

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**

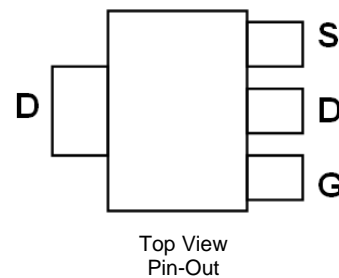
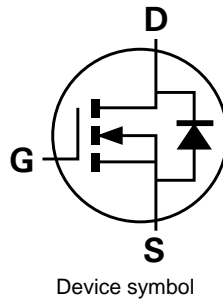
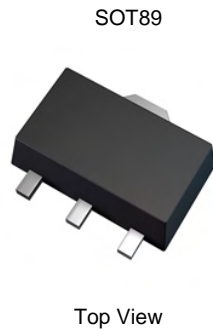
Description and Applications

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)

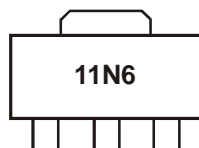


Ordering Information (Note 3)

| 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°C unless otherwise specified

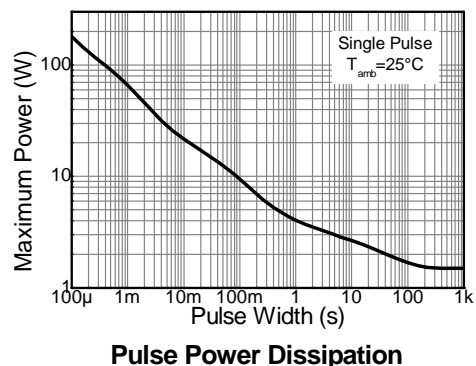
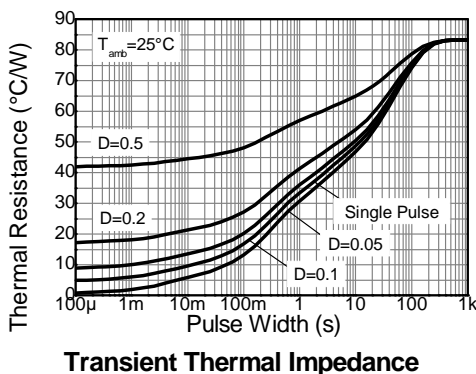
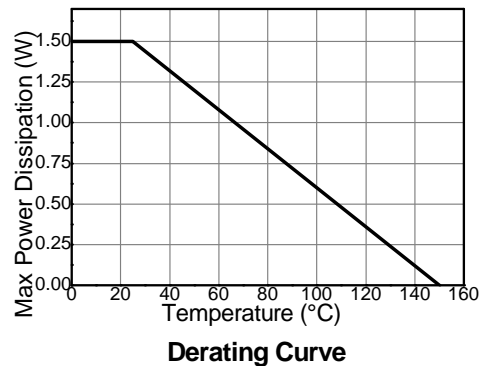
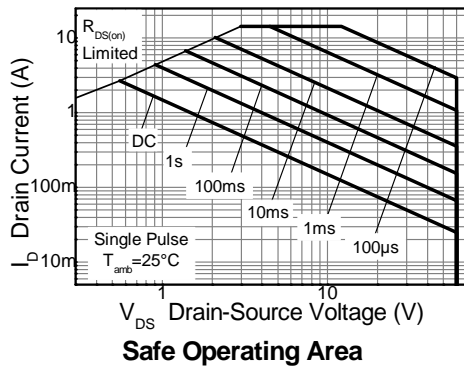
| Characteristic | | Symbol | Value | Unit |
|-------------------------------------------------|--------------|----------------------------------------------------------|-------|------|
| Drain-Source Voltage | | V _{DSS} | 60 | V |
| Gate-Source Voltage | | V _{GSS} | ±20 | V |
| Continuous Drain Current | Steady State | @ V _{GS} = 10V ; T _A = 25°C (Note 5) | 3.6 | A |
| | | @ V _{GS} = 10V ; T _A = 75°C (Note 5) | 2.9 | |
| | | @ V _{GS} = 10V ; T _A = 25°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°C unless otherwise specified

| Characteristic | | Symbol | Value | Unit |
|--------------------------------------------------|--|-----------------------------------|-------------|-------|
| Power Dissipation (Note 4) | | P _D | 1.5 | W |
| Linear Derating Factor | | | 12 | mW/°C |
| Power Dissipation (Note 5) | | P _D | 2.6 | W |
| Linear Derating Factor | | | 21 | mW/°C |
| Thermal Resistance, Junction to Ambient (Note 4) | | R _{θJA} | 83.3 | °C/W |
| Thermal Resistance, Junction to Ambient (Note 5) | | R _{θJA} | 47.4 | °C/W |
| Operating and Storage Temperature Range | | T _J , T _{STG} | -55 to +150 | °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 ≤ 10 sec.
 6. Repetitive rating - 25mm x 25mm FR4 PCB, D = 0.02, pulse width 300µs – pulse width limited by maximum junction temperature.

Thermal Characteristics

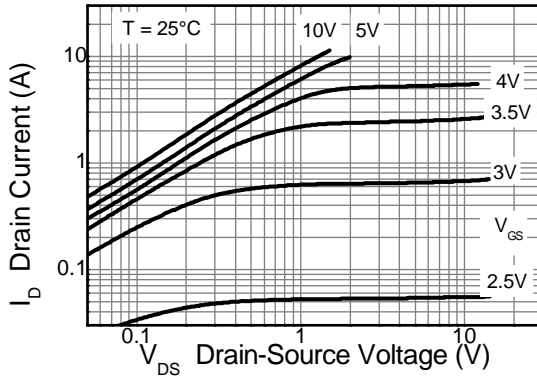


Electrical Characteristics @T_A = 25°C unless otherwise specified

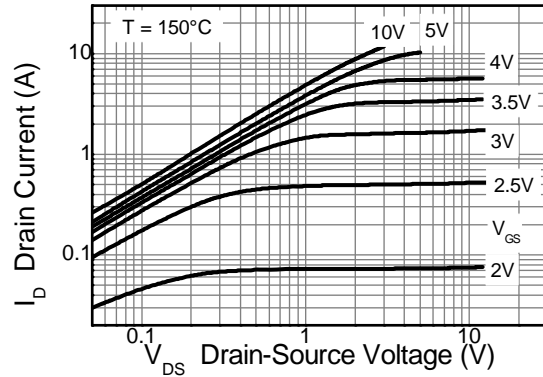
| Characteristic | Symbol | Min | Typ | Max | Unit | Test Condition |
|-------------------------------------------------------|---------------------|-----|------|------|------|---------------------------------------------------------------------------------------------|
| OFF CHARACTERISTICS | | | | | | |
| 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.

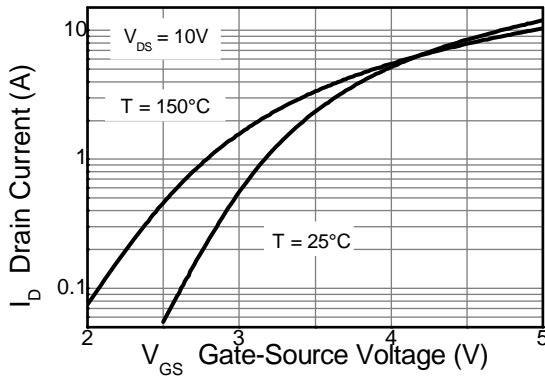
Typical Characteristics



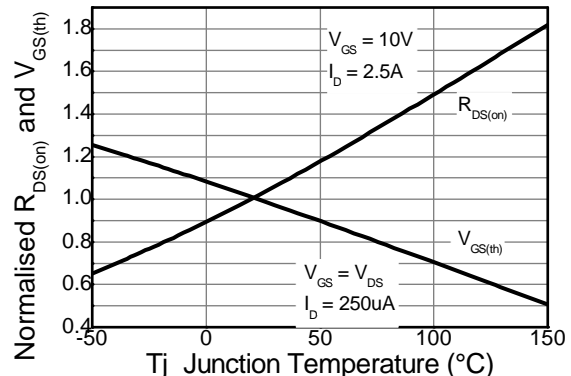
Output Characteristics



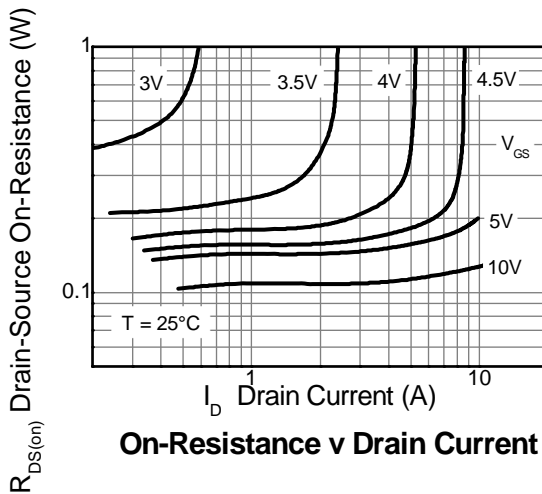
Output Characteristics



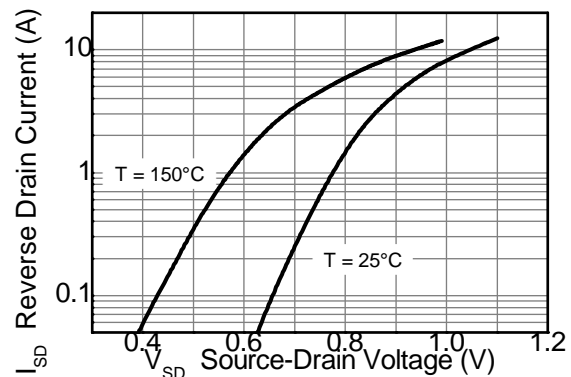
Typical Transfer Characteristics



Normalised Curves v Temperature

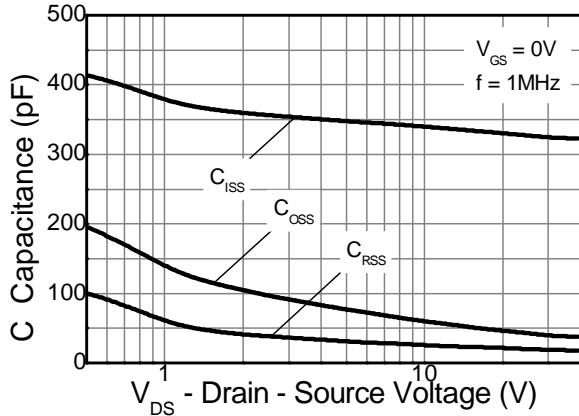


On-Resistance v Drain Current

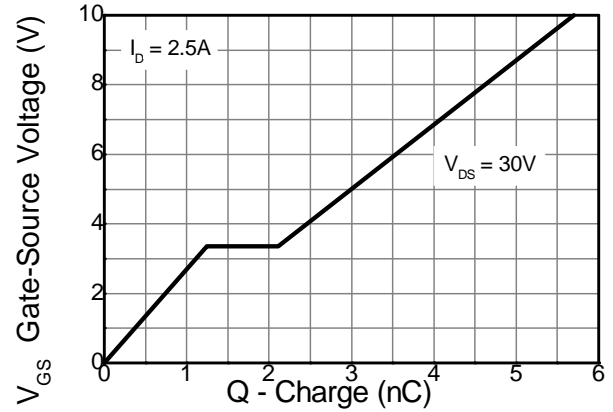


Source-Drain Diode Forward Voltage

Typical Characteristics - Continued

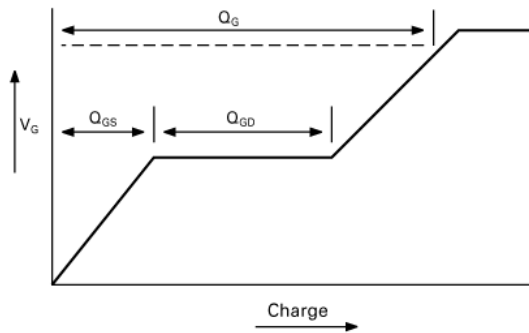


Capacitance v Drain-Source Voltage

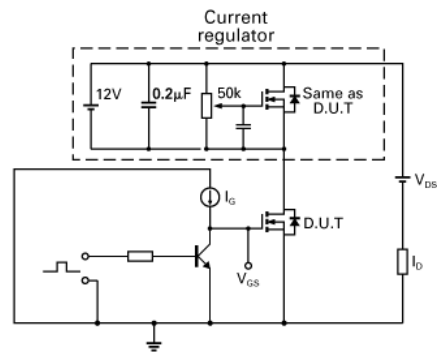


Gate-Source Voltage v Gate Charge

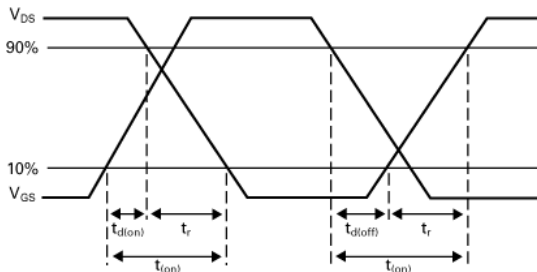
Test Circuits



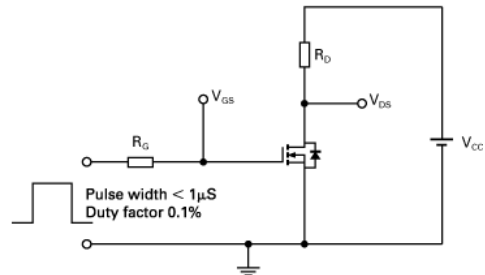
Basic gate charge waveform



Gate charge test circuit

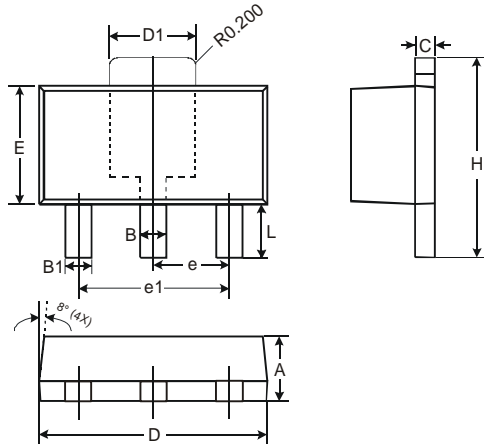


Switching time waveforms



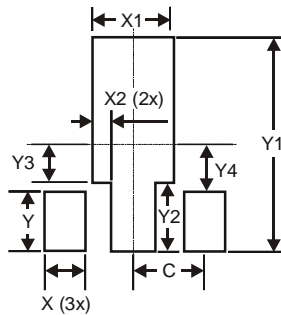
Switching time test circuit

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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