International
IOR Rectifier

PD-91886A

PROVISIONAL

**SMPS MOSFET**

# IRFBA22N50A

HEXFET® Power MOSFET

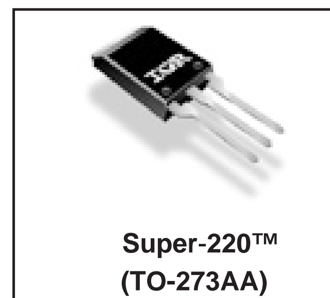
### Applications

- Switch Mode Power Supply (SMPS)
- Uninterruptible Power Supply
- High Speed Power Switching

| $V_{DSS}$ | $R_{DS(on)}$ max | $I_D$ |
|---|---|---|
| 500V | 0.26Ω | 23A |

### Benefits

- Low Gate Charge Qg results in Simple Drive Requirement
- Improved Gate, Avalanche and Dynamic dv/dt Ruggedness
- Fully Characterized Capacitance and Avalanche Voltage and Current
- Effective Coss Specified (See AN1001)



**Super-220™ (TO-273AA)**

### Absolute Maximum Ratings

| | Parameter | Max. | Units |
|---|---|---|---|
| $I_D$ @ $T_C$ = 25°C | Continuous Drain Current, $V_{GS}$ @ 10V | 23 | A |
| $I_D$ @ $T_C$ = 100°C | Continuous Drain Current, $V_{GS}$ @ 10V | 15 | |
| $I_{DM}$ | Pulsed Drain Current ① | 92 | |
| $P_D$ @$T_C$ = 25°C | Power Dissipation | 357 | W |
| | Linear Derating Factor | 2.9 | W/°C |
| $V_{GS}$ | Gate-to-Source Voltage | ± 30 | V |
| dv/dt | Peak Diode Recovery dv/dt ③ | 3.4 | V/ns |
| $T_J$<br>$T_{STG}$ | Operating Junction and<br>Storage Temperature Range | -55 to + 150 | °C |
| | Soldering Temperature, for 10 seconds | 300 (1.6mm from case ) | |
| | Recommended clip force | 20 | N |

### Applicable Off Line SMPS Topologies

- Full Bridge Converters
- Power Factor Correction Boost

Notes ① through ⑤ are on page 8

## Static @ $T_J$ = 25°C (unless otherwise specified)

| | Parameter | Min. | Typ. | Max. | Units | Conditions |
|---|---|---|---|---|---|---|
| $V_{(BR)DSS}$ | Drain-to-Source Breakdown Voltage | 500 | ––– | ––– | V | $V_{GS}$ = 0V, $I_D$ = 250µA |
| $R_{DS(on)}$ | Static Drain-to-Source On-Resistance | ––– | ––– | 0.26 | Ω | $V_{GS}$ = 10V, $I_D$ = 13.8A ④ |
| $V_{GS(th)}$ | Gate Threshold Voltage | 2.0 | ––– | 4.0 | V | $V_{DS}$ = $V_{GS}$, $I_D$ = 250µA |
| $I_{DSS}$ | Drain-to-Source Leakage Current | ––– | ––– | 25 | µA | $V_{DS}$ = 500V, $V_{GS}$ = 0V |
| | | ––– | ––– | 250 | | $V_{DS}$ = 400V, $V_{GS}$ = 0V, $T_J$ = 125°C |
| $I_{GSS}$ | Gate-to-Source Forward Leakage | ––– | ––– | 100 | nA | $V_{GS}$ = 30V |
| | Gate-to-Source Reverse Leakage | ––– | ––– | -100 | | $V_{GS}$ = -30V |

## Dynamic @ $T_J$ = 25°C (unless otherwise specified)

| | Parameter | Min. | Typ. | Max. | Units | Conditions |
|---|---|---|---|---|---|---|
| $g_{fs}$ | Forward Transconductance | 12 | ––– | ––– | S | $V_{DS}$ = 50V, $I_D$ = 13.8A |
| $Q_g$ | Total Gate Charge | ––– | ––– | 114 | nC | $I_D$ = 23A |
| $Q_{gs}$ | Gate-to-Source Charge | ––– | ––– | 28 | | $V_{DS}$ = 400V |
| $Q_{gd}$ | Gate-to-Drain ("Miller") Charge | ––– | ––– | 47 | | $V_{GS}$ = 10V, ④ |
| $t_{d(on)}$ | Turn-On Delay Time | ––– | 20 | ––– | ns | $V_{DD}$ = 250V |
| $t_r$ | Rise Time | ––– | 66 | ––– | | $I_D$ = 23A |
| $t_{d(off)}$ | Turn-Off Delay Time | ––– | 46 | ––– | | $R_G$ = 4.3Ω |
| $t_f$ | Fall Time | ––– | 44 | ––– | | $R_D$ = 10.6Ω, ④ |
| $C_{iss}$ | Input Capacitance | ––– | 3397 | ––– | pF | $V_{GS}$ = 0V |
| $C_{oss}$ | Output Capacitance | ––– | 505 | ––– | | $V_{DS}$ = 25V |
| $C_{rss}$ | Reverse Transfer Capacitance | ––– | 17 | ––– | | ƒ = 1.0MHz, |
| $C_{oss}$ | Output Capacitance | ––– | 4884 | ––– | | $V_{GS}$ = 0V, $V_{DS}$ = 1.0V, ƒ = 1.0MHz |
| $C_{oss}$ | Output Capacitance | ––– | 134 | ––– | | $V_{GS}$ = 0V, $V_{DS}$ = 400V, ƒ = 1.0MHz |
| $C_{oss}$ eff. | Effective Output Capacitance | ––– | 154 | ––– | | $V_{GS}$ = 0V, $V_{DS}$ = 0V to 400V ⑤ |

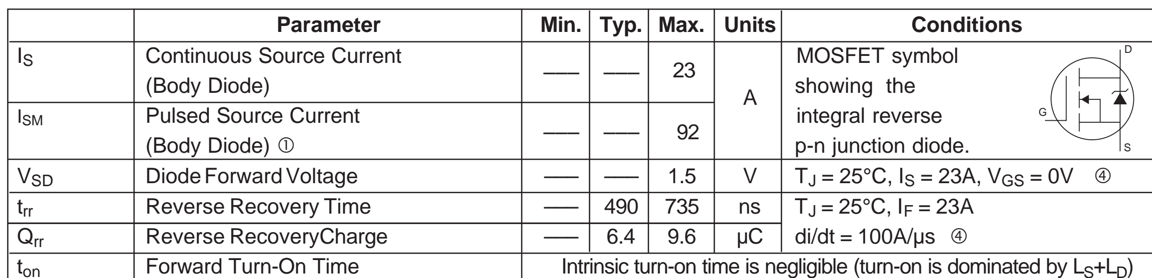
## Avalanche Characteristics

| | Parameter | Typ. | Max. | Units |
|---|---|---|---|---|
| $E_{AS}$ | Single Pulse Avalanche Energy② | ––– | 730 | mJ |
| $I_{AR}$ | Avalanche Current① | ––– | 23 | A |
| $E_{AR}$ | Repetitive Avalanche Energy① | ––– | 36 | mJ |

## Thermal Resistance

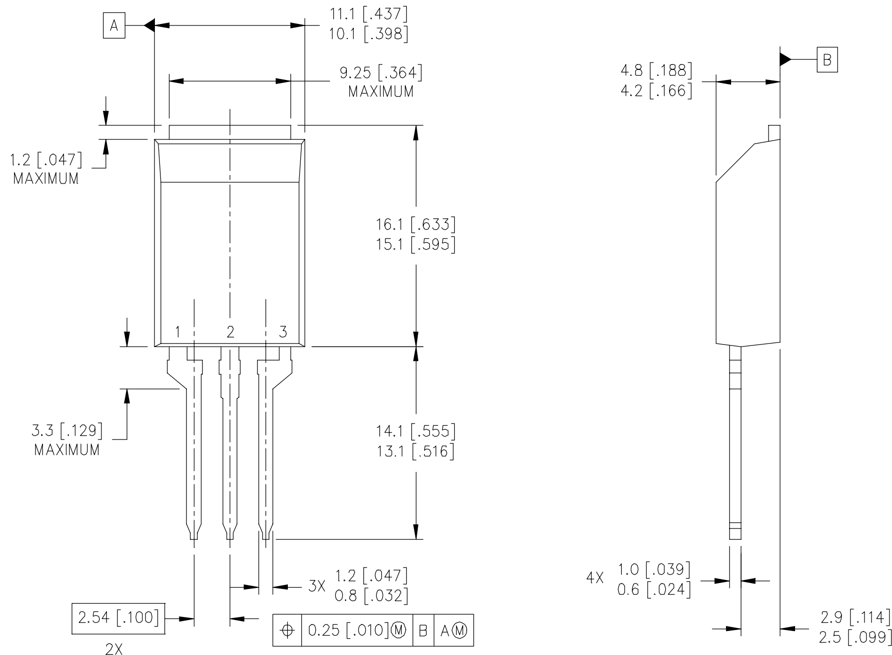
| | Parameter | Typ. | Max. | Units |
|---|---|---|---|---|
| $R_{\theta JC}$ | Junction-to-Case | ––– | 0.37 | °C/W |
| $R_{\theta CS}$ | Case-to-Sink, Flat, Greased Surface | 0.50 | ––– | |
| $R_{\theta JA}$ | Junction-to-Ambient | ––– | 58 | |

## Diode Characteristics



| | Parameter | Min. | Typ. | Max. | Units | Conditions |
|---|---|---|---|---|---|---|
| $I_S$ | Continuous Source Current (Body Diode) | ––– | ––– | 23 | A | MOSFET symbol showing the integral reverse p-n junction diode. |
| $I_{SM}$ | Pulsed Source Current (Body Diode) ① | ––– | ––– | 92 | | |
| $V_{SD}$ | Diode Forward Voltage | ––– | ––– | 1.5 | V | $T_J$ = 25°C, $I_S$ = 23A, $V_{GS}$ = 0V ④ |
| $t_{rr}$ | Reverse Recovery Time | ––– | 490 | 735 | ns | $T_J$ = 25°C, $I_F$ = 23A |
| $Q_{rr}$ | Reverse RecoveryCharge | ––– | 6.4 | 9.6 | µC | di/dt = 100A/µs ④ |
| $t_{on}$ | Forward Turn-On Time | Intrinsic turn-on time is negligible (turn-on is dominated by $L_S$+$L_D$) | | | | |

## Super-220™ (TO-273AA) Package Outline




NOTES:

1. DIMENSIONING & TOLERANCING PER ASME Y14.5M–1994.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
4. OUTLINE CONFORMS TO JEDEC OUTLINE TO–273AA.

LEAD ASSIGNMENTS

| MOSFET | IGBT |
|---|---|
| 1 – GATE | 1 – GATE |
| 2 – DRAIN | 2 – COLLECTOR |
| 3 – SOURCE | 3 – EMITTER |
| 4 – DRAIN | 4 – COLLECTOR |

**Notes:**

① Repetitive rating; pulse width limited by max. junction temperature.

② Starting $T_J$ = 25°C, L = 2.76mH $R_G$ = 25Ω, $I_{AS}$ = 23A.

③ $I_{SD} \le$ 23A, di/dt $\le$ 123A/μs, $V_{DD} \le V_{(BR)DSS}$, $T_J \le$ 150°C

④ Pulse width ≤ 300μs; duty cycle ≤ 2%.

⑤ $C_{oss}$ eff. is a fixed capacitance that gives the same charging time as $C_{oss}$ while $V_{DS}$ is rising from 0 to 80% $V_{DSS}$

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*Data and specifications subject to change without notice. 10/99*