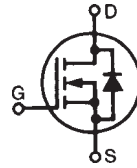


**Polar3™ HiperFET™**  
**Power MOSFET**

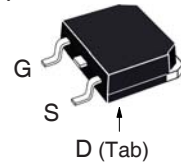
**IXFT50N60P3**  
**IXFQ50N60P3**  
**IXFH50N60P3**

**V<sub>DSS</sub> = 600V**  
**I<sub>D25</sub> = 50A**  
**R<sub>DS(on)</sub> ≤ 160mΩ**

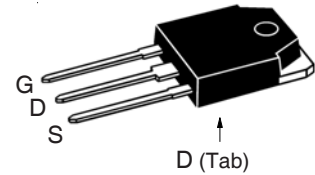
N-Channel Enhancement Mode  
Avalanche Rated  
Fast Intrinsic Rectifier



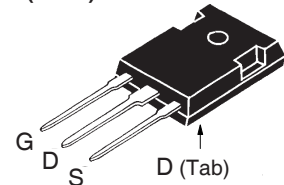
TO-268 (IXFT)



TO-3P (IXFQ)



TO-247 (IXFH)



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

| Symbol            | Test Conditions  | Maximum Ratings |          |
|-------------------|--|-----------------|----------|
| V <sub>DSS</sub>  | T <sub>J</sub> = 25°C to 150°C   | 600             | V        |
| V <sub>DGR</sub>  | T <sub>J</sub> = 25°C to 150°C, R <sub>GS</sub> = 1MΩ  | 600             | V        |
| V <sub>GSS</sub>  | Continuous   | ± 30            | V        |
| V <sub>GSM</sub>  | Transient  | ± 40            | V        |
| I <sub>D25</sub>  | T <sub>C</sub> = 25°C  | 50              | A        |
| I <sub>DM</sub>   | T <sub>C</sub> = 25°C, Pulse Width Limited by T <sub>JM</sub>                                  | 125             | A        |
| I <sub>A</sub>    | T <sub>C</sub> = 25°C  | 25              | A        |
| E <sub>AS</sub>   | T <sub>C</sub> = 25°C  | 1               | J        |
| dv/dt             | I <sub>S</sub> ≤ I <sub>DM</sub> , V <sub>DD</sub> ≤ V <sub>DSS</sub> , T <sub>J</sub> ≤ 150°C | 35              | V/ns     |
| P <sub>D</sub>    | T <sub>C</sub> = 25°C  | 1040            | W        |
| T <sub>J</sub>    |  | -55 ... +150    | °C       |
| T <sub>JM</sub>   |  | 150             | °C       |
| T <sub>stg</sub>  |  | -55 ... +150    | °C       |
| T <sub>L</sub>    | Maximum Lead Temperature for Soldering   | 300             | °C       |
| T <sub>SOLD</sub> | Plastic Body for 10s   | 260             | °C       |
| M <sub>d</sub>    | Mounting Torque (TO-247 & TO-3P)   | 1.13 / 10       | Nm/lb.in |
| Weight            | TO-268   | 4.0             | g        |
|                   | TO-3P  | 5.5             | g        |
|                   | TO-247   | 6.0             | g        |

**Features**

- Fast Intrinsic Rectifier
- Avalanche Rated
- Low R<sub>DS(ON)</sub> and Q<sub>G</sub>
- 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 <sub>J</sub> = 25°C Unless Otherwise Specified)               | Characteristic Values |      |               |
|---------------------|---|-----------------------|------|---------------|
|                     |   | Min.                  | Typ. | Max.          |
| BV <sub>DSS</sub>   | V <sub>GS</sub> = 0V, I <sub>D</sub> = 1mA  | 600                   |      | V             |
| V <sub>GS(th)</sub> | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 4mA                            | 3.0                   |      | 5.0 V         |
| I <sub>GSS</sub>    | V <sub>GS</sub> = ±30V, V <sub>DS</sub> = 0V  |                       |      | ±100 nA       |
| I <sub>DSS</sub>    | V <sub>DS</sub> = V <sub>DSS</sub> , V <sub>GS</sub> = 0V<br>T <sub>J</sub> = 125°C |                       |      | 25 μA<br>2 mA |
| R <sub>DS(on)</sub> | V <sub>GS</sub> = 10V, I <sub>D</sub> = 0.5 • I <sub>D25</sub> , Note 1             |                       |      | 160 mΩ        |

| Symbol       | Test Conditions   | Characteristic Values |      |                    |
|--------------|---|-----------------------|------|--------------------|
|              |   | Min.                  | Typ. | Max.               |
| $g_{fs}$     | $V_{DS} = 20V, I_D = 0.5 \cdot I_{D25}$ , Note 1  | 32                    | 55   | S                  |
| $C_{iss}$    | $V_{GS} = 0V, V_{DS} = 25V, f = 1MHz$   |                       | 6300 | pF                 |
| $C_{oss}$    |   |                       | 630  | pF                 |
| $C_{rss}$    |   |                       | 2.5  | pF                 |
| $R_{Gi}$     | Gate Input Resistance   |                       | 1.0  | $\Omega$           |
| $t_{d(on)}$  | <b>Resistive Switching Times</b><br>$V_{GS} = 10V, V_{DS} = 0.5 \cdot V_{DSS}, I_D = 0.5 \cdot I_{D25}$<br>$R_G = 1\Omega$ (External) |                       | 31   | ns                 |
| $t_r$        |   |                       | 20   | ns                 |
| $t_{d(off)}$ |   |                       | 62   | ns                 |
| $t_f$        |   |                       | 17   | ns                 |
| $Q_{g(on)}$  | $V_{GS} = 10V, V_{DS} = 0.5 \cdot V_{DSS}, I_D = 0.5 \cdot I_{D25}$   |                       | 94   | nC                 |
| $Q_{gs}$     |   |                       | 27   | nC                 |
| $Q_{gd}$     |   |                       | 23   | nC                 |
| $R_{thJC}$   |   |                       |      | 0.12 $^{\circ}C/W$ |
| $R_{thCS}$   | (TO-247 & TO-3P)  | 0.25                  |      | $^{\circ}C/W$      |

### Source-Drain Diode

| Symbol   | Test Conditions   | Characteristic Values |      |         |
|----------|---|-----------------------|------|---------|
|          |   | Min.                  | Typ. | Max.    |
| $I_s$    | $V_{GS} = 0V$   |                       |      | 50 A    |
| $I_{SM}$ | Repetitive, Pulse Width Limited by $T_{JM}$                   |                       |      | 200 A   |
| $V_{SD}$ | $I_F = I_s, V_{GS} = 0V$ , Note 1                             |                       |      | 1.4 V   |
| $t_{rr}$ | $I_F = 25A, -di/dt = 100A/\mu s$<br>$V_R = 100V, V_{GS} = 0V$ |                       |      | 250 ns  |
| $I_{RM}$ |   |                       | 11   | A       |
| $Q_{RM}$ |   |                       | 1.1  | $\mu C$ |

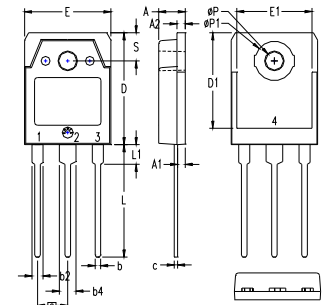
Note 1. Pulse test,  $t \leq 300\mu s$ , duty cycle,  $d \leq 2\%$ .

#### TO-268 Outline

Terminals: 1 - Gate, 2, 4 - Drain, 3 - Source

| SYM | INCHES   |      | MILLIMETERS |       |
|-----|----------|------|-------------|-------|
|     | MIN      | MAX  | MIN         | MAX   |
| A   | .193     | .201 | 4.90        | 5.10  |
| A1  | .106     | .114 | 2.70        | 2.90  |
| A2  | .001     | .010 | 0.02        | 0.25  |
| b   | .045     | .057 | 1.15        | 1.45  |
| b1  | .075     | .083 | 1.90        | 2.10  |
| C   | .016     | .026 | 0.40        | 0.65  |
| C2  | .057     | .063 | 1.45        | 1.60  |
| D   | .543     | .551 | 13.80       | 14.00 |
| D1  | .488     | .500 | 12.40       | 12.70 |
| E   | .624     | .632 | 15.85       | 16.05 |
| E1  | .524     | .535 | 13.30       | 13.60 |
| e   | .215 BSC |      | 5.45 BSC    |       |
| H   | .736     | .752 | 18.70       | 19.10 |
| L   | .094     | .106 | 2.40        | 2.70  |
| L1  | .047     | .055 | 1.20        | 1.40  |
| L2  | .039     | .045 | 1.00        | 1.15  |
| L3  | .010 BSC |      | 0.25 BSC    |       |
| L4  | .150     | .161 | 3.80        | 4.10  |

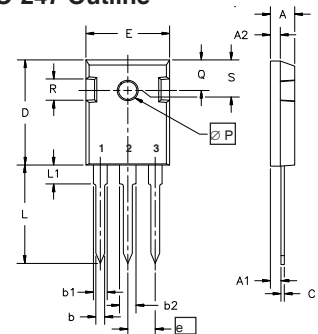
### TO-3P Outline



1 - GATE  
2 - DRAIN  
3 - SOURCE  
4 - DRAIN

| 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  |
| b1        | .075     | .087 | 1.90        | 2.20  |
| b2        | .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  |
| $\phi P$  | .126     | .134 | 3.20        | 3.40  |
| $\phi P1$ | .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  |
| 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  |
| $\phi P$ | 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 @  $T_J = 25^\circ\text{C}$

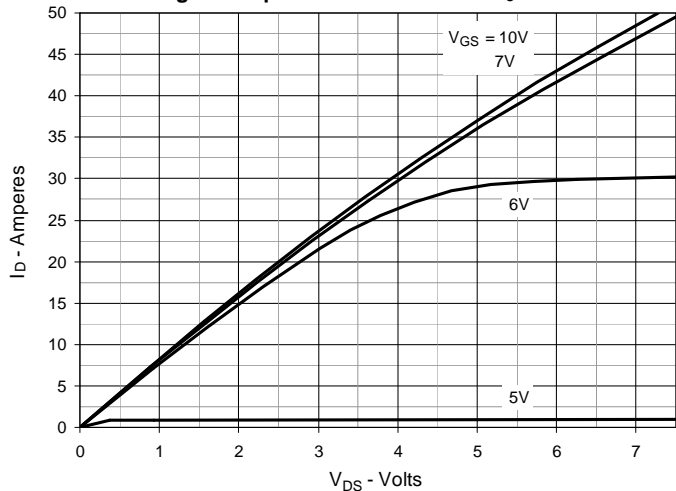


Fig. 2. Extended Output Characteristics @  $T_J = 25^\circ\text{C}$

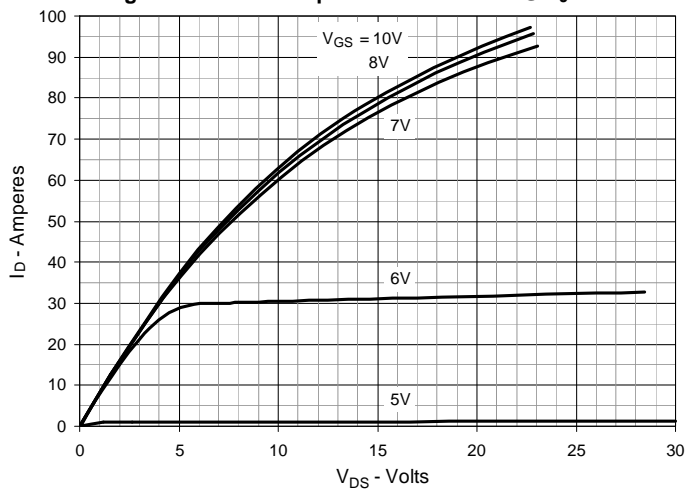


Fig. 3. Output Characteristics @  $T_J = 125^\circ\text{C}$

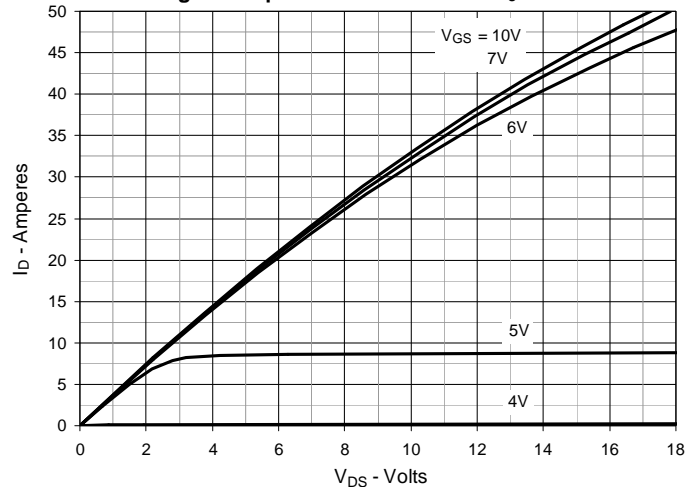


Fig. 4.  $R_{DS(on)}$  Normalized to  $I_D = 25\text{A}$  Value vs. Junction Temperature

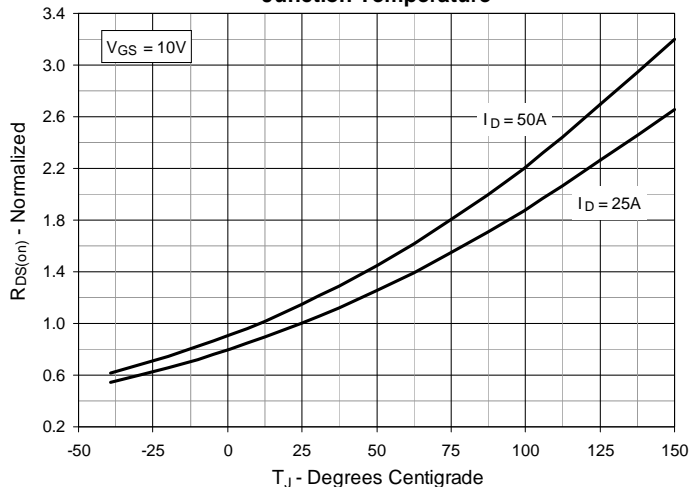


Fig. 5.  $R_{DS(on)}$  Normalized to  $I_D = 25\text{A}$  Value vs. Drain Current

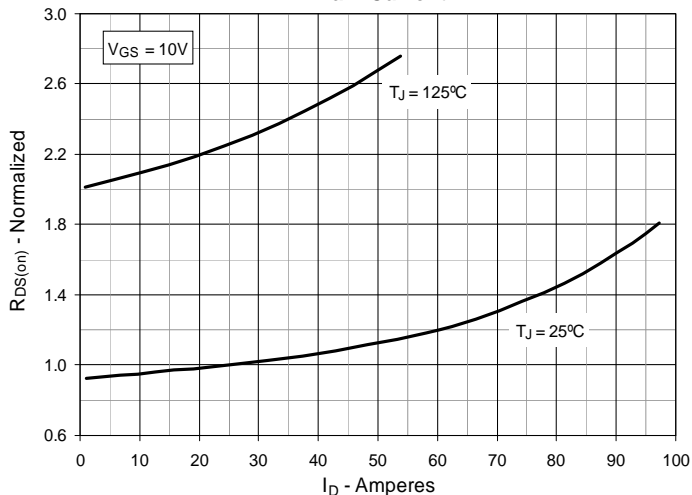


Fig. 6. Maximum Drain Current vs. Case Temperature

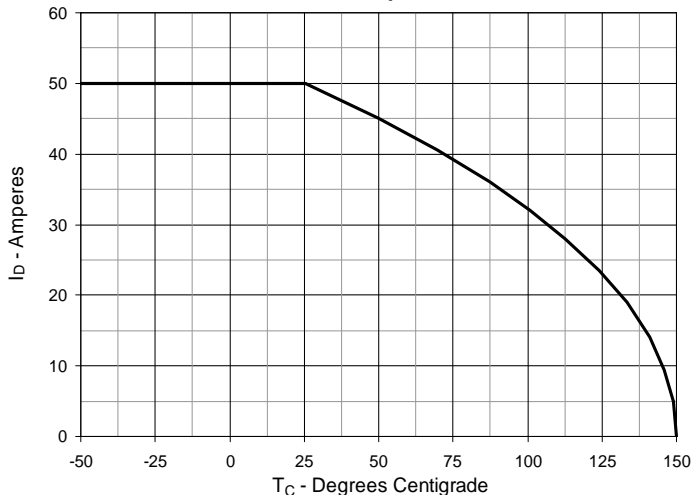


Fig. 7. Input Admittance

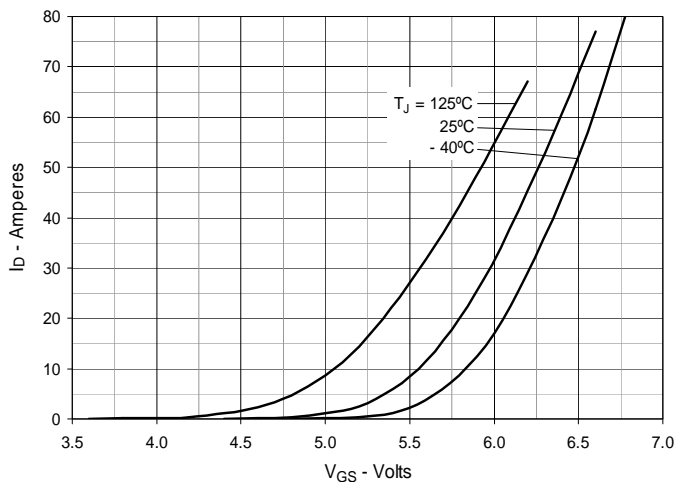


Fig. 8. Transconductance

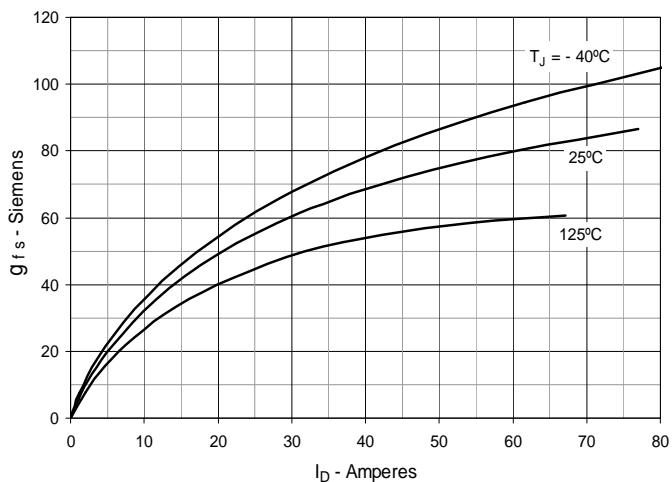


Fig. 9. Forward Voltage Drop of Intrinsic Diode

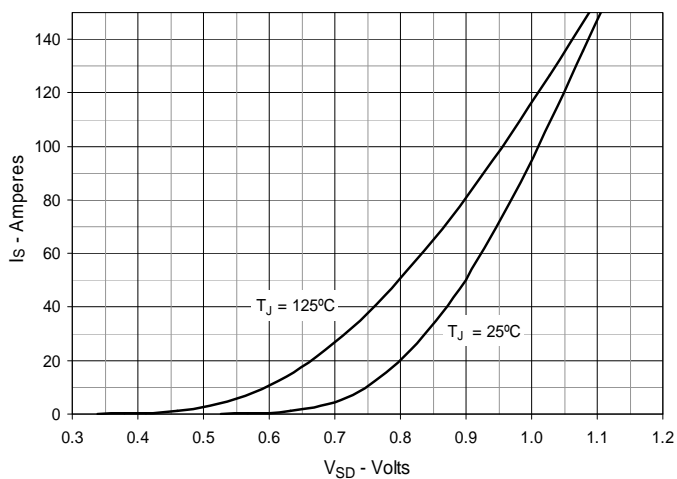


Fig. 10. Gate Charge

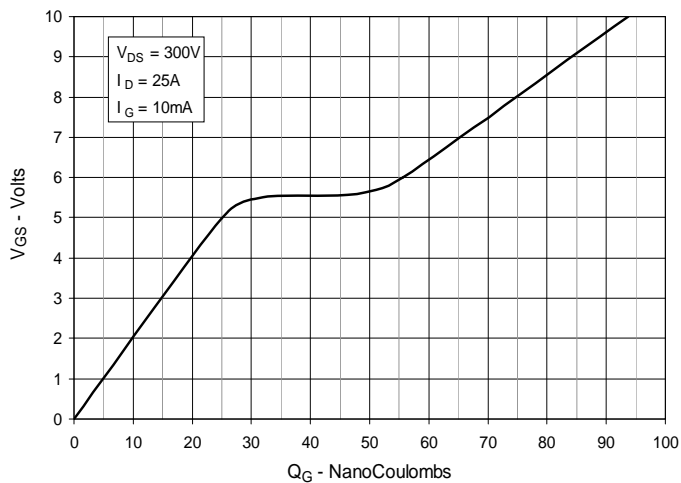


Fig. 11. Capacitance

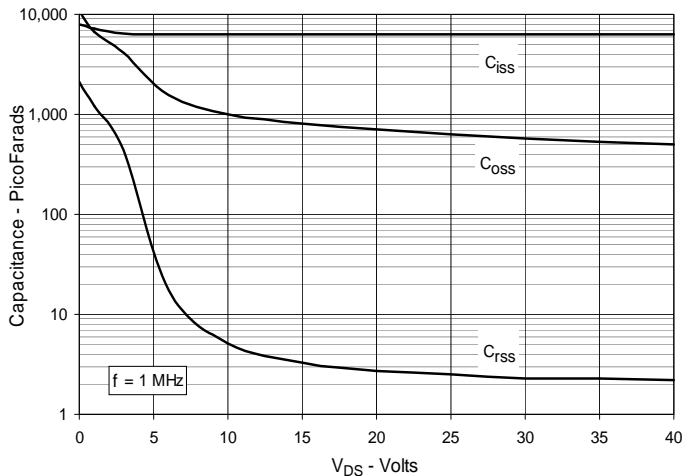


Fig. 12. Forward-Bias Safe Operating Area

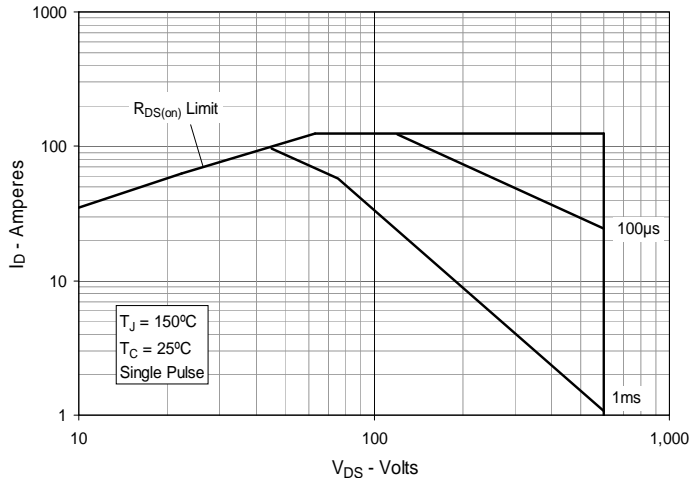
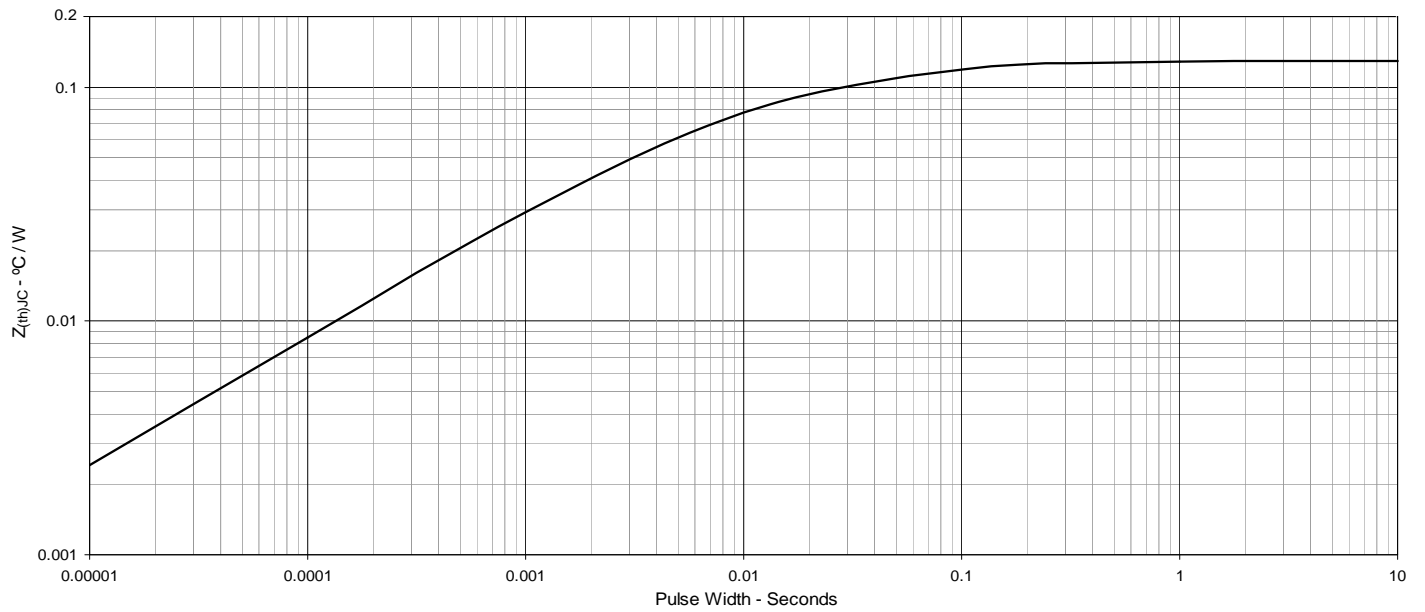


Fig. 13. Maximum Transient Thermal Impedance





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