



# HiPerFET™ Power MOSFETs Q-CLASS

Single MOSFET Die

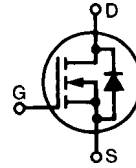
N-Channel Enhancement Mode  
Avalanche Rated, Low Q<sub>g</sub>,  
High dV/dt, Low t<sub>rr</sub>

Preliminary data sheet

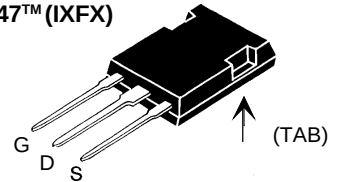
IXFK 24N90Q  
IXFX 24N90Q

V<sub>DSS</sub> = 900 V  
I<sub>D25</sub> = 24 A  
R<sub>DS(on)</sub> = 0.45 Ω

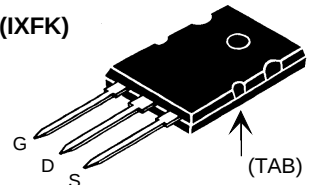
t<sub>rr</sub> ≤ 250 ns



PLUS 247™ (IXFX)



TO-264 AA (IXFK)



G = Gate  
S = Source

D = Drain  
TAB = Drain

| Symbol           | Test Conditions                                                                                                                         | Maximum Ratings |                 |
|------------------|-----------------------------------------------------------------------------------------------------------------------------------------|-----------------|-----------------|
| V <sub>DSS</sub> | T <sub>J</sub> = 25°C to 150°C                                                                                                          | 900             | V               |
| V <sub>DGR</sub> | T <sub>J</sub> = 25°C to 150°C; R <sub>GS</sub> = 1 MΩ                                                                                  | 900             | V               |
| V <sub>GS</sub>  | Continuous                                                                                                                              | ±20             | V               |
| V <sub>GSM</sub> | Transient                                                                                                                               | ±30             | V               |
| I <sub>D25</sub> | T <sub>C</sub> = 25°C                                                                                                                   | 24              | A               |
| I <sub>DM</sub>  | T <sub>C</sub> = 25°C, pulse width limited by T <sub>JM</sub>                                                                           | 96              | A               |
| I <sub>AR</sub>  | T <sub>C</sub> = 25°C                                                                                                                   | 24              | A               |
| E <sub>AR</sub>  | T <sub>C</sub> = 25°C                                                                                                                   | 60              | mJ              |
| E <sub>AS</sub>  | T <sub>C</sub> = 25°C                                                                                                                   | 2.5             | 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> = 2 Ω | 5               | V/ns            |
| P <sub>D</sub>   | T <sub>C</sub> = 25°C                                                                                                                   | 500             | 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 (0.063 in.) from case for 10 s                                                                                                   | 300             | °C              |
| M <sub>d</sub>   | Mounting torque                                                                                                                         | TO-264          | 0.4/6 Nm/lb.in. |
| Weight           |                                                                                                                                         | PLUS 247        | 6 g             |
|                  |                                                                                                                                         | TO-264          | 10 g            |

## Features

- IXYS advanced low Q<sub>g</sub> process
- Low gate charge and capacitances
  - easier to drive
  - faster switching
- International standard packages
- Low R<sub>DS(on)</sub>
- Rated for unclamped Inductive load switching (UIS) rated
- Molding epoxies meet UL 94 V-0 flammability classification

## Applications

- DC-DC converters
- Battery chargers
- Switched-mode and resonant-mode power supplies
- DC choppers
- AC motor control
- Temperature and lighting controls

## Advantages

- PLUS 247™ package for clip or spring mounting
- Space savings
- High power density

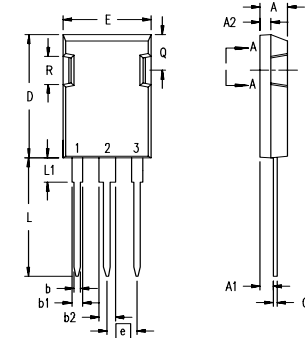
| Symbol              | Test Conditions                                                                       | Characteristic Values<br>(T <sub>J</sub> = 25°C, unless otherwise specified) |      |                |
|---------------------|---------------------------------------------------------------------------------------|------------------------------------------------------------------------------|------|----------------|
|                     |                                                                                       | min.                                                                         | typ. | max.           |
| V <sub>DSS</sub>    | V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250μA                                         | 900                                                                          |      | V              |
| V <sub>GS(th)</sub> | V <sub>DS</sub> = V <sub>DSS</sub> , I <sub>D</sub> = 4mA                             | 2.5                                                                          |      | 4.5 V          |
| I <sub>GSS</sub>    | V <sub>GS</sub> = ±20 V, V <sub>DS</sub> = 0                                          |                                                                              |      | ±100 nA        |
| I <sub>DSS</sub>    | V <sub>DS</sub> = V <sub>DSS</sub><br>V <sub>GS</sub> = 0 V<br>T <sub>J</sub> = 125°C |                                                                              |      | 100 μA<br>2 mA |
| R <sub>DS(on)</sub> | V <sub>GS</sub> = 10 V, I <sub>D</sub> = 0.5 • I <sub>D25</sub><br>Note 1             |                                                                              |      | 0.45 Ω         |

| Symbol       | Test Conditions                                                                                              |        | Characteristic Values<br>( $T_J = 25^\circ\text{C}$ , unless otherwise specified) |      |      |
|--------------|--------------------------------------------------------------------------------------------------------------|--------|-----------------------------------------------------------------------------------|------|------|
|              |                                                                                                              |        | min.                                                                              | typ. | max. |
| $g_{fs}$     | $V_{DS} = 10\text{ V}; I_D = 0.5 \cdot I_{D25}$                                                              | Note 1 | 16                                                                                | 22   | S    |
| $C_{iss}$    | $V_{GS} = 0\text{ V}, V_{DS} = 25\text{ V}, f = 1\text{ MHz}$                                                |        |                                                                                   | 5900 | pF   |
| $C_{oss}$    |                                                                                                              |        |                                                                                   | 650  | pF   |
| $C_{rss}$    |                                                                                                              |        |                                                                                   | 130  | pF   |
| $t_{d(on)}$  | $V_{GS} = 10\text{ V}, V_{DS} = 0.5 \cdot V_{DSS}, I_D = 0.5 \cdot I_{D25}$<br>$R_G = 1\ \Omega$ (External), |        |                                                                                   | 25   | ns   |
| $t_r$        |                                                                                                              |        |                                                                                   | 21   | ns   |
| $t_{d(off)}$ |                                                                                                              |        |                                                                                   | 60   | ns   |
| $t_f$        |                                                                                                              |        |                                                                                   | 12   | ns   |
| $Q_{g(on)}$  | $V_{GS} = 10\text{ V}, V_{DS} = 0.5 \cdot V_{DSS}, I_D = 0.5 \cdot I_{D25}$                                  |        |                                                                                   | 170  | nC   |
| $Q_{gs}$     |                                                                                                              |        |                                                                                   | 38   | nC   |
| $Q_{gd}$     |                                                                                                              |        |                                                                                   | 75   | nC   |
| $R_{thJC}$   |                                                                                                              |        |                                                                                   | 0.26 | K/W  |
| $R_{thCK}$   |                                                                                                              |        |                                                                                   | 0.15 | K/W  |

**Source-Drain Diode**

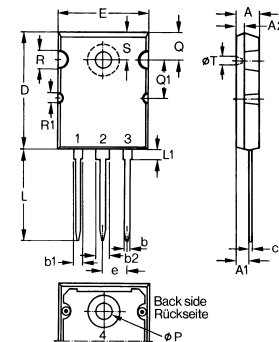
| Symbol   | Test Conditions                                                    |  | Characteristic Values<br>( $T_J = 25^\circ\text{C}$ , unless otherwise specified) |      |               |
|----------|--------------------------------------------------------------------|--|-----------------------------------------------------------------------------------|------|---------------|
|          |                                                                    |  | min.                                                                              | typ. | max.          |
| $I_S$    | $V_{GS} = 0\text{ V}$                                              |  |                                                                                   |      | 24 A          |
| $I_{SM}$ | Repetitive;<br>pulse width limited by $T_{JM}$                     |  |                                                                                   |      | 96 A          |
| $V_{SD}$ | $I_F = I_S, V_{GS} = 0\text{ V}$ , Note 1                          |  |                                                                                   |      | 1.5 V         |
| $t_{rr}$ | $I_F = I_S, -di/dt = 100\text{ A}/\mu\text{s}, V_R = 100\text{ V}$ |  |                                                                                   | 1.4  | 250 ns        |
| $Q_{RM}$ |                                                                    |  |                                                                                   |      | $\mu\text{C}$ |
| $I_{RM}$ |                                                                    |  |                                                                                   |      | A             |

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

**PLUS 247™ Outline**


Terminals: 1 - Gate  
2 - Drain (Collector)  
3 - Source (Emitter)  
4 - Drain (Collector)

| Dim.           | Millimeter |       | Inches   |      |
|----------------|------------|-------|----------|------|
|                | Min.       | Max.  | Min.     | Max. |
| A              | 4.83       | 5.21  | .190     | .205 |
| A <sub>1</sub> | 2.29       | 2.54  | .090     | .100 |
| A <sub>2</sub> | 1.91       | 2.16  | .075     | .085 |
| b              | 1.14       | 1.40  | .045     | .055 |
| b <sub>1</sub> | 1.91       | 2.13  | .075     | .084 |
| b <sub>2</sub> | 2.92       | 3.12  | .115     | .123 |
| C              | 0.61       | 0.80  | .024     | .031 |
| D              | 20.80      | 21.34 | .819     | .840 |
| E              | 15.75      | 16.13 | .620     | .635 |
| e              | 5.45 BSC   |       | .215 BSC |      |
| L              | 19.81      | 20.32 | .780     | .800 |
| L1             | 3.81       | 4.32  | .150     | .170 |
| Q              | 5.59       | 6.20  | .220     | .244 |
| R              | 4.32       | 4.83  | .170     | .190 |

**TO-264 AA Outline**


| Dim. | Millimeter |       | Inches   |       |
|------|------------|-------|----------|-------|
|      | Min.       | Max.  | Min.     | Max.  |
| A    | 4.82       | 5.13  | .190     | .202  |
| A1   | 2.54       | 2.89  | .100     | .114  |
| A2   | 2.00       | 2.10  | .079     | .083  |
| b    | 1.12       | 1.42  | .044     | .056  |
| b1   | 2.39       | 2.69  | .094     | .106  |
| b2   | 2.90       | 3.09  | .114     | .122  |
| c    | 0.53       | 0.83  | .021     | .033  |
| D    | 25.91      | 26.16 | 1.020    | 1.030 |
| E    | 19.81      | 19.96 | .780     | .786  |
| e    | 5.46 BSC   |       | .215 BSC |       |
| J    | 0.00       | 0.25  | .000     | .010  |
| K    | 0.00       | 0.25  | .000     | .010  |
| L    | 20.32      | 20.83 | .800     | .820  |
| L1   | 2.29       | 2.59  | .090     | .102  |
| P    | 3.17       | 3.66  | .125     | .144  |
| Q    | 6.07       | 6.27  | .239     | .247  |
| Q1   | 8.38       | 8.69  | .330     | .342  |
| R    | 3.81       | 4.32  | .150     | .170  |
| R1   | 1.78       | 2.29  | .070     | .090  |
| S    | 6.04       | 6.30  | .238     | .248  |
| T    | 1.57       | 1.83  | .062     | .072  |

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