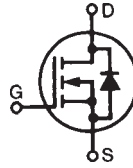


# Polar3™ HiPerFET™ Power MOSFETs

**IXFA16N50P3**  
**IXFP16N50P3**  
**IXFH16N50P3**

$$\begin{aligned}
 V_{DSS} &= 500V \\
 I_{D25} &= 16A \\
 R_{DS(on)} &\leq 360m\Omega
 \end{aligned}$$

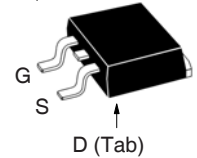
N-Channel Enhancement Mode  
Avalanche Rated  
Fast Intrinsic Rectifier



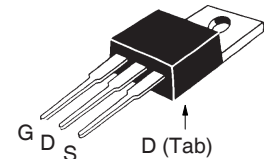
| Symbol        | Test Conditions                                                          | Maximum Ratings    |                  |
|---------------|--------------------------------------------------------------------------|--------------------|------------------|
| $V_{DSS}$     | $T_J = 25^\circ\text{C}$ 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                                                               | $\pm 30$           | V                |
| $V_{GSM}$     | Transient                                                                | $\pm 40$           | V                |
| $I_{D25}$     | $T_C = 25^\circ\text{C}$                                                 | 16                 | A                |
| $I_{DM}$      | $T_C = 25^\circ\text{C}$ , Pulse Width Limited by $T_{JM}$               | 40                 | A                |
| $I_A$         | $T_C = 25^\circ\text{C}$                                                 | 8                  | A                |
| $E_{AS}$      | $T_C = 25^\circ\text{C}$                                                 | 300                | mJ               |
| $dv/dt$       | $I_S \leq I_{DM}$ , $V_{DD} \leq V_{DSS}$ , $T_J \leq 150^\circ\text{C}$ | 35                 | V/ns             |
| $P_D$         | $T_C = 25^\circ\text{C}$                                                 | 330                | 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                | $^\circ\text{C}$ |
| $F_C$         | Mounting Force (TO-263)                                                  | 10..65 / 2.2..14.6 | N/lb             |
| $M_d$         | Mounting Torque (TO-220 & TO-247)                                        | 1.13 / 10          | Nm/lb.in         |
| <b>Weight</b> | TO-263                                                                   | 2.5                | g                |
|               | TO-220                                                                   | 3.0                | g                |
|               | TO-247                                                                   | 6.0                | g                |

| Symbol       | Test Conditions<br>( $T_J = 25^\circ\text{C}$ , Unless Otherwise Specified) | Characteristic Values |      |                           |
|--------------|-----------------------------------------------------------------------------|-----------------------|------|---------------------------|
|              |                                                                             | Min.                  | Typ. | Max.                      |
| $BV_{DSS}$   | $V_{GS} = 0V$ , $I_D = 1mA$                                                 | 500                   |      | V                         |
| $V_{GS(th)}$ | $V_{DS} = V_{GS}$ , $I_D = 2.5mA$                                           | 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>$T_J = 125^\circ\text{C}$             |                       |      | 15 $\mu A$<br>250 $\mu A$ |
| $R_{DS(on)}$ | $V_{GS} = 10V$ , $I_D = 0.5 \cdot I_{D25}$ , Note 1                         |                       |      | 360 m $\Omega$            |

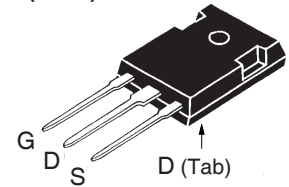
TO-263 AA (IXFA)



TO-220AB (IXFP)



TO-247 (IXFH)



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

## Features

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

## Advantages

- High Power Density
- Easy to Mount
- Space Savings

## Applications

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

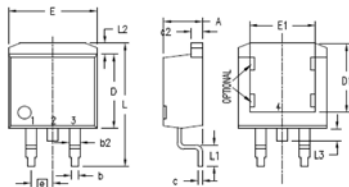
| Symbol       | Test Conditions<br>( $T_J = 25^\circ\text{C}$ , Unless Otherwise Specified)                                                                         | Characteristic Values |      |                        |
|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|------|------------------------|
|              |                                                                                                                                                     | Min.                  | Typ. | Max                    |
| $g_{fs}$     | $V_{DS} = 20\text{V}$ , $I_D = 0.5 \cdot I_{D25}$ , Note 1                                                                                          | 9                     | 15   | S                      |
| $R_{Gi}$     | Gate Input Resistance                                                                                                                               |                       | 2.8  | $\Omega$               |
| $C_{iss}$    | $V_{GS} = 0\text{V}$ , $V_{DS} = 25\text{V}$ , $f = 1\text{MHz}$                                                                                    |                       | 1515 | pF                     |
| $C_{oss}$    |                                                                                                                                                     |                       | 193  | pF                     |
| $C_{rss}$    |                                                                                                                                                     |                       | 7    | 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) |                       | 19   | ns                     |
| $t_r$        |                                                                                                                                                     |                       | 6    | ns                     |
| $t_{d(off)}$ |                                                                                                                                                     |                       | 44   | ns                     |
| $t_f$        |                                                                                                                                                     |                       | 9    | ns                     |
| $Q_{g(on)}$  | $V_{GS} = 10\text{V}$ , $V_{DS} = 0.5 \cdot V_{DSS}$ , $I_D = 0.5 \cdot I_{D25}$                                                                    |                       | 29   | nC                     |
| $Q_{gs}$     |                                                                                                                                                     |                       | 7    | nC                     |
| $Q_{gd}$     |                                                                                                                                                     |                       | 10   | nC                     |
| $R_{thJC}$   |                                                                                                                                                     |                       |      | $0.38^\circ\text{C/W}$ |
| $R_{thCS}$   | TO-220                                                                                                                                              |                       | 0.50 | $^\circ\text{C/W}$     |
|              | TO-247                                                                                                                                              |                       | 0.21 | $^\circ\text{C/W}$     |

## Source-Drain Diode

| Symbol   | Test Conditions<br>( $T_J = 25^\circ\text{C}$ , Unless Otherwise Specified)   | Characteristic Values |      |               |
|----------|-------------------------------------------------------------------------------|-----------------------|------|---------------|
|          |                                                                               | Min.                  | Typ. | Max           |
| $I_s$    | $V_{GS} = 0\text{V}$ , Note 1                                                 |                       |      | 16 A          |
| $I_{SM}$ | Repetitive, Pulse Width Limited by $T_{JM}$                                   |                       |      | 64 A          |
| $V_{SD}$ | $I_F = I_s$ , $V_{GS} = 0\text{V}$ , Note 1                                   |                       |      | 1.4 V         |
| $t_{rr}$ | $I_F = 8\text{A}$ , $-di/dt = 100\text{A}/\mu\text{s}$<br>$V_R = 100\text{V}$ |                       | 0.8  | 250 ns        |
| $Q_{RM}$ |                                                                               |                       | 8.7  | $\mu\text{C}$ |
| $I_{RM}$ |                                                                               |                       |      | A             |

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

## TO-263 Outline



- 1 = Gate  
2 = Drain  
3 = Source  
4 = Drain

| SYM | INCHES   |      | MILLIMETERS |       |
|-----|----------|------|-------------|-------|
|     | MIN      | MAX  | MIN         | MAX   |
| A   | .160     | .190 | 4.06        | 4.83  |
| A1  | .080     | .110 | 2.03        | 2.79  |
| b   | .020     | .039 | 0.51        | 0.99  |
| b2  | .045     | .055 | 1.14        | 1.40  |
| c   | .016     | .029 | 0.40        | 0.74  |
| c2  | .045     | .055 | 1.14        | 1.40  |
| D   | .340     | .380 | 8.64        | 9.65  |
| D1  | .315     | .350 | 8.00        | 8.89  |
| E   | .380     | .410 | 9.65        | 10.41 |
| E1  | .245     | .320 | 6.22        | 8.13  |
| e   | .100 BSC |      | 2.54 BSC    |       |
| L   | .575     | .625 | 14.61       | 15.88 |
| L1  | .090     | .110 | 2.29        | 2.79  |
| L2  | .040     | .055 | 1.02        | 1.40  |
| L3  | .050     | .070 | 1.27        | 1.78  |
| L4  | 0        | .005 | 0           | 0.13  |

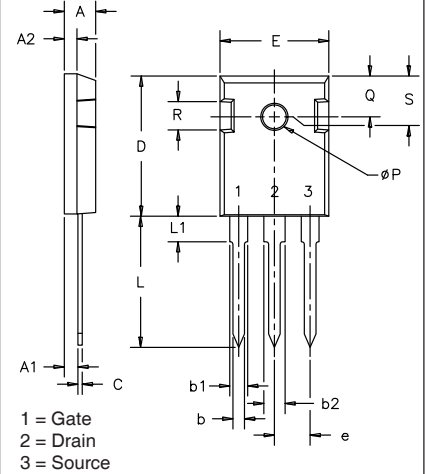
## PRELIMINARY TECHNICAL INFORMATION

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   |             |

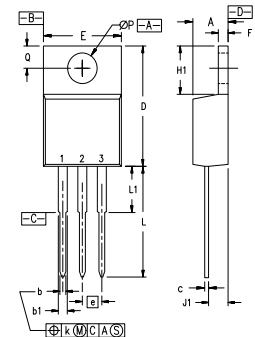
## TO-247 Outline



- 1 = Gate  
2 = Drain  
3 = Source

| SYM      | INCHES   |      | MILLIMETERS |       |
|----------|----------|------|-------------|-------|
|          | MIN      | MAX  | MIN         | MAX   |
| A        | .185     | .209 | 4.7         | 5.3   |
| A1       | .087     | .102 | 2.2         | 2.54  |
| A2       | .059     | .098 | 2.2         | 2.6   |
| b        | .040     | .055 | 1.0         | 1.4   |
| b1       | .065     | .084 | 1.65        | 2.13  |
| b2       | .113     | .123 | 2.87        | 3.12  |
| c        | .016     | .031 | .4          | .8    |
| D        | .819     | .845 | 20.80       | 21.46 |
| E        | .610     | .640 | 15.75       | 16.26 |
| e        | .215 BSC |      | 5.45 BSC    |       |
| L        | .780     | .800 | 19.81       | 20.32 |
| L1       |          | .177 |             | 4.50  |
| $\phi P$ | .140     | .144 | 3.55        | 3.65  |
| Q        | .212     | .244 | 5.4         | 6.2   |
| R        | .170     | .216 | 4.32        | 5.49  |
| S        | .242 BSC |      | 6.15 BSC    |       |

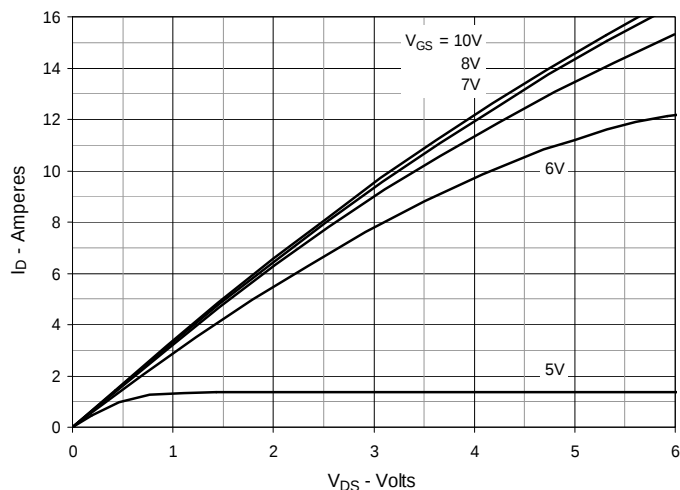
## TO-220 Outline



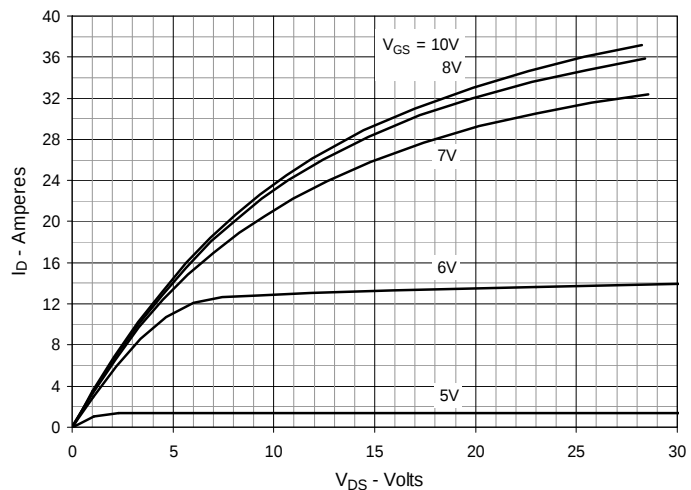
- Pins: 1 - Gate  
2 - Drain  
3 - Source

| SYM      | INCHES   |      | MILLIMETERS |       |
|----------|----------|------|-------------|-------|
|          | MIN      | MAX  | MIN         | MAX   |
| A        | .170     | .190 | 4.32        | 4.83  |
| b        | .025     | .040 | 0.64        | 1.02  |
| b1       | .045     | .065 | 1.15        | 1.65  |
| c        | .014     | .022 | 0.35        | 0.56  |
| D        | .580     | .630 | 14.73       | 16.00 |
| E        | .390     | .420 | 9.91        | 10.66 |
| e        | .100 BSC |      | 2.54 BSC    |       |
| F        | .045     | .055 | 1.14        | 1.40  |
| H1       | .230     | .270 | 5.85        | 6.85  |
| J1       | .090     | .110 | 2.29        | 2.79  |
| k        | 0        | .015 | 0           | 0.38  |
| L        | .500     | .550 | 12.70       | 13.97 |
| L1       | .110     | .230 | 2.79        | 5.84  |
| $\phi P$ | .139     | .161 | 3.53        | 4.08  |
| Q        | .100     | .125 | 2.54        | 3.18  |

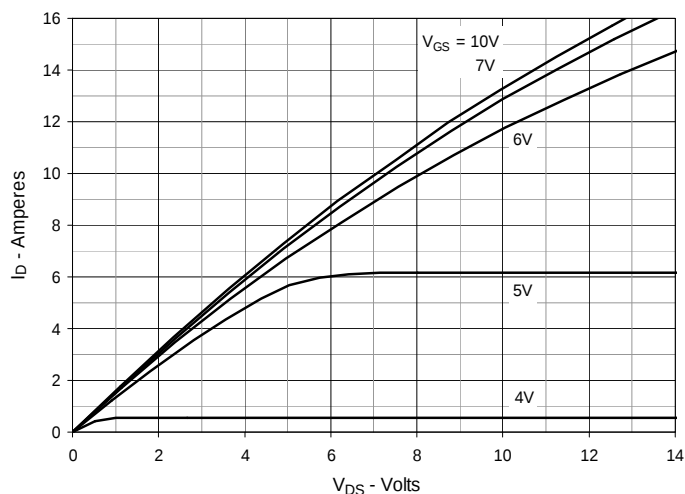
**Fig. 1. Output Characteristics @  $T_J = 25^\circ\text{C}$**



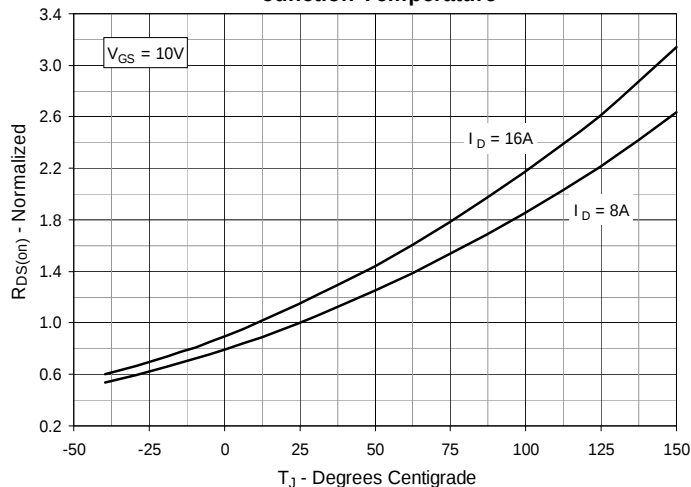
**Fig. 2. Extended Output Characteristics @  $T_J = 25^\circ\text{C}$**



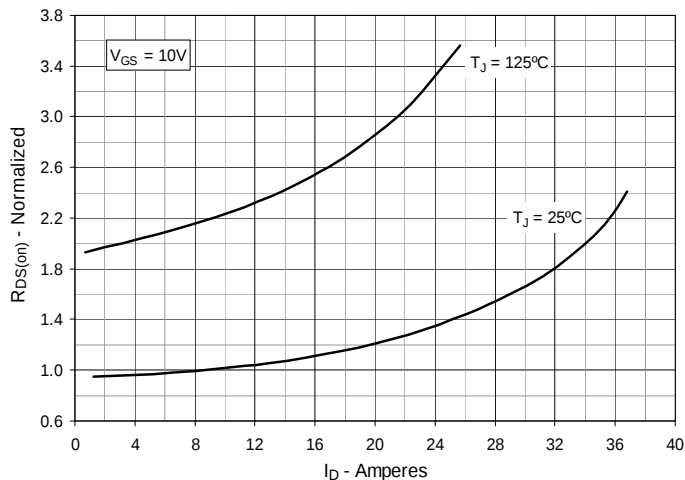
**Fig. 3. Output Characteristics @  $T_J = 125^\circ\text{C}$**



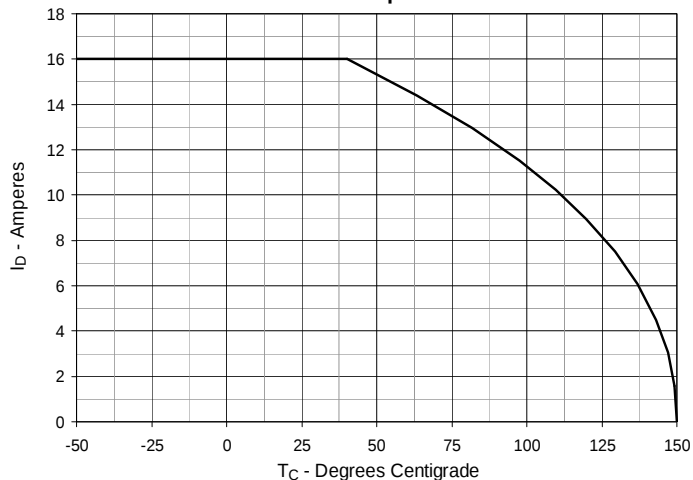
**Fig. 4.  $R_{DS(on)}$  Normalized to  $I_D = 8\text{A}$  Value vs. Junction Temperature**



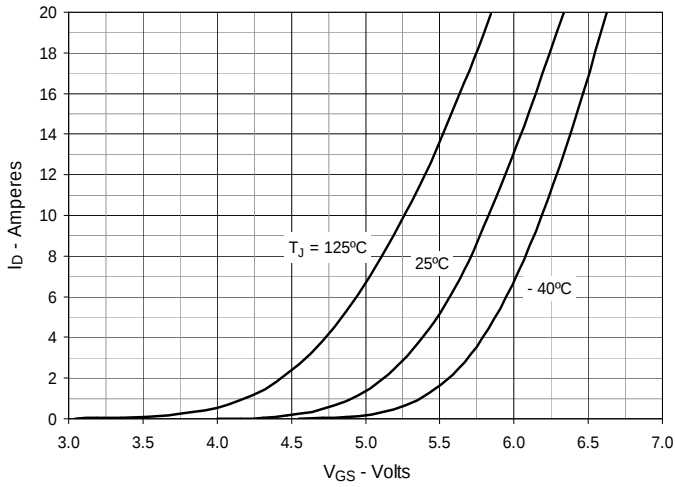
**Fig. 5.  $R_{DS(on)}$  Normalized to  $I_D = 8\text{A}$  Value vs. Drain Current**



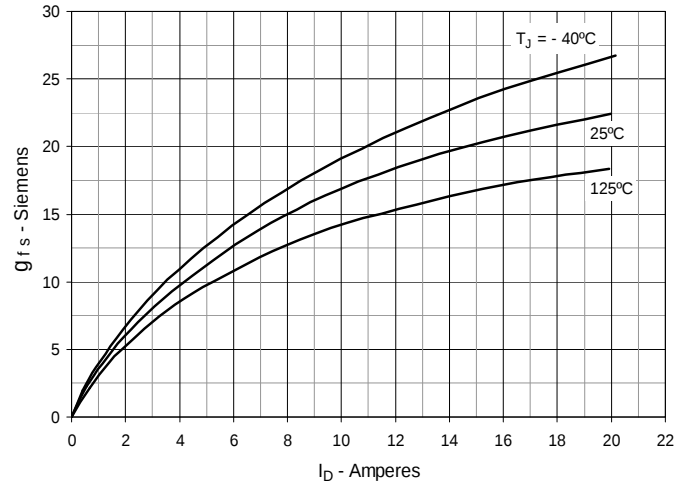
**Fig. 6. Maximum Drain Current vs. Case Temperature**



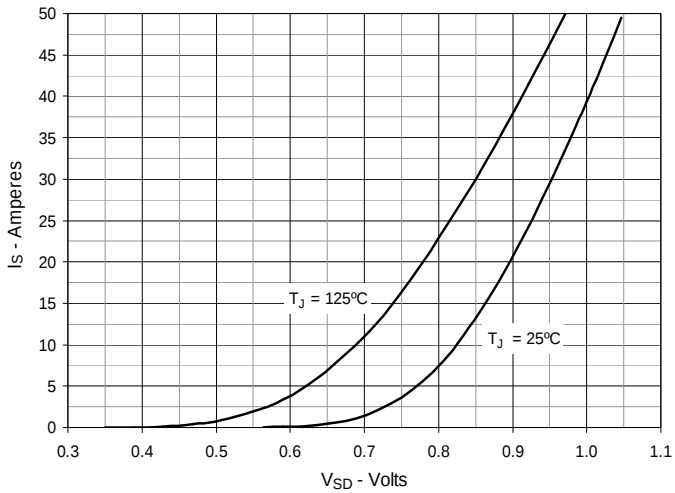
**Fig. 7. Input Admittance**



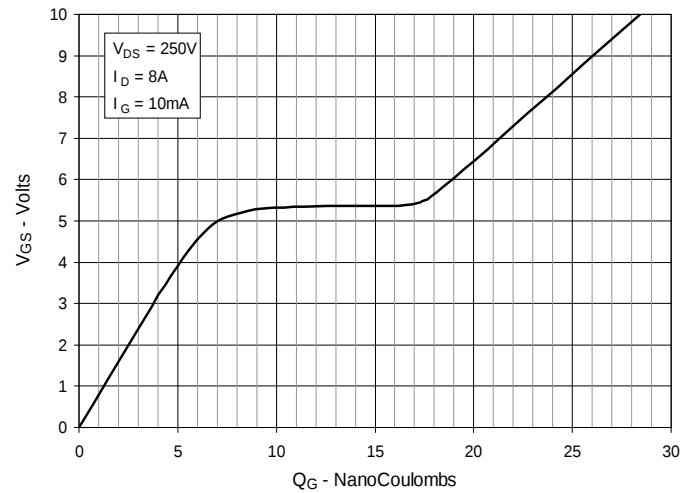
**Fig. 8. Transconductance**



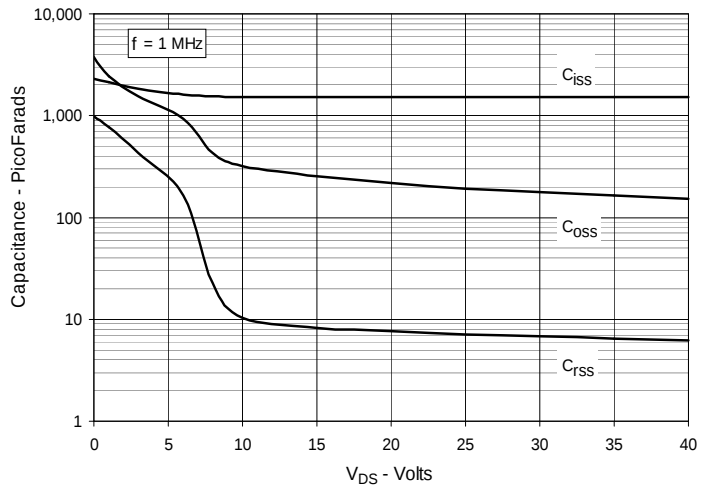
**Fig. 9. Forward Voltage Drop of Intrinsic Diode**



**Fig. 10. Gate Charge**



**Fig. 11. Capacitance**



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

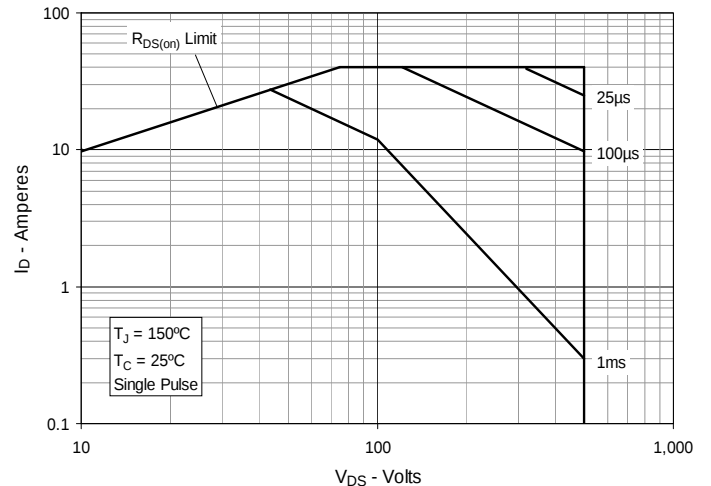


Fig. 13. Maximum Transient Thermal Impedance

