

# High Voltage Power MOSFET

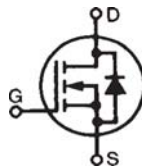
## IXTF1N450

$$V_{DSS} = 4500V$$

$$I_{D25} = 0.9A$$

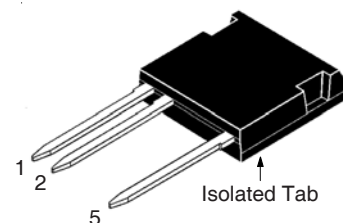
$$R_{DS(on)} \leq 80\Omega$$

(Electrically Isolated Tab)



N-Channel Enhancement Mode

ISOPLUS i4-Pak™



1 = Gate      5 = Drain  
2 = Source

| Symbol     | Test Conditions                                           | Maximum Ratings   |            |
|------------|-----------------------------------------------------------|-------------------|------------|
| $V_{DSS}$  | $T_J = 25^\circ C$ to $150^\circ C$                       | 4500              | V          |
| $V_{DGR}$  | $T_J = 25^\circ C$ to $150^\circ C$ , $R_{GS} = 1M\Omega$ | 4500              | V          |
| $V_{GSS}$  | Continuous                                                | $\pm 20$          | V          |
| $V_{GSM}$  | Transient                                                 | $\pm 30$          | V          |
| $I_{D25}$  | $T_C = 25^\circ C$                                        | 0.9               | A          |
| $I_{DM}$   | $T_C = 25^\circ C$ , Pulse Width Limited by $T_{JM}$      | 3.0               | A          |
| $P_D$      | $T_C = 25^\circ C$                                        | 160               | W          |
| $T_J$      |                                                           | - 55 ... +150     | $^\circ C$ |
| $T_{JM}$   |                                                           | 150               | $^\circ C$ |
| $T_{stg}$  |                                                           | - 55 ... +150     | $^\circ C$ |
| $T_L$      | Maximum Lead Temperature for Soldering                    | 300               | $^\circ C$ |
| $T_{SOLD}$ | Plastic Body for 10s                                      | 260               | $^\circ C$ |
| $F_C$      | Mounting Force                                            | 20..120 / 4.5..27 | N/lb.      |
| $V_{ISOL}$ | 50/60Hz, 1 Minute                                         | 4500              | V~         |
| Weight     |                                                           | 6                 | g          |

### Features

- Silicon Chip on Direct-Copper Bond (DCB) Substrate
- Isolated Mounting Surface
- 4500V~ Electrical Isolation
- Molding Epoxies meet UL 94 V-0 Flammability Classification

### Advantages

- High Voltage Package
- Easy to Mount
- Space Savings
- High Power Density

### Applications

- High Voltage Power Supplies
- Capacitor Discharge Applications
- Pulse Circuits
- Laser and X-Ray Generation Systems

| Symbol       | Test Conditions<br>( $T_J = 25^\circ C$ , Unless Otherwise Specified) | Characteristic Values |      |              |
|--------------|-----------------------------------------------------------------------|-----------------------|------|--------------|
|              |                                                                       | Min.                  | Typ. | Max.         |
| $V_{GS(th)}$ | $V_{DS} = V_{GS}$ , $I_D = 250\mu A$                                  | 3.5                   |      | 6.0 V        |
| $I_{GSS}$    | $V_{GS} = \pm 20V$ , $V_{DS} = 0V$                                    |                       |      | $\pm 100$ nA |
| $I_{DSS}$    | $V_{DS} = 3.6kV$ , $V_{GS} = 0V$                                      |                       |      | 5 $\mu A$    |
|              | $V_{DS} = 4.5kV$                                                      |                       |      | 25 $\mu A$   |
|              | $V_{DS} = 3.6kV$ Note 2, $T_J = 100^\circ C$                          |                       | 15   | $\mu A$      |
| $R_{DS(on)}$ | $V_{GS} = 10V$ , $I_D = 50mA$ , Note 1                                |                       |      | 80 $\Omega$  |

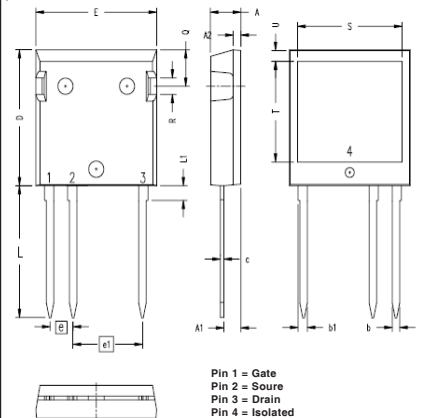
| Symbol       | Test Conditions<br>( $T_J = 25^\circ\text{C}$ , Unless Otherwise Specified)                                                             | Characteristic Values |      |                        |
|--------------|-----------------------------------------------------------------------------------------------------------------------------------------|-----------------------|------|------------------------|
|              |                                                                                                                                         | Min.                  | Typ. | Max.                   |
| $g_{fs}$     | $V_{DS} = 50\text{V}$ , $I_D = 200\text{mA}$ , Note 1                                                                                   | 0.40                  | 0.70 | S                      |
| $C_{iss}$    | $V_{GS} = 0\text{V}$ , $V_{DS} = 25\text{V}$ , $f = 1\text{MHz}$                                                                        |                       | 1700 | pF                     |
| $C_{oss}$    |                                                                                                                                         |                       | 80   | pF                     |
| $C_{rss}$    |                                                                                                                                         |                       | 29   | pF                     |
| $R_{Gi}$     | Gate Input Resistance                                                                                                                   |                       | 12   | $\Omega$               |
| $t_{d(on)}$  | <b>Resistive Switching Times</b><br>$V_{GS} = 10\text{V}$ , $V_{DS} = 500\text{V}$ , $I_D = 0.5\text{A}$<br>$R_G = 10\Omega$ (External) |                       | 30   | ns                     |
| $t_r$        |                                                                                                                                         |                       | 43   | ns                     |
| $t_{d(off)}$ |                                                                                                                                         |                       | 73   | ns                     |
| $t_f$        |                                                                                                                                         |                       | 120  | ns                     |
| $Q_{g(on)}$  | $V_{GS} = 10\text{V}$ , $V_{DS} = 1\text{kV}$ , $I_D = 0.5\text{A}$                                                                     |                       | 46   | nC                     |
| $Q_{gs}$     |                                                                                                                                         |                       | 8    | nC                     |
| $Q_{gd}$     |                                                                                                                                         |                       | 23   | nC                     |
| $R_{thJC}$   |                                                                                                                                         |                       | 0.15 | $0.77^\circ\text{C/W}$ |
| $R_{thCS}$   |                                                                                                                                         |                       |      | $^\circ\text{C/W}$     |

## Source-Drain Diode

| Symbol   | Test Conditions<br>( $T_J = 25^\circ\text{C}$ , Unless Otherwise Specified) | Characteristic Values |      |               |
|----------|-----------------------------------------------------------------------------|-----------------------|------|---------------|
|          |                                                                             | Min.                  | Typ. | Max.          |
| $I_S$    | $V_{GS} = 0\text{V}$                                                        |                       |      | 1 A           |
| $I_{SM}$ | Repetitive, Pulse Width Limited by $T_{JM}$                                 |                       |      | 5 A           |
| $V_{SD}$ | $I_F = 1\text{A}$ , $V_{GS} = 0\text{V}$ , Note 1                           |                       |      | 2.0 V         |
| $t_{rr}$ | $I_F = 1\text{A}$ , $-di/dt = 50\text{A}/\mu\text{s}$ , $V_R = 100\text{V}$ |                       | 1.75 | $\mu\text{s}$ |

- Notes: 1. Pulse test,  $t \leq 300\mu\text{s}$ , duty cycle,  $d \leq 2\%$ .  
 2. Part must be heatsunk for high-temp  $I_{DSS}$  measurement.

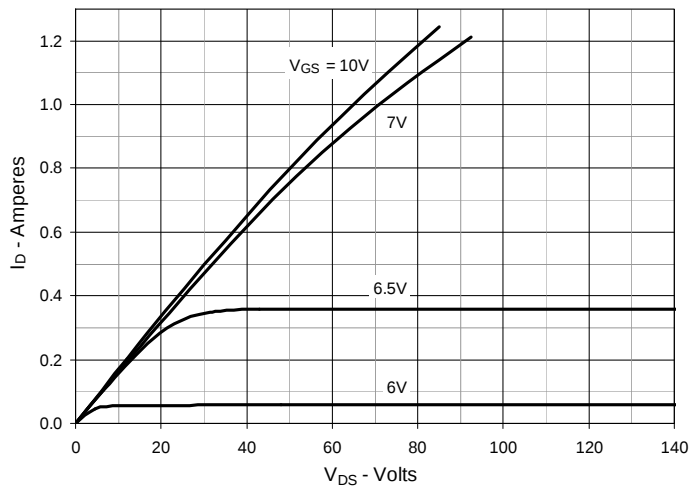
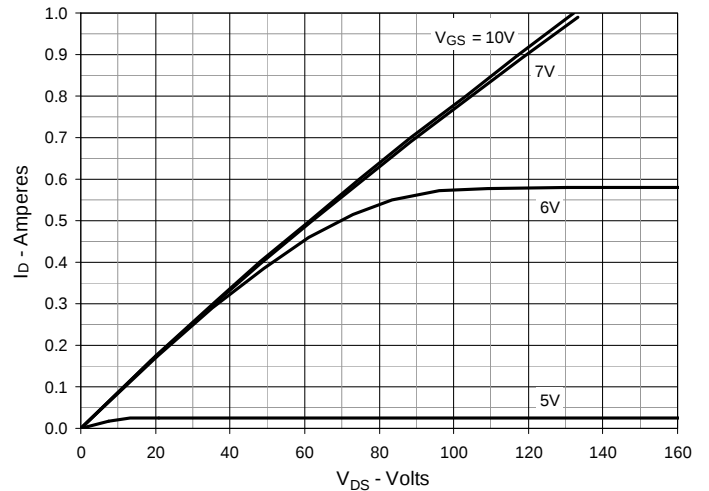
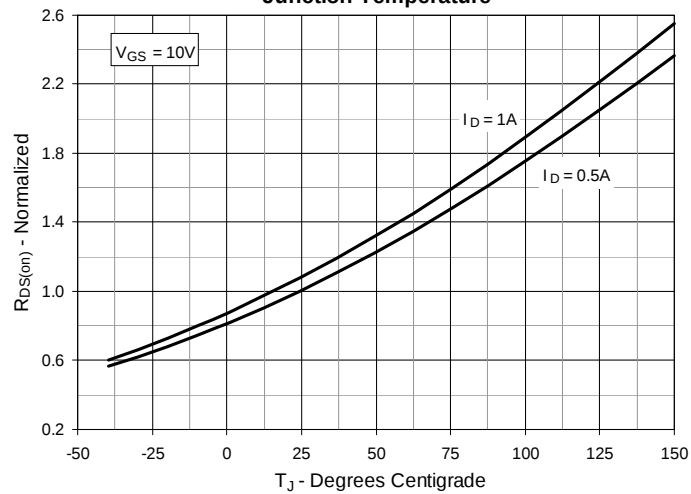
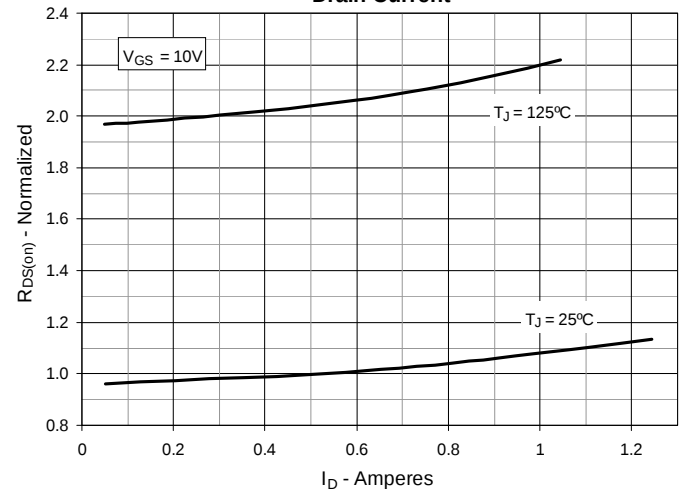
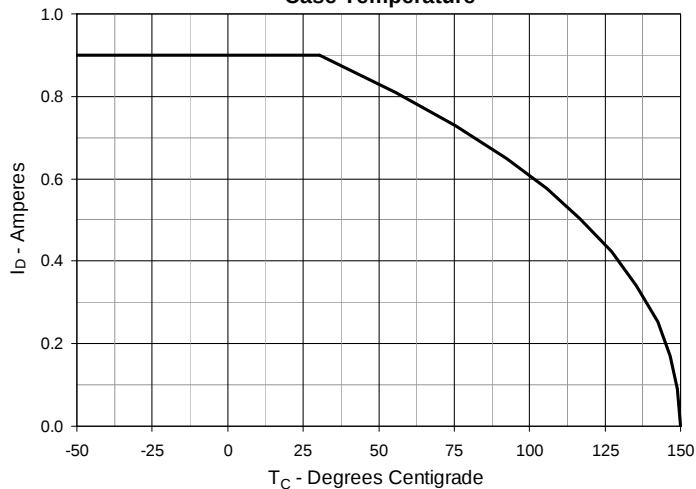
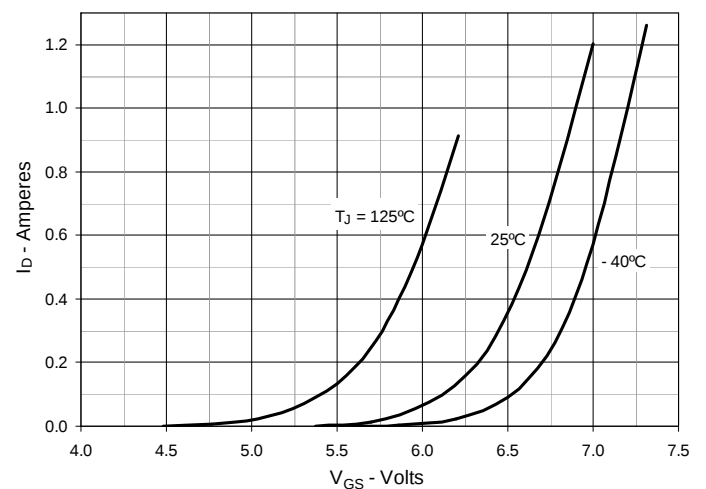
## ISOPLUS i4-Pak™ (HV) Outline

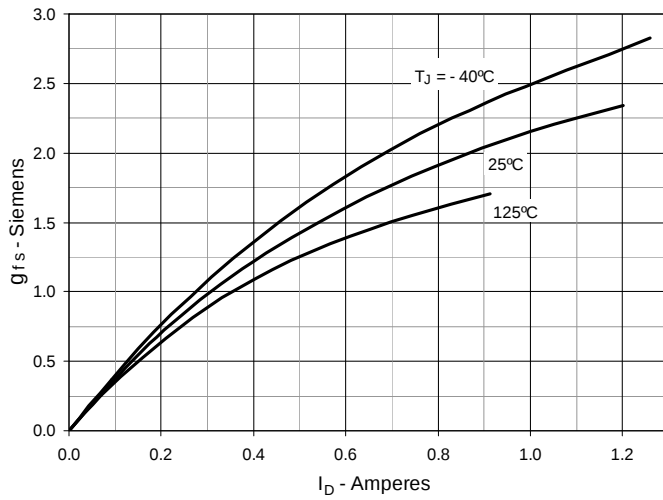
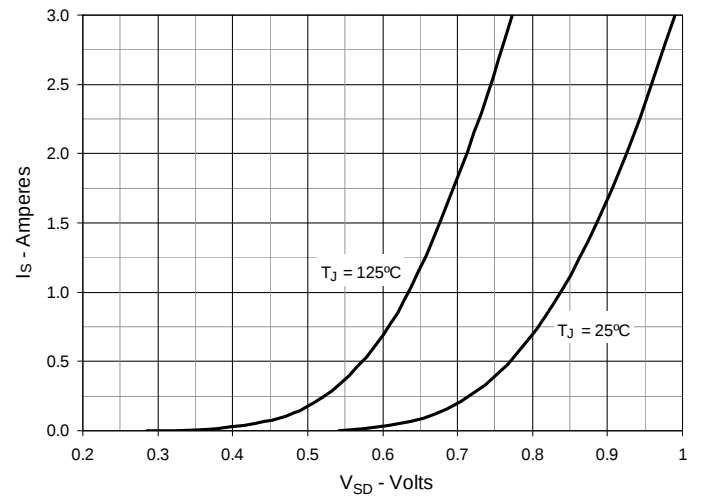
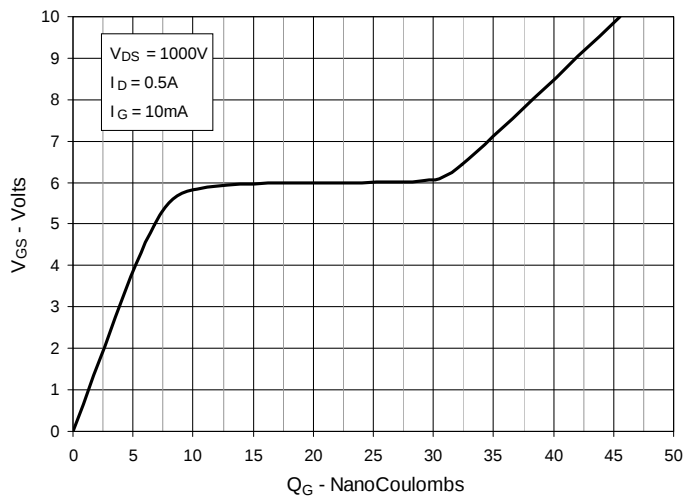
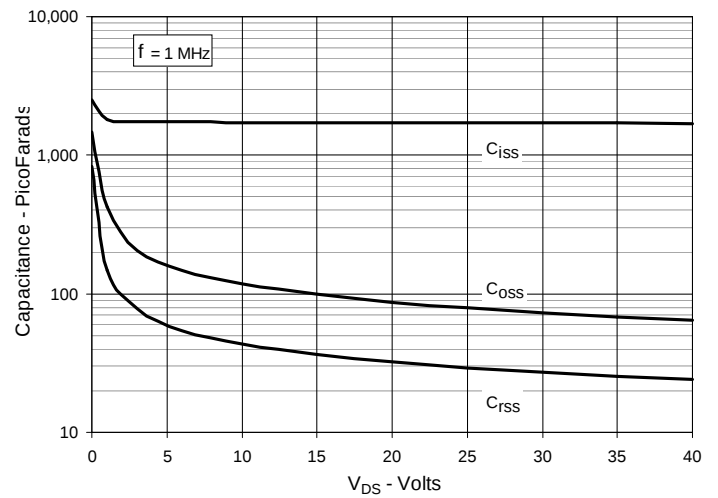
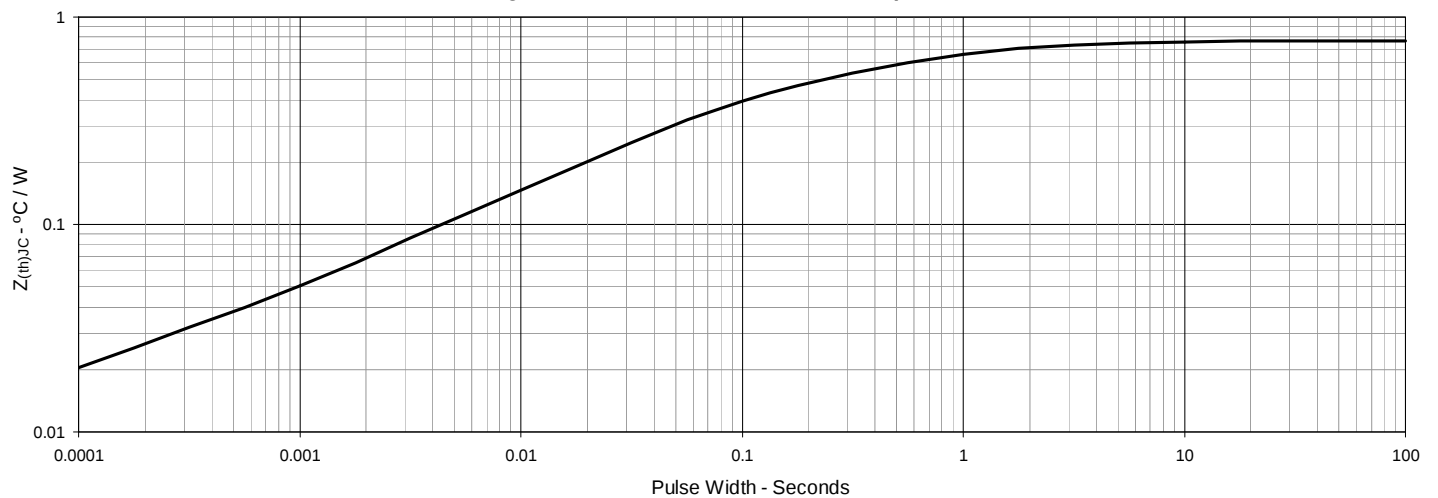


| SYM | INCHES   |      | MILLIMETERS |       |
|-----|----------|------|-------------|-------|
|     | MIN      | MAX  | MIN         | MAX   |
| A   | .190     | .205 | 4.83        | 5.21  |
| A1  | .102     | .118 | 2.59        | 3.00  |
| A2  | .046     | .085 | 1.17        | 2.16  |
| b   | .045     | .055 | 1.14        | 1.40  |
| b1  | .058     | .068 | 1.47        | 1.73  |
| C   | .020     | .029 | 0.51        | 0.74  |
| D   | .819     | .840 | 20.80       | 21.34 |
| E   | .770     | .799 | 19.56       | 20.29 |
| e   | .150 BSC |      | 3.81 BSC    |       |
| e1  | .450 BSC |      | 11.43 BSC   |       |
| L   | .780     | .840 | 19.81       | 21.34 |
| L1  | .083     | .102 | 2.11        | 2.59  |
| Q   | .210     | .244 | 5.33        | 6.20  |
| R   | .100     | .180 | 2.54        | 4.57  |
| S   | .660     | .690 | 16.76       | 17.53 |
| T   | .590     | .620 | 14.99       | 15.75 |
| U   | .065     | .080 | 1.65        | 2.03  |

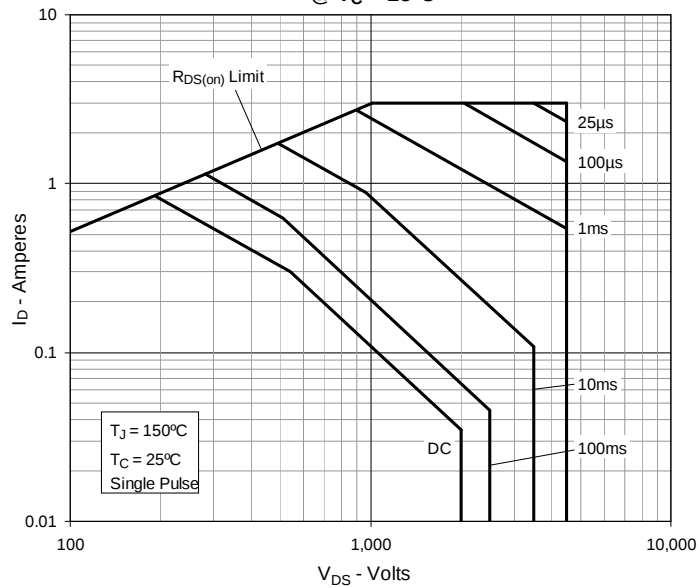
IXYS Reserves the Right to Change Limits, Test Conditions, and Dimensions.

|                                                                                  |           |           |           |           |              |              |              |              |              |             |
|----------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|--------------|--------------|--------------|--------------|--------------|-------------|
| 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    |             |

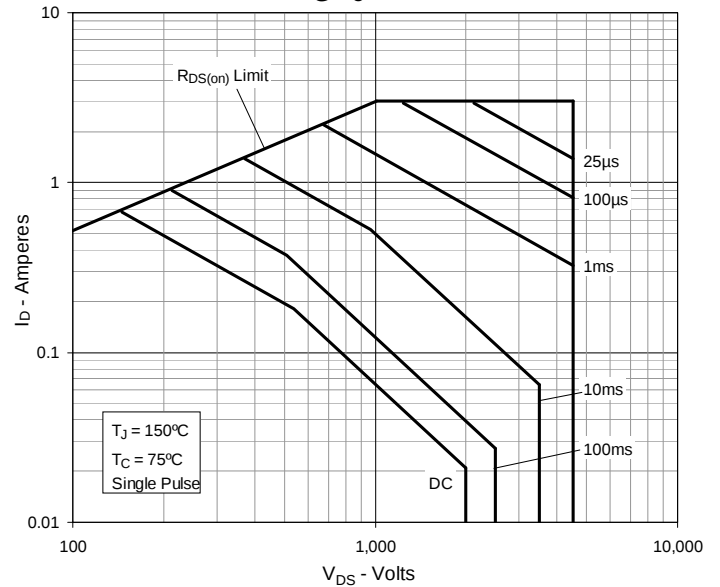
**Fig. 1. Output Characteristics @  $T_J = 25^\circ\text{C}$** 

**Fig. 2. Output Characteristics @  $T_J = 125^\circ\text{C}$** 

**Fig. 3.  $R_{DS(on)}$  Normalized to  $I_D = 0.5\text{A}$  Value vs. Junction Temperature**

**Fig. 4.  $R_{DS(on)}$  Normalized to  $I_D = 0.5\text{A}$  Value vs. Drain Current**

**Fig. 5. Maximum Drain Current vs. Case Temperature**

**Fig. 6. Input Admittance**


**Fig. 7. Transconductance**

**Fig. 8. Forward Voltage Drop of Intrinsic Diode**

**Fig. 9. Gate Charge**

**Fig. 10. Capacitance**

**Fig. 11. Maximum Transient Thermal Impedance**


**Fig. 12. Forward-Bias Safe Operating Area**  
@  $T_C = 25^\circ\text{C}$



**Fig. 13. Forward-Bias Safe Operating Area**  
@  $T_C = 75^\circ\text{C}$





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