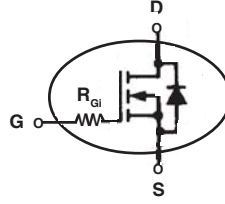


### Power MOSFET with Extended FBSOA

N-Channel Enhancement Mode

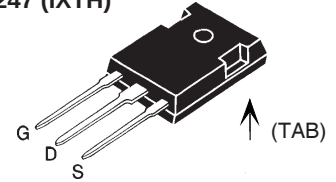
**IXTH30N50L**  
**IXTQ30N50L**  
**IXTT30N50L**



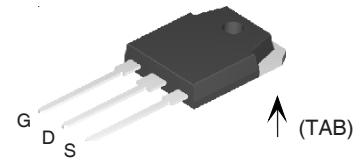
$$\begin{aligned} V_{DSS} &= 500V \\ I_{D25} &= 30A \\ R_{DS(on)} &\leq 0.20\Omega \end{aligned}$$

| 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                                                            | $\pm 20$        | V                |
| $V_{GSM}$  | Transient                                                             | $\pm 30$        | V                |
| $I_{D25}$  | $T_C = 25^\circ\text{C}$                                              | 30              | A                |
| $I_{DM}$   | $T_C = 25^\circ\text{C}$ , pulse width limited by $T_{JM}$            | 60              | A                |
| $I_{AR}$   | $T_C = 25^\circ\text{C}$                                              | 30              | A                |
| $E_{AR}$   | $T_C = 25^\circ\text{C}$                                              | 50              | mJ               |
| $E_{AS}$   |                                                                       | 1.5             | J                |
| $P_D$      | $T_C = 25^\circ\text{C}$                                              | 400             | W                |
| $T_J$      |                                                                       | -55 to +150     | $^\circ\text{C}$ |
| $T_{JM}$   |                                                                       | +150            | $^\circ\text{C}$ |
| $T_{stg}$  |                                                                       | -55 to +150     | $^\circ\text{C}$ |
| $T_L$      | 1.6mm (0.063in) from case for 10s                                     | 300             | $^\circ\text{C}$ |
| $T_{SOLD}$ | Plastic body for 10s                                                  | 260             | $^\circ\text{C}$ |
| $M_d$      | Mounting torque (TO-247, TO-3P)                                       | 1.13/10         | Nm/lb.in.        |
| Weight     | TO-247                                                                | 6.0             | g                |
|            | TO-3P                                                                 | 5.5             | g                |
|            | TO-268                                                                | 5.0             | g                |

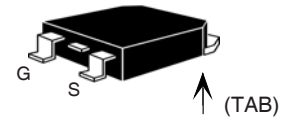
TO-247 (IXTH)



TO-3P (IXTQ)



TO-268 (IXTT)



G = Gate    D = Drain  
S = Source    TAB = Drain

#### Features

- Designed for linear operation
- International standard packages
- Unclamped Inductive Switching (UIS) rated.
- Molding epoxies meet UL 94 V-0 flammability classification
- Integrated gate resistor for easy paralleling
- Guaranteed FBSOA at  $75^\circ\text{C}$

#### Applications

- Solid state circuit breakers
- Soft start controls
- Linear amplifiers
- Programmable loads
- Current regulators

| Symbol       | Test Conditions                                                | Characteristic Values |      |                   |
|--------------|----------------------------------------------------------------|-----------------------|------|-------------------|
|              | $(T_J = 25^\circ\text{C}, \text{ unless otherwise specified})$ | Min.                  | Typ. | Max.              |
| $BV_{DSS}$   | $V_{GS} = 0V, I_D = 250\mu\text{A}$                            | 500                   |      | V                 |
| $V_{GS(th)}$ | $V_{DS} = V_{GS}, I_D = 250\mu\text{A}$                        | 2.5                   |      | V                 |
| $I_{GSS}$    | $V_{GS} = \pm 30V, V_{DS} = 0V$                                |                       |      | $\pm 100$ nA      |
| $I_{DSS}$    | $V_{DS} = V_{DSS}$                                             |                       |      | 50 $\mu\text{A}$  |
|              | $V_{GS} = 0V, T_J = 125^\circ\text{C}$                         |                       |      | 300 $\mu\text{A}$ |
| $R_{DS(on)}$ | $V_{GS} = 10V, I_D = 0.5 \cdot I_{D25}, \text{ Note 1}$        |                       |      | 0.20 $\Omega$     |

| Symbol                                              | Test Conditions                                                                                                                                                                 | Characteristic Values |      |      |
|-----------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|------|------|
|                                                     |                                                                                                                                                                                 | Min.                  | Typ. | Max. |
| (T <sub>J</sub> = 25°C, unless otherwise specified) |                                                                                                                                                                                 |                       |      |      |
| <b>g<sub>fs</sub></b>                               | V <sub>DS</sub> = 10V, I <sub>D</sub> = 0.5 • I <sub>D25</sub> , Note 1                                                                                                         | 9                     | 12   | 15 S |
| <b>C<sub>iss</sub></b>                              | V <sub>GS</sub> = 0V, V <sub>DS</sub> = 25V, f = 1MHz                                                                                                                           |                       | 10.2 | nF   |
| <b>C<sub>oss</sub></b>                              |                                                                                                                                                                                 |                       | 540  | pF   |
| <b>C<sub>rss</sub></b>                              |                                                                                                                                                                                 |                       | 127  | pF   |
| <b>R<sub>Gi</sub></b>                               | Integrated gate input resistor                                                                                                                                                  |                       | 3.5  | Ω    |
| <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> = 0Ω (External) |                       | 35   | ns   |
| <b>t<sub>r</sub></b>                                |                                                                                                                                                                                 |                       | 117  | ns   |
| <b>t<sub>d(off)</sub></b>                           |                                                                                                                                                                                 |                       | 94   | ns   |
| <b>t<sub>f</sub></b>                                |                                                                                                                                                                                 |                       | 40   | 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>                                                                       |                       | 240  | nC   |
| <b>Q<sub>gs</sub></b>                               |                                                                                                                                                                                 |                       | 58   | nC   |
| <b>Q<sub>gd</sub></b>                               |                                                                                                                                                                                 |                       | 135  | nC   |
| <b>R<sub>thJC</sub></b>                             | (TO-247, TO-3P)                                                                                                                                                                 |                       | 0.25 | °C/W |
| <b>R<sub>thCS</sub></b>                             |                                                                                                                                                                                 |                       |      | °C/W |

## Safe Operating Area Specification

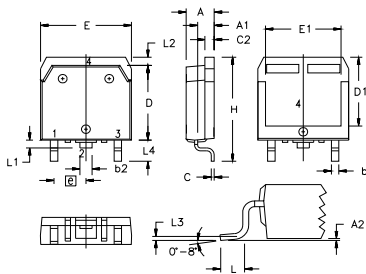
| Symbol     | Test Conditions                                                                           | Min. | Typ. | Max. |
|------------|-------------------------------------------------------------------------------------------|------|------|------|
| <b>SOA</b> | V <sub>DS</sub> = 400V, I <sub>D</sub> = 0.5A, T <sub>C</sub> = 75°C, t <sub>p</sub> = 2s | 200  |      | W    |

## Source-Drain Diode

|                       |                                                                           | Characteristic Values                               |      |       |
|-----------------------|---------------------------------------------------------------------------|-----------------------------------------------------|------|-------|
|                       |                                                                           | (T <sub>J</sub> = 25°C, unless otherwise specified) |      |       |
| Symbol                | Test Conditions                                                           | Min.                                                | Typ. | Max.  |
| <b>I<sub>S</sub></b>  | V <sub>GS</sub> = 0V                                                      |                                                     |      | 30 A  |
| <b>I<sub>SM</sub></b> | Repetitive, pulse width limited by T <sub>JM</sub>                        |                                                     |      | 120 A |
| <b>V<sub>SD</sub></b> | I <sub>F</sub> = I <sub>S</sub> , V <sub>GS</sub> = 0V, Note 1            |                                                     |      | 1.5 V |
| <b>t<sub>rr</sub></b> | I <sub>F</sub> = I <sub>S</sub> , -di/dt = 100A/μs, V <sub>R</sub> = 100V |                                                     | 500  | ns    |

Note 1: Pulse test, t ≤ 300μs; duty cycle, d ≤ 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  |

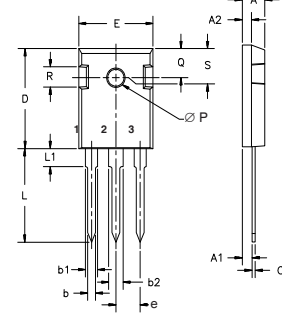
## PRELIMINARY TECHNICAL INFORMATION

The product presented herein is under development. The Technical Specifications offered are derived from data gathered during objective characterizations of preliminary engineering lots; but also may yet contain some information supplied during a pre-production design evaluation. IXYS reserves the right to change limits, test conditions, and dimensions without notice.

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

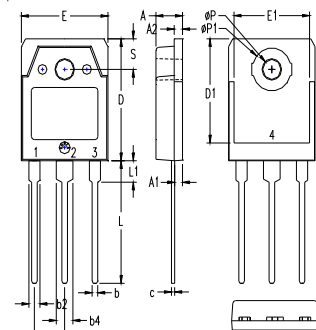
## TO-247 (IXTH) Outline



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 |       |

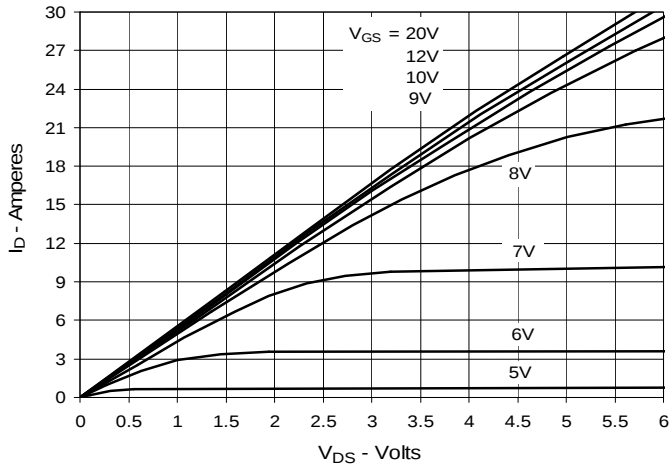
## TO-3P (IXTQ) Outline



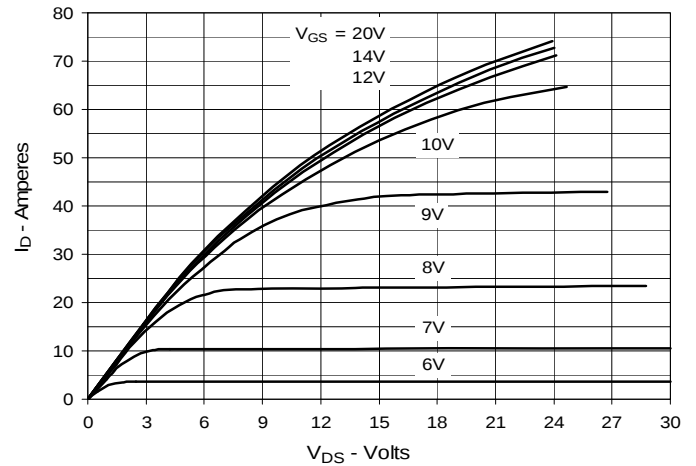
1 - GATE  
2 - DRAIN (COLLECTOR)  
3 - SOURCE (EMITTER)  
4 - DRAIN (COLLECTOR)

| 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  |

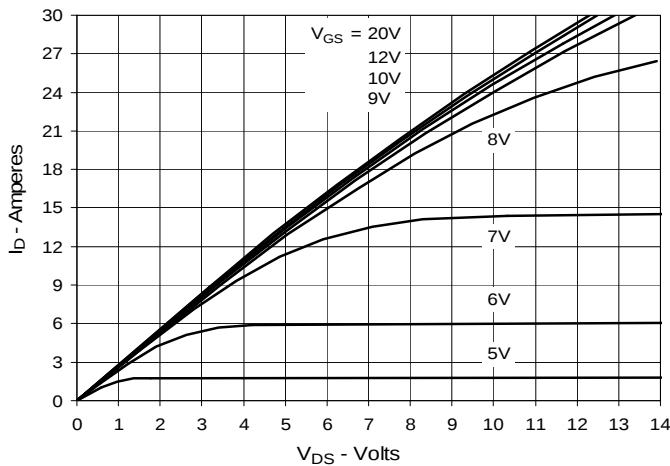
**Fig. 1. Output Characteristics**  
@  $T_J = 25^\circ\text{C}$



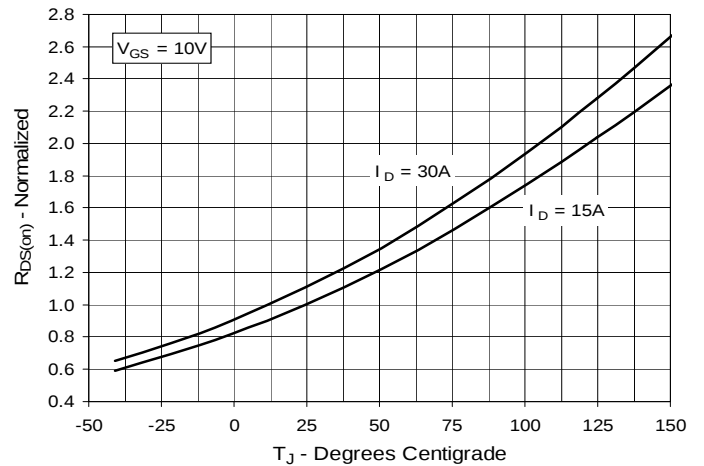
**Fig. 2. Extended Output Characteristics**  
@  $T_J = 25^\circ\text{C}$



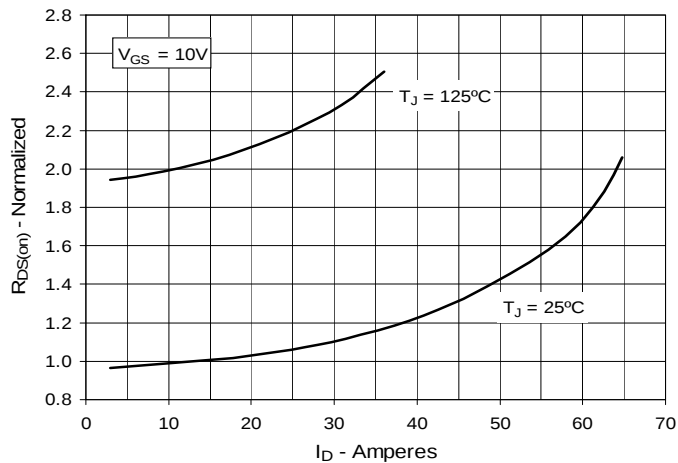
**Fig. 3. Output Characteristics**  
@  $T_J = 125^\circ\text{C}$



**Fig. 4.  $R_{DS(on)}$  Normalized to  $I_D = 15\text{A}$  Value vs. Junction Temperature**



**Fig. 5.  $R_{DS(on)}$  Normalized to  $I_D = 15\text{A}$  Value vs. Drain Current**



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

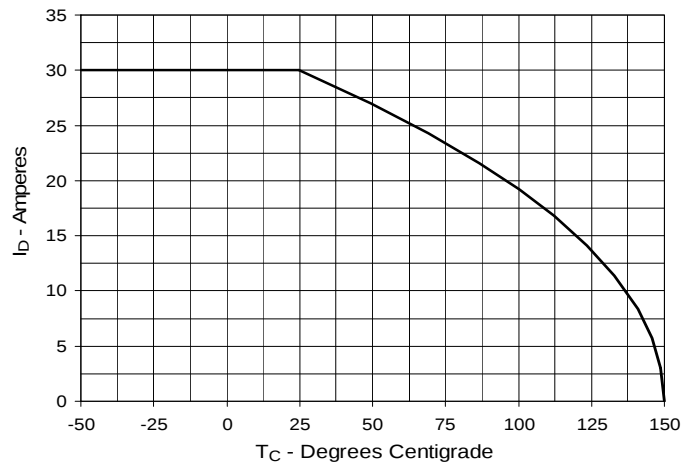


Fig. 7. Input Admittance

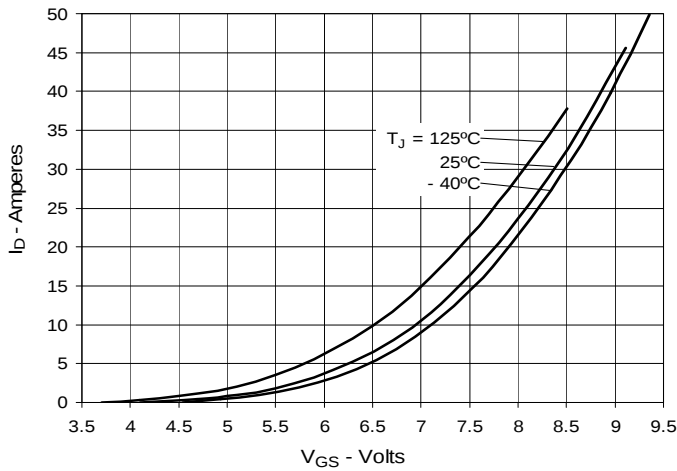


Fig. 8. Transconductance

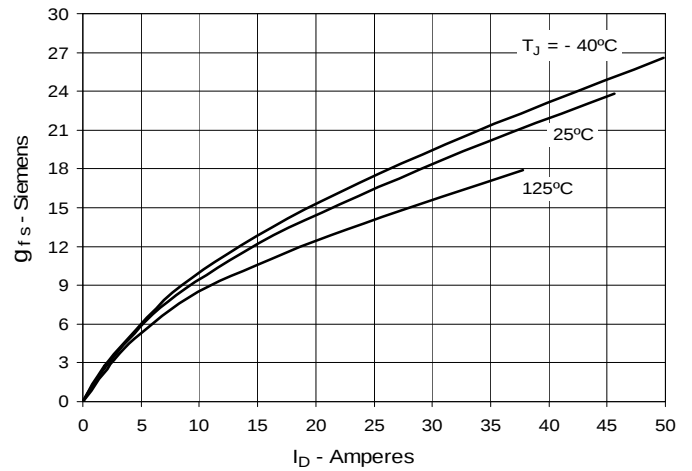


Fig. 9. Forward Voltage Drop of Intrinsic Diode

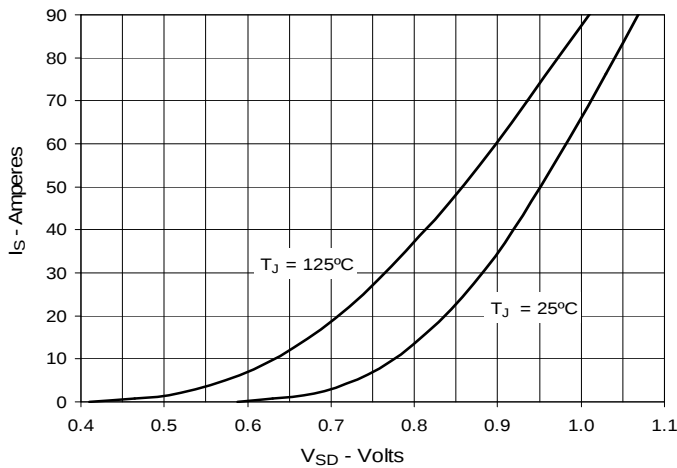


Fig. 10. Gate Charge

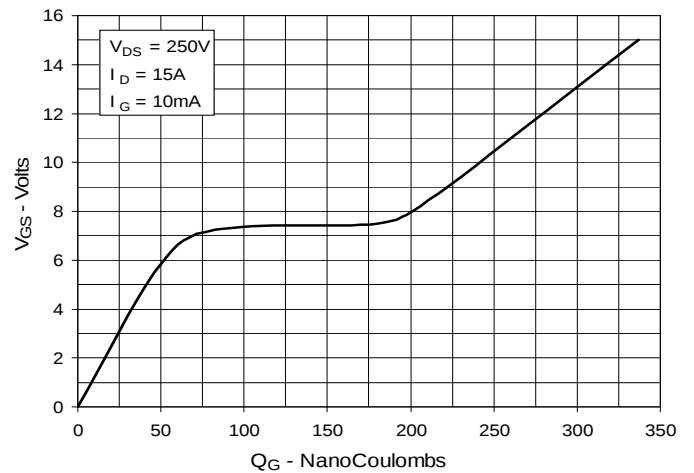


Fig. 11. Capacitance

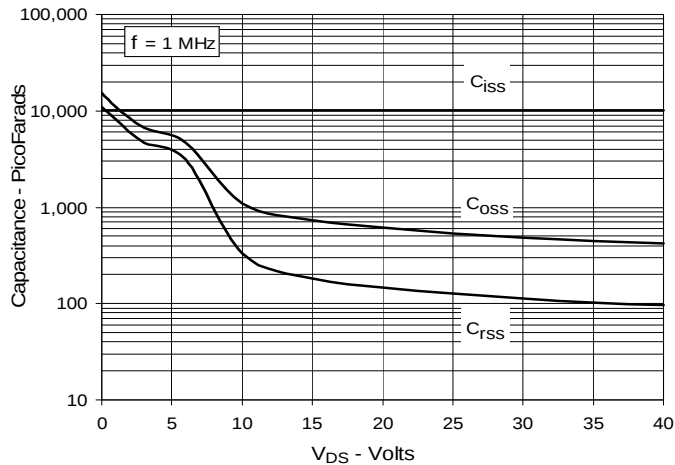
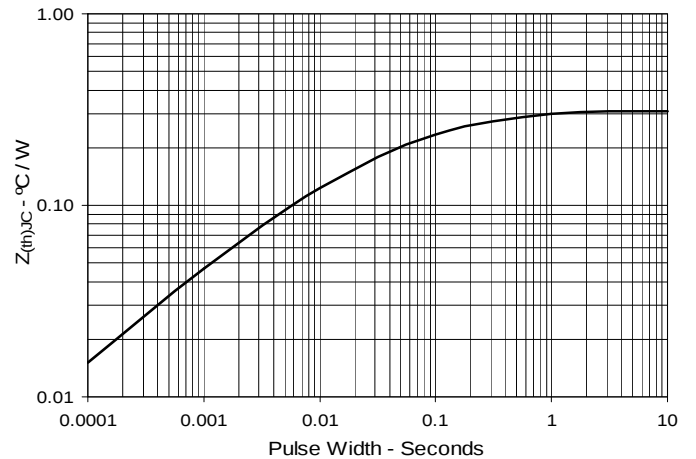
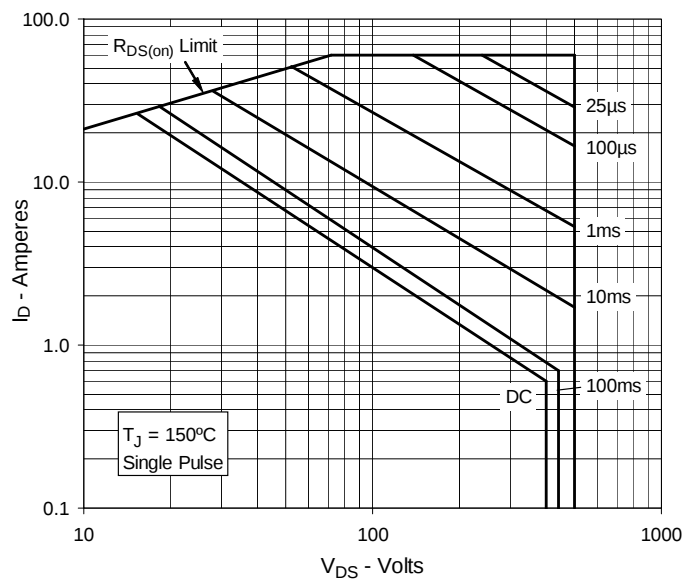


Fig. 12. Maximum Transient Thermal Impedance



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



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

