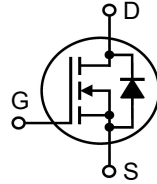


X3-Class HiPerFET™ Power MOSFET

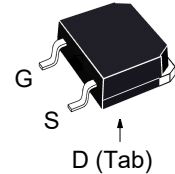
IXFT220N20X3HV
IXFH220N20X3
IXFK220N20X3

V_{DSS} = 200V
I_{D25} = 220A
R_{DS(on)} ≤ 6.2mΩ

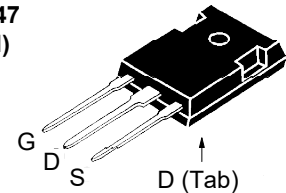
N-Channel Enhancement Mode
Avalanche Rated



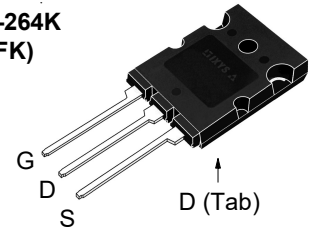
**TO-268HV
(IXFT..HV)**



**TO-247
(IXFH)**



**TO-264K
(IXFK)**



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

| Symbol | Test Conditions | Maximum Ratings | |
|---------------------|------------------------------------------------------------------------------------------------|-----------------|----------|
| V _{DSS} | T _J = 25°C to 150°C | 200 | V |
| V _{DGR} | T _J = 25°C to 150°C, R _{GS} = 1MΩ | 200 | V |
| V _{GSS} | Continuous | ±20 | V |
| V _{GSM} | Transient | ±30 | V |
| I _{D25} | T _C = 25°C (Chip Capability) | 220 | A |
| I _{L(RMS)} | External Lead Current Limit | 160 | A |
| I _{DM} | T _C = 25°C, Pulse Width Limited by T _{JM} | 500 | A |
| I _A | T _C = 25°C | 110 | A |
| E _{AS} | T _C = 25°C | 2.5 | J |
| dv/dt | I _S ≤ I _{DM} , V _{DD} ≤ V _{DSS} , T _J ≤ 150°C | 50 | V/ns |
| P _D | T _C = 25°C | 890 | W |
| T _J | | -55 ... +150 | °C |
| T _{JM} | | 150 | °C |
| T _{stg} | | -55 ... +150 | °C |
| T _L | Maximum Lead Temperature for Soldering | 300 | °C |
| T _{SOLD} | 1.6 mm (0.062 in.) from Case for 10s | 260 | °C |
| M _d | Mounting Torque (TO-247 & TO-264K) | 1.13 / 10 | Nm/lb.in |
| Weight | TO-268HV | 4 | g |
| | TO-247 | 6 | g |
| | TO-264 | 10 | g |

| Symbol | Test Conditions (T _J = 25°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} = ±20V, V _{DS} = 0V | | | ±100 nA |
| I _{DSS} | V _{DS} = V _{DSS} , V _{GS} = 0V T _J = 125°C | | | 10 μA 1 mA |
| R _{DS(on)} | V _{GS} = 10V, I _D = 0.5 • I _{D25} , Note 1 | 5.2 | | 6.2 mΩ |

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 ($T_J = 25^\circ\text{C}$, Unless Otherwise Specified) | Characteristic Values | | |
|-------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|------|-------------------------|
| | | Min. | Typ. | Max |
| g_{fs} | $V_{DS} = 10\text{V}$, $I_D = 60\text{A}$, Note 1 | 70 | 120 | S |
| R_{Gi} | Gate Input Resistance | | 1.6 | Ω |
| C_{iss} | } $V_{GS} = 0\text{V}$, $V_{DS} = 25\text{V}$, $f = 1\text{MHz}$ | | 13.6 | nF |
| C_{oss} | | | 2.2 | nF |
| C_{rss} | | | 9.0 | pF |
| Effective Output Capacitance | | | | |
| $C_{o(er)}$ | Energy related } $V_{GS} = 0\text{V}$ | | 1000 | pF |
| $C_{o(tr)}$ | Time related } $V_{DS} = 0.8 \cdot V_{DSS}$ | | 3250 | pF |
| $t_{d(on)}$ | } Resistive Switching Times $V_{GS} = 10\text{V}$, $V_{DS} = 0.5 \cdot V_{DSS}$, $I_D = 0.5 \cdot I_{D25}$ $R_G = 5\Omega$ (External) | | 37 | ns |
| t_r | | | 27 | ns |
| $t_{d(off)}$ | | | 155 | ns |
| t_f | | | 17 | ns |
| $Q_{g(on)}$ | } $V_{GS} = 10\text{V}$, $V_{DS} = 0.5 \cdot V_{DSS}$, $I_D = 0.5 \cdot I_{D25}$ | | 204 | nC |
| Q_{gs} | | | 65 | nC |
| Q_{gd} | | | 47 | nC |
| R_{thJC} | | | | 0.14 $^\circ\text{C/W}$ |
| R_{thCS} | TO-247 | | 0.21 | $^\circ\text{C/W}$ |
| | TO-264K | | 0.15 | $^\circ\text{C/W}$ |

Source-Drain Diode

| Symbol | Test Conditions ($T_J = 25^\circ\text{C}$, 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} | } $I_F = 110\text{A}$, $-di/dt = 100\text{A}/\mu\text{s}$ $V_R = 100\text{V}$ | | 128 | ns |
| Q_{RM} | | | 580 | nC |
| I_{RM} | | | 9 | A |

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

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

LFMOSFETs 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 @ $T_J = 25^\circ\text{C}$

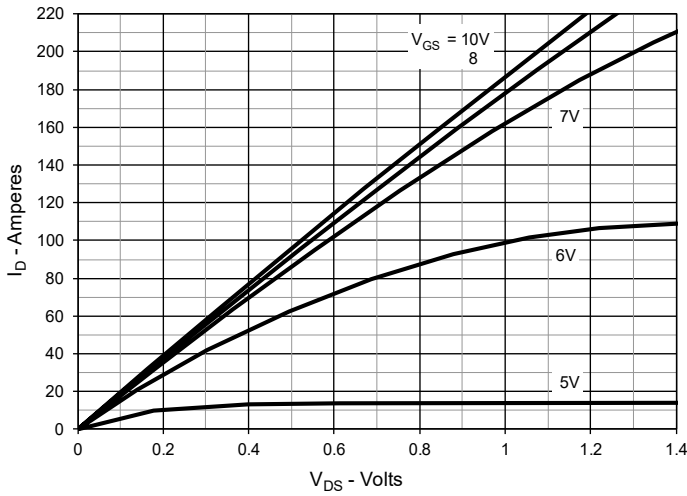


Fig. 2. Extended Output Characteristics @ $T_J = 25^\circ\text{C}$

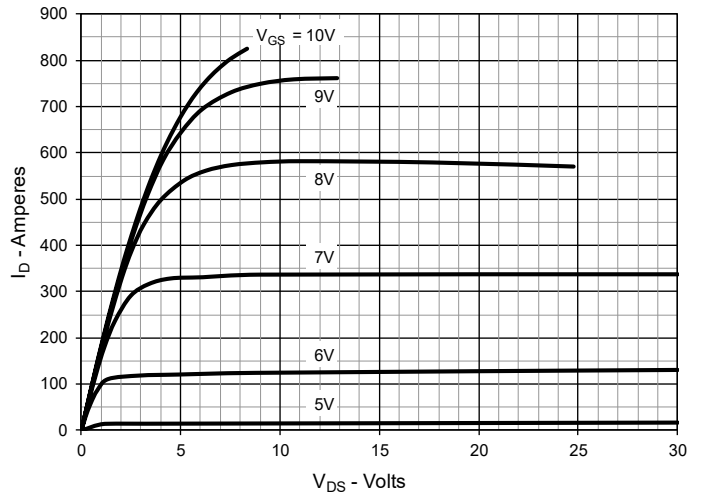


Fig. 3. Output Characteristics @ $T_J = 125^\circ\text{C}$

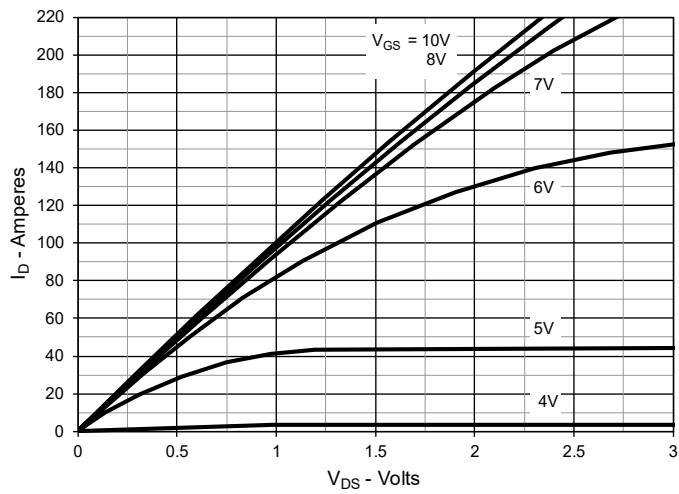


Fig. 4. $R_{DS(on)}$ Normalized to $I_D = 110\text{A}$ Value vs. Junction Temperature

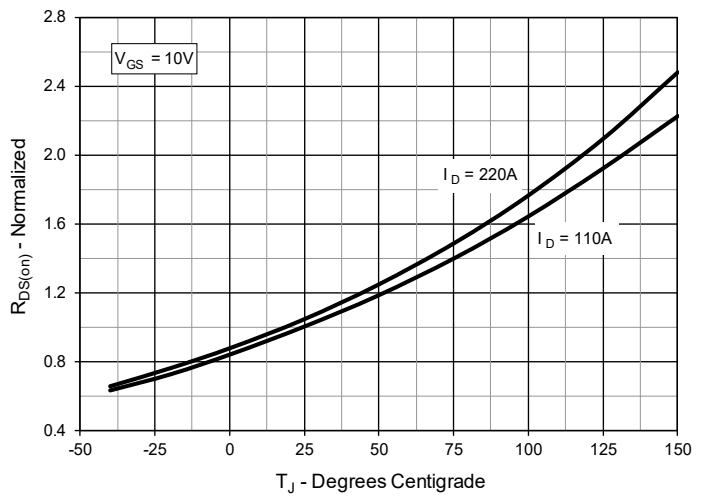


Fig. 5. $R_{DS(on)}$ Normalized to $I_D = 110\text{A}$ Value vs. Drain Current

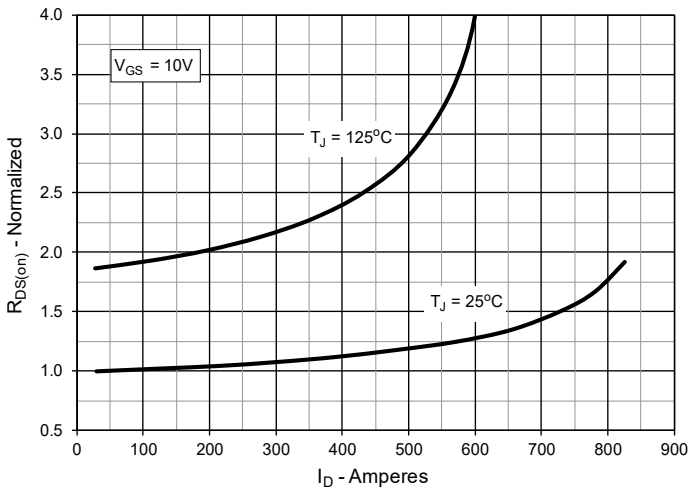


Fig. 6. Normalized Breakdown & Threshold Voltages vs. Junction Temperature

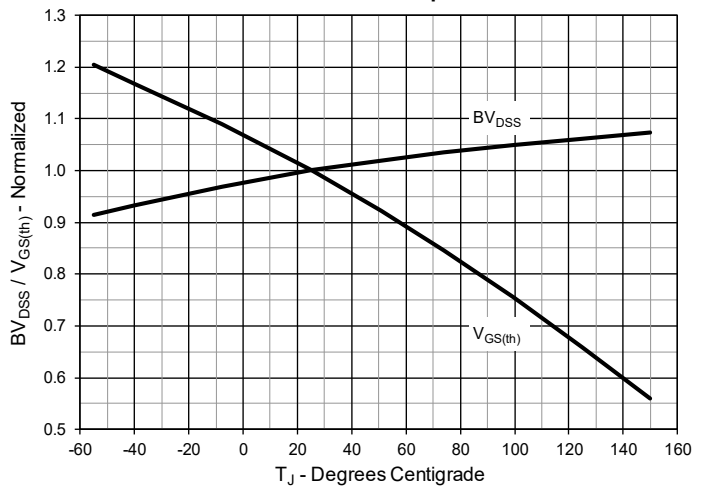


Fig. 7. Maximum Drain Current vs. Case Temperature

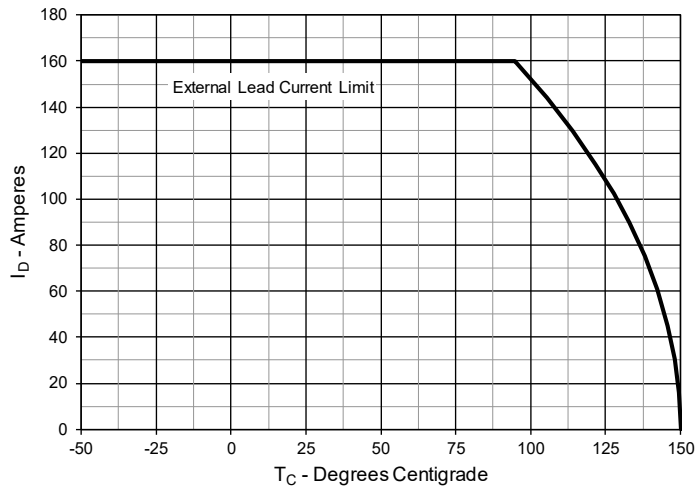


Fig. 8. Input Admittance

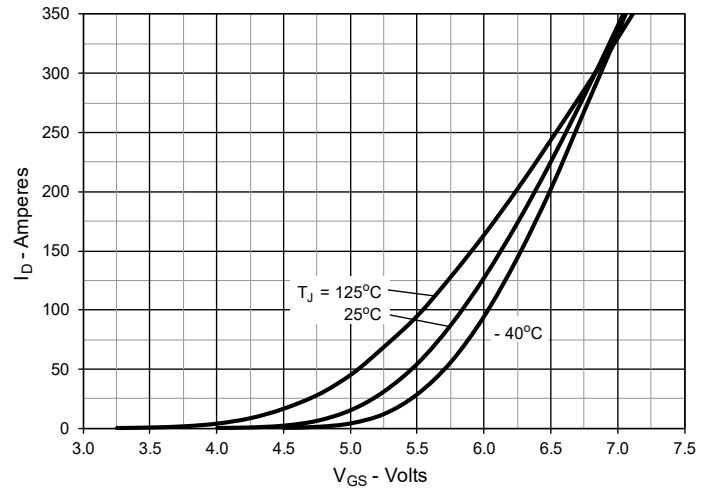


Fig. 9. Transconductance

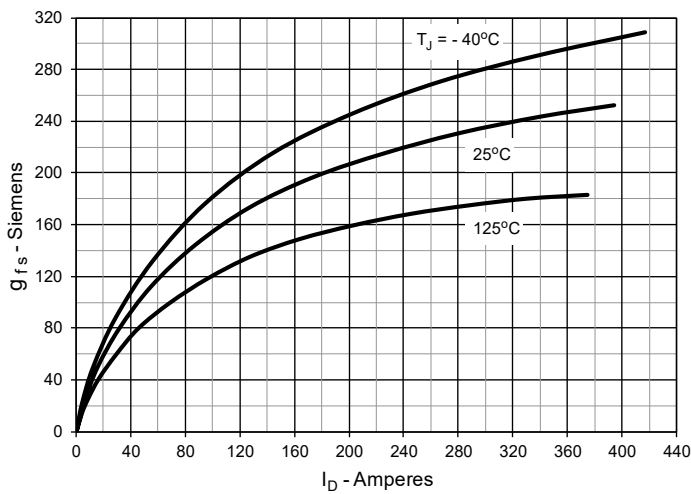


Fig. 10. Forward Voltage Drop of Intrinsic Diode

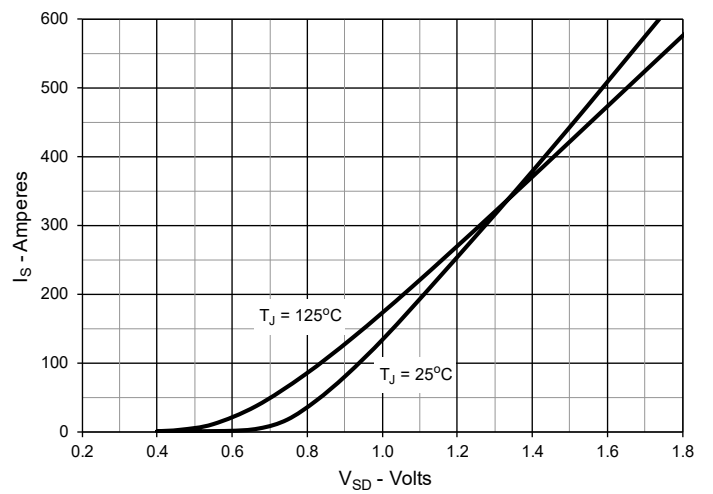


Fig. 11. Gate Charge

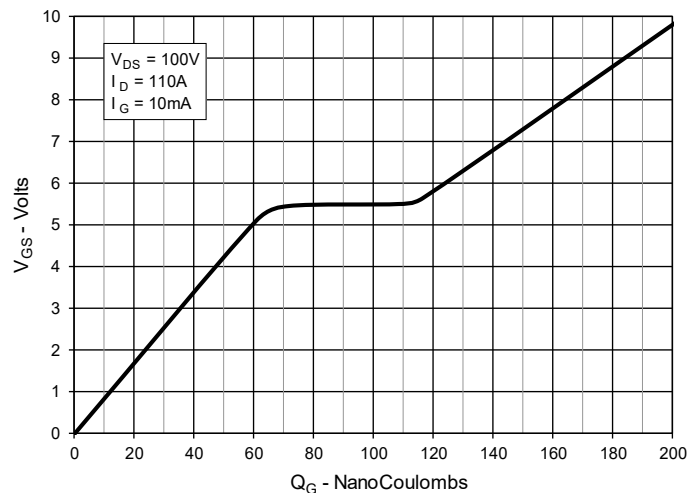


Fig. 12. Capacitance

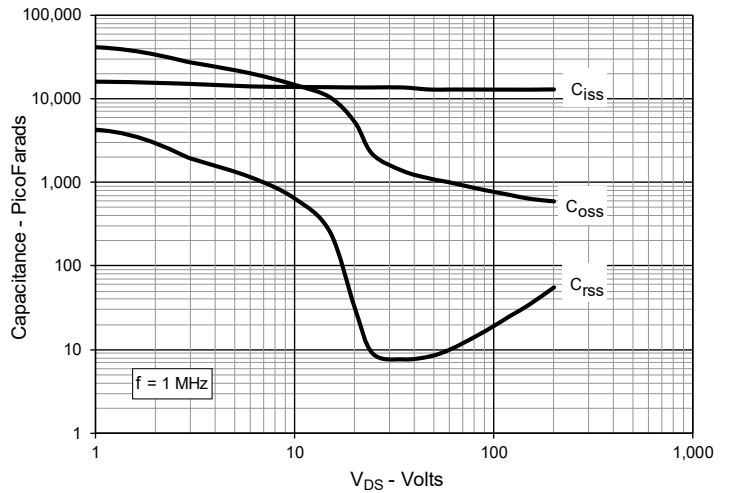


Fig. 13. Output Capacitance Stored Energy

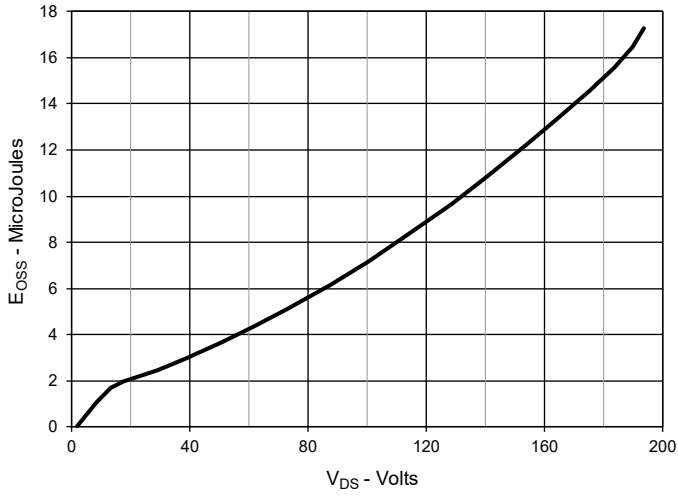


Fig. 14. Forward-Bias Safe Operating Area

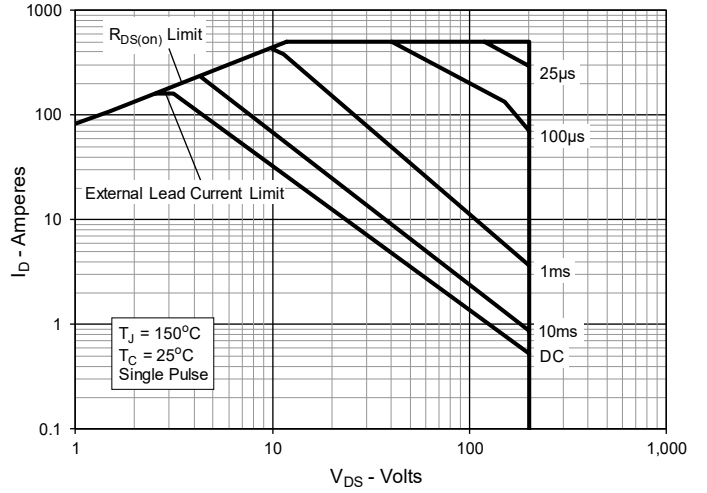
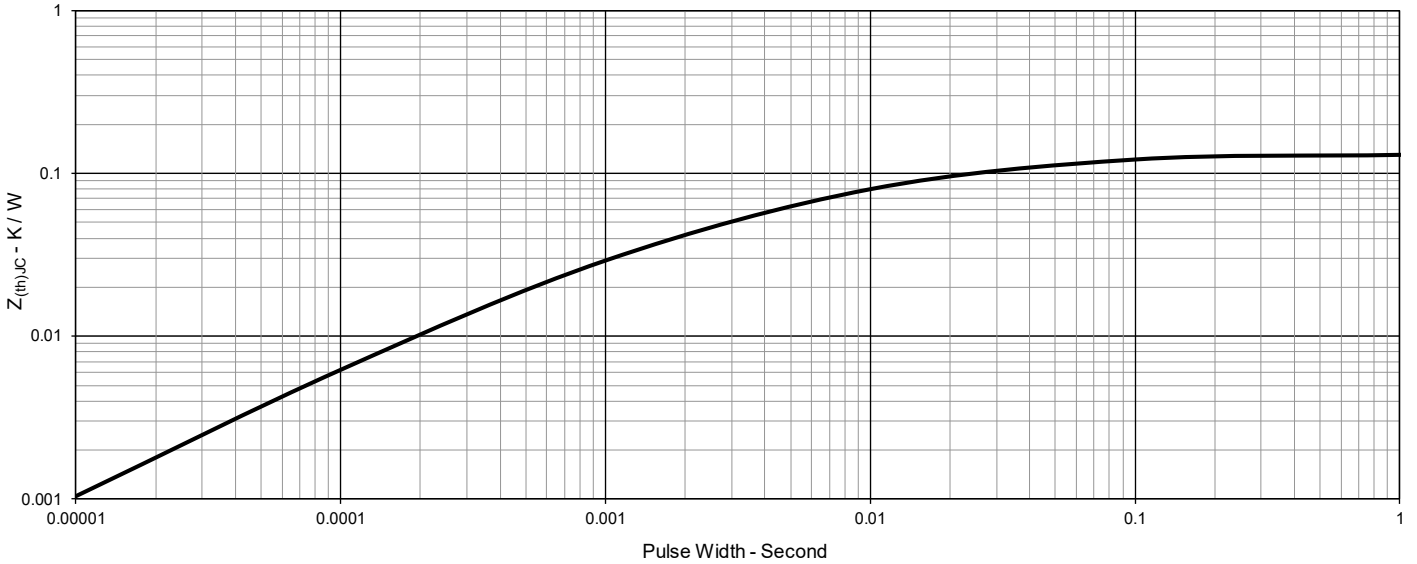
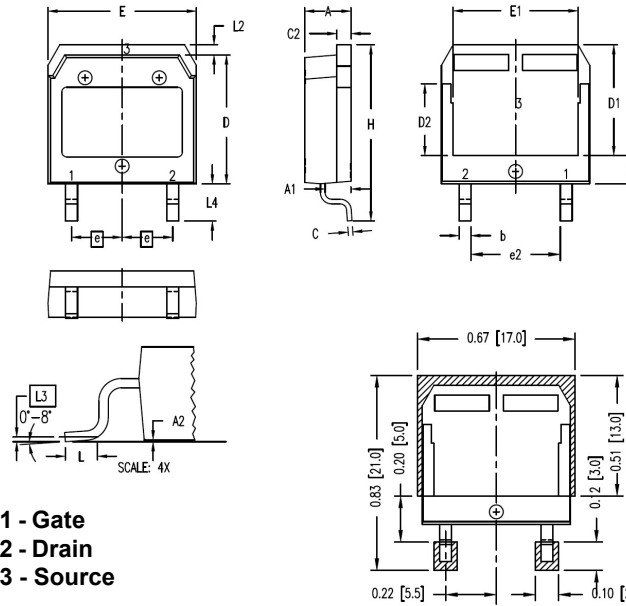


Fig. 15. Maximum Transient Thermal Impedance

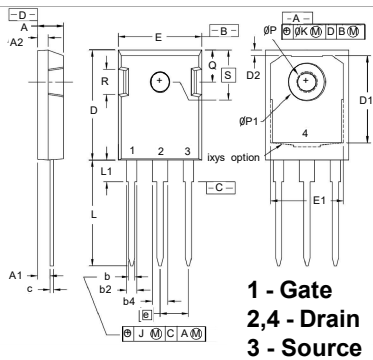


TO-268HV Outline



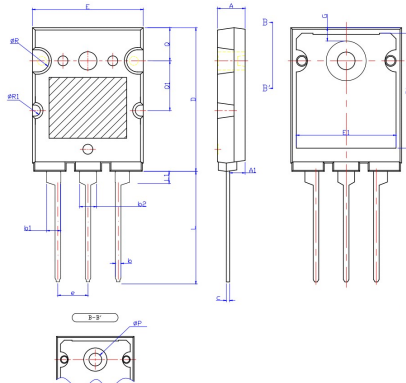
| SYM | INCHES | | MILLIMETER | |
|------|----------|------|------------|-------|
| | MIN | MAX | MIN | MAX |
| A | .193 | .201 | 4.90 | 5.10 |
| A1 | .106 | .114 | 2.70 | 2.90 |
| A2 | .001 | .010 | 0.02 | 0.25 |
| b | .045 | .057 | 1.15 | 1.45 |
| C | .016 | .026 | 0.40 | 0.65 |
| C2 | .057 | .063 | 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-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 | |



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