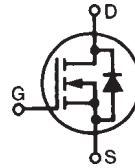


### GigaMOS™ Trench™ HiperFET™ Power MOSFET

### MMIX1F420N10T

$$\begin{aligned} V_{DSS} &= 100V \\ I_{D25} &= 334A \\ R_{DS(on)} &\leq 2.6m\Omega \\ T_{rr} &\leq 140ns \end{aligned}$$

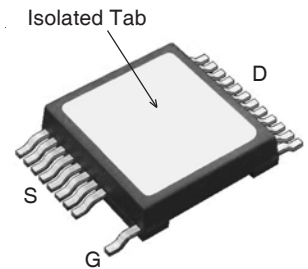
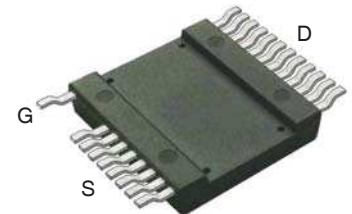
(Electrically Isolated Tab)



N-Channel Enhancement Mode  
Avalanche Rated  
Fast Intrinsic Diode

| Symbol     | Test Conditions                                                          | Maximum Ratings  |                  |
|------------|--------------------------------------------------------------------------|------------------|------------------|
| $V_{DSS}$  | $T_J = 25^\circ\text{C}$ to $175^\circ\text{C}$                          | 100              | V                |
| $V_{DGR}$  | $T_J = 25^\circ\text{C}$ to $175^\circ\text{C}$ , $R_{GS} = 1M\Omega$    | 100              | V                |
| $V_{GSS}$  | Continuous                                                               | $\pm 20$         | V                |
| $V_{GSM}$  | Transient                                                                | $\pm 30$         | V                |
| $I_{D25}$  | $T_C = 25^\circ\text{C}$                                                 | 334              | A                |
| $I_{DM}$   | $T_C = 25^\circ\text{C}$ , Pulse Width Limited by $T_{JM}$               | 1000             | A                |
| $I_A$      | $T_C = 25^\circ\text{C}$                                                 | 200              | A                |
| $E_{AS}$   | $T_C = 25^\circ\text{C}$                                                 | 5                | J                |
| $P_D$      | $T_C = 25^\circ\text{C}$                                                 | 680              | W                |
| $dv/dt$    | $I_S \leq I_{DM}$ , $V_{DD} \leq V_{DSS}$ , $T_J \leq 175^\circ\text{C}$ | 20               | V/ns             |
| $T_J$      |                                                                          | -55 ... +175     | $^\circ\text{C}$ |
| $T_{JM}$   |                                                                          | 175              | $^\circ\text{C}$ |
| $T_{stg}$  |                                                                          | -55 ... +175     | $^\circ\text{C}$ |
| $T_L$      | 1.6mm (0.062 in.) from Case for 10s                                      | 300              | $^\circ\text{C}$ |
| $T_{SOLD}$ | Plastic Body for 10s                                                     | 260              | $^\circ\text{C}$ |
| $V_{ISOL}$ | 50/60 Hz, 1 Minute                                                       | 2500             | V~               |
| $F_C$      | Mounting Force                                                           | 50..200 / 11..45 | N/lb.            |
| Weight     |                                                                          | 8                | g                |

| Symbol       | Test Conditions<br>( $T_J = 25^\circ\text{C}$ , Unless Otherwise Specified) | Characteristic Values |      |                    |
|--------------|-----------------------------------------------------------------------------|-----------------------|------|--------------------|
|              |                                                                             | Min.                  | Typ. | Max.               |
| $BV_{DSS}$   | $V_{GS} = 0V$ , $I_D = 3mA$                                                 | 100                   |      | V                  |
| $V_{GS(th)}$ | $V_{DS} = V_{GS}$ , $I_D = 8mA$                                             | 2.5                   |      | 5.0 V              |
| $I_{GSS}$    | $V_{GS} = \pm 20V$ , $V_{DS} = 0V$                                          |                       |      | $\pm 200$ nA       |
| $I_{DSS}$    | $V_{DS} = V_{DSS}$ , $V_{GS} = 0V$<br>$T_J = 150^\circ\text{C}$             |                       |      | 50 $\mu A$<br>5 mA |
| $R_{DS(on)}$ | $V_{GS} = 10V$ , $I_D = 60A$ , Note 1                                       |                       |      | 2.6 m $\Omega$     |



G = Gate      D = Drain  
S = Source

#### Features

- Silicon Chip on Direct-Copper Bond (DCB) Substrate
- Isolated Substrate
  - Excellent Thermal Transfer
  - Increased Temperature and Power Cycling Capability
  - High Isolation Voltage (2500V~)
- 175°C Operating Temperature
- Very High Current Handling Capability
- Fast Intrinsic Diode
- Avalanche Rated
- Very Low  $R_{DS(on)}$

#### Advantages

- Easy to Mount
- Space Savings
- High Power Density

#### Applications

- DC-DC Converters and Off-Line UPS
- Primary-Side Switch
- High Speed Power Switching Applications

| Symbol       | Test Conditions<br>( $T_J = 25^\circ\text{C}$ , Unless Otherwise Specified)                                                                  | Characteristic Values |      |                         |
|--------------|----------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|------|-------------------------|
|              |                                                                                                                                              | Min.                  | Typ. | Max.                    |
| $g_{fs}$     | $V_{DS} = 10\text{V}$ , $I_D = 60\text{A}$ , Note 1                                                                                          | 110                   | 185  | S                       |
| $C_{iss}$    | $V_{GS} = 0\text{V}$ , $V_{DS} = 25\text{V}$ , $f = 1\text{MHz}$                                                                             |                       | 47   | nF                      |
| $C_{oss}$    |                                                                                                                                              |                       | 4390 | pF                      |
| $C_{rss}$    |                                                                                                                                              |                       | 530  | pF                      |
| $R_{GI}$     | Gate Input Resistance                                                                                                                        |                       | 1.46 | $\Omega$                |
| $t_{d(on)}$  | <b>Resistive Switching Times</b><br>$V_{GS} = 10\text{V}$ , $V_{DS} = 0.5 \cdot V_{DSS}$ , $I_D = 100\text{A}$<br>$R_G = 1\Omega$ (External) |                       | 47   | ns                      |
| $t_r$        |                                                                                                                                              |                       | 155  | ns                      |
| $t_{d(off)}$ |                                                                                                                                              |                       | 115  | ns                      |
| $t_f$        |                                                                                                                                              |                       | 255  | ns                      |
| $Q_{g(on)}$  | $V_{GS} = 10\text{V}$ , $V_{DS} = 0.5 \cdot V_{DSS}$ , $I_D = 210\text{A}$                                                                   |                       | 670  | nC                      |
| $Q_{gs}$     |                                                                                                                                              |                       | 170  | nC                      |
| $Q_{gd}$     |                                                                                                                                              |                       | 195  | nC                      |
| $R_{thJC}$   |                                                                                                                                              |                       |      | 0.22 $^\circ\text{C/W}$ |
| $R_{thCS}$   |                                                                                                                                              |                       | 0.05 | $^\circ\text{C/W}$      |

#### Source-Drain Diode

| Symbol   | Test Conditions<br>( $T_J = 25^\circ\text{C}$ , Unless Otherwise Specified)                            | Characteristic Values |      |        |
|----------|--------------------------------------------------------------------------------------------------------|-----------------------|------|--------|
|          |                                                                                                        | Min.                  | Typ. | Max.   |
| $I_S$    | $V_{GS} = 0\text{V}$                                                                                   |                       |      | 420 A  |
| $I_{SM}$ | Repetitive, Pulse Width Limited by $T_{JM}$                                                            |                       |      | 1680 A |
| $V_{SD}$ | $I_F = 60\text{A}$ , $V_{GS} = 0\text{V}$ , Note 1                                                     |                       |      | 1.2 V  |
| $t_{rr}$ | $I_F = 150\text{A}$ , $V_{GS} = 0\text{V}$<br>$-di/dt = 100\text{A}/\mu\text{s}$<br>$V_R = 60\text{V}$ |                       |      | 140 ns |
| $I_{RM}$ |                                                                                                        |                       | 7    | A      |
| $Q_{RM}$ |                                                                                                        |                       | 380  | nC     |

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

#### ADVANCE TECHNICAL INFORMATION

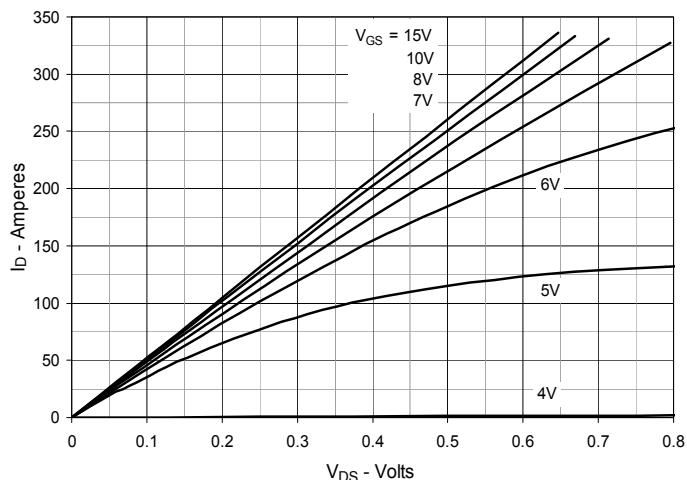
The product presented herein is under development. The Technical Specifications offered are derived from a subjective evaluation of the design, based upon prior knowledge and experience, and constitute a "considered reflection" of the anticipated result. IXYS reserves the right to change limits, test conditions, and dimensions without notice.

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

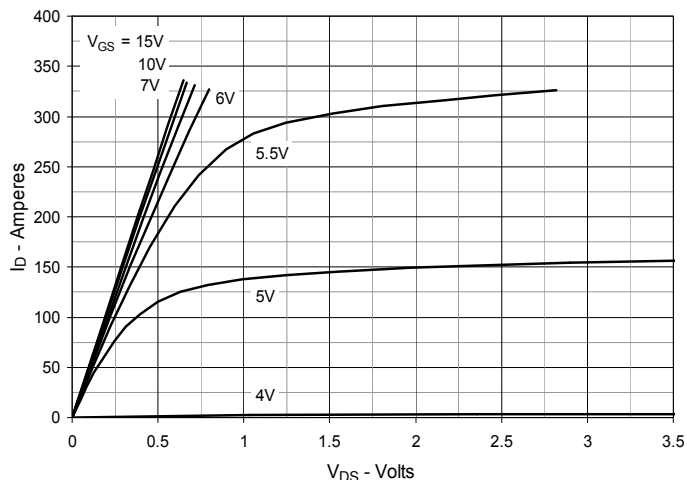
IXYS MOSFETs and IGBTs are covered by one or more of the following U.S. patents:

|           |           |           |           |              |              |              |              |              |             |
|-----------|-----------|-----------|-----------|--------------|--------------|--------------|--------------|--------------|-------------|
| 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 |
| 4,850,072 | 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    |             |

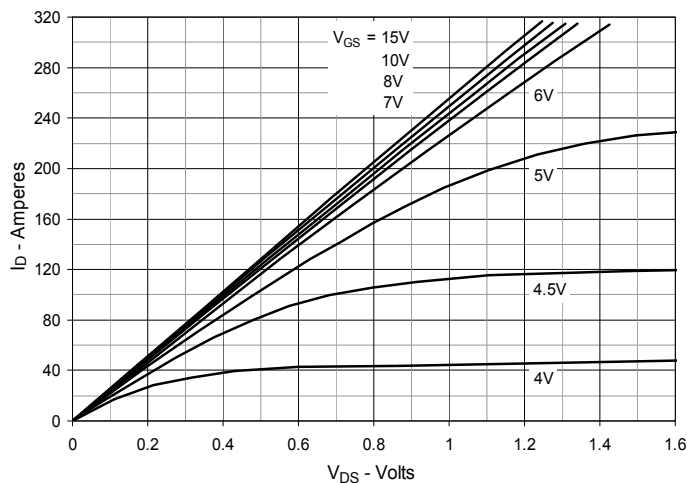
**Fig. 1. Output Characteristics @  $T_J = 25^\circ\text{C}$**



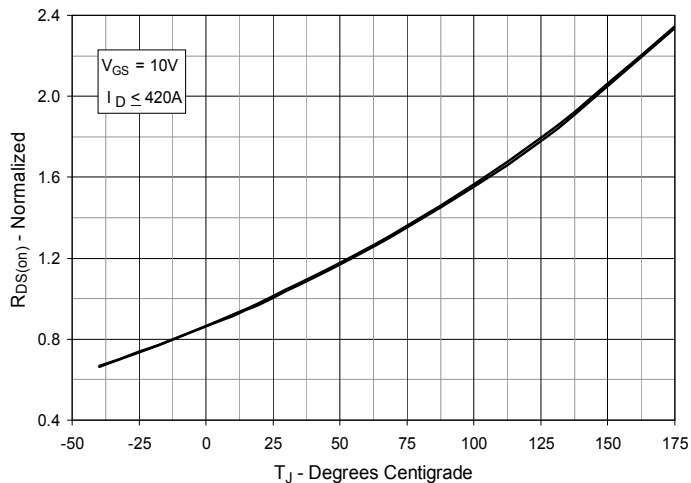
**Fig. 2. Extended Output Characteristics @  $T_J = 25^\circ\text{C}$**



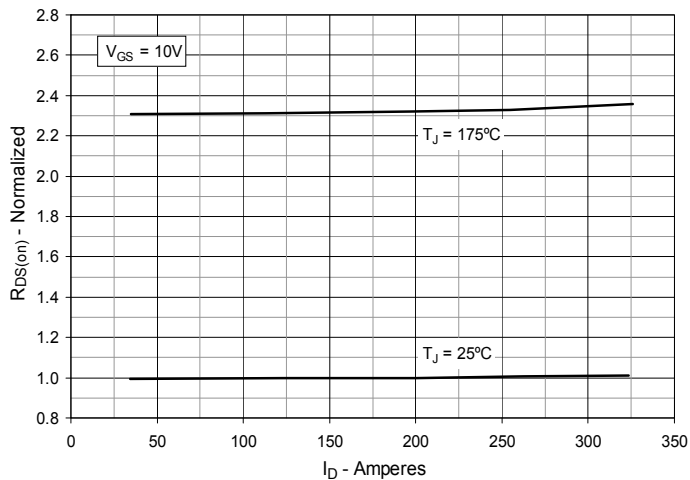
**Fig. 3. Output Characteristics @  $T_J = 150^\circ\text{C}$**



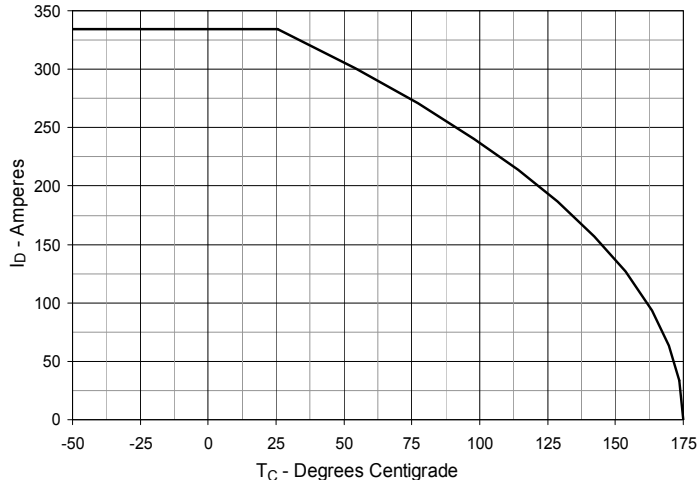
**Fig. 4. Normalized  $R_{DS(on)}$  vs. Junction Temperature**



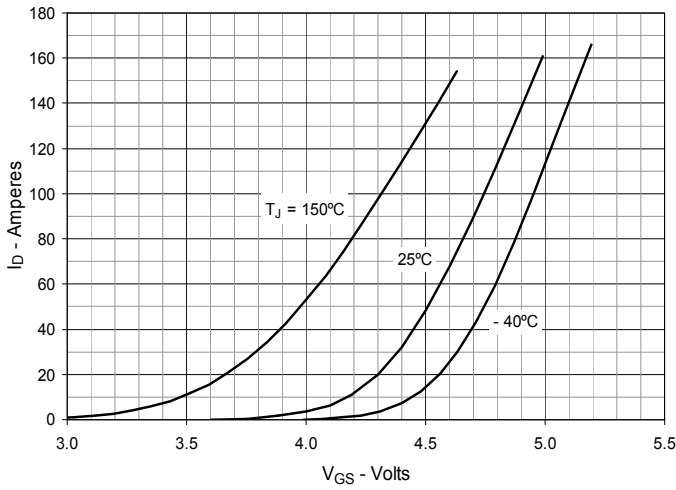
**Fig. 5. Normalized  $R_{DS(on)}$  vs. Drain Current**



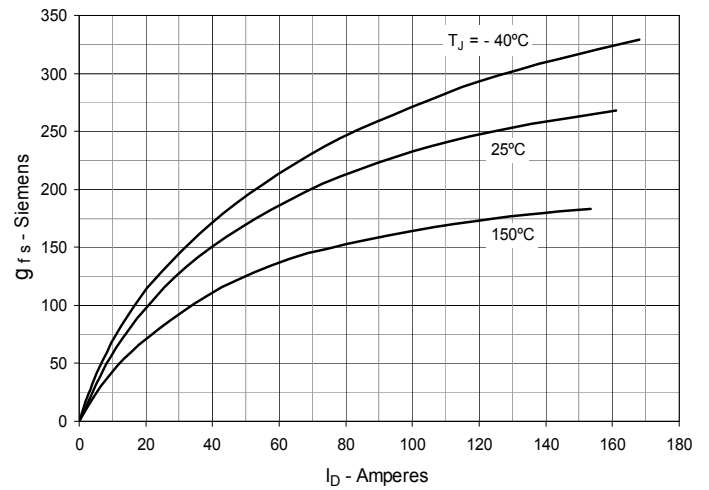
**Fig. 6. Drain Current vs. Case Temperature**



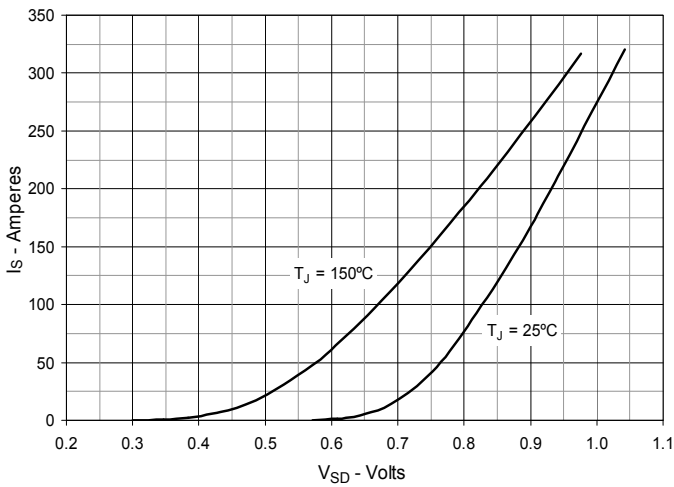
**Fig. 7. Input Admittance**



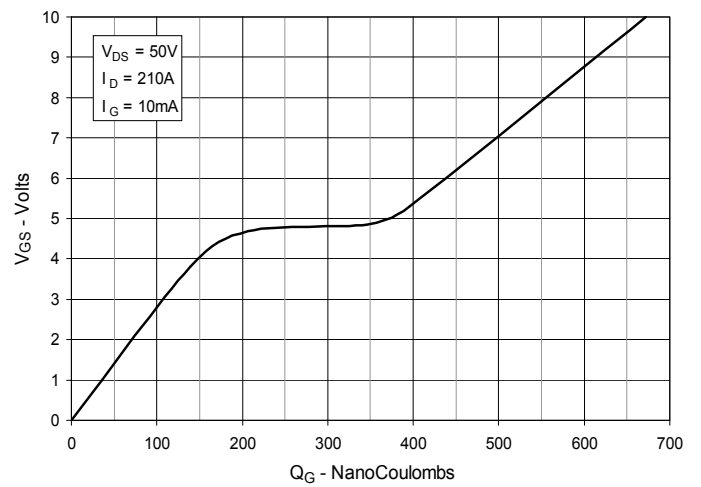
**Fig. 8. Transconductance**



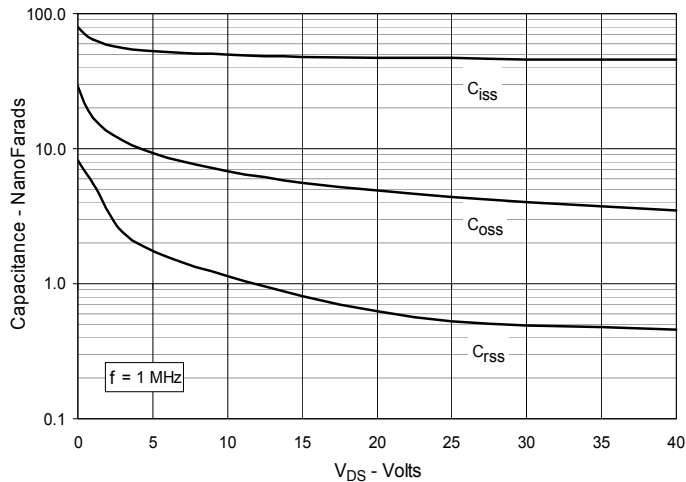
**Fig. 9. Forward Voltage Drop of Intrinsic Diode**



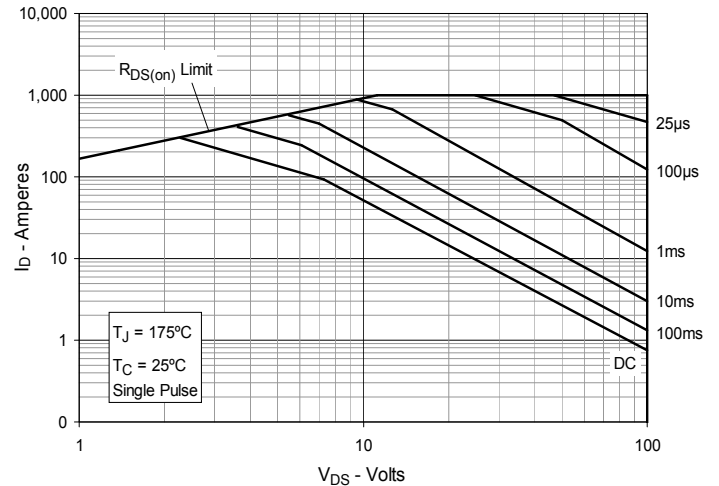
**Fig. 10. Gate Charge**



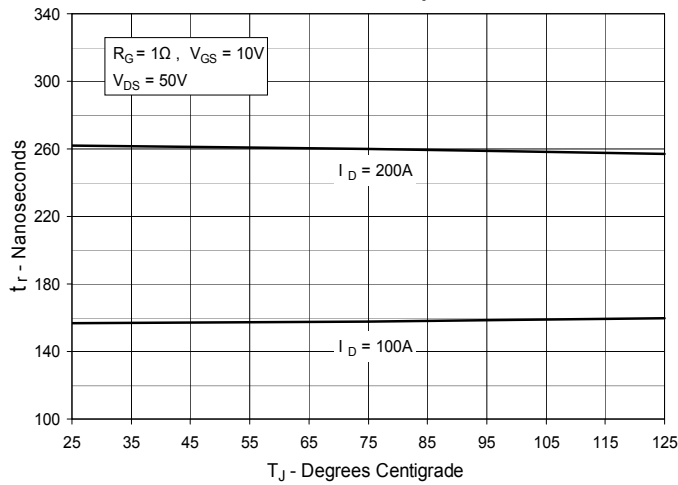
**Fig. 11. Capacitance**



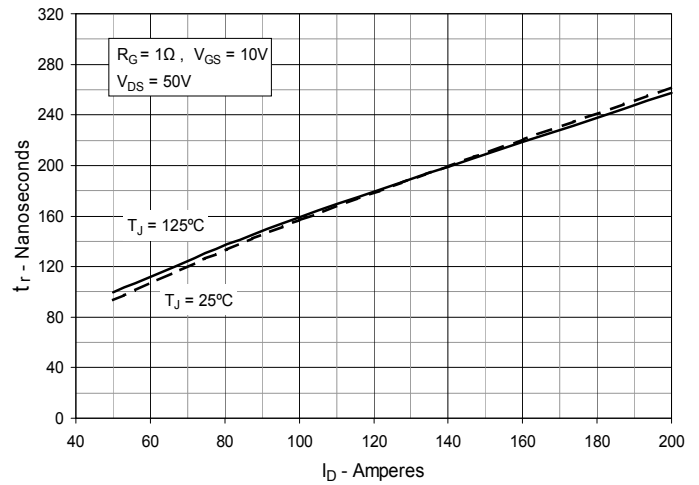
**Fig. 12. Forward-Bias Safe Operating Area**



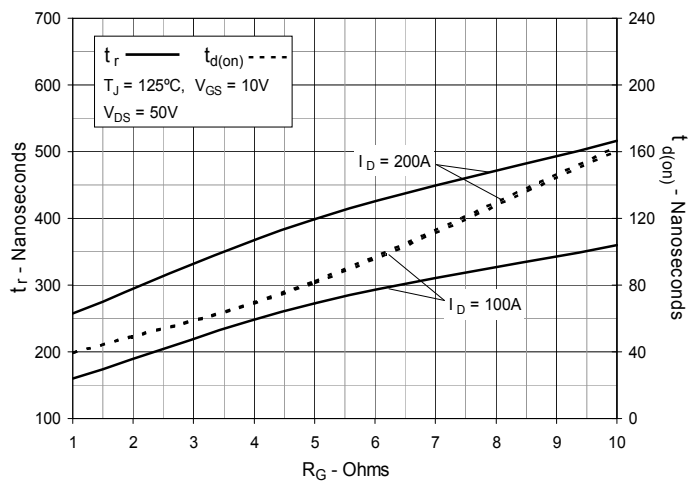
**Fig. 13. Resistive Turn-on Rise Time vs. Junction Temperature**



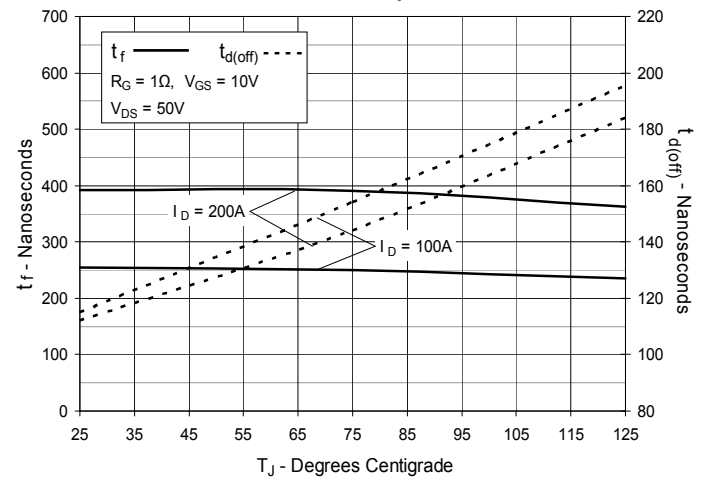
**Fig. 14. Resistive Turn-on Rise Time vs. Drain Current**



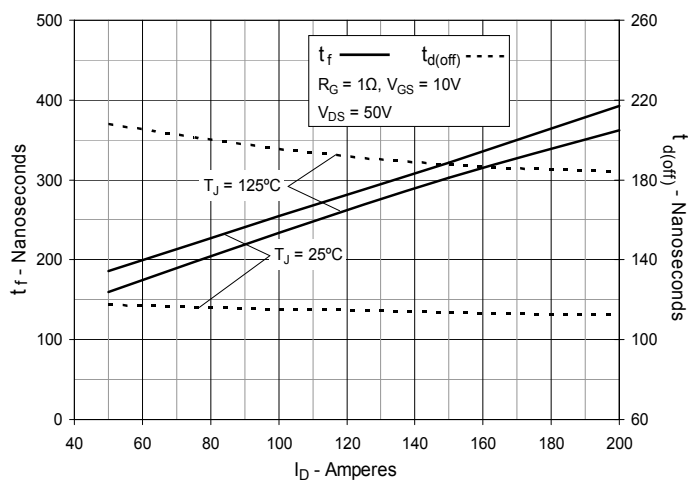
**Fig. 15. Resistive Turn-on Switching Times vs. Gate Resistance**



**Fig. 16. Resistive Turn-off Switching Times vs. Junction Temperature**



**Fig. 17. Resistive Turn-off Switching Times vs. Drain Current**



**Fig. 18. Resistive Turn-off Switching Times vs. Gate Resistance**

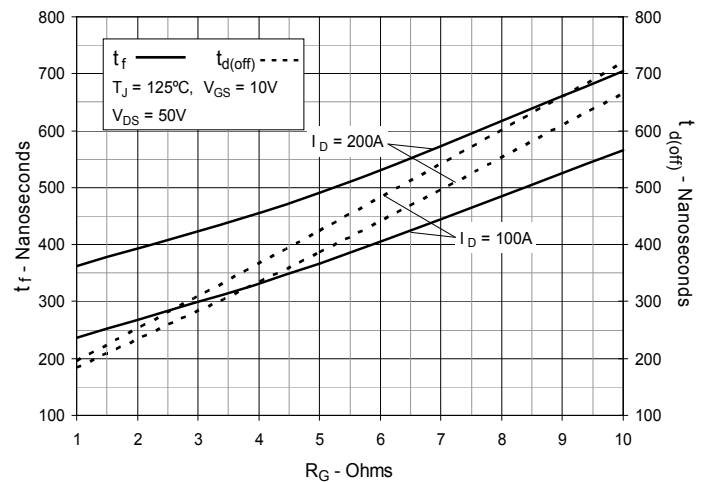
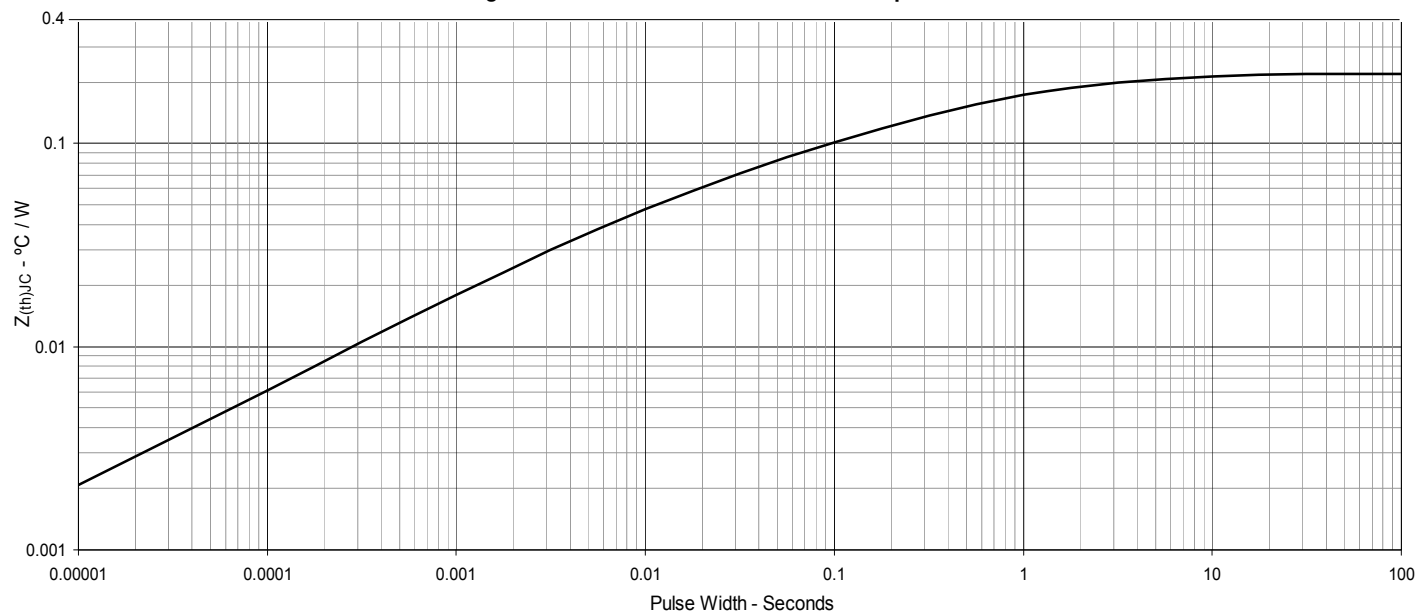
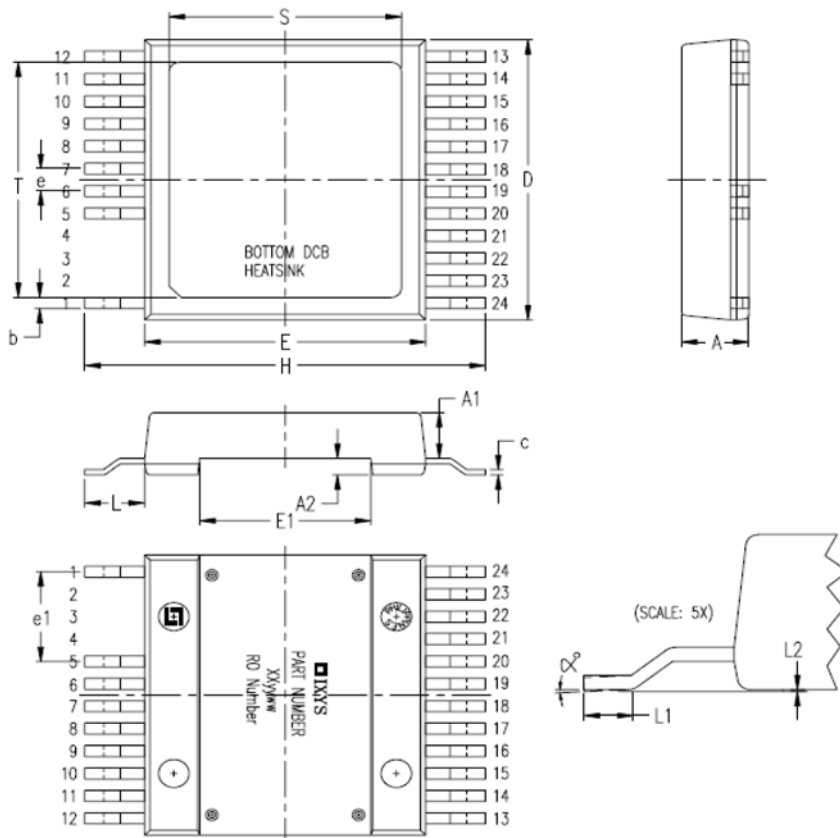


Fig. 19. Maximum Transient Thermal Impedance



## Package Outline



| SYM | INCHES   |       | MILLIMETERS |       |
|-----|----------|-------|-------------|-------|
|     | MIN      | MAX   | MIN         | MAX   |
| A   | .209     | .224  | 5.30        | 5.70  |
| A1  | .154     | .161  | 3.90        | 4.10  |
| A2  | .055     | .063  | 1.40        | 1.60  |
| b   | .035     | .045  | 0.90        | 1.15  |
| c   | .018     | .026  | 0.45        | 0.65  |
| D   | .976     | .994  | 24.80       | 25.25 |
| E   | .898     | .915  | 22.80       | 23.25 |
| E1  | .543     | .559  | 13.80       | 14.20 |
| e   | .079 BSC |       | 2.00 BSC    |       |
| e1  | .315 BSC |       | 8.00 BSC    |       |
| H   | 1.272    | 1.311 | 32.30       | 33.30 |
| L   | .181     | .209  | 4.60        | 5.30  |
| L1  | .051     | .067  | 1.30        | 1.70  |
| L2  | .000     | .006  | 0.00        | 0.15  |
| S   | .736     | .760  | 18.70       | 19.30 |
| T   | .815     | .839  | 20.70       | 21.30 |
| α   | 0        | 4°    | 0           | 4°    |

PIN: 1 = Gate  
5-12 = Source  
13-24 = Drain