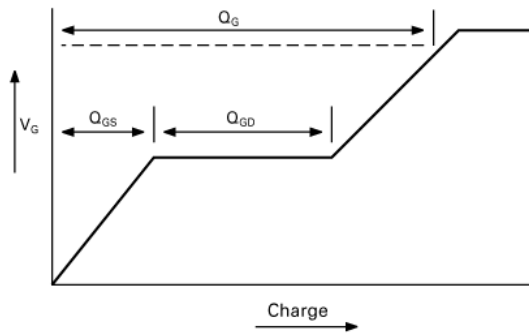


Capacitance v Drain-Source Voltage

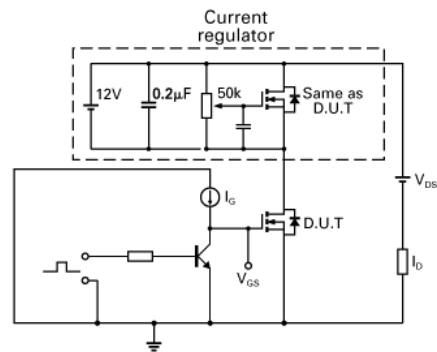


Gate-Source Voltage v Gate Charge

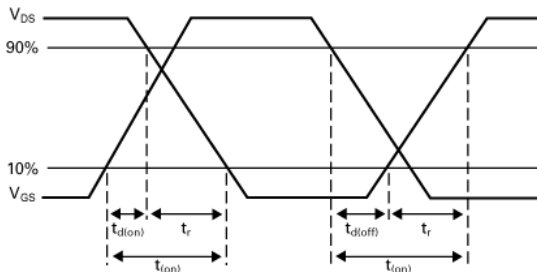
Test Circuits



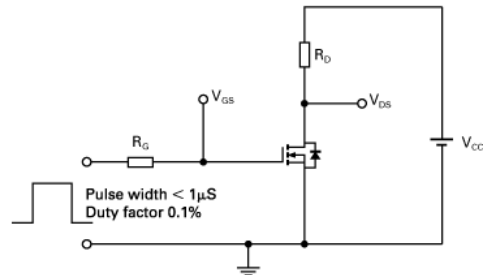
Basic gate charge waveform



Gate charge test circuit

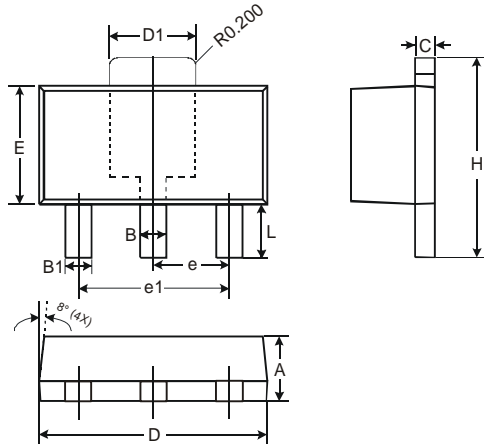


Switching time waveforms



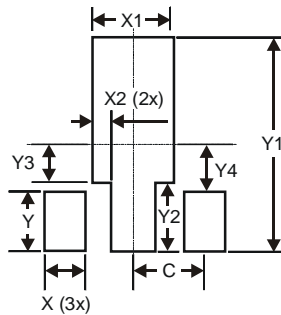
Switching time test circuit

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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