

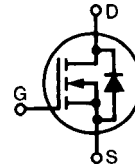
# HiPerFET™ Power MOSFETs Q-Class

IXFH 20N60Q  
IXFT 20N60Q

$V_{DSS} = 600 \text{ V}$   
 $I_{D25} = 20 \text{ A}$   
 $R_{DS(on)} = 0.35 \Omega$

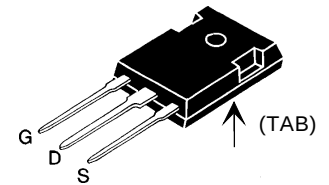
$t_{rr} \leq 250 \text{ ns}$

N-Channel Enhancement Mode  
Avalanche Rated, High  $dv/dt$ ,  
Low Gate Charge and Capacitances

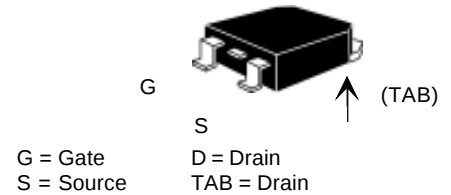


| Symbol    | Test Conditions                                                                                                                         | Maximum Ratings |                  |
|-----------|-----------------------------------------------------------------------------------------------------------------------------------------|-----------------|------------------|
| $V_{DSS}$ | $T_J = 25^\circ\text{C}$ 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                |
| $V_{GS}$  | Continuous                                                                                                                              | $\pm 30$        | V                |
| $V_{GSM}$ | Transient                                                                                                                               | $\pm 40$        | V                |
| $I_{D25}$ | $T_C = 25^\circ\text{C}$                                                                                                                | 20              | A                |
| $I_{DM}$  | $T_C = 25^\circ\text{C}$ , pulse width limited by $T_{JM}$                                                                              | 80              | A                |
| $I_{AR}$  | $T_C = 25^\circ\text{C}$                                                                                                                | 20              | A                |
| $E_{AR}$  | $T_C = 25^\circ\text{C}$                                                                                                                | 30              | 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>$T_J \leq 150^\circ\text{C}$ , $R_G = 2 \Omega$ | 15              | V/ns             |
| $P_D$     | $T_C = 25^\circ\text{C}$                                                                                                                | 300             | 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             | $^\circ\text{C}$ |
| $M_d$     | Mounting torque                                                                                                                         | 1.13/10         | Nm/lb.in.        |
| Weight    | TO-247 AD                                                                                                                               | 6               | g                |
|           | TO-268                                                                                                                                  | 4               | g                |

TO-247 AD (IXFH)



TO-268 (IXFT) Case Style



## Features

- IXYS advanced low gate charge process
- International standard packages
- Low gate charge and capacitance
  - easier to drive
  - faster switching
- Low  $R_{DS(on)}$
- Unclamped Inductive Switching (UIS) rated
- Molding epoxies meet UL 94 V-0 flammability classification

## Advantages

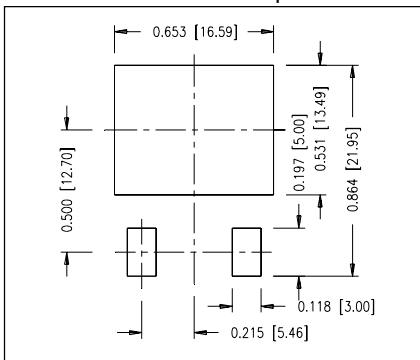
- Easy to mount
- Space savings
- High power density

| Symbol       | Test Conditions<br>( $T_J = 25^\circ\text{C}$ , unless otherwise specified)                                      | Characteristic Values |      |                      |
|--------------|------------------------------------------------------------------------------------------------------------------|-----------------------|------|----------------------|
|              |                                                                                                                  | Min.                  | Typ. | Max.                 |
| $V_{DSS}$    | $V_{GS} = 0 \text{ V}$ , $I_D = 250 \mu\text{A}$                                                                 | 600                   |      | V                    |
| $V_{GS(th)}$ | $V_{DS} = V_{GS}$ , $I_D = 4 \text{ mA}$                                                                         | 2.0                   |      | 4.5 V                |
| $I_{GSS}$    | $V_{GS} = \pm 30 \text{ V}_{DC}$ , $V_{DS} = 0$                                                                  |                       |      | $\pm 100 \text{ nA}$ |
| $I_{DSS}$    | $V_{DS} = V_{DSS}$ , $T_J = 25^\circ\text{C}$                                                                    |                       |      | 25 $\mu\text{A}$     |
|              | $V_{GS} = 0 \text{ V}$ , $T_J = 125^\circ\text{C}$                                                               |                       |      | 1 mA                 |
| $R_{DS(on)}$ | $V_{GS} = 10 \text{ V}$ , $I_D = 0.5 I_{D25}$<br>Pulse test, $t \leq 300 \mu\text{s}$ , duty cycle $d \leq 2 \%$ |                       |      | 0.35 $\Omega$        |

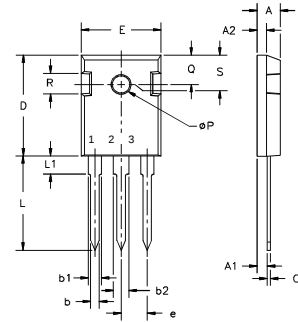
| Symbol                    | Test Conditions                                                                                                                             | Characteristic Values<br>(T <sub>j</sub> = 25°C, unless otherwise specified) |      |          |
|---------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------|------|----------|
|                           |                                                                                                                                             | Min.                                                                         | Typ. | Max.     |
| <b>g<sub>fs</sub></b>     | V <sub>DS</sub> = 10 V; I <sub>D</sub> = 0.5 I <sub>D25</sub> , pulse test                                                                  | 10                                                                           | 20   | S        |
| <b>C<sub>iss</sub></b>    | V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 25 V, f = 1 MHz                                                                                    |                                                                              | 3300 | pF       |
| <b>C<sub>oss</sub></b>    |                                                                                                                                             |                                                                              | 410  | pF       |
| <b>C<sub>rss</sub></b>    |                                                                                                                                             |                                                                              | 130  | pF       |
| <b>t<sub>d(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><br>R <sub>G</sub> = 1.5 Ω (External) |                                                                              | 20   | ns       |
| <b>t<sub>r</sub></b>      |                                                                                                                                             |                                                                              | 20   | ns       |
| <b>t<sub>d(off)</sub></b> |                                                                                                                                             |                                                                              | 45   | ns       |
| <b>t<sub>f</sub></b>      |                                                                                                                                             |                                                                              | 20   | 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>                                      |                                                                              | 90   | nC       |
| <b>Q<sub>gs</sub></b>     |                                                                                                                                             |                                                                              | 20   | nC       |
| <b>Q<sub>gd</sub></b>     |                                                                                                                                             |                                                                              | 45   | nC       |
| <b>R<sub>thJC</sub></b>   | (TO-247)                                                                                                                                    |                                                                              | 0.25 | 0.42 K/W |
| <b>R<sub>thCK</sub></b>   |                                                                                                                                             |                                                                              |      | K/W      |

| Source-Drain Diode    |                                                                                                        | Characteristic Values<br>(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                                                                                  |                                                                              |      | 20 A   |
| <b>I<sub>SM</sub></b> | Repetitive; pulse width limited by T <sub>JM</sub>                                                     |                                                                              |      | 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> = I <sub>S</sub> , -di/dt = 100 A/μs, V <sub>R</sub> = 100 V                            | 0.85                                                                         | 8    | 250 ns |
| <b>Q<sub>RM</sub></b> |                                                                                                        |                                                                              |      | μC     |
| <b>I<sub>RM</sub></b> |                                                                                                        |                                                                              |      | A      |

#### Min Recommended Footprint



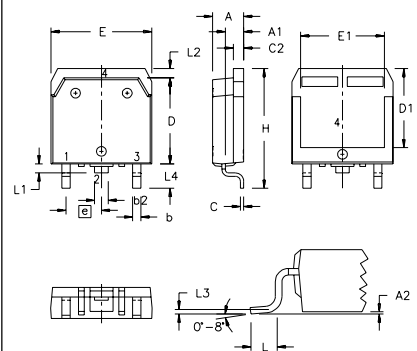
#### TO-247 AD Outline



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

| Dim.           | Millimeter | Inches  |
|----------------|------------|---------|
|                | Min.       | Max.    |
| A              | 4.7        | 5.3     |
| A <sub>1</sub> | 2.2        | 2.54    |
| A <sub>2</sub> | 2.2        | 2.6     |
| b              | 1.0        | 1.4     |
| b <sub>1</sub> | 1.65       | 2.13    |
| b <sub>2</sub> | 2.87       | 3.12    |
| C              | .4         | .8      |
| D              | 20.80      | 21.46   |
| E              | 15.75      | 16.26   |
| e              | 5.20       | 5.72    |
| L              | 19.81      | 20.32   |
| L1             |            | 4.50    |
| ØP             | 3.55       | 3.65    |
| Q              | 5.89       | 6.40    |
| R              | 4.32       | 5.49    |
| S              | 6.15 BSC   | 242 BSC |

#### TO-268 Outline



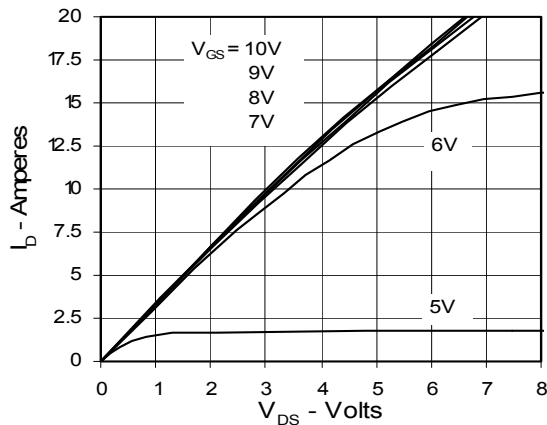
| SYM | INCHES   |      | MILLIMETERS |       |
|-----|----------|------|-------------|-------|
|     | MIN      | MAX  | MIN         | MAX   |
| A   | .193     | .201 | 4.90        | 5.10  |
| A1  | .106     | .114 | 2.70        | 2.90  |
| A2  | .001     | .010 | 0.02        | 0.25  |
| b   | .045     | .057 | 1.15        | 1.45  |
| b2  | .075     | .083 | 1.90        | 2.10  |
| C   | .016     | .026 | 0.40        | 0.65  |
| C2  | .057     | .063 | 1.45        | 1.60  |
| D   | .543     | .551 | 13.80       | 14.00 |
| D1  | .488     | .500 | 12.40       | 12.70 |
| E   | .624     | .632 | 15.85       | 16.05 |
| E1  | .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  |
| L1  | .047     | .055 | 1.20        | 1.40  |
| L2  | .039     | .045 | 1.00        | 1.15  |
| L3  | .010 BSC |      | 0.25 BSC    |       |
| L4  | .150     | .161 | 3.80        | 4.10  |

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

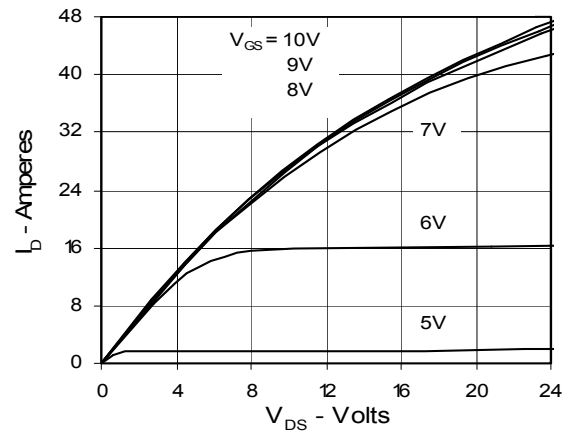
IXYS MOSFETs and IGBTs are covered by one or more of the following U.S. patents:

4,835,592 4,881,106 5,017,508 5,049,961 5,187,117 5,486,715 6,306,728B1 6,259,123B1 6,306,728B1  
4,850,072 4,931,844 5,034,796 5,063,307 5,237,481 5,381,025 6,404,065B1 6,162,665 6,534,343

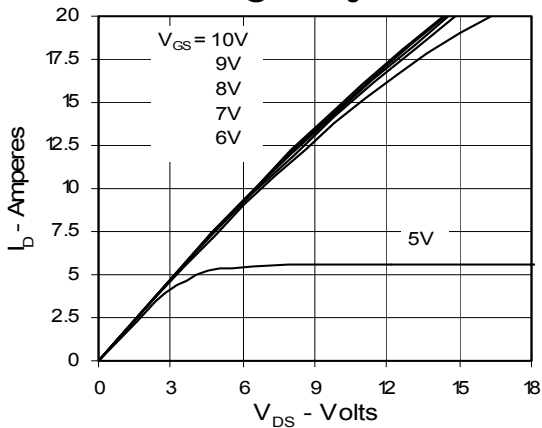
**Fig. 1. Output Characteristics**  
**@ 25 Deg. C**



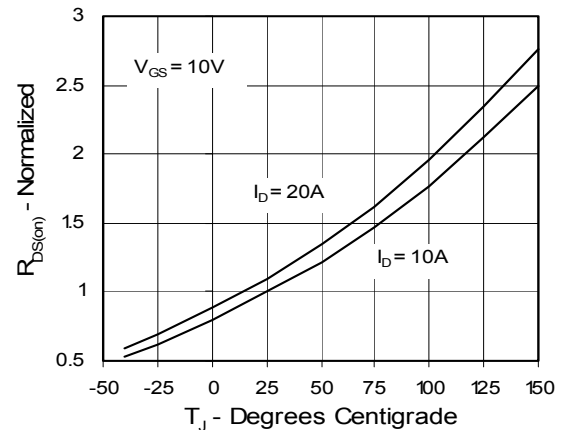
**Fig. 2. Extended Output Characteristics**  
**@ 25 deg. C**



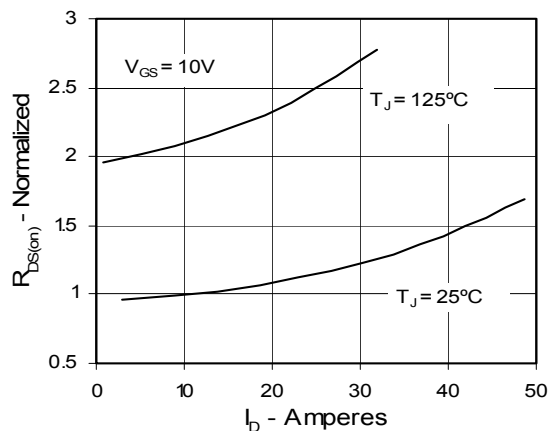
**Fig. 3. Output Characteristics**  
**@ 125 Deg. C**



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



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



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

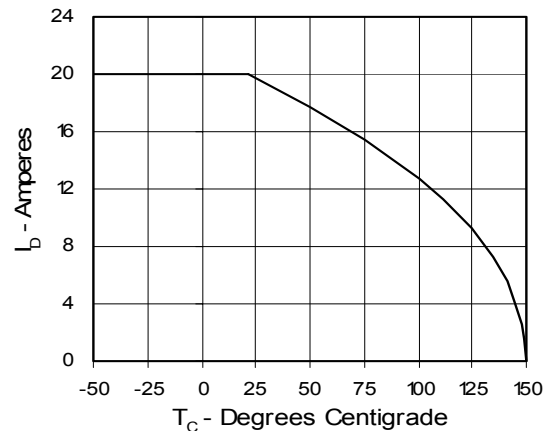


Fig. 7. Input Admittance

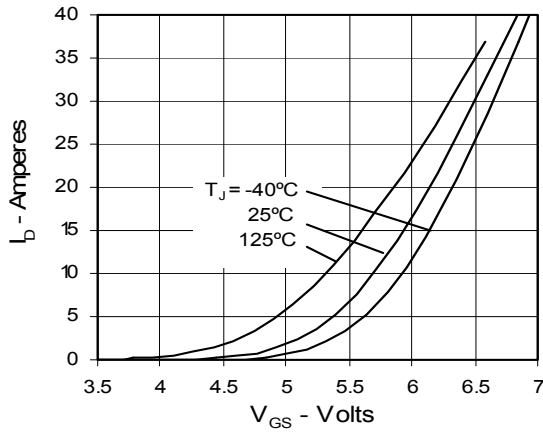


Fig. 8. Transconductance

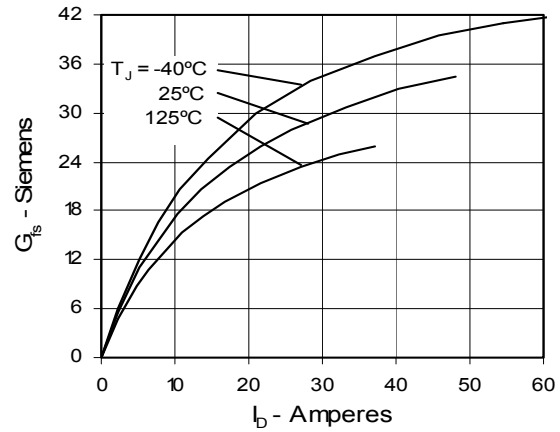


Fig. 9. Source Current vs. Source-To-Drain Voltage

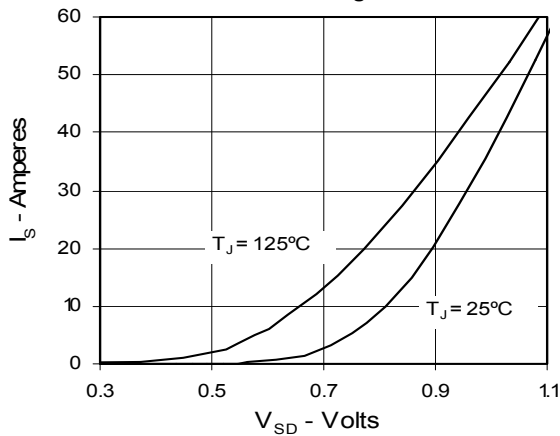


Fig. 10. Gate Charge

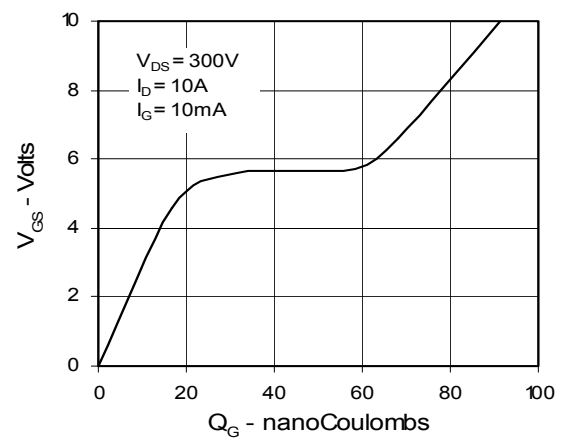


Fig. 11. Capacitance

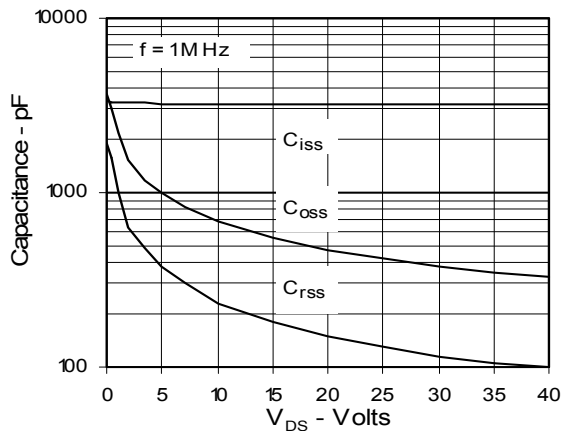
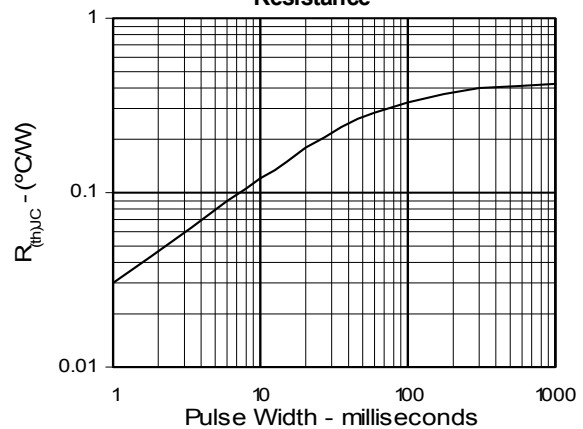


Fig. 12. Maximum Transient Thermal Resistance



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|           |           |           |           |           |           |             |             |             |
|-----------|-----------|-----------|-----------|-----------|-----------|-------------|-------------|-------------|
| 4,835,592 | 4,881,106 | 5,017,508 | 5,049,961 | 5,187,117 | 5,486,715 | 6,306,728B1 | 6,259,123B1 | 6,306,728B1 |
| 4,850,072 | 4,931,844 | 5,034,796 | 5,063,307 | 5,237,481 | 5,381,025 | 6,404,065B1 | 6,162,665   | 6,534,343   |