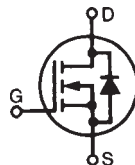


# Polar™ Power MOSFET

## HiPerFET™

**IXFV22N50P**  
**IXFV22N50PS**  
**IXFH22N50P**

N-Channel Enhancement Mode  
Avalanche Rated  
Fast Intrinsic Diode

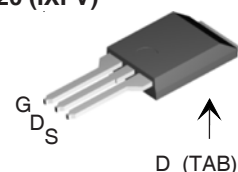


| Symbol     | Test Conditions                                                                  | Maximum Ratings  |                    |
|------------|----------------------------------------------------------------------------------|------------------|--------------------|
| $V_{DSS}$  | $T_J = 25^{\circ}\text{C}$ to $150^{\circ}\text{C}$                              | 500              | V                  |
| $V_{DGR}$  | $T_J = 25^{\circ}\text{C}$ to $150^{\circ}\text{C}$ , $R_{GS} = 1\text{M}\Omega$ | 500              | V                  |
| $V_{GSS}$  | Continuous                                                                       | $\pm 30$         | V                  |
| $V_{GSM}$  | Transient                                                                        | $\pm 40$         | V                  |
| $I_{D25}$  | $T_C = 25^{\circ}\text{C}$                                                       | 22               | A                  |
| $I_{DM}$   | $T_C = 25^{\circ}\text{C}$ , Pulse Width Limited by $T_{JM}$                     | 50               | A                  |
| $I_A$      | $T_C = 25^{\circ}\text{C}$                                                       | 22               | A                  |
| $E_{AS}$   | $T_C = 25^{\circ}\text{C}$                                                       | 750              | mJ                 |
| $dV/dt$    | $I_S \leq I_{DM}$ , $V_{DD} \leq V_{DSS}$ , $T_J \leq 150^{\circ}\text{C}$       | 10               | V/ns               |
| $P_D$      | $T_C = 25^{\circ}\text{C}$                                                       | 350              | 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              | $^{\circ}\text{C}$ |
| $T_{SOLD}$ | Plastic Body for 10s                                                             | 260              | $^{\circ}\text{C}$ |
| $M_d$      | Mounting Torque (TO-247)                                                         | 1.13/10          | Nm/lb.in.          |
| $F_C$      | Mounting Force (PLUS 220)                                                        | 11..65/2.5..14.6 | N/lb.              |
| Weight     | TO-247                                                                           | 6                | g                  |
|            | PLUS 220 types                                                                   | 4                | g                  |

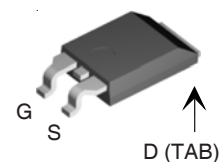
| Symbol       | Test Conditions<br>( $T_J = 25^{\circ}\text{C}$ , Unless Otherwise Specified) | Characteristic Values |      |                                       |
|--------------|-------------------------------------------------------------------------------|-----------------------|------|---------------------------------------|
|              |                                                                               | Min.                  | Typ. | Max.                                  |
| $BV_{DSS}$   | $V_{GS} = 0\text{V}$ , $I_D = 250\mu\text{A}$                                 | 500                   |      | V                                     |
| $V_{GS(th)}$ | $V_{DS} = V_{GS}$ , $I_D = 2.5\text{mA}$                                      | 3.0                   |      | 5.5 V                                 |
| $I_{GSS}$    | $V_{GS} = \pm 30\text{V}$ , $V_{DS} = 0\text{V}$                              |                       |      | $\pm 100$ nA                          |
| $I_{DSS}$    | $V_{DS} = V_{DSS}$ , $V_{GS} = 0\text{V}$<br>$T_J = 125^{\circ}\text{C}$      |                       |      | 15 $\mu\text{A}$<br>250 $\mu\text{A}$ |
| $R_{DS(on)}$ | $V_{GS} = 10\text{V}$ , $I_D = 0.5 \cdot I_{D25}$ , Note 1                    |                       |      | 270 m $\Omega$                        |

$$\begin{aligned} V_{DSS} &= 500\text{V} \\ I_{D25} &= 22\text{A} \\ R_{DS(on)} &\leq 270\text{m}\Omega \\ t_{rr} &\leq 200\text{ns} \end{aligned}$$

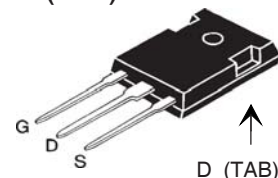
PLUS220 (IXFV)



PLUS220SMD (IXFV\_S)



TO-247 (IXFH)



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

### Features

- International Standard Packages
- Avalanche Rated
- Fast Intrinsic Diode
- Low Package Inductance

### Advantages

- High Power Density
- Easy to Mount
- Space Savings

### Applications

- Switched-Mode and Resonant-Mode Power Supplies
- DC-DC Converters
- Laser Drivers
- AC and DC Motor Drives
- Robotics and Servo Controls

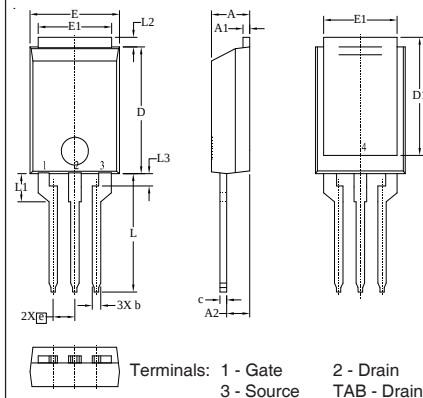
| Symbol       | Test Conditions<br>( $T_J = 25^\circ\text{C}$ Unless Otherwise Specified)                                                                     | Characteristic Values |      |                        |
|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|------|------------------------|
|              |                                                                                                                                               | Min.                  | Typ. | Max.                   |
| $g_{fs}$     | $V_{DS} = 20\text{V}, I_D = 0.5 \cdot I_{D25}$ , Note 1                                                                                       | 12                    | 20   | S                      |
| $C_{iss}$    | $V_{GS} = 0\text{V}, V_{DS} = 25\text{V}, f = 1\text{MHz}$                                                                                    |                       | 2880 | pF                     |
| $C_{oss}$    |                                                                                                                                               |                       | 310  | pF                     |
| $C_{rss}$    |                                                                                                                                               |                       | 29   | pF                     |
| $t_{d(on)}$  | <b>Resistive Switching Times</b><br>$V_{GS} = 10\text{V}, V_{DS} = 0.5 \cdot V_{DSS}, I_D = 0.5 \cdot I_{D25}$<br>$R_G = 10\Omega$ (External) |                       | 22   | ns                     |
| $t_r$        |                                                                                                                                               |                       | 25   | ns                     |
| $t_{d(off)}$ |                                                                                                                                               |                       | 72   | ns                     |
| $t_f$        |                                                                                                                                               |                       | 21   | ns                     |
| $Q_{g(on)}$  | $V_{GS} = 10\text{V}, V_{DS} = 0.5 \cdot V_{DSS}, I_D = 0.5 \cdot I_{D25}$                                                                    |                       | 50   | nC                     |
| $Q_{gs}$     |                                                                                                                                               |                       | 16   | nC                     |
| $Q_{gd}$     |                                                                                                                                               |                       | 18   | nC                     |
| $R_{thJC}$   | (TO-247 & PLUS220)                                                                                                                            |                       |      | $0.35^\circ\text{C/W}$ |
| $R_{thCS}$   |                                                                                                                                               | 0.25                  |      | $^\circ\text{C/W}$     |

### Source-Drain Diode

| Symbol   | Test Conditions<br>( $T_J = 25^\circ\text{C}$ Unless Otherwise Specified)                       | Characteristic Values |      |               |
|----------|-------------------------------------------------------------------------------------------------|-----------------------|------|---------------|
|          |                                                                                                 | Min.                  | Typ. | Max.          |
| $I_S$    | $V_{GS} = 0\text{V}$                                                                            |                       |      | 22 A          |
| $I_{SM}$ | Repetitive, Pulse Width Limited by $T_{JM}$                                                     |                       |      | 88 A          |
| $V_{SD}$ | $I_F = I_S, V_{GS} = 0\text{V}$ , Note 1                                                        |                       |      | 1.5 V         |
| $t_{rr}$ | $I_F = 22\text{A}, -di/dt = 100\text{A}/\mu\text{s}$<br>$V_R = 100\text{V}, V_{GS} = 0\text{V}$ |                       |      | 200 ns        |
| $Q_{RM}$ |                                                                                                 |                       | 0.7  | $\mu\text{C}$ |
| $I_{RM}$ |                                                                                                 |                       | 7.0  | A             |

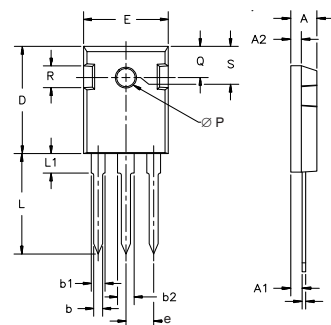
Note 1: Pulse test,  $t \leq 300\mu\text{s}$ ; duty cycle,  $d \leq 2\%$ .

### PLUS220 (IXFV) Outline



| SYM | INCHES |      | MILLIMETER |       |
|-----|--------|------|------------|-------|
|     | MIN    | MAX  | MIN        | MAX   |
| A   | .169   | .185 | 4.30       | 4.70  |
| A1  | .028   | .035 | 0.70       | 0.90  |
| A2  | .098   | .118 | 2.50       | 3.00  |
| b   | .035   | .047 | 0.90       | 1.20  |
| c   | .028   | .035 | 0.70       | 0.90  |
| D   | .551   | .591 | 14.00      | 15.00 |
| D1  | .512   | .539 | 13.00      | 13.70 |
| E   | .394   | .433 | 10.00      | 11.00 |
| E1  | .331   | .346 | 8.40       | 8.80  |
| e   | .100   | BSC  | 2.54       | BSC   |
| L   | .512   | .551 | 13.00      | 14.00 |
| L1  | .118   | .138 | 3.00       | 3.50  |
| L2  | .035   | .051 | 0.90       | 1.30  |
| L3  | .047   | .059 | 1.20       | 1.50  |

### TO-247 (IXFH) Outline



| 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  |
| L <sub>1</sub> |            | 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   |

### PLUS220SMD (IXFV\_S) Outline

| SYM | INCHES |      | MILLIMETER |       |
|-----|--------|------|------------|-------|
|     | MIN    | MAX  | MIN        | MAX   |
| A   | .169   | .185 | 4.30       | 4.70  |
| A1  | .028   | .035 | 0.70       | 0.90  |
| A2  | .098   | .118 | 2.50       | 3.00  |
| A3  | .000   | .010 | 0.00       | 0.25  |
| b   | .035   | .047 | 0.90       | 1.20  |
| c   | .028   | .035 | 0.70       | 0.90  |
| D   | .551   | .591 | 14.00      | 15.00 |
| D1  | .512   | .539 | 13.00      | 13.70 |
| E   | .394   | .433 | 10.00      | 11.00 |
| E1  | .331   | .346 | 8.40       | 8.80  |
| e   | .200   | BSC  | 5.08       | BSC   |
| L   | .209   | .228 | 5.30       | 5.80  |
| L1  | .118   | .138 | 3.00       | 3.50  |
| L2  | .035   | .051 | 0.90       | 1.30  |
| L3  | .047   | .059 | 1.20       | 1.50  |
| L4  | .039   | .059 | 1.00       | 1.50  |

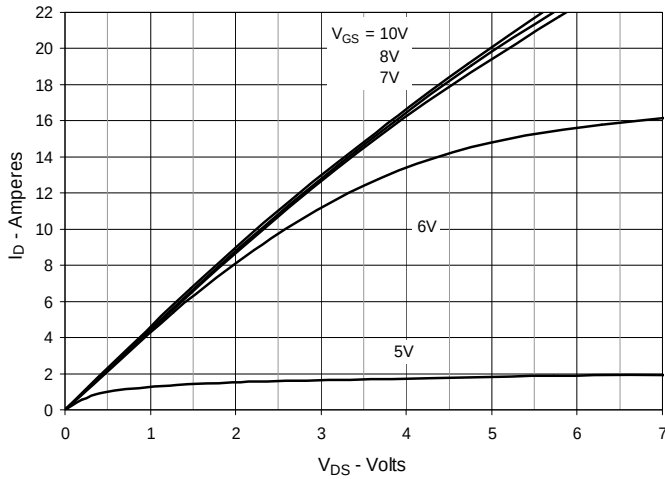
Terminals: 1 - Gate 2 - Drain  
3 - Source TAB - Drain

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

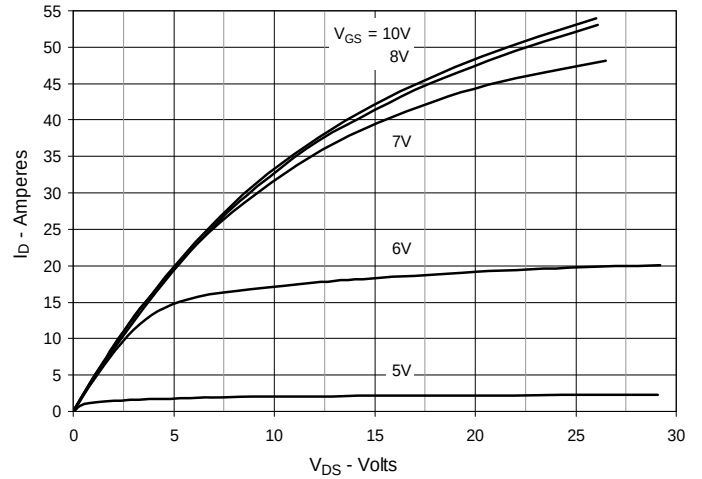
IXYS MOSFETs and IGBTs are covered by one or more of the following U.S. patents:

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

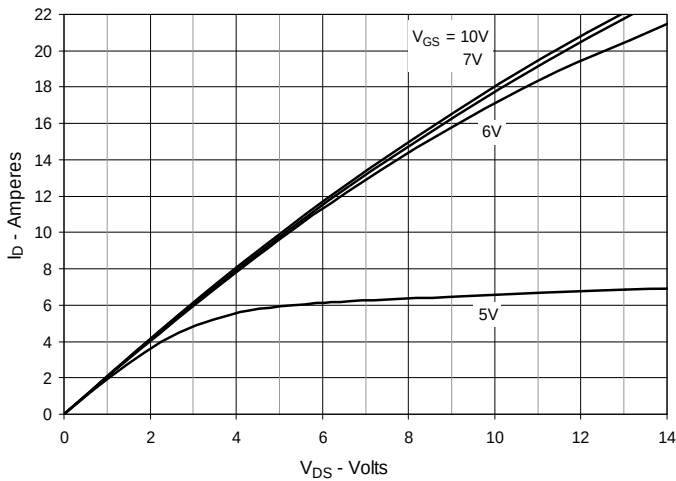
**Fig. 1. Output Characteristics  
@ 25°C**



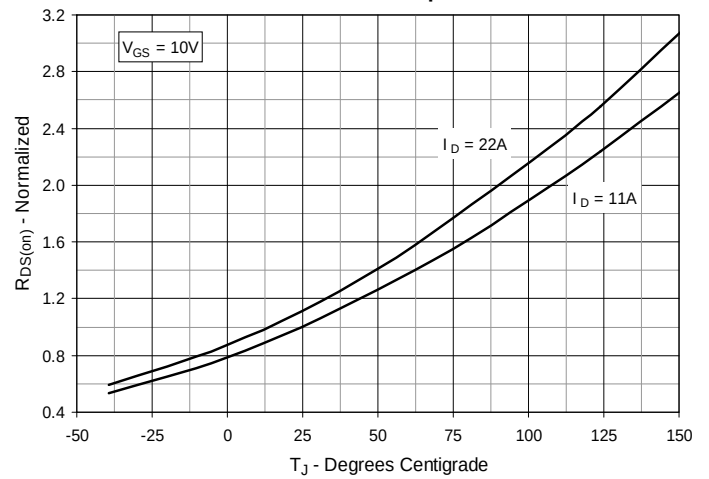
**Fig. 2. Extended Output Characteristics  
@ 25°C**



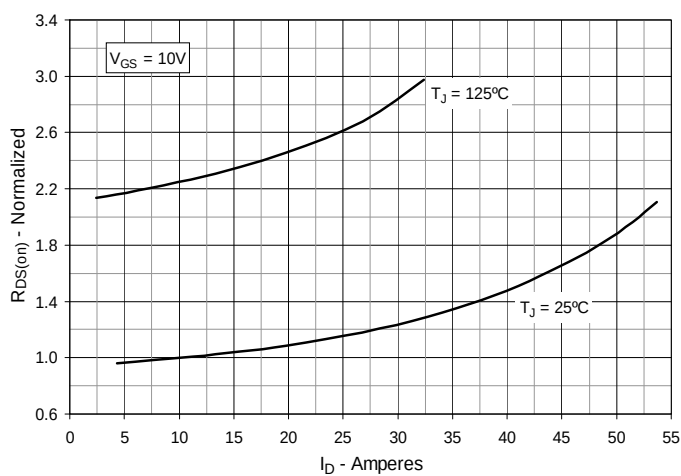
**Fig. 3. Output Characteristics  
@ 125°C**



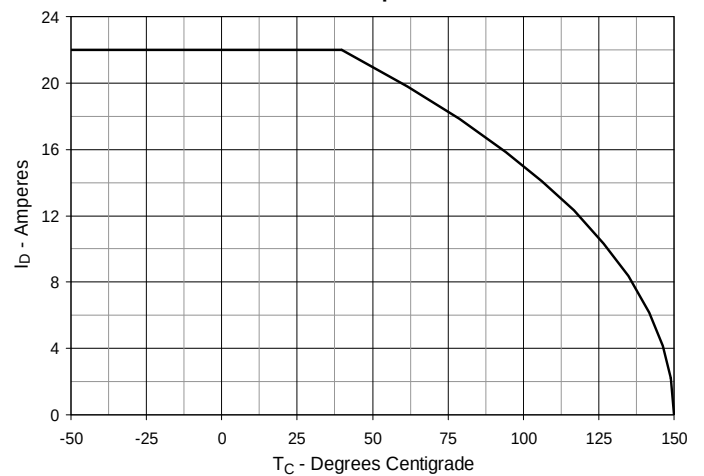
**Fig. 4.  $R_{DS(on)}$  Normalized to  $I_D = 11A$  Value  
vs. Junction Temperature**



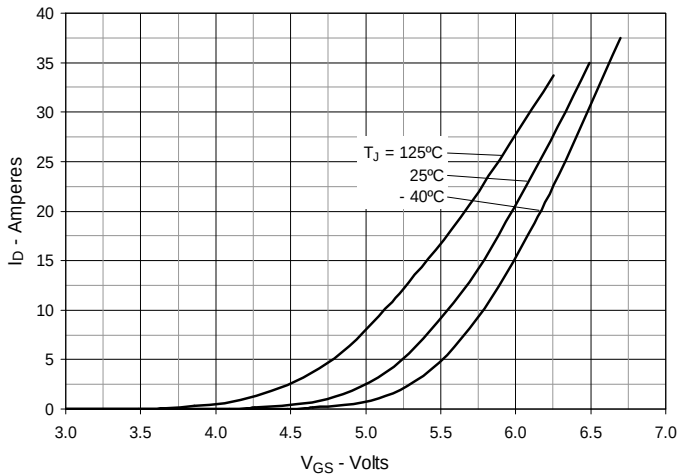
**Fig. 5.  $R_{DS(on)}$  Normalized to  $I_D = 11A$  Value  
vs. Drain Current**



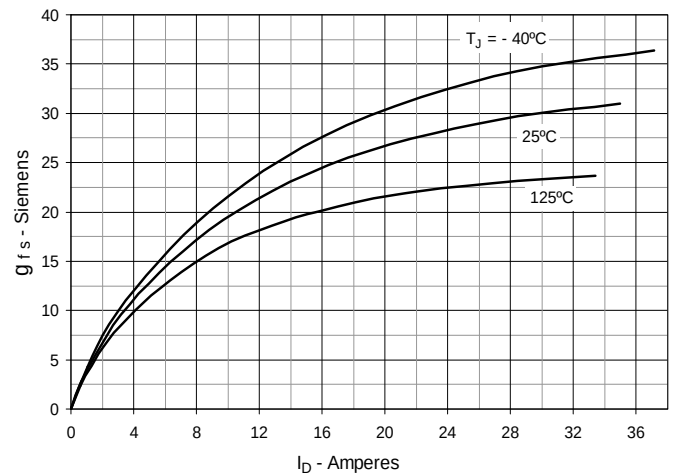
**Fig. 6. Maximum Drain Current vs.  
Case Temperature**



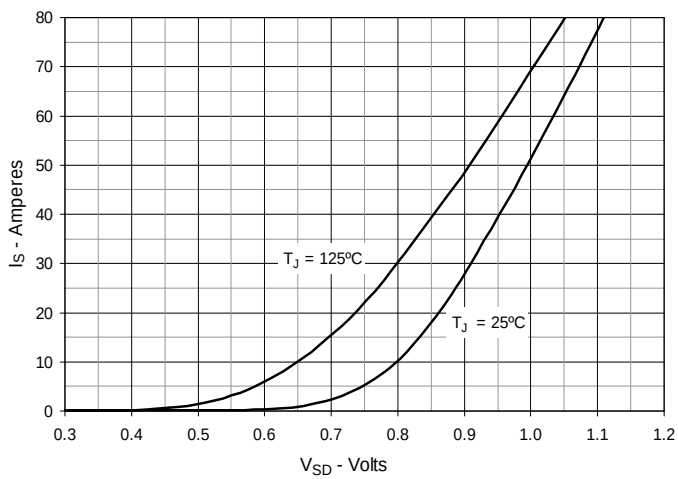
**Fig. 7. Input Admittance**



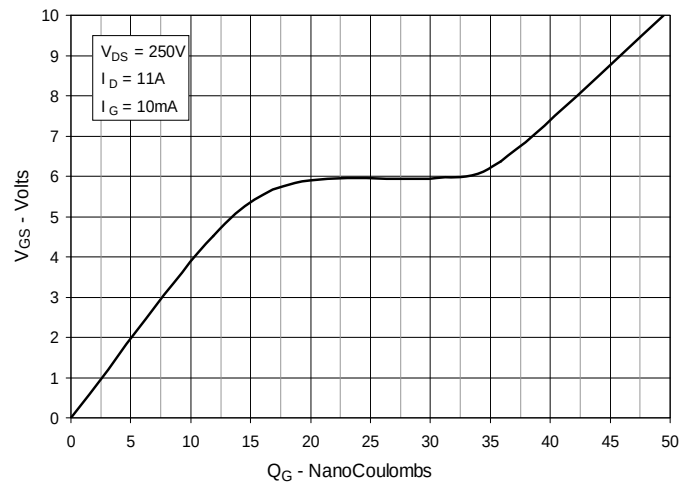
**Fig. 8. Transconductance**



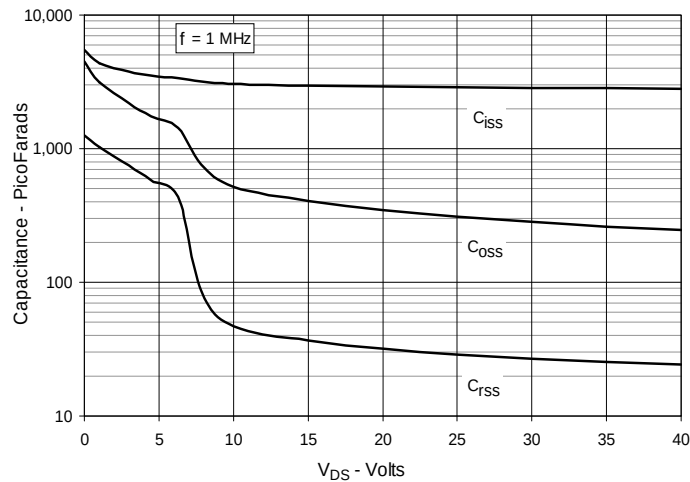
**Fig. 9. Forward Voltage Drop of Intrinsic Diode**



**Fig. 10. Gate Charge**



**Fig. 11. Capacitance**



**Fig. 12. Forward-Bias Safe Operating Area**

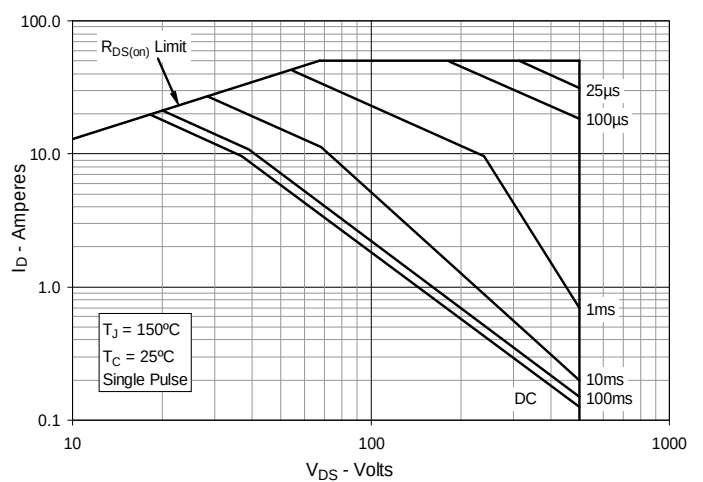
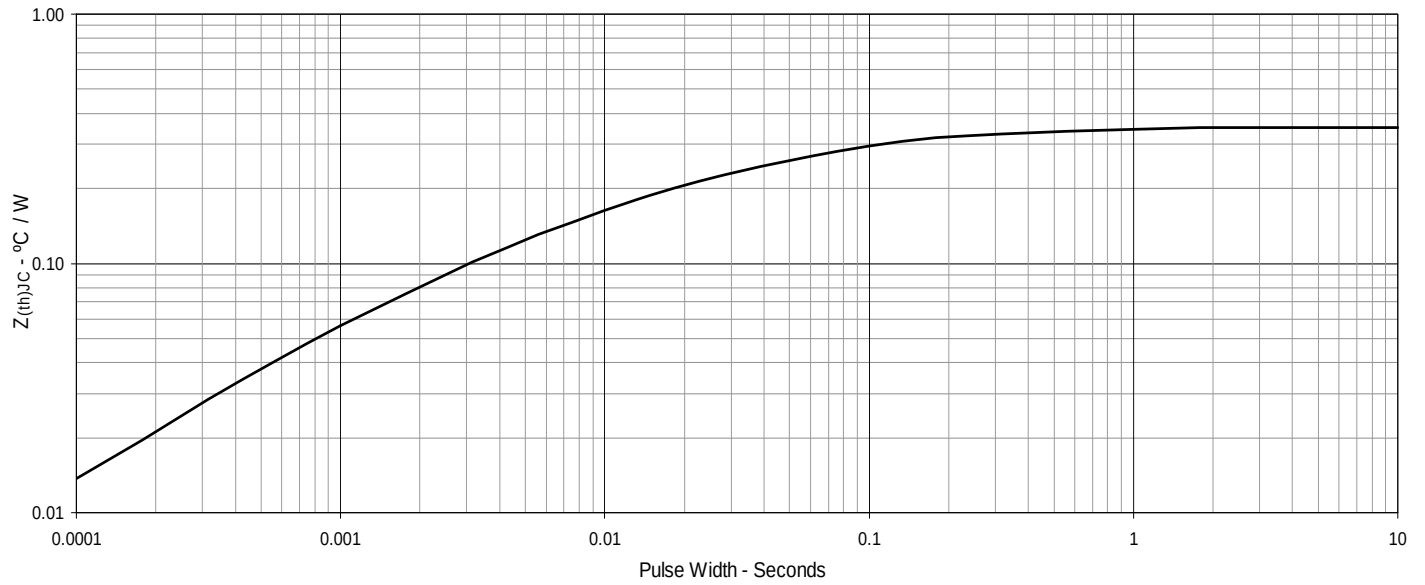


Fig. 13. Maximum Transient Thermal Impedance





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