

# X2-Class HiPERFET Power MOSFET

## IXFP12N65X2A

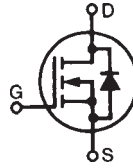
$$V_{DSS} = 650V$$

$$I_{D25} = 12A$$

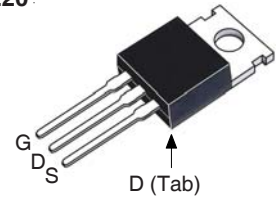
$$R_{DS(on)} \leq 310m\Omega$$

AEC Q101 Qualified

N-Channel Enhancement Mode  
Avalanche Rated



TO-220



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

| Symbol        | Test Conditions  | Maximum Ratings |            |
|---------------|--|-----------------|------------|
| $V_{DSS}$     | $T_J = 25^\circ C$ to $150^\circ C$                                | 650             | V          |
| $V_{DGR}$     | $T_J = 25^\circ C$ to $150^\circ C$ , $R_{GS} = 1M\Omega$          | 650             | V          |
| $V_{GSS}$     | Continuous   | $\pm 30$        | V          |
| $V_{GSM}$     | Transient  | $\pm 40$        | V          |
| $I_{D25}$     | $T_C = 25^\circ C$   | 12              | A          |
| $I_{DM}$      | $T_C = 25^\circ C$ , Pulse Width Limited by $T_{JM}$               | 24              | A          |
| $I_A$         | $T_C = 25^\circ C$   | 6               | A          |
| $E_{AS}$      | $T_C = 25^\circ C$   | 300             | mJ         |
| $dv/dt$       | $I_S \leq I_{DM}$ , $V_{DD} \leq V_{DSS}$ , $T_J \leq 150^\circ C$ | 50              | V/ns       |
| $P_D$         | $T_C = 25^\circ C$   | 180             | 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             | $^\circ C$ |
| $T_{SOLD}$    | 1.6 mm (0.062in.) from Case for 10s                                | 260             | $^\circ C$ |
| $M_d$         | Mounting Torque  | 1.13 / 10       | Nm/lb.in   |
| <b>Weight</b> |  | 3               | g          |

### Features

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

### Advantages

- High Power Density
- Easy to Mount
- Space Savings

### Applications

- Switch-Mode and Resonant-Mode Power Supplies
- DC-DC Converters
- PFC Circuits
- 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.                      |
| $BV_{DSS}$   | $V_{GS} = 0V$ , $I_D = 250\mu A$                                      | 650                   |      | 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>$T_J = 125^\circ C$             |                       |      | 10 $\mu A$<br>500 $\mu A$ |
| $R_{DS(on)}$ | $V_{GS} = 10V$ , $I_D = 0.5 \cdot I_{D25}$ , Note 1                   |                       |      | 310 m $\Omega$            |

| Symbol                              | Test Conditions<br>( $T_J = 25^\circ\text{C}$ , Unless Otherwise Specified)                                     | Characteristic Values                                |      |                         |
|-------------------------------------|---|--|------|-------------------------|
|                                     |   | Min.   | Typ. | Max                     |
| $g_{fs}$                            | $V_{DS} = 10\text{V}$ , $I_D = 0.5 \cdot I_{D25}$ , Note 1  | 4.8  | 8.0  | S                       |
| $R_{Gi}$                            | Gate Input Resistance   |  | 4.0  | $\Omega$                |
| $C_{iss}$                           | $V_{GS} = 0\text{V}$ , $V_{DS} = 25\text{V}$ , $f = 1\text{MHz}$  |  | 1134 | pF                      |
| $C_{oss}$                           |   |  | 712  | pF                      |
| $C_{rss}$                           |   |  | 1    | pF                      |
| <b>Effective Output Capacitance</b> |   |  |      |                         |
| $C_{o(er)}$                         | Energy related  | $V_{GS} = 0\text{V}$<br>$V_{DS} = 0.8 \cdot V_{DSS}$ | 42   | pF                      |
| $C_{o(tr)}$                         | Time related  |  | 132  | pF                      |
| <b>Resistive Switching Times</b>    |   |  |      |                         |
| $t_{d(on)}$                         | $V_{GS} = 10\text{V}$ , $V_{DS} = 0.5 \cdot V_{DSS}$ , $I_D = 0.5 \cdot I_{D25}$<br>$R_G = 20\Omega$ (External) |  | 27   | ns                      |
| $t_r$                               |   |  | 26   | ns                      |
| $t_{d(off)}$                        |   |  | 45   | ns                      |
| $t_f$                               |   |  | 12   | ns                      |
| $Q_{g(on)}$                         | $V_{GS} = 10\text{V}$ , $V_{DS} = 0.5 \cdot V_{DSS}$ , $I_D = 0.5 \cdot I_{D25}$                                |  | 18.5 | nC                      |
| $Q_{gs}$                            |   |  | 6.7  | nC                      |
| $Q_{gd}$                            |   |  | 5.0  | nC                      |
| $R_{thJC}$                          |   |  |      | 0.69 $^\circ\text{C/W}$ |
| $R_{thCS}$                          |   | 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           |
| $I_S$    | $V_{GS} = 0\text{V}$  |                       |      | 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                                   |                       |      | 1.4 V         |
| $t_{rr}$ | $I_F = 6\text{A}$ , $-di/dt = 100\text{A}/\mu\text{s}$<br>$V_R = 100\text{V}$ |                       | 155  | ns            |
| $Q_{RM}$ |   |                       | 1    | $\mu\text{C}$ |
| $I_{RM}$ |   |                       | 13   | A             |

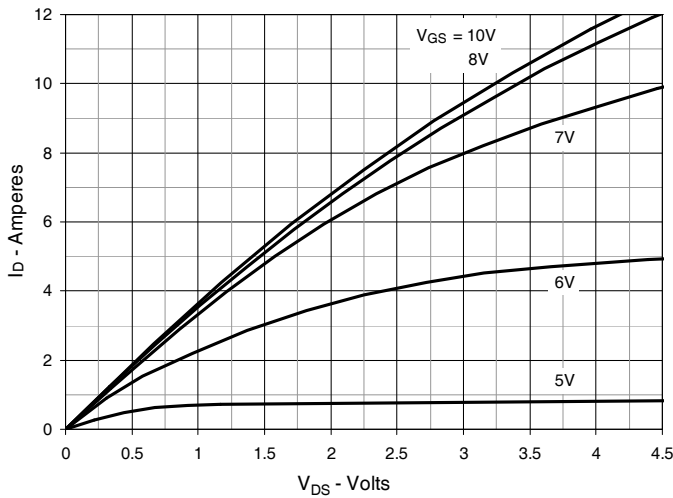
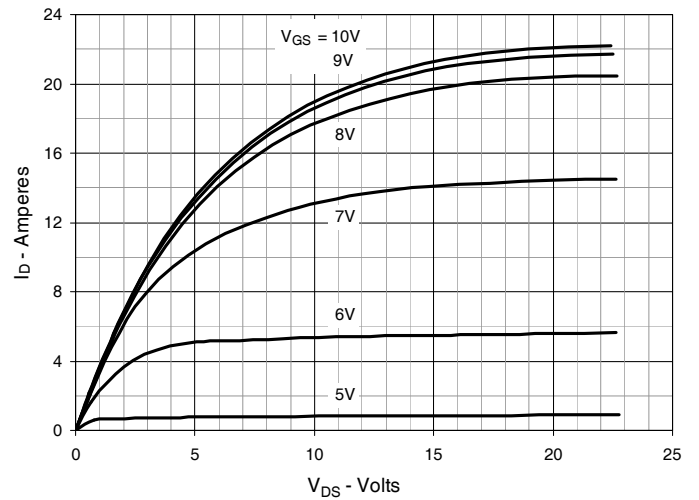
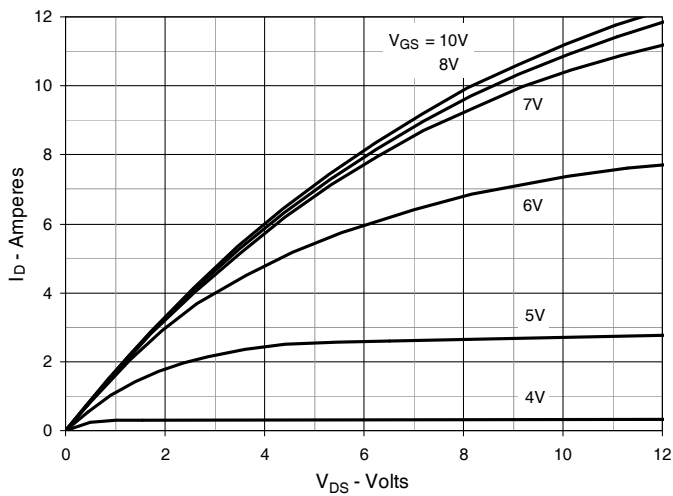
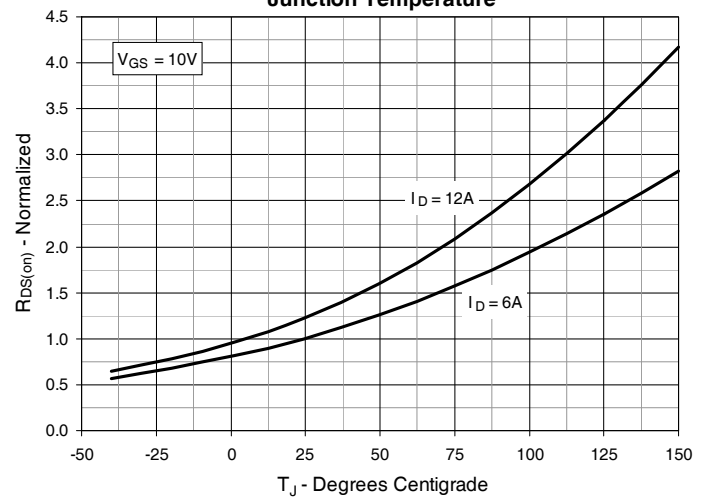
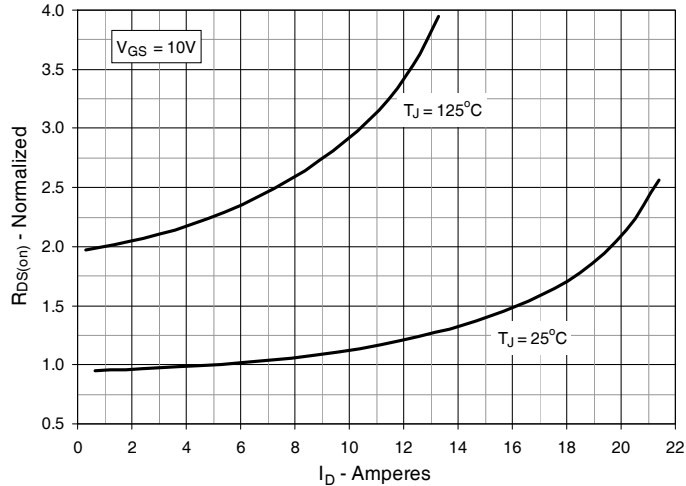
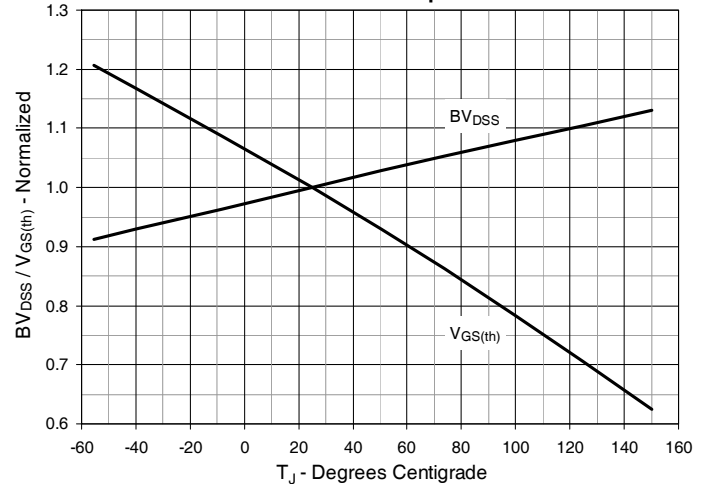
Note 1. Pulse test,  $t \leq 300\mu\text{s}$ , duty cycle,  $d \leq 2\%$ .

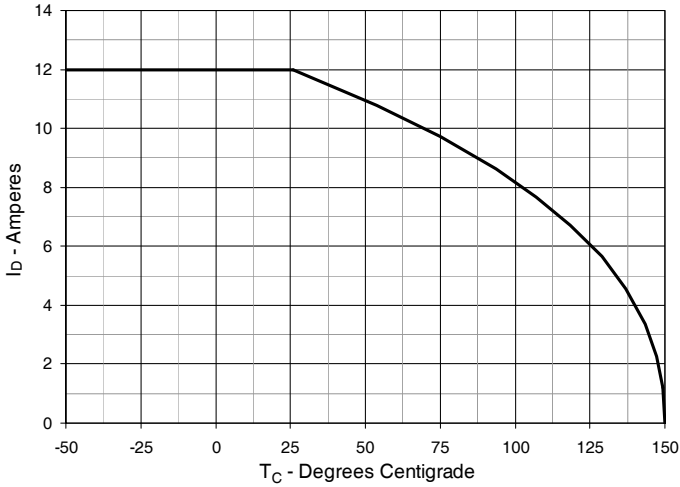
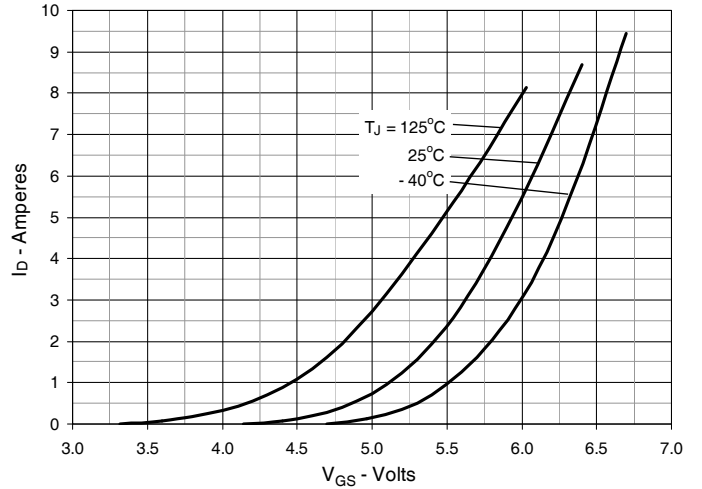
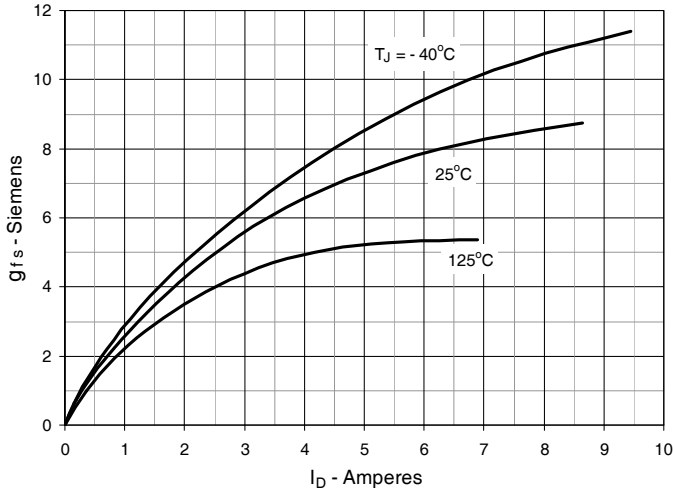
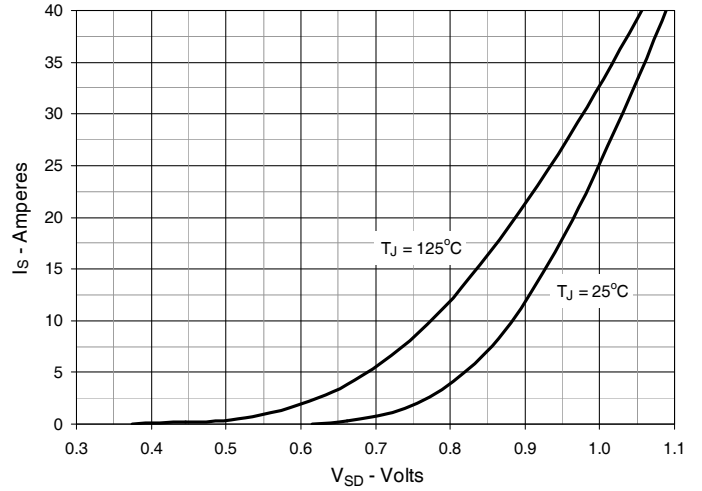
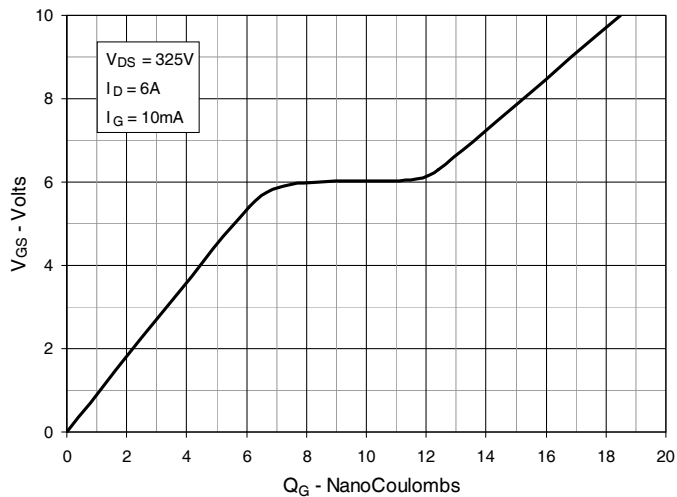
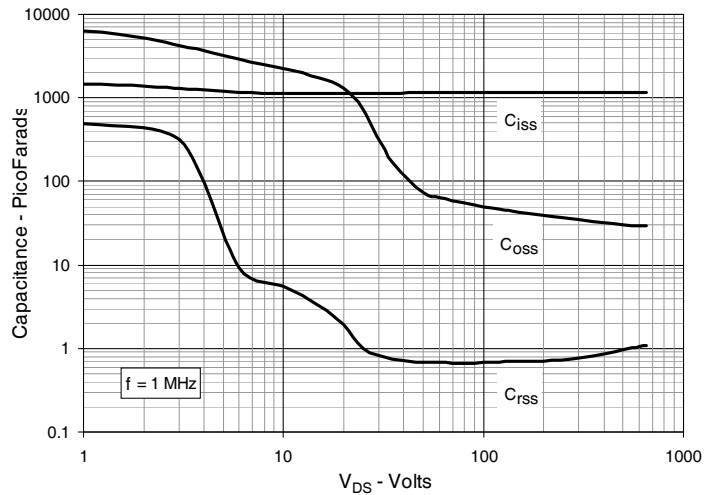
**ADVANCE TECHNICAL INFORMATION**

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.

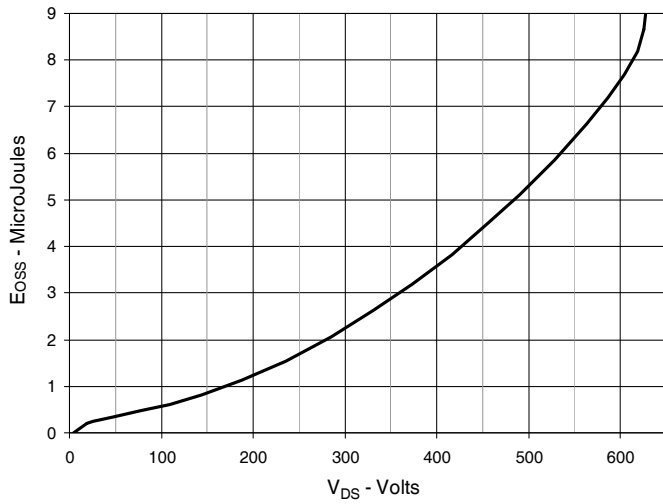
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|  |           |           |           |           |             |             |             |             |             |             |
|--|-----------|-----------|-----------|-----------|-------------|-------------|-------------|-------------|-------------|-------------|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

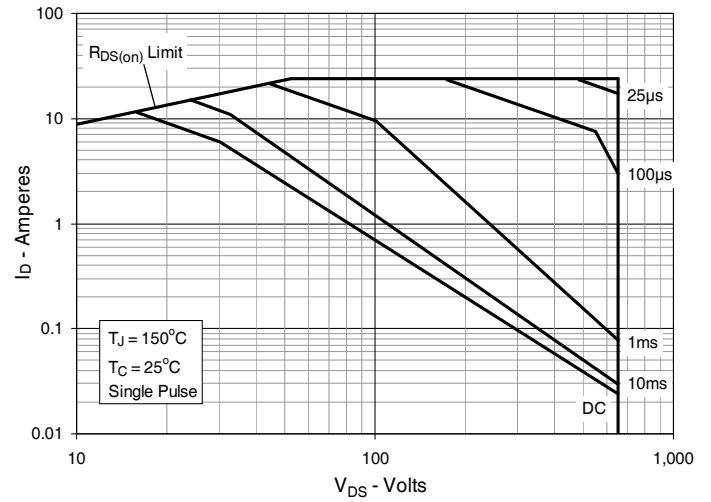
**Fig. 1. Output Characteristics @  $T_J = 25^\circ\text{C}$** 

**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  $I_D = 6\text{A}$  Value vs. Junction Temperature**

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

**Fig. 6. Normalized Breakdown & Threshold Voltages vs. Junction Temperature**


**Fig. 7. Maximum Drain Current vs. Case Temperature**

**Fig. 8. Input Admittance**

**Fig. 9. Transconductance**

**Fig. 10. Forward Voltage Drop of Intrinsic Diode**

**Fig. 11. Gate Charge**

**Fig. 12. Capacitance**


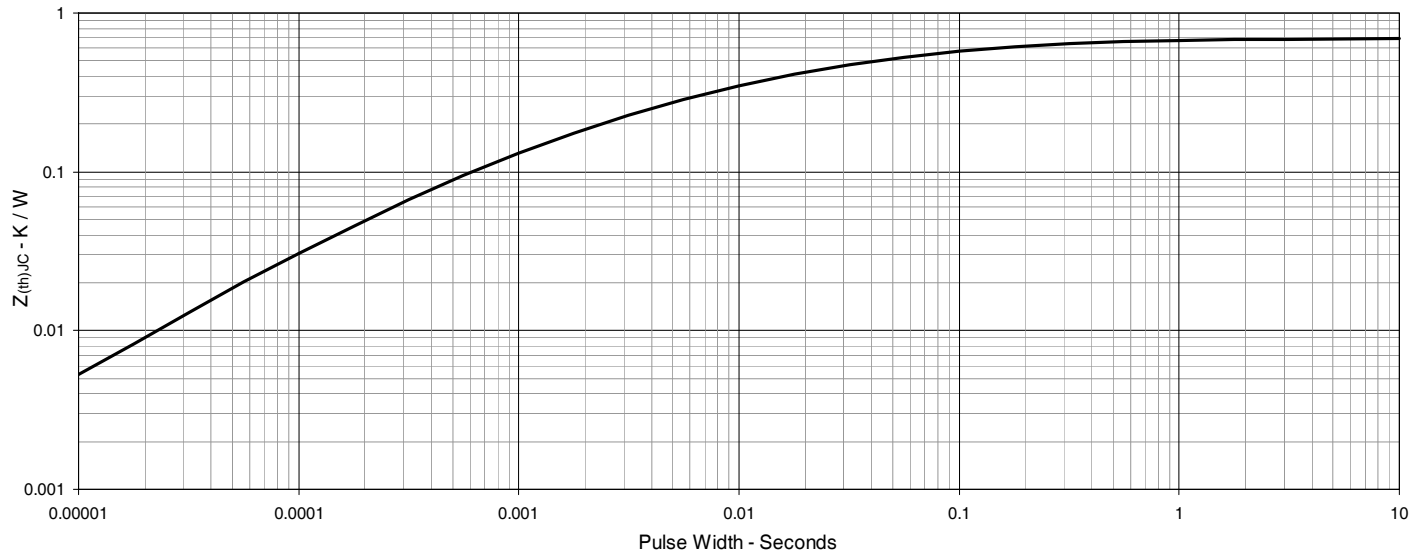
**Fig. 13. Output Capacitance Stored Energy**

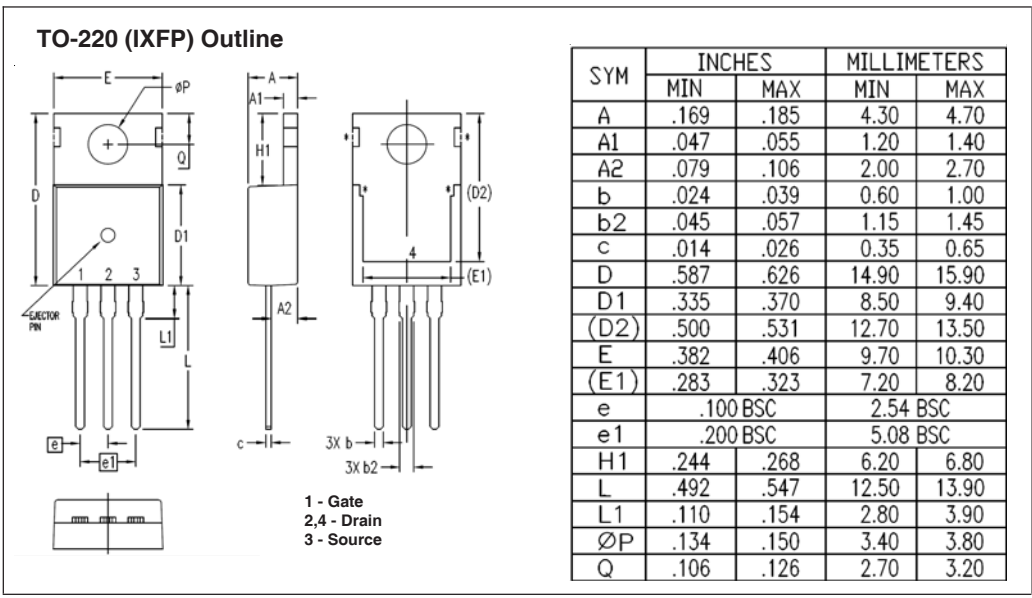


**Fig. 14. Forward-Bias Safe Operating Area**



**Fig. 15. Maximum Transient Thermal Impedance**







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