

**Polar™  
Power MOSFET**

**IXTA12N50P  
IXTP12N50P**

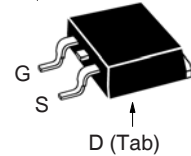
$V_{DSS} = 500V$   
 $I_{D25} = 12A$   
 $R_{DS(on)} \leq 500m\Omega$

N-Channel Enhancement Mode  
 Avalanche Rated  
 Fast Intrinsic Rectifier

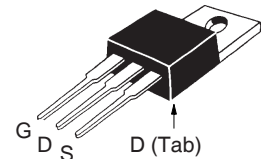


| Symbol     | Test Conditions  | Maximum Ratings |            |
|------------|--|-----------------|------------|
| $V_{DSS}$  | $T_J = 25^\circ C$ to $150^\circ C$                                | 500             | V          |
| $V_{DGR}$  | $T_J = 25^\circ C$ to $150^\circ C$ , $R_{GS} = 1M\Omega$          | 500             | V          |
| $V_{GSS}$  | Continuous   | $\pm 30$        | V          |
| $V_{GSM}$  | Transient  | $\pm 40$        | V          |
| $I_{D25}$  | $T_C = 25^\circ C$   | 12              | A          |
| $I_{DM}$   | $T_C = 25^\circ C$ , Pulse Width Limited by $T_{JM}$               | 30              | A          |
| $I_A$      | $T_C = 25^\circ C$   | 12              | A          |
| $E_{AS}$   | $T_C = 25^\circ C$   | 600             | mJ         |
| $dv/dt$    | $I_S \leq I_{DM}$ , $V_{DD} \leq V_{DSS}$ , $T_J \leq 150^\circ C$ | 10              | V/ns       |
| $P_D$      | $T_C = 25^\circ C$   | 200             | W          |
| $T_J$      |  | -55 ... +150    | $^\circ C$ |
| $T_{JM}$   |  | 150             | $^\circ C$ |
| $T_{stg}$  |  | -55 ... +150    | $^\circ C$ |
| $T_L$      | 1.6mm (0.062in.) from Case for 10s                                 | 300             | $^\circ C$ |
| $T_{sold}$ | Plastic Body for 10 Seconds  | 260             | $^\circ C$ |
| $M_d$      | Mounting Torque (TO-220)   | 1.13 / 10       | Nm/lb.in.  |
| Weight     | TO-263   | 2.5             | g          |
|            | TO-220   | 3.0             | g          |

TO-263 AA (IXTA)



TO-220AB (IXTP)



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

**Features**

- International Standard Packages
- Dynamic  $dv/dt$  Rating
- Avalanche Rated
- Fast Intrinsic Rectifier
- Low  $Q_G$
- Low  $R_{DS(on)}$
- Low Drain-to-Tab Capacitance
- Low Package Inductance

**Advantages**

- Easy to Mount
- Space Savings

**Applications**

- DC-DC Converters
- Battery Chargers
- Switch-Mode and Resonant-Mode Power Supplies
- Uninterrupted Power Supplies
- AC Motor Drives
- High Speed Power Switching Applications

| 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                        |
| $V_{GS(th)}$ | $V_{DS} = V_{GS}$ , $I_D = 250\mu A$                                | 3.0                   |      | 5.5 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>250 $\mu A$ |
| $R_{DS(on)}$ | $V_{GS} = 10V$ , $I_D = 0.5 \cdot I_{D25}$ , Notes 1, 2             |                       |      | 500 m $\Omega$           |

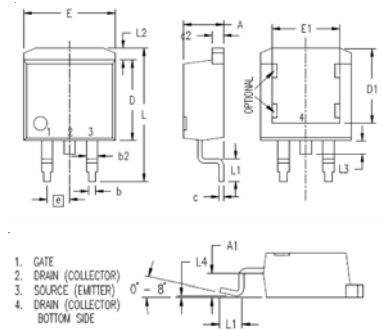
| Symbol       | Test Conditions<br>( $T_J = 25^\circ\text{C}$ , Unless Otherwise Specified)  | Characteristic Values |      |                         |
|--------------|--|-----------------------|------|-------------------------|
|              |  | Min.                  | Typ. | Max.                    |
| $g_{fs}$     | $V_{DS} = 10\text{V}$ , $I_D = 0.5 \cdot I_{D25}$ , Note 1   | 7.5                   | 13   | S                       |
| $C_{iss}$    | $V_{GS} = 0\text{V}$ , $V_{DS} = 25\text{V}$ , $f = 1\text{MHz}$   |                       | 1830 | pF                      |
| $C_{oss}$    |  |                       | 182  | pF                      |
| $C_{rss}$    |  |                       | 16   | pF                      |
| $t_{d(on)}$  | <b>Resistive Switching Time</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) |                       | 22   | ns                      |
| $t_r$        |  |                       | 27   | ns                      |
| $t_{d(off)}$ |  |                       | 65   | ns                      |
| $t_f$        |  |                       | 20   | ns                      |
| $Q_{g(on)}$  | $V_{GS} = 10\text{V}$ , $V_{DS} = 0.5 \cdot V_{DSS}$ , $I_D = 0.5 \cdot I_{D25}$   |                       | 29   | nC                      |
| $Q_{gs}$     |  |                       | 11   | nC                      |
| $Q_{gd}$     |  |                       | 10   | nC                      |
| $R_{thJC}$   | TO-220   |                       | 0.50 | 0.62 $^\circ\text{C/W}$ |
| $R_{thCH}$   |  |                       |      | $^\circ\text{C/W}$      |

### 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  |                       |      | 1.5 V         |
| $t_{rr}$ | $I_F = 6\text{A}$ , $-di/dt = 150\text{A}/\mu\text{s}$ ,<br>$V_R = 100\text{V}$ , $V_{GS} = 0\text{V}$ |                       | 2.8  | 300 ns        |
| $Q_{RM}$ |  |                       |      | $\mu\text{C}$ |
| $I_{RM}$ |  |                       |      | A             |
|          |  |                       |      | 18.2          |

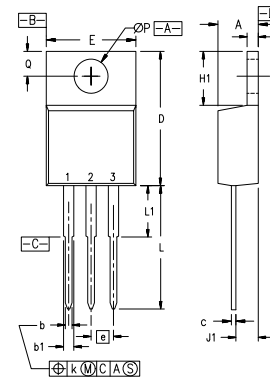
- Notes: 1. Pulse test,  $t \leq 300\mu\text{s}$ , duty cycle,  $d \leq 2\%$ .  
2. On through-hole packages,  $R_{DS(on)}$  Kelvin test contact location must be 5mm or less from the package body.

### 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-220 Outline



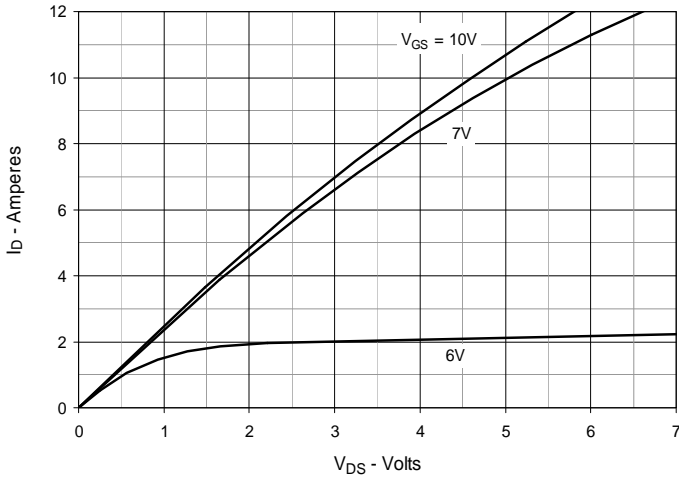
- Pins: 1 - Gate 2 - Drain  
3 - Source

| 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  |

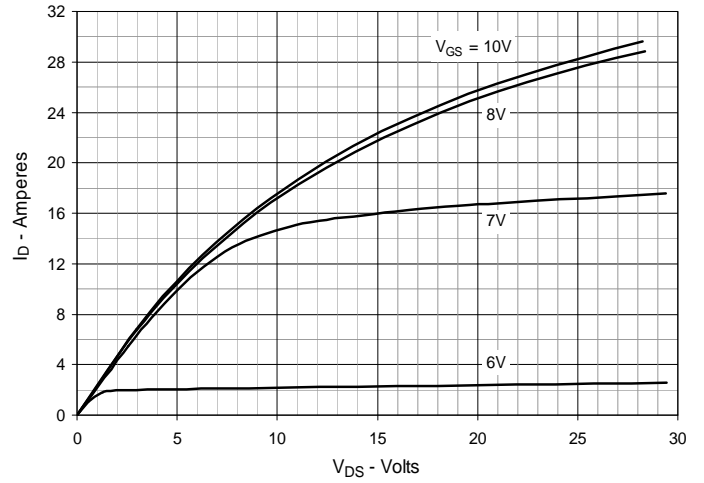
IXYS Reserves the Right to Change Limits, Test Conditions, and Dimensions.

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

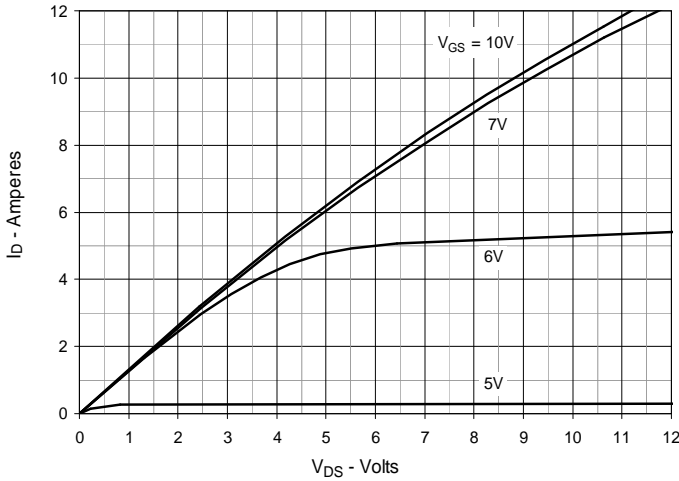
**Fig. 1. Output Characteristics @  $T_J = 25^\circ\text{C}$**



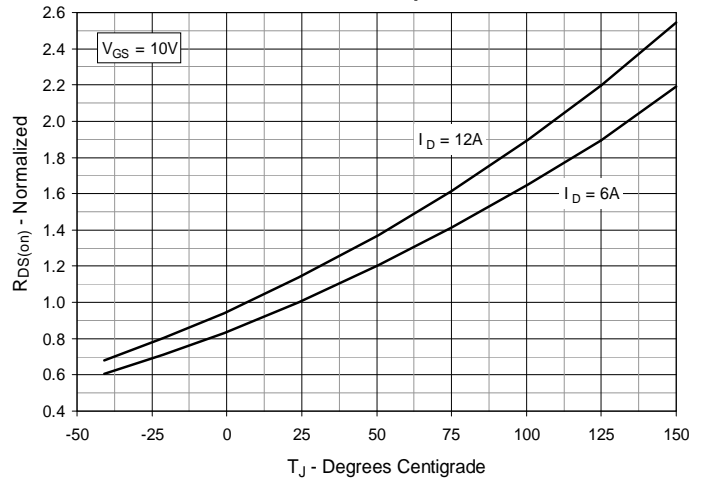
**Fig. 2. Extended Output Characteristics @  $T_J = 25^\circ\text{C}$**



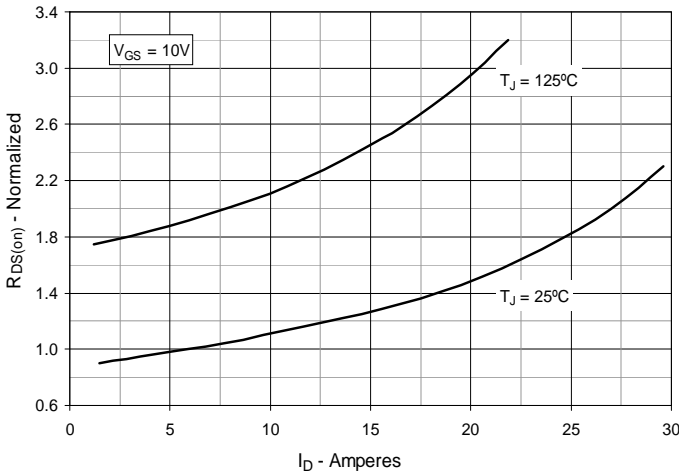
**Fig. 3. Output Characteristics @  $T_J = 125^\circ\text{C}$**



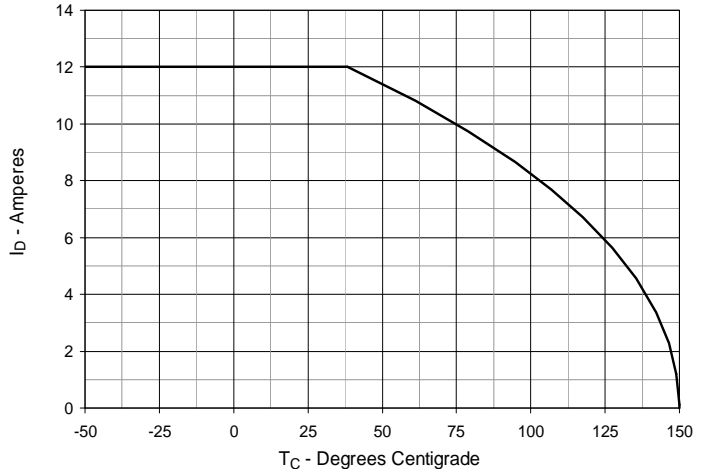
**Fig. 4.  $R_{DS(on)}$  Normalized to  $I_D = 6\text{A}$  Value vs. Junction Temperature**



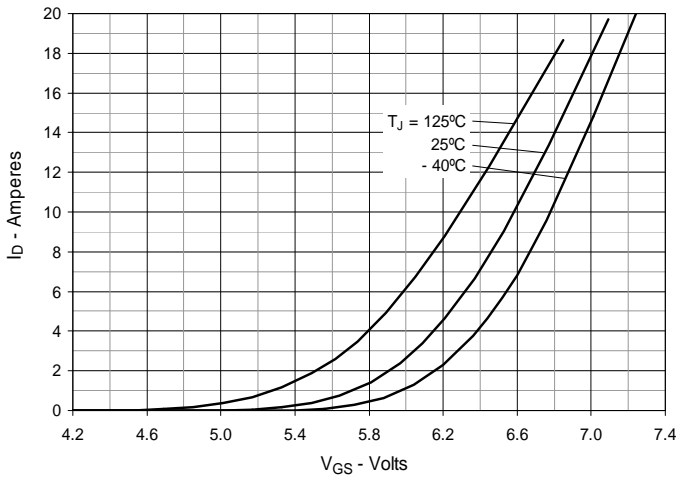
**Fig. 5.  $R_{DS(on)}$  Normalized to  $I_D = 6\text{A}$  Value vs. Drain Current**



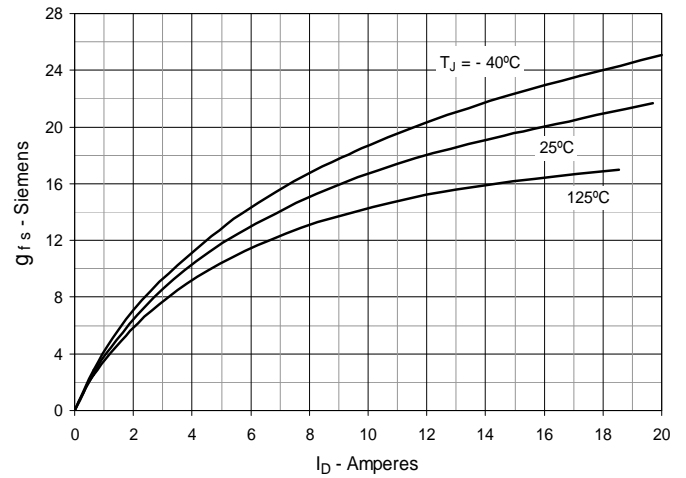
**Fig. 6. Maximum Drain Current vs. Case Temperature**



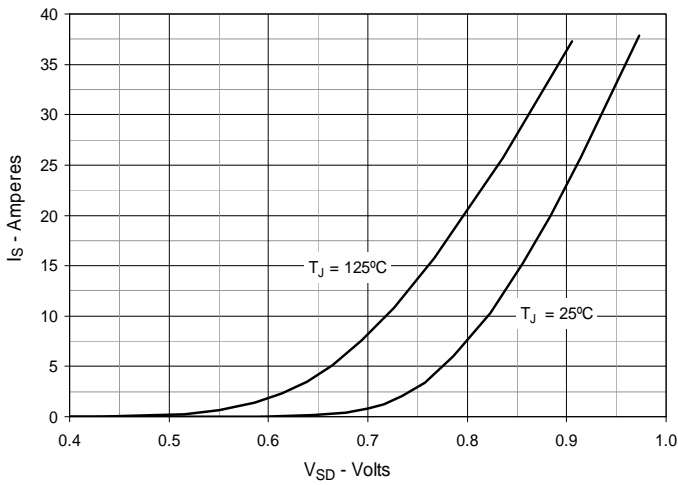
**Fig. 7. Input Admittance**



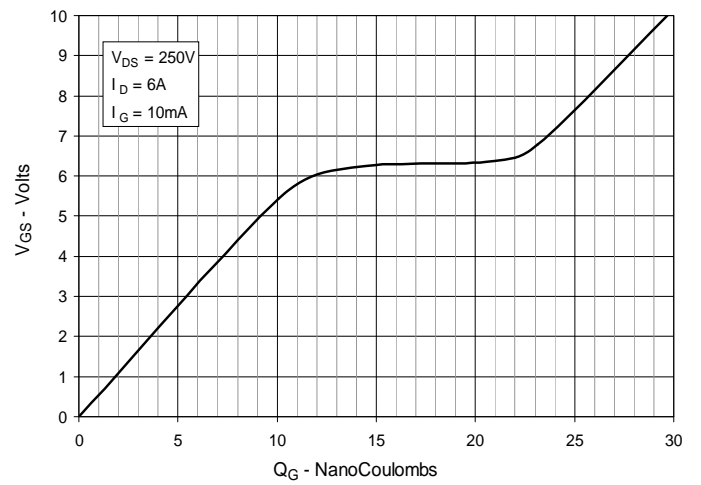
**Fig. 8. Transconductance**



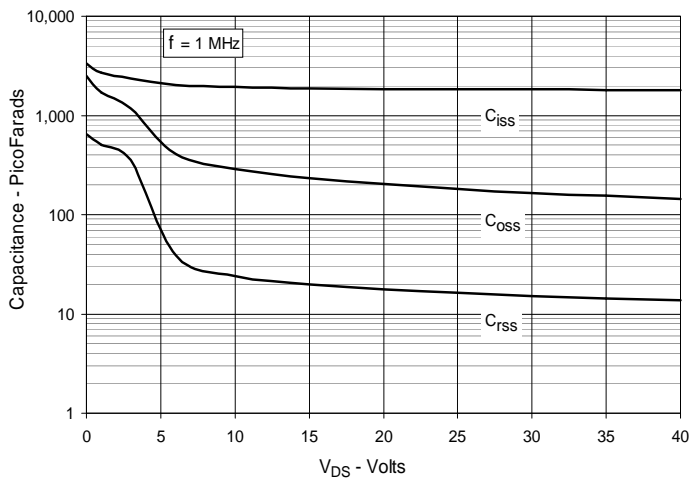
**Fig. 9. Forward Voltage Drop of Intrinsic Diode**



**Fig. 10. Gate Charge**



**Fig. 11. Capacitance**



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

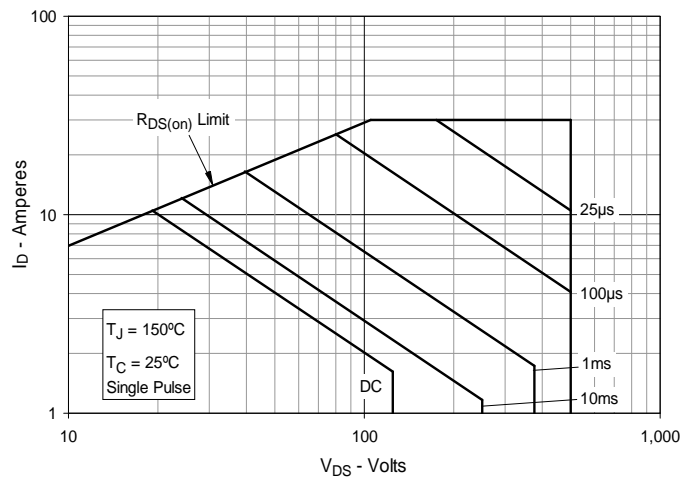
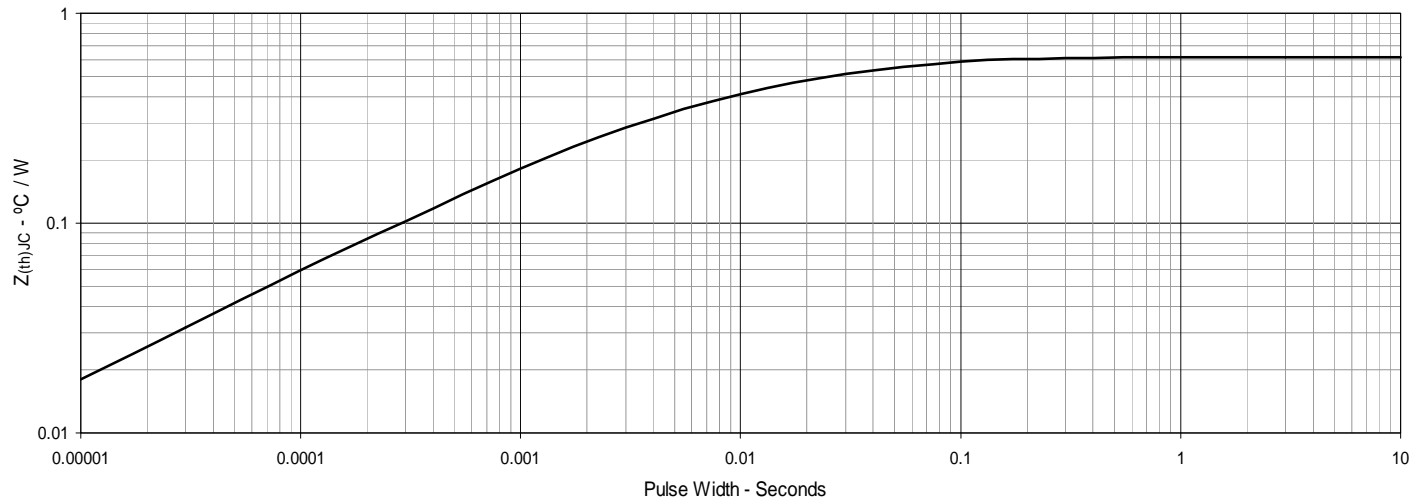


Fig. 13. Maximum Transient Thermal Impedance





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