

# Polar™ HiPerFET Power MOSFET

N-Channel Enhancement Mode  
Avalanche Rated  
Fast Intrinsic Diode

**IXFA10N80P**  
**IXFP10N80P**  
**IXFQ10N80P**  
**IXFH10N80P**

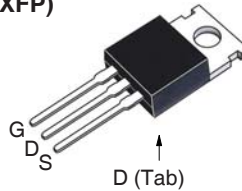


$V_{DSS} = 800V$   
 $I_{D25} = 10A$   
 $R_{DS(on)} \leq 1.1\Omega$   
 $t_{rr} \leq 250ns$

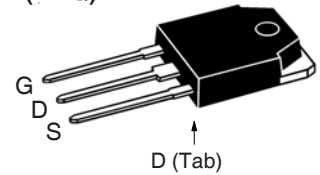
TO-263 (IXFA)



TO-220 (IXFP)

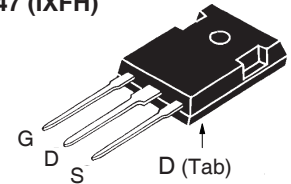


TO-3P (IXFQ)



| Symbol        | Test Conditions  | Maximum Ratings    |            |
|---------------|--|--------------------|------------|
| $V_{DSS}$     | $T_J = 25^\circ C$ to $150^\circ C$                                | 800                | V          |
| $V_{DGR}$     | $T_J = 25^\circ C$ to $150^\circ C$ , $R_{GS} = 1M\Omega$          | 800                | V          |
| $V_{GSS}$     | Continuous   | $\pm 30$           | V          |
| $V_{GSM}$     | Transient  | $\pm 40$           | V          |
| $I_{D25}$     | $T_C = 25^\circ C$   | 10                 | A          |
| $I_{DM}$      | $T_C = 25^\circ C$ , Pulse Width Limited by $T_{JM}$               | 30                 | A          |
| $I_A$         | $T_C = 25^\circ C$   | 5                  | A          |
| $E_{AS}$      | $T_C = 25^\circ C$   | 600                | mJ         |
| $dV/dt$       | $I_S \leq I_{DM}$ , $V_{DD} \leq V_{DSS}$ , $T_J \leq 150^\circ C$ | 10                 | V/ns       |
| $P_D$         | $T_C = 25^\circ C$   | 300                | 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                | $^\circ C$ |
| $F_C$         | Mounting Force (TO-263)  | 10..65 / 2.2..14.6 | N/lb       |
| $M_d$         | Mounting Torque (TO-220, TO-247 & TO-3P)                           | 1.13 / 10          | Nm/lb.in   |
| <b>Weight</b> | TO-263   | 2.5                | g          |
|               | TO-220   | 3.0                | g          |
|               | TO-3P  | 5.5                | g          |
|               | TO-247   | 6.0                | g          |

TO-247 (IXFH)



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

## Features

- International Standard Packages
- Avalanche Rated
- Low Package Inductance
- Easy to Drive and to Protect

## Advantages

- Easy to Mount
- Space Savings
- High Power Density

## Applications

- Switched-Mode and Resonant-Mode Power Supplies
- DC-DC Converters
- Laser Drivers
- AC and DC Motor Drives
- Robotics and Servo Controls

| Symbol       | Test Conditions<br>( $T_J = 25^\circ C$ Unless Otherwise Specified) | Characteristic Values |      |              |
|--------------|---|-----------------------|------|--------------|
|              |   | Min.                  | Typ. | Max.         |
| $BV_{DSS}$   | $V_{GS} = 0V$ , $I_D = 250\mu A$                                    | 800                   |      | V            |
| $V_{GS(th)}$ | $V_{DS} = V_{GS}$ , $I_D = 2.5mA$                                   | 3.0                   |      | 5.5 V        |
| $I_{GSS}$    | $V_{GS} = \pm 30V$ , $V_{DS} = 0V$                                  |                       |      | $\pm 100$ nA |
| $I_{DSS}$    | $V_{DS} = V_{DSS}$ , $V_{GS} = 0V$<br>$T_J = 150^\circ C$           |                       |      | 25 $\mu A$   |
|              |   |                       |      | 500 $\mu A$  |
| $R_{DS(on)}$ | $V_{GS} = 10V$ , $I_D = 0.5 \cdot I_{D25}$ , Note 1                 |                       |      | 1.1 $\Omega$ |

| 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   | 7                     | 11   | S                       |
| $C_{iss}$    | } $V_{GS} = 0\text{V}$ , $V_{DS} = 25\text{V}$ , $f = 1\text{MHz}$   |                       | 2050 | pF                      |
| $C_{oss}$    |  |                       | 172  | pF                      |
| $C_{rss}$    |  |                       | 16   | pF                      |
| $t_{d(on)}$  | } <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>$R_G = 5\Omega$ (External) |                       | 21   | ns                      |
| $t_r$        |  |                       | 22   | ns                      |
| $t_{d(off)}$ |  |                       | 62   | ns                      |
| $t_f$        |  |                       | 22   | ns                      |
| $Q_{g(on)}$  | } $V_{GS} = 10\text{V}$ , $V_{DS} = 0.5 \cdot V_{DSS}$ , $I_D = 0.5 \cdot I_{D25}$   |                       | 40   | nC                      |
| $Q_{gs}$     |  |                       | 12   | nC                      |
| $Q_{gd}$     |  |                       | 14   | nC                      |
| $R_{thJC}$   |  |                       |      | 0.42 $^\circ\text{C/W}$ |
| $R_{thCS}$   | (TO-220)   |                       | 0.50 | $^\circ\text{C/W}$      |
| $R_{thCS}$   | (TO-247 & TO-3P)   |                       | 0.25 | $^\circ\text{C/W}$      |

#### Source-Drain Diode

| Symbol   | Test Conditions<br>( $T_J = 25^\circ\text{C}$ , Unless Otherwise Specified)                              | Characteristic Values |      |               |
|----------|--|-----------------------|------|---------------|
|          |  | Min.                  | Typ. | Max           |
| $I_S$    | $V_{GS} = 0\text{V}$   |                       |      | 10 A          |
| $I_{SM}$ | Repetitive, Pulse Width Limited by $T_{JM}$  |                       |      | 30 A          |
| $V_{SD}$ | $I_F = I_S$ , $V_{GS} = 0\text{V}$ , Note 1  |                       |      | 1.5 V         |
| $t_{rr}$ | } $I_F = 10\text{A}$ , $V_{GS} = 0\text{V}$<br>$-di/dt = 100\text{A}/\mu\text{s}$<br>$V_R = 100\text{V}$ |                       | 200  | 250 ns        |
| $I_{RM}$ |  |                       | 3.0  | A             |
| $Q_{RM}$ |  |                       | 0.6  | $\mu\text{C}$ |

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 | 7,157,338B2 |
| 4,850,072 | 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 @  $T_J = 25^\circ\text{C}$

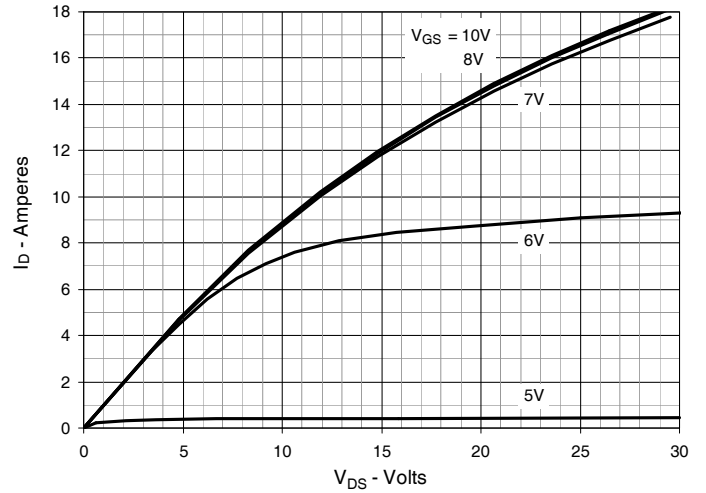


Fig. 3. Output Characteristics @  $T_J = 125^\circ\text{C}$

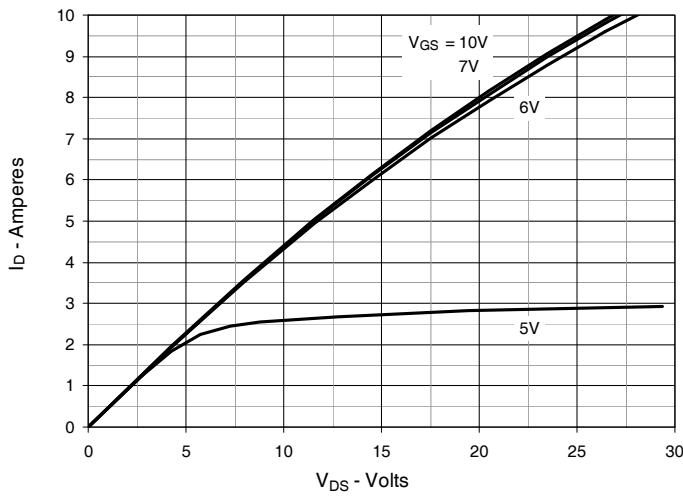


Fig. 4.  $R_{DS(on)}$  Normalized to  $I_D = 5A$  Value vs. Junction Temperature

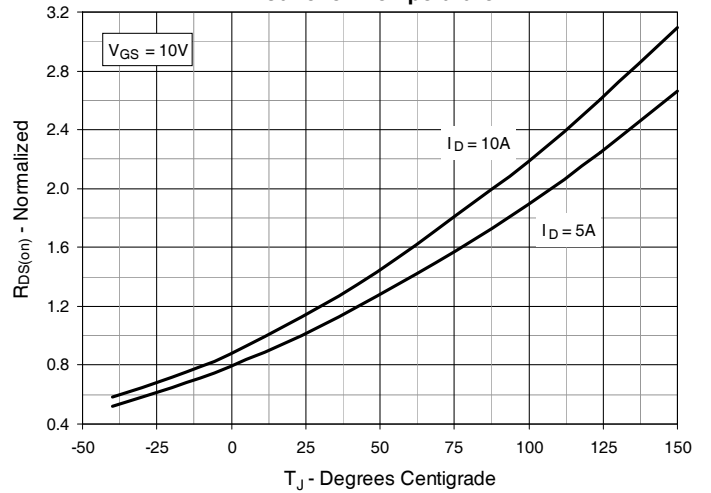


Fig. 5.  $R_{DS(on)}$  Normalized to  $I_D = 5A$  Value vs. Drain Current

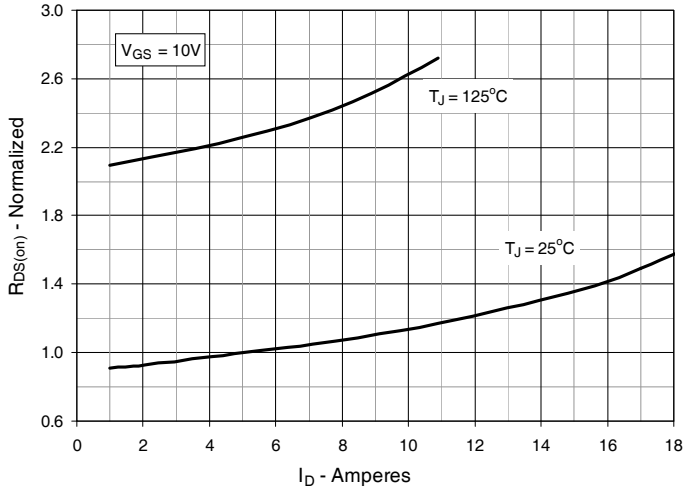


Fig. 6. Maximum Drain Current vs. Case Temperature

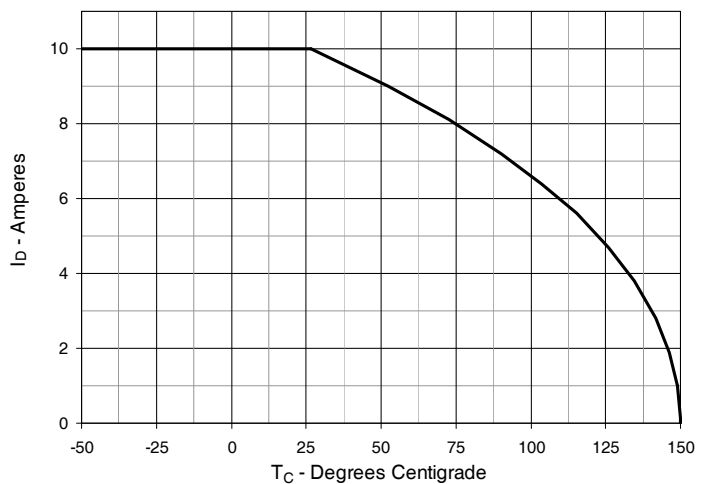


Fig. 7. Input Admittance



Fig. 8. Transconductance

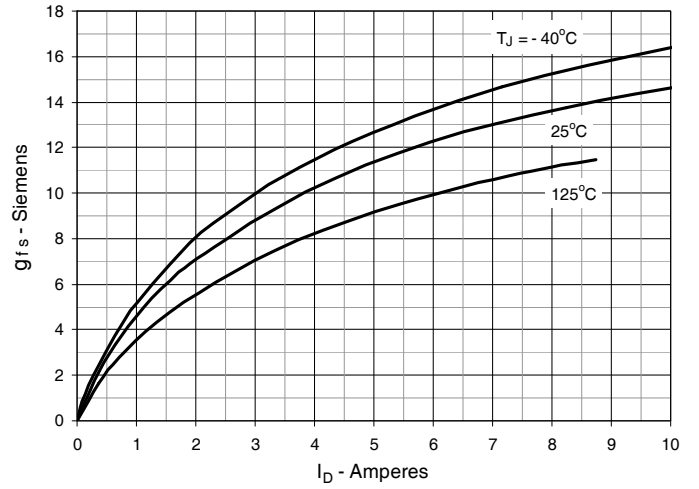


Fig. 9. Forward Voltage Drop of Intrinsic Diode

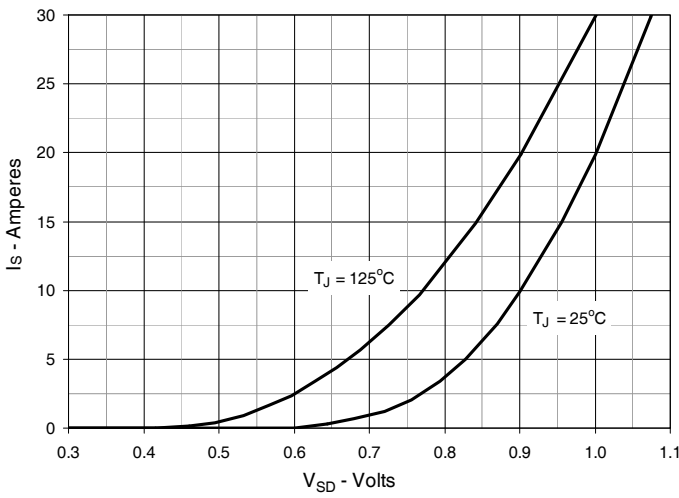


Fig. 10. Gate Charge

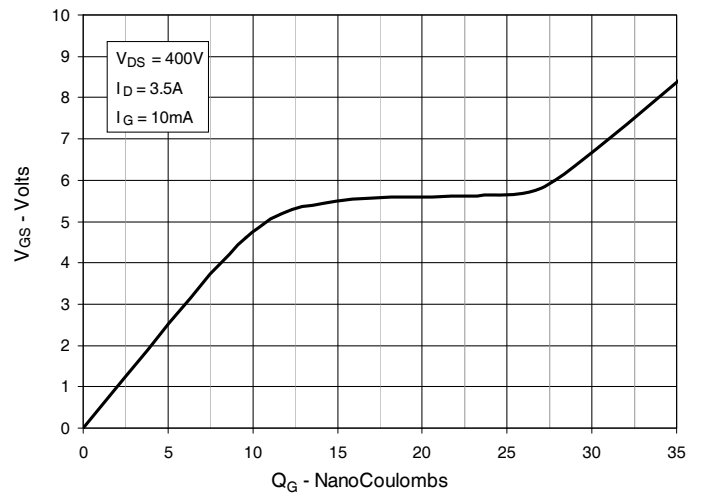


Fig. 11. Capacitance

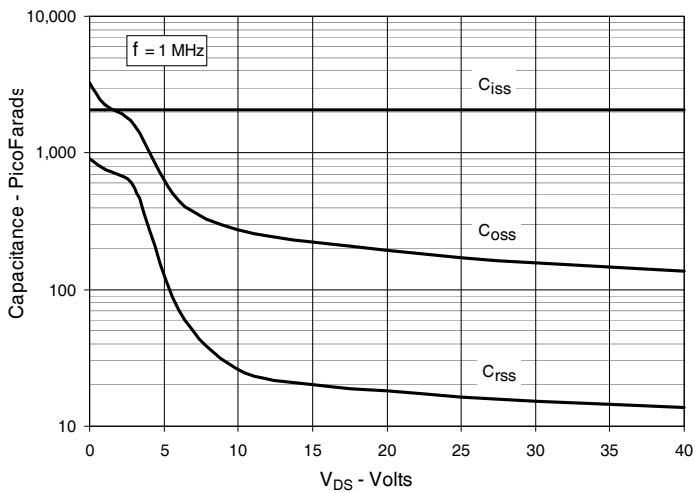


Fig. 12. Forward-Bias Safe Operating Area

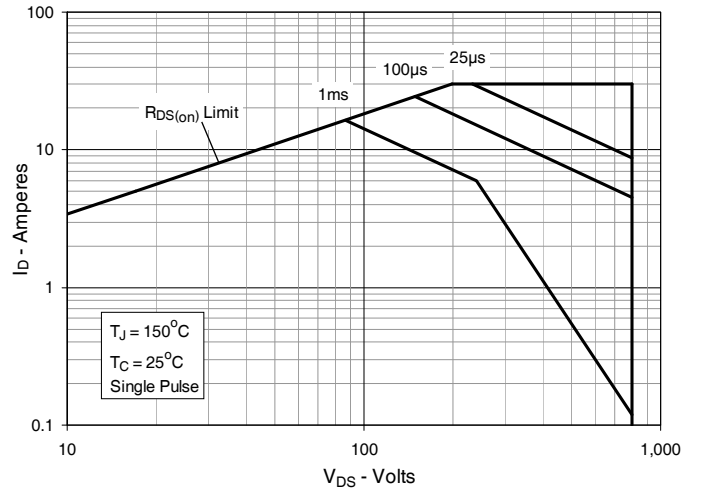
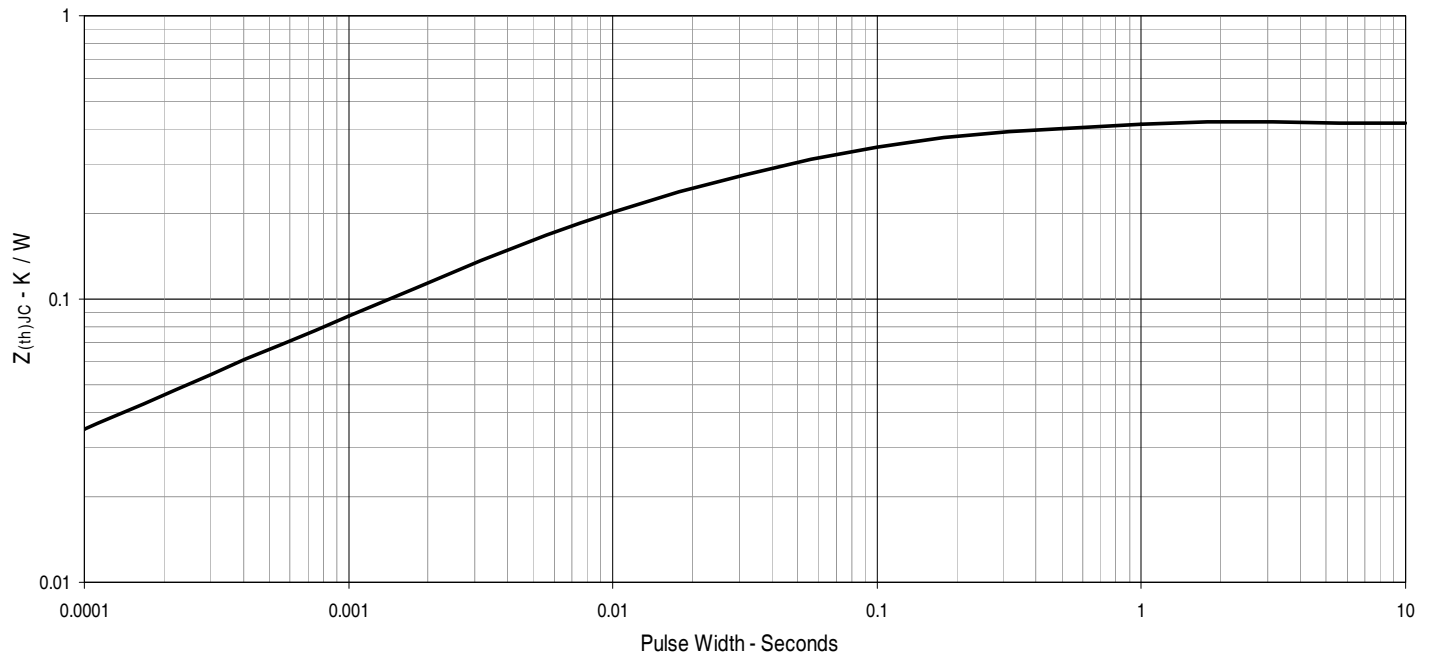
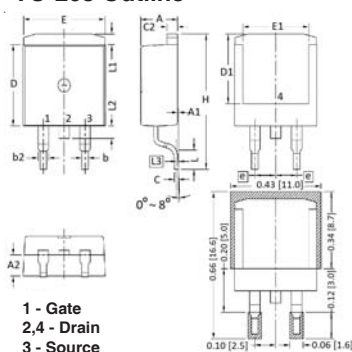


Fig. 13. Maximum Transient Thermal Impedance



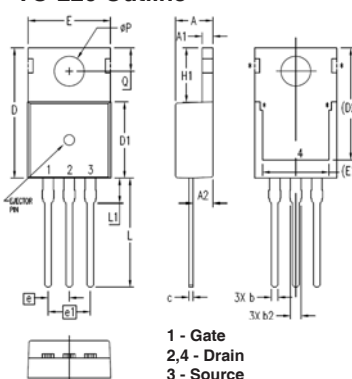
### TO-263 Outline



1 - Gate  
2,4 - Drain  
3 - Source

| SYM | INCHES   |      | MILLIMETER |       |
|-----|----------|------|------------|-------|
|     | MIN      | MAX  | MIN        | MAX   |
| A   | .170     | .185 | 4.30       | 4.70  |
| A1  | .000     | .008 | 0.00       | 0.20  |
| A2  | .091     | .098 | 2.30       | 2.50  |
| b   | .028     | .035 | 0.70       | 0.90  |
| b2  | .046     | .060 | 1.18       | 1.52  |
| C   | .018     | .024 | 0.45       | 0.60  |
| C2  | .049     | .060 | 1.25       | 1.52  |
| D   | .340     | .370 | 8.63       | 9.40  |
| D1  | .300     | .327 | 7.62       | 8.30  |
| E   | .380     | .410 | 9.65       | 10.41 |
| E1  | .270     | .330 | 6.86       | 8.38  |
| e   | .100 BSC |      | 2.54 BSC   |       |
| H   | .580     | .620 | 14.73      | 15.75 |
| L   | .075     | .105 | 1.91       | 2.67  |
| L1  | .039     | .060 | 1.00       | 1.52  |
| L2  | —        | .070 | —          | 1.77  |
| L3  | .010 BSC |      | 0.254 BSC  |       |

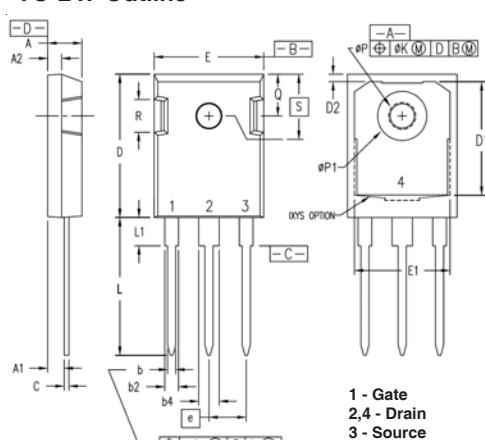
### TO-220 Outline



1 - Gate  
2,4 - Drain  
3 - Source

| SYM  | INCHES   |      | MILLIMETERS |       |
|------|----------|------|-------------|-------|
|      | MIN      | MAX  | MIN         | MAX   |
| A    | .169     | .185 | 4.30        | 4.70  |
| A1   | .047     | .055 | 1.20        | 1.40  |
| A2   | .079     | .106 | 2.00        | 2.70  |
| b    | .024     | .039 | 0.60        | 1.00  |
| b2   | .045     | .057 | 1.15        | 1.45  |
| c    | .014     | .026 | 0.35        | 0.65  |
| D    | .587     | .626 | 14.90       | 15.90 |
| D1   | .335     | .370 | 8.50        | 9.40  |
| (D2) | .500     | .531 | 12.70       | 13.50 |
| E    | .382     | .406 | 9.70        | 10.30 |
| (E1) | .283     | .323 | 7.20        | 8.20  |
| e    | .100 BSC |      | 2.54 BSC    |       |
| e1   | .200 BSC |      | 5.08 BSC    |       |
| H1   | .244     | .268 | 6.20        | 6.80  |
| L    | .492     | .547 | 12.50       | 13.90 |
| L1   | .110     | .154 | 2.80        | 3.90  |
| ∅P   | .134     | .150 | 3.40        | 3.80  |
| Q    | .106     | .126 | 2.70        | 3.20  |

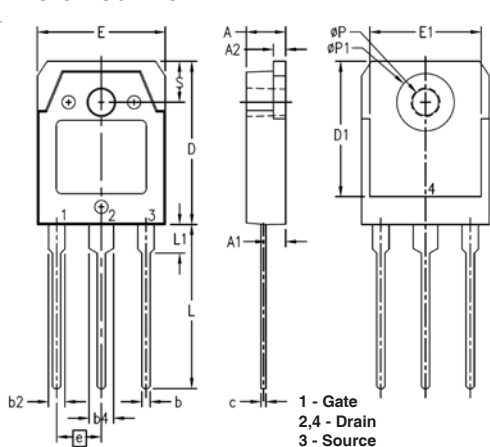
### TO-247 Outline



1 - Gate  
2,4 - Drain  
3 - Source

| 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  |
| ∅P  | .140     | .144 | 3.55        | 3.65  |
| ∅P1 | .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-3P Outline



1 - Gate  
2,4 - Drain  
3 - Source

| SYM | INCHES   |      | MILLIMETERS |       |
|-----|----------|------|-------------|-------|
|     | MIN      | MAX  | MIN         | MAX   |
| A   | .181     | .197 | 4.60        | 5.00  |
| A1  | .087     | 1.02 | 2.20        | 2.60  |
| A2  | .057     | .065 | 1.45        | 1.65  |
| b   | .031     | .047 | 0.80        | 1.20  |
| b2  | .071     | .087 | 1.80        | 2.20  |
| b4  | .110     | .126 | 2.80        | 3.20  |
| c   | .022     | .031 | 0.55        | 0.80  |
| D   | .776     | .791 | 19.70       | 20.10 |
| D1  | .640     | .680 | 16.26       | 17.27 |
| E   | .606     | .622 | 15.40       | 15.80 |
| E1  | .531     | .539 | 13.50       | 13.70 |
| e   | .215 BSC |      | 5.45 BSC    |       |
| L   | .779     | .795 | 19.80       | 20.20 |
| L1  | .130     | .146 | 3.30        | 3.70  |
| ∅P  | .122     | .134 | 3.10        | 3.40  |
| ∅P1 | .272     | .280 | 6.90        | 7.10  |
| S   | .189     | .205 | 4.80        | 5.20  |



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