# HiPerFET™ Power MOSFETs
## Q-Class

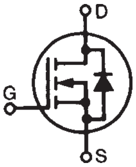
**IXFH 23N60Q**
**IXFT 23N60Q**

$V_{DSS}$ = 600 V
$I_{D25}$ = 23 A
$R_{DS(on)}$ = 0.32 Ω

$t_{rr} \leq$ 250ns

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

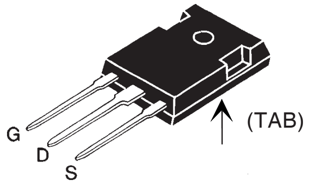
Preliminary Data Sheet



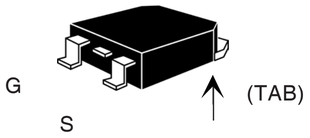
| Symbol | Test Conditions | Maximum Ratings | |
|---|---|---|---|
| $V_{DSS}$ | $T_J$ = 25°C to 150°C | 600 | V |
| $V_{DGR}$ | $T_J$ = 25°C to 150°C; $R_{GS}$ = 1 MΩ | 600 | V |
| $V_{GS}$ | Continuous | ±30 | V |
| $V_{GSM}$ | Transient | ±40 | V |
| $I_{D25}$ | $T_C$ = 25°C | 23 | A |
| $I_{DM}$ | $T_C$ = 25°C, pulse width limited by $T_{JM}$ | 92 | A |
| $I_{AR}$ | $T_C$ = 25°C | 23 | A |
| $E_{AR}$ | $T_C$ = 25°C | 30 | mJ |
| $E_{AS}$ | $T_C$ = 25°C | 1.5 | J |
| dv/dt | $I_S \leq I_{DM}$, di/dt ≤ 100 A/µs, $V_{DD} \leq V_{DSS}$,<br>$T_J \leq$ 150°C, $R_G$ = 2 Ω | 15 | V/ns |
| $P_D$ | $T_C$ = 25°C | 400 | W |
| $T_J$ | | -55 ... +150 | °C |
| $T_{JM}$ | | 150 | °C |
| $T_{stg}$ | | -55 ... +150 | °C |
| $T_L$ | 1.6 mm (0.062 in.) from case for 10 s | 300 | °C |
| $M_d$ | Mounting torque | 1.13/10 | Nm/lb.in. |
| Weight | TO-247 AD<br>TO-268 | 6<br>4 | g<br>g |

| Symbol | Test Conditions<br>($T_J$ = 25°C, unless otherwise specified) | Characteristic Values<br>Min. | <br>Typ. | <br>Max. | |
|---|---|---|---|---|---|
| $V_{DSS}$ | $V_{GS}$ = 0 V, $I_D$ = 250 µA | 600 | | | V |
| $V_{GS(th)}$ | $V_{DS}$ = $V_{GS}$, $I_D$ = 4 mA | 2.0 | | 4.5 | V |
| $I_{GSS}$ | $V_{GS}$ = ±30 $V_{DC}$, $V_{DS}$ = 0 | | | ±100 | nA |
| $I_{DSS}$ | $V_{DS}$ = $V_{DSS}$ $T_J$ = 25°C<br>$V_{GS}$ = 0 V $T_J$ = 125°C | | | 25<br>1 | µA<br>mA |
| $R_{DS(on)}$ | $V_{GS}$ = 10 V, $I_D$ = 0.5 $I_{D25}$<br>Pulse test, t ≤ 300 µs, duty cycle d ≤ 2 % | | | 0.32 | Ω |

**TO-247 AD (IXFH)**



**TO-268 (IXFT) Case Style**



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

### 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

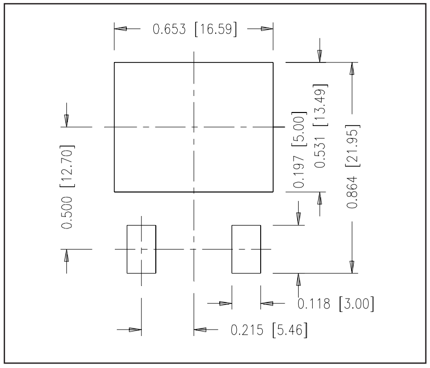
- Easy to mount
- Space savings
- High power density

| Symbol | Test Conditions | Characteristic Values ($T_J$ = 25°C, unless otherwise specified) Min. | Typ. | Max. | |
|---|---|---|---|---|---|
| $g_{fs}$ | $V_{DS}$ = 10 V; $I_D = 0.5\ I_{D25}$, pulse test | 10 | 20 | | S |
| $C_{iss}$ | $V_{GS}$ = 0 V, $V_{DS}$ = 25 V, f = 1 MHz | | 3300 | | pF |
| $C_{oss}$ | | | 410 | | pF |
| $C_{rss}$ | | | 130 | | pF |
| $t_{d(on)}$ | $V_{GS}$ = 10 V, $V_{DS} = 0.5\ V_{DSS}$, $I_D = 0.5\ I_{D25}$<br>$R_G$ = 1.5 Ω (External) | | 20 | | ns |
| $t_r$ | | | 20 | | ns |
| $t_{d(off)}$ | | | 45 | | ns |
| $t_f$ | | | 20 | | ns |
| $Q_{g(on)}$ | $V_{GS}$ = 10 V, $V_{DS} = 0.5\ V_{DSS}$, $I_D = 0.5\ I_{D25}$ | | 90 | | nC |
| $Q_{gs}$ | | | 20 | | nC |
| $Q_{gd}$ | | | 45 | | nC |
| $R_{thJC}$ | | | | 0.31 | K/W |
| $R_{thCK}$ | (TO-247) | | 0.25 | | K/W |

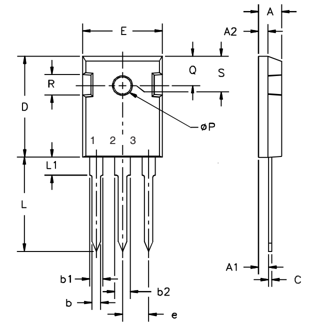
**Source-Drain Diode**

| Symbol | Test Conditions | Characteristic Values ($T_J$ = 25°C, unless otherwise specified) min. | typ. | max. | |
|---|---|---|---|---|---|
| $I_S$ | $V_{GS}$ = 0 V | | | 23 | A |
| $I_{SM}$ | Repetitive; pulse width limited by $T_{JM}$ | | | 92 | A |
| $V_{SD}$ | $I_F = I_S$, $V_{GS}$ = 0 V,<br>Pulse test, t ≤ 300 µs, duty cycle d ≤ 2 % | | | 1.5 | V |
| $t_{rr}$ | $I_F = I_S$, -di/dt = 100 A/µs, $V_R$ = 100 V | | | 250 | ns |
| $Q_{RM}$ | | | 0.85 | | µC |
| $I_{RM}$ | | | 8 | | A |

Min Recommended Footprint



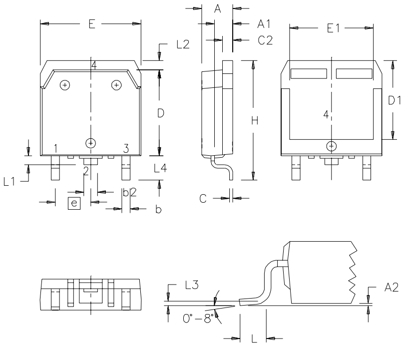
**TO-247 AD Outline**



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

| Dim. | Millimeter Min. | Max. | Inches Min. | Max. |
|---|---|---|---|---|
| A | 4.7 | 5.3 | .185 | .209 |
| $A_1$ | 2.2 | 2.54 | .087 | .102 |
| $A_2$ | 2.2 | 2.6 | .059 | .098 |
| b | 1.0 | 1.4 | .040 | .055 |
| $b_1$ | 1.65 | 2.13 | .065 | .084 |
| $b_2$ | 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 |
| L1 | | 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 Outline**



| SYM | INCHES MIN | MAX | MILLIMETERS 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 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**

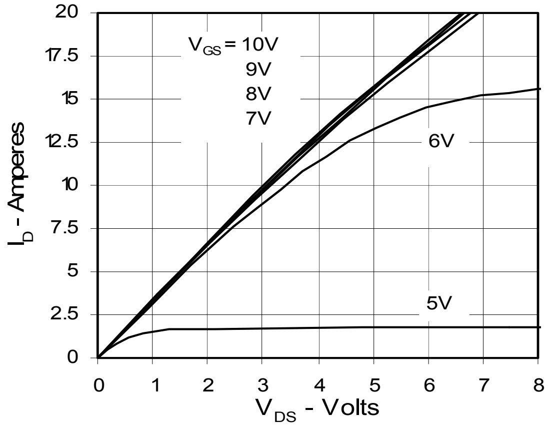


**Fig. 2. Extended Output Characteristics @ 25 deg. C**

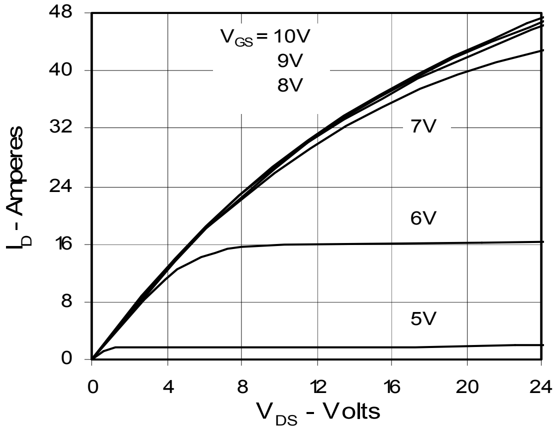


**Fig. 3. Output Characteristics @ 125 Deg. C**

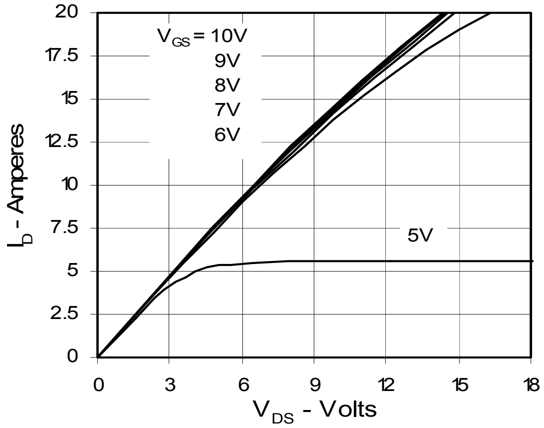


**Fig. 4. $R_{DS(on)}$ Normalized to $I_{D25}$ Value vs. Junction Temperature**

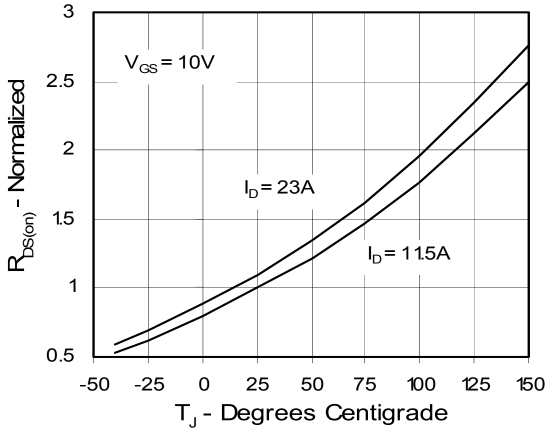


**Fig. 5. $R_{DS(on)}$ Normalized to $I_{D25}$ Value vs. $I_D$**

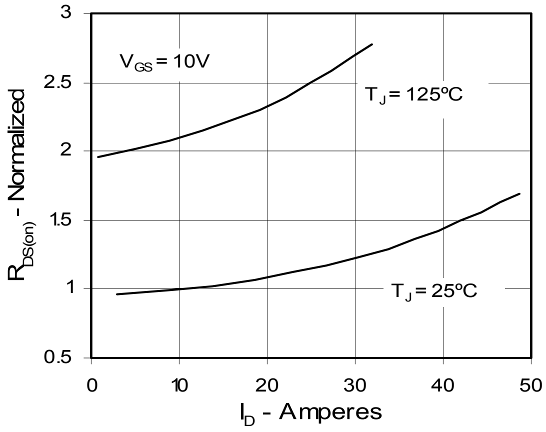


**Fig. 6. Drain Current vs. Case Temperature**

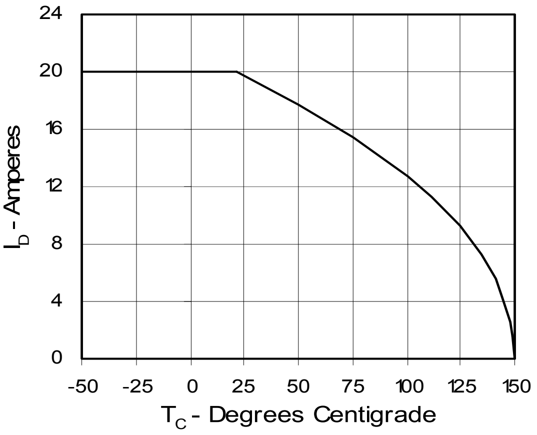


**Fig. 7. Input Admittance**

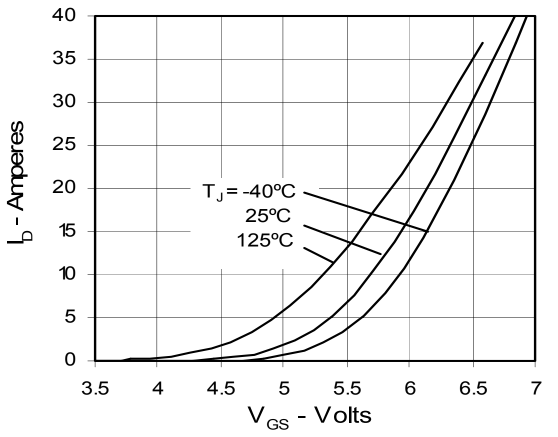


**Fig. 8. Transconductance**

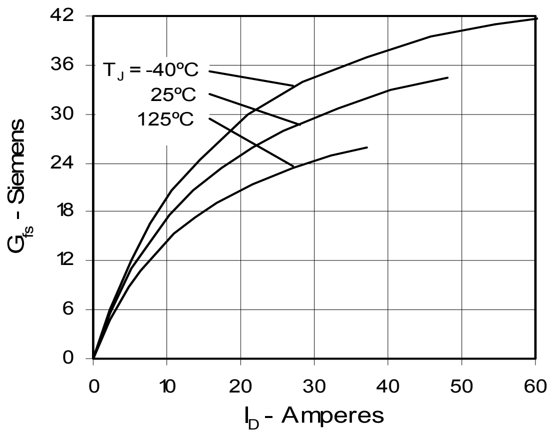


**Fig. 9. Source Current vs. Source-To-Drain Voltage**

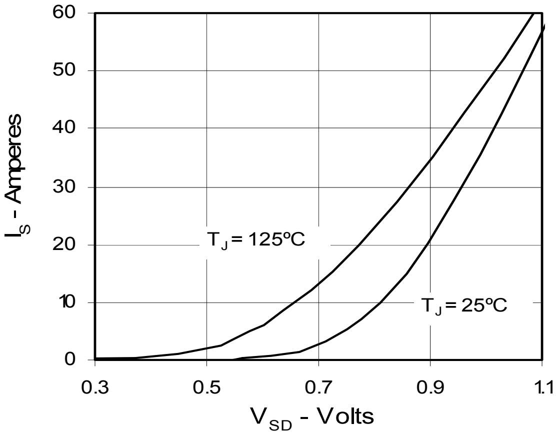


**Fig. 10. Gate Charge**

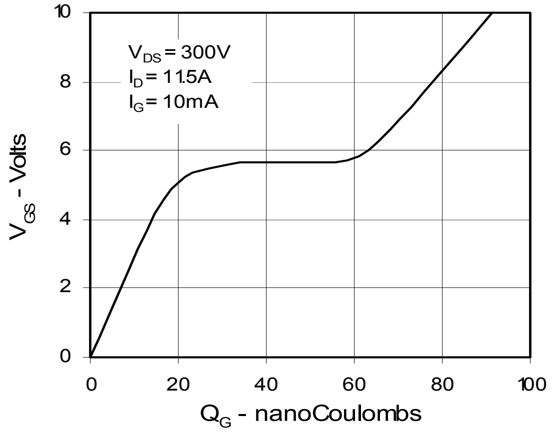


**Fig. 11. Capacitance**

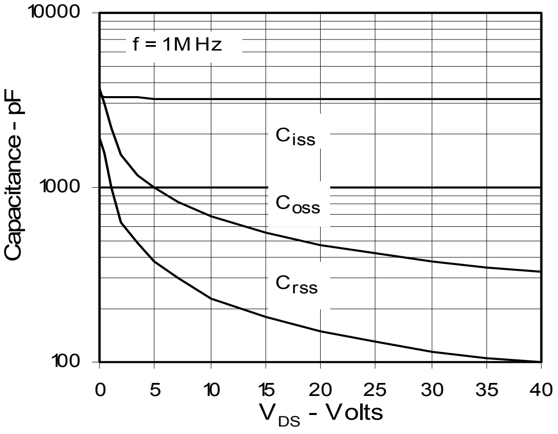
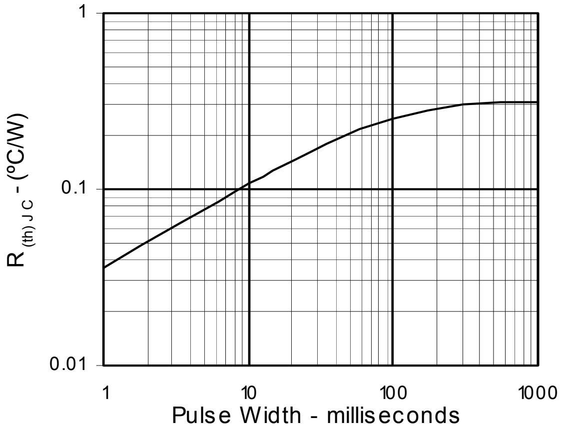


**Fig. 12. Maximum Transient Thermal Resistance**



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