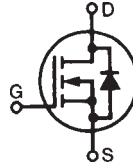


# Polar3™ HiPerFET™ Power MOSFETs

IXFY4N60P3  
IXFA4N60P3  
IXFP4N60P3

$$\begin{aligned} V_{DSS} &= 600V \\ I_{D25} &= 4A \\ R_{DS(on)} &\leq 2.2\Omega \end{aligned}$$

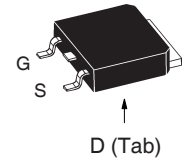
N-Channel Enhancement Mode  
Avalanche Rated  
Fast Intrinsic Rectifier



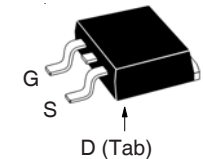
| Symbol     | Test Conditions                                                          | Maximum Ratings  |                  |
|------------|--------------------------------------------------------------------------|------------------|------------------|
| $V_{DSS}$  | $T_J = 25^\circ\text{C}$ to $150^\circ\text{C}$                          | 600              | V                |
| $V_{DGR}$  | $T_J = 25^\circ\text{C}$ to $150^\circ\text{C}$ , $R_{GS} = 1M\Omega$    | 600              | V                |
| $V_{GSS}$  | Continuous                                                               | $\pm 30$         | V                |
| $V_{GSM}$  | Transient                                                                | $\pm 40$         | V                |
| $I_{D25}$  | $T_C = 25^\circ\text{C}$                                                 | 4                | A                |
| $I_{DM}$   | $T_C = 25^\circ\text{C}$ , Pulse Width Limited by $T_{JM}$               | 8                | A                |
| $I_A$      | $T_C = 25^\circ\text{C}$                                                 | 2                | A                |
| $E_{AS}$   | $T_C = 25^\circ\text{C}$                                                 | 200              | mJ               |
| $dv/dt$    | $I_S \leq I_{DM}$ , $V_{DD} \leq V_{DSS}$ , $T_J \leq 150^\circ\text{C}$ | 35               | V/ns             |
| $P_D$      | $T_C = 25^\circ\text{C}$                                                 | 114              | W                |
| $T_J$      |                                                                          | $-55 \dots +150$ | $^\circ\text{C}$ |
| $T_{JM}$   |                                                                          | 150              | $^\circ\text{C}$ |
| $T_{stg}$  |                                                                          | $-55 \dots +150$ | $^\circ\text{C}$ |
| $T_L$      | 1.6mm (0.062) from Case for 10s                                          | 300              | $^\circ\text{C}$ |
| $T_{SOLD}$ | Plastic Body for 10s                                                     | 260              | $^\circ\text{C}$ |
| $M_d$      | Mounting Torque (TO-220)                                                 | 1.13 / 10        | Nm/lb.in.        |
| Weight     | TO-252                                                                   | 0.35             | g                |
|            | TO-263                                                                   | 2.50             | g                |
|            | TO-220                                                                   | 3.00             | g                |

| Symbol       | Test Conditions<br>( $T_J = 25^\circ\text{C}$ , Unless Otherwise Specified) | Characteristic Values |      |                           |
|--------------|-----------------------------------------------------------------------------|-----------------------|------|---------------------------|
|              |                                                                             | Min.                  | Typ. | Max.                      |
| $BV_{DSS}$   | $V_{GS} = 0V$ , $I_D = 1mA$                                                 | 600                   |      | 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>$T_J = 125^\circ\text{C}$             |                       |      | 10 $\mu A$<br>100 $\mu A$ |
| $R_{DS(on)}$ | $V_{GS} = 10V$ , $I_D = 0.5 \cdot I_{D25}$ , Note 1                         |                       |      | 2.2 $\Omega$              |

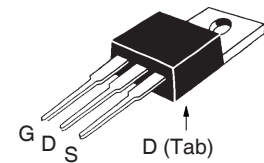
## TO-252 (IXFY)



## TO-263 AA (IXFA)



## TO-220AB (IXFP)



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

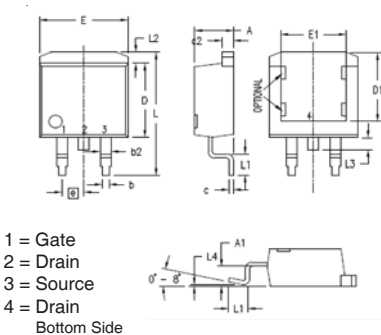
| Symbol       | Test Conditions<br>( $T_J = 25^\circ\text{C}$ , Unless Otherwise Specified)                                                                         | Characteristic Values |      |                         |
|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|------|-------------------------|
|              |                                                                                                                                                     | Min.                  | Typ. | Max                     |
| $g_{fs}$     | $V_{DS} = 20\text{V}$ , $I_D = 0.5 \cdot I_{D25}$ , Note 1                                                                                          | 2.2                   | 3.7  | S                       |
| $R_{Gi}$     | Gate Input Resistance                                                                                                                               |                       | 6.0  | $\Omega$                |
| $C_{iss}$    | $V_{GS} = 0\text{V}$ , $V_{DS} = 25\text{V}$ , $f = 1\text{MHz}$                                                                                    |                       | 365  | pF                      |
| $C_{oss}$    |                                                                                                                                                     |                       | 46   | pF                      |
| $C_{rss}$    |                                                                                                                                                     |                       | 3    | 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>$R_G = 30\Omega$ (External) |                       | 15   | ns                      |
| $t_r$        |                                                                                                                                                     |                       | 24   | ns                      |
| $t_{d(off)}$ |                                                                                                                                                     |                       | 24   | ns                      |
| $t_f$        |                                                                                                                                                     |                       | 23   | ns                      |
| $Q_{g(on)}$  | $V_{GS} = 10\text{V}$ , $V_{DS} = 0.5 \cdot V_{DSS}$ , $I_D = 0.5 \cdot I_{D25}$                                                                    |                       | 6.9  | nC                      |
| $Q_{gs}$     |                                                                                                                                                     |                       | 1.7  | nC                      |
| $Q_{gd}$     |                                                                                                                                                     |                       | 2.8  | nC                      |
| $R_{thJC}$   | TO-220                                                                                                                                              |                       |      | 1.10 $^\circ\text{C/W}$ |
| $R_{thCS}$   |                                                                                                                                                     | 0.50                  |      | $^\circ\text{C/W}$      |

### 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                                                |                       |      | 4 A           |
| $I_{SM}$ | Repetitive, Pulse Width Limited by $T_{JM}$                                  |                       |      | 16 A          |
| $V_{SD}$ | $I_F = I_s$ , $V_{GS} = 0\text{V}$ , Note 1                                  |                       |      | 1.4 V         |
| $t_{rr}$ | $I_F = 4\text{A}$ , $-di/dt = 25\text{A}/\mu\text{s}$<br>$V_R = 100\text{V}$ |                       |      | 250 ns        |
| $Q_{RM}$ |                                                                              | 0.35                  |      | $\mu\text{C}$ |
| $I_{RM}$ |                                                                              | 2.15                  |      | A             |

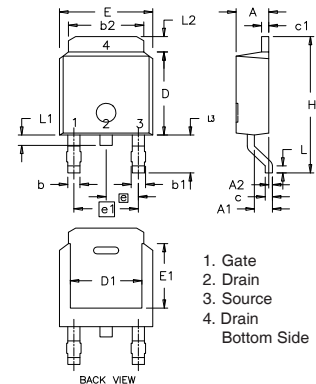
Note 1. Pulse test,  $t \leq 300\mu\text{s}$ , duty cycle,  $d \leq 2\%$ .

### TO-263 Outline



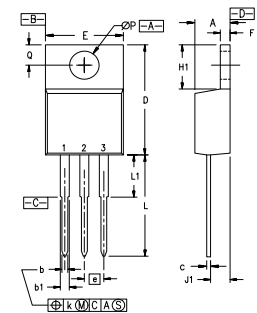
| SYM | INCHES   |      | MILLIMETERS |       |
|-----|----------|------|-------------|-------|
|     | MIN      | MAX  | MIN         | MAX   |
| A   | .160     | .190 | 4.06        | 4.83  |
| A1  | .080     | .110 | 2.03        | 2.79  |
| b   | .020     | .039 | 0.51        | 0.99  |
| b2  | .045     | .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  |

### TO-252 AA Outline



| Dim. | Millimeter |       | Inches    |       |
|------|------------|-------|-----------|-------|
|      | Min.       | Max.  | Min.      | Max.  |
| A    | 2.19       | 2.38  | 0.086     | 0.094 |
| A1   | 0.89       | 1.14  | 0.035     | 0.045 |
| A2   | 0          | 0.13  | 0         | 0.005 |
| b    | 0.64       | 0.89  | 0.025     | 0.035 |
| b1   | 0.76       | 1.14  | 0.030     | 0.045 |
| b2   | 5.21       | 5.46  | 0.205     | 0.215 |
| c    | 0.46       | 0.58  | 0.018     | 0.023 |
| c1   | 0.46       | 0.58  | 0.018     | 0.023 |
| D    | 5.97       | 6.22  | 0.235     | 0.245 |
| D1   | 4.32       | 5.21  | 0.170     | 0.205 |
| E    | 6.35       | 6.73  | 0.250     | 0.265 |
| E1   | 4.32       | 5.21  | 0.170     | 0.205 |
| e    | 2.28 BSC   |       | 0.090 BSC |       |
| e1   | 4.57 BSC   |       | 0.180 BSC |       |
| H    | 9.40       | 10.42 | 0.370     | 0.410 |
| L    | 0.51       | 1.02  | 0.020     | 0.040 |
| L1   | 0.64       | 1.02  | 0.025     | 0.040 |
| L2   | 0.89       | 1.27  | 0.035     | 0.050 |
| L3   | 2.54       | 2.92  | 0.100     | 0.115 |

### 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  |
| ØP  | .139     | .161 | 3.53        | 4.08  |
| Q   | .100     | .125 | 2.54        | 3.18  |

### 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 |
|                                                                                  | 4,850,072 | 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   |             |

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

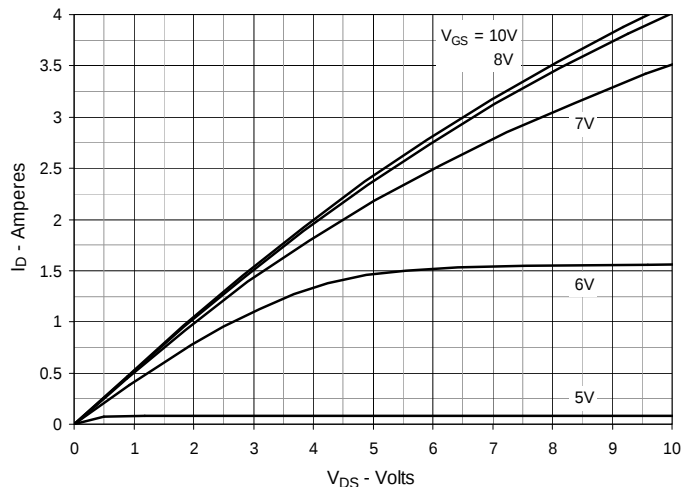


Fig. 2. Extended Output Characteristics @  $T_J = 25^\circ\text{C}$

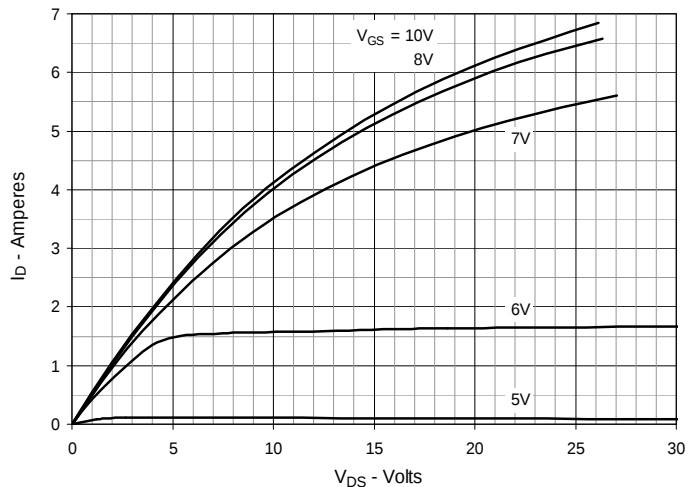


Fig. 3. Output Characteristics @  $T_J = 125^\circ\text{C}$

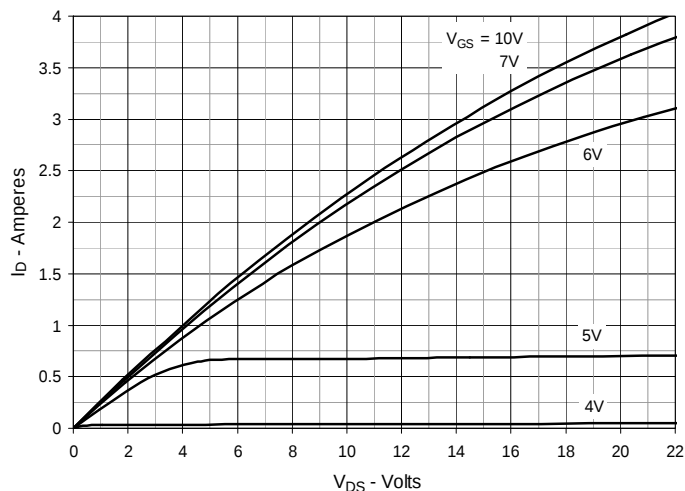


Fig. 4.  $R_{DS(on)}$  Normalized to  $I_D = 2\text{A}$  Value vs. Junction Temperature

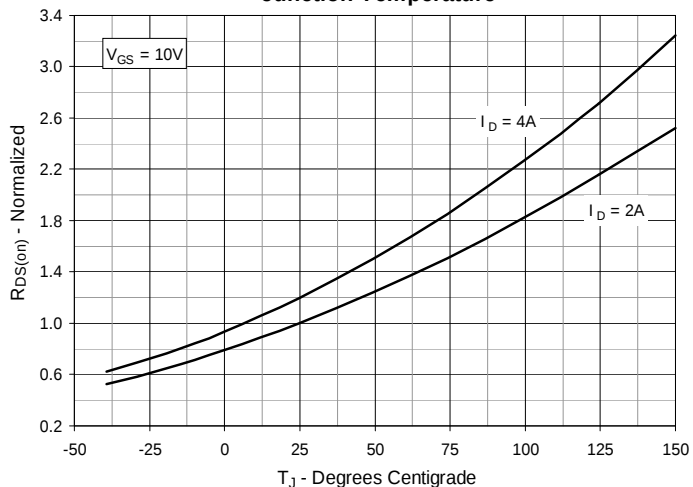


Fig. 5.  $R_{DS(on)}$  Normalized to  $I_D = 2\text{A}$  Value vs. Drain Current

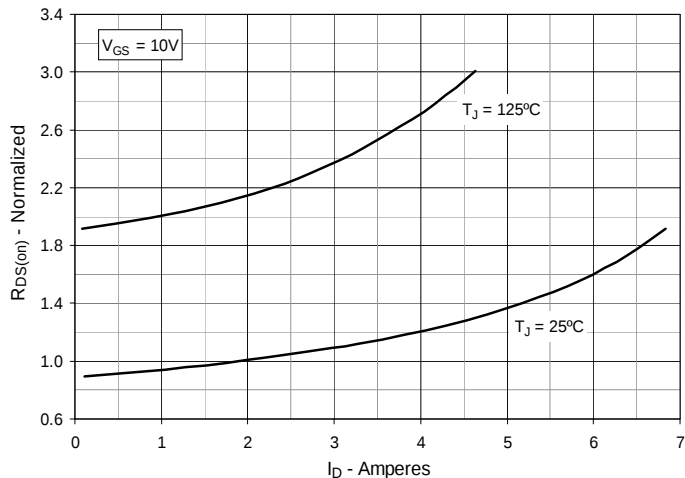


Fig. 6. Maximum Drain Current vs. Case Temperature

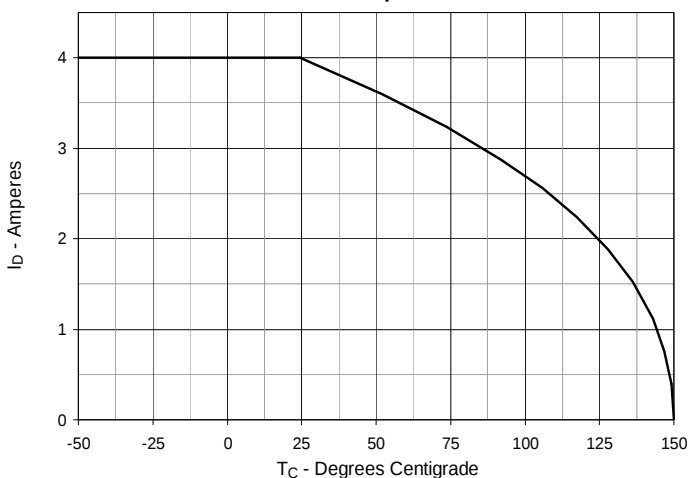


Fig. 7. Input Admittance

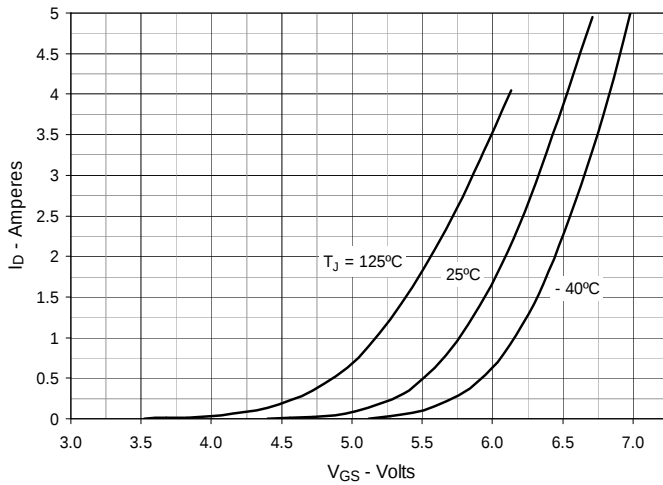


Fig. 8. Transconductance

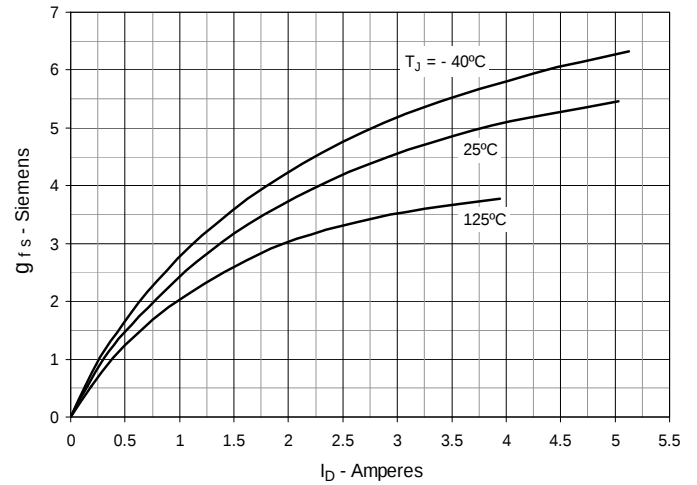


Fig. 9. Forward Voltage Drop of Intrinsic Diode

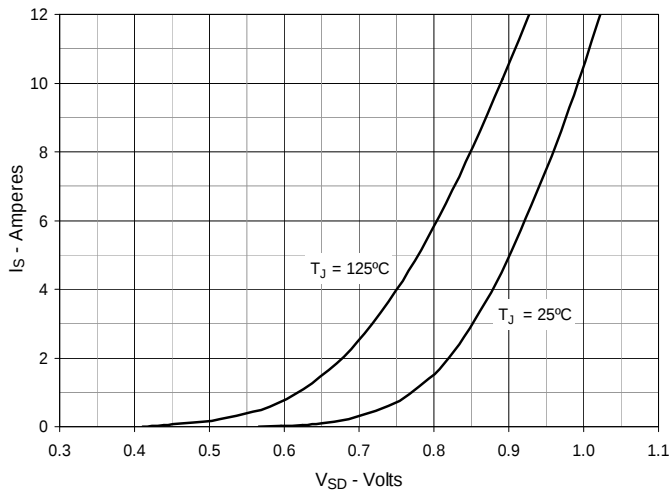


Fig. 10. Gate Charge

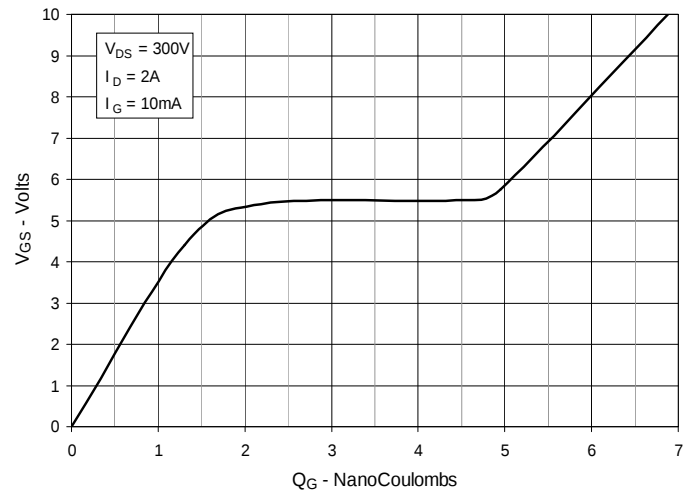


Fig. 11. Capacitance

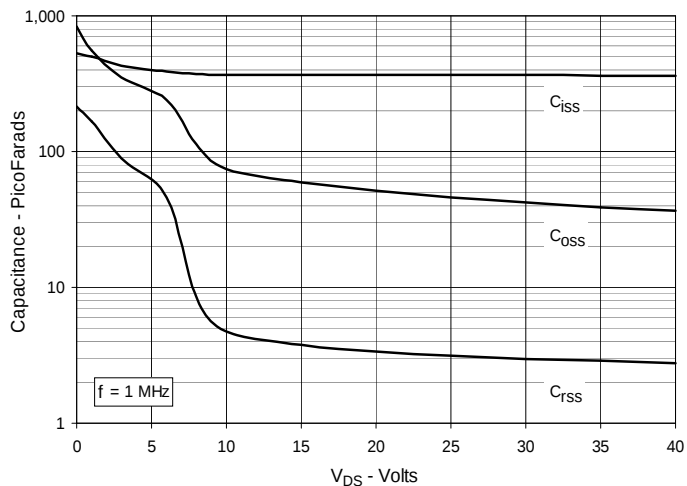


Fig. 12. Forward-Bias Safe Operating Area

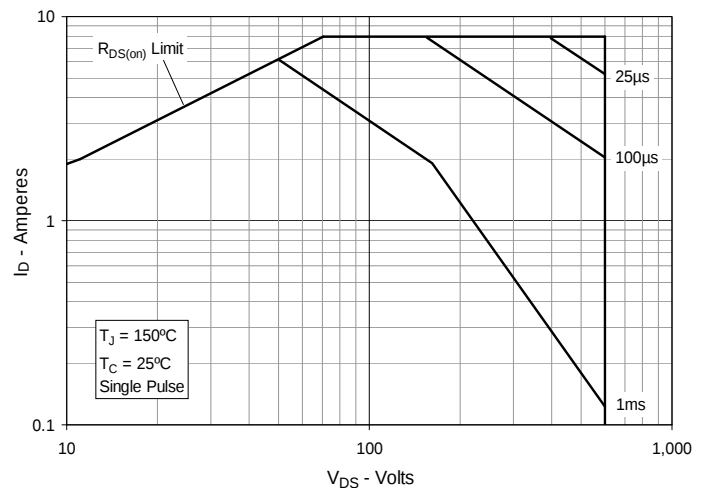


Fig. 13. Maximum Transient Thermal Impedance

