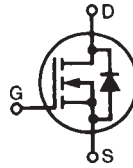


## X3-Class HiPerFET™ Power MOSFET

## IXFK400N15X3 IXFX400N15X3

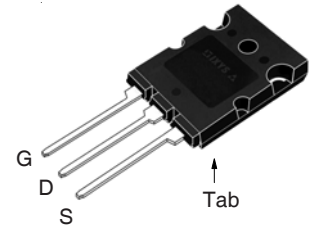
$$\begin{aligned} V_{DSS} &= 150V \\ I_{D25} &= 400A \\ R_{DS(on)} &\leq 3m\Omega \end{aligned}$$

N-Channel Enhancement Mode  
Avalanche Rated

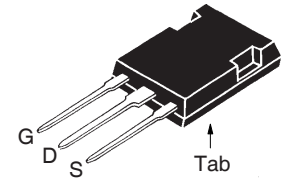


| Symbol        | Test Conditions                                                          | Maximum Ratings   |                  |
|---------------|--------------------------------------------------------------------------|-------------------|------------------|
| $V_{DSS}$     | $T_J = 25^\circ\text{C}$ to $150^\circ\text{C}$                          | 150               | V                |
| $V_{DGR}$     | $T_J = 25^\circ\text{C}$ to $150^\circ\text{C}$ , $R_{GS} = 1M\Omega$    | 150               | V                |
| $V_{GSS}$     | Continuous                                                               | $\pm 20$          | V                |
| $V_{GSM}$     | Transient                                                                | $\pm 30$          | V                |
| $I_{D25}$     | $T_C = 25^\circ\text{C}$                                                 | 400               | A                |
| $I_{L(RMS)}$  | External Lead Current Limit                                              | 160               | A                |
| $I_{DM}$      | $T_C = 25^\circ\text{C}$ , Pulse Width Limited by $T_{JM}$               | 900               | A                |
| $I_A$         | $T_C = 25^\circ\text{C}$                                                 | 200               | A                |
| $E_{AS}$      | $T_C = 25^\circ\text{C}$                                                 | 3.5               | J                |
| $dv/dt$       | $I_S \leq I_{DM}$ , $V_{DD} \leq V_{DSS}$ , $T_J \leq 150^\circ\text{C}$ | 20                | V/ns             |
| $P_D$         | $T_C = 25^\circ\text{C}$                                                 | 1250              | W                |
| $T_J$         |                                                                          | -55 ... +150      | $^\circ\text{C}$ |
| $T_{JM}$      |                                                                          | 150               | $^\circ\text{C}$ |
| $T_{stg}$     |                                                                          | -55 ... +150      | $^\circ\text{C}$ |
| $T_L$         | Maximum Lead Temperature for Soldering                                   | 300               | $^\circ\text{C}$ |
| $T_{SOLD}$    | 1.6 mm (0.062in.) from Case for 10s                                      | 260               | $^\circ\text{C}$ |
| $M_d$         | Mounting Torque (TO-264)                                                 | 1.13/10           | Nm/lb.in         |
| $F_C$         | Mounting Force (PLUS247)                                                 | 20..120 / 4.5..27 | N/lb             |
| <b>Weight</b> | TO-264                                                                   | 10                | g                |
|               | PLUS247                                                                  | 6                 | g                |

TO-264 (IXFK)



PLUS247 (IXFX)



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

### Features

- International Standard Packages
- Low  $R_{DS(ON)}$  and  $Q_G$
- Avalanche Rated
- Low Package Inductance

### Advantages

- High Power Density
- Easy to Mount
- Space Savings

### Applications

- Switch-Mode and Resonant-Mode Power Supplies
- DC-DC Converters
- PFC Circuits
- AC and DC Motor Drives
- Robotics and Servo Controls

| Symbol       | Test Conditions<br>( $T_J = 25^\circ\text{C}$ , Unless Otherwise Specified) | Characteristic Values |      |                      |
|--------------|-----------------------------------------------------------------------------|-----------------------|------|----------------------|
|              |                                                                             | Min.                  | Typ. | Max.                 |
| $BV_{DSS}$   | $V_{GS} = 0V$ , $I_D = 3mA$                                                 | 150                   |      | V                    |
| $V_{GS(th)}$ | $V_{DS} = V_{GS}$ , $I_D = 8mA$                                             | 2.5                   |      | 4.5 V                |
| $I_{GSS}$    | $V_{GS} = \pm 20V$ , $V_{DS} = 0V$                                          |                       |      | $\pm 200$ nA         |
| $I_{DSS}$    | $V_{DS} = V_{DSS}$ , $V_{GS} = 0V$<br>$T_J = 125^\circ\text{C}$             |                       |      | 25 $\mu A$<br>1.5 mA |
| $R_{DS(on)}$ | $V_{GS} = 10V$ , $I_D = 0.5 \cdot I_{D25}$ , Note 1                         |                       |      | 3 m $\Omega$         |

| Symbol                              | Test Conditions<br>(T <sub>J</sub> = 25°C, Unless Otherwise Specified)                                                                                                          | Characteristic Values                                            |      |           |
|-------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------|------|-----------|
|                                     |                                                                                                                                                                                 | Min.                                                             | Typ. | Max       |
| <b>g<sub>fs</sub></b>               | V <sub>DS</sub> = 10V, I <sub>D</sub> = 60A, Note 1                                                                                                                             | 85                                                               | 145  | S         |
| <b>R<sub>Gi</sub></b>               | Gate Input Resistance                                                                                                                                                           |                                                                  | 2.15 | Ω         |
| <b>C<sub>iss</sub></b>              | V <sub>GS</sub> = 0V, V <sub>DS</sub> = 25V, f = 1MHz                                                                                                                           |                                                                  | 23.7 | nF        |
| <b>C<sub>oss</sub></b>              |                                                                                                                                                                                 |                                                                  | 3730 | PF        |
| <b>C<sub>rss</sub></b>              |                                                                                                                                                                                 |                                                                  | 140  | pF        |
| <b>Effective Output Capacitance</b> |                                                                                                                                                                                 |                                                                  |      |           |
| <b>C<sub>o(er)</sub></b>            | Energy related                                                                                                                                                                  | V <sub>GS</sub> = 0V<br>V <sub>DS</sub> = 0.8 • V <sub>DSS</sub> | 2200 | pF        |
| <b>C<sub>o(tr)</sub></b>            | Time related                                                                                                                                                                    |                                                                  | 5330 | pF        |
| <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> = 1Ω (External) |                                                                  | 36   | ns        |
| <b>t<sub>r</sub></b>                |                                                                                                                                                                                 |                                                                  | 30   | ns        |
| <b>t<sub>d(off)</sub></b>           |                                                                                                                                                                                 |                                                                  | 210  | ns        |
| <b>t<sub>f</sub></b>                |                                                                                                                                                                                 |                                                                  | 19   | 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>                                                                       |                                                                  | 365  | nC        |
| <b>Q<sub>gs</sub></b>               |                                                                                                                                                                                 |                                                                  | 103  | nC        |
| <b>Q<sub>gd</sub></b>               |                                                                                                                                                                                 |                                                                  | 87   | nC        |
| <b>R<sub>thJC</sub></b>             |                                                                                                                                                                                 |                                                                  |      | 0.10 °C/W |
| <b>R<sub>thCS</sub></b>             |                                                                                                                                                                                 |                                                                  | 0.15 | °C/W      |

### Source-Drain Diode

| Symbol   | Test Conditions<br>( $T_J = 25^\circ\text{C}$ , Unless Otherwise Specified)     | Characteristic Values |      |        |
|----------|---------------------------------------------------------------------------------|-----------------------|------|--------|
|          |                                                                                 | Min.                  | Typ. | Max    |
| $I_S$    | $V_{GS} = 0\text{V}$                                                            |                       |      | 400 A  |
| $I_{SM}$ | Repetitive, pulse Width Limited by $T_{JM}$                                     |                       |      | 1600 A |
| $V_{SD}$ | $I_F = 100\text{A}$ , $V_{GS} = 0\text{V}$ , Note 1                             |                       |      | 1.4 V  |
| $t_{rr}$ | $I_F = 150\text{A}$ , $-di/dt = 100\text{A}/\mu\text{s}$<br>$V_R = 100\text{V}$ |                       | 132  | ns     |
| $Q_{RM}$ |                                                                                 |                       | 580  | nC     |
| $I_{RM}$ |                                                                                 |                       | 8.8  | A      |

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

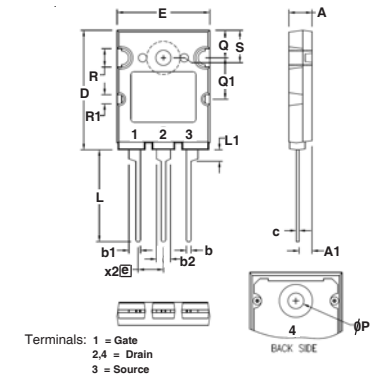
### ADVANCE TECHNICAL INFORMATION

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.

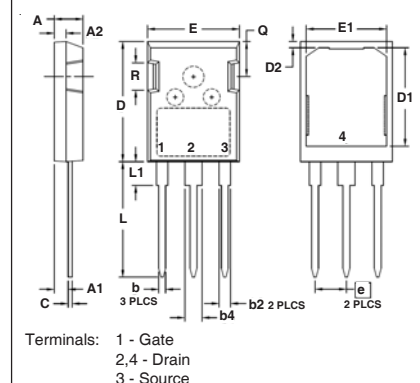
|                                                                                  |           |           |           |           |             |             |             |             |             |             |
|----------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-------------|-------------|-------------|-------------|-------------|-------------|
| 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   | 6,404,065B1 | 6,683,344   | 6,727,585   | 7,005,734B2 | 7,157,338B2 |
|                                                                                  | 4,860,072 | 5,017,508 | 5,063,307 | 5,381,025 | 6,259,123B1 | 6,534,343   | 6,710,405B2 | 6,759,692   | 7,063,975B2 |             |
|                                                                                  | 4,881,106 | 5,034,796 | 5,187,117 | 5,486,715 | 6,306,728B1 | 6,583,505   | 6,710,463   | 6,771,478B2 | 7,071,537   |             |

### TO-264 Outline



| SYM | INCHES  |       | MILLIMETERS |       |
|-----|---------|-------|-------------|-------|
|     | MIN     | MAX   | MIN         | MAX   |
| A   | .185    | .209  | 4.70        | 5.30  |
| A1  | .102    | .118  | 2.60        | 3.00  |
| b   | .035    | .049  | 0.90        | 1.25  |
| b1  | .091    | .106  | 2.30        | 2.70  |
| b2  | .110    | .126  | 2.80        | 3.20  |
| c   | .020    | .033  | 0.50        | 0.85  |
| D   | 1.012   | 1.035 | 25.70       | 26.30 |
| E   | .776    | .799  | 19.70       | 20.30 |
| e   | .215BSC |       | 5.46 BSC    |       |
| L   | .768    | .807  | 19.50       | 20.50 |
| L1  | .091    | .106  | 2.30        | 2.70  |
| Q   | .122    | .138  | 3.10        | 3.50  |
| Q1  | .228    | .244  | 5.80        | 6.20  |
| Q1  | .346    | .362  | 8.80        | 9.20  |
| Q1  | .150    | .165  | 3.80        | 4.20  |
| Q1  | .071    | .087  | 1.80        | 2.20  |
| S   | .228    | .244  | 5.80        | 6.20  |

### PLUS 247™ Outline



| SYM | INCHES   |      | MILLIMETERS |       |
|-----|----------|------|-------------|-------|
|     | MIN      | MAX  | MIN         | MAX   |
| A   | .190     | .205 | 4.83        | 5.21  |
| A1  | .090     | .100 | 2.29        | 2.54  |
| A2  | .075     | .085 | 1.91        | 2.16  |
| b   | .045     | .055 | 1.14        | 1.40  |
| b2  | .075     | .087 | 1.91        | 2.20  |
| b4  | .115     | .126 | 2.92        | 3.20  |
| C   | .024     | .031 | 0.61        | 0.80  |
| D   | .819     | .840 | 20.80       | 21.34 |
| D1  | .650     | .690 | 16.51       | 17.53 |
| D2  | .035     | .050 | 0.89        | 1.27  |
| E   | .620     | .635 | 15.75       | 16.13 |
| E1  | .520     | .560 | 13.08       | 14.22 |
| e   | .215 BSC |      | 5.45 BSC    |       |
| L   | .780     | .810 | 19.81       | 20.57 |
| L1  | .150     | .170 | 3.81        | 4.32  |
| Q   | .220     | .244 | 5.59        | 6.20  |
| R   | .170     | .190 | 4.32        | 4.83  |

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

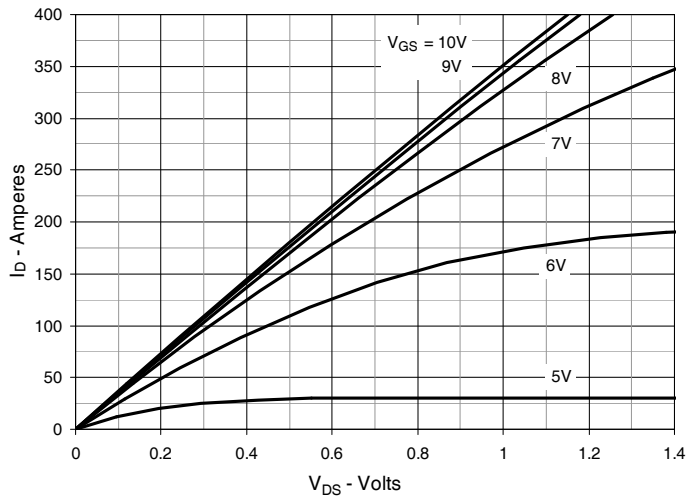


Fig. 2. Extended Output Characteristics @  $T_J = 25^\circ\text{C}$

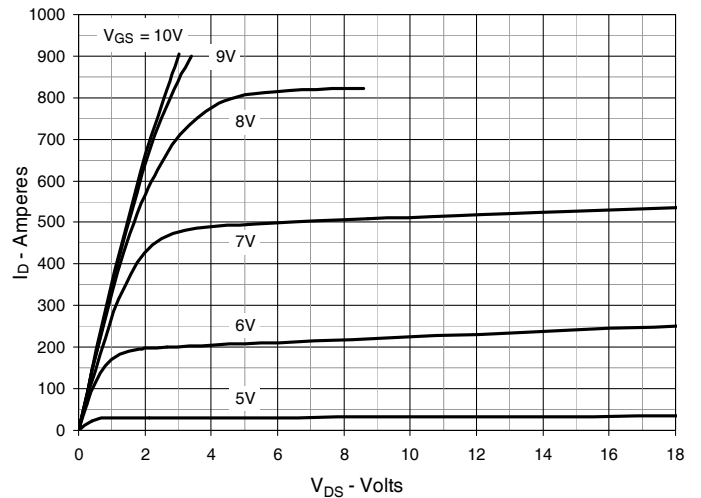


Fig. 3. Output Characteristics @  $T_J = 125^\circ\text{C}$

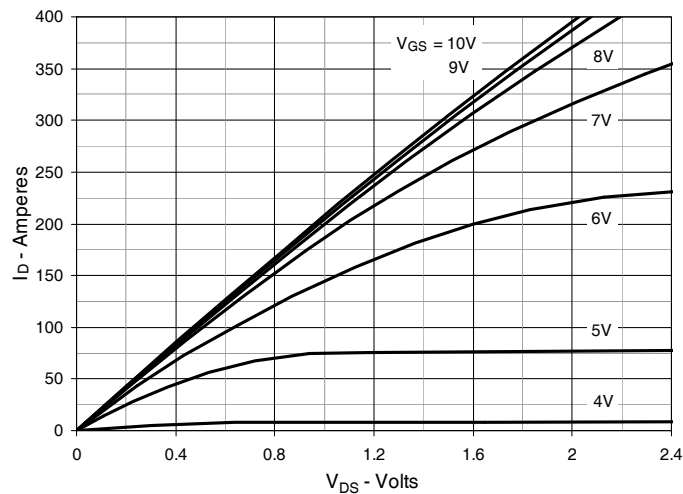


Fig. 4.  $R_{DS(on)}$  Normalized to  $I_D = 200\text{A}$  Value vs. Junction Temperature

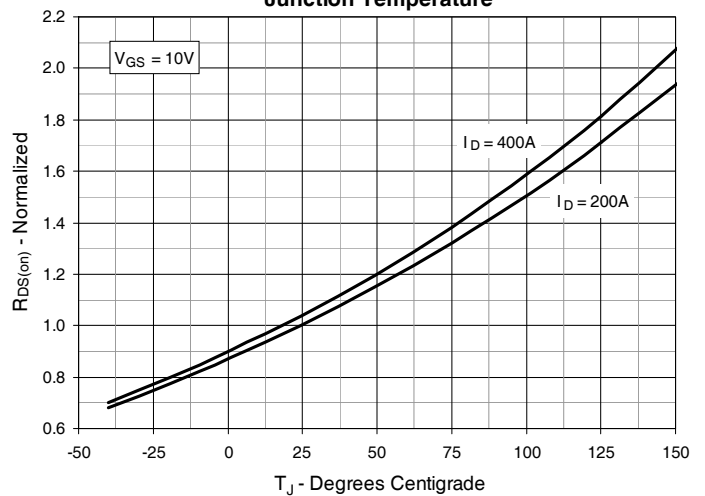


Fig. 5.  $R_{DS(on)}$  Normalized to  $I_D = 200\text{A}$  Value vs. Drain Current

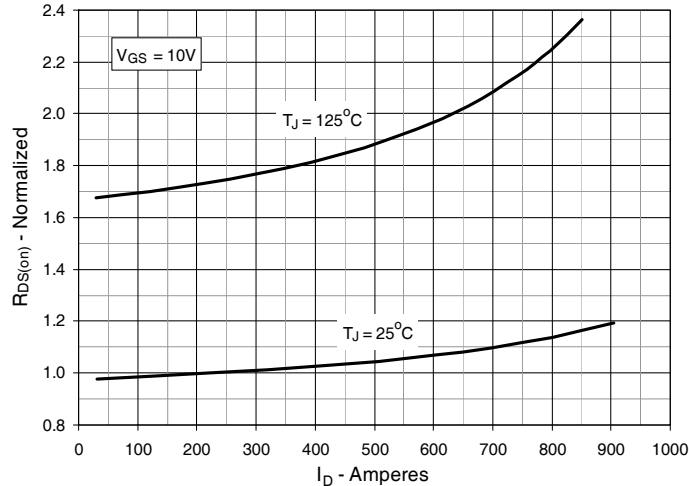
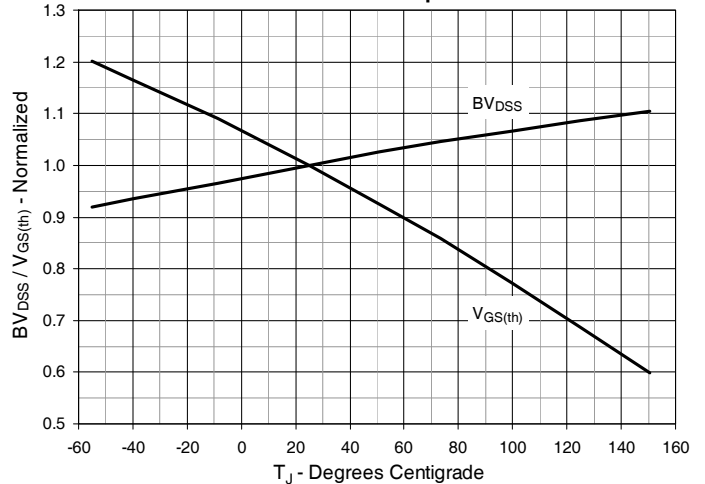
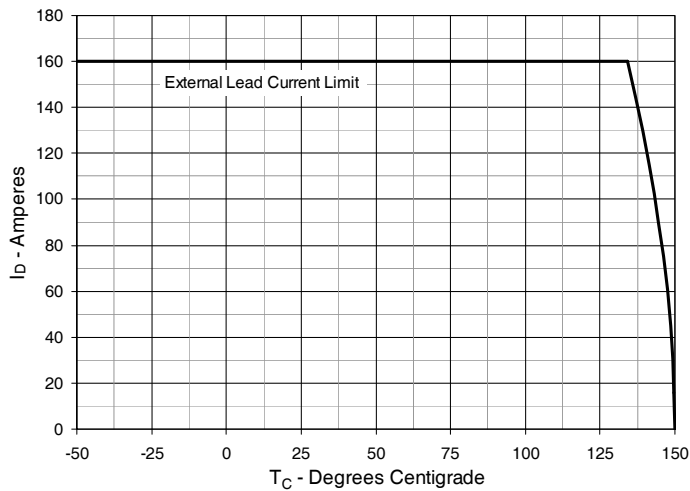


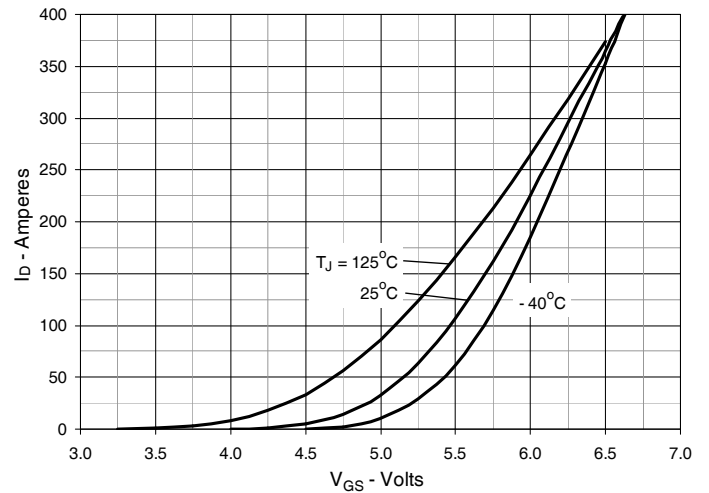
Fig. 6. Normalized Breakdown & Threshold Voltages vs. Junction Temperature



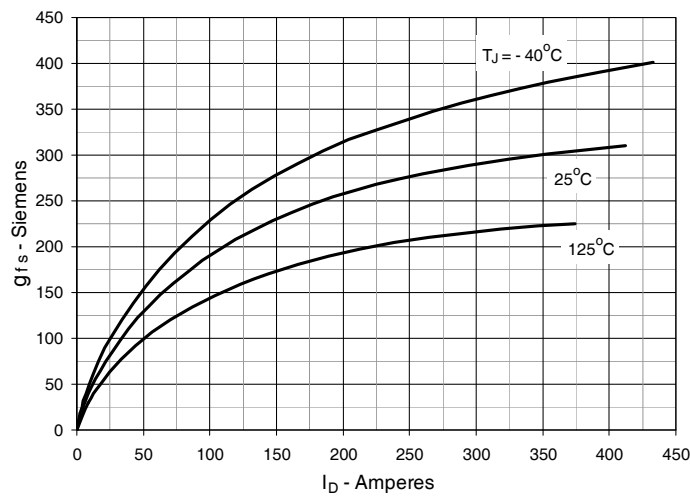
**Fig. 7. Maximum Drain Current vs. Case Temperature**



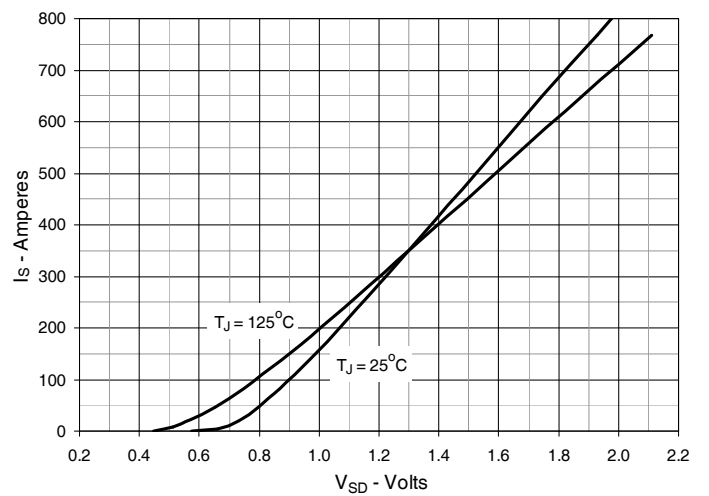
**Fig. 8. Input Admittance**



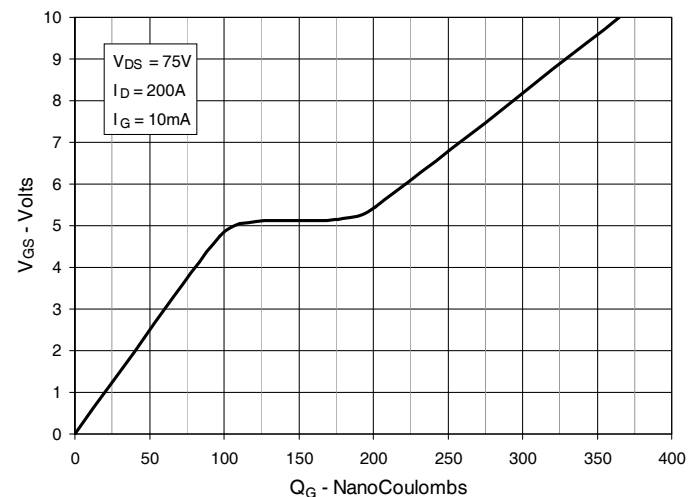
**Fig. 9. Transconductance**



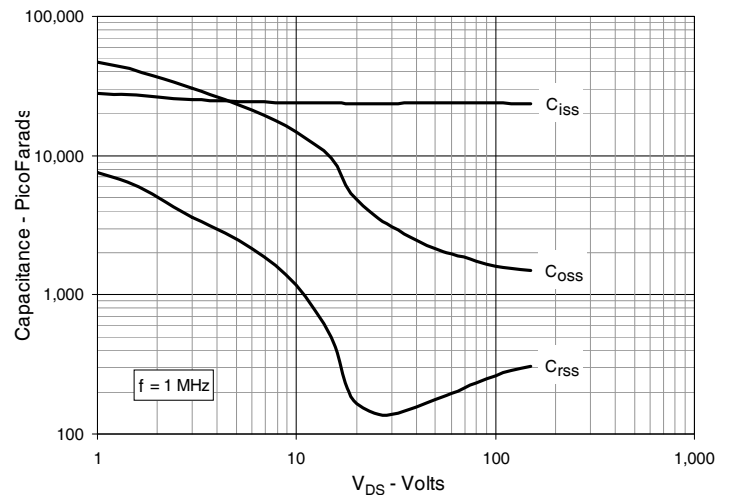
**Fig. 10. Forward Voltage Drop of Intrinsic Diode**



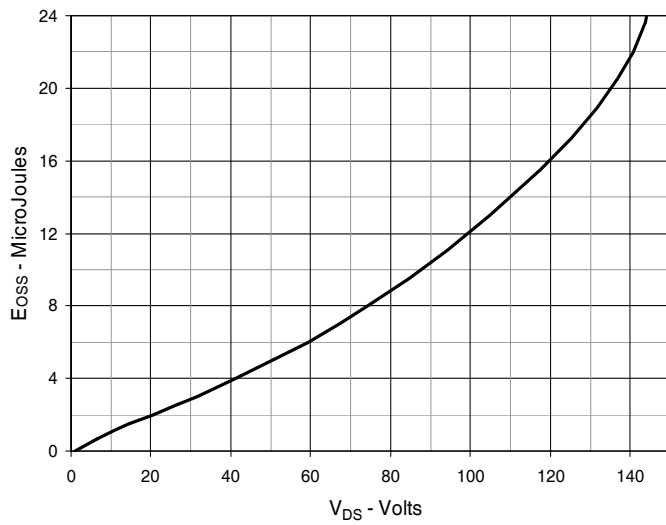
**Fig. 11. Gate Charge**



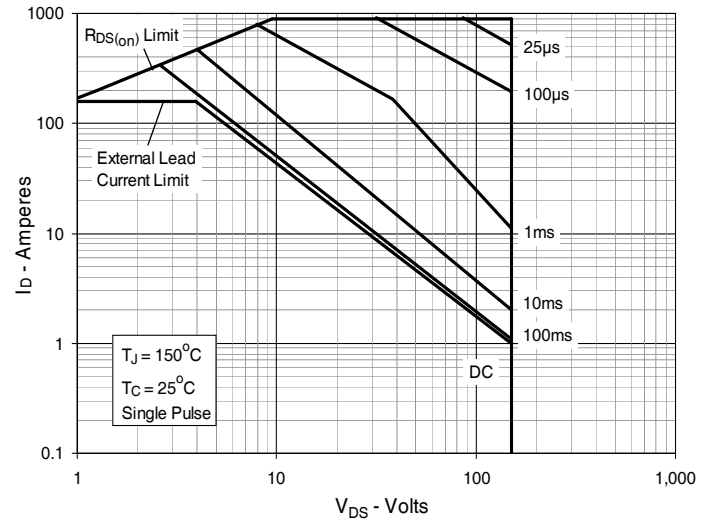
**Fig. 12. Capacitance**



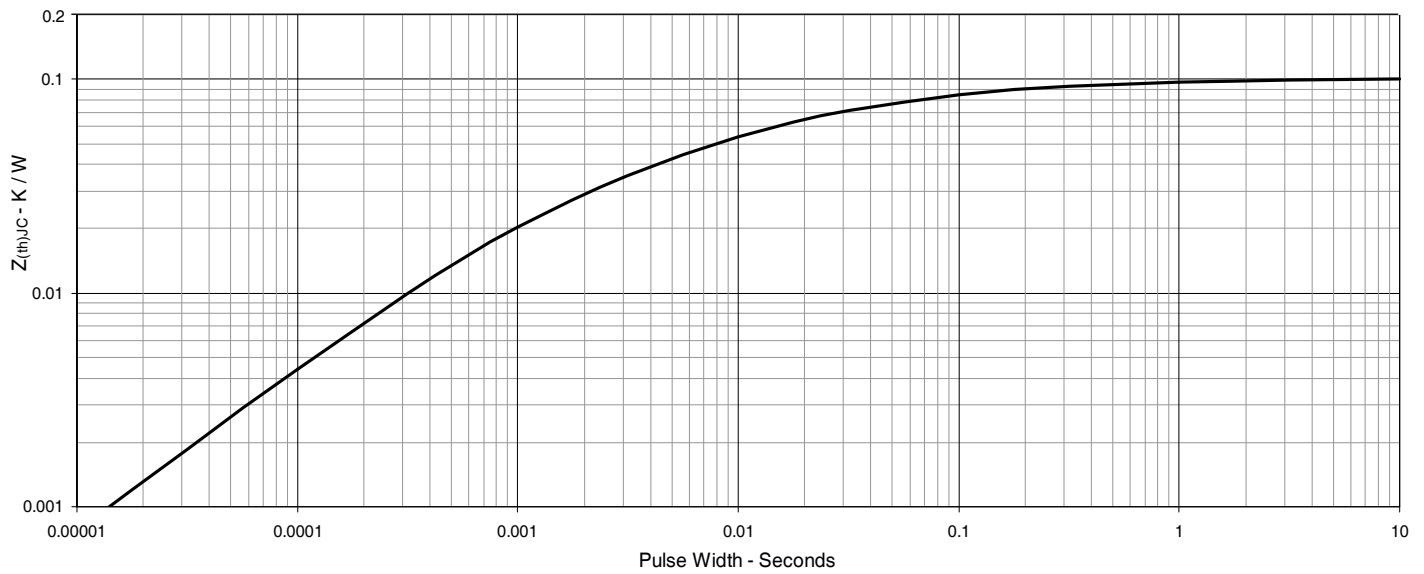
**Fig. 13. Output Capacitance Stored Energy**



**Fig. 14. Forward-Bias Safe Operating Area**



**Fig. 15. Maximum Transient Thermal Impedance**





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