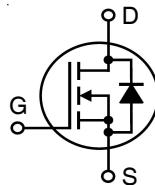


## Polar™ HiPerFET™ Power MOSFET

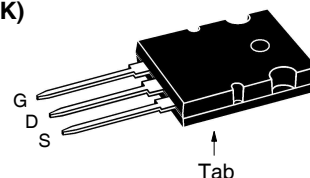
**IXFK20N120P**  
**IXFX20N120P**

N-Channel Enhancement Mode  
Avalanche Rated  
Fast Intrinsic Diode

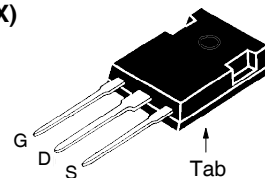


$$\begin{aligned} V_{DSS} &= 1200V \\ I_{D25} &= 20A \\ R_{DS(on)} &\leq 570m\Omega \\ t_{rr} &\leq 300ns \end{aligned}$$

**TO-264**  
**(IXFK)**



**PLUS247**  
**(IXFX)**



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

| Symbol        | Test Conditions                                                    | Maximum Ratings   |                  |
|---------------|--------------------------------------------------------------------|-------------------|------------------|
| $V_{DSS}$     | $T_J = 25^\circ\text{C to } 150^\circ\text{C}$                     | 1200              | V                |
| $V_{DGR}$     | $T_J = 25^\circ\text{C to } 150^\circ\text{C}, R_{GS} = 1M\Omega$  | 1200              | V                |
| $V_{GSS}$     | Continuous                                                         | $\pm 30$          | V                |
| $V_{GSM}$     | Transient                                                          | $\pm 40$          | V                |
| $I_{D25}$     | $T_C = 25^\circ\text{C}$                                           | 20                | A                |
| $I_{DM}$      | $T_C = 25^\circ\text{C}$ , Pulse Width Limited by $T_{JM}$         | 50                | A                |
| $I_A$         | $T_C = 25^\circ\text{C}$                                           | 10                | A                |
| $E_{AS}$      | $T_C = 25^\circ\text{C}$                                           | 1                 | J                |
| $dv/dt$       | $I_S \leq I_{DM}, V_{DD} \leq V_{DSS}, T_J \leq 150^\circ\text{C}$ | 15                | V/ns             |
| $P_D$         | $T_C = 25^\circ\text{C}$                                           | 780               | 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               | $^\circ\text{C}$ |
| $M_d$         | Mounting Torque (TO-264)                                           | 1.13/10           | Nm/lb.in         |
| $F_C$         | Mounting Force (PLUS247)                                           | 20..120 / 4.5..27 | N/lb             |
| <b>Weight</b> | TO-264                                                             | 10                | g                |
|               | PLUS247                                                            | 6                 | g                |

### Features

- Fast Intrinsic Diode
- Dynamic  $dv/dt$  Rating
- Avalanche Rated
- Low  $R_{DS(ON)}$  and  $Q_G$
- Low Package Inductance

### Advantages

- High Power Density
- Easy to Mount
- Space Savings

### Applications

- Switch-Mode and Resonant-Mode Power Supplies
- DC-DC Converters
- Discharger Circuits in Lesers Pulsers, Spark Igniters, RF Generators
- High Voltage Pulse Power Supplies
- AC and DC Motor Drives
- High Speed Power Switching Application

| Symbol       | Test Conditions<br>( $T_J = 25^\circ\text{C}$ Unless Otherwise Specified) | Characteristic Values |      |                          |
|--------------|---------------------------------------------------------------------------|-----------------------|------|--------------------------|
|              |                                                                           | Min.                  | Typ. | Max.                     |
| $BV_{DSS}$   | $V_{GS} = 0V, I_D = 1mA$                                                  | 1200                  |      | V                        |
| $V_{GS(th)}$ | $V_{DS} = V_{GS}, I_D = 1mA$                                              | 3.5                   |      | 6.5 V                    |
| $I_{GSS}$    | $V_{GS} = \pm 30V, V_{DS} = 0V$                                           |                       |      | $\pm 200$ nA             |
| $I_{DSS}$    | $V_{DS} = V_{DSS}, V_{GS} = 0V$<br>$T_J = 125^\circ\text{C}$              |                       |      | 50 $\mu\text{A}$<br>5 mA |
| $R_{DS(on)}$ | $V_{GS} = 10V, I_D = 0.5 \cdot I_{D25}$ , Note 1                          |                       |      | 570 m $\Omega$           |

| 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                                                                                         | 10                    | 16   | S                      |
| $C_{iss}$    | $V_{GS} = 0\text{V}$ , $V_{DS} = 25\text{V}$ , $f = 1\text{MHz}$                                                                                   |                       | 11.1 | nF                     |
| $C_{oss}$    |                                                                                                                                                    |                       | 600  | pF                     |
| $C_{rss}$    |                                                                                                                                                    |                       | 60   | pF                     |
| $R_{Gi}$     | Gate Input Resistance                                                                                                                              |                       | 1.6  | $\Omega$               |
| $t_{d(on)}$  | <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>$R_G = 1\Omega$ (External) |                       | 48   | ns                     |
| $t_r$        |                                                                                                                                                    |                       | 45   | ns                     |
| $t_{d(off)}$ |                                                                                                                                                    |                       | 72   | ns                     |
| $t_f$        |                                                                                                                                                    |                       | 70   | ns                     |
| $Q_{g(on)}$  | $V_{GS} = 10\text{V}$ , $V_{DS} = 0.5 \cdot V_{DSS}$ , $I_D = 0.5 \cdot I_{D25}$                                                                   |                       | 193  | nC                     |
| $Q_{gs}$     |                                                                                                                                                    |                       | 74   | nC                     |
| $Q_{gd}$     |                                                                                                                                                    |                       | 85   | nC                     |
| $R_{thJC}$   |                                                                                                                                                    |                       | 0.15 | $0.16^\circ\text{C/W}$ |
| $R_{thCS}$   |                                                                                                                                                    |                       |      | $^\circ\text{C/W}$     |

## Source-Drain Diode

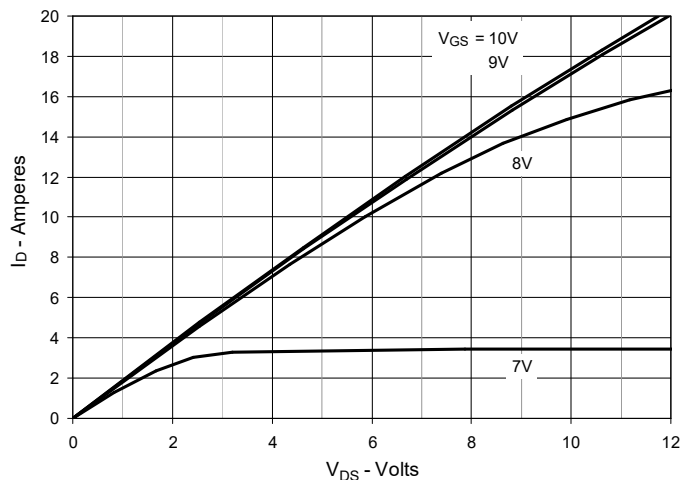
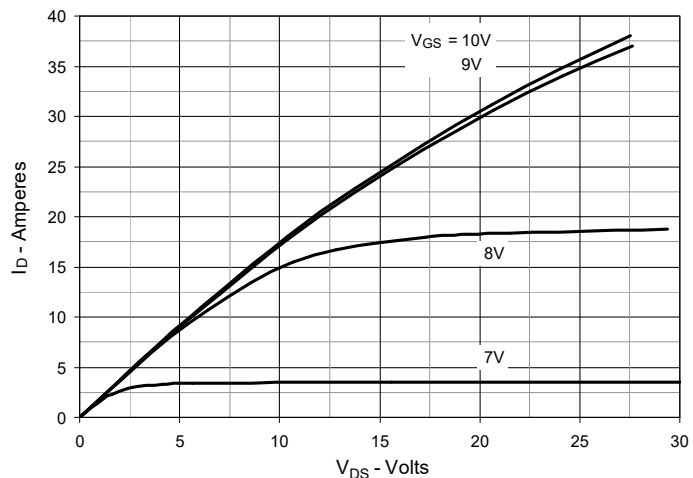
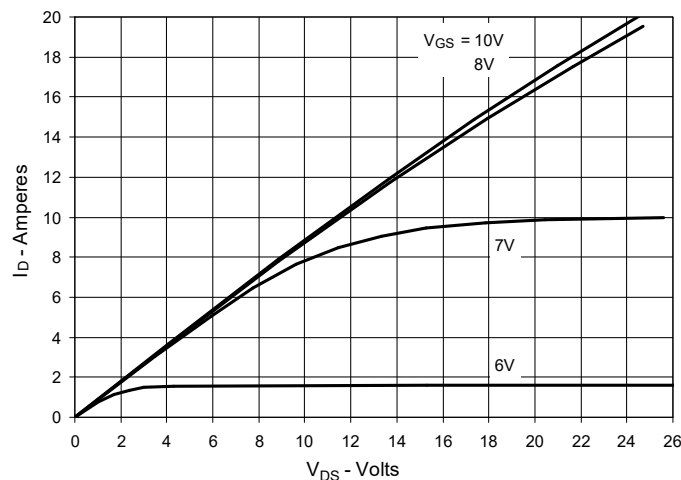
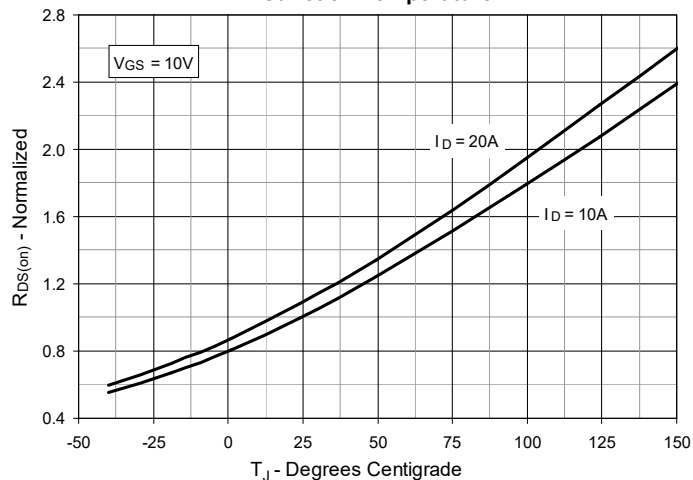
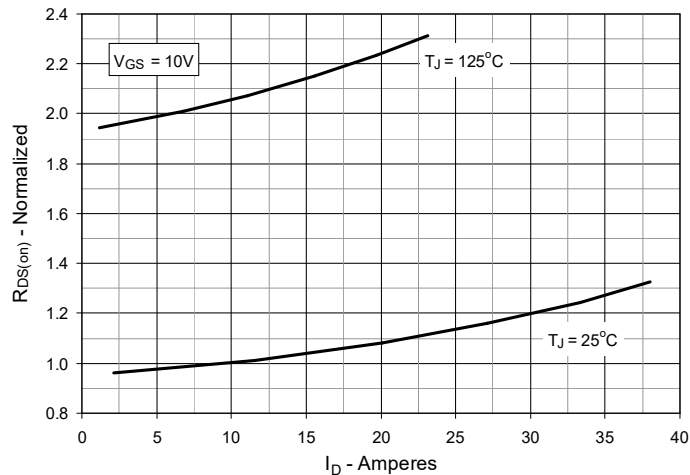
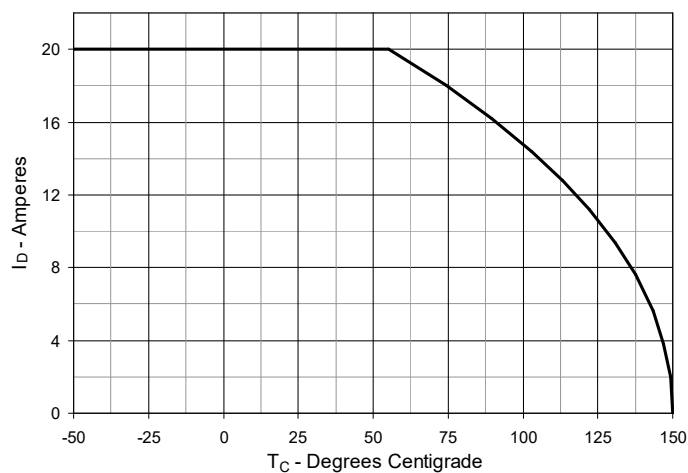
| Symbol   | Test Conditions<br>( $T_J = 25^\circ\text{C}$ Unless Otherwise Specified)                             | Characteristic Values |      |        |
|----------|-------------------------------------------------------------------------------------------------------|-----------------------|------|--------|
|          |                                                                                                       | Min.                  | Typ. | Max.   |
| $I_S$    | $V_{GS} = 0\text{V}$                                                                                  |                       |      | 20 A   |
| $I_{SM}$ | Repetitive, Pulse Width Limited by $T_{JM}$                                                           |                       |      | 80 A   |
| $V_{SD}$ | $I_F = I_S$ , $V_{GS} = 0\text{V}$ , Note 1                                                           |                       |      | 1.5 V  |
| $t_{rr}$ | $I_F = 10\text{A}$ , $-di/dt = 100\text{A}/\mu\text{s}$<br>$V_R = 100\text{V}$ , $V_{GS} = 0\text{V}$ |                       | 840  | 300 ns |
| $Q_{RM}$ |                                                                                                       |                       | 9    | nC     |
| $I_{RM}$ |                                                                                                       |                       |      | A      |

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

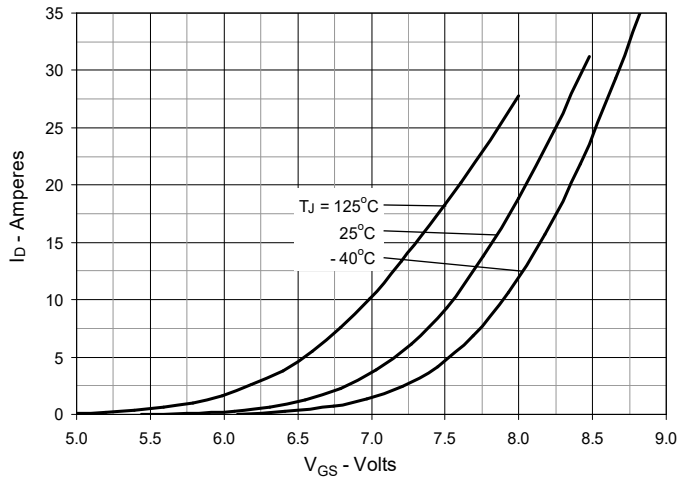
IXYS reserves the right to change limits, test conditions, and dimensions.

IXYS MOSFETs and IGBTs are covered by one or more of the following U.S. patents:

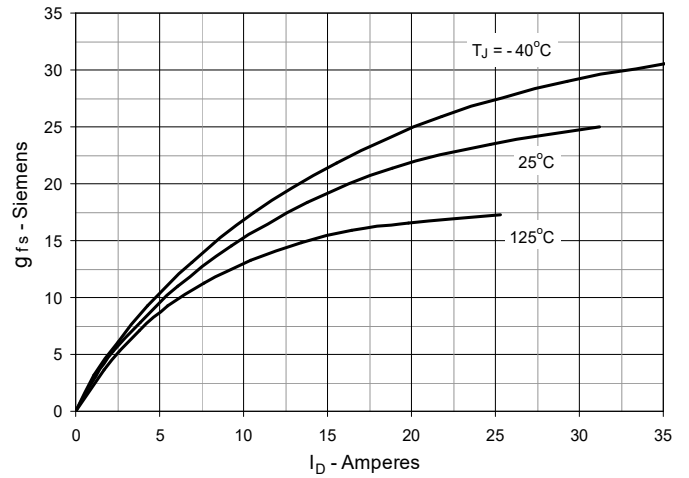
|           |           |           |           |              |              |              |              |              |              |
|-----------|-----------|-----------|-----------|--------------|--------------|--------------|--------------|--------------|--------------|
| 4,835,592 | 4,931,844 | 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. 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  $I_D = 10\text{A}$  Value vs. Junction Temperature**

**Fig. 5.  $R_{DS(on)}$  Normalized to  $I_D = 10\text{A}$  Value vs. Drain Current**

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


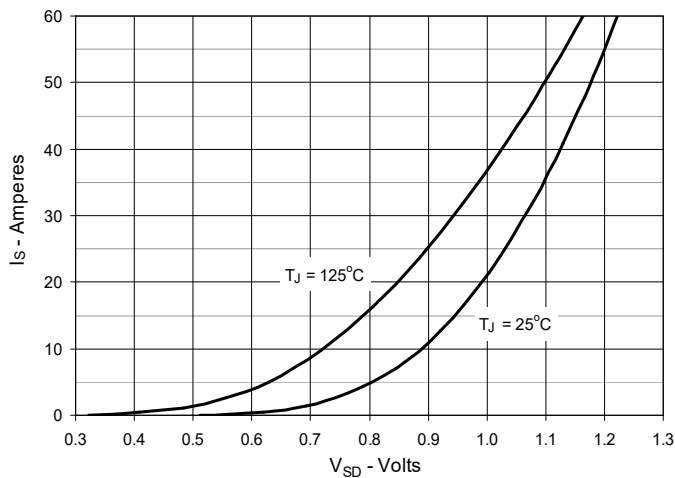
**Fig. 7. Input Admittance**



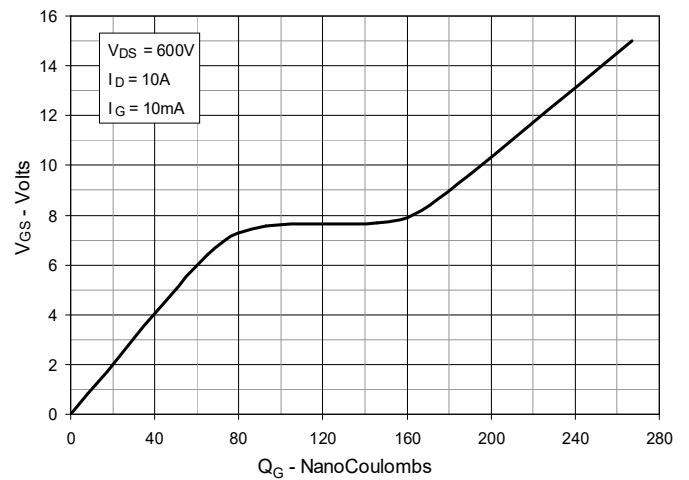
**Fig. 8. Transconductance**



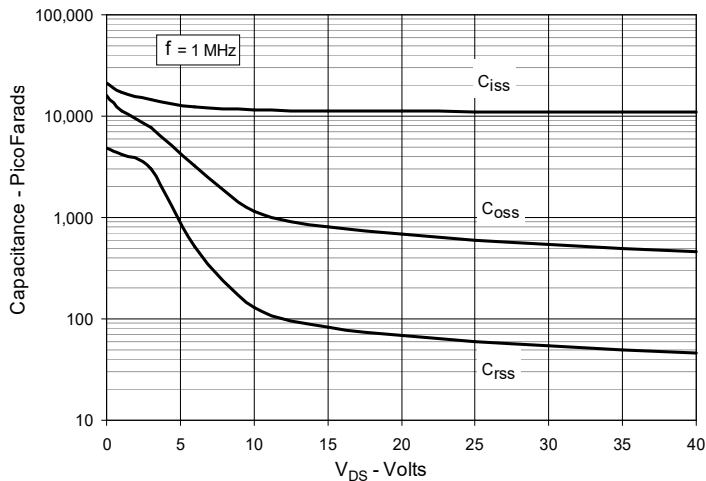
**Fig. 9. Forward Voltage Drop of Intrinsic Diode**



**Fig. 10. Gate Charge**



**Fig. 11. Capacitance**



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

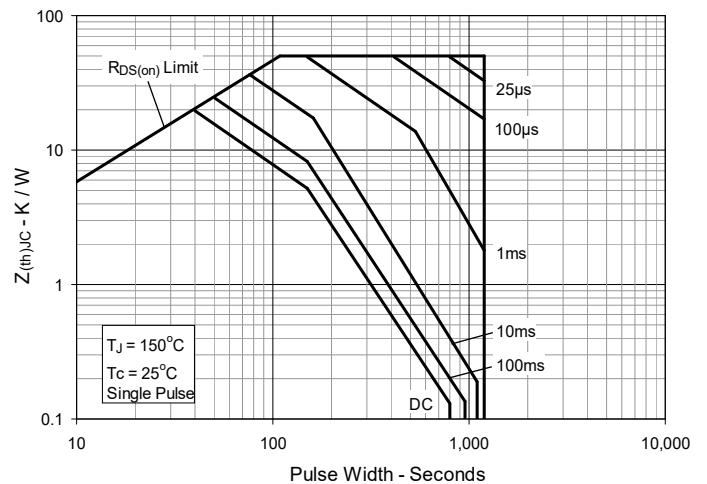
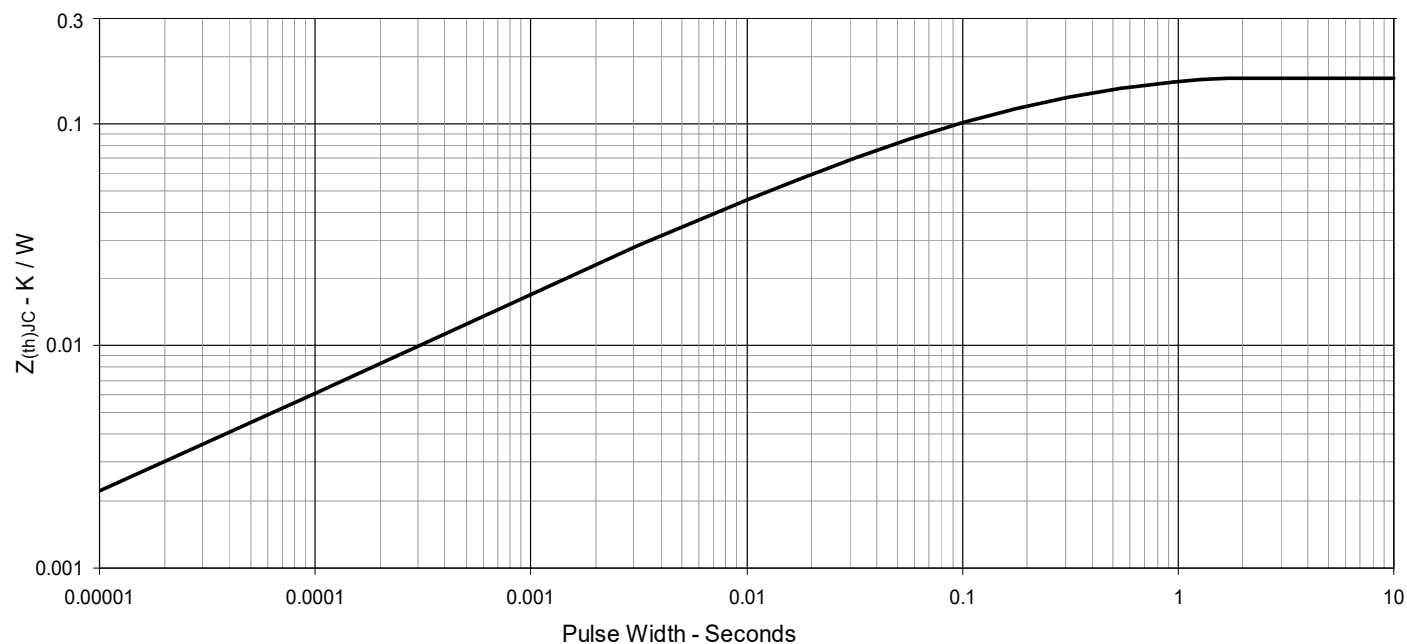
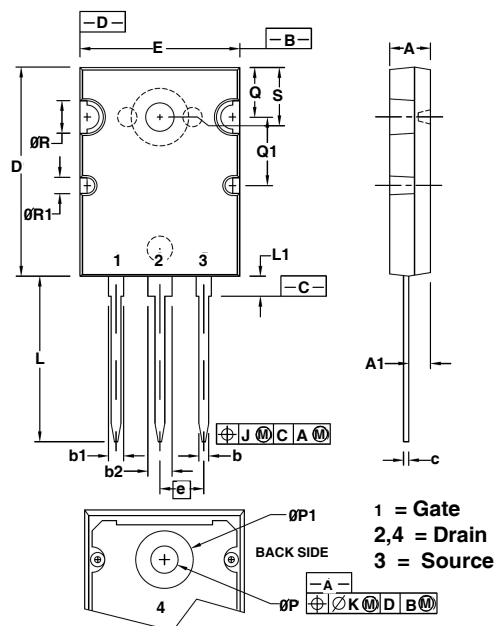
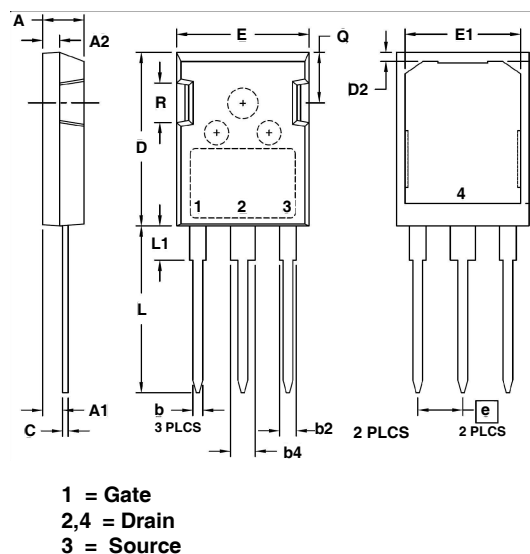


Fig. 13 Maximum Transient Thermal Impedance



**TO-264 Outline**


| SYMBOL | INCHES   |       | MILLIMETERS |       |
|--------|----------|-------|-------------|-------|
|        | MIN      | MAX   | MIN         | MAX   |
| A      | .185     | .209  | 4.70        | 5.31  |
| A1     | .102     | .118  | 2.59        | 3.00  |
| b      | .037     | .055  | 0.94        | 1.40  |
| b1     | .087     | .102  | 2.21        | 2.59  |
| b2     | .110     | .126  | 2.79        | 3.20  |
| c      | .017     | .029  | 0.43        | 0.74  |
| D      | 1.007    | 1.047 | 25.58       | 26.59 |
| E      | .760     | .799  | 19.30       | 20.29 |
| e      | .215 BSC |       | 5.46 BSC    |       |
| J      | .000     | .010  | 0.00        | 0.25  |
| K      | .000     | .010  | 0.00        | 0.25  |
| L      | .779     | .842  | 19.79       | 21.39 |
| L1     | .087     | .102  | 2.21        | 2.59  |
| øP     | .122     | .138  | 3.10        | 3.51  |
| øP1    | .270     | .290  | 6.86        | 7.37  |
| Q      | .240     | .256  | 6.10        | 6.50  |
| Q1     | .330     | .346  | 8.38        | 8.79  |
| øR     | .155     | .187  | 3.94        | 4.75  |
| øR1    | .085     | .093  | 2.16        | 2.36  |
| S      | .243     | .253  | 6.17        | 6.43  |

**PLUS247™ Outline**


| SYM | INCHES   |      | MILLIMETERS |       |
|-----|----------|------|-------------|-------|
|     | MIN      | MAX  | MIN         | MAX   |
| A   | .190     | .205 | 4.83        | 5.21  |
| A1  | .090     | .100 | 2.29        | 2.54  |
| A2  | .075     | .085 | 1.91        | 2.16  |
| b   | .045     | .055 | 1.14        | 1.40  |
| b2  | .075     | .087 | 1.91        | 2.20  |
| b4  | .115     | .126 | 2.92        | 3.20  |
| C   | .024     | .031 | 0.61        | 0.80  |
| D   | .819     | .840 | 20.80       | 21.34 |
| D1  | .650     | .690 | 16.51       | 17.53 |
| D2  | .035     | .050 | 0.89        | 1.27  |
| E   | .620     | .635 | 15.75       | 16.13 |
| E1  | .520     | .560 | 13.08       | 14.22 |
| e   | .215 BSC |      | 5.45 BSC    |       |
| L   | .780     | .810 | 19.81       | 20.57 |
| L1  | .150     | .170 | 3.81        | 4.32  |
| Q   | .220     | .244 | 5.59        | 6.20  |
| R   | .170     | .190 | 4.32        | 4.83  |

