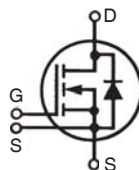


## X4-Class Power MOSFET™

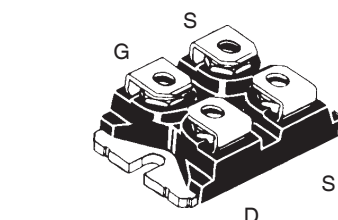
## IXTN400N15X4

N-Channel Enhancement Mode  
Avalanche Rated



$$\begin{aligned} V_{DSS} &= 150V \\ I_{D25} &= 400A \\ R_{DS(on)} &\leq 2.35m\Omega \end{aligned}$$

miniBLOC, SOT-227  
E153432



G = Gate  
S = Source  
D = Drain

| Symbol       | Test Conditions                                                          | Maximum Ratings                  |                      |
|--------------|--------------------------------------------------------------------------|----------------------------------|----------------------|
| $V_{DSS}$    | $T_J = 25^\circ\text{C}$ to $175^\circ\text{C}$                          | 150                              | V                    |
| $V_{DGR}$    | $T_J = 25^\circ\text{C}$ to $175^\circ\text{C}$ , $R_{GS} = 1M\Omega$    | 150                              | V                    |
| $V_{GSS}$    | Continuous                                                               | $\pm 20$                         | V                    |
| $V_{GSM}$    | Transient                                                                | $\pm 30$                         | V                    |
| $I_{D25}$    | $T_C = 25^\circ\text{C}$ (Chip Capability)                               | 400                              | A                    |
| $I_{L(RMS)}$ | External Lead Current Limit                                              | 200                              | A                    |
| $I_{DM}$     | $T_C = 25^\circ\text{C}$ , Pulse Width Limited by $T_{JM}$               | 900                              | A                    |
| $I_A$        | $T_C = 25^\circ\text{C}$                                                 | 200                              | A                    |
| $E_{AS}$     | $T_C = 25^\circ\text{C}$                                                 | 3                                | J                    |
| $P_D$        | $T_C = 25^\circ\text{C}$                                                 | 830                              | W                    |
| $dv/dt$      | $I_S \leq I_{DM}$ , $V_{DD} \leq V_{DSS}$ , $T_J \leq 150^\circ\text{C}$ | 50                               | V/ns                 |
| $T_J$        |                                                                          | -55 ... +175                     | $^\circ\text{C}$     |
| $T_{JM}$     |                                                                          | 175                              | $^\circ\text{C}$     |
| $T_{stg}$    |                                                                          | -55 ... +175                     | $^\circ\text{C}$     |
| $V_{ISOL}$   | 50/60 Hz, RMS<br>$I_{ISOL} \leq 1\text{mA}$                              | $t = 1$ minute<br>$t = 1$ second | 2500 V~<br>3000 V~   |
| $M_d$        | Mounting Torque<br>Terminal Connection Torque                            | 1.5/13<br>1.3/11.5               | Nm/lb.in<br>Nm/lb.in |
| Weight       |                                                                          | 30                               | g                    |

### Features

- International Standard Package
- miniBLOC, with Aluminium Nitride Isolation
- Isolation Voltage 2500 V~
- High Current Handling Capability
- Low  $Q_G$
- Avalanche Rated
- Low Package Inductance

### Advantages

- High Power Density
- Easy to Mount
- Space Savings

### Applications

- Switch-Mode and Resonant-Mode Power Supplies
- DC-DC Converters
- PFC Circuits
- AC and DC Motor Drives
- Robotics and Servo Controls

| Symbol       | Test Conditions<br>( $T_J = 25^\circ\text{C}$ Unless Otherwise Specified) | Characteristic Values |      |                          |
|--------------|---------------------------------------------------------------------------|-----------------------|------|--------------------------|
|              |                                                                           | Min.                  | Typ. | Max.                     |
| $BV_{DSS}$   | $V_{GS} = 0V$ , $I_D = 1\text{mA}$                                        | 150                   |      | V                        |
| $V_{GS(th)}$ | $V_{DS} = V_{GS}$ , $I_D = 1\text{mA}$                                    | 2.5                   |      | 4.5 V                    |
| $I_{GSS}$    | $V_{GS} = \pm 20V$ , $V_{DS} = 0V$                                        |                       |      | $\pm 200$ nA             |
| $I_{DSS}$    | $V_{DS} = V_{DSS}$ , $V_{GS} = 0V$<br>$T_J = 150^\circ\text{C}$           |                       |      | 25 $\mu\text{A}$<br>2 mA |
| $R_{DS(on)}$ | $V_{GS} = 10V$ , $I_D = 100A$ , Note 1                                    |                       |      | 2.35 m $\Omega$          |

| Symbol                              | Test Conditions<br>(T <sub>J</sub> = 25°C, Unless Otherwise Specified)                                                                                                          | Characteristic Values                                            |      |           |
|-------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------|------|-----------|
|                                     |                                                                                                                                                                                 | Min.                                                             | Typ. | Max       |
| <b>g<sub>fs</sub></b>               | V <sub>DS</sub> = 10V, I <sub>D</sub> = 60A, Note 1                                                                                                                             | 100                                                              | 170  | S         |
| <b>R<sub>Gi</sub></b>               | Gate Input Resistance                                                                                                                                                           |                                                                  | 1.2  | Ω         |
| <b>C<sub>iss</sub></b>              | V <sub>GS</sub> = 0V, V <sub>DS</sub> = 25V, f = 1MHz                                                                                                                           |                                                                  | 14.5 | nF        |
| <b>C<sub>oss</sub></b>              |                                                                                                                                                                                 |                                                                  | 3.1  | nF        |
| <b>C<sub>rss</sub></b>              |                                                                                                                                                                                 |                                                                  | 8.0  | pF        |
| <b>Effective Output Capacitance</b> |                                                                                                                                                                                 |                                                                  |      |           |
| <b>C<sub>o(er)</sub></b>            | Energy related                                                                                                                                                                  | V <sub>GS</sub> = 0V<br>V <sub>DS</sub> = 0.8 • V <sub>DSS</sub> | 2500 | pF        |
| <b>C<sub>o(tr)</sub></b>            | Time related                                                                                                                                                                    |                                                                  | 9400 | pF        |
| <b>t<sub>d(on)</sub></b>            | <b>Resistive Switching Times</b><br>V <sub>GS</sub> = 10V, V <sub>DS</sub> = 0.5 • V <sub>DSS</sub> , I <sub>D</sub> = 0.5 • I <sub>D25</sub><br>R <sub>G</sub> = 1Ω (External) |                                                                  | 40   | ns        |
| <b>t<sub>r</sub></b>                |                                                                                                                                                                                 |                                                                  | 22   | ns        |
| <b>t<sub>d(off)</sub></b>           |                                                                                                                                                                                 |                                                                  | 180  | ns        |
| <b>t<sub>f</sub></b>                |                                                                                                                                                                                 |                                                                  | 8    | ns        |
| <b>Q<sub>g(on)</sub></b>            | V <sub>GS</sub> = 10V, V <sub>DS</sub> = 0.5 • V <sub>DSS</sub> , I <sub>D</sub> = 0.5 • I <sub>D25</sub>                                                                       |                                                                  | 430  | nC        |
| <b>Q<sub>gs</sub></b>               |                                                                                                                                                                                 |                                                                  | 100  | nC        |
| <b>Q<sub>gd</sub></b>               |                                                                                                                                                                                 |                                                                  | 100  | nC        |
| <b>R<sub>thJC</sub></b>             |                                                                                                                                                                                 |                                                                  |      | 0.18 °C/W |
| <b>R<sub>thCS</sub></b>             |                                                                                                                                                                                 |                                                                  | 0.05 | °C/W      |

## Source-Drain Diode

| Symbol   | Test Conditions<br>( $T_J = 25^\circ\text{C}$ , Unless Otherwise Specified)                            | Characteristic Values |      |               |
|----------|--------------------------------------------------------------------------------------------------------|-----------------------|------|---------------|
|          |                                                                                                        | Min.                  | Typ. | Max.          |
| $I_S$    | $V_{GS} = 0\text{V}$                                                                                   |                       |      | 400 A         |
| $I_{SM}$ | Repetitive, Pulse Width Limited by $T_{JM}$                                                            |                       |      | 1600 A        |
| $V_{SD}$ | $I_F = 100\text{A}$ , $V_{GS} = 0\text{V}$ , Note 1                                                    |                       |      | 1.4 V         |
| $t_{rr}$ | $I_F = 150\text{A}$ , $-di/dt = 100\text{A}/\mu\text{s}$<br>$V_R = 100\text{V}$ , $V_{GS} = 0\text{V}$ |                       | 175  | ns            |
| $Q_{RM}$ |                                                                                                        |                       | 1.1  | $\mu\text{C}$ |
| $I_{RM}$ |                                                                                                        |                       | 12.3 | A             |

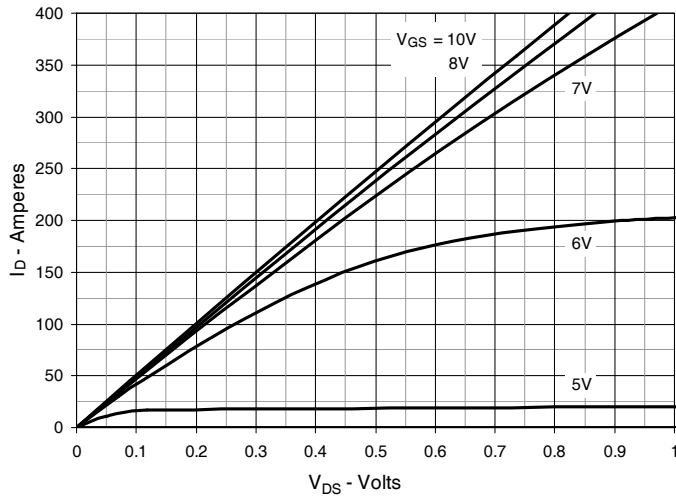
Note 1. Pulse test,  $t \leq 300\mu\text{s}$ , duty cycle,  $d \leq 2\%$ .

IXYS Reserves the Right to Change Limits, Test Conditions, and Dimensions.

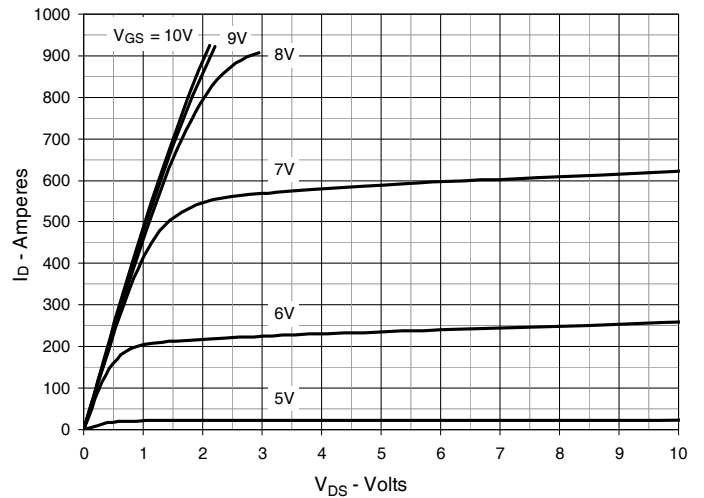
IXYS MOSFETs and IGBTs are covered by one or more of the following U.S. patents:

|           |           |           |           |              |              |              |              |              |             |
|-----------|-----------|-----------|-----------|--------------|--------------|--------------|--------------|--------------|-------------|
| 4,835,592 | 4,931,844 | 5,049,961 | 5,237,481 | 6,162,665    | 6,404,065 B1 | 6,683,344    | 6,727,585    | 7,005,734 B2 | 7,157,338B2 |
| 4,860,072 | 5,017,508 | 5,063,307 | 5,381,025 | 6,259,123 B1 | 6,534,343    | 6,710,405 B2 | 6,759,692    | 7,063,975 B2 |             |
| 4,881,106 | 5,034,796 | 5,187,117 | 5,486,715 | 6,306,728 B1 | 6,583,505    | 6,710,463    | 6,771,478 B2 | 7,071,537    |             |

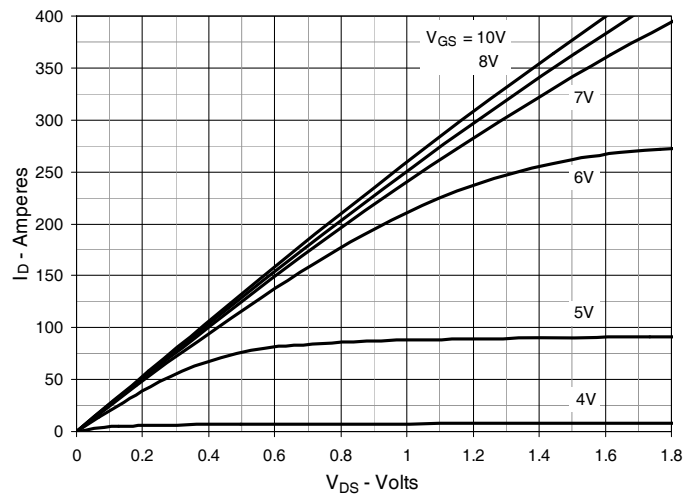
**Fig. 1. Output Characteristics @  $T_J = 25^\circ\text{C}$**



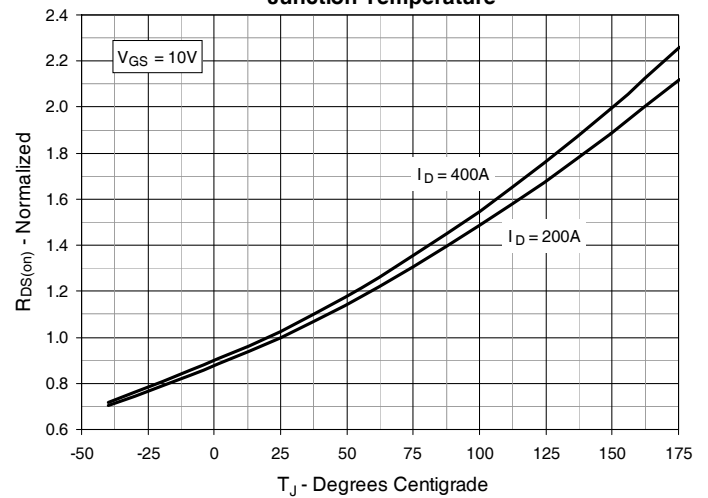
**Fig. 2. Extended Output Characteristics @  $T_J = 25^\circ\text{C}$**



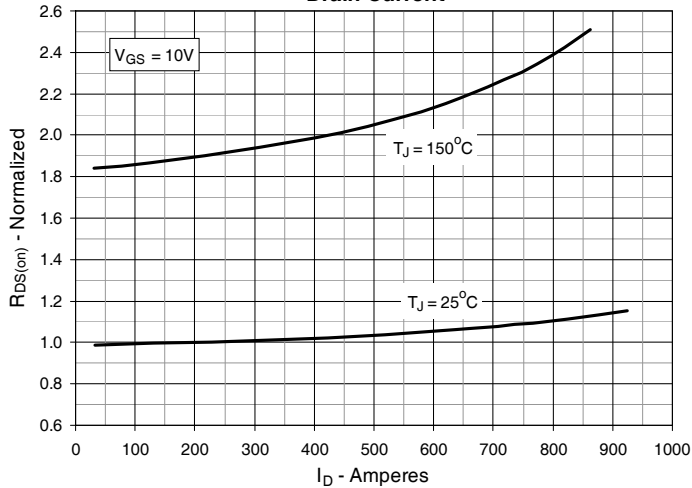
**Fig. 3. Output Characteristics @  $T_J = 150^\circ\text{C}$**



**Fig. 4.  $R_{DS(on)}$  Normalized to  $I_D = 200\text{A}$  Value vs. Junction Temperature**



**Fig. 5.  $R_{DS(on)}$  Normalized to  $I_D = 200\text{A}$  Value vs. Drain Current**



**Fig. 6. Normalized Breakdown & Threshold Voltages vs. Junction Temperature**

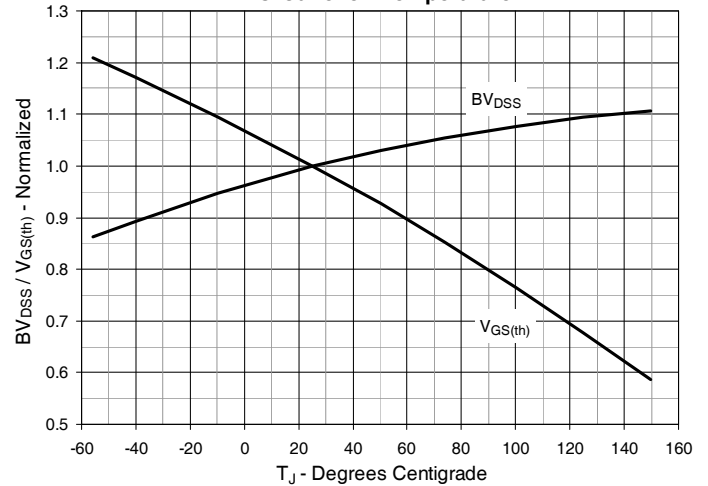


Fig. 7. Maximum Drain Current vs. Case Temperature

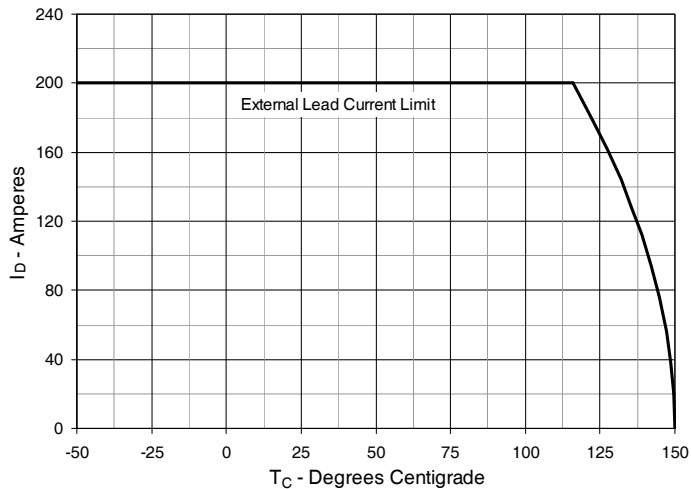


Fig. 8. Input Admittance

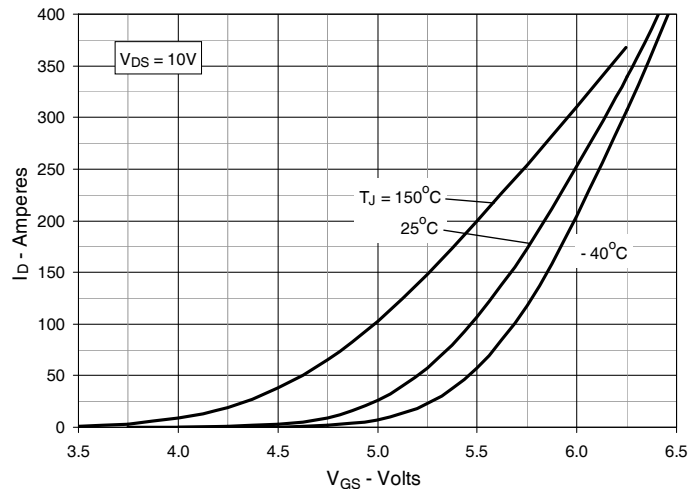


Fig. 9. Transconductance

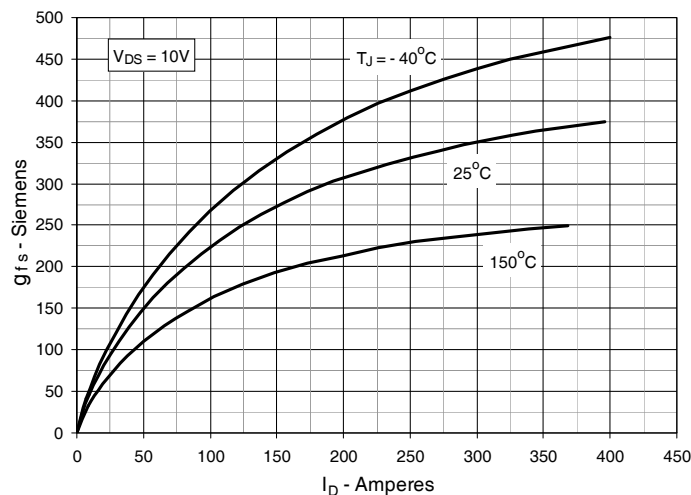


Fig. 10. Forward Voltage Drop of Intrinsic Diode

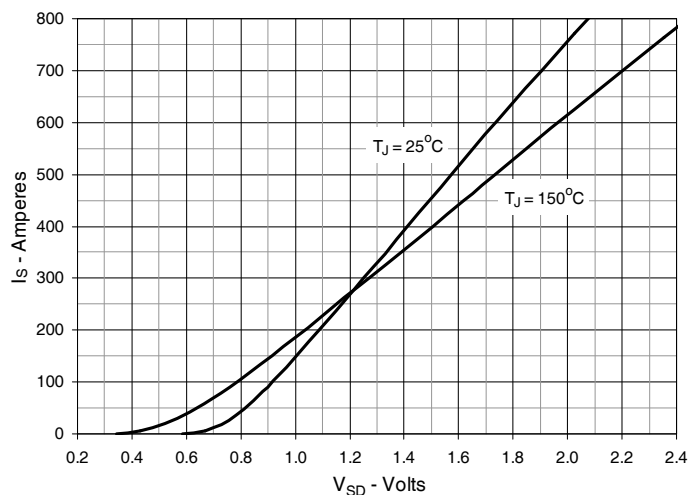


Fig. 11. Gate Charge

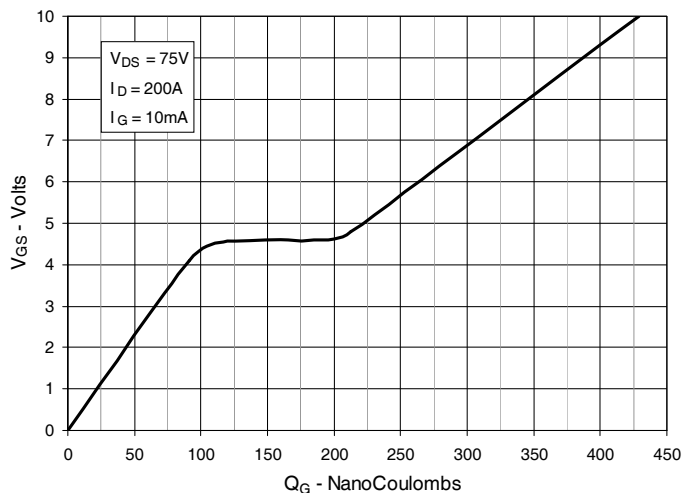
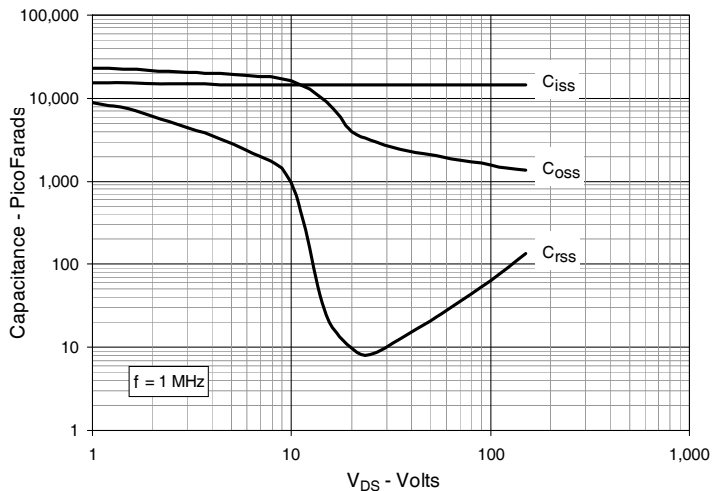
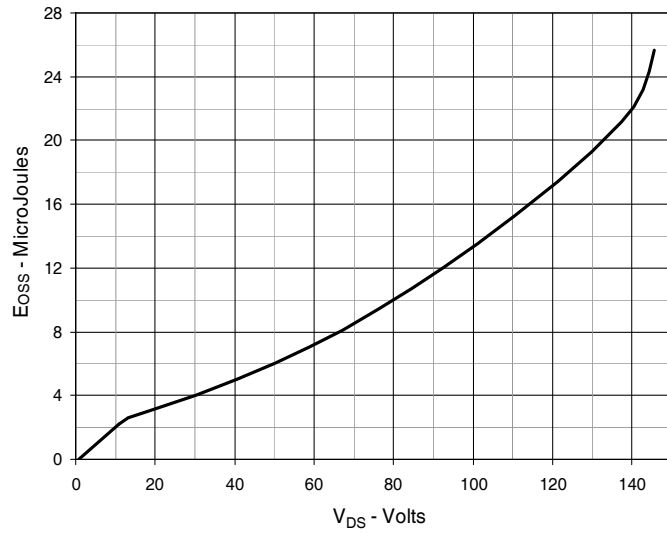
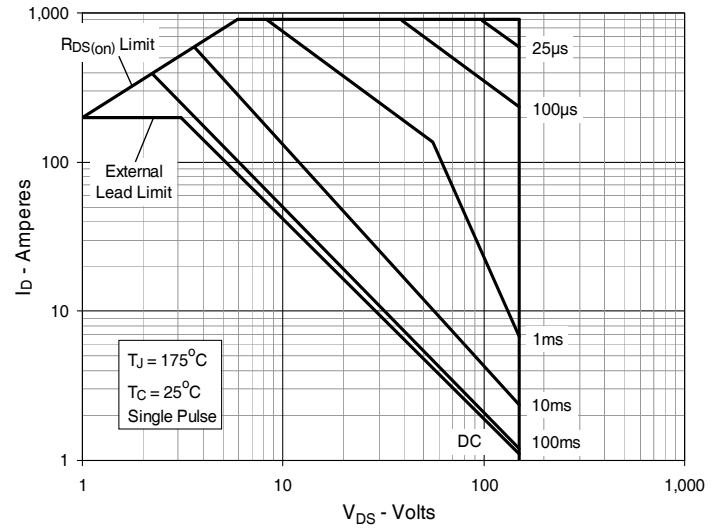
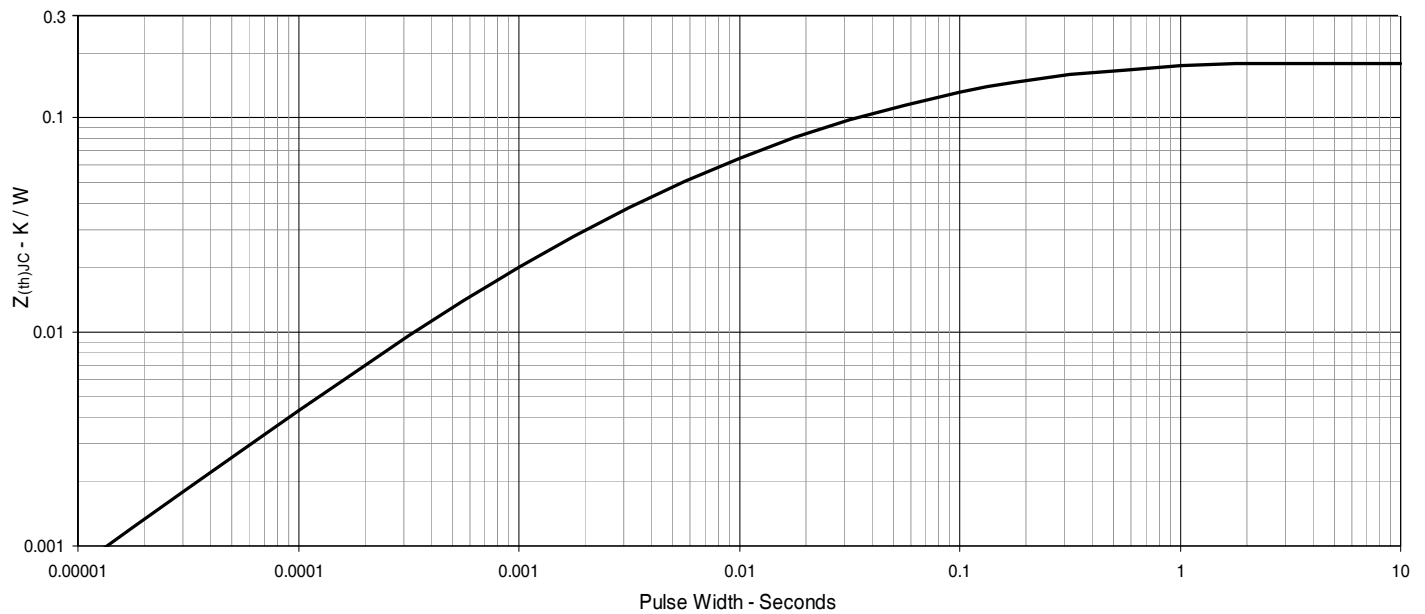
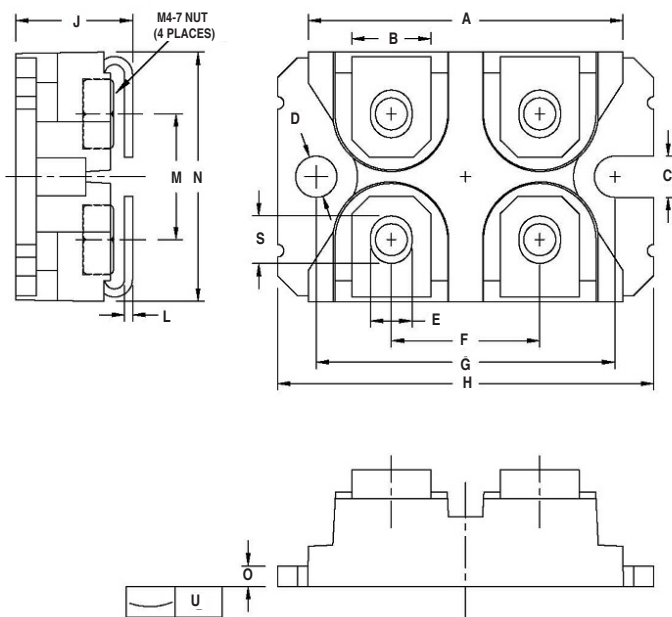


Fig. 12. Capacitance



**Fig. 13. Output Capacitance Stored Energy**

**Fig. 14. Forward-Bias Safe Operating Area**

**Fig. 15. Maximum Transient Thermal Impedance**


## SOT-227 Outline



| SYM | INCHES |       | MILLIMETERS |       |
|-----|--------|-------|-------------|-------|
|     | MIN    | MAX   | MIN         | MAX   |
| A   | 1.224  | 1.260 | 31.10       | 32.00 |
| B   | .303   | .327  | 7.70        | 8.30  |
| C   | .161   | .173  | 4.10        | 4.40  |
| D   | .161   | .173  | 4.10        | 4.40  |
| E   | .161   | .173  | 4.10        | 4.40  |
| F   | .587   | .598  | 14.90       | 15.20 |
| G   | 1.181  | 1.201 | 30.00       | 30.50 |
| H   | 1.488  | 1.508 | 37.80       | 38.30 |
| J   | .461   | .484  | 11.70       | 12.30 |
| L   | .030   | .033  | 0.75        | 0.85  |
| M   | .492   | .512  | 12.50       | 13.00 |
| N   | .984   | 1.004 | 25.00       | 25.50 |
| O   | .075   | .087  | 1.90        | 2.20  |
| S   | .181   | .193  | 4.60        | 4.90  |
| U   | .000   | .005  | 0.00        | 0.13  |

- NUT MATERIAL:  
STANDARD - Low carbon steel with Ni plating.  
OPTIONAL: - Brass Nut is available.  
PART NUMBER-BN
- ALL METAL SURFACE ARE PRE NI PLATED EXCEPT TRIM AREA.



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