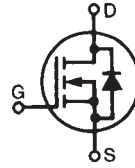


# Polar2™ Power MOSFETs

## IXTP450P2 IXTQ450P2 IXTH450P2

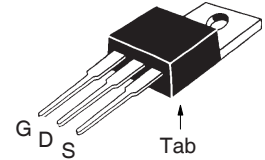
N-Channel Enhancement Mode  
Avalanche Rated  
Fast Intrinsic Diode



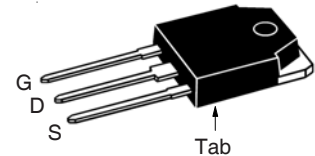
$V_{DSS} = 500V$   
 $I_{D25} = 16A$   
 $R_{DS(on)} \leq 330m\Omega$   
 $t_{rr(typ)} = 400ns$

| Symbol     | Test Conditions  | Maximum Ratings |            |
|------------|--|-----------------|------------|
| $V_{DSS}$  | $T_J = 25^\circ C$ to $150^\circ C$                                | 500             | V          |
| $V_{DGR}$  | $T_J = 25^\circ C$ to $150^\circ C$ , $R_{GS} = 1M\Omega$          | 500             | V          |
| $V_{GSS}$  | Continuous   | $\pm 30$        | V          |
| $V_{GSM}$  | Transient  | $\pm 40$        | V          |
| $I_{D25}$  | $T_C = 25^\circ C$   | 16              | A          |
| $I_{DM}$   | $T_C = 25^\circ C$ , Pulse Width Limited by $T_{JM}$               | 48              | A          |
| $I_A$      | $T_C = 25^\circ C$   | 16              | A          |
| $E_{AS}$   | $T_C = 25^\circ C$   | 750             | mJ         |
| dv/dt      | $I_S \leq I_{DM}$ , $V_{DD} \leq V_{DSS}$ , $T_J \leq 150^\circ C$ | 10              | V/ns       |
| $P_D$      | $T_C = 25^\circ C$   | 300             | W          |
| $T_J$      |  | -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  | 1.13/10         | Nm/lb.in.  |
| Weight     | TO-220   | 3.0             | g          |
|            | TO-3P  | 5.5             | g          |
|            | TO-247   | 6.0             | g          |

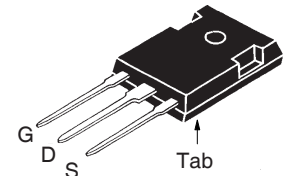
TO-220AB (IXTP)



TO-3P (IXTQ)



TO-247 (IXTH)



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

### Features

- Avalanche Rated
- Fast Intrinsic Diode
- Dynamic dv/dt Rated
- 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>( $T_J = 25^\circ C$ , Unless Otherwise Specified) | Characteristic Values |      |                         |
|--------------|---|-----------------------|------|-------------------------|
|              |   | Min.                  | Typ. | Max.                    |
| $BV_{DSS}$   | $V_{GS} = 0V$ , $I_D = 250\mu A$                                      | 500                   |      | V                       |
| $V_{GS(th)}$ | $V_{DS} = V_{GS}$ , $I_D = 250\mu A$                                  | 2.5                   |      | 4.5 V                   |
| $I_{GSS}$    | $V_{GS} = \pm 30V$ , $V_{DS} = 0V$                                    |                       |      | $\pm 100$ nA            |
| $I_{DSS}$    | $V_{DS} = V_{DSS}$ , $V_{GS} = 0V$<br>$T_J = 125^\circ C$             |                       |      | 5 $\mu A$<br>25 $\mu A$ |
| $R_{DS(on)}$ | $V_{GS} = 10V$ , $I_D = 0.5 \cdot I_{D25}$ , Note 1                   |                       |      | 330 m $\Omega$          |

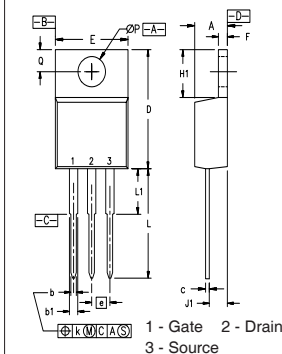
| Symbol       | Test Conditions<br>( $T_J = 25^\circ\text{C}$ Unless Otherwise Specified)   | Characteristic Values |      |                         |
|--------------|---|-----------------------|------|-------------------------|
|              |   | Min.                  | Typ. | Max.                    |
| $g_{fs}$     | $V_{DS} = 20\text{V}, I_D = 0.5 \cdot I_{D25}$ , Note 1   | 12                    | 20   | S                       |
| $C_{iss}$    | $V_{GS} = 0\text{V}, V_{DS} = 25\text{V}, f = 1\text{MHz}$  |                       | 2280 | pF                      |
| $C_{oss}$    |   |                       | 257  | pF                      |
| $C_{rss}$    |   |                       | 30   | 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) |                       | 16   | ns                      |
| $t_r$        |   |                       | 10   | ns                      |
| $t_{d(off)}$ |   |                       | 50   | ns                      |
| $t_f$        |   |                       | 18   | ns                      |
| $Q_{g(on)}$  | $V_{GS} = 10\text{V}, V_{DS} = 0.5 \cdot V_{DSS}, I_D = 0.5 \cdot I_{D25}$  |                       | 43   | nC                      |
| $Q_{gs}$     |   |                       | 18   | nC                      |
| $Q_{gd}$     |   |                       | 11   | nC                      |
| $R_{thJC}$   |   |                       |      | 0.42 $^\circ\text{C/W}$ |
| $R_{thCS}$   | TO-220  |                       | 0.50 | $^\circ\text{C/W}$      |
| $R_{thCS}$   | TO-3P & TO-247  |                       | 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.  |
| $I_S$    | $V_{GS} = 0\text{V}$  |                       |      | 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  |                       |      | 1.3 V |
| $t_{rr}$ | $I_F = 16\text{A}, -di/dt = 100\text{A}/\mu\text{s}$<br>$V_R = 100\text{V}, V_{GS} = 0\text{V}$ |                       | 400  | ns    |

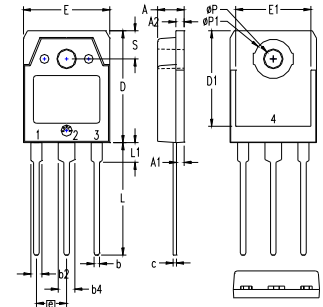
Note 1. Pulse test,  $t \leq 300\mu\text{s}$ , duty cycle,  $d \leq 2\%$ .

### TO-220 Outline



| SYM            | INCHES   |      | MILLIMETERS |       |
|----------------|----------|------|-------------|-------|
|                | MIN      | MAX  | MIN         | MAX   |
| A              | .170     | .190 | 4.32        | 4.83  |
| b              | .025     | .040 | 0.64        | 1.02  |
| b <sub>1</sub> | .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  |

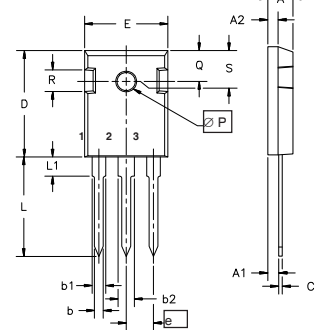
### TO-3P Outline



- 1 - GATE  
2 - DRAIN (COLLECTOR)  
3 - SOURCE (EMITTER)  
4 - DRAIN (COLLECTOR)

| SYM            | INCHES   |      | MILLIMETERS |       |
|----------------|----------|------|-------------|-------|
|                | MIN      | MAX  | MIN         | MAX   |
| A              | .185     | .193 | 4.70        | 4.90  |
| A1             | .051     | .059 | 1.30        | 1.50  |
| A2             | .057     | .065 | 1.45        | 1.65  |
| b              | .035     | .045 | 0.90        | 1.15  |
| b <sub>2</sub> | .075     | .087 | 1.90        | 2.20  |
| b <sub>4</sub> | .114     | .126 | 2.90        | 3.20  |
| c              | .022     | .031 | 0.55        | 0.80  |
| D              | .780     | .799 | 19.80       | 20.30 |
| D1             | .665     | .677 | 16.90       | 17.20 |
| E              | .610     | .622 | 15.50       | 15.80 |
| E1             | .531     | .539 | 13.50       | 13.70 |
| e              | .215 BSC |      | 5.45 BSC    |       |
| L              | .779     | .795 | 19.80       | 20.20 |
| L1             | .134     | .142 | 3.40        | 3.60  |
| ØP             | .126     | .134 | 3.20        | 3.40  |
| ØP1            | .272     | .280 | 6.90        | 7.10  |
| S              | .193     | .201 | 4.90        | 5.10  |

### TO-247 Outline



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

| 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  |
| L1             |            | 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 |        |       |

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 @  $T_J = 25^\circ\text{C}$

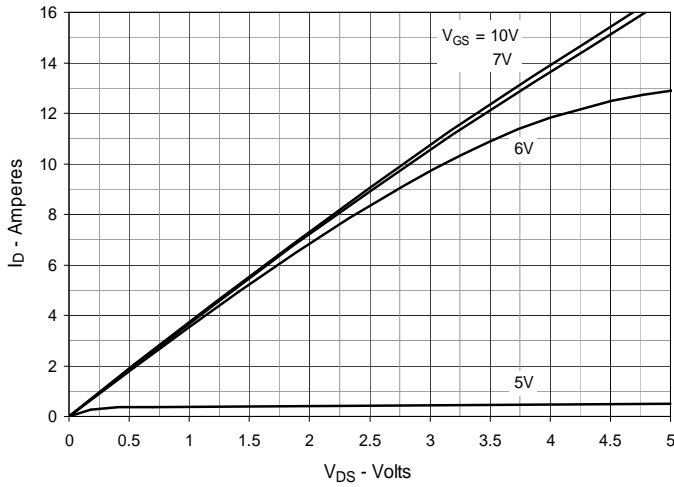


Fig. 2. Extended Output Characteristics @  $T_J = 25^\circ\text{C}$

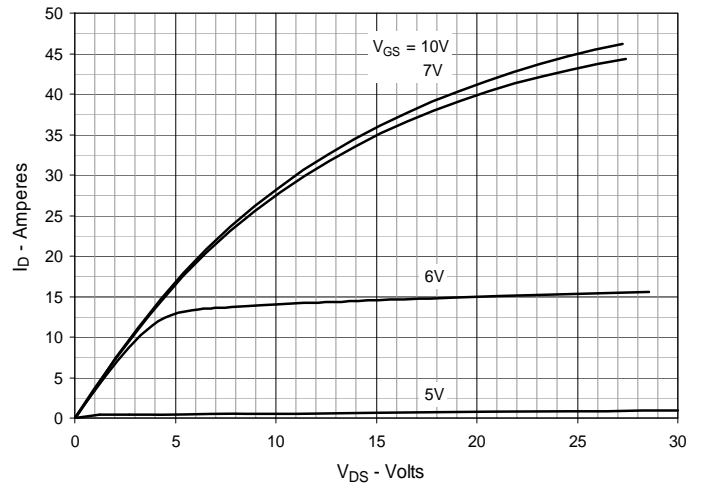


Fig. 3. Output Characteristics @  $T_J = 125^\circ\text{C}$

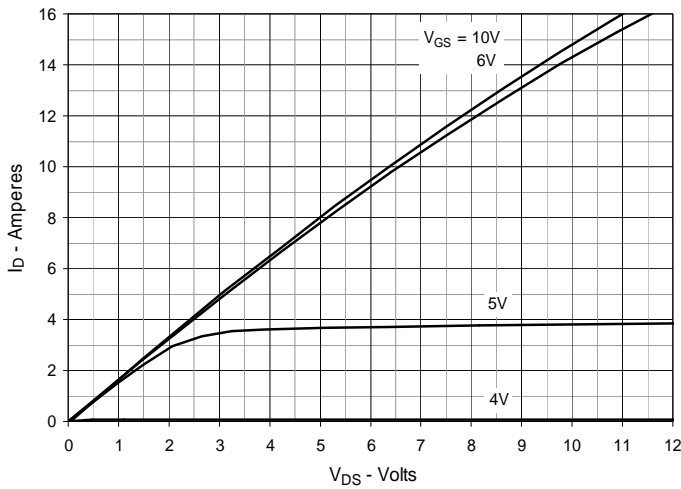


Fig. 4.  $R_{DS(on)}$  Normalized to  $I_D = 8\text{A}$  Value vs. Junction Temperature

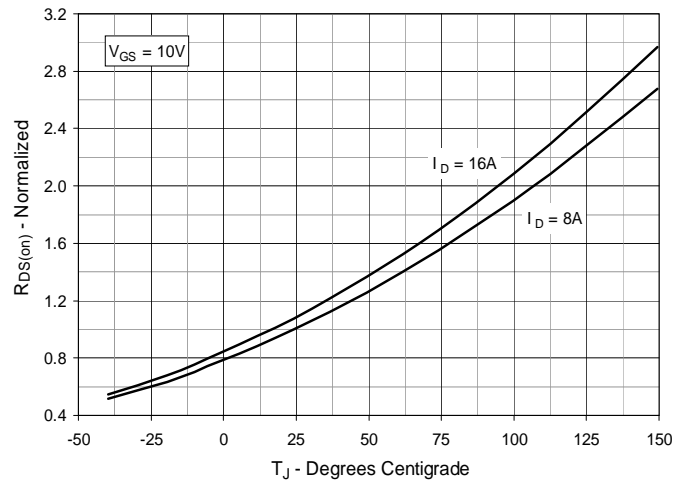


Fig. 5.  $R_{DS(on)}$  Normalized to  $I_D = 8\text{A}$  Value vs. Drain Current

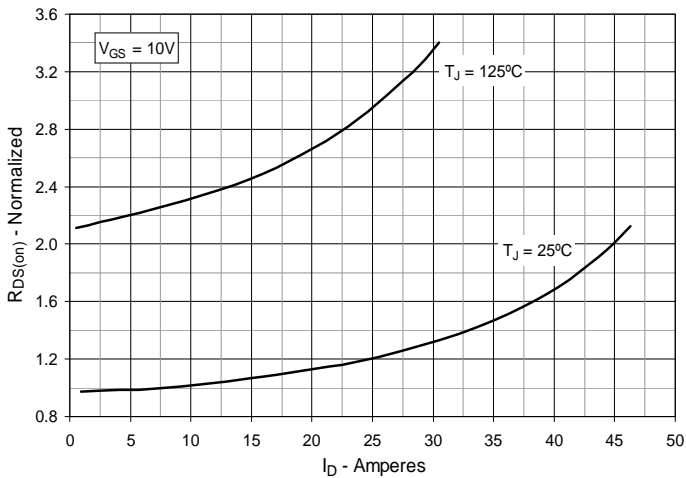
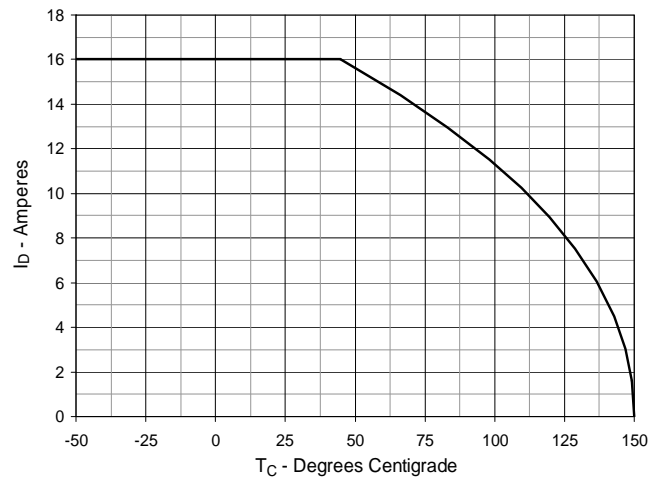
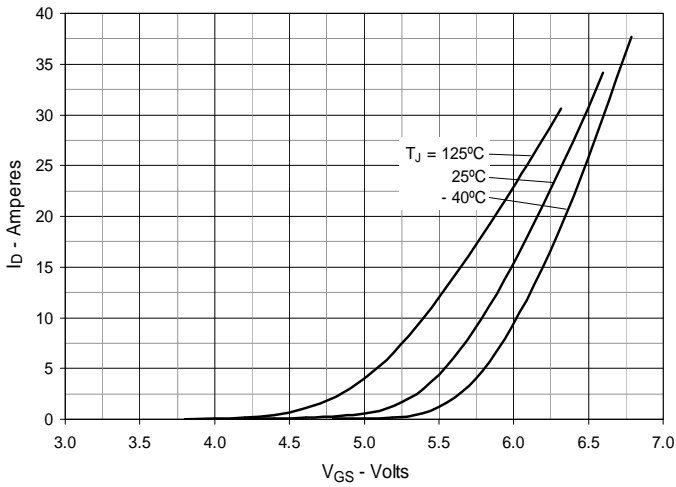


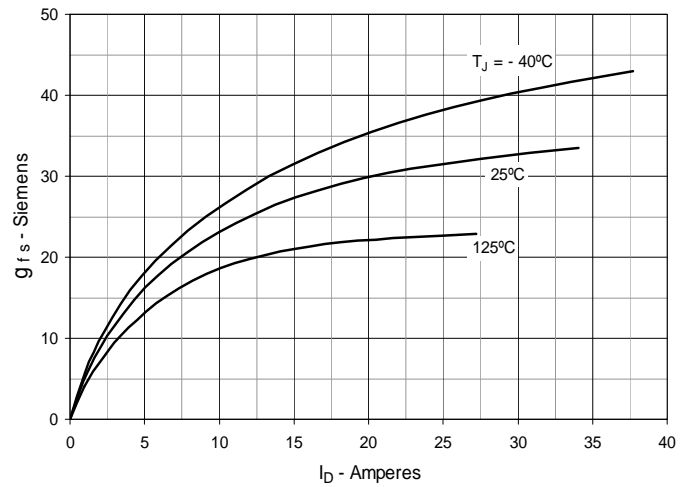
Fig. 6. Maximum Drain Current vs. Case Temperature



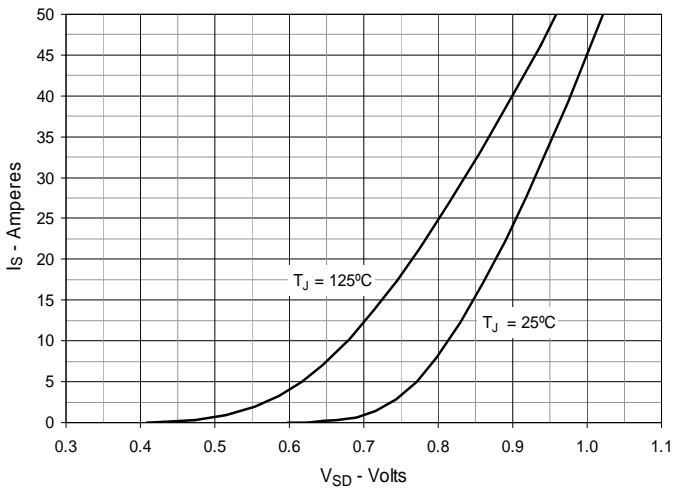
**Fig. 7. Input Admittance**



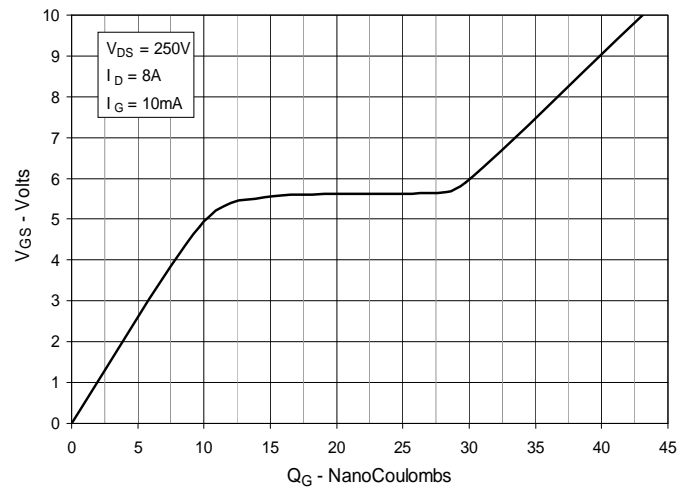
**Fig. 8. Transconductance**



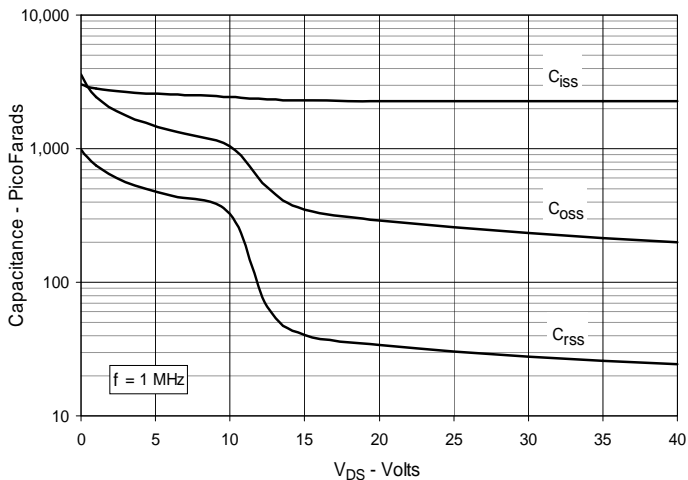
**Fig. 9. Forward Voltage Drop of Intrinsic Diode**



**Fig. 10. Gate Charge**



**Fig. 11. Capacitance**



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

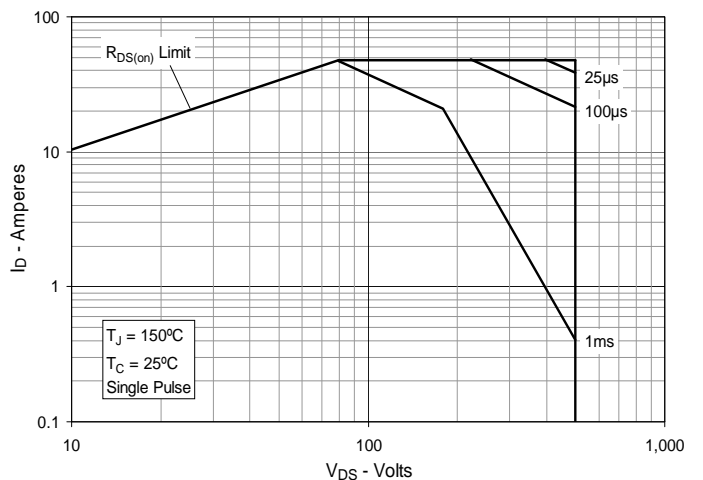


Fig. 13. Maximum Transient Thermal Impedance

