

# X2-Class Power MOSFET

## IXTK102N65X2 IXTX102N65X2

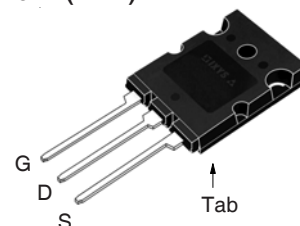
$V_{DSS} = 650V$   
 $I_{D25} = 102A$   
 $R_{DS(on)} \leq 30m\Omega$

N-Channel Enhancement Mode  
Avalanche Rated

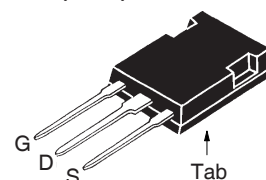


| Symbol     | Test Conditions                                                    | Maximum Ratings  |            |
|------------|--------------------------------------------------------------------|------------------|------------|
| $V_{DSS}$  | $T_J = 25^\circ C$ to $150^\circ C$                                | 650              | V          |
| $V_{DGR}$  | $T_J = 25^\circ C$ to $150^\circ C$ , $R_{GS} = 1M\Omega$          | 650              | V          |
| $V_{GSS}$  | Continuous                                                         | $\pm 30$         | V          |
| $V_{GSM}$  | Transient                                                          | $\pm 40$         | V          |
| $I_{D25}$  | $T_C = 25^\circ C$                                                 | 102              | A          |
| $I_{DM}$   | $T_C = 25^\circ C$ , Pulse Width Limited by $T_{JM}$               | 204              | A          |
| $I_A$      | $T_C = 25^\circ C$                                                 | 25               | A          |
| $E_{AS}$   | $T_C = 25^\circ C$                                                 | 3                | J          |
| $P_D$      | $T_C = 25^\circ C$                                                 | 1040             | W          |
| $dv/dt$    | $I_S \leq I_{DM}$ , $V_{DD} \leq V_{DSS}$ , $T_J \leq 150^\circ C$ | 15               | V/ns       |
| $T_J$      |                                                                    | -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              | $^\circ C$ |
| $M_d$      | Mounting Torque (TO-264P)                                          | 1.13/10          | Nm/lb.in   |
| $F_c$      | Mounting Force (PLUS247)                                           | 20..120 /4.5..27 | N/lb       |
| Weight     | TO-264P                                                            | 10               | g          |
|            | PLUS247                                                            | 6                | g          |

TO-264P (IXTK)



PLUS247 (IXTX)



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

### Features

- International Standard Packages
- Low  $Q_G$
- 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>( $T_J = 25^\circ C$ Unless Otherwise Specified) | Characteristic Values |      |                           |
|--------------|---------------------------------------------------------------------|-----------------------|------|---------------------------|
|              |                                                                     | Min.                  | Typ. | Max.                      |
| $BV_{DSS}$   | $V_{GS} = 0V$ , $I_D = 1mA$                                         | 650                   |      | V                         |
| $V_{GS(th)}$ | $V_{DS} = V_{GS}$ , $I_D = 250\mu A$                                | 3.0                   |      | 5.0 V                     |
| $I_{GSS}$    | $V_{GS} = \pm 30V$ , $V_{DS} = 0V$                                  |                       |      | $\pm 100$ nA              |
| $I_{DSS}$    | $V_{DS} = V_{DSS}$ , $V_{GS} = 0V$<br>$T_J = 125^\circ C$           |                       |      | 25 $\mu A$<br>350 $\mu A$ |
| $R_{DS(on)}$ | $V_{GS} = 10V$ , $I_D = 0.5 \cdot I_{D25}$ , Note 1                 |                       |      | 30 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> = 0.5 • I <sub>D25</sub> , Note 1                                                                                                         | 50                    | 82   | S         |
| <b>R<sub>Gi</sub></b>               | Gate Input Resistance                                                                                                                                                           |                       | 0.7  | Ω         |
| <b>C<sub>iss</sub></b>              | } V <sub>GS</sub> = 0V, V <sub>DS</sub> = 25V, f = 1MHz                                                                                                                         |                       | 10.9 | nF        |
| <b>C<sub>oss</sub></b>              |                                                                                                                                                                                 |                       | 6100 | pF        |
| <b>C<sub>rss</sub></b>              |                                                                                                                                                                                 |                       | 12.6 | pF        |
| <b>Effective Output Capacitance</b> |                                                                                                                                                                                 |                       |      |           |
| <b>C<sub>o(er)</sub></b>            | Energy related } V <sub>GS</sub> = 0V                                                                                                                                           |                       | 367  | pF        |
| <b>C<sub>o(tr)</sub></b>            | Time related } V <sub>DS</sub> = 0.8 • V <sub>DSS</sub>                                                                                                                         |                       | 1420 | 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> = 2Ω (External) |                       | 37   | ns        |
| <b>t<sub>r</sub></b>                |                                                                                                                                                                                 |                       | 28   | ns        |
| <b>t<sub>d(off)</sub></b>           |                                                                                                                                                                                 |                       | 67   | ns        |
| <b>t<sub>f</sub></b>                |                                                                                                                                                                                 |                       | 11   | 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>                                                                     |                       | 152  | nC        |
| <b>Q<sub>gs</sub></b>               |                                                                                                                                                                                 |                       | 57   | nC        |
| <b>Q<sub>gd</sub></b>               |                                                                                                                                                                                 |                       | 33   | nC        |
| <b>R<sub>thJC</sub></b>             |                                                                                                                                                                                 |                       |      | 0.12 °C/W |
| <b>R<sub>thCS</sub></b>             |                                                                                                                                                                                 | 0.15                  |      | °C/W      |

### Source-Drain Diode

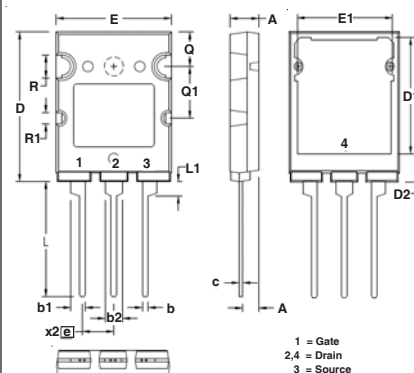
| Symbol   | Test Conditions<br>( $T_J = 25^\circ\text{C}$ , Unless Otherwise Specified)                           | Characteristic Values |      |               |
|----------|-------------------------------------------------------------------------------------------------------|-----------------------|------|---------------|
|          |                                                                                                       | Min.                  | Typ. | Max.          |
| $I_S$    | $V_{GS} = 0\text{V}$                                                                                  |                       |      | 102 A         |
| $I_{SM}$ | Repetitive, Pulse Width Limited by $T_{JM}$                                                           |                       |      | 408 A         |
| $V_{SD}$ | $I_F = I_S$ , $V_{GS} = 0\text{V}$ , Note 1                                                           |                       |      | 1.4 V         |
| $t_{rr}$ | $I_F = 51\text{A}$ , $-di/dt = 100\text{A}/\mu\text{s}$<br>$V_R = 100\text{V}$ , $V_{GS} = 0\text{V}$ |                       | 450  | ns            |
| $Q_{RM}$ |                                                                                                       |                       | 11.7 | $\mu\text{C}$ |
| $I_{RM}$ |                                                                                                       |                       | 52   | A             |

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

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

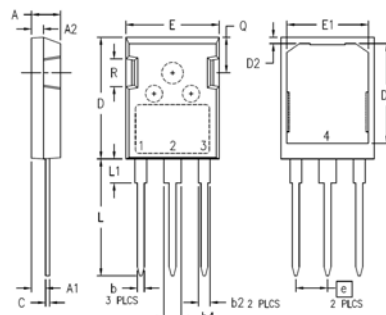
|                                                                                  |           |           |           |           |              |              |              |              |              |             |
|----------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|----------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

### TO-264P 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 |
| D1        | .783     | .799  | 19.90       | 20.30 |
| D2        | .185     | .205  | 4.70        | 5.20  |
| E         | .776     | .799  | 19.70       | 20.30 |
| E1        | .661     | .677  | 16.80       | 17.20 |
| e         | .215 BSC |       | 5.46 BSC    |       |
| L         | .768     | .807  | 19.50       | 20.50 |
| L1        | .091     | .106  | 2.30        | 2.70  |
| Q         | .228     | .244  | 5.80        | 6.20  |
| Q1        | .346     | .362  | 8.80        | 9.20  |
| $\phi R$  | .150     | .165  | 3.80        | 4.20  |
| $\phi R1$ | .071     | .087  | 1.80        | 2.20  |

### PLUS247™ Outline



Terminals: 1 - Gate  
2,4 - Drain  
3 - Source

| 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  |

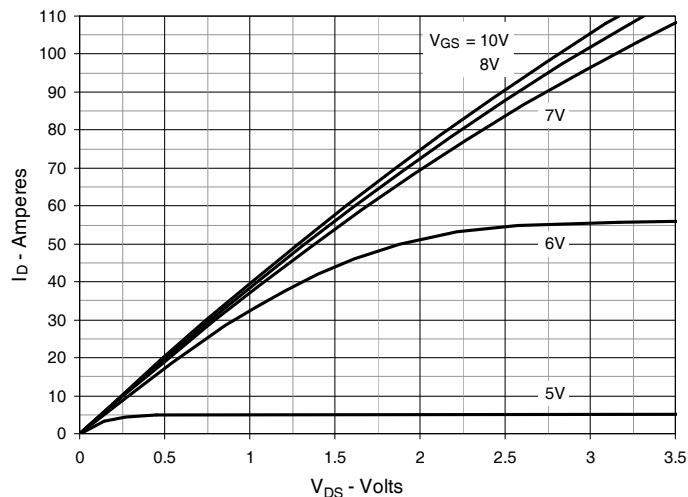
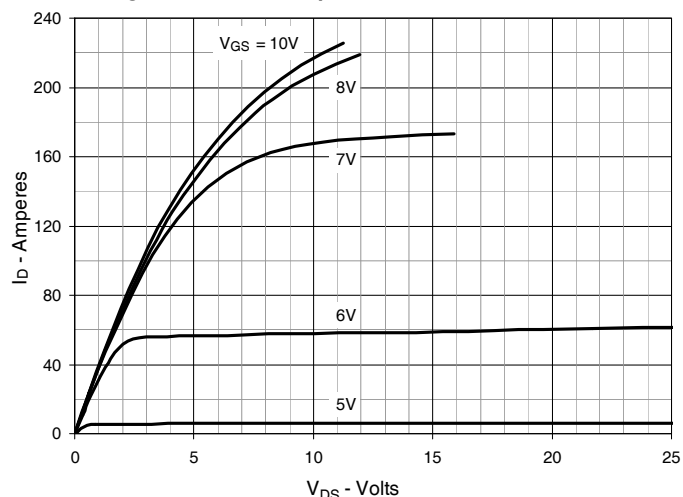
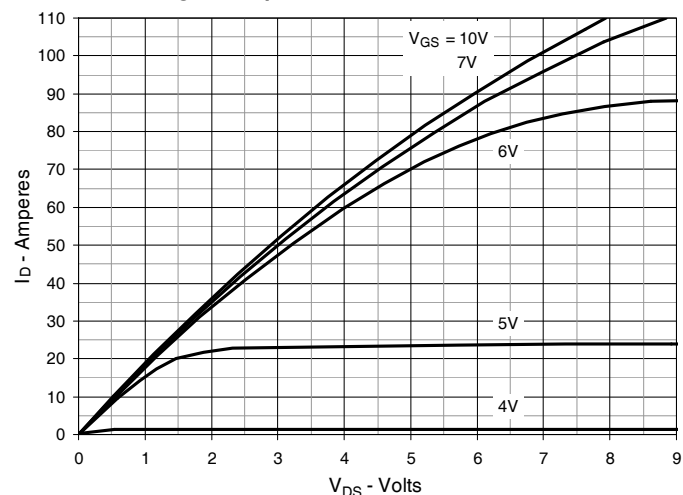
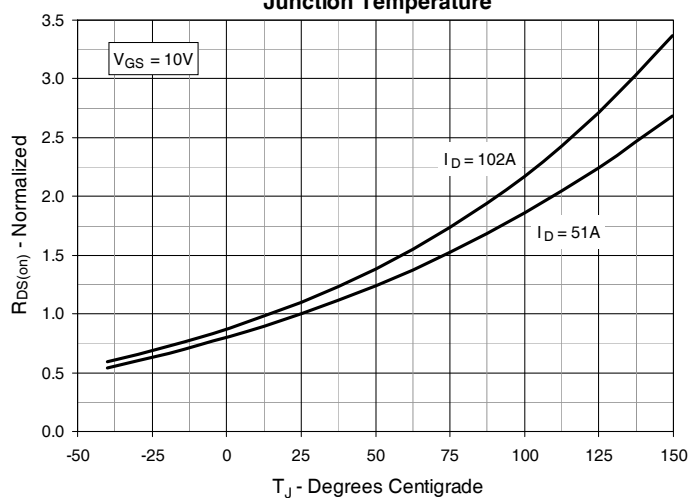
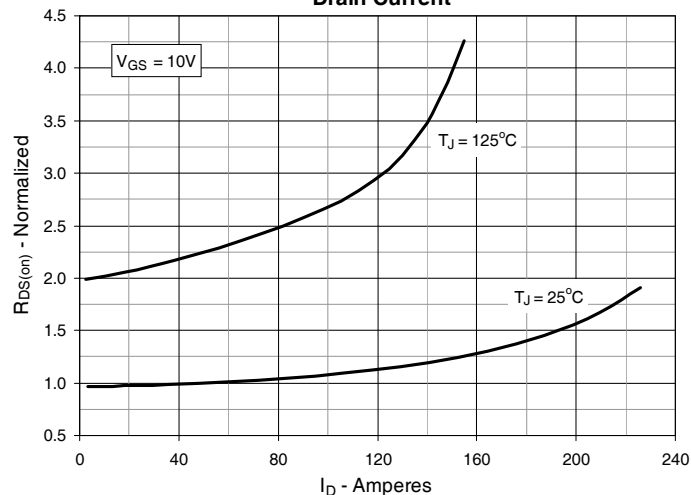
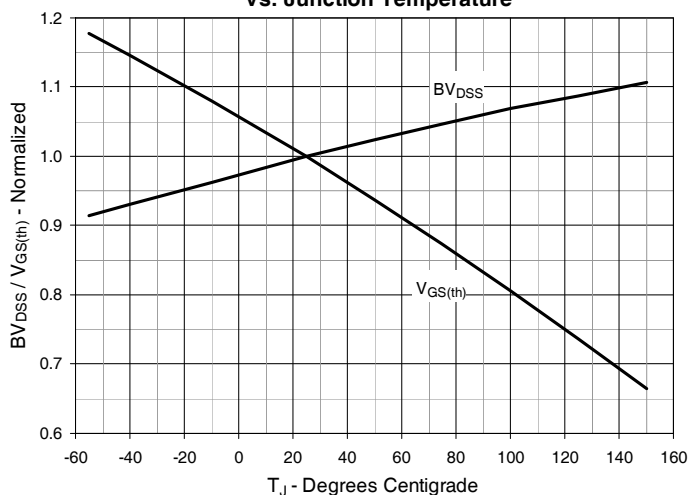
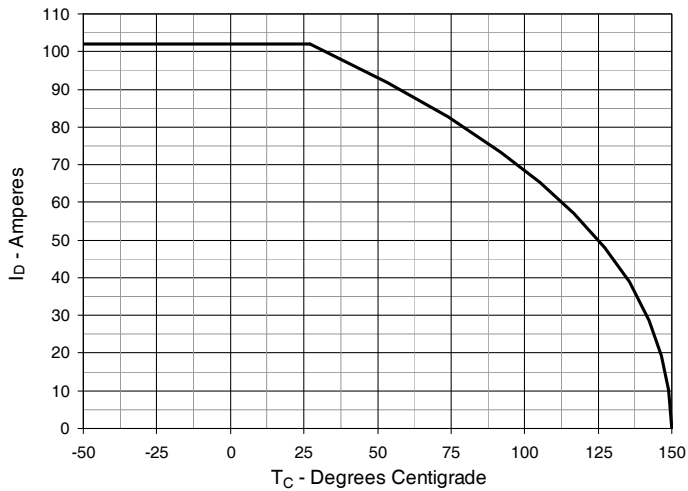
Fig. 1. Output Characteristics @  $T_J = 25^\circ\text{C}$ 

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  $I_D = 51\text{A}$  Value vs. Junction Temperature

Fig. 5.  $R_{DS(on)}$  Normalized to  $I_D = 51\text{A}$  Value vs. Drain Current


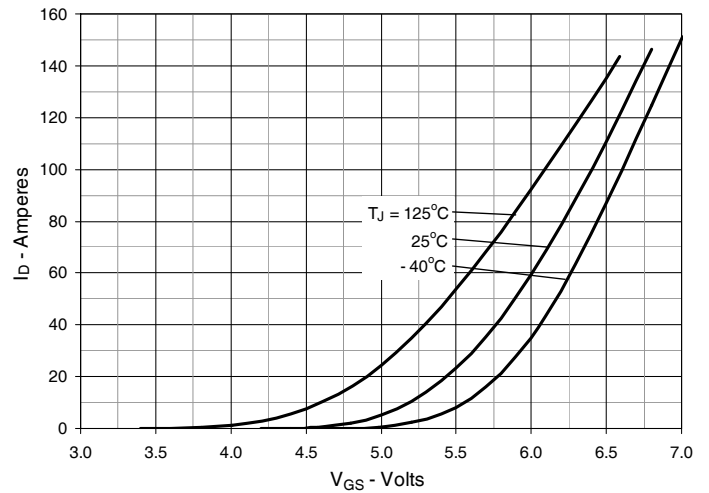
Fig. 6. Normalized Breakdown &amp; Threshold Voltages vs. Junction Temperature



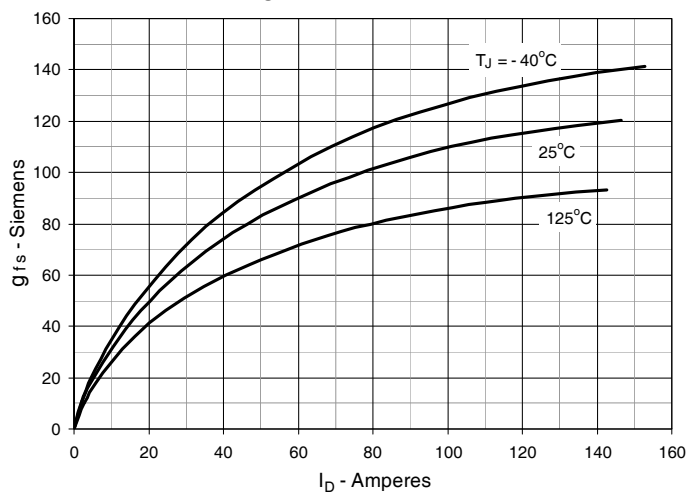
**Fig. 7. Maximum Drain Current vs. Case Temperature**



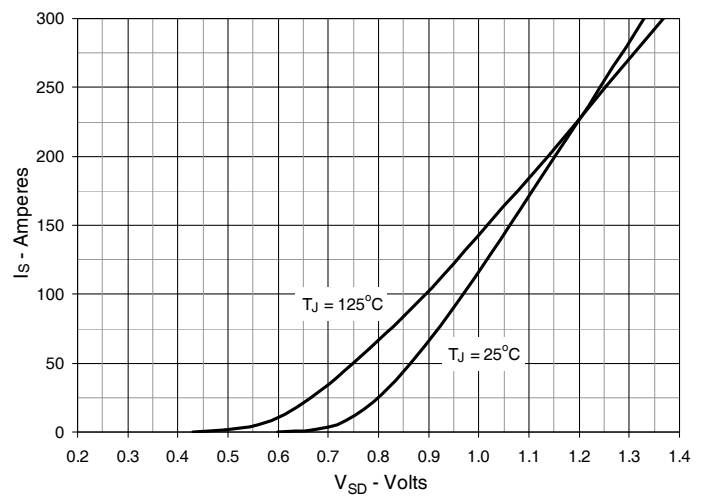
**Fig. 8. Input Admittance**



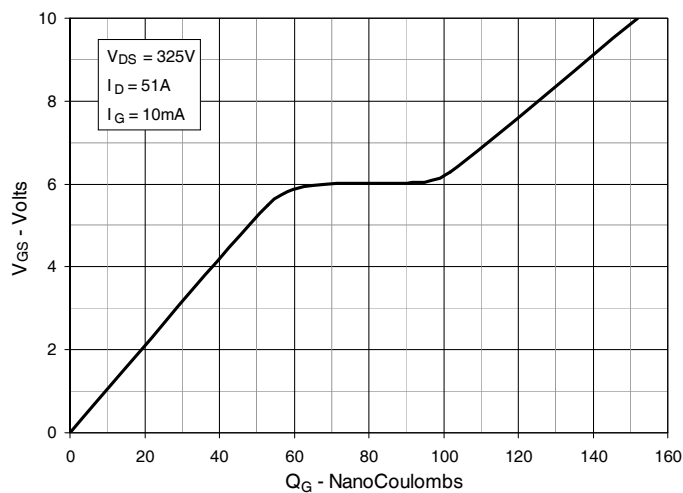
**Fig. 9. Transconductance**



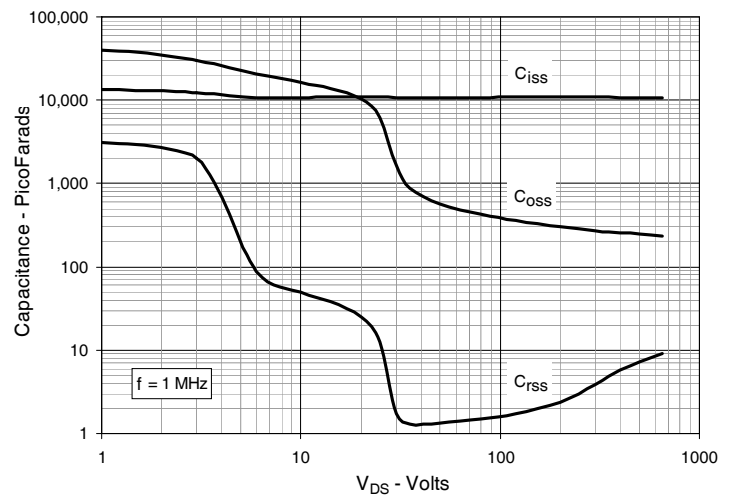
**Fig. 10. Forward Voltage Drop of Intrinsic Diode**



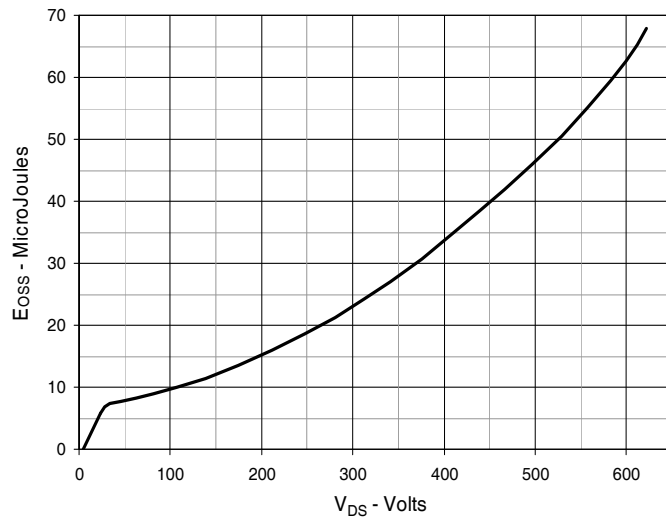
**Fig. 11. Gate Charge**



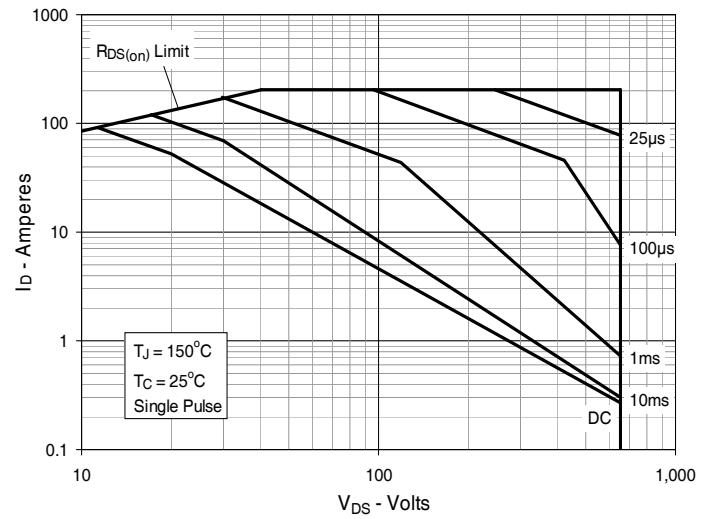
**Fig. 12. Capacitance**



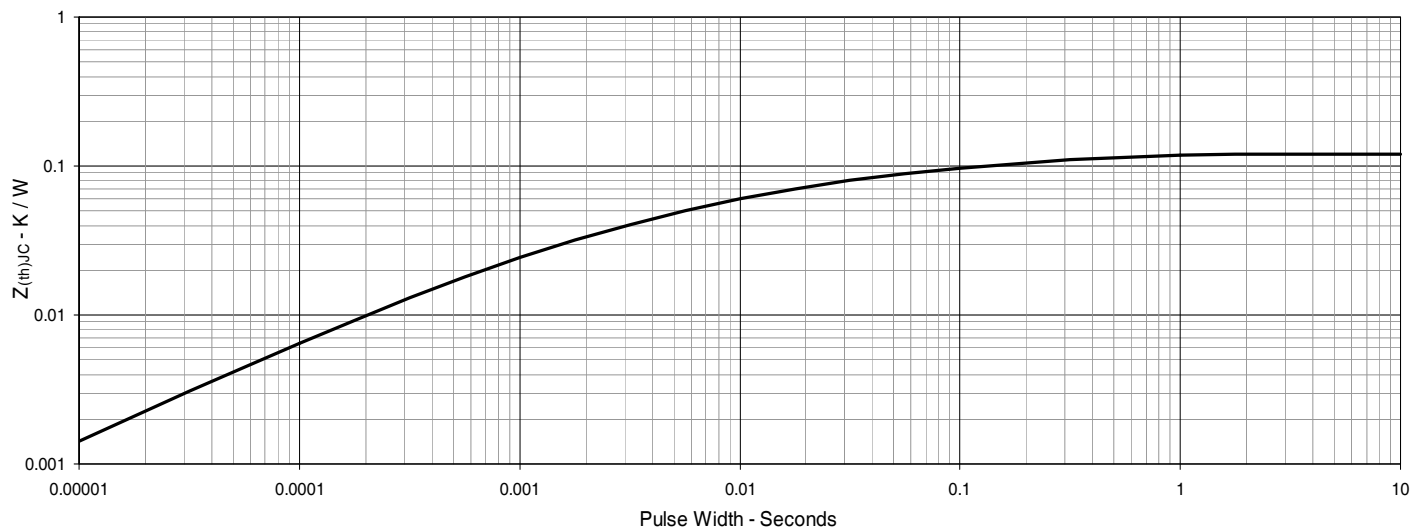
**Fig. 13. Output Capacitance Stored Energy**



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



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





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