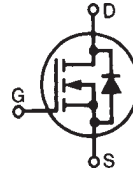


### Linear L2™ Power MOSFET w/ Extended FBSOA

**IXTT60N20L2**  
**IXTQ60N20L2**  
**IXTH60N20L2**

**$V_{DSS} = 200V$**   
 **$I_{D25} = 60A$**   
 **$R_{DS(on)} \leq 45m\Omega$**

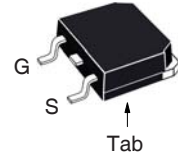
N-Channel Enhancement Mode  
Avalanche Rated



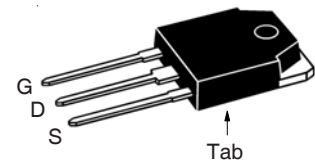
| Symbol     | Test Conditions                                           | Maximum Ratings |            |
|------------|-----------------------------------------------------------|-----------------|------------|
| $V_{DSS}$  | $T_J = 25^\circ C$ to $150^\circ C$                       | 200             | V          |
| $V_{DGR}$  | $T_J = 25^\circ C$ to $150^\circ C$ , $R_{GS} = 1M\Omega$ | 200             | V          |
| $V_{GSS}$  | Continuous                                                | $\pm 20$        | V          |
| $V_{GSM}$  | Transient                                                 | $\pm 30$        | V          |
| $I_{D25}$  | $T_C = 25^\circ C$                                        | 60              | A          |
| $I_{DM}$   | $T_C = 25^\circ C$ , Pulse Width Limited by $T_{JM}$      | 150             | A          |
| $I_A$      | $T_C = 25^\circ C$                                        | 60              | A          |
| $E_{AS}$   | $T_C = 25^\circ C$                                        | 2               | J          |
| $P_D$      | $T_C = 25^\circ C$                                        | 540             | W          |
| $T_J$      |                                                           | -55 to +150     | $^\circ C$ |
| $T_{JM}$   |                                                           | +150            | $^\circ C$ |
| $T_{stg}$  |                                                           | -55 to +150     | $^\circ C$ |
| $T_L$      | 1.6mm (0.063in) from Case for 10s                         | 300             | $^\circ C$ |
| $T_{SOLD}$ | Plastic Body for 10s                                      | 260             | $^\circ C$ |
| $M_d$      | Mounting Torque (TO-247&TO-3P)                            | 1.13/10         | Nm/lb.in.  |
| Weight     | TO-268                                                    | 4.0             | g          |
|            | TO-3P                                                     | 5.5             | g          |
|            | TO-247                                                    | 6.0             | g          |

| Symbol       | Test Conditions<br>( $T_J = 25^\circ C$ , Unless Otherwise Specified) | Characteristic Values |      |               |
|--------------|-----------------------------------------------------------------------|-----------------------|------|---------------|
|              |                                                                       | Min.                  | Typ. | Max.          |
| $BV_{DSS}$   | $V_{GS} = 0V$ , $I_D = 1mA$                                           | 200                   |      | 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>$T_J = 125^\circ C$             |                       |      | 5 $\mu A$     |
|              |                                                                       |                       |      | 50 $\mu A$    |
| $R_{DS(on)}$ | $V_{GS} = 10V$ , $I_D = 0.5 \cdot I_{D25}$ , Note 1                   |                       |      | 45 m $\Omega$ |

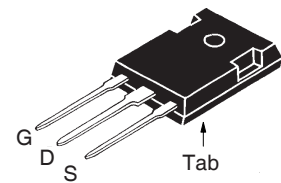
TO-268 (IXTT)



TO-3P (IXTQ)



TO-247(IXTH)



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

#### Features

- Designed for Linear Operation
- International Standard Packages
- Avalanche Rated
- Guaranteed FBSOA at  $75^\circ C$

#### Advantages

- Easy to Mount
- Space Savings
- High Power Density

#### Applications

- Solid State Circuit Breakers
- Soft Start Controls
- Linear Amplifiers
- Programmable Loads
- Current Regulators

| Symbol       | Test Conditions                                                                                                                               | Characteristic Values |      |           |
|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|------|-----------|
|              |                                                                                                                                               | Min.                  | Typ. | Max.      |
| $g_{fs}$     | $V_{DS} = 10V, I_D = 0.5 \cdot I_{D25}, \text{Note 1}$                                                                                        | 35                    | 44   | 53        |
| $C_{iss}$    | $V_{GS} = 0V, V_{DS} = 25V, f = 1MHz$                                                                                                         |                       | 10.5 | nF        |
| $C_{oss}$    |                                                                                                                                               |                       | 1080 | pF        |
| $C_{rss}$    |                                                                                                                                               |                       | 255  | pF        |
| $t_{d(on)}$  | <b>Resistive Switching Times</b><br>$V_{GS} = 10V, V_{DS} = 0.5 \cdot V_{DSS}, I_D = 0.5 \cdot I_{D25}$<br>$R_G = 1\Omega \text{ (External)}$ |                       | 26   | ns        |
| $t_r$        |                                                                                                                                               |                       | 23   | ns        |
| $t_{d(off)}$ |                                                                                                                                               |                       | 90   | ns        |
| $t_f$        |                                                                                                                                               |                       | 18   | ns        |
| $Q_{g(on)}$  | $V_{GS} = 10V, V_{DS} = 0.5 \cdot V_{DSS}, I_D = 0.5 \cdot I_{D25}$                                                                           |                       | 255  | nC        |
| $Q_{gs}$     |                                                                                                                                               |                       | 48   | nC        |
| $Q_{gd}$     |                                                                                                                                               |                       | 90   | nC        |
| $R_{thJC}$   |                                                                                                                                               |                       |      | 0.23 °C/W |
| $R_{thCS}$   | (TO-247&TO-3P)                                                                                                                                |                       | 0.25 | °C/W      |

### Safe Operating Area Specification

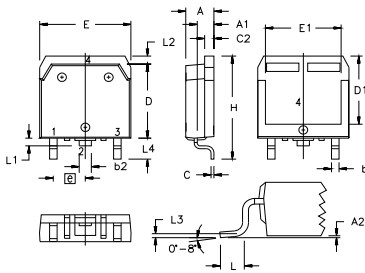
| Symbol | Test Conditions                                          | Min. | Typ. | Max. |
|--------|----------------------------------------------------------|------|------|------|
| SOA    | $V_{DS} = 160V, I_D = 1.88A, T_C = 75^\circ C, t_p = 3s$ | 300  |      | W    |

### Source-Drain Diode

| Symbol   | Test Conditions                                               | Characteristic Values |      |         |
|----------|---------------------------------------------------------------|-----------------------|------|---------|
|          |                                                               | Min.                  | Typ. | Max.    |
| $I_S$    | $V_{GS} = 0V$                                                 |                       |      | 60 A    |
| $I_{SM}$ | Repetitive, Pulse Width Limited by $T_{JM}$                   |                       |      | 240 A   |
| $V_{SD}$ | $I_F = I_S, V_{GS} = 0V, \text{Note 1}$                       |                       |      | 1.4 V   |
| $t_{rr}$ | $I_F = 30A, -di/dt = 100A/\mu s,$<br>$V_R = 75V, V_{GS} = 0V$ |                       | 330  | ns      |
| $I_{RM}$ |                                                               |                       | 25.0 | A       |
| $Q_{RM}$ |                                                               |                       | 4.13 | $\mu C$ |

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

### TO-268 (IXTT) Outline



| SYM | INCHES   |      | MILLIMETERS |       |
|-----|----------|------|-------------|-------|
|     | MIN      | MAX  | MIN         | MAX   |
| A   | .193     | .201 | 4.90        | 5.10  |
| A1  | .106     | .114 | 2.70        | 2.90  |
| A2  | .001     | .010 | 0.02        | 0.25  |
| b   | .045     | .057 | 1.15        | 1.45  |
| b2  | .075     | .083 | 1.90        | 2.10  |
| C   | .016     | .026 | 0.40        | 0.65  |
| C2  | .057     | .063 | 1.45        | 1.60  |
| D   | .543     | .551 | 13.80       | 14.00 |
| D1  | .488     | .500 | 12.40       | 12.70 |
| E   | .624     | .632 | 15.85       | 16.05 |
| E1  | .524     | .535 | 13.30       | 13.60 |
| e   | .215 BSC |      | 5.45 BSC    |       |
| H   | .736     | .752 | 18.70       | 19.10 |
| L   | .094     | .106 | 2.40        | 2.70  |
| L1  | .047     | .055 | 1.20        | 1.40  |
| L2  | .039     | .045 | 1.00        | 1.15  |
| L3  | .010 BSC |      | 0.25 BSC    |       |
| L4  | .150     | .161 | 3.80        | 4.10  |

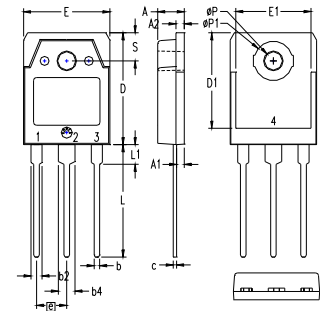
### ADVANCE TECHNICAL INFORMATION

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    |             |

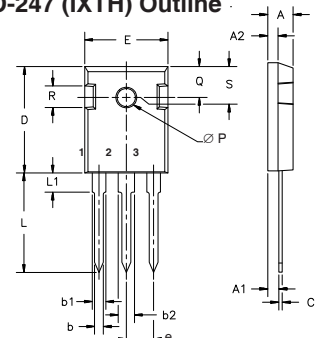
### TO-3P (IXTQ) Outline



- 1 - GATE  
2 - DRAIN (COLLECTOR)  
3 - SOURCE (EMITTER)  
4 - DRAIN (COLLECTOR)

| SYM | INCHES   |      | MILLIMETERS |       |
|-----|----------|------|-------------|-------|
|     | MIN      | MAX  | MIN         | MAX   |
| A   | .185     | .193 | 4.70        | 4.90  |
| A1  | .051     | .059 | 1.30        | 1.50  |
| A2  | .057     | .065 | 1.45        | 1.65  |
| b   | .035     | .045 | 0.90        | 1.15  |
| b2  | .075     | .087 | 1.90        | 2.20  |
| b4  | .114     | .126 | 2.90        | 3.20  |
| c   | .022     | .031 | 0.55        | 0.80  |
| D   | .780     | .799 | 19.80       | 20.30 |
| D1  | .665     | .677 | 16.90       | 17.20 |
| E   | .610     | .622 | 15.50       | 15.80 |
| E1  | .531     | .539 | 13.50       | 13.70 |
| e   | .215 BSC |      | 5.45 BSC    |       |
| L   | .779     | .795 | 19.80       | 20.20 |
| L1  | .134     | .142 | 3.40        | 3.60  |
| ØP  | .126     | .134 | 3.20        | 3.40  |
| ØP1 | .272     | .280 | 6.90        | 7.10  |
| S   | .193     | .201 | 4.90        | 5.10  |

### TO-247 (IXTH) Outline



- Terminals: 1 - Gate 2 - Drain  
3 - Source Tab - Drain

| 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 |       |

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

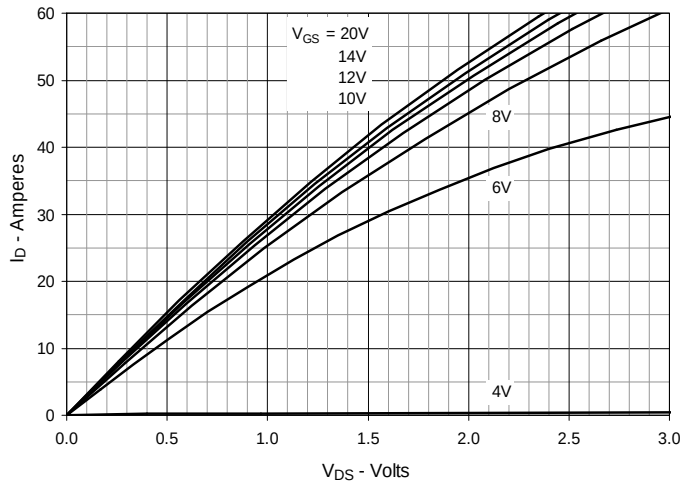


Fig. 2. Extended Output Characteristics @  $T_J = 25^\circ\text{C}$

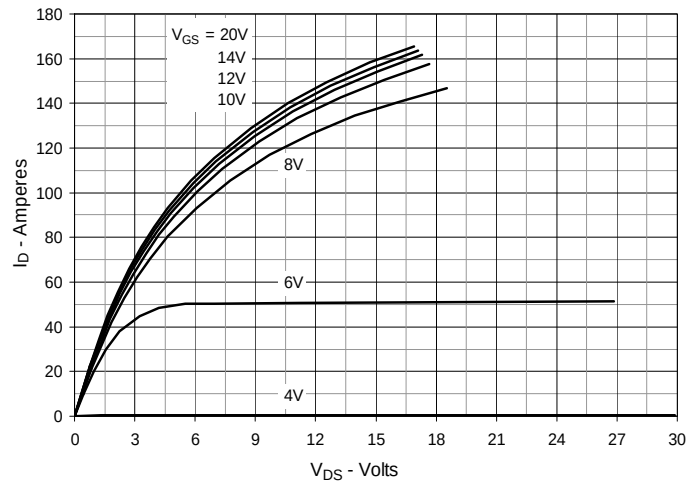


Fig. 3. Output Characteristics @  $T_J = 125^\circ\text{C}$

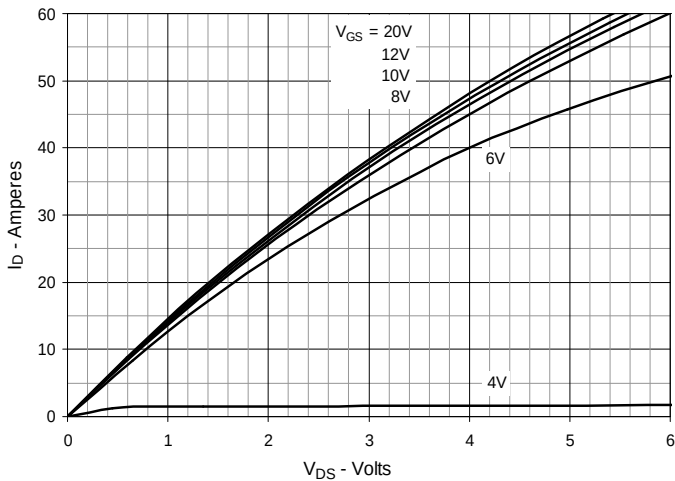


Fig. 4.  $R_{DS(on)}$  Normalized to  $I_D = 30\text{A}$  Value vs. Junction Temperature

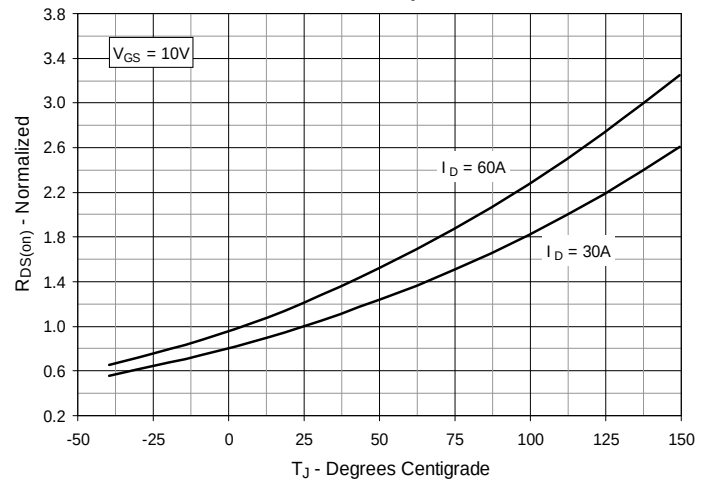


Fig. 5.  $R_{DS(on)}$  Normalized to  $I_D = 30\text{A}$  Value vs. Drain Current

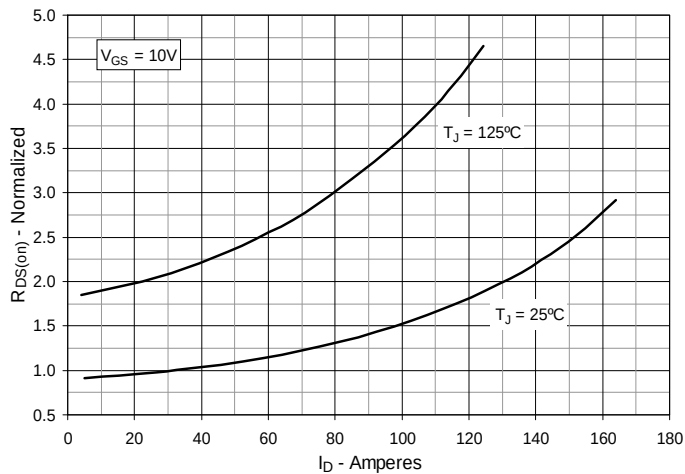


Fig. 6. Maximum Drain Current vs. Case Temperature

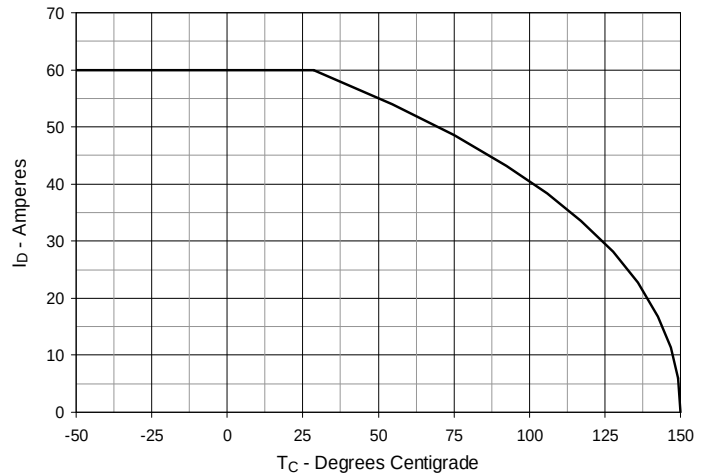


Fig. 7. Input Admittance

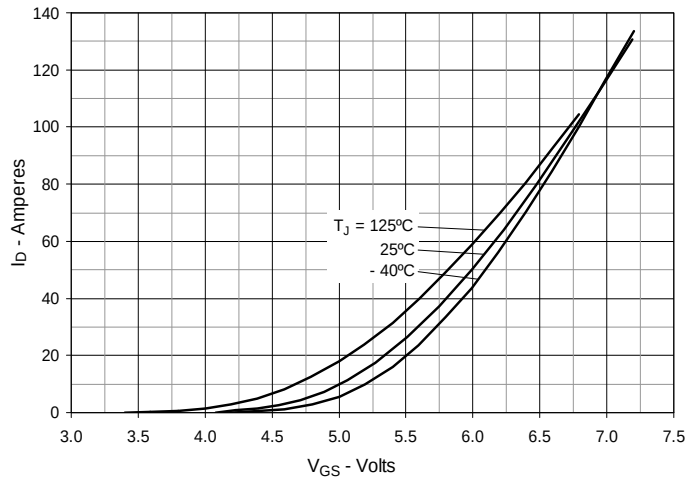


Fig. 8. Transconductance

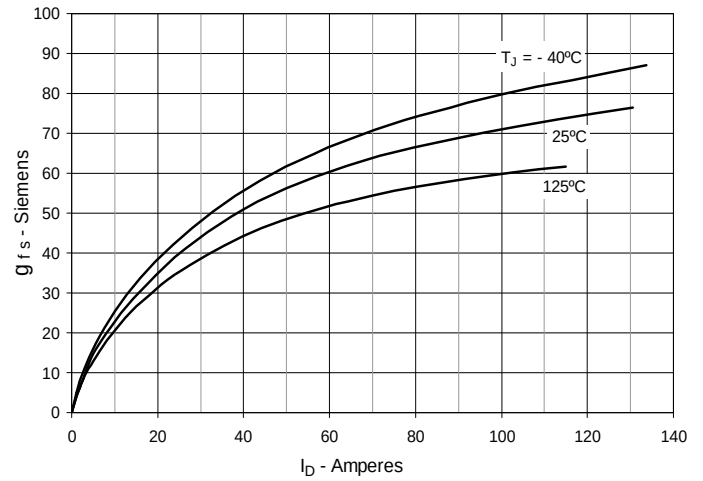


Fig. 9. Forward Voltage Drop of Intrinsic Diode

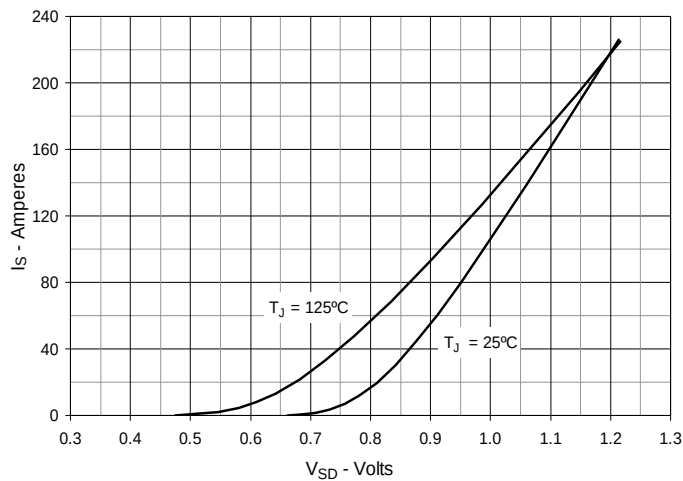


Fig. 10. Gate Charge

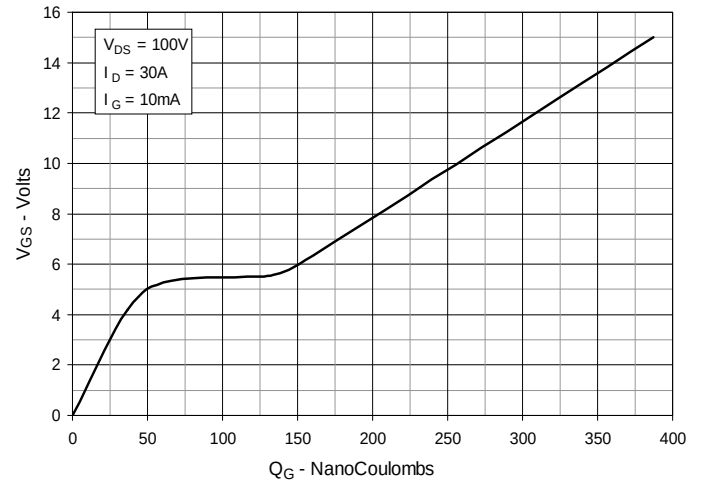


Fig. 11. Capacitance

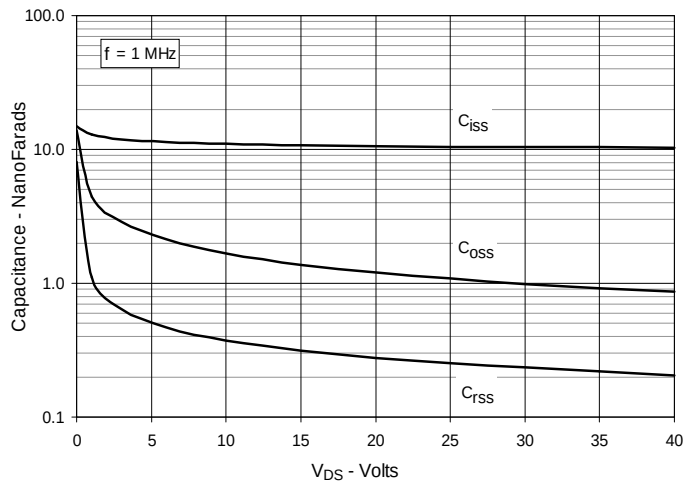


Fig. 12. Maximum Transient Thermal Impedance

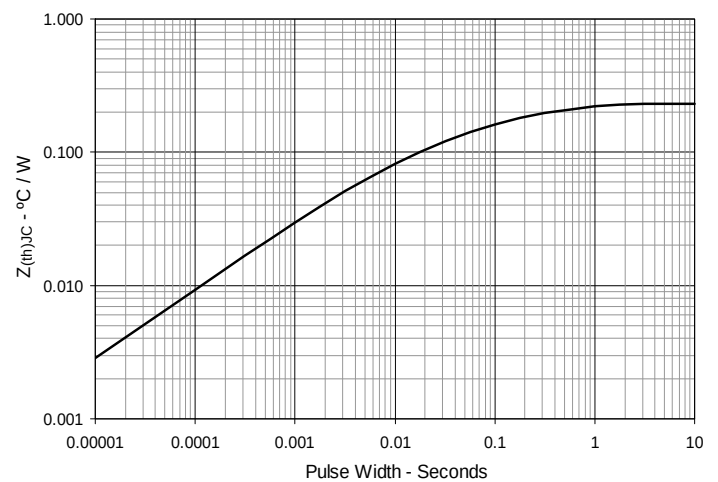


Fig. 13. Forward-Bias Safe Operating Area  
@  $T_C = 25^\circ\text{C}$

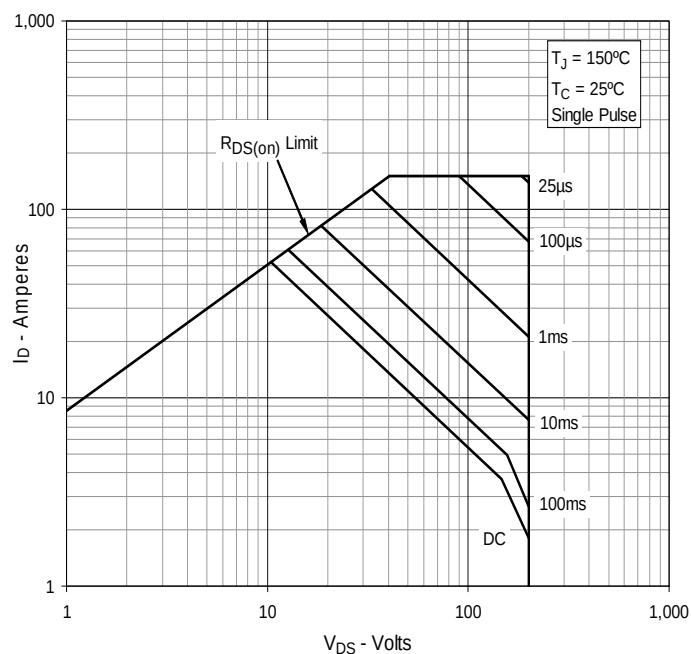
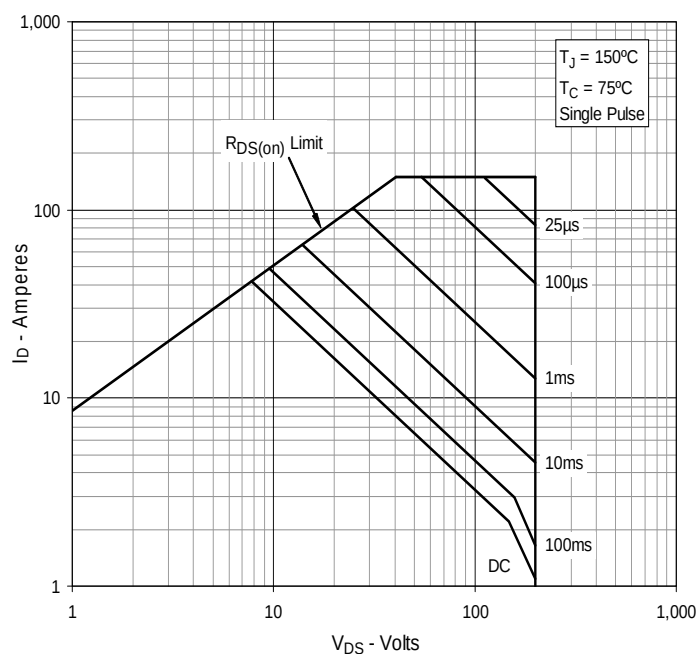


Fig. 14. Forward-Bias Safe Operating Area  
@  $T_C = 75^\circ\text{C}$





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