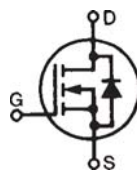


## Linear™ Power MOSFET w/ Extended FBSOA

## IXTH24N50L

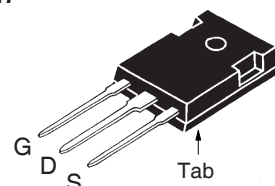
N-Channel Enhancement Mode  
Avalanche Rated



$$\begin{aligned} V_{DSS} &= 500V \\ I_{D25} &= 24A \\ R_{DS(on)} &\leq 300m\Omega \end{aligned}$$

| Symbol     | Test Conditions                                                       | Maximum Ratings |                  |
|------------|-----------------------------------------------------------------------|-----------------|------------------|
| $V_{DSS}$  | $T_J = 25^\circ\text{C}$ to $150^\circ\text{C}$                       | 500             | V                |
| $V_{DGR}$  | $T_J = 25^\circ\text{C}$ to $150^\circ\text{C}$ , $R_{GS} = 1M\Omega$ | 500             | V                |
| $V_{GSS}$  | Continuous                                                            | $\pm 30$        | V                |
| $V_{GSM}$  | Transient                                                             | $\pm 40$        | V                |
| $I_{D25}$  | $T_C = 25^\circ\text{C}$                                              | 24              | A                |
| $I_{DM}$   | $T_C = 25^\circ\text{C}$ , Pulse Width Limited by $T_{JM}$            | 50              | A                |
| $I_A$      | $T_C = 25^\circ\text{C}$                                              | 12              | A                |
| $E_{AS}$   | $T_C = 25^\circ\text{C}$                                              | 1.5             | J                |
| $P_D$      | $T_C = 25^\circ\text{C}$                                              | 400             | W                |
| $T_J$      |                                                                       | -55 ... +150    | $^\circ\text{C}$ |
| $T_{JM}$   |                                                                       | 150             | $^\circ\text{C}$ |
| $T_{stg}$  |                                                                       | -55 ... +150    | $^\circ\text{C}$ |
| $T_L$      | 1.6mm (0.062in.) from Case for 10s                                    | 300             | $^\circ\text{C}$ |
| $T_{sold}$ | Plastic Body for 10 seconds                                           | 260             | $^\circ\text{C}$ |
| $M_d$      | Mounting Torque                                                       | 1.13 / 10       | Nm/lb.in.        |
| Weight     |                                                                       | 6               | g                |

TO-247



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

### Features

- Designed for Linear Operation
- International Standard Package
- Avalanche Rated
- Molding Epoxy Meets UL94 V-0 Flammability Classification

### Advantages

- Easy to Mount
- Space Savings
- High Power Density

### Applications

- Programmable Loads
- Current Regulators
- DC-DC Converters
- Battery Chargers
- DC Choppers
- Temperature and Lighting Controls

| Symbol       | Test Conditions<br>( $T_J = 25^\circ\text{C}$ , Unless Otherwise Specified) | Characteristic Values |      |                           |
|--------------|-----------------------------------------------------------------------------|-----------------------|------|---------------------------|
|              |                                                                             | Min.                  | Typ. | Max.                      |
| $BV_{DSS}$   | $V_{GS} = 0V$ , $I_D = 250\mu A$                                            | 500                   |      | V                         |
| $V_{GS(th)}$ | $V_{DS} = V_{GS}$ , $I_D = 250\mu A$                                        | 3.5                   |      | 6.0 V                     |
| $I_{GSS}$    | $V_{GS} = \pm 30V$ , $V_{DS} = 0V$                                          |                       |      | $\pm 100$ nA              |
| $I_{DSS}$    | $V_{DS} = V_{DSS}$ , $V_{GS} = 0V$<br>$T_J = 125^\circ\text{C}$             |                       |      | 50 $\mu A$<br>500 $\mu A$ |
| $R_{DS(on)}$ | $V_{GS} = 20V$ , $I_D = 0.5 \cdot I_{D25}$ , Note 1                         |                       |      | 300 m $\Omega$            |

| Symbol       | Test Conditions<br>( $T_J = 25^\circ\text{C}$ , Unless Otherwise Specified)                                                                          | Characteristic Values |      |                         |
|--------------|------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|------|-------------------------|
|              |                                                                                                                                                      | Min.                  | Typ. | Max.                    |
| $g_{fs}$     | $V_{DS} = 20\text{V}$ , $I_D = 0.5 \cdot I_{D25}$ , Note 1                                                                                           | 3                     | 7    | 11 S                    |
| $C_{iss}$    | $V_{GS} = 0\text{V}$ , $V_{DS} = 25\text{V}$ , $f = 1\text{MHz}$                                                                                     |                       | 2500 | pF                      |
| $C_{oss}$    |                                                                                                                                                      |                       | 400  | pF                      |
| $C_{rss}$    |                                                                                                                                                      |                       | 100  | pF                      |
| $t_{d(on)}$  | <b>Resistive Switching Times</b><br>$V_{GS} = 15\text{V}$ , $V_{DS} = 0.5 \cdot V_{DSS}$ , $I_D = 0.5 \cdot I_{D25}$<br>$R_G = 4.7\Omega$ (External) |                       | 35   | ns                      |
| $t_r$        |                                                                                                                                                      |                       | 85   | ns                      |
| $t_{d(off)}$ |                                                                                                                                                      |                       | 110  | ns                      |
| $t_f$        |                                                                                                                                                      |                       | 75   | ns                      |
| $Q_{g(on)}$  | $V_{GS} = 20\text{V}$ , $V_{DS} = 0.5 \cdot V_{DSS}$ , $I_D = 0.5 \cdot I_{D25}$                                                                     |                       | 160  | nC                      |
| $Q_{gs}$     |                                                                                                                                                      |                       | 30   | nC                      |
| $Q_{gd}$     |                                                                                                                                                      |                       | 50   | nC                      |
| $R_{thJC}$   |                                                                                                                                                      | 0.21                  |      | 0.31 $^\circ\text{C/W}$ |
| $R_{thCS}$   |                                                                                                                                                      |                       |      | $^\circ\text{C/W}$      |

## Safe-Operating-Area Specification

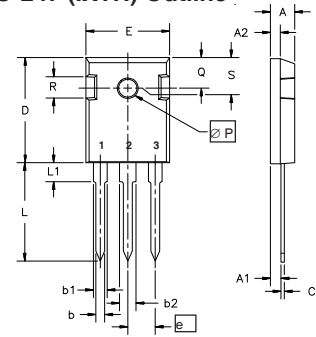
| Symbol | Test Conditions                                                         | Characteristic Values |      |      |
|--------|-------------------------------------------------------------------------|-----------------------|------|------|
|        |                                                                         | Min.                  | Typ. | Max. |
| SOA    | $V_{DS} = 400\text{V}$ , $I_D = 0.5\text{A}$ , $T_C = 60^\circ\text{C}$ | 200                   |      | W    |

## Source-Drain Diode

| Symbol   | Test Conditions<br>( $T_J = 25^\circ\text{C}$ , Unless Otherwise Specified)                    | Characteristic Values |      |       |
|----------|------------------------------------------------------------------------------------------------|-----------------------|------|-------|
|          |                                                                                                | Min.                  | Typ. | Max.  |
| $I_S$    | $V_{GS} = 0\text{V}$                                                                           |                       |      | 24 A  |
| $I_{SM}$ | Repetitive, Pulse Width Limited by $T_{JM}$                                                    |                       |      | 96 A  |
| $V_{SD}$ | $I_F = I_S$ , $V_{GS} = 0\text{V}$ , Note 1                                                    |                       |      | 1.5 V |
| $t_{rr}$ | $I_F = I_S$ , $-di/dt = 100\text{A}/\mu\text{s}$<br>$V_R = 100\text{V}$ , $V_{GS} = 0\text{V}$ |                       | 500  | ns    |

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

## TO-247 (IXTH) Outline



Terminals: 1 - Gate  
2 - Drain  
3 - Source

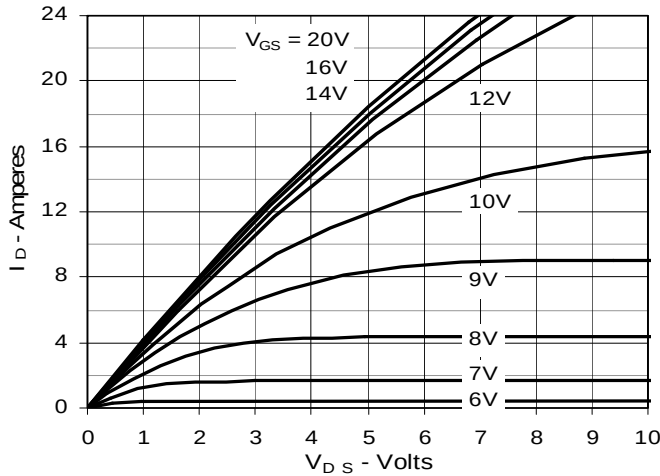
| Dim.           | Millimeter |       | Inches |       |
|----------------|------------|-------|--------|-------|
|                | Min.       | Max.  | Min.   | Max.  |
| A              | 4.7        | 5.3   | .185   | .209  |
| A <sub>1</sub> | 2.2        | 2.54  | .087   | .102  |
| A <sub>2</sub> | 2.2        | 2.6   | .059   | .098  |
| b              | 1.0        | 1.4   | .040   | .055  |
| b <sub>1</sub> | 1.65       | 2.13  | .065   | .084  |
| b <sub>2</sub> | 2.87       | 3.12  | .113   | .123  |
| C              | .4         | .8    | .016   | .031  |
| D              | 20.80      | 21.46 | .819   | .845  |
| E              | 15.75      | 16.26 | .610   | .640  |
| e              | 5.20       | 5.72  | 0.205  | 0.225 |
| L              | 19.81      | 20.32 | .780   | .800  |
| L1             |            | 4.50  |        | .177  |
| ØP             | 3.55       | 3.65  | .140   | .144  |
| Q              | 5.89       | 6.40  | 0.232  | 0.252 |
| R              | 4.32       | 5.49  | .170   | .216  |
| S              | 6.15       | BSC   | .242   | BSC   |

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

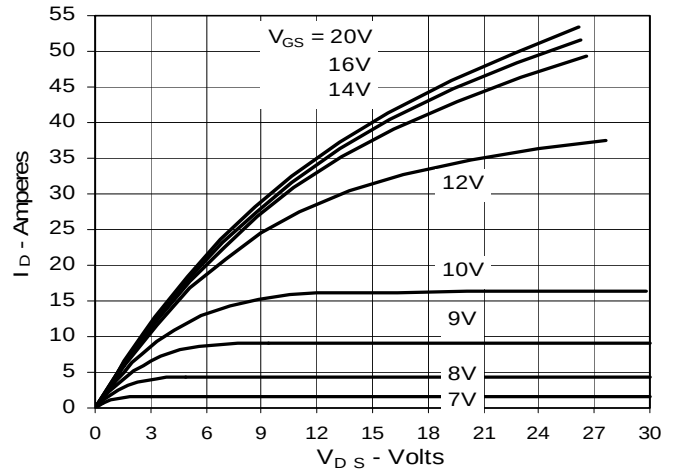
IXYS MOSFETs and IGBTs are covered by one or more of the following U.S. patents:

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

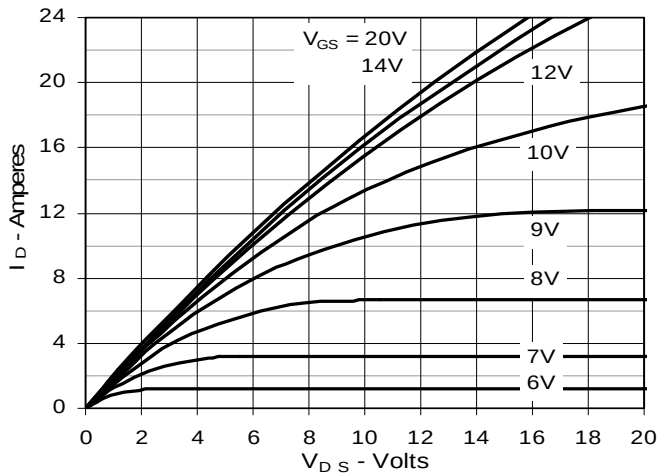
**Fig. 1. Output Characteristics**  
@  $T_J = 25^\circ\text{C}$



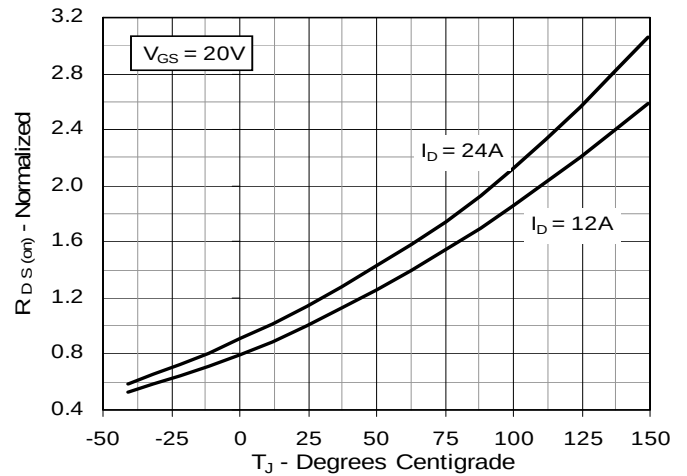
**Fig. 2. Extended Output Characteristics**  
@  $T_J = 25^\circ\text{C}$



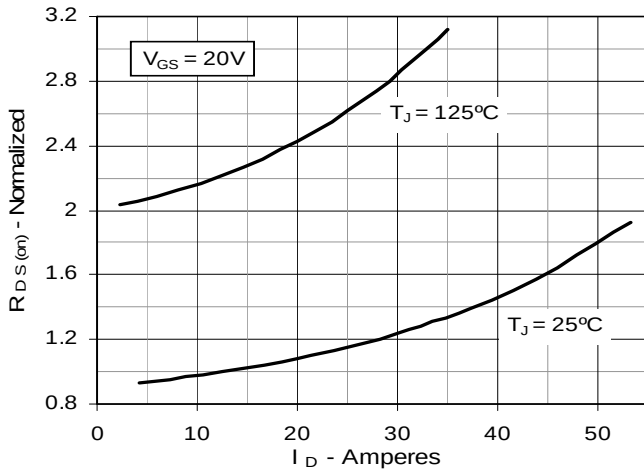
**Fig. 3. Output Characteristics**  
@  $T_J = 125^\circ\text{C}$



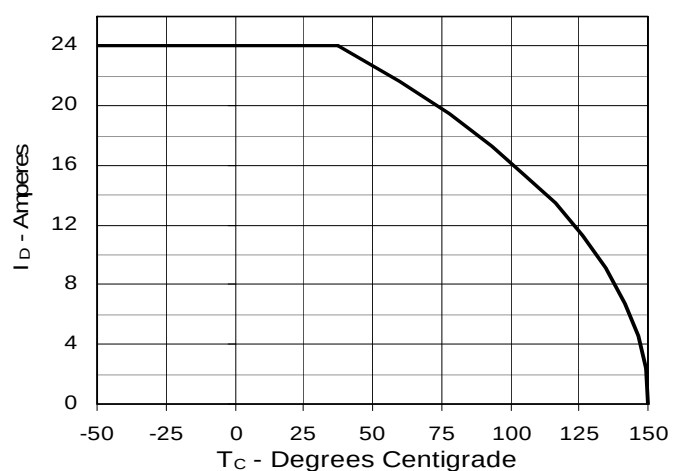
**Fig. 4.  $R_{DS(on)}$  Normalized to 0.5  $I_{D25}$  Value vs. Junction Temperature**

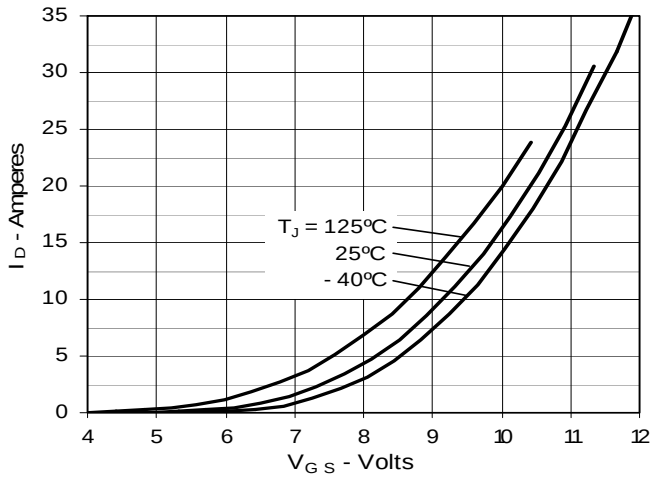
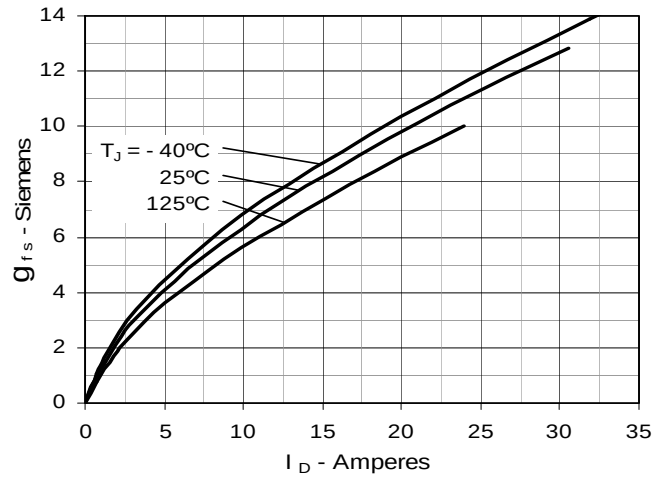
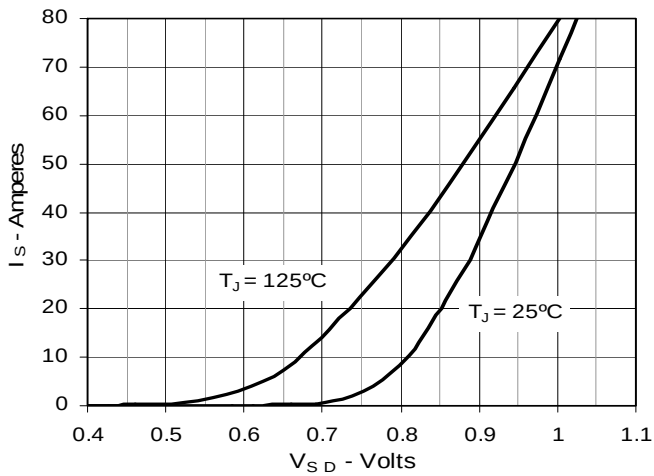
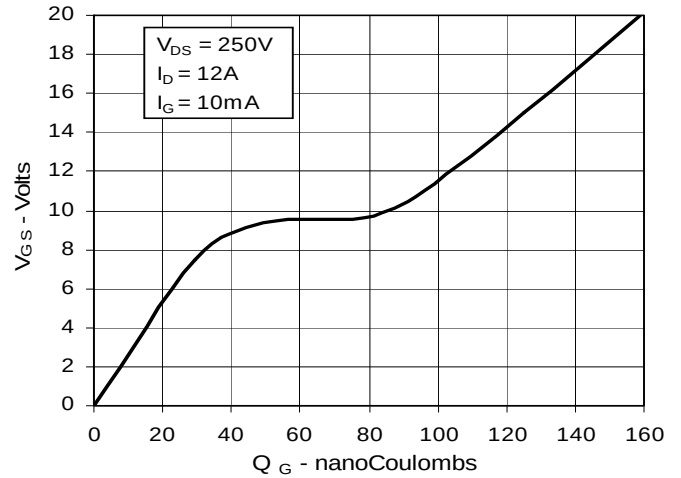
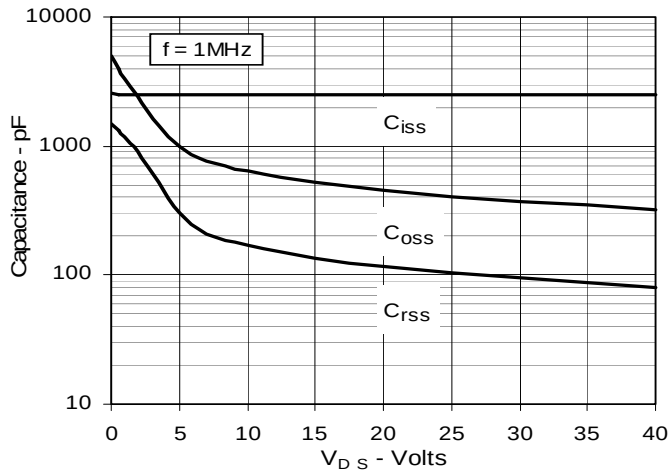
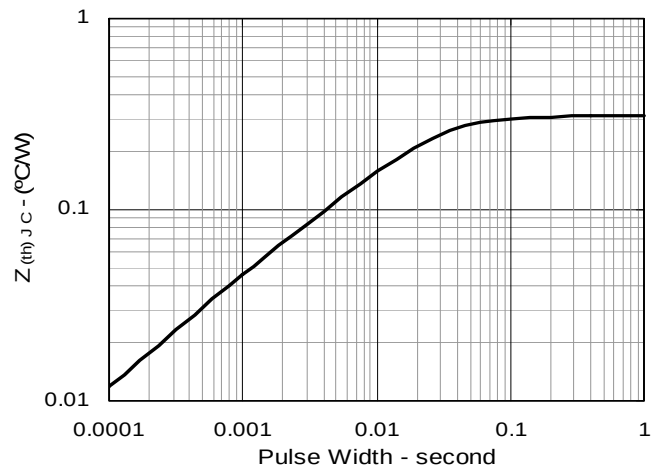


**Fig. 5.  $R_{DS(on)}$  Normalized to 0.5  $I_{D25}$  Value vs.  $I_D$**

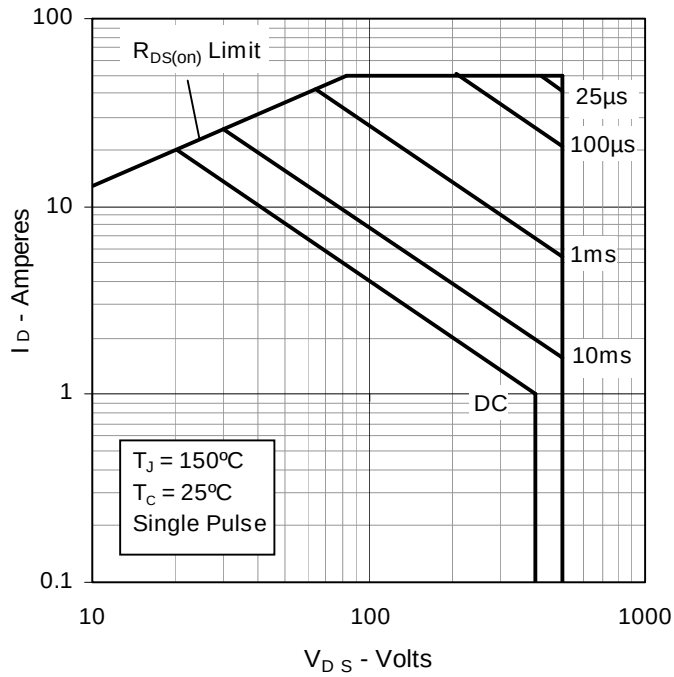


**Fig. 6. Drain Current vs. Case Temperature**

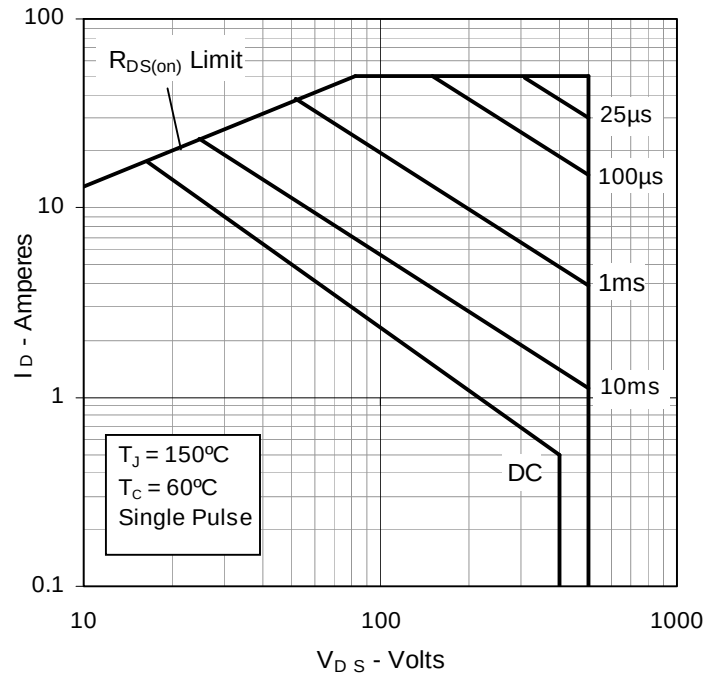


**Fig. 7. Input Admittance**

**Fig. 8. Transconductance**

**Fig. 9. Source Current vs. Source-To-Drain Voltage**

**Fig. 10. Gate Charge**

**Fig. 11. Capacitance**

**Fig. 12. Maximum Transient Thermal Impedance**


**Fig. 13. Forward-Bias Safe  
Operating Area @  $T_C = 25^\circ\text{C}$**



**Fig. 14. Forward-Bias Safe  
Operating Area @  $T_C = 60^\circ\text{C}$**





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