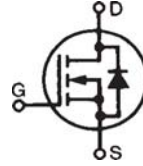


## High Voltage Power MOSFET

## IXTF1R4N450

$$\begin{aligned} V_{DSS} &= 4500V \\ I_{D25} &= 1.4A \\ R_{DS(on)} &\leq 40\Omega \end{aligned}$$

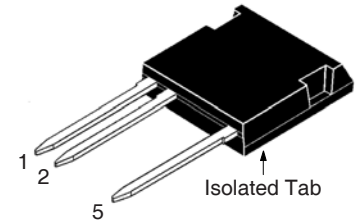
(Electrically Isolated Tab)



N-Channel Enhancement Mode

| Symbol     | Test Conditions                                                       | Maximum Ratings   |                  |
|------------|-----------------------------------------------------------------------|-------------------|------------------|
| $V_{DSS}$  | $T_J = 25^\circ\text{C}$ to $150^\circ\text{C}$                       | 4500              | V                |
| $V_{DGR}$  | $T_J = 25^\circ\text{C}$ to $150^\circ\text{C}$ , $R_{GS} = 1M\Omega$ | 4500              | V                |
| $V_{GSS}$  | Continuous                                                            | $\pm 20$          | V                |
| $V_{GSM}$  | Transient                                                             | $\pm 30$          | V                |
| $I_{D25}$  | $T_C = 25^\circ\text{C}$                                              | 1.4               | A                |
| $I_{DM}$   | $T_C = 25^\circ\text{C}$ , Pulse Width Limited by $T_{JM}$            | 4.2               | A                |
| $P_D$      | $T_C = 25^\circ\text{C}$                                              | 190               | 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               | $^\circ\text{C}$ |
| $T_{SOLD}$ | 1.6 mm (0.062in.) from Case for 10s                                   | 260               | $^\circ\text{C}$ |
| $F_C$      | Mounting Force                                                        | 20..120 / 4.5..27 | N/lb             |
| $V_{ISOL}$ | 50/60Hz, 1 Minute                                                     | 4500              | V~               |
| Weight     |                                                                       | 6                 | g                |

ISOPLUS i4-Pak™



1 = Gate      5 = Drain  
2 = Source

### Features

- Silicon Chip on Direct-Copper Bond (DCB) Substrate
- Isolated Mounting Surface
- 4500V~ Electrical Isolation
- Molding Epoxies meet UL 94 V-0 Flammability Classification

### Advantages

- High Voltage Package
- Easy to Mount
- Space Savings
- High Power Density

### Applications

- High Voltage Power Supplies
- Capacitor Discharge Applications
- Pulse Circuits
- Laser and X-Ray Generation Systems

| Symbol       | Test Conditions<br>( $T_J = 25^\circ\text{C}$ , Unless Otherwise Specified)                                | Characteristic Values |      |                                                      |
|--------------|------------------------------------------------------------------------------------------------------------|-----------------------|------|------------------------------------------------------|
|              |                                                                                                            | Min.                  | Typ. | Max.                                                 |
| $V_{GS(th)}$ | $V_{DS} = V_{GS}$ , $I_D = 250\mu\text{A}$                                                                 | 4.0                   |      | 6.0 V                                                |
| $I_{GSS}$    | $V_{GS} = \pm 20V$ , $V_{DS} = 0V$                                                                         |                       |      | $\pm 100$ nA                                         |
| $I_{DSS}$    | $V_{DS} = 3.6kV$ , $V_{GS} = 0V$<br>$V_{DS} = 4.5kV$<br>$V_{DS} = 3.6kV$ Note 2, $T_J = 100^\circ\text{C}$ |                       | 25   | 5 $\mu\text{A}$<br>25 $\mu\text{A}$<br>$\mu\text{A}$ |
| $R_{DS(on)}$ | $V_{GS} = 10V$ , $I_D = 50mA$ , Note 1                                                                     |                       |      | 40 $\Omega$                                          |

| Symbol       | Test Conditions<br>( $T_J = 25^\circ\text{C}$ , Unless Otherwise Specified)                                                                   | Characteristic Values |                         |                    |
|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|-------------------------|--------------------|
|              |                                                                                                                                               | Min.                  | Typ.                    | Max.               |
| $g_{fs}$     | $V_{DS} = 50\text{V}$ , $I_D = 700\text{mA}$ , Note 1                                                                                         | 1.2                   | 2.0                     | S                  |
| $C_{iss}$    | $V_{GS} = 0\text{V}$ , $V_{DS} = 25\text{V}$ , $f = 1\text{MHz}$                                                                              |                       | 3300                    | pF                 |
| $C_{oss}$    |                                                                                                                                               |                       | 134                     | pF                 |
| $C_{rss}$    |                                                                                                                                               |                       | 52                      | pF                 |
| $R_{Gi}$     | Gate Input Resistance                                                                                                                         |                       | 7.8                     | $\Omega$           |
| $t_{d(on)}$  | <b>Resistive Switching Times</b><br>$V_{GS} = 10\text{V}$ , $V_{DS} = 500\text{V}$ , $I_D = 0.5 \cdot I_{D25}$<br>$R_G = 10\Omega$ (External) |                       | 44                      | ns                 |
| $t_r$        |                                                                                                                                               |                       | 60                      | ns                 |
| $t_{d(off)}$ |                                                                                                                                               |                       | 126                     | ns                 |
| $t_f$        |                                                                                                                                               |                       | 170                     | ns                 |
| $Q_{g(on)}$  | $V_{GS} = 10\text{V}$ , $V_{DS} = 0.5 \cdot V_{DSS}$ , $I_D = 0.5 \cdot I_{D25}$                                                              |                       | 88                      | nC                 |
| $Q_{gs}$     |                                                                                                                                               |                       | 16                      | nC                 |
| $Q_{gd}$     |                                                                                                                                               |                       | 42                      | nC                 |
| $R_{thJC}$   |                                                                                                                                               |                       | 0.65 $^\circ\text{C/W}$ | $^\circ\text{C/W}$ |
| $R_{thCS}$   |                                                                                                                                               | 0.15                  |                         |                    |

#### Source-Drain Diode

| Symbol   | Test Conditions<br>( $T_J = 25^\circ\text{C}$ , Unless Otherwise Specified)   | Characteristic Values |      |               |
|----------|-------------------------------------------------------------------------------|-----------------------|------|---------------|
|          |                                                                               | Min.                  | Typ. | Max           |
| $I_S$    | $V_{GS} = 0\text{V}$ , Note 1                                                 |                       |      | 1.4 A         |
| $I_{SM}$ | Repetitive, pulse Width Limited by $T_{JM}$                                   |                       |      | 5.6 A         |
| $V_{SD}$ | $I_F = I_S$ , $V_{GS} = 0\text{V}$ , Note 1                                   |                       |      | 1.5 V         |
| $t_{rr}$ | $I_F = 1\text{A}$ , $-di/dt = 100\text{A}/\mu\text{s}$<br>$V_R = 100\text{V}$ |                       | 660  | ns            |
| $Q_{RM}$ |                                                                               |                       | 4.6  | $\mu\text{C}$ |
| $I_{RM}$ |                                                                               |                       | 14.0 | A             |

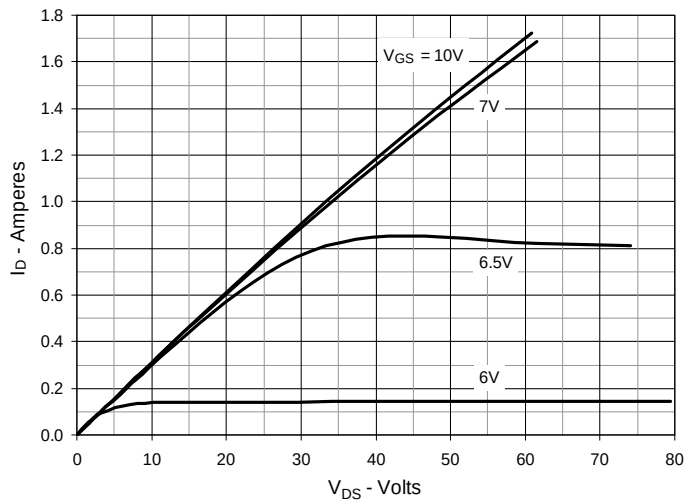
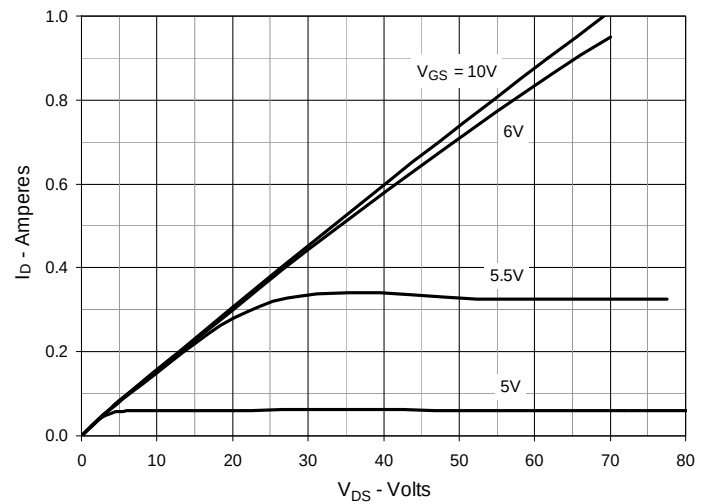
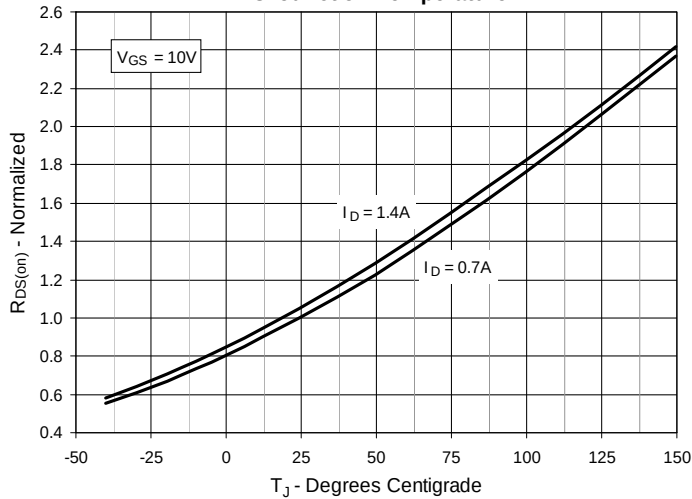
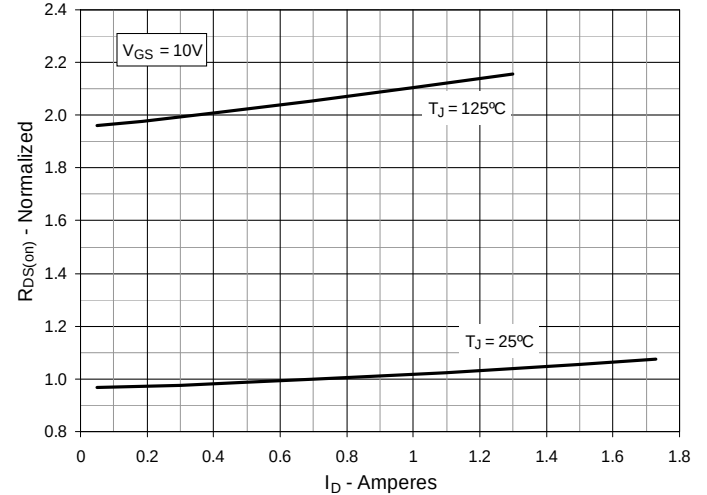
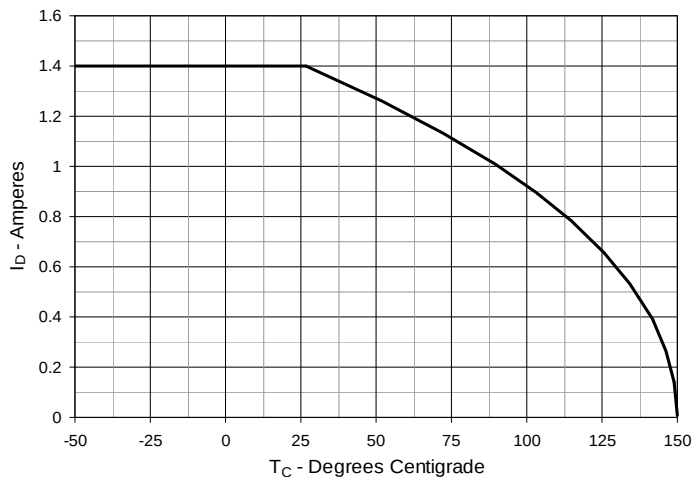
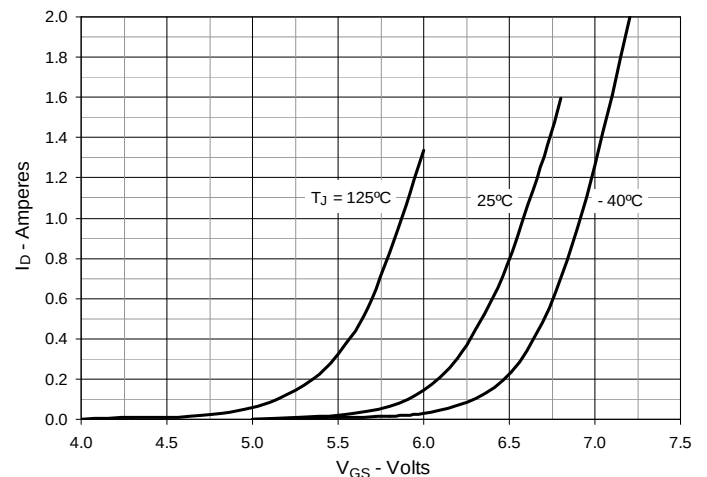
- Notes: 1. Pulse test,  $t \leq 300\mu\text{s}$ , duty cycle,  $d \leq 2\%$ .  
2. Part must be heatsunk for high-temp  $I_{DSS}$  measurement.

#### ADVANCE TECHNICAL INFORMATION

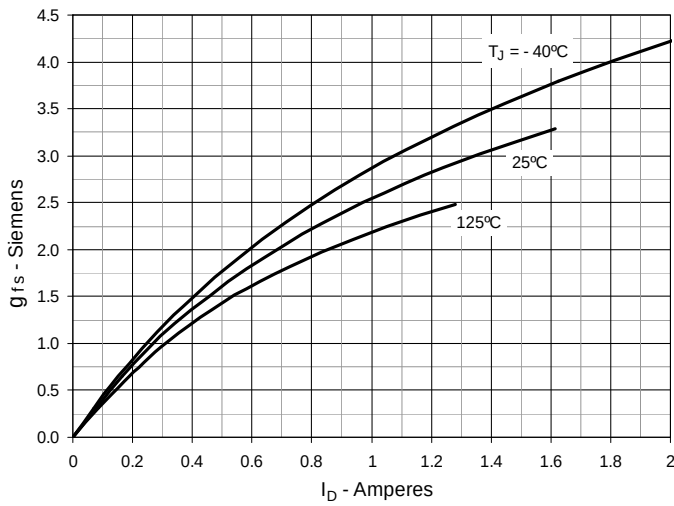
The product presented herein is under development. The Technical Specifications offered are derived from a subjective evaluation of the design, based upon prior knowledge and experience, and constitute a "considered reflection" of the anticipated result. IXYS reserves the right to change limits, test conditions, and dimensions without notice.

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

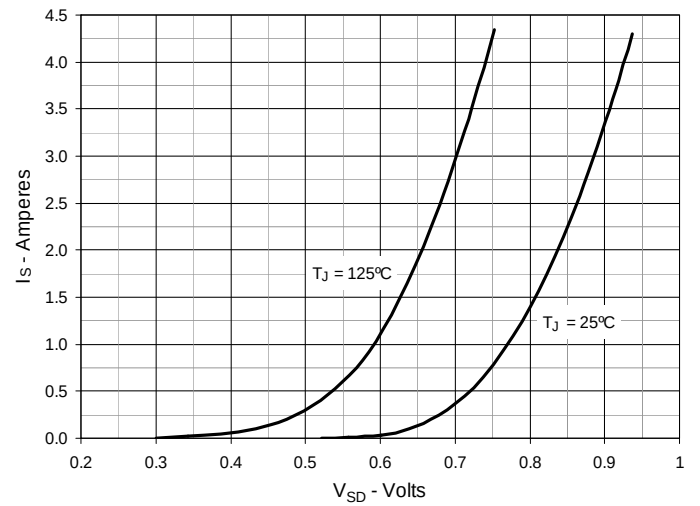
|                                                                                  |           |           |           |           |              |              |              |              |              |              |
|----------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|--------------|--------------|--------------|--------------|--------------|--------------|
| 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 | 7,157,338 B2 |
|                                                                                  | 4,860,072 | 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. Output Characteristics @  $T_J = 125^\circ\text{C}$** 

**Fig. 3.  $R_{DS(on)}$  Normalized to  $I_D = 0.7\text{A}$  Value vs. Junction Temperature**

**Fig. 4.  $R_{DS(on)}$  Normalized to  $I_D = 0.7\text{A}$  Value vs. Drain Current**

**Fig. 5. Maximum Drain Current vs. Case Temperature**

**Fig. 6. Input Admittance**


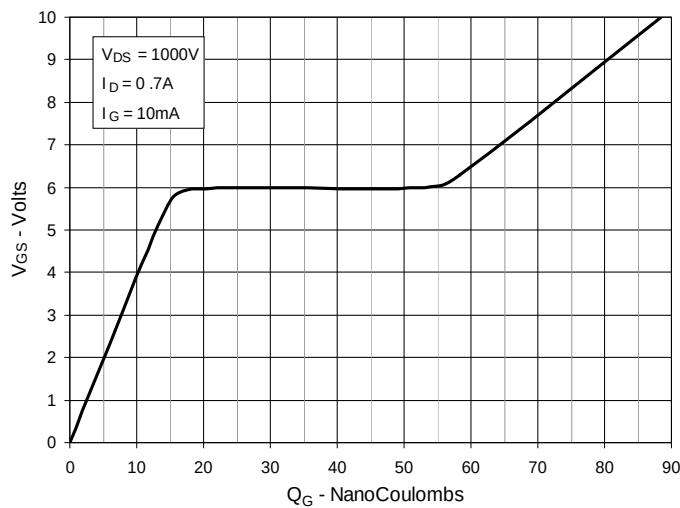
**Fig. 7. Transconductance**



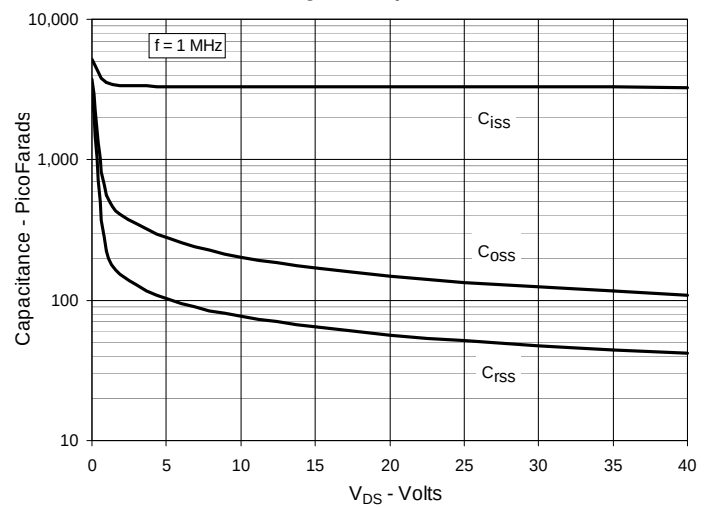
**Fig. 8. Forward Voltage Drop of Intrinsic Diode**



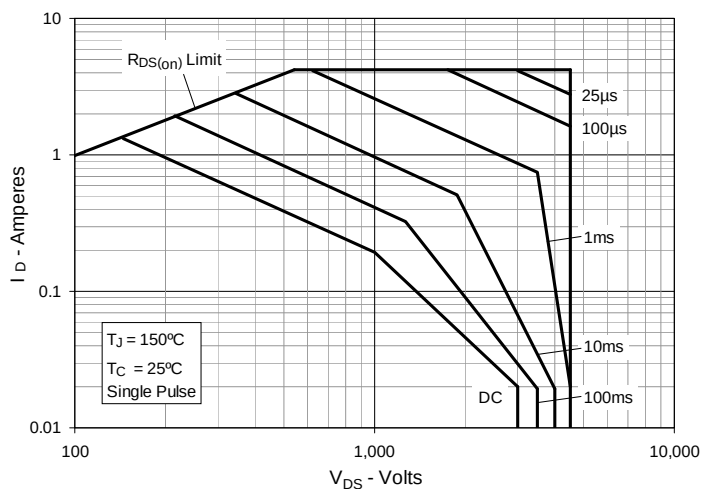
**Fig. 9. Gate Charge**



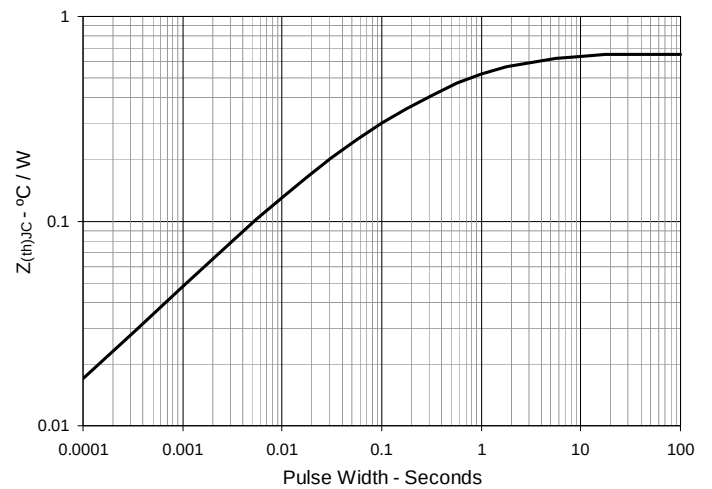
**Fig. 10. Capacitance**



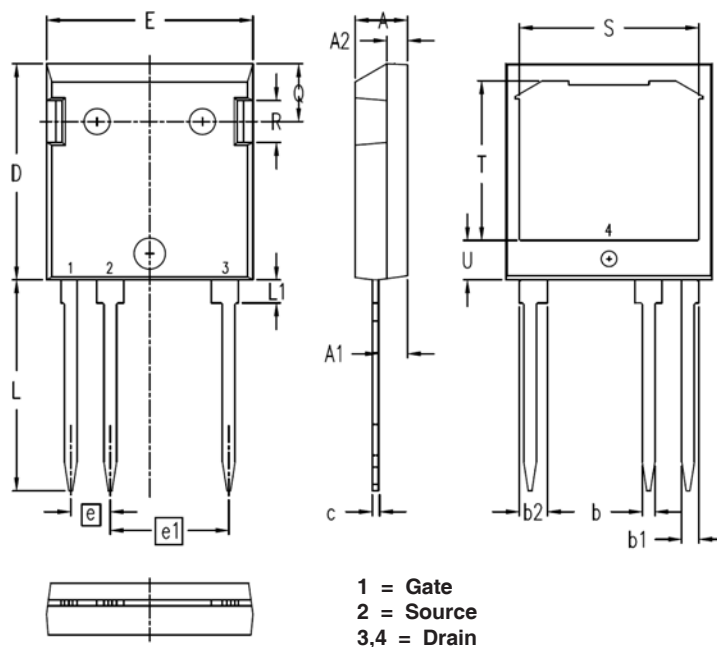
**Fig. 11. Forward-Bias Safe Operating Area**



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



## ISOPLUS i4-Pak Outline



| SYM | INCHES   |      | MILLIMETERS |       |
|-----|----------|------|-------------|-------|
|     | MIN      | MAX  | MIN         | MAX   |
| A   | .193     | .201 | 4.90        | 5.10  |
| A1  | .106     | .114 | 2.70        | 2.90  |
| A2  | .075     | .083 | 1.90        | 2.10  |
| b   | .047     | .055 | 1.20        | 1.40  |
| b1  | .061     | .069 | 1.55        | 1.75  |
| b2  | .087     | .094 | 2.20        | 2.40  |
| c   | .020     | .029 | 0.51        | 0.74  |
| D   | .819     | .846 | 20.80       | 21.50 |
| E   | .768     | .799 | 19.50       | 20.30 |
| e   | .150 BSC |      | 3.81 BSC    |       |
| e1  | .450 BSC |      | 11.43 BSC   |       |
| L   | .780     | .838 | 19.80       | 21.30 |
| L1  | .083     | .094 | 2.10        | 2.40  |
| Q   | .213     | .236 | 5.40        | 6.00  |
| R   | .157     | .169 | 4.00        | 4.30  |
| S   | .673     | .685 | 17.10       | 17.40 |
| T   | .602     | .614 | 15.30       | 15.60 |
| U   | .142     | .154 | 3.60        | 3.90  |



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