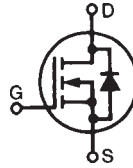


# X-Class HiPerFET™ Power MOSFET

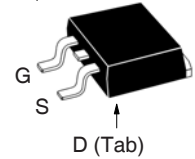
**IXFA18N60X**  
**IXFP18N60X**  
**IXFH18N60X**

$$\begin{aligned} V_{DSS} &= 600V \\ I_{D25} &= 18A \\ R_{DS(on)} &\leq 230m\Omega \end{aligned}$$

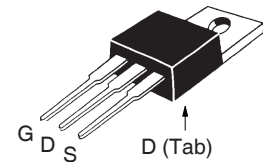
N-Channel Enhancement Mode  
Avalanche Rated  
Fast Intrinsic Diode



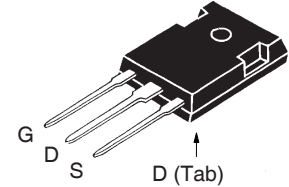
TO-263 AA (IXFA)



TO-220AB (IXFP)



TO-247 (IXFH)



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

| 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 $150^\circ\text{C}$ , $R_{GS} = 1M\Omega$    | 600                | V                |
| $V_{GSS}$  | Continuous                                                               | $\pm 30$           | V                |
| $V_{GSM}$  | Transient                                                                | $\pm 40$           | V                |
| $I_{D25}$  | $T_C = 25^\circ\text{C}$                                                 | 18                 | A                |
| $I_{DM}$   | $T_C = 25^\circ\text{C}$ , Pulse Width Limited by $T_{JM}$               | 36                 | A                |
| $I_A$      | $T_C = 25^\circ\text{C}$                                                 | 5                  | A                |
| $E_{AS}$   | $T_C = 25^\circ\text{C}$                                                 | 500                | mJ               |
| $dv/dt$    | $I_S \leq I_{DM}$ , $V_{DD} \leq V_{DSS}$ , $T_J \leq 150^\circ\text{C}$ | 50                 | V/ns             |
| $P_D$      | $T_C = 25^\circ\text{C}$                                                 | 320                | W                |
| $T_J$      |                                                                          | -55 ... +150       | $^\circ\text{C}$ |
| $T_{JM}$   |                                                                          | 150                | $^\circ\text{C}$ |
| $T_{stg}$  |                                                                          | -55 ... +150       | $^\circ\text{C}$ |
| $T_L$      | Maximum Lead Temperature for Soldering                                   | 300                | $^\circ\text{C}$ |
| $T_{SOLD}$ | 1.6 mm (0.062in.) from Case for 10s                                      | 260                | $^\circ\text{C}$ |
| $F_C$      | Mounting Force (TO-263)                                                  | 10..65 / 2.2..14.6 | N/lb             |
| $M_d$      | Mounting Torque (TO-247 & TO-220)                                        | 1.13 / 10          | Nm/lb.in         |
| Weight     | TO-263                                                                   | 2.5                | g                |
|            | TO-220                                                                   | 3.0                | g                |
|            | TO-247                                                                   | 6.0                | g                |

| Symbol       | Test Conditions<br>( $T_J = 25^\circ\text{C}$ , Unless Otherwise Specified) | Characteristic Values |      |                           |
|--------------|-----------------------------------------------------------------------------|-----------------------|------|---------------------------|
|              |                                                                             | Min.                  | Typ. | Max.                      |
| $BV_{DSS}$   | $V_{GS} = 0V$ , $I_D = 250\mu A$                                            | 600                   |      | V                         |
| $V_{GS(th)}$ | $V_{DS} = V_{GS}$ , $I_D = 1.5mA$                                           | 2.5                   |      | 4.5 V                     |
| $I_{GSS}$    | $V_{GS} = \pm 30V$ , $V_{DS} = 0V$                                          |                       |      | $\pm 100$ nA              |
| $I_{DSS}$    | $V_{DS} = V_{DSS}$ , $V_{GS} = 0V$<br>$T_J = 125^\circ\text{C}$             |                       |      | 10 $\mu A$<br>500 $\mu A$ |
| $R_{DS(on)}$ | $V_{GS} = 10V$ , $I_D = 0.5 \cdot I_{D25}$ , Note 1                         |                       |      | 230 m $\Omega$            |

## 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                                                                                                                                                           | Characteristic Values                                            |      |           |
|-----------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------|------|-----------|
| (T <sub>J</sub> = 25°C, Unless Otherwise Specified) |                                                                                                                                                                           | Min.                                                             | Typ. | Max       |
| g <sub>fs</sub>                                     | V <sub>DS</sub> = 10V, I <sub>D</sub> = 0.5 • I <sub>D25</sub> , Note 1                                                                                                   | 6                                                                | 10   | S         |
| R <sub>Gi</sub>                                     | Gate Input Resistance                                                                                                                                                     |                                                                  | 3.3  | Ω         |
| C <sub>iss</sub>                                    | V <sub>GS</sub> = 0V, V <sub>DS</sub> = 25V, f = 1MHz                                                                                                                     |                                                                  | 1440 | pF        |
| C <sub>oss</sub>                                    |                                                                                                                                                                           |                                                                  | 1110 | pF        |
| C <sub>rss</sub>                                    |                                                                                                                                                                           |                                                                  | 14   | pF        |
| Effective Output Capacitance                        |                                                                                                                                                                           |                                                                  |      |           |
| C <sub>o(er)</sub>                                  | Energy related                                                                                                                                                            | V <sub>GS</sub> = 0V<br>V <sub>DS</sub> = 0.8 • V <sub>DSS</sub> | 84   | pF        |
| C <sub>o(tr)</sub>                                  | Time related                                                                                                                                                              |                                                                  | 255  | pF        |
| t <sub>d(on)</sub>                                  | Resistive Switching Times<br>V <sub>GS</sub> = 10V, V <sub>DS</sub> = 0.5 • V <sub>DSS</sub> , I <sub>D</sub> = 0.5 • I <sub>D25</sub><br>R <sub>G</sub> = 10Ω (External) |                                                                  | 20   | ns        |
| t <sub>r</sub>                                      |                                                                                                                                                                           |                                                                  | 30   | ns        |
| t <sub>d(off)</sub>                                 |                                                                                                                                                                           |                                                                  | 63   | ns        |
| t <sub>f</sub>                                      |                                                                                                                                                                           |                                                                  | 24   | ns        |
| Q <sub>g(on)</sub>                                  | V <sub>GS</sub> = 10V, V <sub>DS</sub> = 0.5 • V <sub>DSS</sub> , I <sub>D</sub> = 0.5 • I <sub>D25</sub>                                                                 |                                                                  | 35   | nC        |
| Q <sub>gs</sub>                                     |                                                                                                                                                                           |                                                                  | 8    | nC        |
| Q <sub>gd</sub>                                     |                                                                                                                                                                           |                                                                  | 18   | nC        |
| R <sub>thJC</sub>                                   |                                                                                                                                                                           |                                                                  |      | 0.39 °C/W |
| R <sub>thCS</sub>                                   | TO-220                                                                                                                                                                    |                                                                  | 0.50 | °C/W      |
|                                                     | TO-247                                                                                                                                                                    |                                                                  | 0.21 | °C/W      |

#### Source-Drain Diode

| Symbol   | Test Conditions<br>( $T_J = 25^{\circ}\text{C}$ , Unless Otherwise Specified) | Characteristic Values |      |       |
|----------|-------------------------------------------------------------------------------|-----------------------|------|-------|
|          |                                                                               | Min.                  | Typ. | Max   |
| $I_S$    | $V_{GS} = 0\text{V}$                                                          |                       |      | 18 A  |
| $I_{SM}$ | Repetitive, pulse Width Limited by $T_{JM}$                                   |                       |      | 72 A  |
| $V_{SD}$ | $I_F = I_S$ , $V_{GS} = 0\text{V}$ , Note 1                                   |                       |      | 1.4 V |
| $t_{rr}$ | $I_F = 9\text{A}$ , $-di/dt = 100\text{A}/\mu\text{s}$<br>$V_R = 100\text{V}$ |                       | 127  | ns    |
| $Q_{RM}$ |                                                                               |                       | 705  | nC    |
| $I_{RM}$ |                                                                               |                       | 11   | A     |

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

#### PRELIMINARY TECHNICAL INFORMATION

The product presented herein is under development. The Technical Specifications offered are derived from a subjective evaluation of the design, based upon prior knowledge and experience, and constitute a "considered reflection" of the anticipated result. IXYS reserves the right to change limits, test conditions, and dimensions without notice.

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   | 6,404,065B1 | 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 @  $T_J = 25^\circ\text{C}$

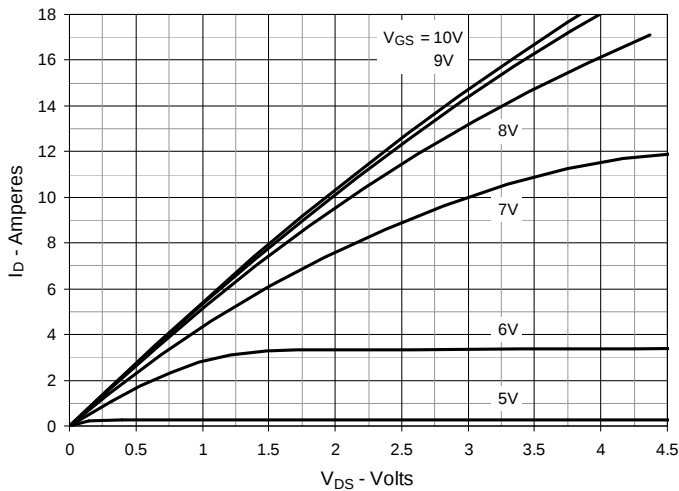


Fig. 2. Extended Output Characteristics @  $T_J = 25^\circ\text{C}$

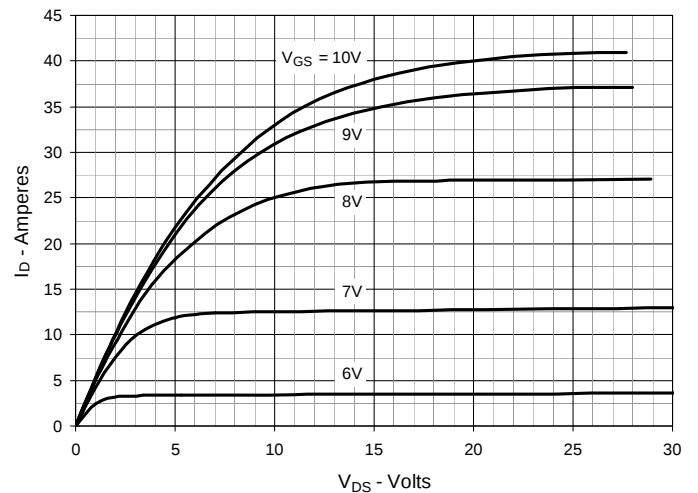


Fig. 3. Output Characteristics @  $T_J = 125^\circ\text{C}$

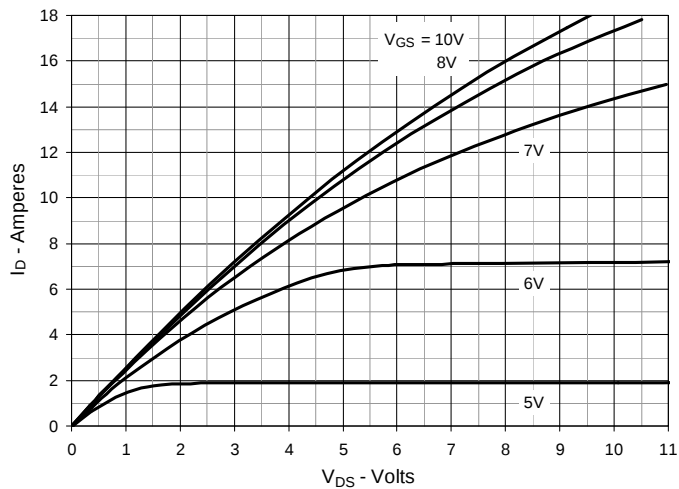


Fig. 4.  $R_{DS(on)}$  Normalized to  $I_D = 9\text{A}$  Value vs. Junction Temperature

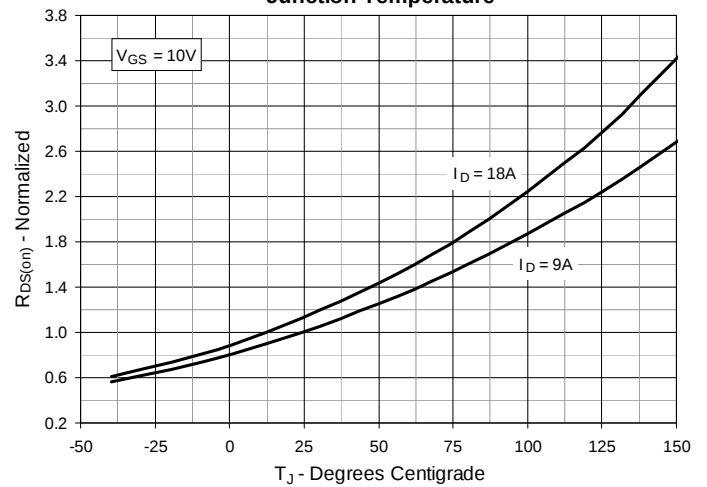


Fig. 5.  $R_{DS(on)}$  Normalized to  $I_D = 9\text{A}$  Value vs. Drain Current

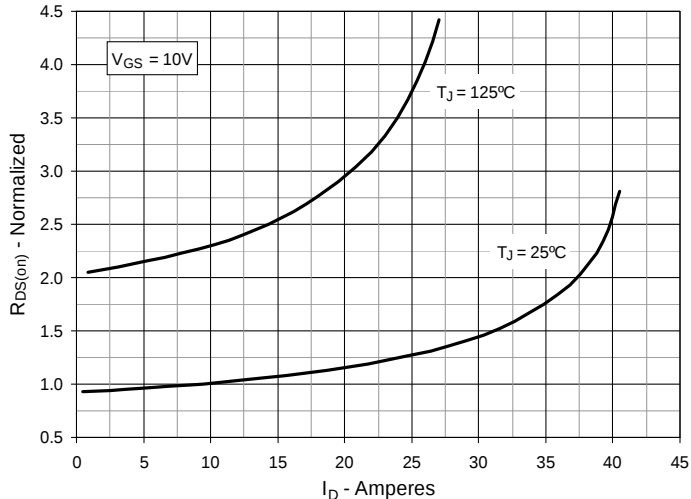
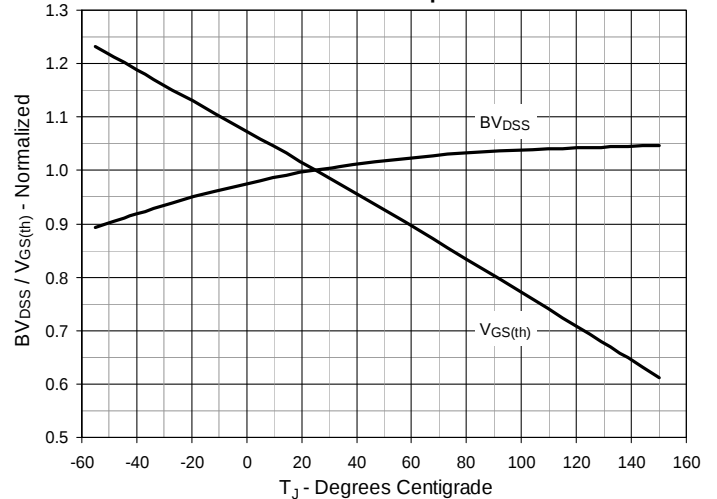
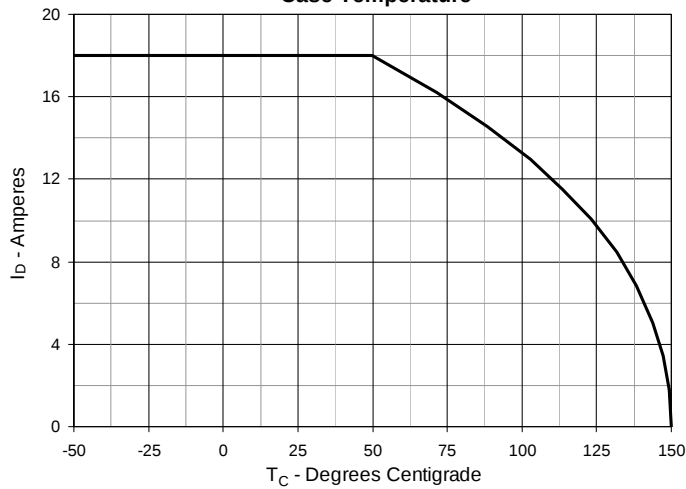


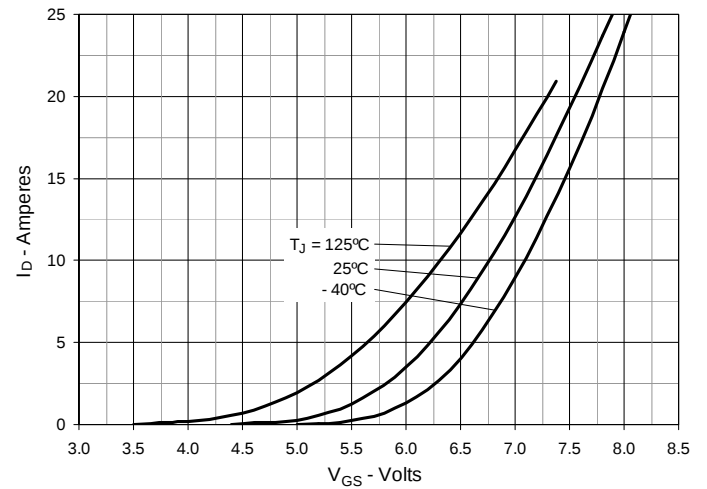
Fig. 6. Normalized Breakdown & Threshold Voltages vs. Junction Temperature



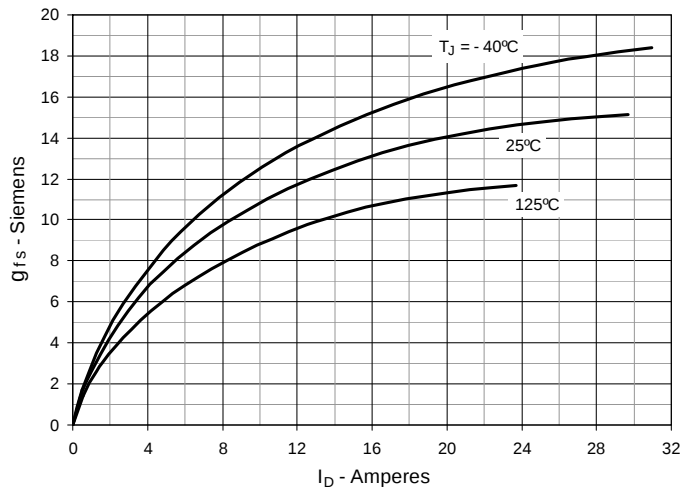
**Fig. 7. Maximum Drain Current vs.  
Case Temperature**



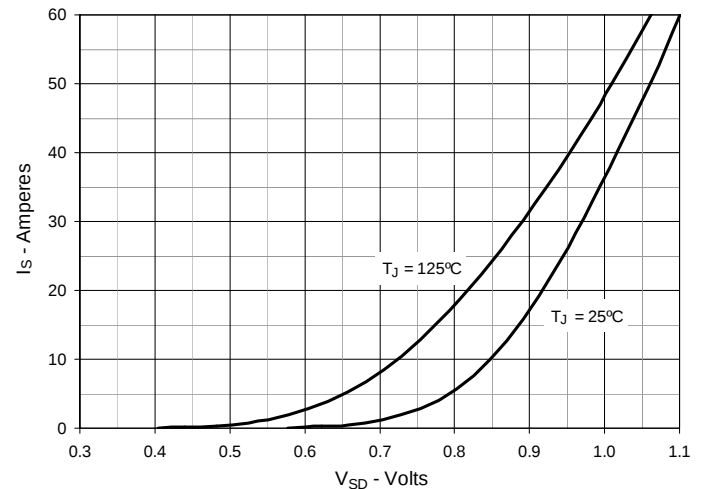
**Fig. 8. Input Admittance**



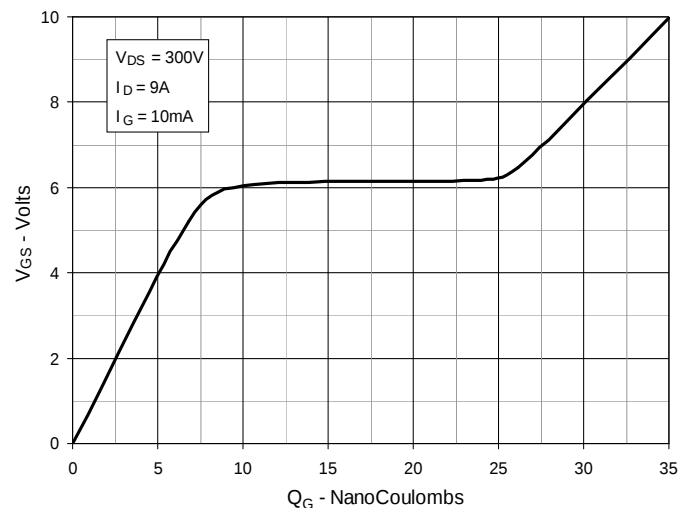
**Fig. 9. Transconductance**



**Fig. 10. Forward Voltage Drop of Intrinsic Diode**



**Fig. 11. Gate Charge**



**Fig. 12. Capacitance**

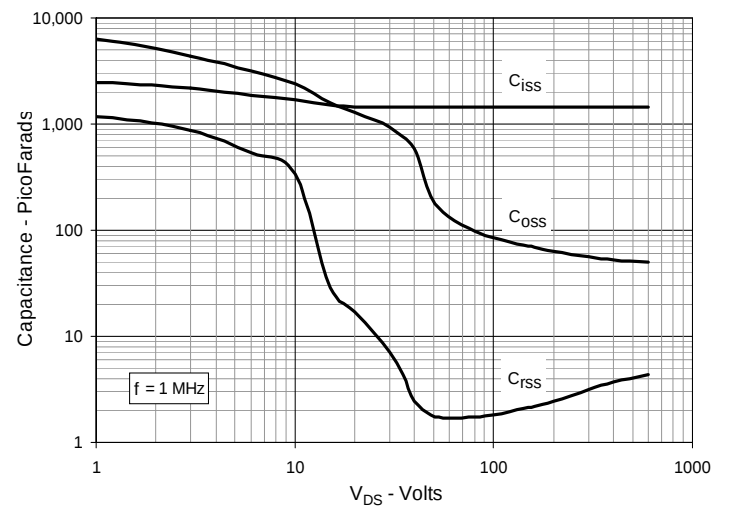


Fig. 13. Output Capacitance Stored Energy

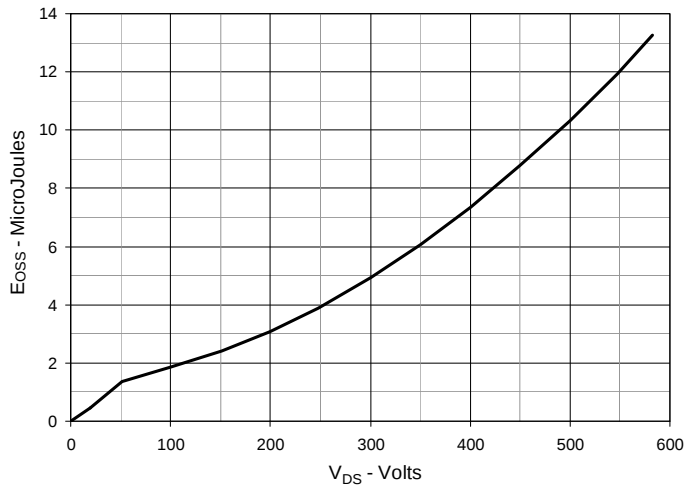


Fig. 14. Forward-Bias Safe Operating Area

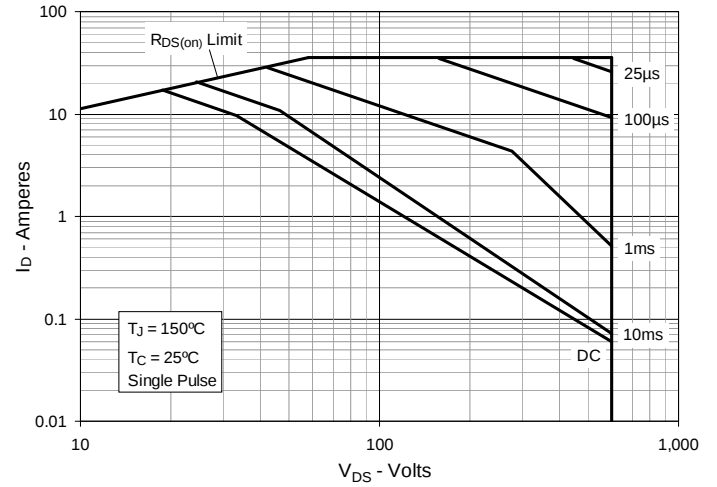
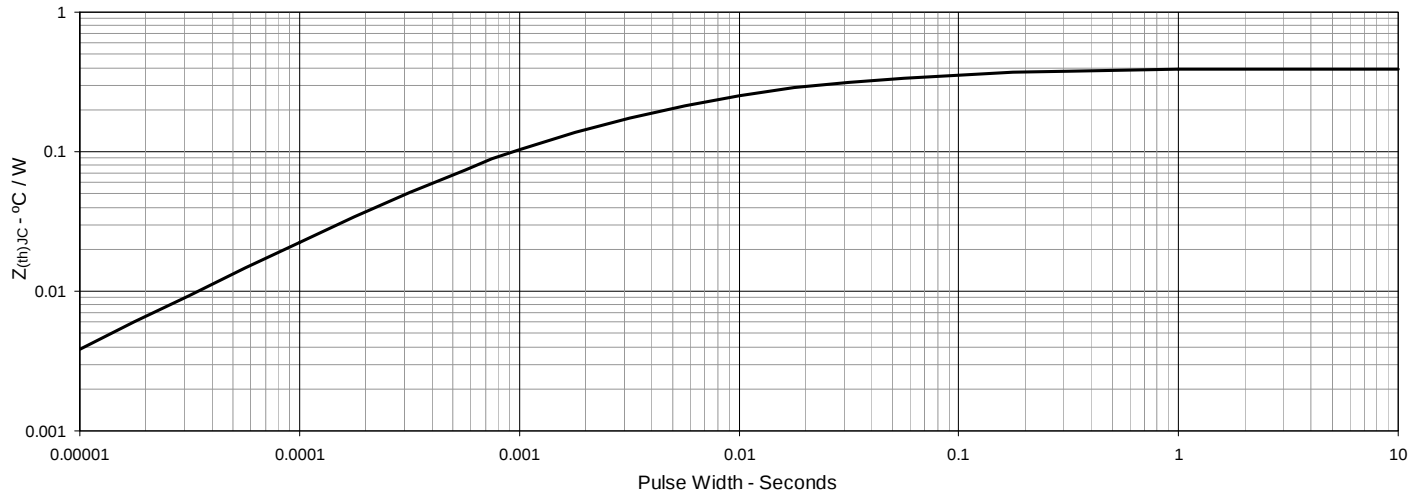
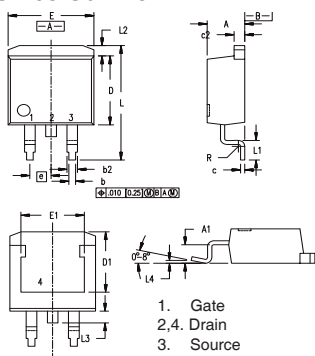


Fig. 15. Maximum Transient Thermal Impedance

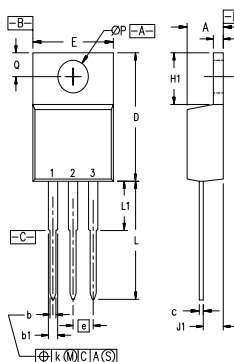


## TO-263 Outline



| Dim. | Millimeter |       | Inches |      |
|------|------------|-------|--------|------|
|      | Min.       | Max.  | Min.   | Max. |
| A    | 4.06       | 4.83  | .160   | .190 |
| b    | 0.51       | 0.99  | .020   | .039 |
| b2   | 1.14       | 1.40  | .045   | .055 |
| c    | 0.40       | 0.74  | .016   | .029 |
| c2   | 1.14       | 1.40  | .045   | .055 |
| D    | 8.64       | 9.65  | .340   | .380 |
| D1   | 8.00       | 8.89  | .280   | .320 |
| E    | 9.65       | 10.41 | .380   | .405 |
| E1   | 6.22       | 8.13  | .270   | .320 |
| e    | 2.54       | BSC   | .100   | BSC  |
| L    | 14.61      | 15.88 | .575   | .625 |
| L1   | 2.29       | 2.79  | .090   | .110 |
| L2   | 1.02       | 1.40  | .040   | .055 |
| L3   | 1.27       | 1.78  | .050   | .070 |
| L4   | 0          | 0.13  | 0      | .005 |

## TO-220 Outline

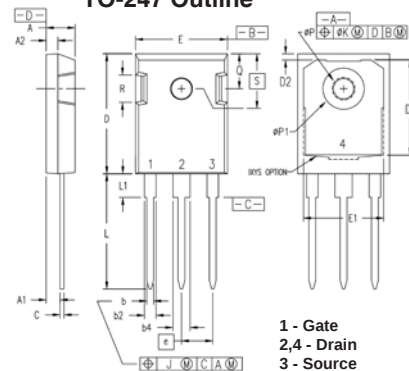


Pins:

- 1 - Gate  
2 - Drain  
3 - Source

| SYM | INCHES   |      | MILLIMETERS |       |
|-----|----------|------|-------------|-------|
|     | MIN      | MAX  | MIN         | MAX   |
| A   | .170     | .190 | 4.32        | 4.83  |
| b   | .025     | .040 | 0.64        | 1.02  |
| b1  | .045     | .065 | 1.15        | 1.65  |
| c   | .014     | .022 | 0.35        | 0.56  |
| D   | .580     | .630 | 14.73       | 16.00 |
| E   | .390     | .420 | 9.91        | 10.66 |
| e   | .100 BSC |      | 2.54 BSC    |       |
| F   | .045     | .055 | 1.14        | 1.40  |
| H1  | .230     | .270 | 5.85        | 6.85  |
| J1  | .090     | .110 | 2.29        | 2.79  |
| k   | 0        | .015 | 0           | 0.38  |
| L   | .500     | .550 | 12.70       | 13.97 |
| L1  | .110     | .230 | 2.79        | 5.84  |
| ØP  | .139     | .161 | 3.53        | 4.08  |
| Ø   | .100     | .125 | 2.54        | 3.18  |

## 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 |
| Ø P  | 3.55       | 3.65  | 0.140     | 0.144 |
| Ø P1 | -          | 7.39  | -         | 0.290 |
| Q    | 5.38       | 6.19  | 0.212     | 0.244 |
| S    | 6.14 BSC   |       | 0.242 BSC |       |



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