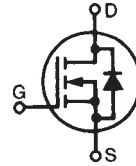


X3-Class HiPerFET™ Power MOSFET

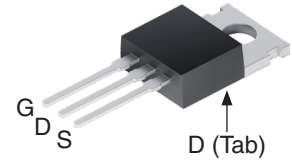
IXFP90N20X3
IXFQ90N20X3
IXFH90N20X3

$V_{DSS} = 200V$
 $I_{D25} = 90A$
 $R_{DS(on)} \leq 12.8m\Omega$

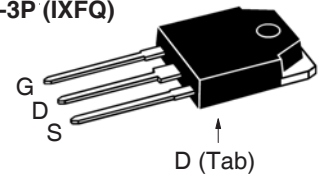
N-Channel Enhancement Mode
Avalanche Rated



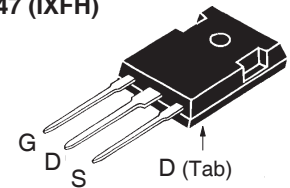
TO-220AB (IXFP)



TO-3P (IXFQ)



TO-247 (IXFH)



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

| Symbol | Test Conditions | Maximum Ratings | |
|------------|--|-----------------|------------|
| V_{DSS} | $T_J = 25^\circ C$ to $150^\circ C$ | 200 | V |
| V_{DGR} | $T_J = 25^\circ C$ to $150^\circ C$, $R_{GS} = 1M\Omega$ | 200 | V |
| V_{GSS} | Continuous | ± 20 | V |
| V_{GSM} | Transient | ± 30 | V |
| I_{D25} | $T_C = 25^\circ C$ | 90 | A |
| I_{DM} | $T_C = 25^\circ C$, Pulse Width Limited by T_{JM} | 220 | A |
| I_A | $T_C = 25^\circ C$ | 45 | A |
| E_{AS} | $T_C = 25^\circ C$ | 1.5 | J |
| dv/dt | $I_S \leq I_{DM}$, $V_{DD} \leq V_{DSS}$, $T_J \leq 150^\circ C$ | 20 | V/ns |
| P_D | $T_C = 25^\circ C$ | 390 | 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 (0.062in.) from Case for 10s | 260 | $^\circ C$ |
| M_d | Mounting Torque | 1.13 / 10 | Nm/lb.in |
| Weight | TO-220 | 3.0 | g |
| | TO-3P | 5.5 | g |
| | TO-247 | 6.0 | g |

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 ($T_J = 25^\circ C$, Unless Otherwise Specified) | Characteristic Values | | |
|--------------|---|-----------------------|------|--------------|
| | | Min. | Typ. | Max. |
| BV_{DSS} | $V_{GS} = 0V$, $I_D = 250\mu A$ | 200 | | V |
| $V_{GS(th)}$ | $V_{DS} = V_{GS}$, $I_D = 1.5mA$ | 2.5 | | 4.5 V |
| I_{GSS} | $V_{GS} = \pm 20V$, $V_{DS} = 0V$ | | | ± 100 nA |
| I_{DSS} | $V_{DS} = V_{DSS}$, $V_{GS} = 0V$ $T_J = 125^\circ C$ | | | 5 μA |
| | | | | 300 μA |
| $R_{DS(on)}$ | $V_{GS} = 10V$, $I_D = 0.5 \cdot I_{D25}$, Note 1 | 10.5 | 12.8 | m Ω |

| Symbol | Test Conditions ($T_J = 25^\circ\text{C}$, Unless Otherwise Specified) | Characteristic Values | | |
|-------------------------------------|--|--|------|-------------------------|
| | | Min. | Typ. | Max |
| g_{fs} | $V_{DS} = 10\text{V}$, $I_D = 0.5 \cdot I_{D25}$, Note 1 | 40 | 67 | S |
| R_{Gi} | Gate Input Resistance | | 1.4 | Ω |
| C_{iss} | $V_{GS} = 0\text{V}$, $V_{DS} = 25\text{V}$, $f = 1\text{MHz}$ | | 5420 | pF |
| C_{oss} | | | 930 | pF |
| C_{rss} | | | 4 | pF |
| Effective Output Capacitance | | | | |
| $C_{o(er)}$ | Energy related | $V_{GS} = 0\text{V}$ $V_{DS} = 0.8 \cdot V_{DSS}$ | 420 | pF |
| $C_{o(tr)}$ | Time related | | 1300 | pF |
| Resistive Switching Times | | | | |
| $t_{d(on)}$ | $V_{GS} = 10\text{V}$, $V_{DS} = 0.5 \cdot V_{DSS}$, $I_D = 0.5 \cdot I_{D25}$ $R_G = 5\Omega$ (External) | | 22 | ns |
| t_r | | | 26 | ns |
| $t_{d(off)}$ | | | 62 | ns |
| t_f | | | 13 | ns |
| $Q_{g(on)}$ | $V_{GS} = 10\text{V}$, $V_{DS} = 0.5 \cdot V_{DSS}$, $I_D = 0.5 \cdot I_{D25}$ | | 78 | nC |
| Q_{gs} | | | 23 | nC |
| Q_{gd} | | | 22 | nC |
| R_{thJC} | | | | 0.32 $^\circ\text{C/W}$ |
| R_{thCS} | TO-220 | | 0.50 | $^\circ\text{C/W}$ |
| | TO-247 & TO-3P | | 0.25 | $^\circ\text{C/W}$ |

Source-Drain Diode

| Symbol | Test Conditions ($T_J = 25^\circ\text{C}$, Unless Otherwise Specified) | Characteristic Values | | |
|----------|--|-----------------------|------|-------|
| | | Min. | Typ. | Max |
| I_S | $V_{GS} = 0\text{V}$ | | | 90 A |
| I_{SM} | Repetitive, pulse Width Limited by T_{JM} | | | 360 A |
| V_{SD} | $I_F = I_S$, $V_{GS} = 0\text{V}$, Note 1 | | | 1.4 V |
| t_{rr} | $I_F = 45\text{A}$, $-di/dt = 100\text{A}/\mu\text{s}$ $V_R = 100\text{V}$ | | 95 | ns |
| Q_{RM} | | | 360 | nC |
| I_{RM} | | | 7.6 | A |

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

Fig. 1. Output Characteristics @ $T_J = 25^\circ\text{C}$

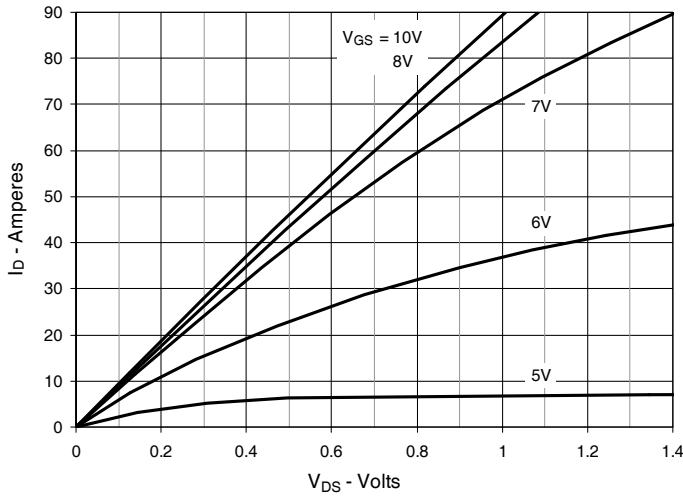


Fig. 2. Extended Output Characteristics @ $T_J = 25^\circ\text{C}$

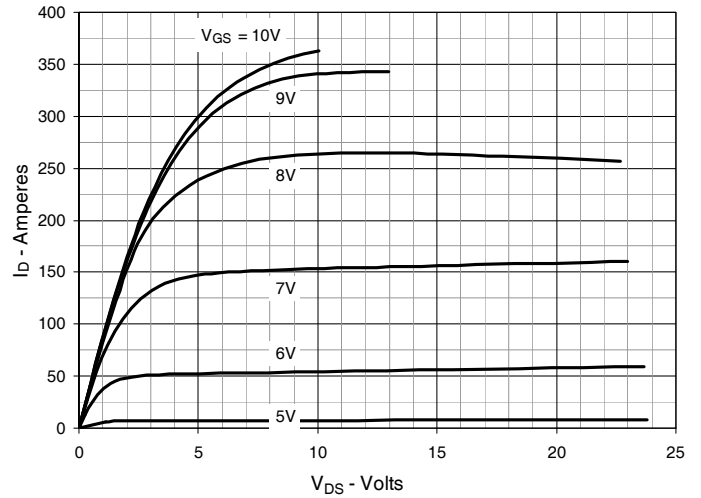


Fig. 3. Output Characteristics @ $T_J = 125^\circ\text{C}$

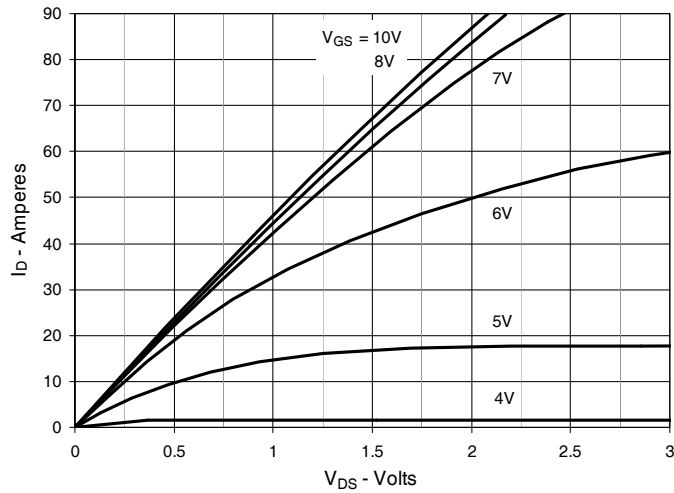


Fig. 4. $R_{DS(on)}$ Normalized to $I_D = 45A$ Value vs. Junction Temperature

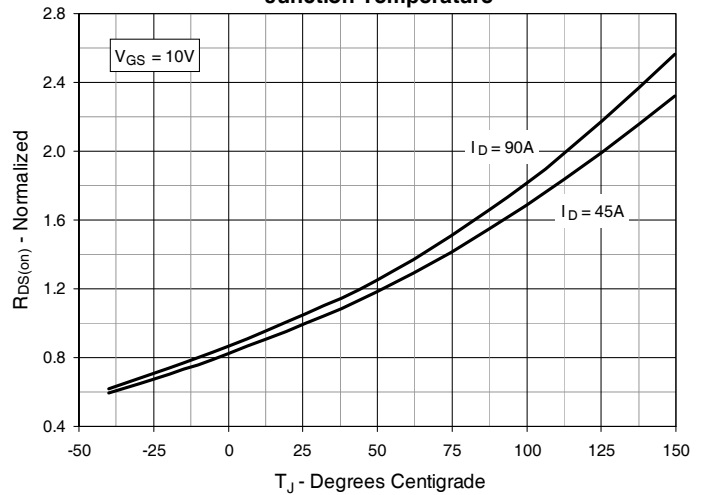


Fig. 5. $R_{DS(on)}$ Normalized to $I_D = 45A$ Value vs. Drain Current

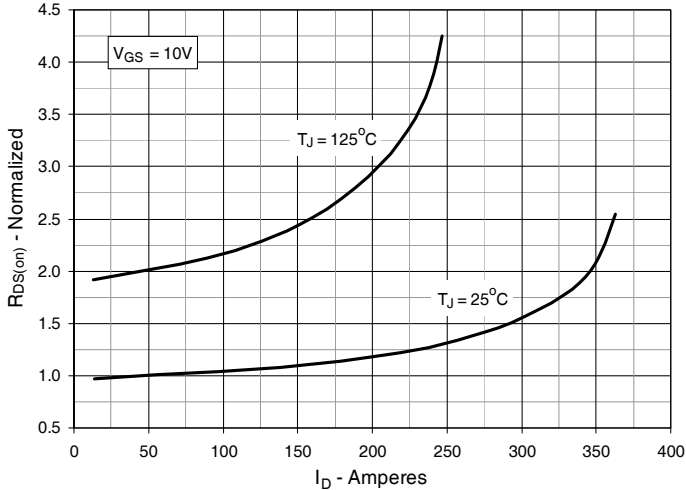


Fig. 6. Normalized Breakdown & Threshold Voltages vs. Junction Temperature

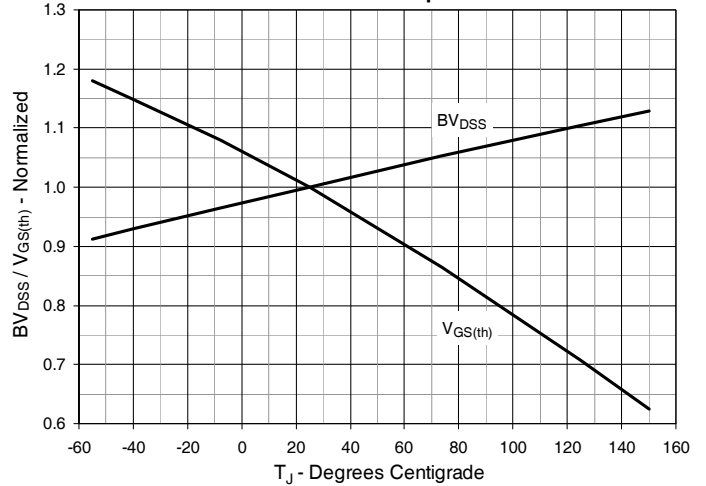


Fig. 7. Maximum Drain Current vs. Case Temperature

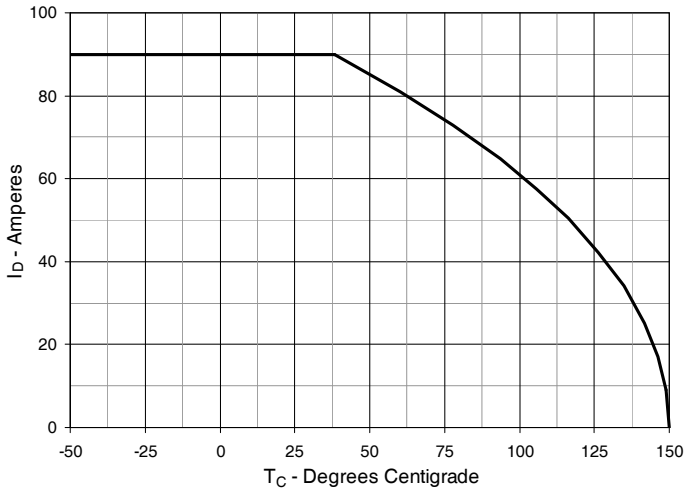


Fig. 8. Input Admittance

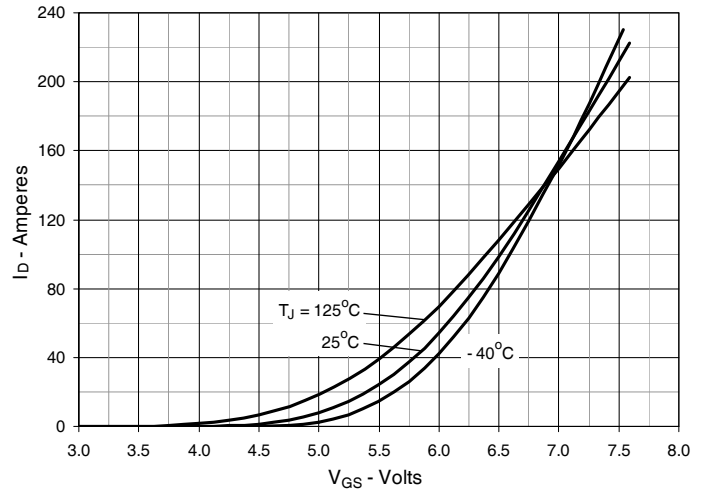


Fig. 9. Transconductance

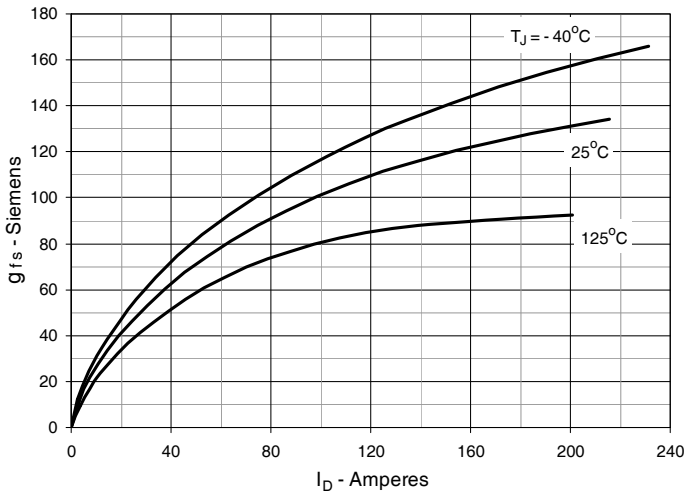


Fig. 10. Forward Voltage Drop of Intrinsic Diode

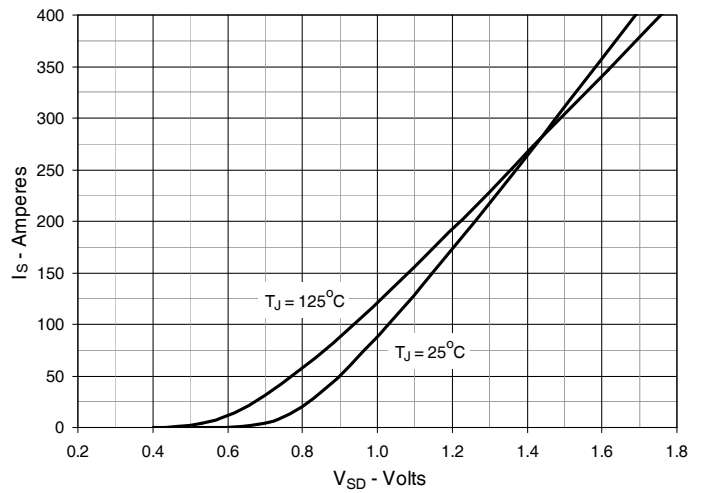


Fig. 11. Gate Charge

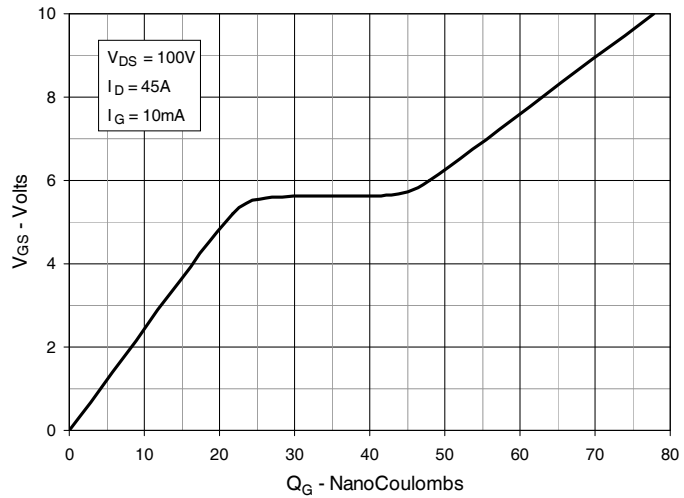


Fig. 12. Capacitance

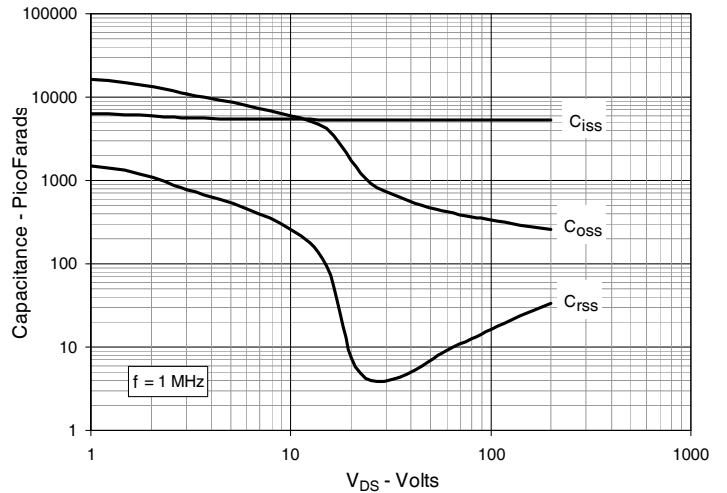


Fig. 13. Output Capacitance Stored Energy

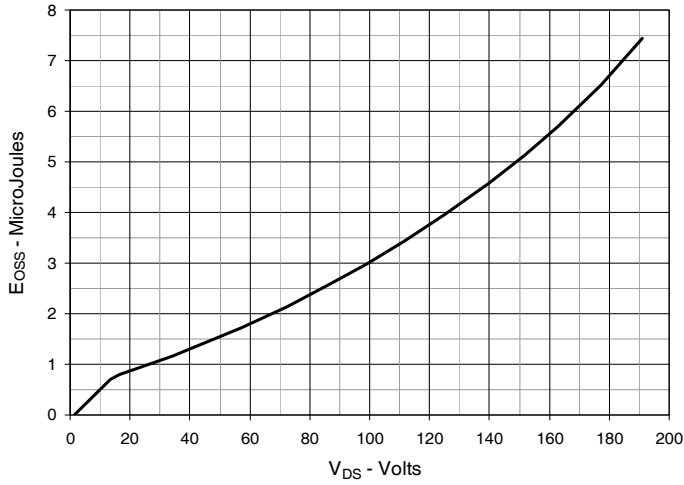


Fig. 14. Forward-Bias Safe Operating Area

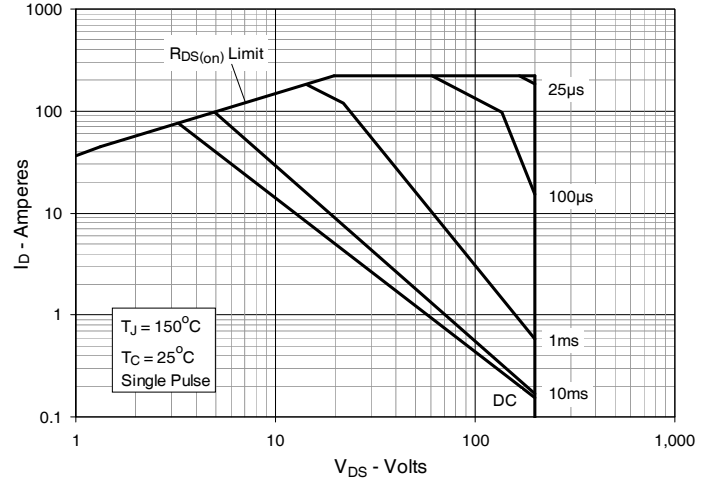
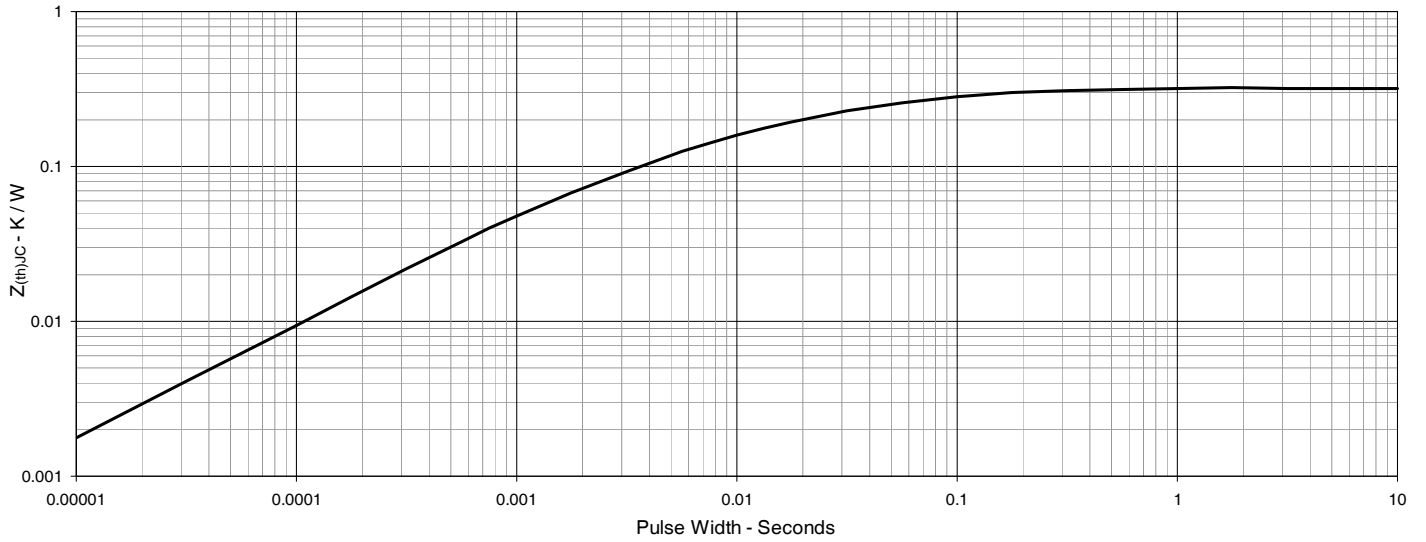
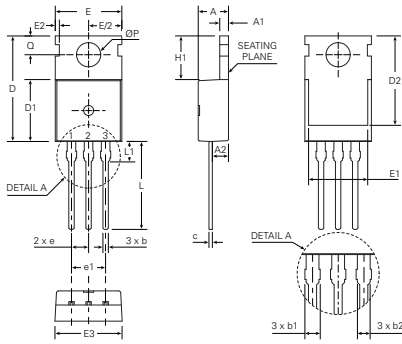


Fig. 15. Maximum Transient Thermal Impedance



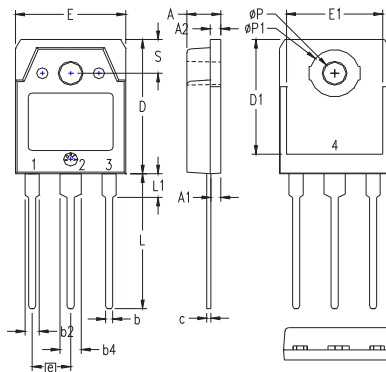
TO-220 Outline



Pins: 1 - Gate
2 - Drain
3 - Source

| Symbol | Inches | | | Millimeters | | |
|--------|--------|---------|-------|-------------|----------|-------|
| | Min. | Typical | Max. | Min. | Typical | Max. |
| A | 0.169 | 0.177 | 0.185 | 4.30 | 4.50 | 4.70 |
| A1 | 0.049 | 0.051 | 0.055 | 1.25 | 1.30 | 1.40 |
| A2 | 0.087 | 0.094 | 0.102 | 2.20 | 2.40 | 2.60 |
| b | 0.028 | 0.031 | 0.035 | 0.70 | 0.80 | 0.90 |
| b1 | 0.056 | 0.060 | 0.064 | 1.42 | 1.52 | 1.62 |
| b2 | 0.046 | 0.050 | 0.054 | 1.17 | 1.27 | 1.37 |
| c | 0.018 | 0.020 | 0.024 | 0.45 | 0.50 | 0.60 |
| D | 0.610 | 0.618 | 0.626 | 15.50 | 15.70 | 15.90 |
| D1 | 0.354 | 0.362 | 0.370 | 9.00 | 9.20 | 9.40 |
| D2 | 0.516 | 0.524 | 0.531 | 13.10 | 13.30 | 13.50 |
| E | 0.382 | 0.390 | 0.400 | 9.70 | 9.90 | 10.10 |
| E1 | | 0.346 | | | 8.80 | |
| E2 | | 0.024 | | | 0.60 | |
| E3 | 0.386 | 0.394 | 0.402 | 9.80 | 10.00 | 10.20 |
| e | | 0.100 | | | 2.54 BSC | |
| e1 | | 0.200 | | | 5.08 BSC | |
| H1 | 0.248 | 0.256 | 0.264 | 6.30 | 6.50 | 6.70 |
| L | 0.507 | 0.515 | 0.523 | 12.88 | 13.08 | 13.28 |
| L1 | | 0.118 | | | 3.00 | |
| ØP | 0.134 | 0.142 | 0.150 | 3.40 | 3.60 | 3.80 |
| Q | 0.106 | 0.110 | 0.114 | 2.70 | 2.80 | 2.90 |

TO-3P Outline

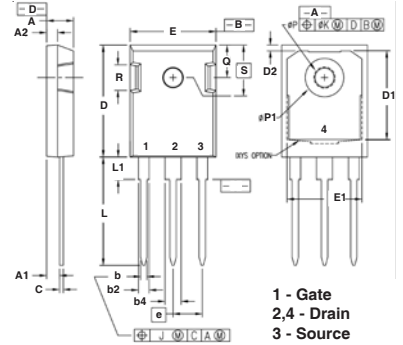


Pins: 1 - Gate 2 - Drain
3 - Source 4 - Drain

| SYM | INCHES | | MILLIMETERS | |
|-----|----------|------|-------------|-------|
| | MIN | MAX | MIN | MAX |
| A | .185 | .193 | 4.70 | 4.90 |
| A1 | .051 | .059 | 1.30 | 1.50 |
| A2 | .057 | .065 | 1.45 | 1.65 |
| b | .035 | .045 | 0.90 | 1.15 |
| b2 | .075 | .087 | 1.90 | 2.20 |
| b4 | .114 | .126 | 2.90 | 3.20 |
| c | .022 | .031 | 0.55 | 0.80 |
| D | .780 | .791 | 19.80 | 20.10 |
| D1 | .665 | .677 | 16.90 | 17.20 |
| E | .610 | .622 | 15.50 | 15.80 |
| E1 | .531 | .539 | 13.50 | 13.70 |
| e | .215 BSC | | 5.45 BSC | |
| L | .779 | .795 | 19.80 | 20.20 |
| L1 | .134 | .142 | 3.40 | 3.60 |
| ØP | .126 | .134 | 3.20 | 3.40 |
| ØP1 | .272 | .280 | 6.90 | 7.10 |
| S | .193 | .201 | 4.90 | 5.10 |

All metal area are tin plated.

TO-247 Outline



1 - Gate
2,4 - Drain
3 - Source

| Dim. | Millimeter | | Inches | |
|------|------------|-------|-----------|-------|
| | min | max | min | max |
| A | 4.70 | 5.30 | 0.185 | 0.209 |
| A1 | 2.21 | 2.59 | 0.087 | 0.102 |
| A2 | 1.50 | 2.49 | 0.059 | 0.098 |
| b | 0.99 | 1.40 | 0.039 | 0.055 |
| b2 | 1.65 | 2.39 | 0.065 | 0.094 |
| b4 | 2.59 | 3.43 | 0.102 | 0.135 |
| c | 0.38 | 0.89 | 0.015 | 0.035 |
| D | 20.79 | 21.45 | 0.819 | 0.845 |
| D1 | 13.07 | - | 0.515 | - |
| D2 | 0.51 | 1.35 | 0.020 | 0.053 |
| E | 15.48 | 16.24 | 0.610 | 0.640 |
| E1 | 13.45 | - | 0.53 | - |
| E2 | 4.31 | 5.48 | 0.170 | 0.216 |
| e | 5.45 BSC | | 0.215 BSC | |
| L | 19.80 | 20.30 | 0.078 | 0.800 |
| L1 | - | 4.49 | - | 0.177 |
| ØP | 3.55 | 3.65 | 0.140 | 0.144 |
| ØP1 | - | 7.39 | - | 0.290 |
| Q | 5.38 | 6.19 | 0.212 | 0.244 |
| S | 6.14 BSC | | 0.242 BSC | |

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