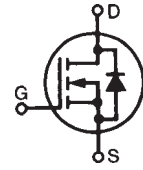


# PolarHV™ Power MOSFET

N-Channel Enhancement Mode  
Avalanche Rated

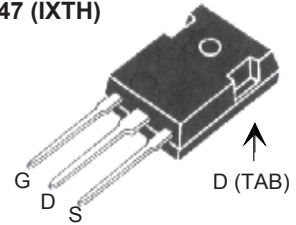
**IXTH 30N60P**  
**IXTQ 30N60P**  
**IXTT 30N60P**  
**IXTV 30N60P**  
**IXTV 30N60PS**

$V_{DSS} = 600 \text{ V}$   
 $I_{D25} = 30 \text{ A}$   
 $R_{DS(on)} \leq 240 \text{ m}\Omega$

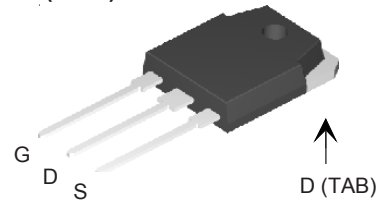


| Symbol     | Test Conditions   | Maximum Ratings |                  |
|------------|---|-----------------|------------------|
| $V_{DSS}$  | $T_J = 25^\circ\text{C}$ to $150^\circ\text{C}$   | 600             | V                |
| $V_{DGR}$  | $T_J = 25^\circ\text{C}$ to $150^\circ\text{C}$ ; $R_{GS} = 1 \text{ M}\Omega$  | 600             | V                |
| $V_{GSS}$  | Continuous  | $\pm 30$        | V                |
| $V_{GSM}$  | Transient   | $\pm 40$        | V                |
| $I_{D25}$  | $T_C = 25^\circ\text{C}$  | 30              | A                |
| $I_{DM}$   | $T_C = 25^\circ\text{C}$ , pulse width limited by $T_{JM}$  | 80              | A                |
| $I_{AR}$   | $T_C = 25^\circ\text{C}$  | 30              | A                |
| $E_{AR}$   | $T_C = 25^\circ\text{C}$  | 50              | mJ               |
| $E_{AS}$   | $T_C = 25^\circ\text{C}$  | 1.5             | J                |
| $dv/dt$    | $I_S \leq I_{DM}$ , $di/dt \leq 100 \text{ A}/\mu\text{s}$ , $V_{DD} \leq V_{DSS}$ ,<br>$T_J \leq 150^\circ\text{C}$ , $R_G = 4 \Omega$ | 10              | V/ns             |
| $P_D$      | $T_C = 25^\circ\text{C}$  | 540             | W                |
| $T_J$      |   | -55 ... +150    | $^\circ\text{C}$ |
| $T_{JM}$   |   | 150             | $^\circ\text{C}$ |
| $T_{stg}$  |   | -55 ... +150    | $^\circ\text{C}$ |
| $T_L$      | 1.6 mm (0.062 in.) from case for 10 s   | 300             | $^\circ\text{C}$ |
| $T_{SOLD}$ | Plastic body for 10 s   | 260             | $^\circ\text{C}$ |
| $M_d$      | Mounting torque (TO-3P, TO-247)   | 1.13/10         | Nm/lb.in.        |
| $F_C$      | Mounting force (PLUS220)  | 11..65/2.5..15  | N/lb.            |
| Weight     | TO-247  | 6.0             | g                |
|            | TO-3P   | 5.5             | g                |
|            | PLUS220   | 4.0             | g                |
|            | TO-268  | 5.0             | g                |

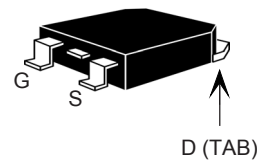
TO-247 (IXTH)



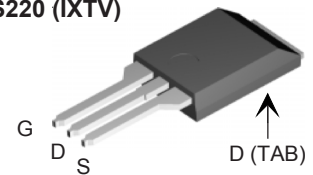
TO-3P (IXTQ)



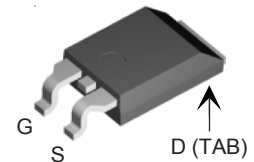
TO-268 (IXTT)



PLUS220 (IXTV)



PLUS220 (IXTV...S)



G = Gate      D = Drain  
S = Source    TAB = Drain

### Features

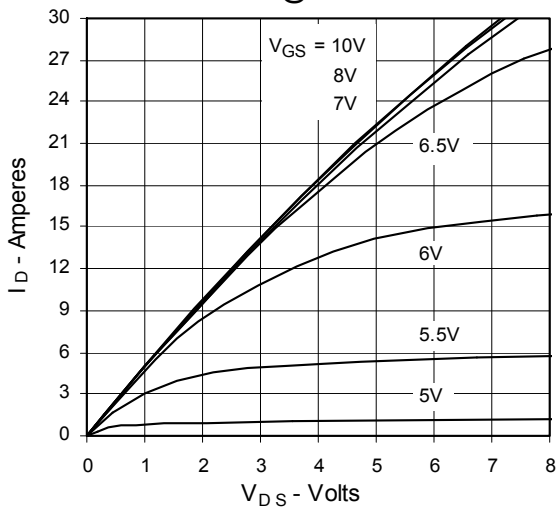
- <sup>1</sup> Fast Recovery diode
- <sup>1</sup> Unclamped Inductive Switching (UIS) rated
- <sup>1</sup> International standard packages
- <sup>1</sup> Low package inductance
- easy to drive and to protect

| Symbol       | Test Conditions<br>( $T_J = 25^\circ\text{C}$ , unless otherwise specified)                                      | Characteristic Values |      |                      |
|--------------|--|-----------------------|------|----------------------|
|              |  | Min.                  | Typ. | Max.                 |
| $BV_{DSS}$   | $V_{GS} = 0 \text{ V}$ , $I_D = 250 \mu\text{A}$   | 600                   |      | V                    |
| $V_{GS(th)}$ | $V_{DS} = V_{GS}$ , $I_D = 250 \mu\text{A}$  | 3.0                   |      | V                    |
| $I_{GSS}$    | $V_{GS} = \pm 30 \text{ V}$ , $V_{DS} = 0$   |                       |      | $\pm 100 \text{ nA}$ |
| $I_{DSS}$    | $V_{DS} = V_{DSS}$<br>$V_{GS} = 0 \text{ V}$ $T_J = 125^\circ\text{C}$   |                       |      | 25 $\mu\text{A}$     |
|              |  |                       |      | 250 $\mu\text{A}$    |
| $R_{DS(on)}$ | $V_{GS} = 10 \text{ V}$ , $I_D = 0.5 I_{D25}$<br>Pulse test, $t \leq 300 \mu\text{s}$ , duty cycle $d \leq 2 \%$ |                       |      | 240 $\text{m}\Omega$ |

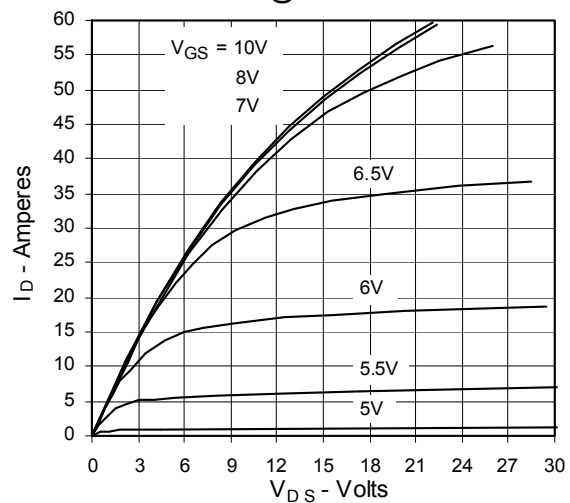
| Symbol                    | Test Conditions  | Characteristic Values                                |      |           |
|---------------------------|--|--|------|-----------|
|                           |  | (T <sub>J</sub> = 25° C, unless otherwise specified) |      |           |
|                           |  | Min.   | Typ. | Max.      |
| <b>g<sub>fs</sub></b>     | V <sub>DS</sub> = 20 V; I <sub>D</sub> = 0.5 I <sub>D25</sub> , pulse test                             | 22   | 25   | S         |
| <b>C<sub>iss</sub></b>    | V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 25 V, f = 1 MHz   |  | 5050 | pF        |
| <b>C<sub>oss</sub></b>    |  |  | 540  | pF        |
| <b>C<sub>rss</sub></b>    |  |  | 53   | pF        |
| <b>t<sub>d(on)</sub></b>  | V <sub>GS</sub> = 10 V, V <sub>DS</sub> = 0.5 I <sub>D25</sub><br>R <sub>G</sub> = 4 Ω (External)      |  | 29   | ns        |
| <b>t<sub>r</sub></b>      |  |  | 20   | ns        |
| <b>t<sub>d(off)</sub></b> |  |  | 80   | ns        |
| <b>t<sub>f</sub></b>      |  |  | 25   | ns        |
| <b>Q<sub>g(on)</sub></b>  | V <sub>GS</sub> = 10 V, V <sub>DS</sub> = 0.5 V <sub>DSS</sub> , I <sub>D</sub> = 0.5 I <sub>D25</sub> |  | 82   | nC        |
| <b>Q<sub>gs</sub></b>     |  |  | 28   | nC        |
| <b>Q<sub>gd</sub></b>     |  |  | 30   | nC        |
| <b>R<sub>thJC</sub></b>   |  |  |      | 0.23 °C/W |
| <b>R<sub>thCS</sub></b>   |  | 0.21   |      | °C/W      |

| Source-Drain Diode    |  | Characteristic Values                                |      |       |
|-----------------------|--|--|------|-------|
|                       |  | (T <sub>J</sub> = 25° C, unless otherwise specified) |      |       |
| Symbol                | Test Conditions  | Min.   | Typ. | Max.  |
| <b>I<sub>S</sub></b>  | V <sub>GS</sub> = 0 V  |  |      | 30 A  |
| <b>I<sub>SM</sub></b> | Repetitive   |  |      | 80 A  |
| <b>V<sub>SD</sub></b> | I <sub>F</sub> = I <sub>S</sub> , V <sub>GS</sub> = 0 V,<br>Pulse test, t ≤ 300 μs, duty cycle d ≤ 2 % |  |      | 1.5 V |
| <b>t<sub>rr</sub></b> | I <sub>F</sub> = 25A, -di/dt = 100 A/μs  |  | 500  | ns    |
| <b>Q<sub>RM</sub></b> | V <sub>R</sub> = 100V  |  | 4.0  | μC    |

**Fig. 1. Output Characteristics @ 25°C**



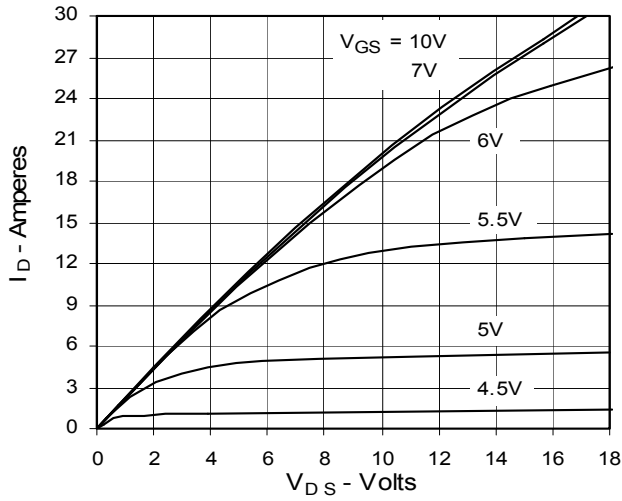
**Fig. 2. Extended Output Characteristics @ 25°C**



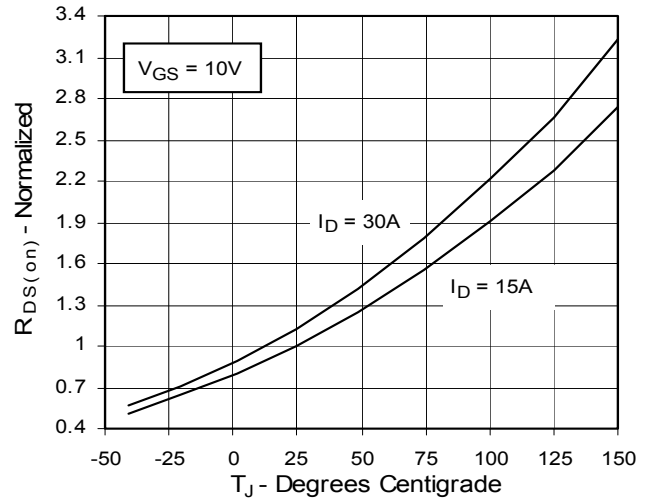
IXYS reserves the right to change limits, test conditions, and dimensions.

IXYS MOSFETs and IGBTs are covered by 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  
one or more of the following U.S. patents: 4,850,072 5,017,508 5,063,307 5,381,025 6,259,123 B1 6,534,343 6,710,405B2 6,759,692  
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

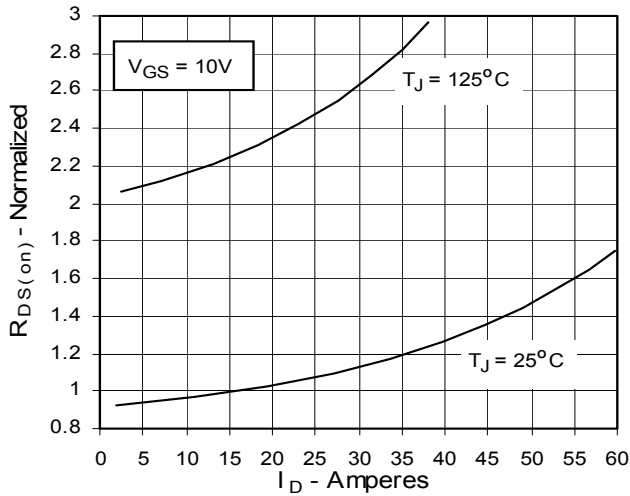
**Fig. 3. Output Characteristics @ 125°C**



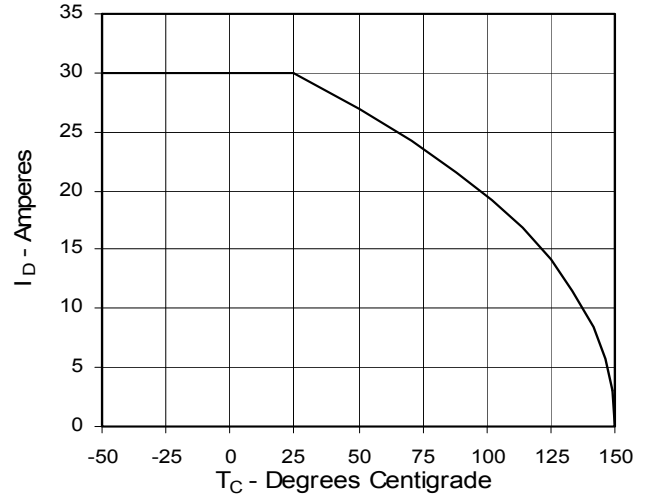
**Fig. 4.  $R_{DS(on)}$  Normalized to 0.5  $I_{D25}$  Value vs. Junction Temperature**



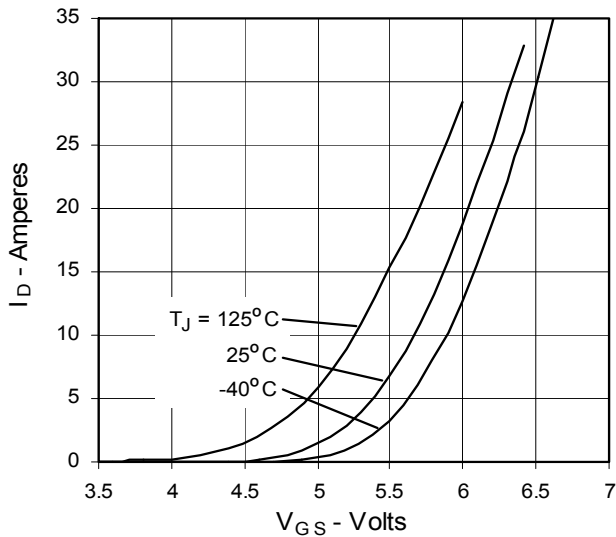
**Fig. 5.  $R_{DS(on)}$  Normalized to 0.5  $I_{D25}$  Value vs.  $I_D$**



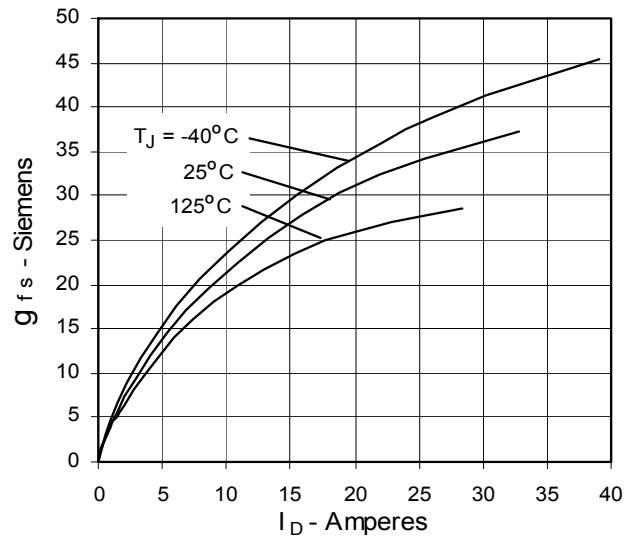
**Fig. 6. Drain Current vs. Case Temperature**



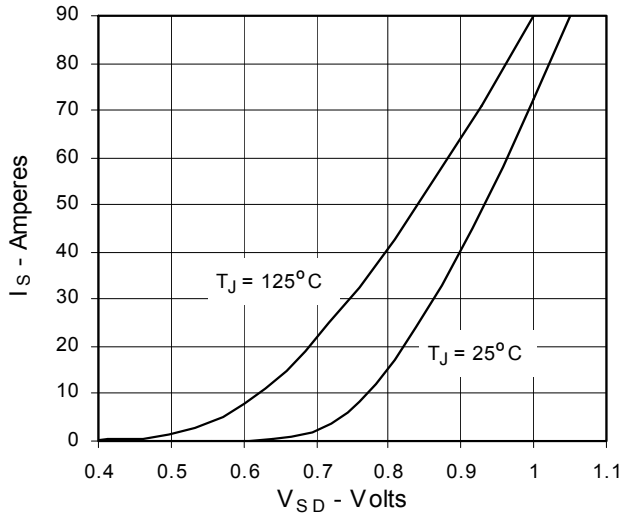
**Fig. 7. Input Admittance**



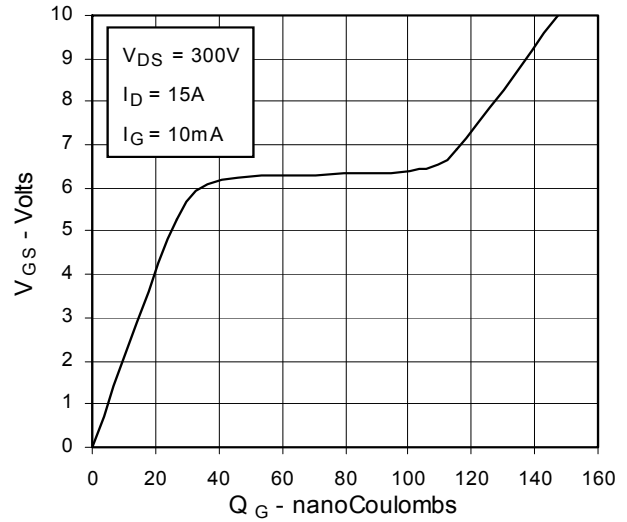
**Fig. 8. Transconductance**



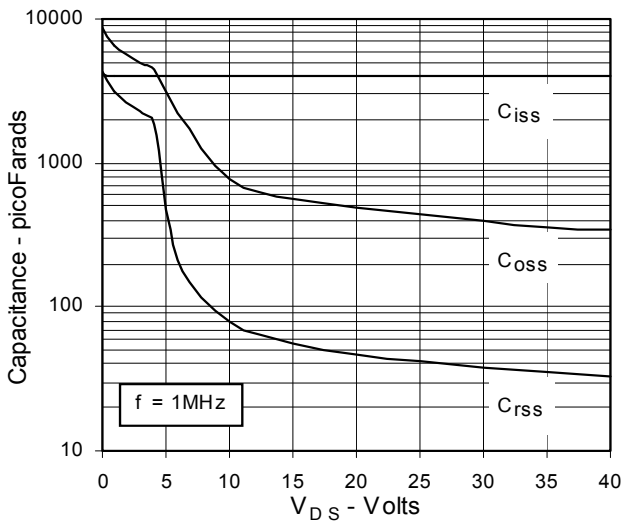
**Fig. 9. Source Current vs. Source-To-Drain Voltage**



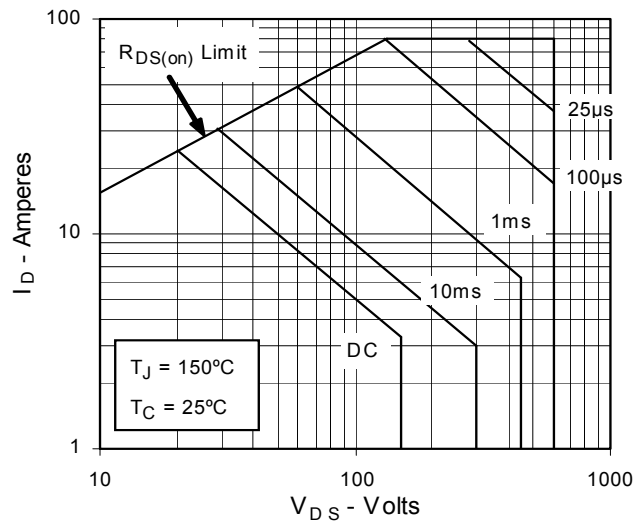
**Fig. 10. Gate Charge**



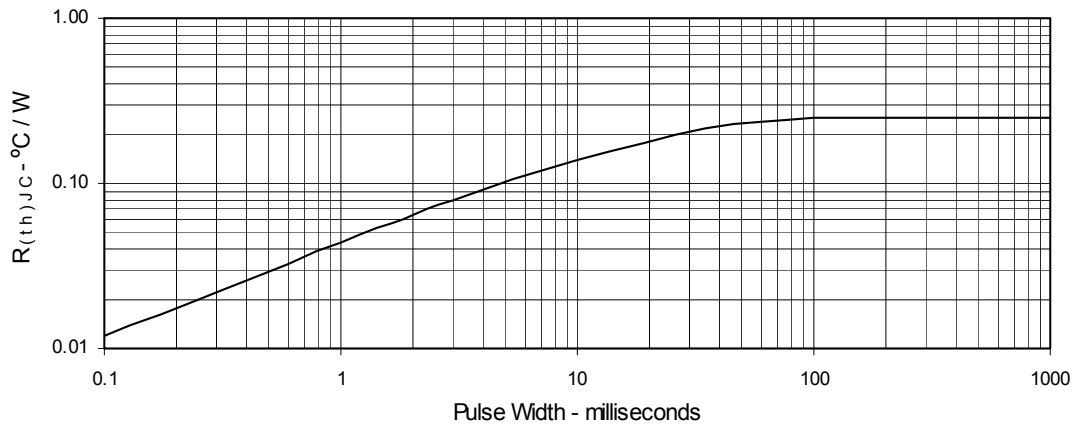
**Fig. 11. Capacitance**



**Fig. 12. Forward-Bias Safe Operating Area**

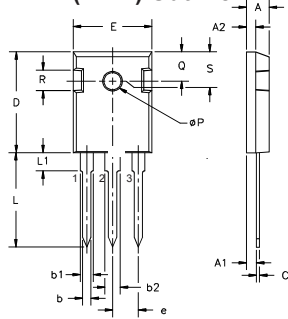


**Fig. 13. Maximum Transient Thermal Resistance**



Package Outline Drawings

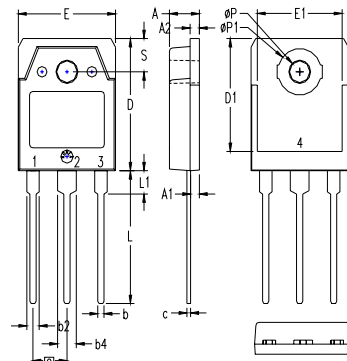
TO-247AD (IXTH) Outline



Terminals: 1 - Gate 2 - Drain  
3 - Source Tab - Drain

| Dim.           | Millimeter |       | Inches |       |
|----------------|------------|-------|--------|-------|
|                | Min.       | Max.  | Min.   | Max.  |
| A              | 4.7        | 5.3   | .185   | .209  |
| A <sub>1</sub> | 2.2        | 2.54  | .087   | .102  |
| A <sub>2</sub> | 2.2        | 2.6   | .059   | .098  |
| b              | 1.0        | 1.4   | .040   | .055  |
| b <sub>1</sub> | 1.65       | 2.13  | .065   | .084  |
| b <sub>2</sub> | 2.87       | 3.12  | .113   | .123  |
| C              | .4         | .8    | .016   | .031  |
| D              | 20.80      | 21.46 | .819   | .845  |
| E              | 15.75      | 16.26 | .610   | .640  |
| e              | 5.20       | 5.72  | 0.205  | 0.225 |
| L              | 19.81      | 20.32 | .780   | .800  |
| L <sub>1</sub> |            | 4.50  |        | .177  |
| ØP             | 3.55       | 3.65  | .140   | .144  |
| Q              | 5.89       | 6.40  | 0.232  | 0.252 |
| R              | 4.32       | 5.49  | .170   | .216  |
| S              | 6.15       | BSC   | 242    | BSC   |

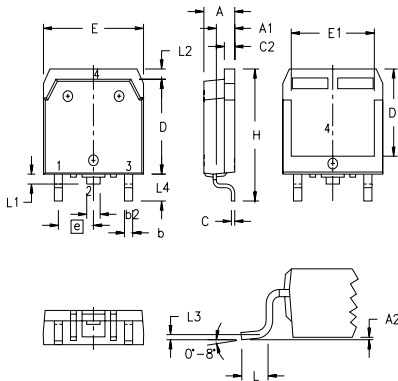
TO-3P (IXTQ) Outline



1 - GATE  
2 - DRAIN (COLLECTOR)  
3 - SOURCE (EMITTER)  
4 - DRAIN (COLLECTOR)

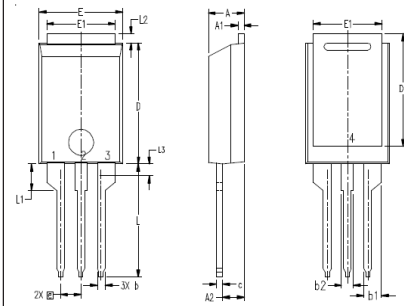
| SYM             | INCHES   |      | MILLIMETERS |       |
|-----------------|----------|------|-------------|-------|
|                 | MIN      | MAX  | MIN         | MAX   |
| A               | .185     | .193 | 4.70        | 4.90  |
| A <sub>1</sub>  | .051     | .059 | 1.30        | 1.50  |
| A <sub>2</sub>  | .057     | .065 | 1.45        | 1.65  |
| b               | .035     | .045 | 0.90        | 1.15  |
| b <sub>2</sub>  | .075     | .087 | 1.90        | 2.20  |
| b <sub>4</sub>  | .114     | .126 | 2.90        | 3.20  |
| c               | .022     | .031 | 0.55        | 0.80  |
| D               | .780     | .799 | 19.80       | 20.30 |
| D <sub>1</sub>  | .665     | .677 | 16.90       | 17.20 |
| E               | .610     | .622 | 15.50       | 15.80 |
| E <sub>1</sub>  | .531     | .539 | 13.50       | 13.70 |
| e               | .215 BSC |      | 5.45 BSC    |       |
| L               | .779     | .795 | 19.80       | 20.20 |
| L <sub>1</sub>  | .134     | .142 | 3.40        | 3.60  |
| ØP              | .126     | .134 | 3.20        | 3.40  |
| ØP <sub>1</sub> | .272     | .280 | 6.90        | 7.10  |
| S               | .193     | .201 | 4.90        | 5.10  |

TO-268 (IXTT) Outline



| SYM            | INCHES   |      | MILLIMETERS |       |
|----------------|----------|------|-------------|-------|
|                | MIN      | MAX  | MIN         | MAX   |
| A              | .193     | .201 | 4.90        | 5.10  |
| A <sub>1</sub> | .106     | .114 | 2.70        | 2.90  |
| A <sub>2</sub> | .001     | .010 | 0.02        | 0.25  |
| b              | .045     | .057 | 1.15        | 1.45  |
| b <sub>2</sub> | .075     | .083 | 1.90        | 2.10  |
| C              | .016     | .026 | 0.40        | 0.65  |
| C <sub>2</sub> | .057     | .063 | 1.45        | 1.60  |
| D              | .543     | .551 | 13.80       | 14.00 |
| D <sub>1</sub> | .488     | .500 | 12.40       | 12.70 |
| E              | .624     | .632 | 15.85       | 16.05 |
| E <sub>1</sub> | .524     | .535 | 13.30       | 13.60 |
| e              | .215 BSC |      | 5.45 BSC    |       |
| H              | .736     | .752 | 18.70       | 19.10 |
| L              | .094     | .106 | 2.40        | 2.70  |
| L <sub>1</sub> | .047     | .055 | 1.20        | 1.40  |
| L <sub>2</sub> | .039     | .045 | 1.00        | 1.15  |
| L <sub>3</sub> | .010 BSC |      | 0.25 BSC    |       |
| L <sub>4</sub> | .150     | .161 | 3.80        | 4.10  |

PLUS220 (IXTV) Outline

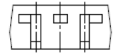
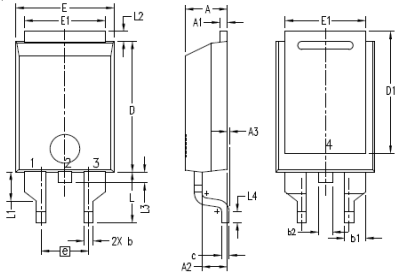


1. GATE  
2. DRAIN (COLLECTOR)  
3. SOURCE (EMITTER)  
4. DRAIN (COLLECTOR)

| SYM            | INCHES   |      | MILLIMETER |       |
|----------------|----------|------|------------|-------|
|                | MIN      | MAX  | MIN        | MAX   |
| A              | .169     | .185 | 4.30       | 4.70  |
| A <sub>1</sub> | .028     | .035 | 0.70       | 0.90  |
| A <sub>2</sub> | .098     | .118 | 2.50       | 3.00  |
| b              | .035     | .047 | 0.90       | 1.20  |
| b <sub>1</sub> | .080     | .095 | 2.03       | 2.41  |
| b <sub>2</sub> | .054     | .064 | 1.37       | 1.63  |
| c              | .028     | .035 | 0.70       | 0.90  |
| D              | .551     | .591 | 14.00      | 15.00 |
| D <sub>1</sub> | .512     | .539 | 13.00      | 13.70 |
| E              | .394     | .433 | 10.00      | 11.00 |
| E <sub>1</sub> | .331     | .346 | 8.40       | 8.80  |
| e              | .100 BSC |      | 2.54 BSC   |       |
| L              | .512     | .551 | 13.00      | 14.00 |
| L <sub>1</sub> | .118     | .138 | 3.00       | 3.50  |
| L <sub>2</sub> | .035     | .051 | 0.90       | 1.30  |
| L <sub>3</sub> | .047     | .059 | 1.20       | 1.50  |

Package Outline Drawings

PLUS220SMD (IXTV\_S) Outline



1. GATE
2. DRAIN (COLLECTOR)
3. SOURCE (EMITTER)
4. DRAIN (COLLECTOR)

| SYM | INCHES  |      | MILLIMETER |       |
|-----|---------|------|------------|-------|
|     | MIN     | MAX  | MIN        | MAX   |
| A   | .169    | .185 | 4.30       | 4.70  |
| A1  | .028    | .035 | 0.70       | 0.90  |
| A2  | .098    | .118 | 2.50       | 3.00  |
| A3  | .000    | .010 | 0.00       | 0.25  |
| b   | .035    | .047 | 0.90       | 1.20  |
| b1  | .080    | .095 | 2.03       | 2.41  |
| b2  | .054    | .064 | 1.37       | 1.63  |
| c   | .028    | .035 | 0.70       | 0.90  |
| D   | .551    | .591 | 14.00      | 15.00 |
| D1  | .512    | .539 | 13.00      | 13.70 |
| E   | .394    | .433 | 10.00      | 11.00 |
| E1  | .331    | .346 | 8.40       | 8.80  |
| e   | .200BSC |      | 5.08 BSC   |       |
| L   | .209    | .228 | 5.30       | 5.80  |
| L1  | .118    | .138 | 3.00       | 3.50  |
| L2  | .035    | .051 | 0.90       | 1.30  |
| L3  | .047    | .059 | 1.20       | 1.50  |
| L4  | .039    | .059 | 1.00       | 1.50  |