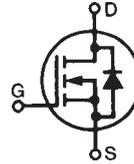


# PolarHV™ HiPerFET Power MOSFET

N-Channel Enhancement Mode  
Avalanche Rated  
Fast Intrinsic Diode

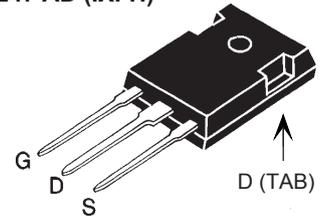
**IXFH 30N50P**  
**IXFT 30N50P**  
**IXFV 30N50P**  
**IXFV 30N50PS**

**V<sub>DSS</sub> = 500 V**  
**I<sub>D25</sub> = 30 A**  
**R<sub>DS(on)</sub> ≤ 200 mΩ**  
**t<sub>rr</sub> ≤ 200 ns**

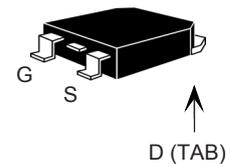


| Symbol            | Test Conditions                                                                                                                            | Maximum Ratings |          |
|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------|-----------------|----------|
|                   |                                                                                                                                            |                 |          |
| V <sub>DSS</sub>  | T <sub>J</sub> = 25° C to 150° C                                                                                                           | 500             | V        |
| V <sub>DGR</sub>  | T <sub>J</sub> = 25° C to 150° C; R <sub>GS</sub> = 1 MΩ                                                                                   | 500             | V        |
| V <sub>GSS</sub>  | Continuous                                                                                                                                 | ±30             | V        |
| V <sub>GSM</sub>  | Transient                                                                                                                                  | ±40             | V        |
| I <sub>D25</sub>  | T <sub>C</sub> = 25° C                                                                                                                     | 30              | A        |
| I <sub>DM</sub>   | T <sub>C</sub> = 25° C, pulse width limited by T <sub>JM</sub>                                                                             | 75              | A        |
| I <sub>AR</sub>   | T <sub>C</sub> = 25° C                                                                                                                     | 30              | A        |
| E <sub>AR</sub>   | T <sub>C</sub> = 25° C                                                                                                                     | 40              | mJ       |
| E <sub>AS</sub>   | T <sub>C</sub> = 25° C                                                                                                                     | 1.2             | J        |
| dv/dt             | I <sub>S</sub> ≤ I <sub>DM</sub> , di/dt ≤ 100 A/μs, V <sub>DD</sub> ≤ V <sub>DSS</sub> ,<br>T <sub>J</sub> ≤ 150° C, R <sub>G</sub> = 5 Ω | 10              | V/ns     |
| P <sub>D</sub>    | T <sub>C</sub> = 25° C                                                                                                                     | 460             | W        |
| T <sub>J</sub>    |                                                                                                                                            | -55 ... +150    | °C       |
| T <sub>JM</sub>   |                                                                                                                                            | 150             | °C       |
| T <sub>stg</sub>  |                                                                                                                                            | -55 ... +150    | °C       |
| T <sub>L</sub>    | 1.6 mm (0.062 in.) from case for 10 s                                                                                                      | 300             | °C       |
| T <sub>SOLD</sub> | Plastic body for 10 s                                                                                                                      | 260             | °C       |
| M <sub>d</sub>    | Mounting torque (TO-247, TO-3P)                                                                                                            | 1.13/10         | Nm/lb.in |
| F <sub>c</sub>    | Mounting force (PLUS220, PLUS220SMD)                                                                                                       | 11 65/2.5 15    | N/lb.    |
| Weight            | PLUS220, PLUS220SMD                                                                                                                        | 4               | g        |
|                   | TO-268                                                                                                                                     | 5               | g        |
|                   | TO-247                                                                                                                                     | 6               | g        |

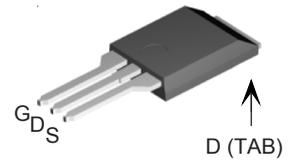
TO-247 AD (IXFH)



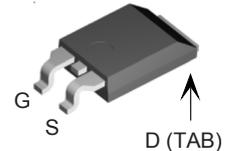
TO-268 (IXFT)



PLUS220 (IXFV)



PLUS220 SMD(IXFV..S)



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

| Symbol              | Test Conditions<br>(T <sub>J</sub> = 25° C, unless otherwise specified)                                     | Characteristic Values |      |                 |
|---------------------|-------------------------------------------------------------------------------------------------------------|-----------------------|------|-----------------|
|                     |                                                                                                             | Min.                  | Typ. | Max.            |
| BV <sub>DSS</sub>   | V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA                                                              | 500                   |      | V               |
| V <sub>GS(th)</sub> | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 4 mA                                                   | 3.0                   |      | 5.0 V           |
| I <sub>GSS</sub>    | V <sub>GS</sub> = ±30 V, V <sub>DS</sub> = 0 V                                                              |                       |      | ±100 nA         |
| I <sub>DSS</sub>    | V <sub>DS</sub> = V <sub>DSS</sub><br>V <sub>GS</sub> = 0 V      T <sub>J</sub> = 125° C                    |                       |      | 25 μA<br>750 μA |
| R <sub>DS(on)</sub> | V <sub>GS</sub> = 10 V, I <sub>D</sub> = 0.5 I <sub>D25</sub><br>Pulse test, t ≤ 300 μs, duty cycle d ≤ 2 % | 165                   | 200  | mΩ              |

### Features

- International standard packages
- Unclamped Inductive Switching (UIS) rated
- Low package inductance
  - easy to drive and to protect

### Advantages

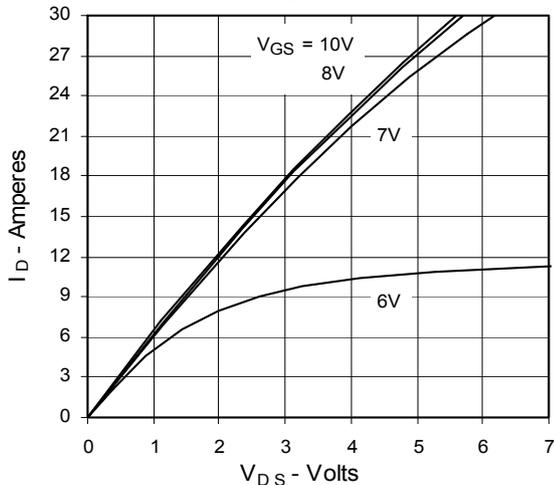
- Easy to mount
- Space savings
- High power density

| Symbol       | Test Conditions                                                                                 | Characteristic Values<br>( $T_J = 25^\circ\text{C}$ , unless otherwise specified) |      |           |
|--------------|-------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------|-----------|
|              |                                                                                                 | Min.                                                                              | Typ. | Max.      |
| $g_{fs}$     | $V_{DS} = 20\text{ V}; I_D = 0.5 I_{D25}$ , pulse test                                          | 17                                                                                | 27   | S         |
| $C_{iss}$    | $V_{GS} = 0\text{ V}, V_{DS} = 25\text{ V}, f = 1\text{ MHz}$                                   |                                                                                   | 4150 | pF        |
| $C_{oss}$    |                                                                                                 |                                                                                   | 445  | pF        |
| $C_{rss}$    |                                                                                                 |                                                                                   | 28   | pF        |
| $t_{d(on)}$  | $V_{GS} = 10\text{ V}, V_{DS} = 0.5 V_{DSS}, I_D = 0.5 I_{D25}$<br>$R_G = 5\ \Omega$ (External) |                                                                                   | 25   | ns        |
| $t_r$        |                                                                                                 |                                                                                   | 24   | ns        |
| $t_{d(off)}$ |                                                                                                 |                                                                                   | 82   | ns        |
| $t_f$        |                                                                                                 |                                                                                   | 24   | ns        |
| $Q_{g(on)}$  | $V_{GS} = 10\text{ V}, V_{DS} = 0.5 V_{DSS}, I_D = 0.5 I_{D25}$                                 |                                                                                   | 70   | nC        |
| $Q_{gs}$     |                                                                                                 |                                                                                   | 27   | nC        |
| $Q_{gd}$     |                                                                                                 |                                                                                   | 22   | nC        |
| $R_{thJC}$   |                                                                                                 |                                                                                   |      | 0.27° C/W |
| $R_{thCs}$   | (TO-247, PLUS220)                                                                               | 0.21                                                                              |      | ° C/W     |

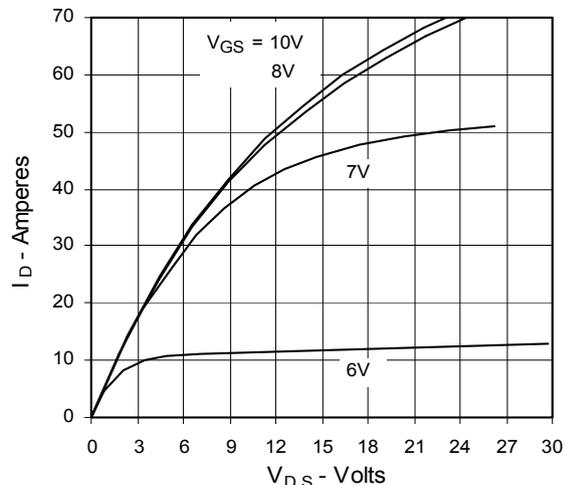
| Source-Drain Diode |                                                                                                       | Characteristic Values<br>( $T_J = 25^\circ\text{C}$ , unless otherwise specified) |      |               |
|--------------------|-------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------|---------------|
| Symbol             | Test Conditions                                                                                       | Min.                                                                              | Typ. | Max.          |
| $I_S$              | $V_{GS} = 0\text{ V}$                                                                                 |                                                                                   |      | 30 A          |
| $I_{SM}$           | Repetitive                                                                                            |                                                                                   |      | 90 A          |
| $V_{SD}$           | $I_F = I_S, V_{GS} = 0\text{ V}$ ,<br>Pulse test, $t \leq 300\ \mu\text{s}$ , duty cycle $d \leq 2\%$ |                                                                                   |      | 1.5 V         |
| $t_{rr}$           | $I_F = 25\text{ A}; -di/dt = 100\text{ A}/\mu\text{s}$                                                |                                                                                   |      | 200 ns        |
| $I_{RM}$           | $V_R = 100\text{ V}; V_{GS} = 0\text{ V}$                                                             |                                                                                   | 6    | A             |
| $Q_{RM}$           |                                                                                                       |                                                                                   | 0.6  | $\mu\text{C}$ |

### Characteristic Curves

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



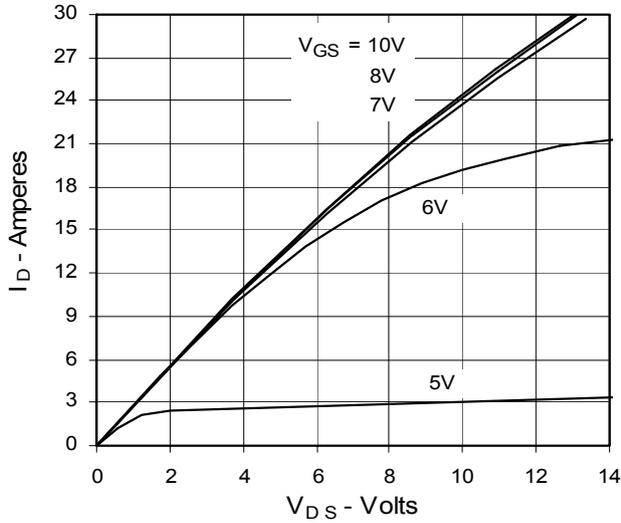
**Fig. 2. Extended Output Characteristics**  
**@ 25°C**



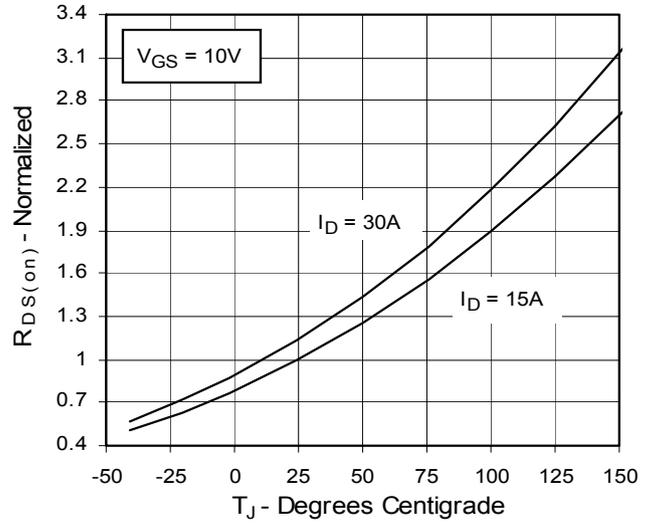
IXYS reserves the right to change limits, test conditions, and dimensions.

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 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

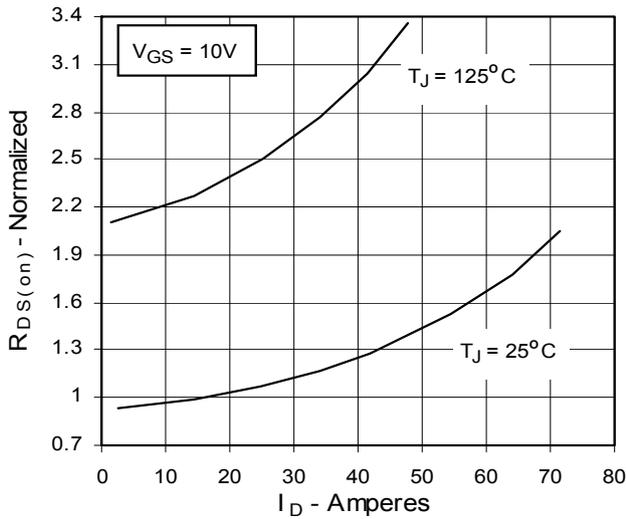
**Fig. 3. Output Characteristics  
@ 125°C**



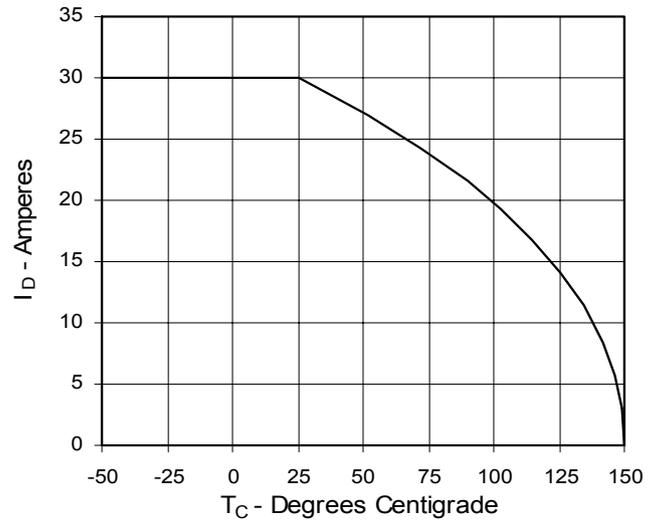
**Fig. 4.  $R_{DS(on)}$  Normalized to 0.5  $I_{D25}$   
Value vs. Junction Temperature**



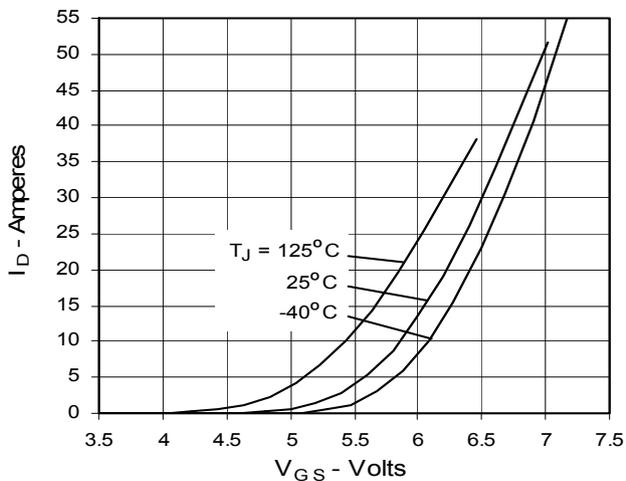
**Fig. 5.  $R_{DS(on)}$  Normalized to  
0.5  $I_{D25}$  Value vs.  $I_D$**



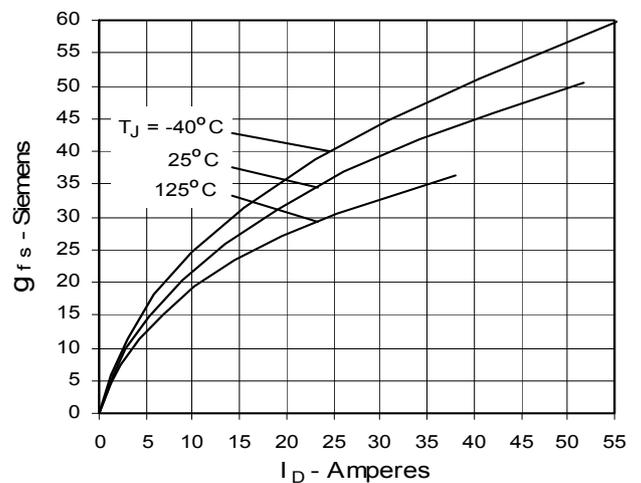
**Fig. 6. Drain Current vs. Case  
Temperature**



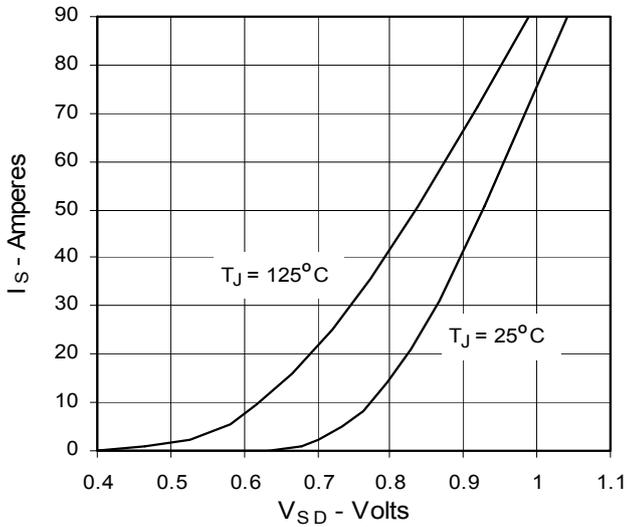
**Fig. 7. Input Admittance**



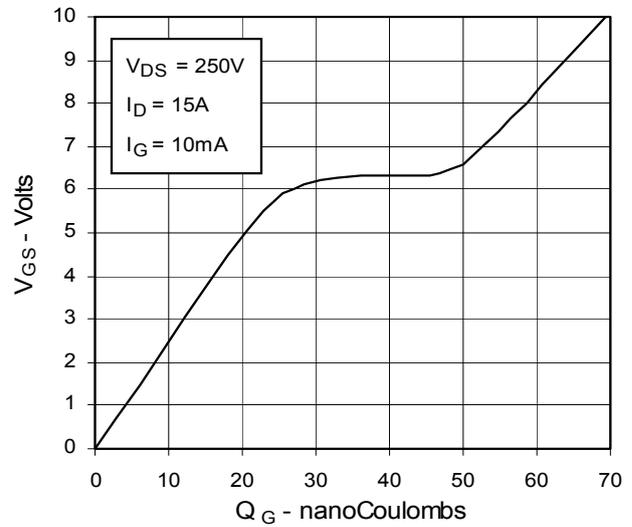
**Fig. 8. Transconductance**



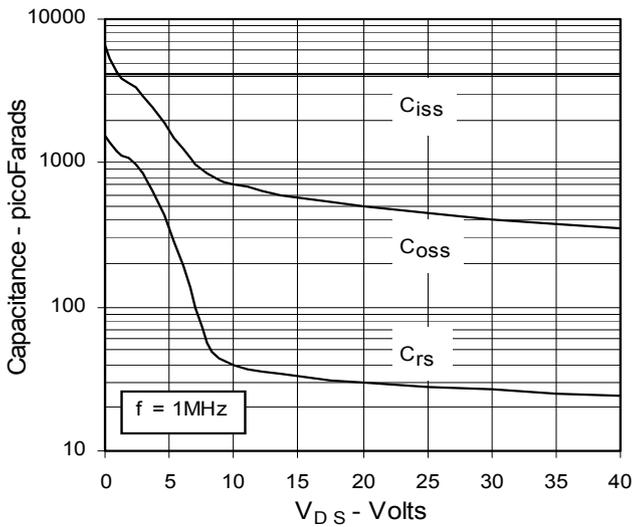
**Fig. 9. Source Current vs. Source-To-Drain Voltage**



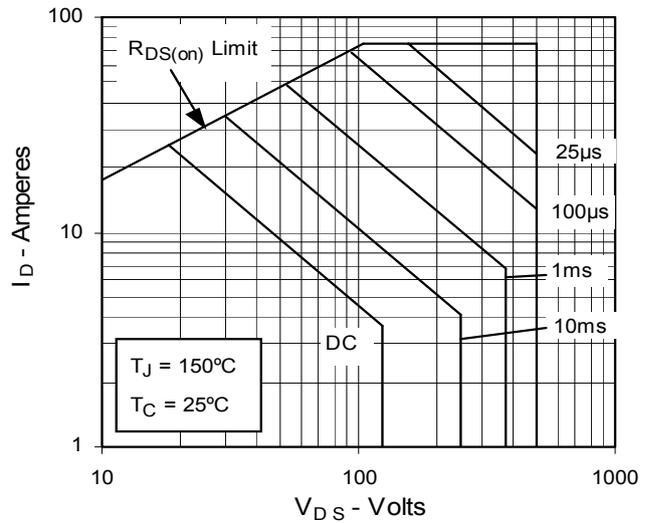
**Fig. 10. Gate Charge**



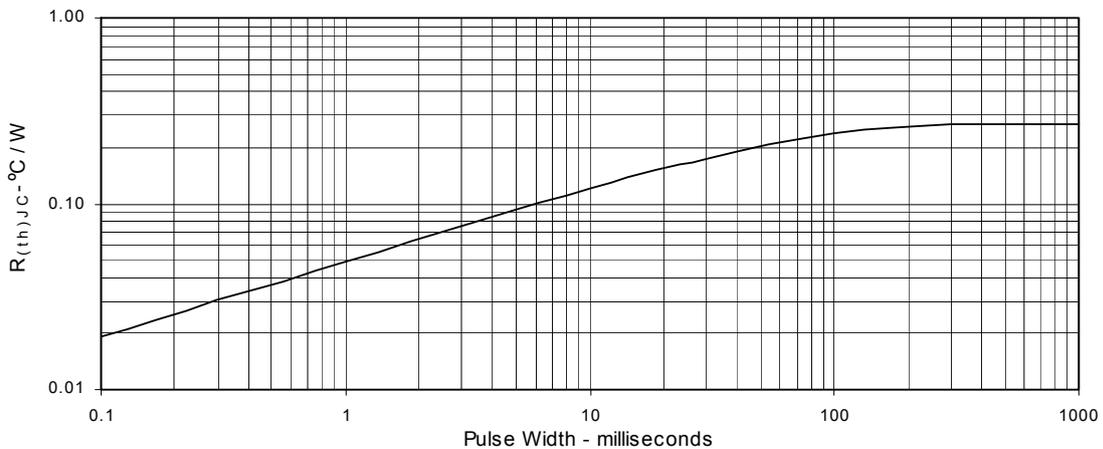
**Fig. 11. Capacitance**



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



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



### Package Outline Drawings

#### TO-247 (IXFH) 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  |
| ∅P             | 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-268 (IXFT) 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 (IXFV) Outline

- GATE
- DRAIN (COLLECTOR)
- SOURCE (EMITTER)
- 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  |

#### PLUS220SMD (IXFV\_S) Outline

- GATE
- DRAIN (COLLECTOR)
- SOURCE (EMITTER)
- 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  |
| A <sub>3</sub> | .000     | .010 | 0.00       | 0.25  |
| 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              | .200 BSC |      | 5.08 BSC   |       |
| L              | .209     | .228 | 5.30       | 5.80  |
| 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  |
| L <sub>4</sub> | .039     | .059 | 1.00       | 1.50  |



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