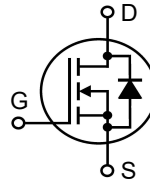


# X3-Class HiPerFET™ Power MOSFET

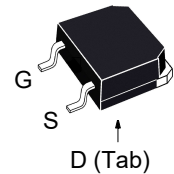
**IXFT170N25X3HV**  
**IXFH170N25X3**  
**IXFK170N25X3**

**$V_{DSS} = 250V$**   
 **$I_{D25} = 170A$**   
 **$R_{DS(on)} \leq 7.4m\Omega$**

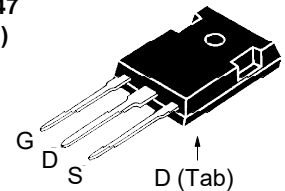
N-Channel Enhancement Mode  
Avalanche Rated  
Fast Intrinsic Diode



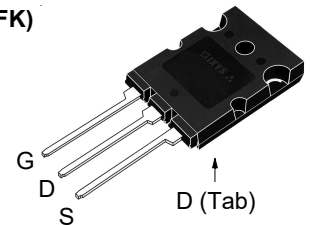
**TO-268HV**  
(IXFT...HV)



**TO-247**  
(IXFH)



**TO-264K**  
(IXFK)



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

| Symbol        | Test Conditions                                                    | Maximum Ratings |            |
|---------------|--------------------------------------------------------------------|-----------------|------------|
| $V_{DSS}$     | $T_J = 25^\circ C$ to $150^\circ C$                                | 250             | V          |
| $V_{DGR}$     | $T_J = 25^\circ C$ to $150^\circ C$ , $R_{GS} = 1M\Omega$          | 250             | V          |
| $V_{GSS}$     | Continuous                                                         | $\pm 20$        | V          |
| $V_{GSM}$     | Transient                                                          | $\pm 30$        | V          |
| $I_{D25}$     | $T_C = 25^\circ C$ (Chip Capability)                               | 170             | A          |
| $I_{L(RMS)}$  | External Lead Current Limit                                        | 160             | A          |
| $I_{DM}$      | $T_C = 25^\circ C$ , Pulse Width Limited by $T_{JM}$               | 400             | A          |
| $I_A$         | $T_C = 25^\circ C$                                                 | 85              | A          |
| $E_{AS}$      | $T_C = 25^\circ C$                                                 | 2.3             | J          |
| $dv/dt$       | $I_S \leq I_{DM}$ , $V_{DD} \leq V_{DSS}$ , $T_J \leq 150^\circ C$ | 50              | V/ns       |
| $P_D$         | $T_C = 25^\circ C$                                                 | 890             | W          |
| $T_J$         |                                                                    | -55 ... +150    | $^\circ C$ |
| $T_{JM}$      |                                                                    | 150             | $^\circ C$ |
| $T_{stg}$     |                                                                    | -55 ... +150    | $^\circ C$ |
| $T_L$         | Maximum Lead Temperature for Soldering                             | 300             | $^\circ C$ |
| $T_{SOLD}$    | 1.6 mm (0.062 in.) from Case for 10s                               | 260             | $^\circ C$ |
| $M_d$         | Mounting Torque (TO-247 & TO-264K)                                 | 1.13 / 10       | Nm/lb.in   |
| <b>Weight</b> | TO-268HV                                                           | 4               | g          |
|               | TO-247                                                             | 6               | g          |
|               | TO-264K                                                            | 10              | g          |

| Symbol       | Test Conditions<br>( $T_J = 25^\circ C$ , Unless Otherwise Specified) | Characteristic Values |      |                    |
|--------------|-----------------------------------------------------------------------|-----------------------|------|--------------------|
|              |                                                                       | Min.                  | Typ. | Max.               |
| $BV_{DSS}$   | $V_{GS} = 0V$ , $I_D = 1mA$                                           | 250                   |      | 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>$T_J = 125^\circ C$             |                       |      | 10 $\mu A$<br>1 mA |
| $R_{DS(on)}$ | $V_{GS} = 10V$ , $I_D = 0.5 \cdot I_{D25}$ , Note 1                   |                       | 6.1  | 7.4 m $\Omega$     |

## 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          |
| g <sub>fs</sub>              | V <sub>DS</sub> = 10V, I <sub>D</sub> = 60A, Note 1                                                                                                                      | 66                                                               | 110          | S            |
| R <sub>Gi</sub>              | Gate Input Resistance                                                                                                                                                    |                                                                  | 1.3          | Ω            |
| C <sub>iss</sub>             | V <sub>GS</sub> = 0V, V <sub>DS</sub> = 25V, f = 1MHz                                                                                                                    |                                                                  | 13.5         | nF           |
| C <sub>oss</sub>             |                                                                                                                                                                          |                                                                  | 2.3          | nF           |
| C <sub>rss</sub>             |                                                                                                                                                                          |                                                                  | 1.6          | pF           |
| Effective Output Capacitance |                                                                                                                                                                          |                                                                  |              |              |
| C <sub>o(er)</sub>           | Energy related                                                                                                                                                           | V <sub>GS</sub> = 0V<br>V <sub>DS</sub> = 0.8 • V <sub>DSS</sub> | 800          | pF           |
| C <sub>o(tr)</sub>           | Time related                                                                                                                                                             |                                                                  | 3280         | pF           |
| t <sub>d(on)</sub>           | Resistive Switching Times<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) |                                                                  | 18           | ns           |
| t <sub>r</sub>               |                                                                                                                                                                          |                                                                  | 10           | ns           |
| t <sub>d(off)</sub>          |                                                                                                                                                                          |                                                                  | 62           | ns           |
| t <sub>f</sub>               |                                                                                                                                                                          |                                                                  | 7            | ns           |
| Q <sub>g(on)</sub>           | 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>                                                                |                                                                  | 190          | nC           |
| Q <sub>gs</sub>              |                                                                                                                                                                          |                                                                  | 55           | nC           |
| Q <sub>gd</sub>              |                                                                                                                                                                          |                                                                  | 45           | nC           |
| R <sub>thJC</sub>            | TO-247<br>TO-264K                                                                                                                                                        |                                                                  |              | 0.14 °C/W    |
| R <sub>thCS</sub>            |                                                                                                                                                                          |                                                                  | 0.21<br>0.15 | °C/W<br>°C/W |

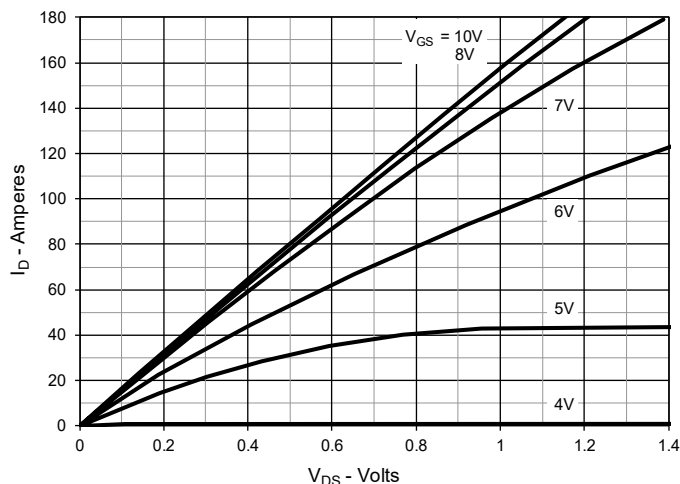
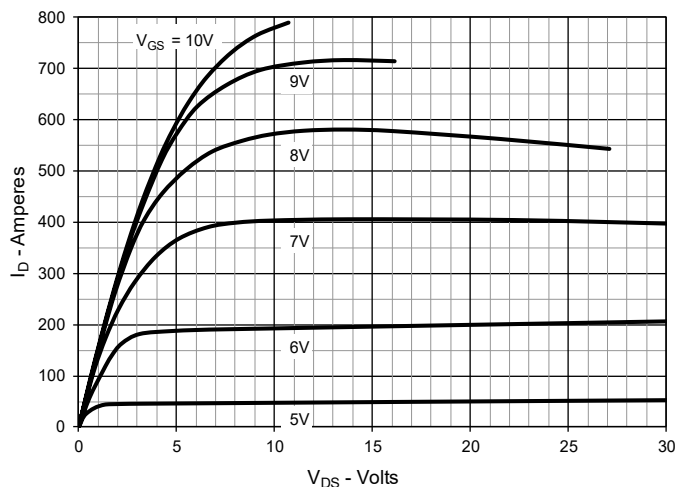
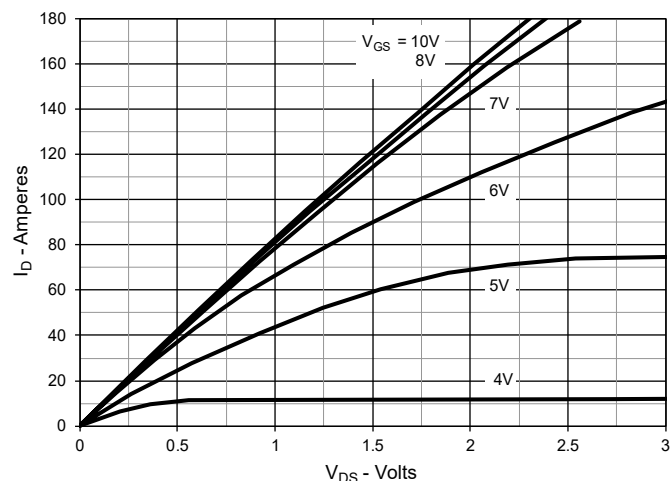
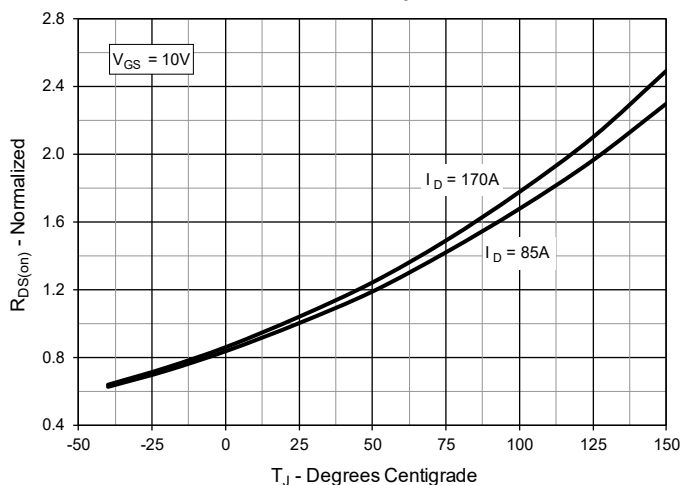
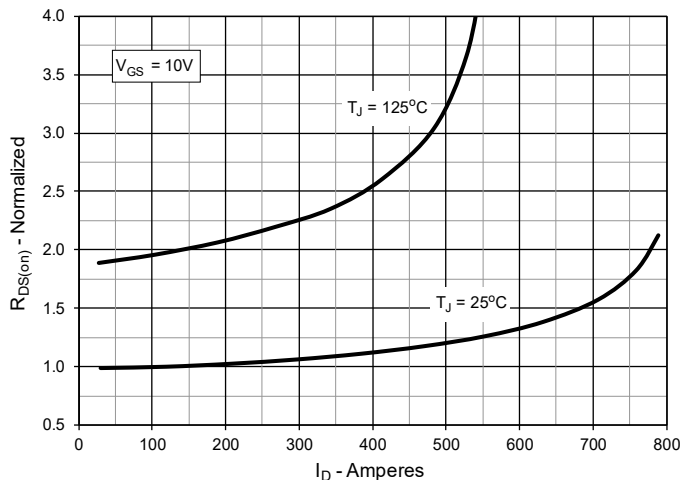
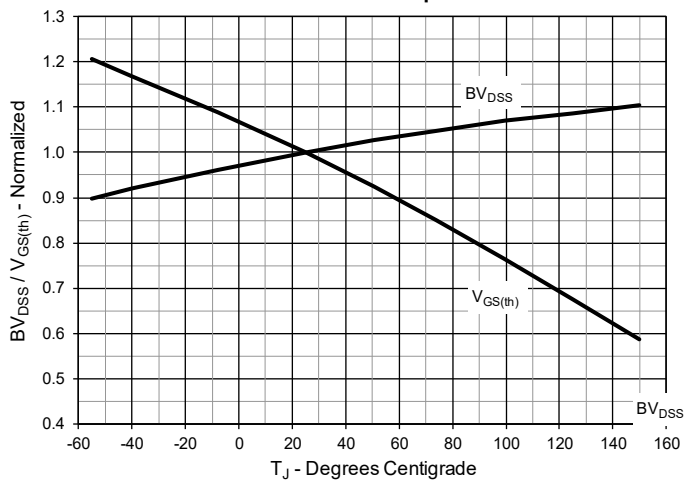
#### Source-Drain Diode

| Symbol   | Test Conditions<br>( $T_J = 25^\circ\text{C}$ , Unless Otherwise Specified)    | Characteristic Values |      |       |
|----------|--------------------------------------------------------------------------------|-----------------------|------|-------|
|          |                                                                                | Min.                  | Typ. | Max   |
| $I_S$    | $V_{GS} = 0\text{V}$                                                           |                       |      | 170 A |
| $I_{SM}$ | Repetitive, Pulse Width Limited by $T_{JM}$                                    |                       |      | 680 A |
| $V_{SD}$ | $I_F = I_S$ , $V_{GS} = 0\text{V}$ , Note 1                                    |                       |      | 1.4 V |
| $t_{rr}$ | $I_F = 85\text{A}$ , $-di/dt = 100\text{A}/\mu\text{s}$<br>$V_R = 100\text{V}$ |                       | 140  | ns    |
| $Q_{RM}$ |                                                                                |                       | 770  | nC    |
| $I_{RM}$ |                                                                                |                       | 11   | A     |

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

Littelfuse 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  $I_D = 85\text{A}$  Value vs. Junction Temperature**

**Fig. 5.  $R_{DS(on)}$  Normalized to  $I_D = 85\text{A}$  Value vs. Drain Current**

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


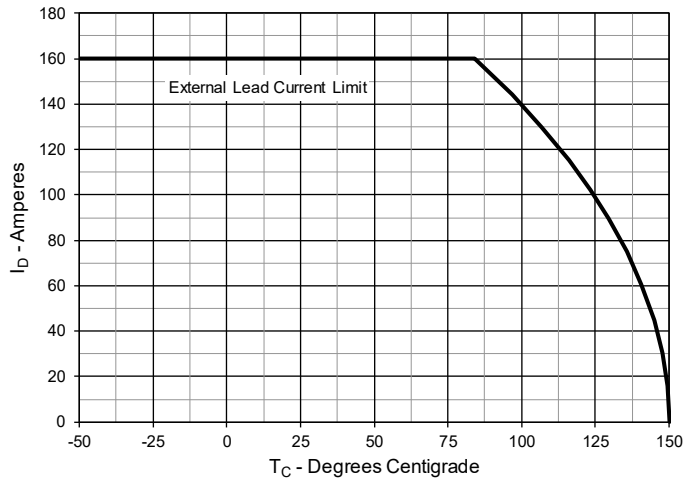
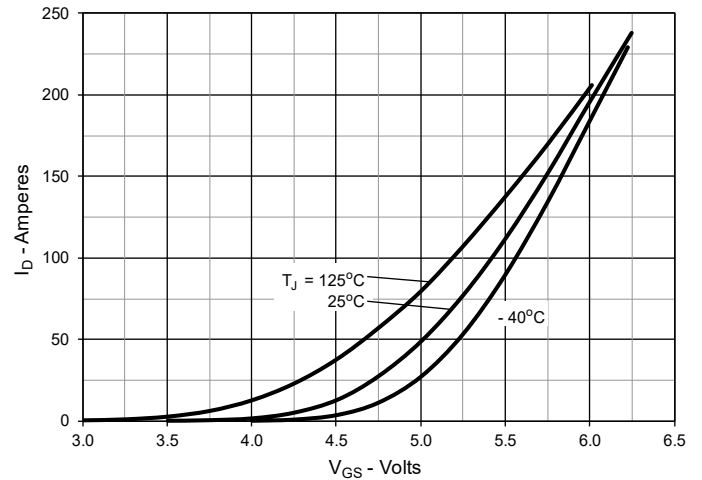
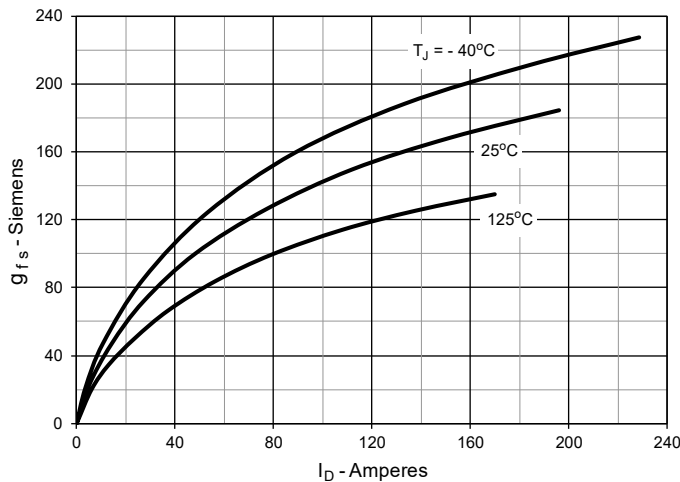
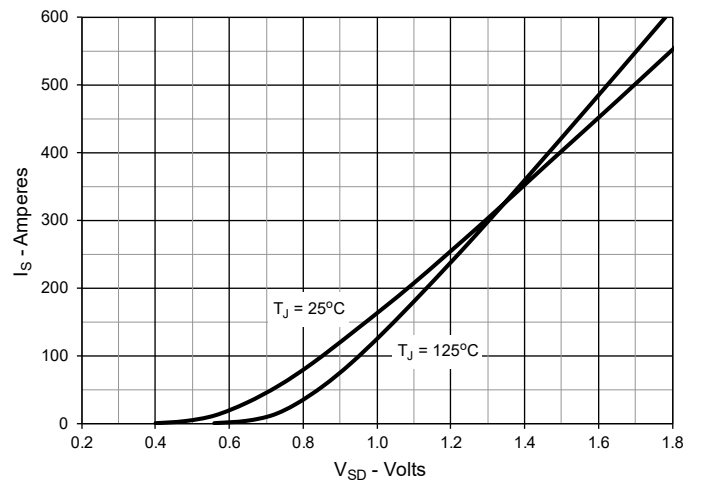
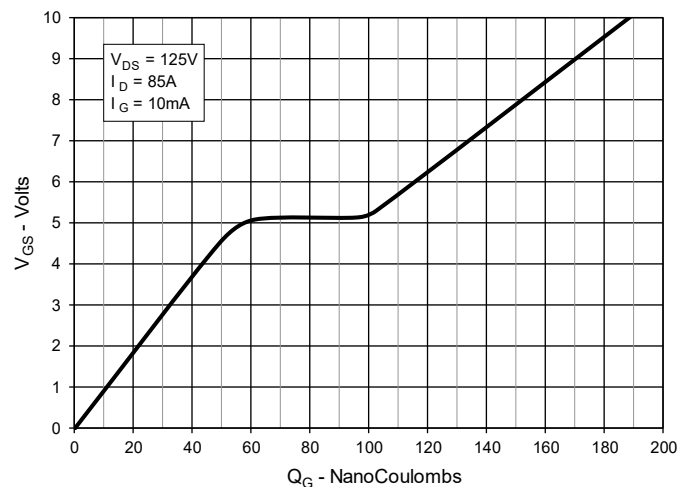
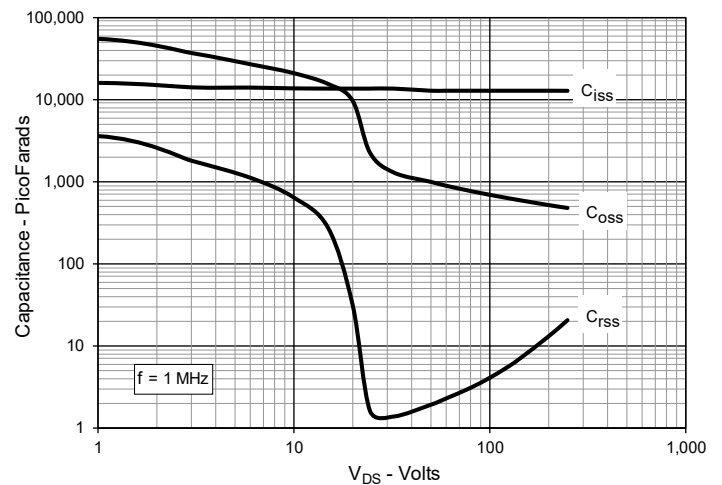
**Fig. 7. Maximum Drain Current vs. Case Temperature**

**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

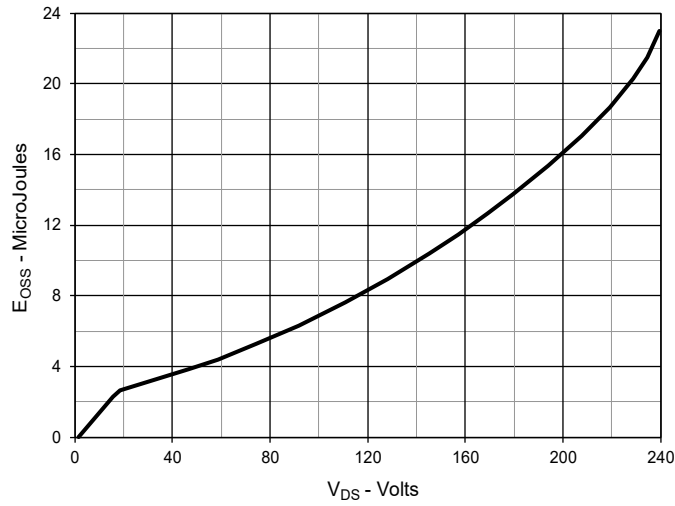


Fig. 14. Forward-Bias Safe Operating Area

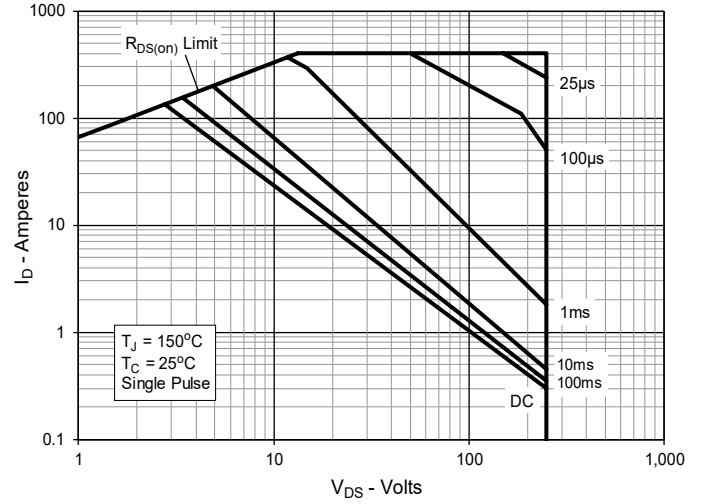
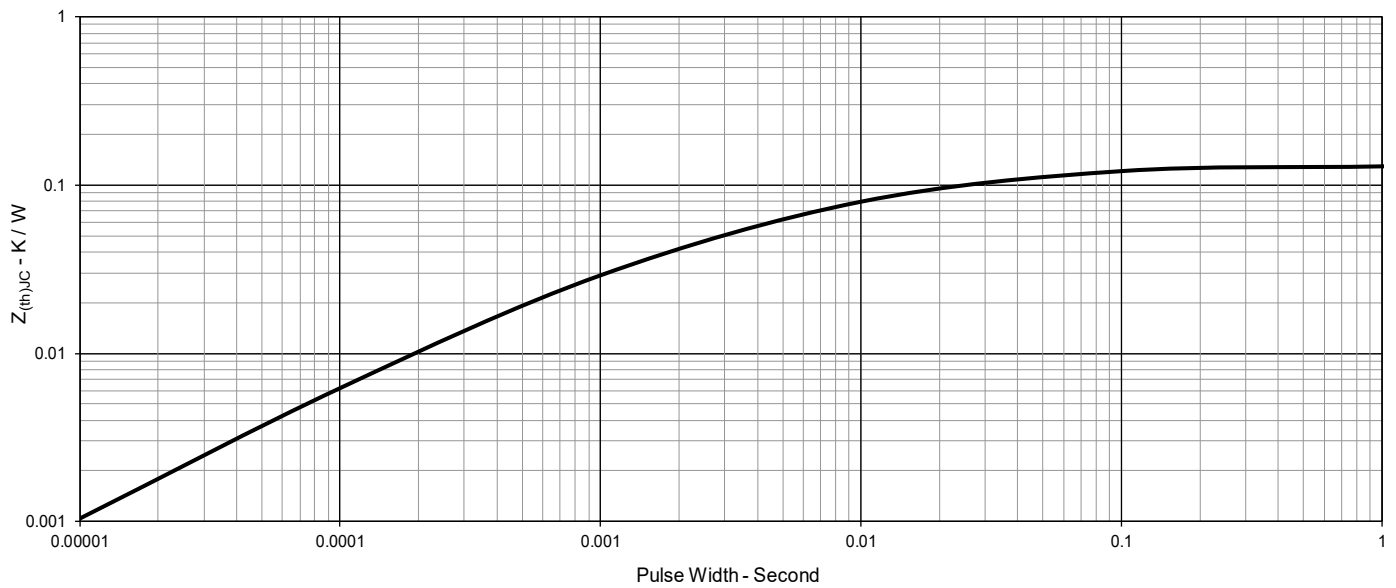
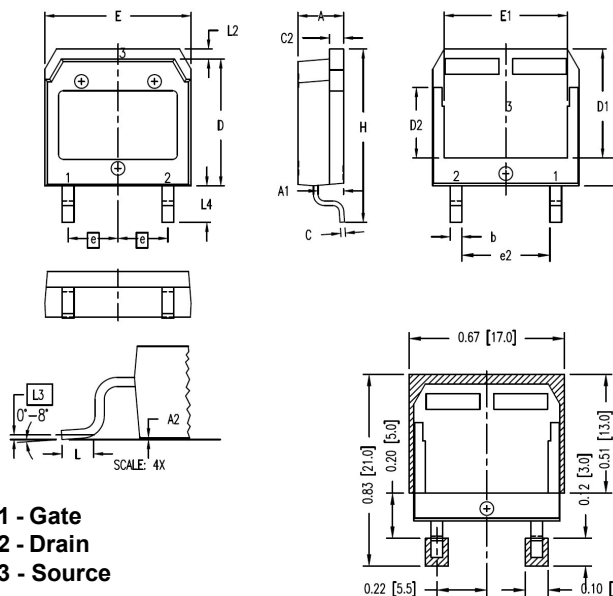


Fig. 15. Maximum Transient Thermal Impedance

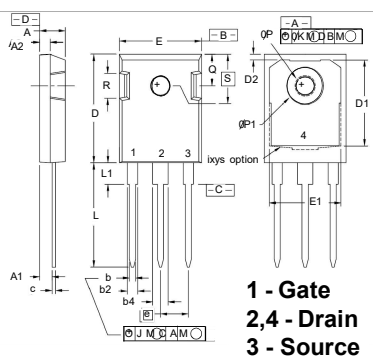


## TO-268HV Outline



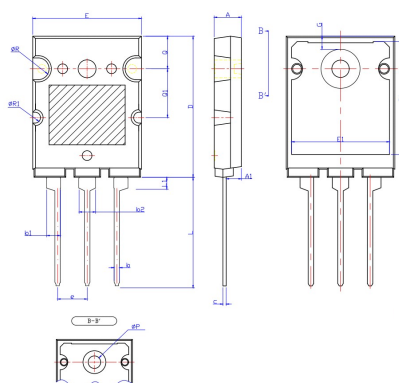
| SYM       | INCHES |      | MILLIMETER |       |
|-----------|--------|------|------------|-------|
|           | MIN    | MAX  | MIN        | MAX   |
| A         | .193   | .201 | 4.90       | 5.10  |
| A1        | .106   | .114 | 2.70       | 2.90  |
| A2        | .001   | .010 | 0.02       | 0.25  |
| 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 |
| <u>E</u>  | .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  |
| <u>L3</u> | .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-264K Outline



| SYM | INCHES |       | MILLIMETERS |       |
|-----|--------|-------|-------------|-------|
|     | MIN    | MAX   | MIN         | MAX   |
| A   | 0.189  | 0.205 | 4.80        | 5.20  |
| A1  | 0.098  | 0.122 | 2.50        | 3.10  |
| b   | 0.035  | 0.049 | 0.90        | 1.25  |
| b1  | 0.091  | 0.106 | 2.30        | 2.70  |
| b2  | 0.110  | 0.126 | 2.80        | 3.20  |
| c   | 0.020  | 0.033 | 0.50        | 0.85  |
| D   | 1.016  | 1.031 | 25.80       | 26.20 |
| E   | 0.780  | 0.795 | 19.80       | 20.20 |
| e   | 0.203  | 0.226 | 5.15        | 5.75  |
| L   | 0.768  | 0.807 | 19.50       | 20.50 |
| L1  | 0.094  | 0.102 | 2.40        | 2.60  |
| ØP  | 0.118  | 0.134 | 3.00        | 3.40  |
| Q   | 0.228  | 0.244 | 5.80        | 6.20  |
| Q1  | 0.346  | 0.362 | 8.80        | 9.20  |
| E1  | 0.701  | 0.717 | 17.80       | 18.20 |
| D1  | 0.811  | 0.827 | 20.60       | 21.00 |
| G   | 0.087  | 0.102 | 2.20        | 2.60  |
| ØR  | 0.079  |       | 2.00        |       |
| ØR1 | 0.039  |       | 1.00        |       |

