# Advanced Power MOSFET

# IRFZ44A

## FEATURES

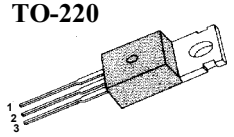
- Avalanche Rugged Technology
- Rugged Gate Oxide Technology
- Lower Input Capacitance
- Improved Gate Charge
- Extended Safe Operating Area
- 175℃ Operating Temperature
- Lower Leakage Current : 10 μA (Max.) @ $V_{DS}$ = 60V
- Lower $R_{DS(ON)}$ : 0.020 Ω (Typ.)

$BV_{DSS}$ = 60 V

$R_{DS(on)}$ = 0.024 Ω

$I_D$ = 50 A

**TO-220**




**1.Gate 2. Drain 3. Source**

## Absolute Maximum Ratings

| Symbol | Characteristic | Value | Units |
|---|---|---|---|
| $V_{DSS}$ | Drain-to-Source Voltage | 60 | V |
| $I_D$ | Continuous Drain Current ($T_C$=25 °C) | 50 | A |
| | Continuous Drain Current ($T_C$=100 °C) | 35.4 | |
| $I_{DM}$ | Drain Current-Pulsed ① | 200 | A |
| $V_{GS}$ | Gate-to-Source Voltage | ± 20 | V |
| $E_{AS}$ | Single Pulsed Avalanche Energy ② | 857 | mJ |
| $I_{AR}$ | Avalanche Current ① | 50 | A |
| $E_{AR}$ | Repetitive Avalanche Energy ① | 12.6 | mJ |
| dv/dt | Peak Diode Recovery dv/dt ③ | 5.5 | V/ns |
| $P_D$ | Total Power Dissipation ($T_C$=25 °C) | 126 | W |
| | Linear Derating Factor | 0.84 | W/ °C |
| $T_J$ , $T_{STG}$ | Operating Junction and Storage Temperature Range | - 55 to +175 | °C |
| $T_L$ | Maximum Lead Temp. for Soldering Purposes, 1/8 " from case for 5-seconds | 300 | |

## Thermal Resistance

| Symbol | Characteristic | Typ. | Max. | Units |
|---|---|---|---|---|
| $R_{\theta JC}$ | Junction-to-Case | -- | 1.19 | °C /W |
| $R_{\theta CS}$ | Case-to-Sink | 0.5 | -- | |
| $R_{\theta JA}$ | Junction-to-Ambient | -- | 62.5 | |

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## Electrical Characteristics ($T_C$=25°C unless otherwise specified)

| Symbol | Characteristic | Min. | Typ. | Max. | Units | Test Condition |
|---|---|---|---|---|---|---|
| $BV_{DSS}$ | Drain-Source Breakdown Voltage | 60 | -- | -- | V | $V_{GS}$=0V,$I_D$=250μA |
| $\Delta BV/\Delta T_J$ | Breakdown Voltage Temp. Coeff. | -- | 0.063 | -- | V/°C | $I_D$=250μA ***See Fig 7*** |
| $V_{GS(th)}$ | Gate Threshold Voltage | 2.0 | -- | 4.0 | V | $V_{DS}$=5V,$I_D$=250 μA |
| $I_{GSS}$ | Gate-Source Leakage , Forward | -- | -- | 100 | nA | $V_{GS}$=20V |
| | Gate-Source Leakage , Reverse | -- | -- | -100 | | $V_{GS}$=-20V |
| $I_{DSS}$ | Drain-to-Source Leakage Current | -- | -- | 10 | μA | $V_{DS}$=60V |
| | | -- | -- | 100 | | $V_{DS}$=48V,$T_C$=150°C |
| $R_{DS(on)}$ | Static Drain-Source On-State Resistance | -- | -- | 0.024 | Ω | $V_{GS}$=10V,$I_D$=25A ④ |
| $g_{fs}$ | Forward Transconductance | -- | 32.6 | -- | ℧ | $V_{DS}$=30V,$I_D$=25A ④ |
| $C_{iss}$ | Input Capacitance | -- | 1770 | 2300 | pF | $V_{GS}$=0V,$V_{DS}$=25V,f =1MHz ***See Fig 5*** |
| $C_{oss}$ | Output Capacitance | -- | 590 | 680 | | |
| $C_{rss}$ | Reverse Transfer Capacitance | -- | 220 | 255 | | |
| $t_{d(on)}$ | Turn-On Delay Time | -- | 20 | 40 | ns | $V_{DD}$=30V,$I_D$=50A, $R_G$=9.1Ω ***See Fig 13*** ④⑤ |
| $t_r$ | Rise Time | -- | 16 | 40 | | |
| $t_{d(off)}$ | Turn-Off Delay Time | -- | 68 | 140 | | |
| $t_f$ | Fall Time | -- | 70 | 140 | | |
| $Q_g$ | Total Gate Charge | -- | 64 | 83 | nC | $V_{DS}$=48V,$V_{GS}$=10V, $I_D$=50A ***See Fig 6 & Fig 12*** ④⑤ |
| $Q_{gs}$ | Gate-Source Charge | -- | 12.3 | -- | | |
| $Q_{gd}$ | Gate-Drain( “Miller “) Charge | -- | 23.6 | -- | | |

## Source-Drain Diode Ratings and Characteristics

| Symbol | Characteristic | Min. | Typ. | Max. | Units | Test Condition |
|---|---|---|---|---|---|---|
| $I_S$ | Continuous Source Current | -- | -- | 50 | A | Integral reverse pn-diode in the MOSFET |
| $I_{SM}$ | Pulsed-Source Current ① | -- | -- | 200 | | |
| $V_{SD}$ | Diode Forward Voltage ④ | -- | -- | 1.8 | V | $T_J$=25°C,$I_S$=50A,$V_{GS}$=0V |
| $t_{rr}$ | Reverse Recovery Time | -- | 85 | -- | ns | $T_J$=25°C,$I_F$=50A |
| $Q_{rr}$ | Reverse Recovery Charge | -- | 0.24 | -- | μC | $di_F/dt$=100A/μs ④ |

**Notes ;**

① Repetitive Rating : Pulse Width Limited by Maximum Junction Temperature

② L=0.4mH, $I_{AS}$=50A, $V_{DD}$=25V, $R_G$=27Ω , Starting $T_J$=25°C

③ $I_{SD}$≤50A, di/dt≤350A/μs, $V_{DD}$≤$BV_{DSS}$ , Starting $T_J$=25°C

④ Pulse Test : Pulse Width = 250μs, Duty Cycle ≤ 2%

⑤ Essentially Independent of Operating Temperature

**Fig 1. Output Characteristics**

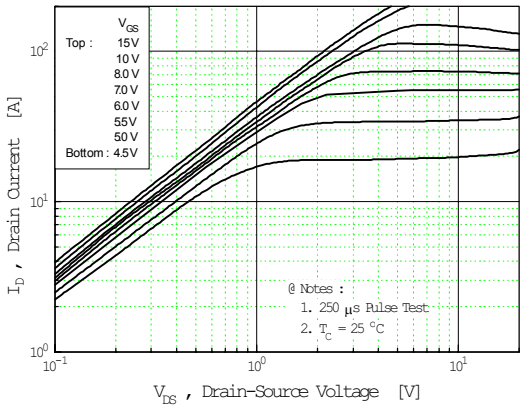


**Fig 2. Transfer Characteristics**

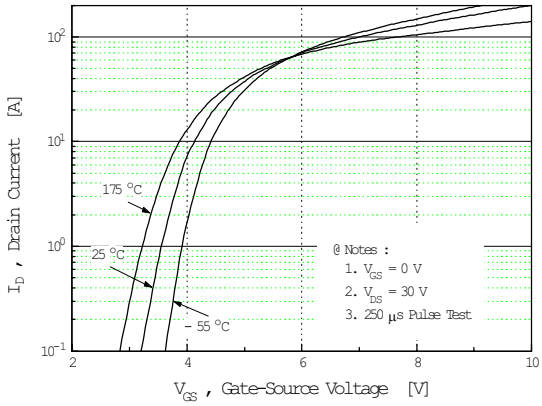


**Fig 3. On-Resistance vs. Drain Current**

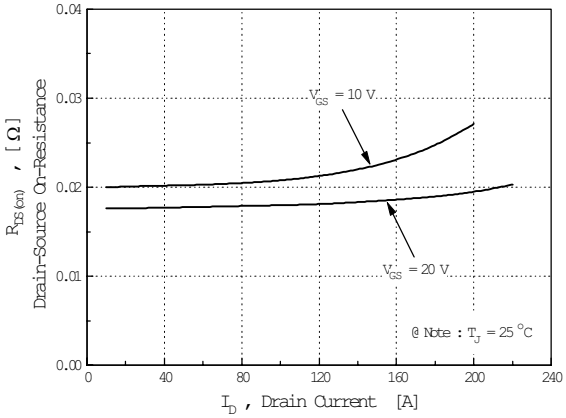


**Fig 4. Source-Drain Diode Forward Voltage**

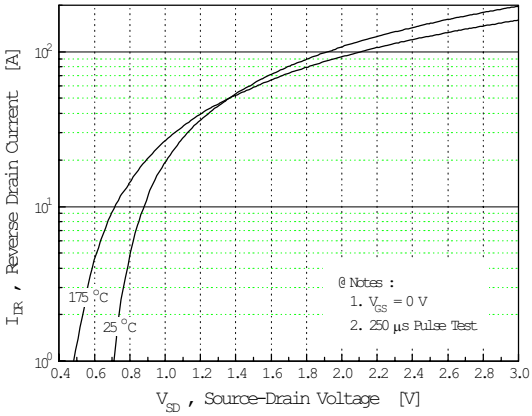


**Fig 5. Capacitance vs. Drain-Source Voltage**

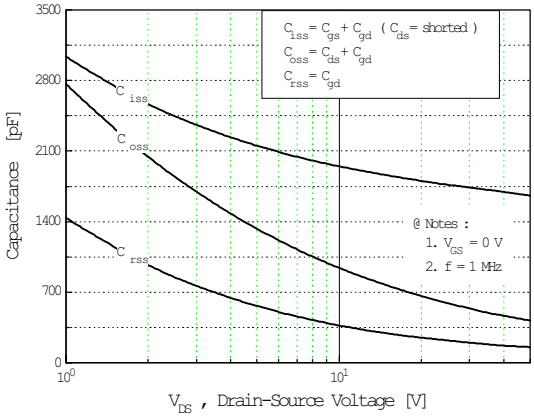


**Fig 6. Gate Charge vs. Gate-Source Voltage**

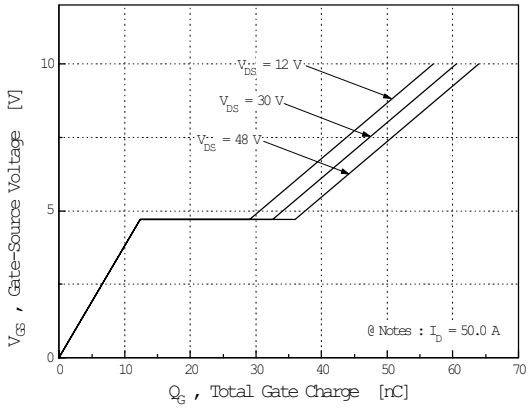

**Fig 7. Breakdown Voltage vs. Temperature**

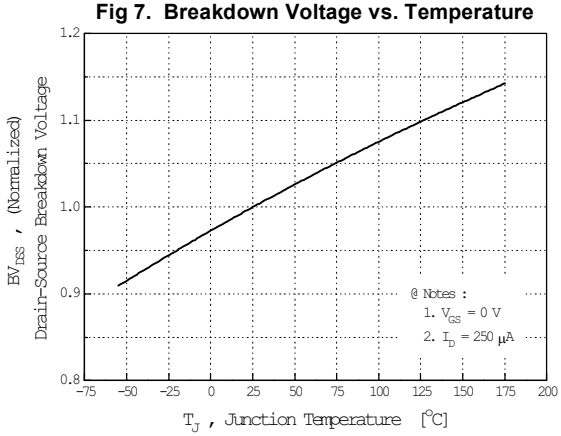


**Fig 8. On-Resistance vs. Temperature**

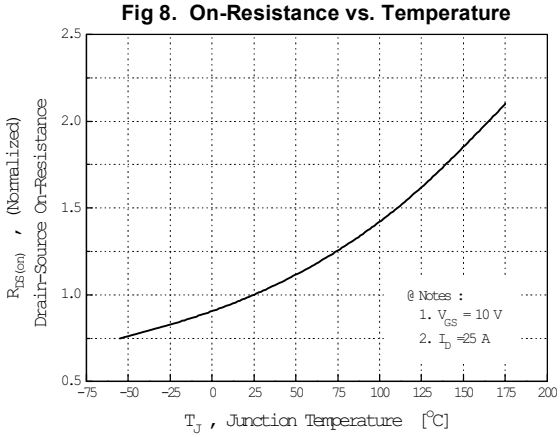


**Fig 9. Max. Safe Operating Area**

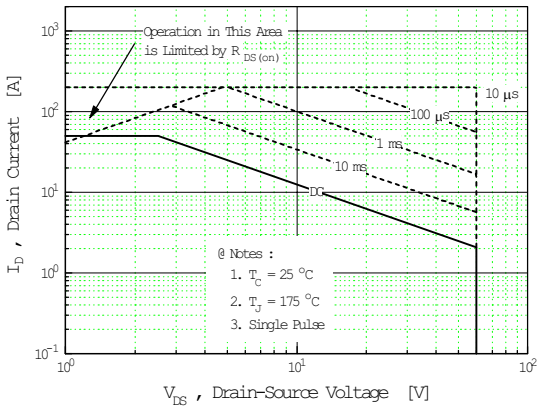


**Fig 10. Max. Drain Current vs. Case Temperature**

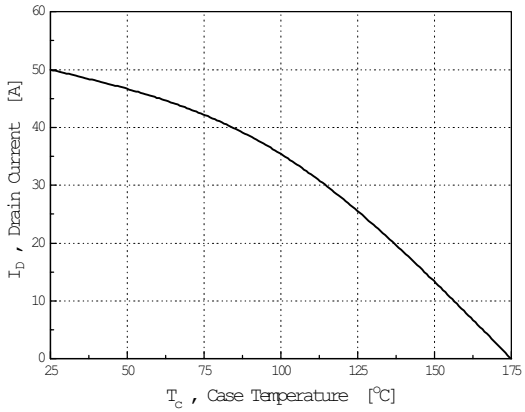


**Fig 11. Thermal Response**

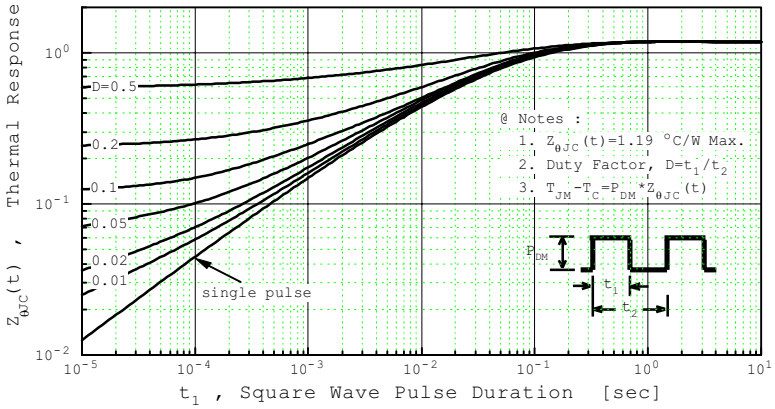

**Fig 12. Gate Charge Test Circuit & Waveform**

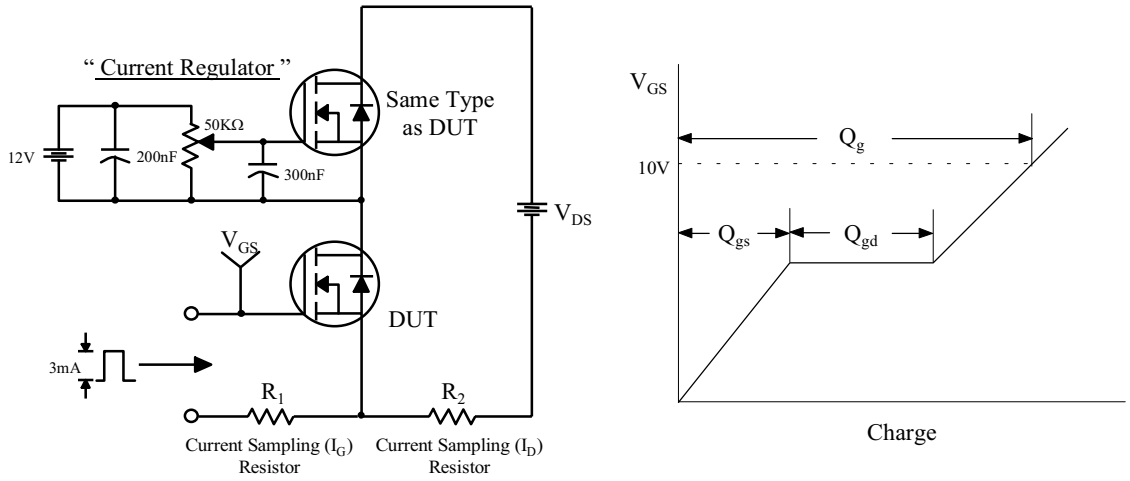


**Fig 13. Resistive Switching Test Circuit & Waveforms**

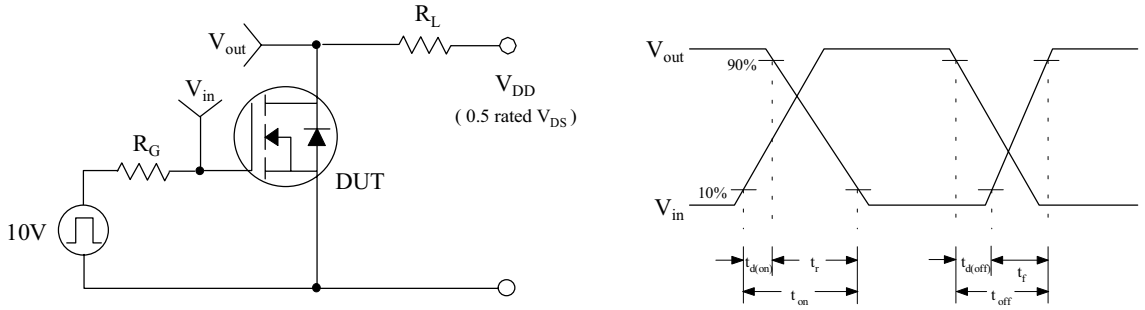


**Fig 14. Unclamped Inductive Switching Test Circuit & Waveforms**

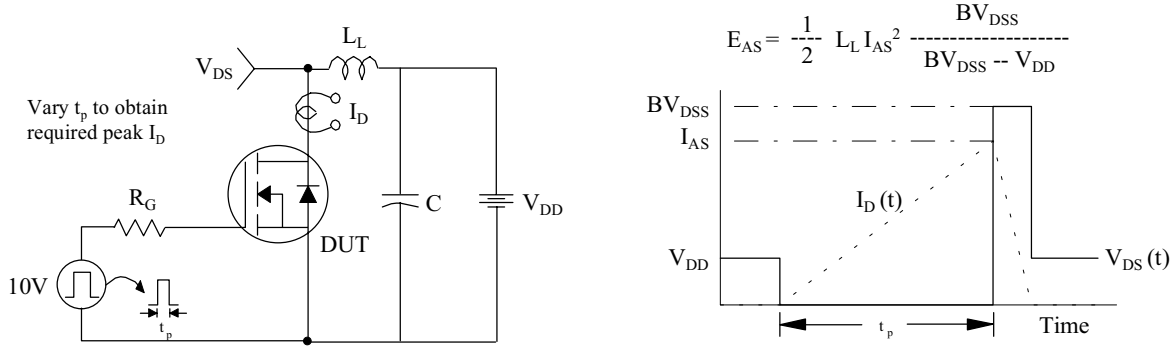

**Fig 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms**