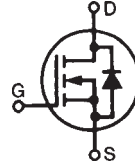


### Polar™ Power MOSFET HiPerFET™

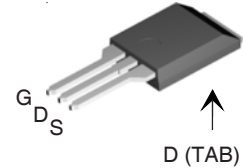
**IXFH12N90P**  
**IXFV12N90P**  
**IXFV12N90PS**

N-Channel Enhancement Mode  
Avalanche Rated  
Fast Intrinsic Diode

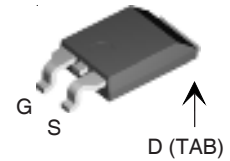


$$\begin{aligned} V_{DSS} &= 900V \\ I_{D25} &= 12A \\ R_{DS(on)} &\leq 900m\Omega \\ t_{rr} &\leq 300ns \end{aligned}$$

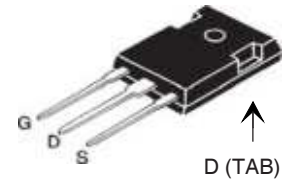
PLUS220 (IXFV)



PLUS220SMD (IXFV\_S)



TO-247 (IXFH)



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

| Symbol     | Test Conditions                                                          | Maximum Ratings  |                  |
|------------|--------------------------------------------------------------------------|------------------|------------------|
| $V_{DSS}$  | $T_J = 25^\circ\text{C}$ to $150^\circ\text{C}$                          | 900              | V                |
| $V_{DGR}$  | $T_J = 25^\circ\text{C}$ to $150^\circ\text{C}$ , $R_{GS} = 1M\Omega$    | 900              | V                |
| $V_{GSS}$  | Continuous                                                               | $\pm 30$         | V                |
| $V_{GSM}$  | Transient                                                                | $\pm 40$         | V                |
| $I_{D25}$  | $T_C = 25^\circ\text{C}$                                                 | 12               | A                |
| $I_{DM}$   | $T_C = 25^\circ\text{C}$ , pulse width limited by $T_{JM}$               | 24               | A                |
| $I_A$      | $T_C = 25^\circ\text{C}$                                                 | 6                | A                |
| $E_{AS}$   | $T_C = 25^\circ\text{C}$                                                 | 500              | mJ               |
| $dV/dt$    | $I_S \leq I_{DM}$ , $V_{DD} \leq V_{DSS}$ , $T_J \leq 150^\circ\text{C}$ | 15               | V/ns             |
| $P_D$      | $T_C = 25^\circ\text{C}$                                                 | 380              | 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 (PLUS220)                                                 | 11..65/2.5..14.6 | N/lb.            |
| Weight     | TO-247                                                                   | 6                | g                |
|            | PLUS220 types                                                            | 4                | g                |

| Symbol       | Test Conditions<br>( $T_J = 25^\circ\text{C}$ , unless otherwise specified)           | Characteristic Values |      |                |
|--------------|---------------------------------------------------------------------------------------|-----------------------|------|----------------|
|              |                                                                                       | Min.                  | Typ. | Max.           |
| $BV_{DSS}$   | $V_{GS} = 0V$ , $I_D = 1mA$                                                           | 900                   |      | V              |
| $V_{GS(th)}$ | $V_{DS} = V_{GS}$ , $I_D = 1mA$                                                       | 3.5                   |      | 6.5 V          |
| $I_{GSS}$    | $V_{GS} = \pm 30V$ , $V_{DS} = 0V$                                                    |                       |      | $\pm 100$ nA   |
| $I_{DSS}$    | $V_{DS} = V_{DSS}$                                                                    |                       |      | 25 $\mu A$     |
|              | $V_{GS} = 0V$ <span style="float: right;"><math>T_J = 125^\circ\text{C}</math></span> |                       |      | 1 mA           |
| $R_{DS(on)}$ | $V_{GS} = 10V$ , $I_D = 0.5 \cdot I_{D25}$ , Note 1                                   |                       |      | 900 m $\Omega$ |

#### Features

- International standard packages
- Avalanche Rated
- Low package inductance
- Fast intrinsic diode

#### Advantages

- Easy to mount
- Space savings
- High power density

#### Applications:

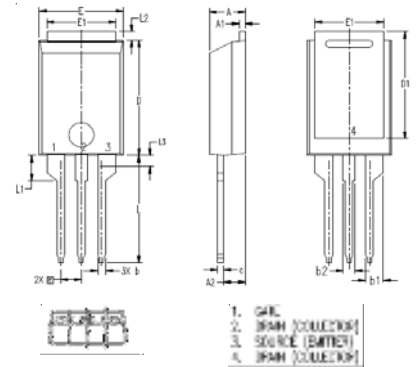
- Switched-mode and resonant-mode power supplies
- DC-DC Converters
- Laser Drivers
- AC and DC motor drives
- Robotics and servo controls

| 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                                                                                         | 5.0                   | 8.2  | S                       |
| $R_{Gi}$     | Gate input resistance                                                                                                                              |                       | 1.7  | $\Omega$                |
| $C_{iss}$    | $V_{GS} = 0\text{V}$ , $V_{DS} = 25\text{V}$ , $f = 1\text{MHz}$                                                                                   |                       | 3080 | pF                      |
| $C_{oss}$    |                                                                                                                                                    |                       | 200  | pF                      |
| $C_{rss}$    |                                                                                                                                                    |                       | 33   | 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>$R_G = 2\Omega$ (External) |                       | 32   | ns                      |
| $t_r$        |                                                                                                                                                    |                       | 34   | ns                      |
| $t_{d(off)}$ |                                                                                                                                                    |                       | 50   | ns                      |
| $t_f$        |                                                                                                                                                    |                       | 68   | ns                      |
| $Q_{g(on)}$  | $V_{GS} = 10\text{V}$ , $V_{DS} = 0.5 \cdot V_{DSS}$ , $I_D = 0.5 \cdot I_{D25}$                                                                   |                       | 56   | nC                      |
| $Q_{gs}$     |                                                                                                                                                    |                       | 18   | nC                      |
| $Q_{gd}$     |                                                                                                                                                    |                       | 27   | nC                      |
| $R_{thJC}$   | (TO-247, PLUS220)                                                                                                                                  |                       |      | 0.33 $^\circ\text{C/W}$ |
| $R_{thCS}$   |                                                                                                                                                    | 0.25                  |      | $^\circ\text{C/W}$      |

| Source-Drain Diode                                   |                                                                                                      | Characteristic Values |      |               |
|------------------------------------------------------|------------------------------------------------------------------------------------------------------|-----------------------|------|---------------|
| $T_J = 25^\circ\text{C}$ unless otherwise specified) |                                                                                                      | Min.                  | Typ. | Max.          |
| $I_S$                                                | $V_{GS} = 0\text{V}$                                                                                 |                       |      | 12 A          |
| $I_{SM}$                                             | Repetitive, pulse width limited by $T_{JM}$                                                          |                       |      | 48 A          |
| $V_{SD}$                                             | $I_F = I_S$ , $V_{GS} = 0\text{V}$ , Note 1                                                          |                       |      | 1.5 V         |
| $t_{rr}$                                             | $I_F = 6\text{A}$ , $-di/dt = 100\text{A}/\mu\text{s}$<br>$V_R = 100\text{V}$ , $V_{GS} = 0\text{V}$ |                       |      | 300 ns        |
| $Q_{RM}$                                             |                                                                                                      |                       | 0.9  | $\mu\text{C}$ |
| $I_{RM}$                                             |                                                                                                      |                       | 7.8  | A             |

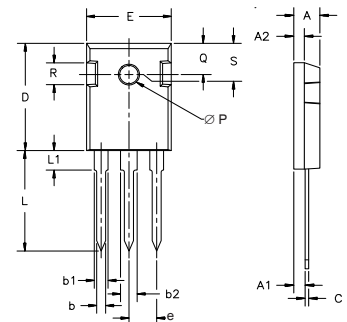
Note 1: Pulse test,  $t \leq 300\mu\text{s}$ ; duty cycle,  $d \leq 2\%$ .

### PLUS220 (IXFV) Outline



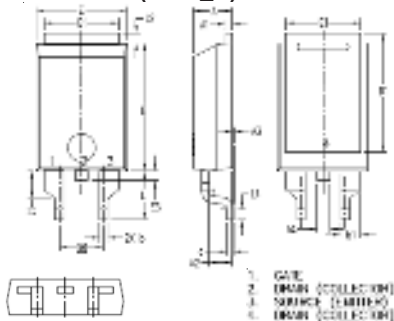
| SYM | INCHES   |      | MILLIMETER |       |
|-----|----------|------|------------|-------|
|     | MIN      | MAX  | MIN        | MAX   |
| A   | .169     | .185 | 4.30       | 4.70  |
| A1  | .028     | .035 | 0.70       | 0.90  |
| A2  | .098     | .118 | 2.50       | 3.00  |
| b   | .035     | .047 | 0.90       | 1.20  |
| b1  | .080     | .095 | 2.03       | 2.41  |
| b2  | .054     | .064 | 1.37       | 1.63  |
| 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  |
| A1   | 2.2        | 2.54  | .087   | .102  |
| A2   | 2.2        | 2.6   | .059   | .098  |
| b    | 1.0        | 1.4   | .040   | .055  |
| b1   | 1.65       | 2.13  | .065   | .084  |
| b2   | 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   |

### 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  |
| b1  | .080     | .095 | 2.03       | 2.41  |
| b2  | .054     | .064 | 1.37       | 1.63  |
| 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  |
| L4  | .039     | .059 | 1.00       | 1.50  |

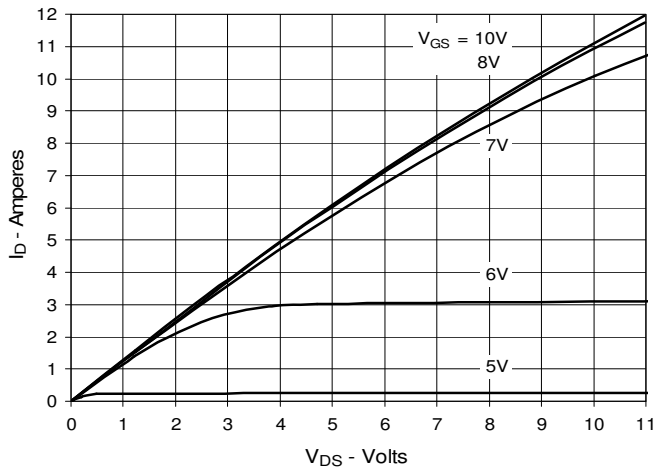
### PRELIMINARY TECHNICAL INFORMATION

The product presented herein is under development. The Technical Specifications offered are derived from data gathered during objective characterizations of preliminary engineering lots; but also may yet contain some information supplied during a pre-production design evaluation. IXYS reserves the right to change limits, test conditions, and dimensions without notice.

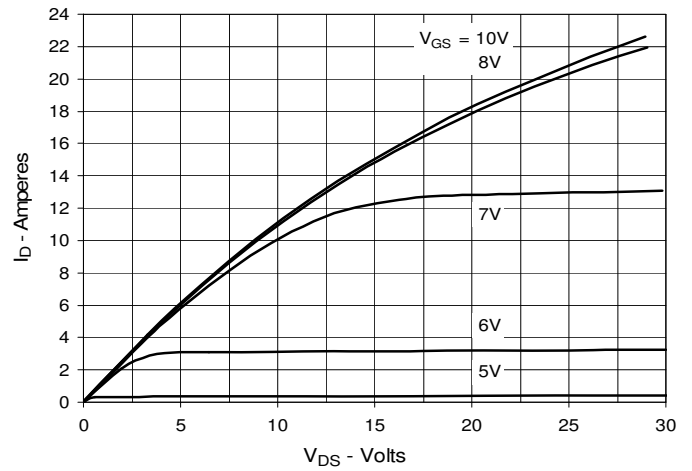
IXYS reserves the right to change limits, test conditions, and dimensions.

IXYS MOSFETs and IGBTs are covered 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 7,157,338 B2  
by one or more of the following U.S. patents: 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

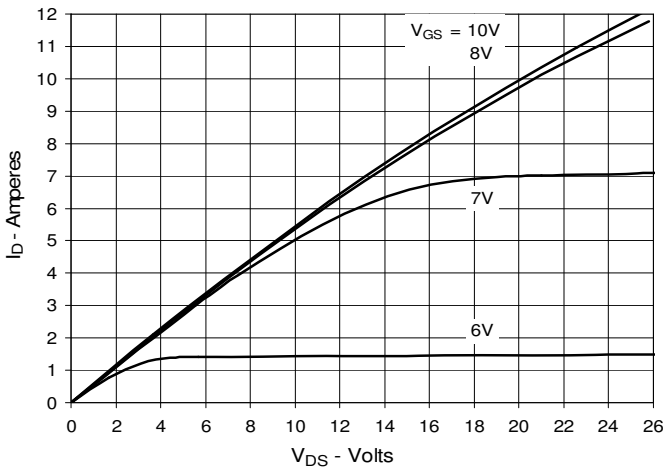
**Fig. 1. Output Characteristics  
@ 25°C**



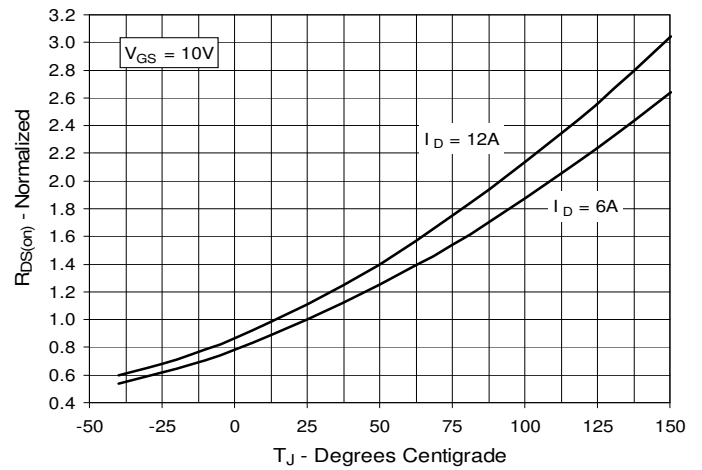
**Fig. 2. Extended Output Characteristics  
@ 25°C**



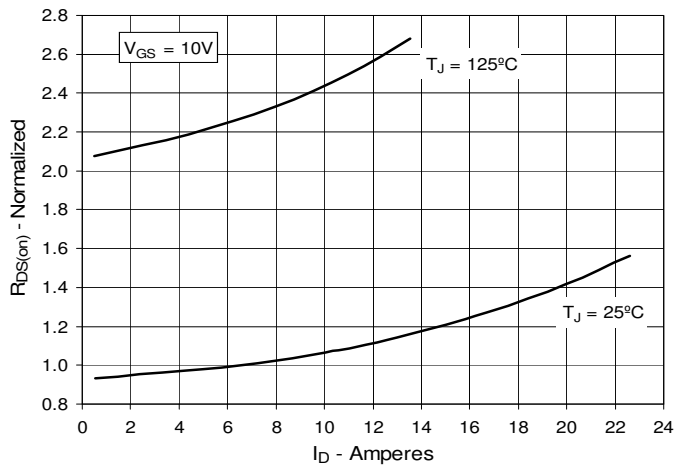
**Fig. 3. Output Characteristics  
@ 125°C**



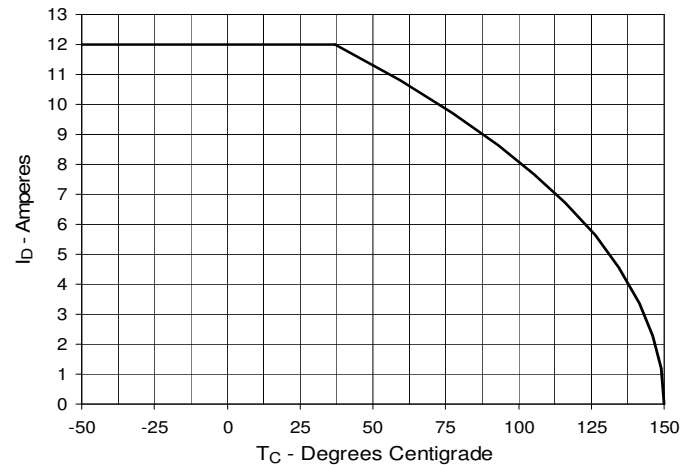
**Fig. 4.  $R_{DS(on)}$  Normalized to  $I_D = 6A$  Value  
vs. Junction Temperature**



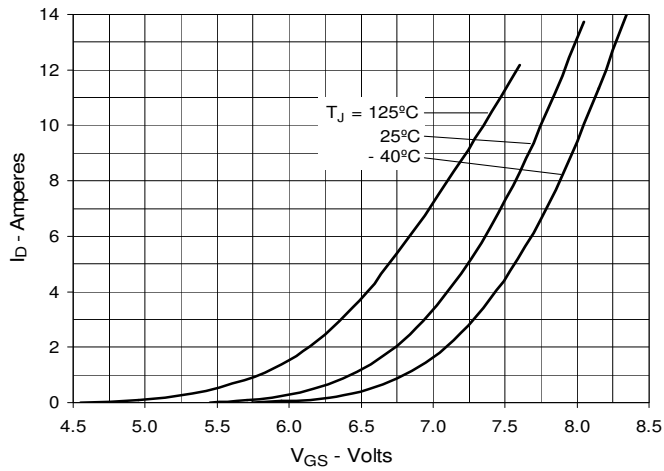
**Fig. 5.  $R_{DS(on)}$  Normalized to  $I_D = 6A$  Value  
vs. Drain Current**



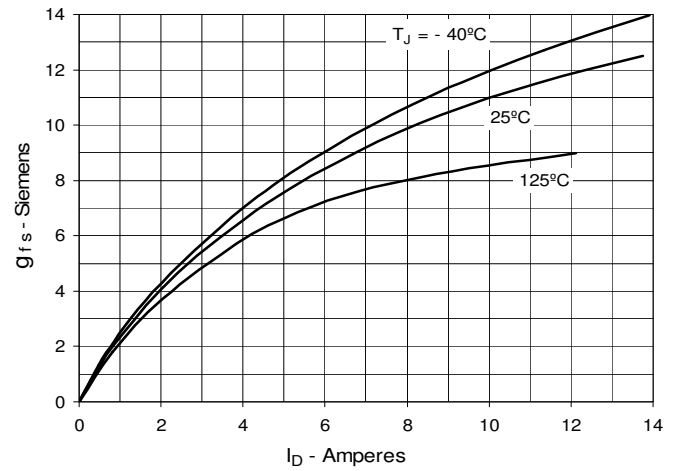
**Fig. 6. Maximum Drain Current vs.  
Case Temperature**



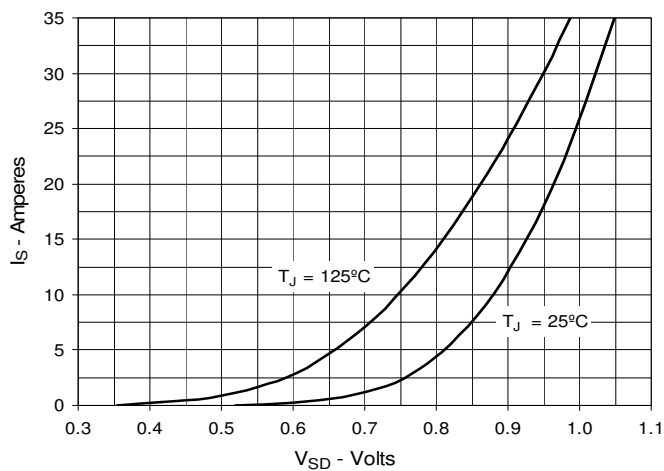
**Fig. 7. Input Admittance**



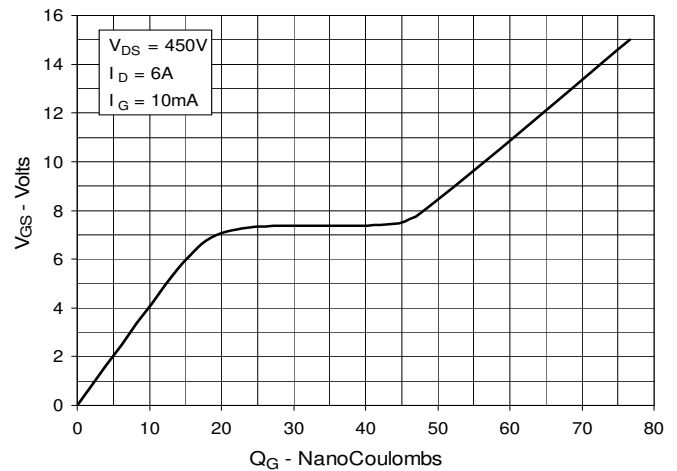
**Fig. 8. Transconductance**



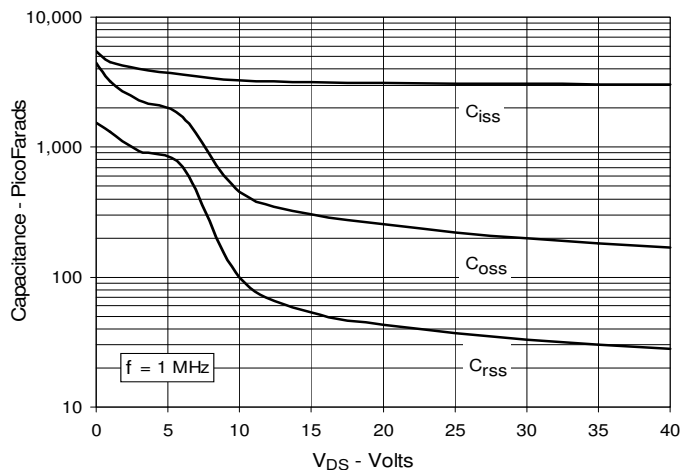
**Fig. 9. Forward Voltage Drop of Intrinsic Diode**



**Fig. 10. Gate Charge**



**Fig. 11. Capacitance**



**Fig. 12. Maximum Transient Thermal Impedance**

