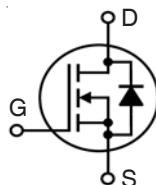


## X3-Class HiPerFET™ Power MOSFET

**IXFT220N20X3HV**  
**IXFH220N20X3**  
**IXFK220N20X3**

$$\begin{aligned} V_{DSS} &= 200V \\ I_{D25} &= 220A \\ R_{DS(on)} &\leq 6.2m\Omega \end{aligned}$$

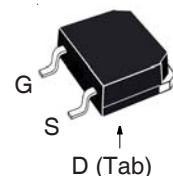
N-Channel Enhancement Mode  
Avalanche Rated



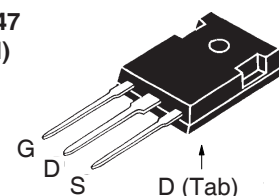
| Symbol        | Test Conditions                                                          | Maximum Ratings |                  |
|---------------|--------------------------------------------------------------------------|-----------------|------------------|
| $V_{DSS}$     | $T_J = 25^\circ\text{C}$ to $150^\circ\text{C}$                          | 200             | V                |
| $V_{DGR}$     | $T_J = 25^\circ\text{C}$ to $150^\circ\text{C}$ , $R_{GS} = 1M\Omega$    | 200             | V                |
| $V_{GSS}$     | Continuous                                                               | $\pm 20$        | V                |
| $V_{GSM}$     | Transient                                                                | $\pm 30$        | V                |
| $I_{D25}$     | $T_C = 25^\circ\text{C}$ (Chip Capability)                               | 220             | A                |
| $I_{L(RMS)}$  | External Lead Current Limit                                              | 160             | A                |
| $I_{DM}$      | $T_C = 25^\circ\text{C}$ , Pulse Width Limited by $T_{JM}$               | 500             | A                |
| $I_A$         | $T_C = 25^\circ\text{C}$                                                 | 110             | A                |
| $E_{AS}$      | $T_C = 25^\circ\text{C}$                                                 | 2.5             | J                |
| $dv/dt$       | $I_S \leq I_{DM}$ , $V_{DD} \leq V_{DSS}$ , $T_J \leq 150^\circ\text{C}$ | 50              | V/ns             |
| $P_D$         | $T_C = 25^\circ\text{C}$                                                 | 890             | 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-247 & TO-264)                                        | 1.13 / 10       | Nm/lb.in         |
| <b>Weight</b> | TO-268HV                                                                 | 4               | g                |
|               | TO-247                                                                   | 6               | g                |
|               | TO-264                                                                   | 10              | g                |

| Symbol       | Test Conditions<br>( $T_J = 25^\circ\text{C}$ , Unless Otherwise Specified) | Characteristic Values |      |                          |
|--------------|-----------------------------------------------------------------------------|-----------------------|------|--------------------------|
|              |                                                                             | Min.                  | Typ. | Max.                     |
| $BV_{DSS}$   | $V_{GS} = 0V$ , $I_D = 1mA$                                                 | 200                   |      | V                        |
| $V_{GS(th)}$ | $V_{DS} = V_{GS}$ , $I_D = 4mA$                                             | 2.5                   |      | 4.5 V                    |
| $I_{GSS}$    | $V_{GS} = \pm 20V$ , $V_{DS} = 0V$                                          |                       |      | $\pm 100$ nA             |
| $I_{DSS}$    | $V_{DS} = V_{DSS}$ , $V_{GS} = 0V$<br>$T_J = 125^\circ\text{C}$             |                       |      | 10 $\mu\text{A}$<br>1 mA |
| $R_{DS(on)}$ | $V_{GS} = 10V$ , $I_D = 0.5 \cdot I_{D25}$ , Note 1                         | 5.2                   |      | 6.2 m $\Omega$           |

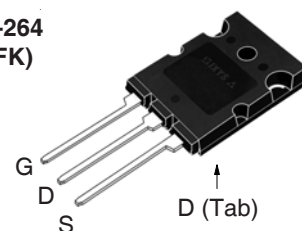
TO-268HV  
(IXFT..HV)



TO-247  
(IXFH)



TO-264  
(IXFK)



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

### Features

- International Standard Packages
- 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 <sub>J</sub> = 25°C, Unless Otherwise Specified)                                                                                                          | Characteristic Values                                            |              |              |
|-------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------|--------------|--------------|
|                                     |                                                                                                                                                                                 | Min.                                                             | Typ.         | Max          |
| <b>g<sub>fs</sub></b>               | V <sub>DS</sub> = 10V, I <sub>D</sub> = 60A, Note 1                                                                                                                             | 70                                                               | 120          | S            |
| <b>R<sub>Gi</sub></b>               | Gate Input Resistance                                                                                                                                                           |                                                                  | 1.6          | Ω            |
| <b>C<sub>iss</sub></b>              | V <sub>GS</sub> = 0V, V <sub>DS</sub> = 25V, f = 1MHz                                                                                                                           |                                                                  | 13.6         | nF           |
| <b>C<sub>oss</sub></b>              |                                                                                                                                                                                 |                                                                  | 2.2          | nF           |
| <b>C<sub>rss</sub></b>              |                                                                                                                                                                                 |                                                                  | 9.0          | pF           |
| <b>Effective Output Capacitance</b> |                                                                                                                                                                                 |                                                                  |              |              |
| <b>C<sub>o(er)</sub></b>            | Energy related                                                                                                                                                                  | V <sub>GS</sub> = 0V<br>V <sub>DS</sub> = 0.8 • V <sub>DSS</sub> | 1000         | pF           |
| <b>C<sub>o(tr)</sub></b>            | Time related                                                                                                                                                                    |                                                                  | 3250         | pF           |
| <b>t<sub>d(on)</sub></b>            | <b>Resistive Switching Times</b><br>V <sub>GS</sub> = 10V, V <sub>DS</sub> = 0.5 • V <sub>DSS</sub> , I <sub>D</sub> = 0.5 • I <sub>D25</sub><br>R <sub>G</sub> = 5Ω (External) |                                                                  | 37           | ns           |
| <b>t<sub>r</sub></b>                |                                                                                                                                                                                 |                                                                  | 27           | ns           |
| <b>t<sub>d(off)</sub></b>           |                                                                                                                                                                                 |                                                                  | 155          | ns           |
| <b>t<sub>f</sub></b>                |                                                                                                                                                                                 |                                                                  | 17           | ns           |
| <b>Q<sub>g(on)</sub></b>            | V <sub>GS</sub> = 10V, V <sub>DS</sub> = 0.5 • V <sub>DSS</sub> , I <sub>D</sub> = 0.5 • I <sub>D25</sub>                                                                       |                                                                  | 204          | nC           |
| <b>Q<sub>gs</sub></b>               |                                                                                                                                                                                 |                                                                  | 65           | nC           |
| <b>Q<sub>gd</sub></b>               |                                                                                                                                                                                 |                                                                  | 47           | nC           |
| <b>R<sub>thJC</sub></b>             | TO-247<br>TO-264                                                                                                                                                                |                                                                  |              | 0.14 °C/W    |
| <b>R<sub>thCS</sub></b>             |                                                                                                                                                                                 |                                                                  | 0.21<br>0.15 | °C/W<br>°C/W |

#### Source-Drain Diode

| Symbol   | Test Conditions<br>( $T_J = 25^\circ\text{C}$ , Unless Otherwise Specified)     | Characteristic Values |      |       |
|----------|---------------------------------------------------------------------------------|-----------------------|------|-------|
|          |                                                                                 | Min.                  | Typ. | Max   |
| $I_S$    | $V_{GS} = 0\text{V}$                                                            |                       |      | 220 A |
| $I_{SM}$ | Repetitive, Pulse Width Limited by $T_{JM}$                                     |                       |      | 880 A |
| $V_{SD}$ | $I_F = 100\text{A}$ , $V_{GS} = 0\text{V}$ , Note 1                             |                       |      | 1.4 V |
| $t_{rr}$ | $I_F = 110\text{A}$ , $-di/dt = 100\text{A}/\mu\text{s}$<br>$V_R = 100\text{V}$ |                       | 128  | ns    |
| $Q_{RM}$ |                                                                                 |                       | 580  | nC    |
| $I_{RM}$ |                                                                                 |                       | 9    | 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   | 6,404,065B1 | 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 @  $T_J = 25^\circ\text{C}$

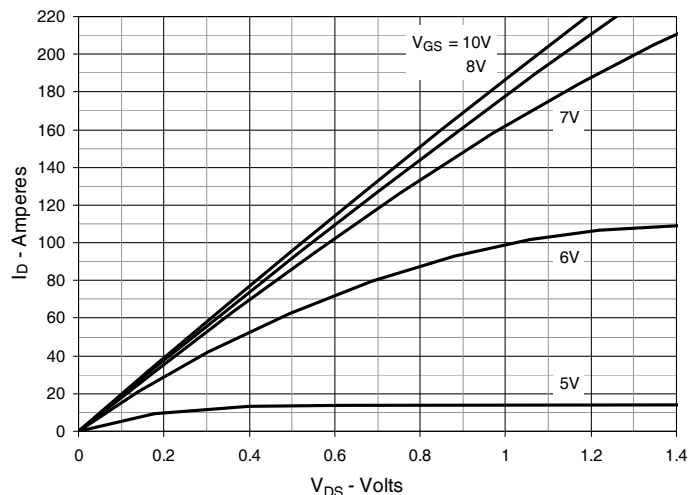


Fig. 2. Extended Output Characteristics @  $T_J = 25^\circ\text{C}$

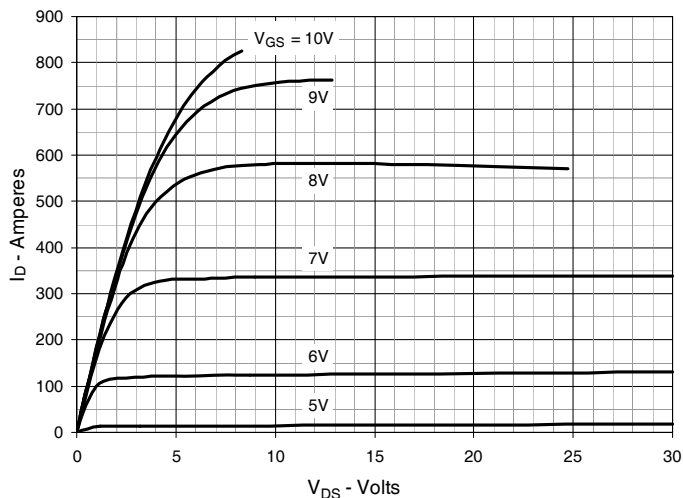


Fig. 3. Output Characteristics @  $T_J = 125^\circ\text{C}$

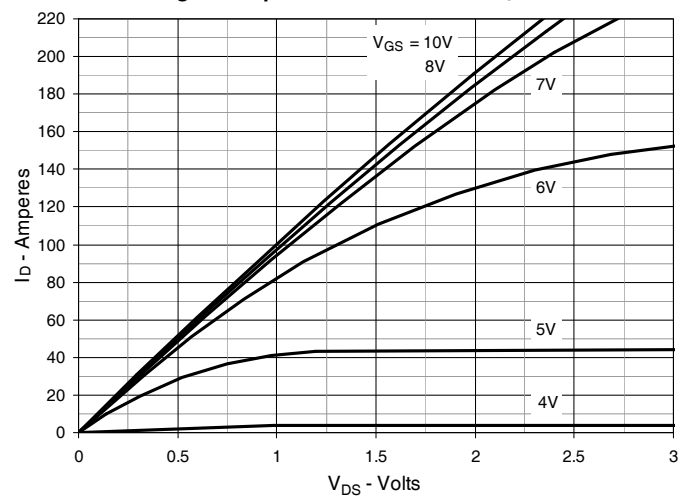


Fig. 4.  $R_{DS(on)}$  Normalized to  $I_D = 110\text{A}$  Value vs. Junction Temperature

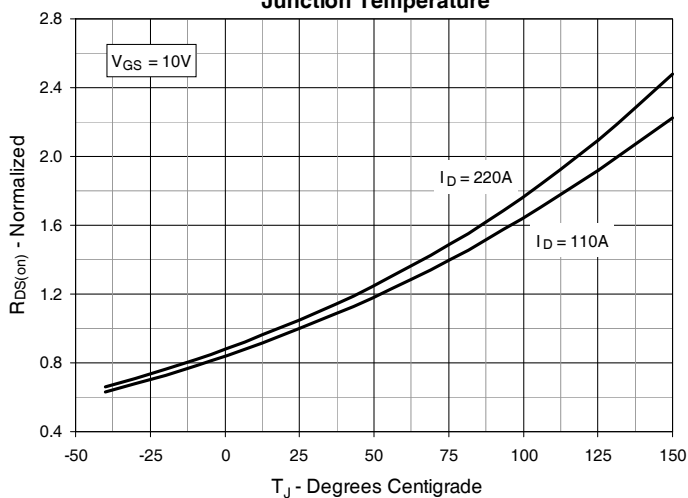


Fig. 5.  $R_{DS(on)}$  Normalized to  $I_D = 110\text{A}$  Value vs. Drain Current

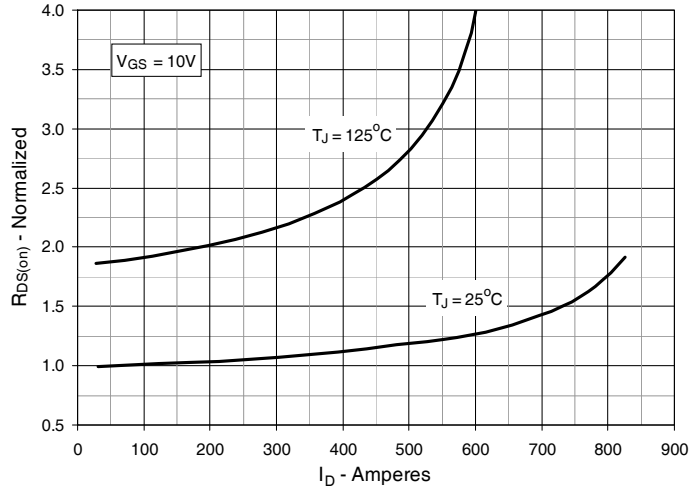


Fig. 6. Normalized Breakdown & Threshold Voltages vs. Junction Temperature

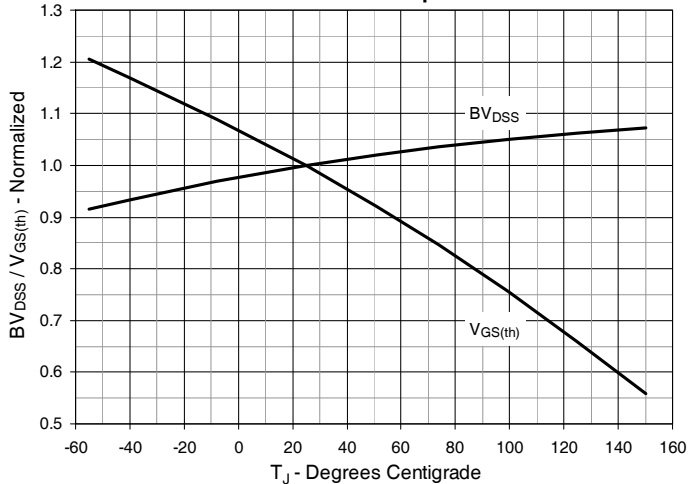


Fig. 7. Maximum Drain Current vs. Case Temperature

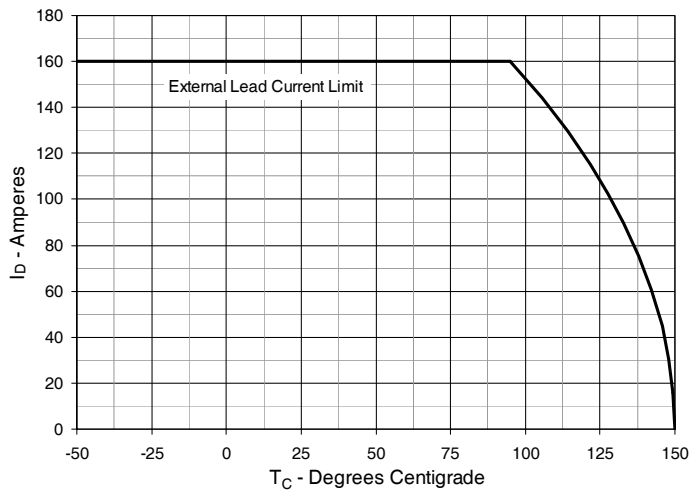


Fig. 8. Input Admittance

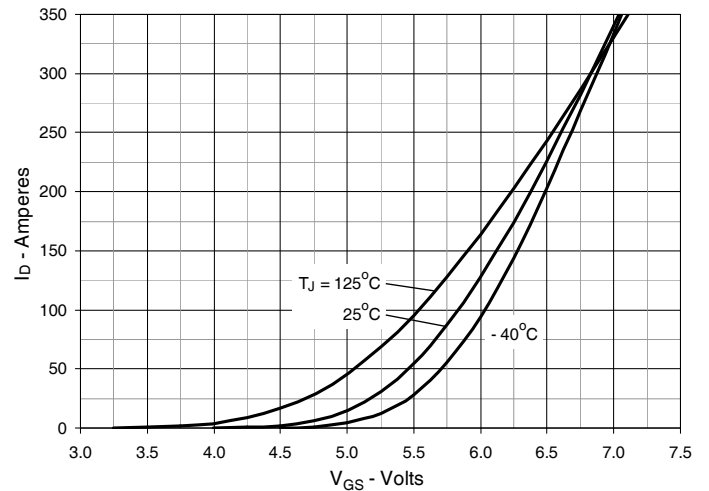


Fig. 9. Transconductance

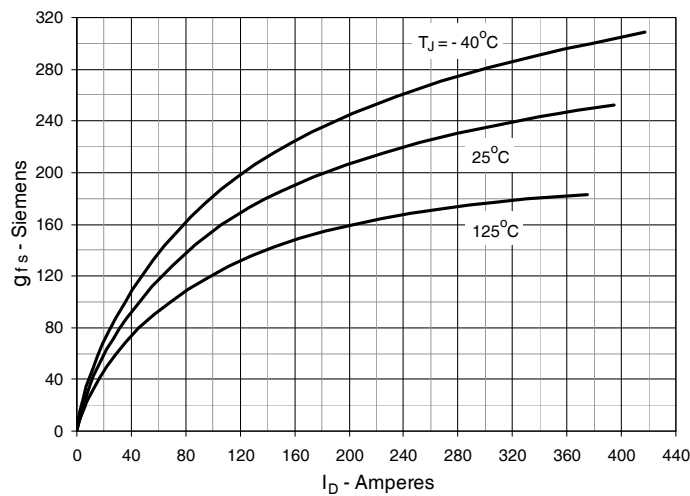


Fig. 10. Forward Voltage Drop of Intrinsic Diode

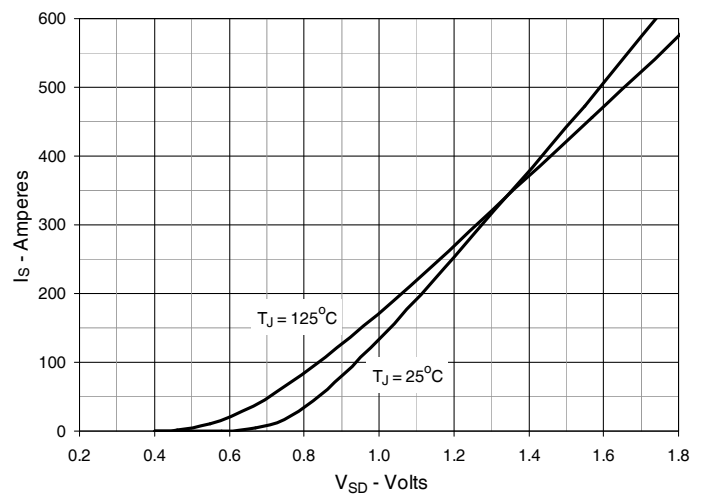


Fig. 11. Gate Charge

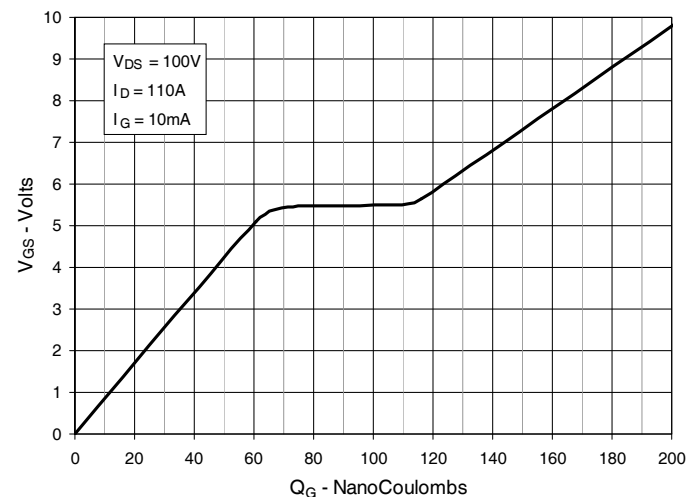


Fig. 12. Capacitance

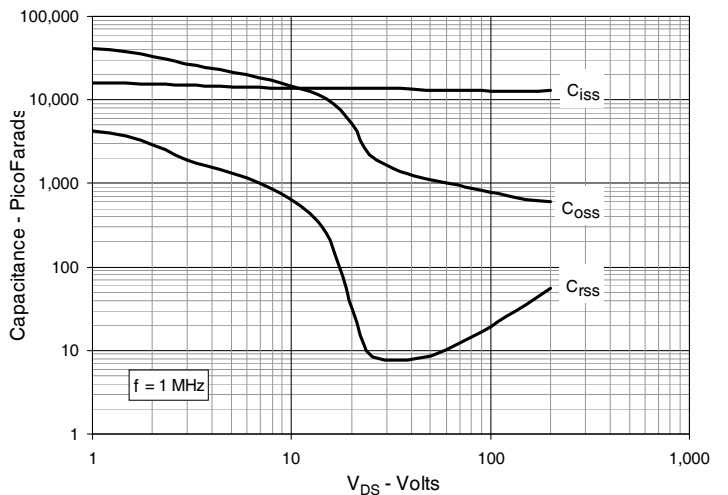


Fig. 13. Output Capacitance Stored Energy

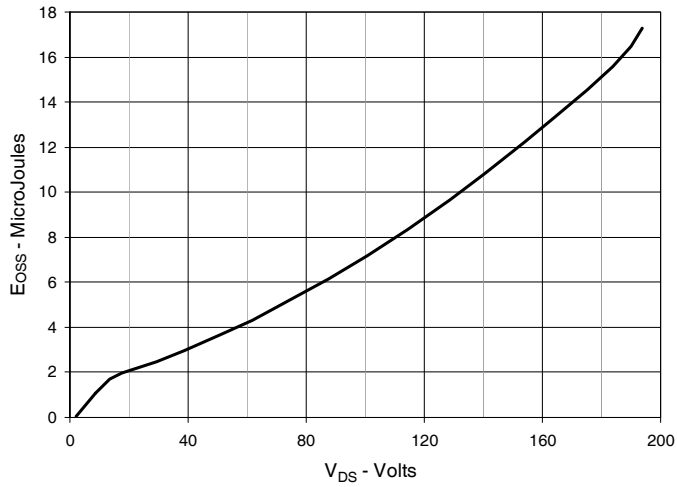


Fig. 14. Forward-Bias Safe Operating Area

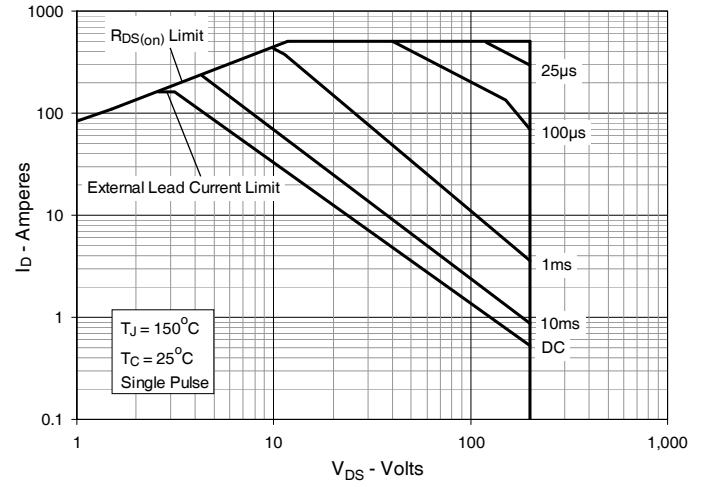
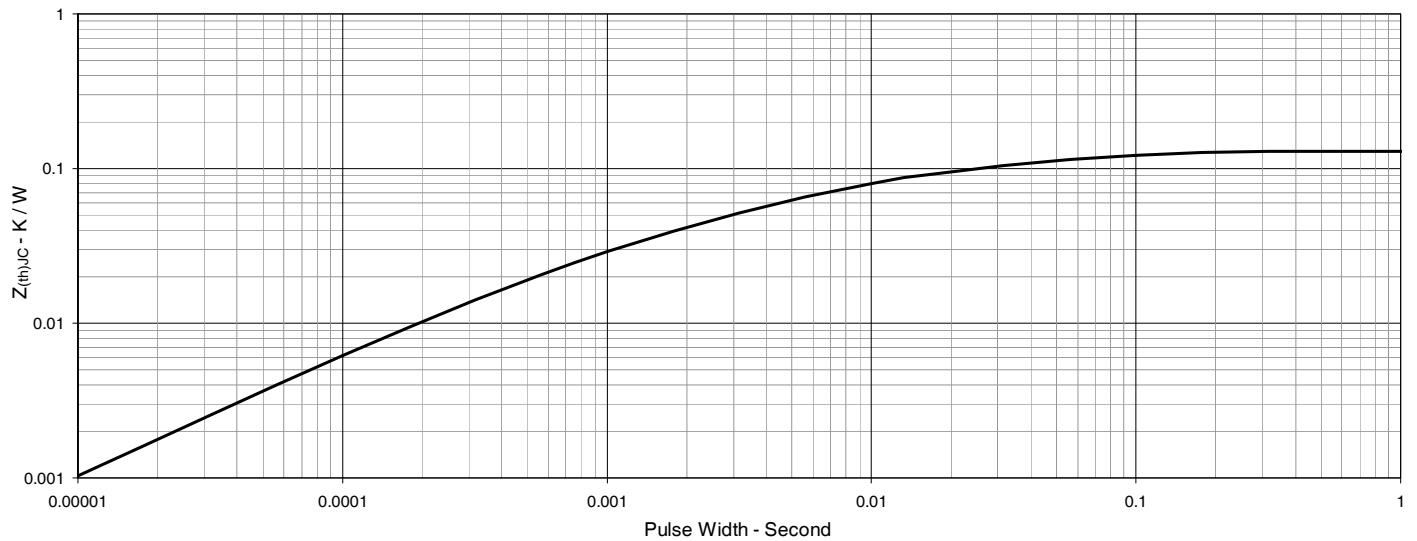
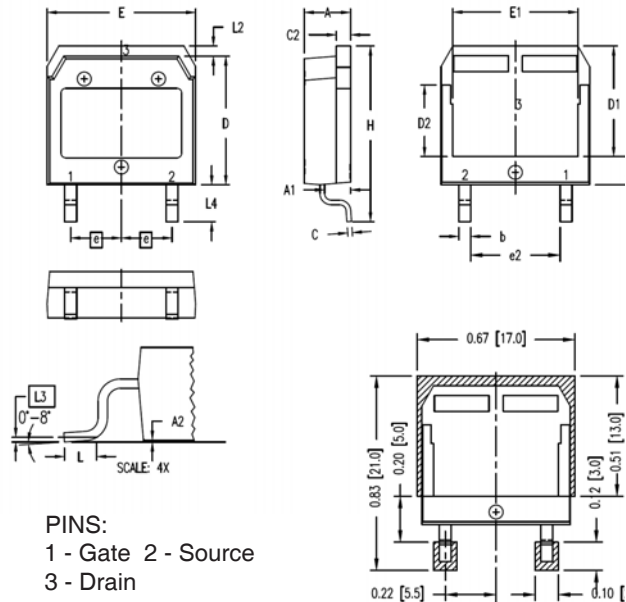


Fig. 15. Maximum Transient Thermal Impedance

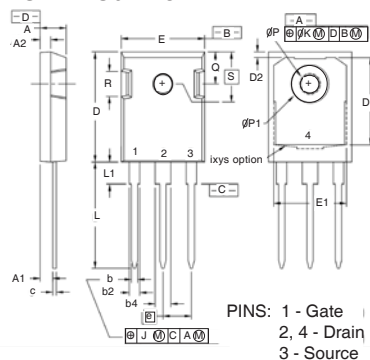


### TO-268HV Outline



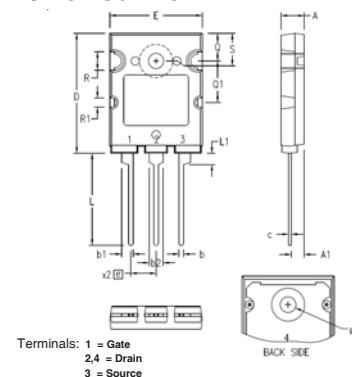
| SYM  | INCHES   |      | MILLIMETER |       |
|------|----------|------|------------|-------|
|      | MIN      | MAX  | MIN        | MAX   |
| A    | .193     | .201 | 4.90       | 5.10  |
| A1   | .106     | .114 | 2.70       | 2.90  |
| A2   | .001     | .010 | 0.02       | 0.25  |
| b    | .045     | .057 | 1.15       | 1.45  |
| C    | .016     | .026 | 0.40       | 0.65  |
| C2   | .057     | .063 | 1.45       | 1.60  |
| D    | .543     | .551 | 13.80      | 14.00 |
| D1   | .465     | .476 | 11.80      | 12.10 |
| D2   | .295     | .307 | 7.50       | 7.80  |
| D3   | .114     | .126 | 2.90       | 3.20  |
| E    | .624     | .632 | 15.85      | 16.05 |
| E1   | .524     | .535 | 13.30      | 13.60 |
| e    | .215 BSC |      | 5.45 BSC   |       |
| (e2) | .374     | .386 | 9.50       | 9.80  |
| H    | .736     | .752 | 18.70      | 19.10 |
| L    | .067     | .079 | 1.70       | 2.00  |
| L2   | .039     | .045 | 1.00       | 1.15  |
| L3   | .010 BSC |      | 0.25 BSC   |       |
| L4   | .150     | .161 | 3.80       | 4.10  |

### TO-247 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  | .545     | .565 | 13.84       | 14.35 |
| e   | .215 BSC |      | 5.45 BSC    |       |
| J   | --       | .010 | --          | 0.25  |
| K   | --       | .025 | --          | 0.64  |
| L   | .780     | .810 | 19.81       | 20.57 |
| L1  | .150     | .170 | 3.81        | 4.32  |
| øP  | .140     | .144 | 3.55        | 3.65  |
| øP1 | .275     | .290 | 6.99        | 7.37  |
| Q   | .220     | .244 | 5.59        | 6.20  |
| R   | .170     | .190 | 4.32        | 4.83  |
| S   | .242 BSC |      | 6.15 BSC    |       |

### TO-264 Outline



| SYM | INCHES   |       | MILLIMETERS |       |
|-----|----------|-------|-------------|-------|
|     | MIN      | MAX   | MIN         | MAX   |
| A   | .185     | .209  | 4.70        | 5.30  |
| A1  | .102     | .118  | 2.60        | 3.00  |
| b   | .035     | .049  | 0.90        | 1.25  |
| b1  | .091     | .106  | 2.30        | 2.70  |
| b2  | .110     | .126  | 2.80        | 3.20  |
| c   | .020     | .033  | 0.50        | 0.85  |
| D   | 1.012    | 1.035 | 25.70       | 26.30 |
| E   | .776     | .799  | 19.70       | 20.30 |
| e   | .215 BSC |       | 5.46 BSC    |       |
| L   | .768     | .807  | 19.50       | 20.50 |
| L1  | .091     | .106  | 2.30        | 2.70  |
| øP  | .122     | .138  | 3.10        | 3.50  |
| Q   | .228     | .244  | 5.80        | 6.20  |
| Q1  | .346     | .362  | 8.80        | 9.20  |
| øR  | .150     | .165  | 3.80        | 4.20  |
| øR1 | .071     | .087  | 1.80        | 2.20  |
| S   | .228     | .244  | 5.80        | 6.20  |

