

HiPerFET™ Power MOSFETs

N-Channel Enhancement Mode
High dv/dt, Low t_{rr} , HDMOS™ Family

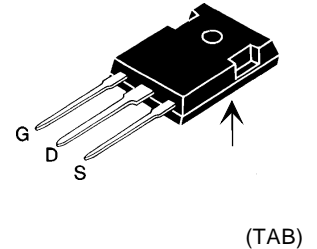
IXFH/IXFM 10 N90
IXFH/IXFM 12 N90
IXFH/IXFT 13 N90



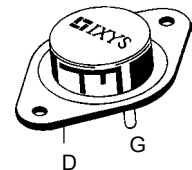
| V_{DSS} | I_{D25} | $R_{DS(on)}$ |
|-----------|-----------|--------------|
| 900 V | 10 A | 1.1 Ω |
| 900 V | 12 A | 0.9 Ω |
| 900 V | 13 A | 0.8 Ω |

$t_{rr} \leq 250$ ns

TO-247 AD (IXFH)



TO-204 AA (IXFM)



TO-268 (IXFT)



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

| Symbol | Test Conditions | Maximum Ratings | |
|-----------|--|-------------------------------------|------------------|
| V_{DSS} | $T_J = 25^\circ\text{C}$ to 150°C | 900 | V |
| V_{DGR} | $T_J = 25^\circ\text{C}$ to 150°C ; $R_{GS} = 1$ M Ω | 900 | V |
| V_{GS} | Continuous | ± 20 | V |
| V_{GSM} | Transient | ± 30 | V |
| I_{D25} | $T_C = 25^\circ\text{C}$ | 10N90: 10 12N90: 12 13N90: 13 | A |
| I_{DM} | $T_C = 25^\circ\text{C}$, pulse width limited by T_{JM} | 10N90: 40 12N90: 48 13N90: 52 | A |
| I_{AR} | $T_C = 25^\circ\text{C}$ | 10N90: 10 12N90: 12 13N90: 13 | A |
| E_{AR} | $T_C = 25^\circ\text{C}$ | 30 | mJ |
| dv/dt | $I_S \leq I_{DM}$, $di/dt \leq 100$ A/ μs , $V_{DD} \leq V_{DSS}$, $T_J \leq 150^\circ\text{C}$, $R_G = 2$ Ω | 5 | 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-204 = 18 g, TO-247 = 6 g | |

| Symbol | Test Conditions | Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified) | | |
|--------------|--|---|------|--------------------------|
| | | min. | typ. | max. |
| V_{DSS} | $V_{GS} = 0$ V, $I_D = 3$ mA | 900 | | V |
| $V_{GS(th)}$ | $V_{DS} = V_{GS}$, $I_D = 4$ mA | 2.0 | | 4.5 V |
| I_{GSS} | $V_{GS} = \pm 20$ V $_{DC}$, $V_{DS} = 0$ | | | ± 100 nA |
| I_{DSS} | $V_{DS} = V_{DSS}$, $V_{GS} = 0$ V $T_J = 25^\circ\text{C}$ $T_J = 125^\circ\text{C}$ | | | 25 μA 1 mA |
| $R_{DS(on)}$ | $V_{GS} = 10$ V, $I_D = 0.5 \cdot I_{D25}$ Pulse test, $t \leq 300$ μs , duty cycle $d \leq 2$ % | 10N90: 1.1 12N90: 0.9 13N90: 0.8 | | Ω |

Features

- International standard packages
- Low $R_{DS(on)}$ HDMOS™ process
- Rugged polysilicon gate cell structure
- Unclamped Inductive Switching (UIS) rated
- Low package inductance
- easy to drive and to protect
- Fast intrinsic Rectifier

Applications

- DC-DC converters
- Synchronous rectification
- Battery chargers
- Switched-mode and resonant-mode power supplies
- DC choppers
- AC motor control
- Temperature and lighting controls
- Low voltage relays

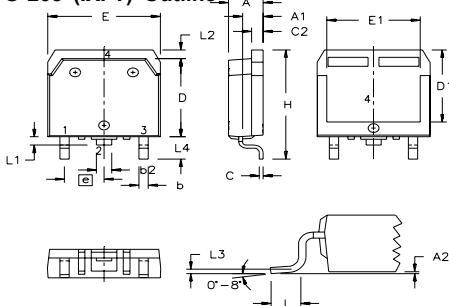
Advantages

- Easy to mount with 1 screw (TO-247) (isolated mounting screw hole)
- Space savings
- High power density

| Symbol | Test Conditions | Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified) | | |
|--------------|---|---|------|--------|
| | | min. | typ. | max. |
| g_{fs} | $V_{DS} = 10\text{ V}; I_D = 0.5 \cdot I_{D25}$, pulse test | 6 | 12 | S |
| C_{iss} | $V_{GS} = 0\text{ V}, V_{DS} = 25\text{ V}, f = 1\text{ MHz}$ | | 4200 | pF |
| C_{oss} | | | 315 | pF |
| C_{rss} | | | 90 | pF |
| $t_{d(on)}$ | $V_{GS} = 10\text{ V}, V_{DS} = 0.5 \cdot V_{DSS}, I_D = 0.5 \cdot I_{D25}$ $R_G = 2\ \Omega$ (External) | | 18 | 50 ns |
| t_r | | | 12 | 50 ns |
| $t_{d(off)}$ | | | 51 | 100 ns |
| t_f | | | 18 | 50 ns |
| $Q_{g(on)}$ | $V_{GS} = 10\text{ V}, V_{DS} = 0.5 \cdot V_{DSS}, I_D = 0.5 \cdot I_{D25}$ | | 123 | 155 nC |
| Q_{gs} | | | 27 | 45 nC |
| Q_{gd} | | | 49 | 80 nC |
| R_{thJC} | | | 0.42 | K/W |
| R_{thCK} | (IXFH/IXFM) | | 0.25 | K/W |

| Symbol | Test Conditions | Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified) | | |
|----------|---|---|------|----------------------|
| | | min. | typ. | max. |
| I_S | $V_{GS} = 0\text{ V}$ | 10N90 12N90 13N90 | | 10 A 12 A 13 A |
| I_{SM} | Repetitive; pulse width limited by T_{JM} | 10N90 12N90 13N90 | | 40 A 48 A 52 A |
| V_{SD} | $I_F = I_S, V_{GS} = 0\text{ V}$, Pulse test, $t \leq 300\ \mu\text{s}$, duty cycle $d \leq 2\%$ | | | 1.5 V |
| t_{tr} | $I_F = I_S$ $-di/dt = 100\text{ A}/\mu\text{s}$, $V_R = 100\text{ V}$ | $T_J = 25^\circ\text{C}$ | | 250 ns |
| | | $T_J = 125^\circ\text{C}$ | | 400 ns |
| Q_{RM} | | $T_J = 25^\circ\text{C}$ | 1 | μC |
| | | $T_J = 125^\circ\text{C}$ | 2 | μC |
| I_{RM} | | $T_J = 25^\circ\text{C}$ | 10 | A |
| | | $T_J = 125^\circ\text{C}$ | 15 | A |

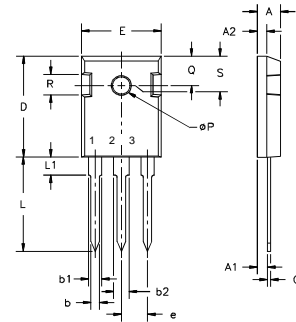
TO-268 (IXFT) Outline



| 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 |
| L1 | .094 | .106 | 2.40 | 2.70 |
| L2 | .047 | .053 | 1.20 | 1.40 |
| L3 | .039 | .045 | 1.00 | 1.15 |
| L4 | .010 BSC | | 0.25 BSC | |
| L4 | .150 | .161 | 3.80 | 4.10 |

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

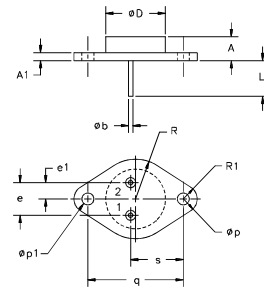
TO-247 AD (IXFH) Outline



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

| Dim. | Millimeter | | Inches | |
|----------------|------------|-------|--------|-------|
| | Min. | Max. | Min. | Max. |
| A | 4.7 | 5.3 | .185 | .209 |
| A ₁ | 2.2 | 2.54 | .087 | .102 |
| A ₂ | 2.2 | 2.6 | .087 | .102 |
| 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-204 AA (IXFM) Outline



Pins 1 - Gate 2 - Source
Case - Drain

| Dim. | Millimeter | | Inches | |
|------|------------|-------|--------|------|
| | Min. | Max. | Min. | Max. |
| A | 6.4 | 11.4 | .250 | .450 |
| A1 | | 3.42 | | .135 |
| ∅b | .97 | 1.09 | .038 | .043 |
| ∅D | | 22.22 | | .875 |
| e | 10.67 | 11.17 | .420 | .440 |
| e1 | 5.21 | 5.71 | .205 | .225 |
| L | 7.93 | | .312 | |
| ∅p | 3.84 | 4.19 | .151 | .165 |
| ∅p1 | 3.84 | 4.19 | .151 | .165 |
| q | 30.15 | BSC | 1.187 | BSC |
| R | | 13.33 | | .525 |
| R1 | | 4.77 | | .188 |
| s | 16.64 | 17.14 | .655 | .675 |

Fig. 1. Output Characteristics

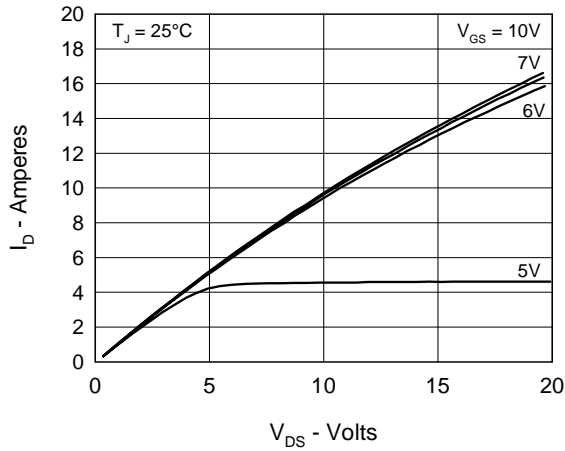


Fig. 2. Input Admittance

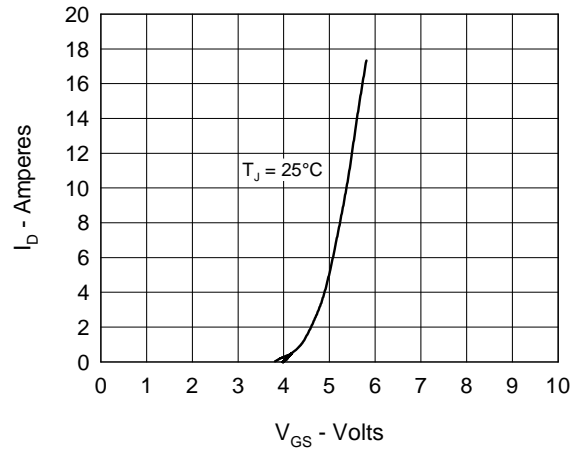


Fig. 3. $R_{DS(on)}$ vs. Drain Current

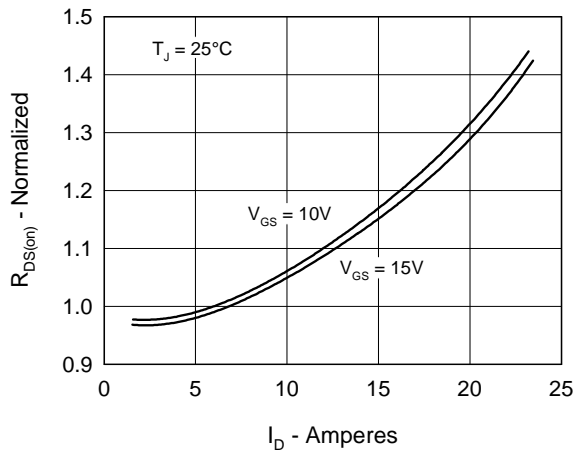


Fig. 4. Temperature Dependence of Drain to Source Resistance

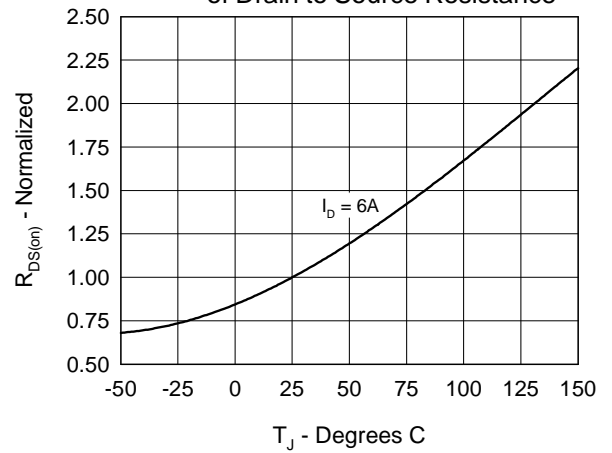


Fig. 5. Drain Current vs. Case Temperature

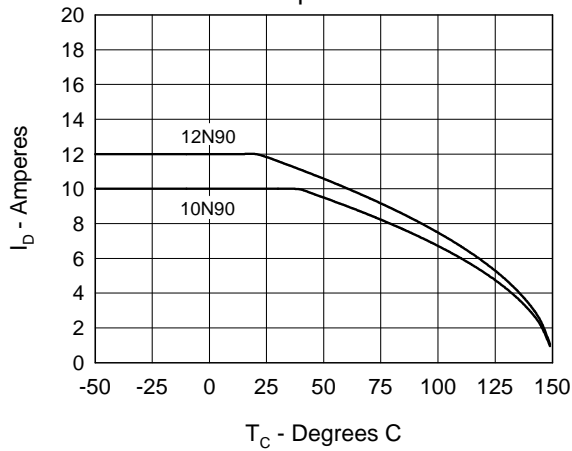


Fig. 6. Temperature Dependence of Breakdown and Threshold Voltage

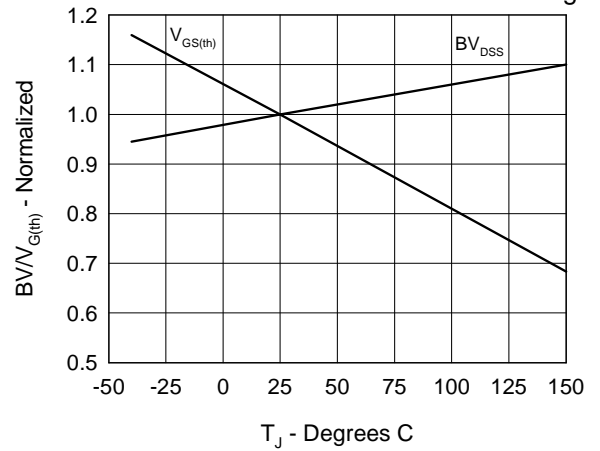


Fig.7. Gate Charge Characteristic Curve

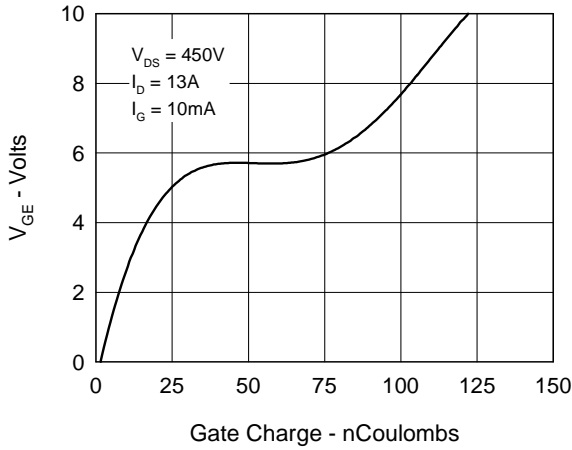


Fig.8. Capacitance Curves

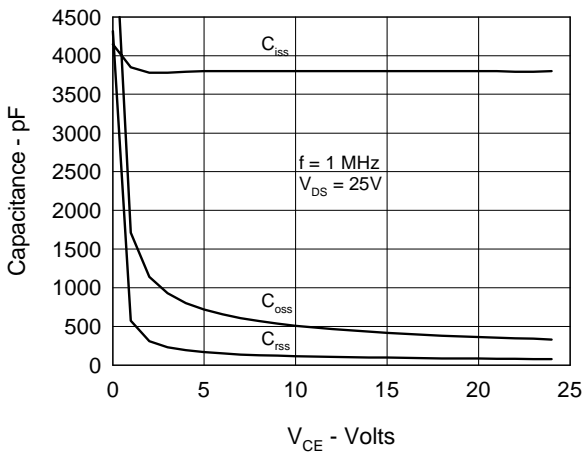


Fig.9. Source Current vs. Source to Drain Voltage

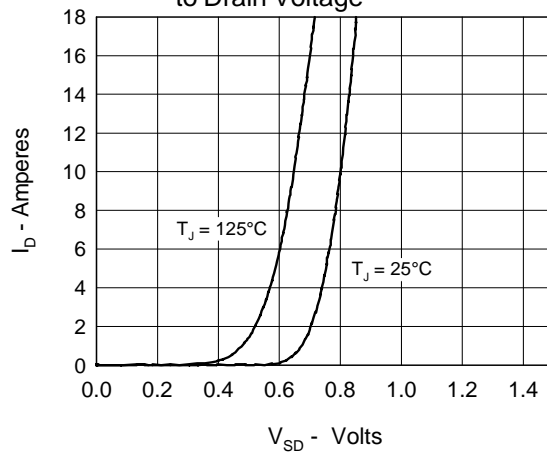
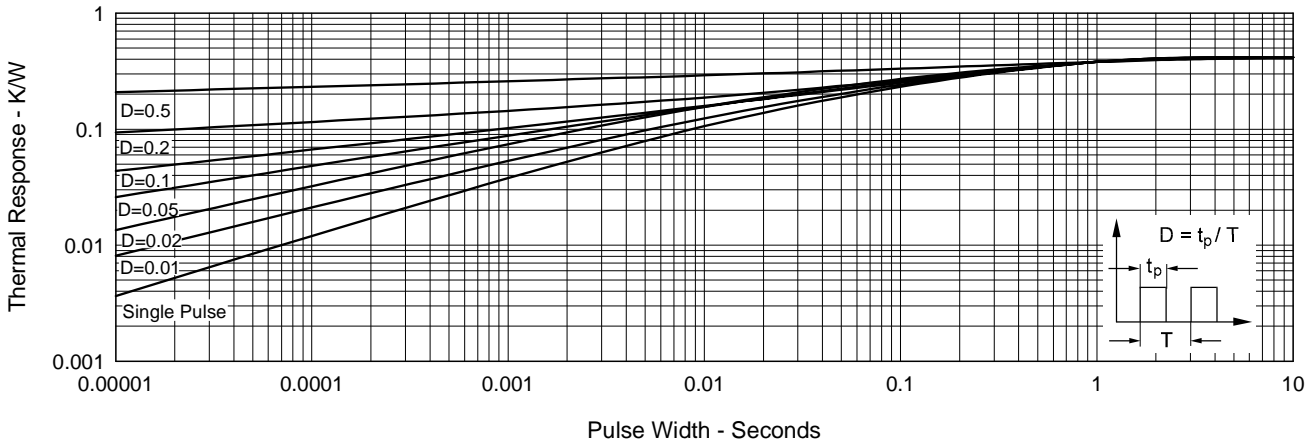


Fig.10. Transient Thermal Impedance



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 |
| 4,850,072 | 4,931,844 | 5,034,796 | 5,063,307 | 5,237,481 | 5,381,025 | |