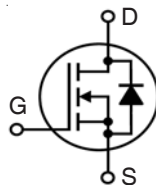


# X4-Class Power MOSFET™

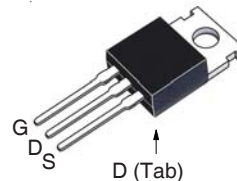
## IXTP170N13X4

N-Channel Enhancement Mode  
Avalanche Rated



$$\begin{aligned} V_{DSS} &= 135V \\ I_{D25} &= 170A \\ R_{DS(on)} &\leq 6.30m\Omega \end{aligned}$$

TO-220  
(IXTP)



G = Gate      D = Drain  
S = Source    Tab = Drain

| Symbol       | Test Conditions                                                    | Maximum Ratings |                  |
|--------------|--------------------------------------------------------------------|-----------------|------------------|
| $V_{DSS}$    | $T_J = 25^\circ\text{C to } 175^\circ\text{C}$                     | 135             | V                |
| $V_{DGR}$    | $T_J = 25^\circ\text{C to } 175^\circ\text{C}, R_{GS} = 1M\Omega$  | 135             | V                |
| $V_{GSS}$    | Continuous                                                         | $\pm 20$        | V                |
| $V_{GSM}$    | Transient                                                          | $\pm 30$        | V                |
| $I_{D25}$    | $T_C = 25^\circ\text{C}$ (Chip Capability)                         | 170             | A                |
| $I_{L(RMS)}$ | External Lead Current Limit                                        | 120             | A                |
| $I_{DM}$     | $T_C = 25^\circ\text{C}$ , Pulse Width Limited by $T_{JM}$         | 340             | A                |
| $I_A$        | $T_C = 25^\circ\text{C}$                                           | 85              | A                |
| $E_{AS}$     | $T_C = 25^\circ\text{C}$                                           | 1               | J                |
| $dv/dt$      | $I_S \leq I_{DM}, V_{DD} \leq V_{DSS}, T_J \leq 150^\circ\text{C}$ | 50              | V/ns             |
| $P_D$        | $T_C = 25^\circ\text{C}$                                           | 480             | W                |
| $T_J$        |                                                                    | -55 ... +175    | $^\circ\text{C}$ |
| $T_{JM}$     |                                                                    | 175             | $^\circ\text{C}$ |
| $T_{stg}$    |                                                                    | -55 ... +175    | $^\circ\text{C}$ |
| $T_L$        | Maximum Lead Temperature for Soldering                             | 300             | $^\circ\text{C}$ |
| $T_{SOLD}$   | 1.6 mm (0.062in.) from Case for 10s                                | 260             | $^\circ\text{C}$ |
| $M_d$        | Mounting Torque                                                    | 1.13 / 10       | Nm/lb.in         |
| Weight       |                                                                    | 3               | g                |

### Features

- International Standard Package
- Low  $R_{DS(ON)}$  and  $Q_G$
- 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.                      |
| $BV_{DSS}$   | $V_{GS} = 0V, I_D = 250\mu A$                                               | 135                   |      | V                         |
| $V_{GS(th)}$ | $V_{DS} = V_{GS}, I_D = 250\mu A$                                           | 2.5                   |      | 4.5 V                     |
| $I_{GSS}$    | $V_{GS} = \pm 20V, V_{DS} = 0V$                                             |                       |      | $\pm 100$ nA              |
| $I_{DSS}$    | $V_{DS} = V_{DSS}, V_{GS} = 0V$<br>$T_J = 150^\circ\text{C}$                |                       |      | 10 $\mu A$<br>500 $\mu A$ |
| $R_{DS(on)}$ | $V_{GS} = 10V, I_D = 0.5 \cdot I_{D25}$ , Note 1                            | 5.15                  | 6.30 | m $\Omega$                |

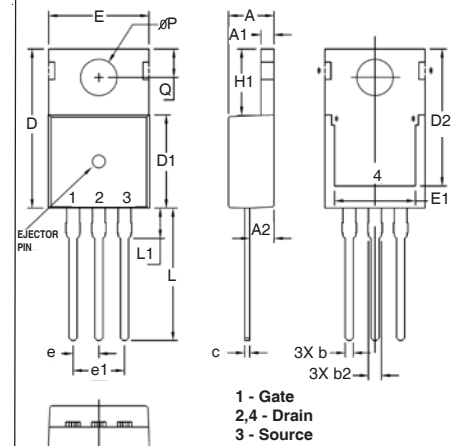
| Symbol                              | Test Conditions<br>(T <sub>J</sub> = 25°C, Unless Otherwise Specified)                                                                                                            | Characteristic Values |      |           |
|-------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|------|-----------|
|                                     |                                                                                                                                                                                   | Min.                  | Typ. | Max       |
| <b>g<sub>fs</sub></b>               | V <sub>DS</sub> = 20V, I <sub>D</sub> = 60A, Note 1                                                                                                                               | 70                    | 120  | S         |
| <b>R<sub>Gi</sub></b>               | Gate Input Resistance                                                                                                                                                             |                       | 0.9  | Ω         |
| <b>C<sub>iss</sub></b>              | } V <sub>GS</sub> = 0V, V <sub>DS</sub> = 25V, f = 1MHz                                                                                                                           |                       | 5460 | pF        |
| <b>C<sub>oss</sub></b>              |                                                                                                                                                                                   |                       | 960  | pF        |
| <b>C<sub>rss</sub></b>              |                                                                                                                                                                                   |                       | 29   | pF        |
| <b>Effective Output Capacitance</b> |                                                                                                                                                                                   |                       |      |           |
| <b>C<sub>o(er)</sub></b>            | Energy related } V <sub>GS</sub> = 0V                                                                                                                                             |                       | 720  | pF        |
| <b>C<sub>o(tr)</sub></b>            | Time related } V <sub>DS</sub> = 0.8 • V <sub>DSS</sub>                                                                                                                           |                       | 1800 | 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> = 2Ω (External) |                       | 26   | ns        |
| <b>t<sub>r</sub></b>                |                                                                                                                                                                                   |                       | 8    | ns        |
| <b>t<sub>d(off)</sub></b>           |                                                                                                                                                                                   |                       | 46   | ns        |
| <b>t<sub>f</sub></b>                |                                                                                                                                                                                   |                       | 7    | 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>                                                                       |                       | 105  | nC        |
| <b>Q<sub>gs</sub></b>               |                                                                                                                                                                                   |                       | 30   | nC        |
| <b>Q<sub>gd</sub></b>               |                                                                                                                                                                                   |                       | 29   | nC        |
| <b>R<sub>thJC</sub></b>             |                                                                                                                                                                                   |                       |      | 0.31 °C/W |
| <b>R<sub>thCS</sub></b>             |                                                                                                                                                                                   | 0.50                  |      | °C/W      |

## Source-Drain Diode

| Symbol   | Test Conditions<br>( $T_J = 25^{\circ}\text{C}$ , Unless Otherwise Specified)   | Characteristic Values |      |       |
|----------|---------------------------------------------------------------------------------|-----------------------|------|-------|
|          |                                                                                 | Min.                  | Typ. | Max   |
| $I_S$    | $V_{GS} = 0\text{V}$                                                            |                       |      | 170 A |
| $I_{SM}$ | Repetitive, pulse Width Limited by $T_{JM}$                                     |                       |      | 680 A |
| $V_{SD}$ | $I_F = 100\text{A}$ , $V_{GS} = 0\text{V}$ , Note 1                             |                       |      | 1.4 V |
| $t_{rr}$ | $I_F = 85\text{A}$ , $-di/dt = 100\text{A}/\mu\text{s}$<br>$V_R = 67.5\text{V}$ |                       | 86   | ns    |
| $Q_{RM}$ |                                                                                 |                       | 250  | nC    |
| $I_{RM}$ |                                                                                 |                       | 6    | A     |

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

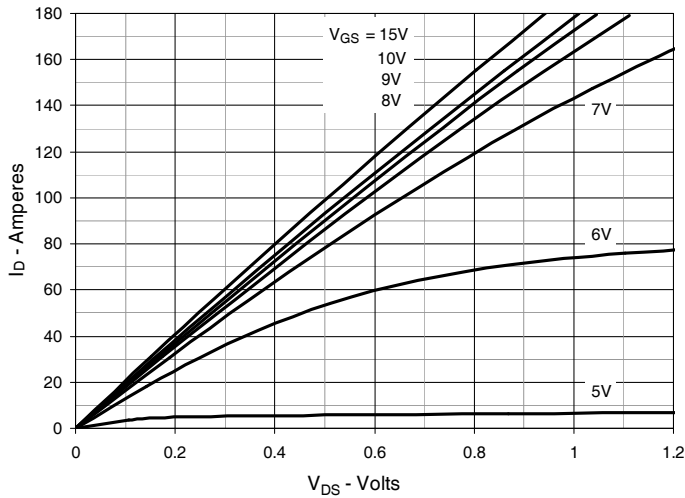
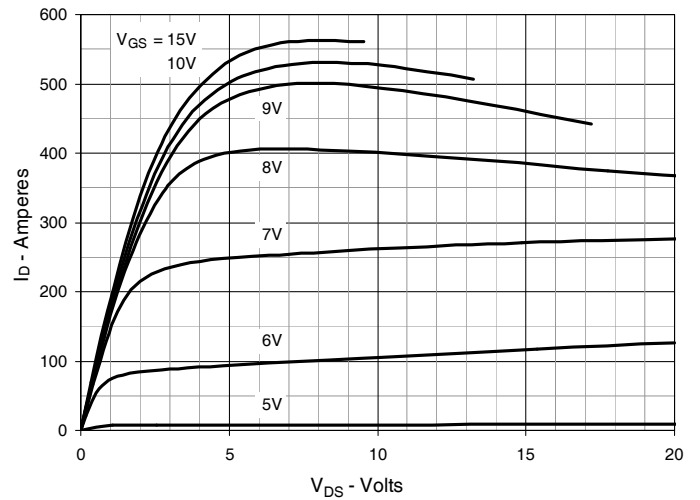
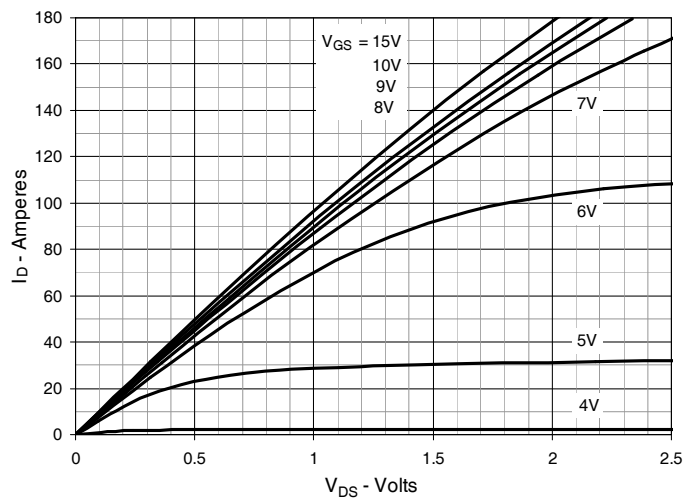
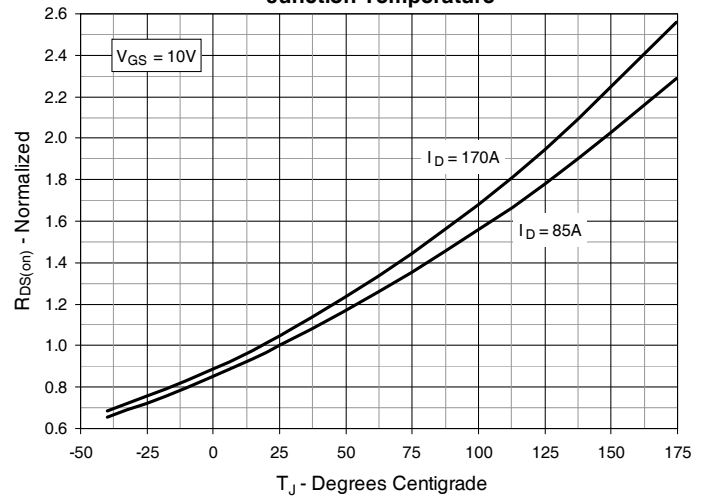
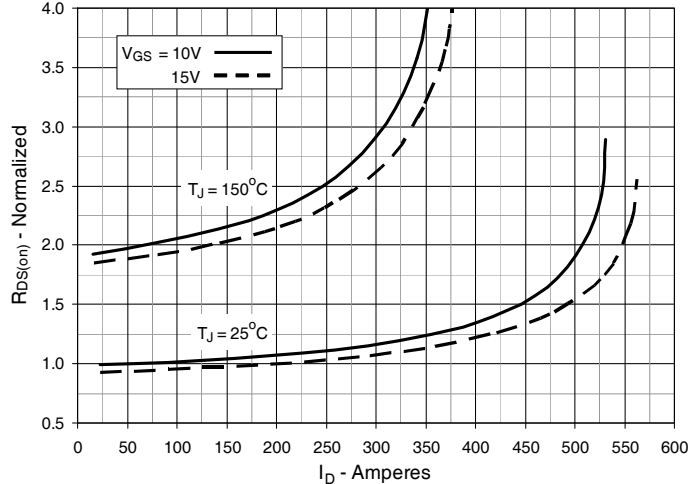
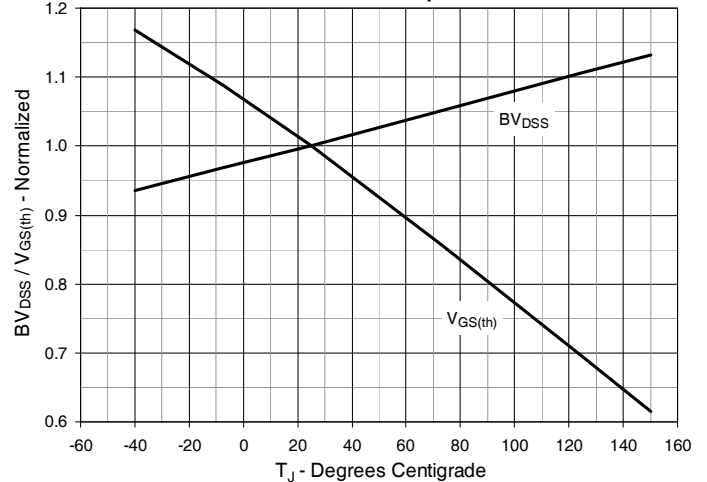
## TO-220 Outline

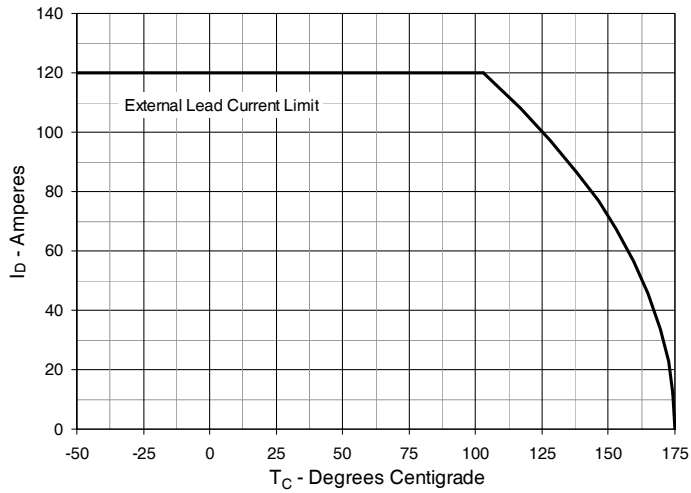
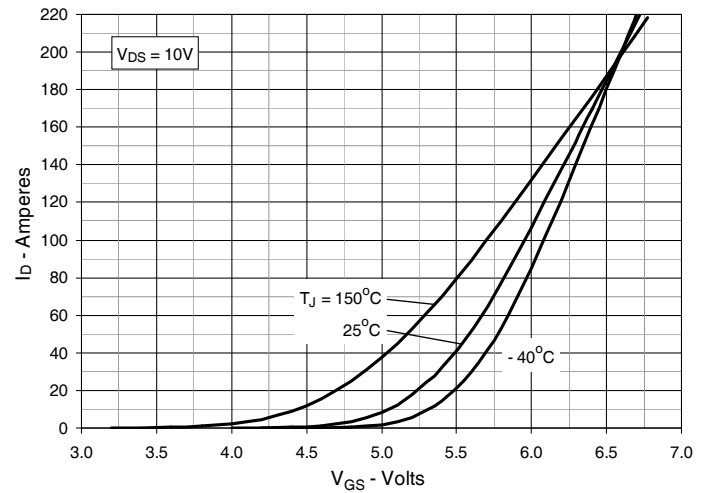
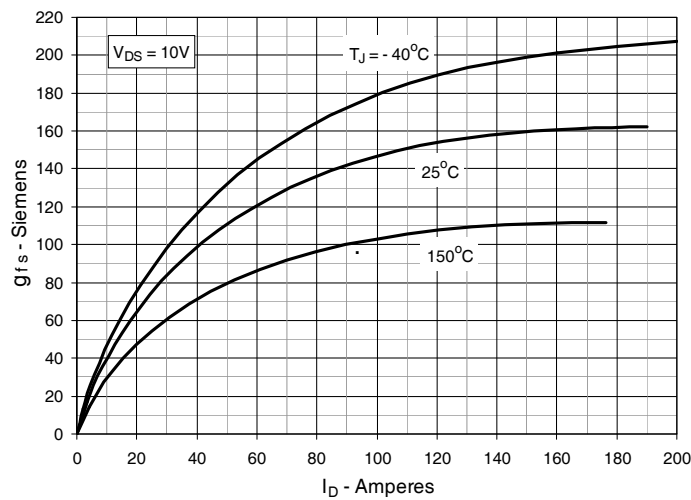
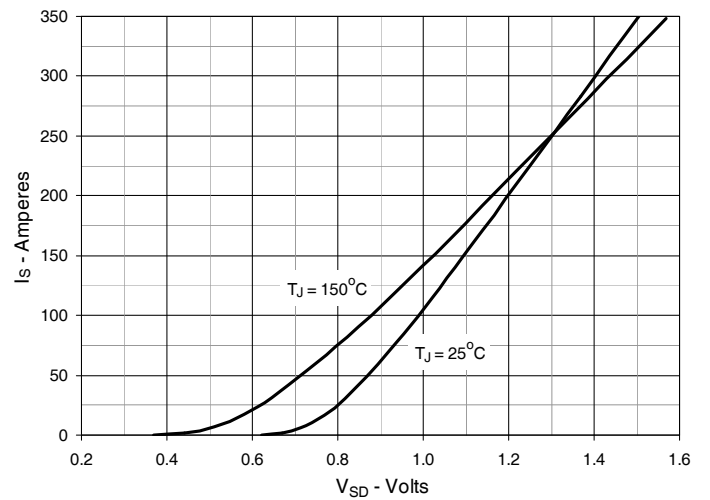
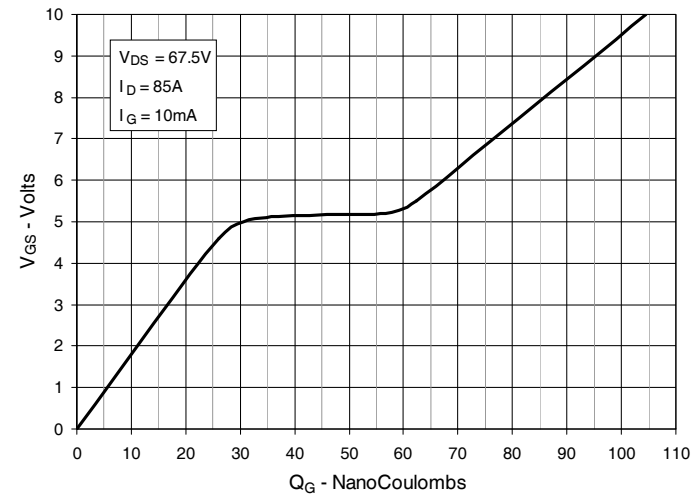
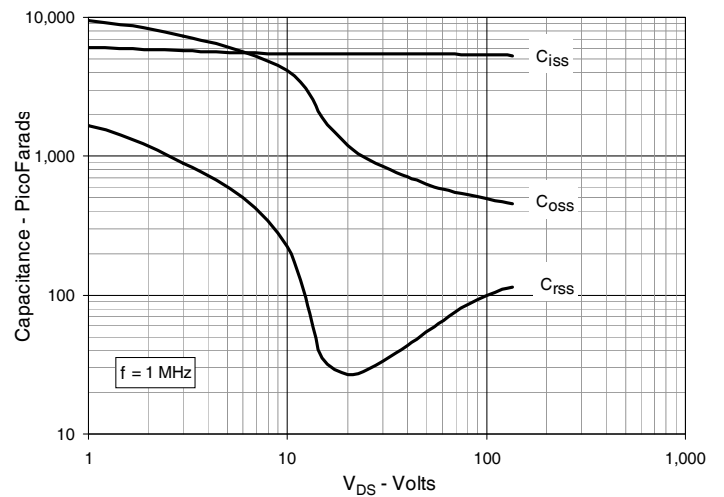


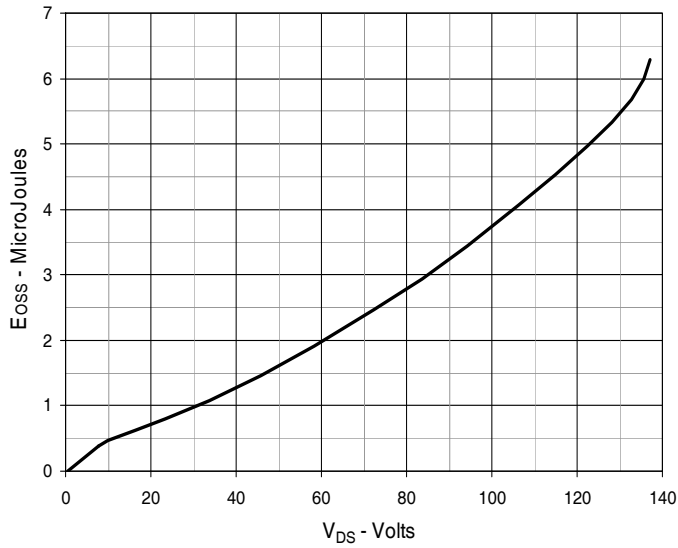
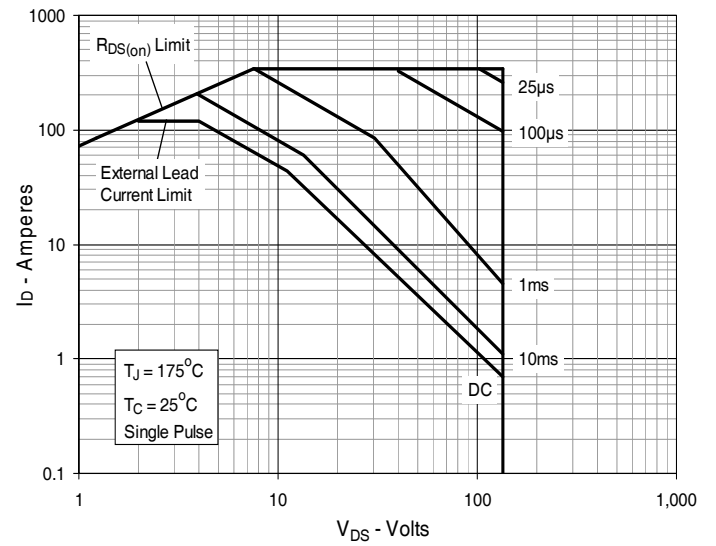
| SYM  | INCHES   |      | MILLIMETERS |       |
|------|----------|------|-------------|-------|
|      | MIN      | MAX  | MIN         | MAX   |
| A    | .169     | .185 | 4.30        | 4.70  |
| A1   | .047     | .055 | 1.20        | 1.40  |
| A2   | .079     | .106 | 2.00        | 2.70  |
| b    | .024     | .039 | 0.60        | 1.00  |
| b2   | .045     | .057 | 1.15        | 1.45  |
| c    | .014     | .026 | 0.35        | 0.65  |
| D    | .587     | .626 | 14.90       | 15.90 |
| D1   | .335     | .370 | 8.50        | 9.40  |
| (D2) | .500     | .531 | 12.70       | 13.50 |
| E    | .382     | .406 | 9.70        | 10.30 |
| (E1) | .283     | .323 | 7.20        | 8.20  |
| e    | .100 BSC |      | 2.54 BSC    |       |
| e1   | .200 BSC |      | 5.08 BSC    |       |
| H1   | .244     | .268 | 6.20        | 6.80  |
| L    | .492     | .547 | 12.50       | 13.90 |
| L1   | .110     | .154 | 2.80        | 3.90  |
| ØP   | .134     | .150 | 3.40        | 3.80  |
| Q    | .106     | .126 | 2.70        | 3.20  |

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   | 6,404,065B1 | 6,683,344   | 6,727,585   | 7,005,734B2 | 7,157,338B2 |
|                                                                                  | 4,860,072 | 5,017,508 | 5,063,307 | 5,381,025 | 6,259,123B1 | 6,534,343   | 6,710,405B2 | 6,759,692   | 7,063,975B2 |             |
|                                                                                  | 4,881,106 | 5,034,796 | 5,187,117 | 5,486,715 | 6,306,728B1 | 6,583,505   | 6,710,463   | 6,771,478B2 | 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  $I_D = 85\text{A}$  Value vs. Junction Temperature**

**Fig. 5.  $R_{DS(on)}$  Normalized to  $I_D = 85\text{A}$  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**
