# Advanced Power MOSFET

# IRF710A

## FEATURES

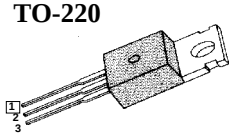
- ♦ Avalanche Rugged Technology
- ♦ Rugged Gate Oxide Technology
- ♦ Lower Input Capacitance
- ♦ Improved Gate Charge
- ♦ Extended Safe Operating Area
- ♦ Lower Leakage Current: 10μA (Max.) @ $V_{DS}$ = 400V
- ♦ Low $R_{DS(ON)}$: 2.815Ω (Typ.)

$BV_{DSS}$ = 400 V

$R_{DS(on)}$ = 3.6Ω

$I_D$ = 2 A

**TO-220**



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

## Absolute Maximum Ratings

| Symbol | Characteristic | Value | Units |
|---|---|---|---|
| $V_{DSS}$ | Drain-to-Source Voltage | 400 | V |
| $I_D$ | Continuous Drain Current ($T_C$=25°C) | 2 | A |
| | Continuous Drain Current ($T_C$=100°C) | 1.3 | |
| $I_{DM}$ | Drain Current-Pulsed (1) | 6 | A |
| $V_{GS}$ | Gate-to-Source Voltage | ±30 | V |
| $E_{AS}$ | Single Pulsed Avalanche Energy (2) | 114 | mJ |
| $I_{AR}$ | Avalanche Current (1) | 2 | A |
| $E_{AR}$ | Repetitive Avalanche Energy (1) | 3.6 | mJ |
| dv/dt | Peak Diode Recovery dv/dt (3) | 4.0 | V/ns |
| $P_D$ | Total Power Dissipation ($T_C$=25°C) | 36 | W |
| | Linear Derating Factor | 0.29 | W/°C |
| $T_J$ , $T_{STG}$ | Operating Junction and Storage Temperature Range | - 55 to +150 | °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 | -- | 3.44 | °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 | 400 | -- | -- | V | $V_{GS}$=0V,$I_D$=250μA |
| $\Delta BV/\Delta T_J$ | Breakdown Voltage Temp. Coeff. | -- | 0.53 | -- | V/°C | $I_D$=250μA ***See Fig 7*** |
| $V_{GS(th)}$ | Gate Threshold Voltage | 2.0 | -- | 4.0 | V | $V_{DS}$=5V,$I_D$=250μA |
| $I_{GSS}$ | Gate-Source Leakage , Forward | -- | -- | 100 | nA | $V_{GS}$=30V |
| | Gate-Source Leakage , Reverse | -- | -- | -100 | | $V_{GS}$=-30V |
| $I_{DSS}$ | Drain-to-Source Leakage Current | -- | -- | 10 | μA | $V_{DS}$=400V |
| | | -- | -- | 100 | | $V_{DS}$=320V,$T_C$=125°C |
| $R_{DS(on)}$ | Static Drain-Source On-State Resistance | -- | -- | 3.6 | Ω | $V_{GS}$=10V,$I_D$=1A (4) |
| $g_{fs}$ | Forward Transconductance | -- | 1.29 | -- | ℧ | $V_{DS}$=50V,$I_D$=1A (4) |
| $C_{iss}$ | Input Capacitance | -- | 215 | 280 | pF | $V_{GS}$=0V,$V_{DS}$=25V,f =1MHz ***See Fig 5*** |
| $C_{oss}$ | Output Capacitance | -- | 35 | 42 | | |
| $C_{rss}$ | Reverse Transfer Capacitance | -- | 13 | 17 | | |
| $t_{d(on)}$ | Turn-On Delay Time | -- | 11 | 30 | ns | $V_{DD}$=200V,$I_D$=2A, $R_G$=24Ω ***See Fig 13*** (4) (5) |
| $t_r$ | Rise Time | -- | 15 | 40 | | |
| $t_{d(off)}$ | Turn-Off Delay Time | -- | 38 | 90 | | |
| $t_f$ | Fall Time | -- | 13 | 35 | | |
| $Q_g$ | Total Gate Charge | -- | 10 | 14 | nC | $V_{DS}$=320V,$V_{GS}$=10V, $I_D$=2A ***See Fig 6 & Fig 12*** (4) (5) |
| $Q_{gs}$ | Gate-Source Charge | -- | 1.8 | -- | | |
| $Q_{gd}$ | Gate-Drain (. Miller. ) Charge | -- | 5.4 | -- | | |

## Source-Drain Diode Ratings and Characteristics

| Symbol | Characteristic | Min. | Typ. | Max. | Units | Test Condition |
|---|---|---|---|---|---|---|
| $I_S$ | Continuous Source Current | -- | -- | 2 | A | Integral reverse pn-diode in the MOSFET |
| $I_{SM}$ | Pulsed-Source Current (1) | -- | -- | 6 | | |
| $V_{SD}$ | Diode Forward Voltage (4) | -- | -- | 1.5 | V | $T_J$=25°C,$I_S$=2A,$V_{GS}$=0V |
| $t_{rr}$ | Reverse Recovery Time | -- | 224 | -- | ns | $T_J$=25°C,$I_F$=2A |
| $Q_{rr}$ | Reverse Recovery Charge | -- | 0.87 | -- | μC | $di_F/dt$=100A/μs (4) |

**Notes;**

(1) Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature

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

(3) $I_{SD}$ ≤ 2A, di/dt ≤ 80A/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

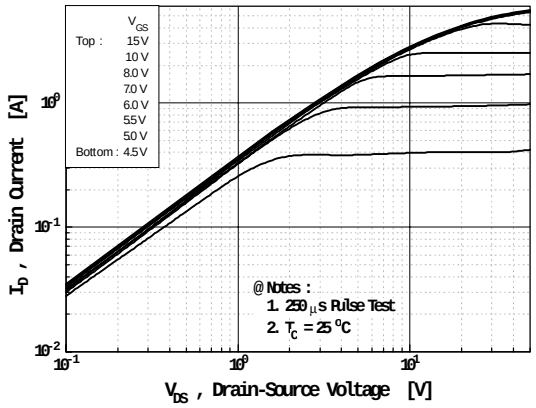



Fig 2. Transfer Characteristics

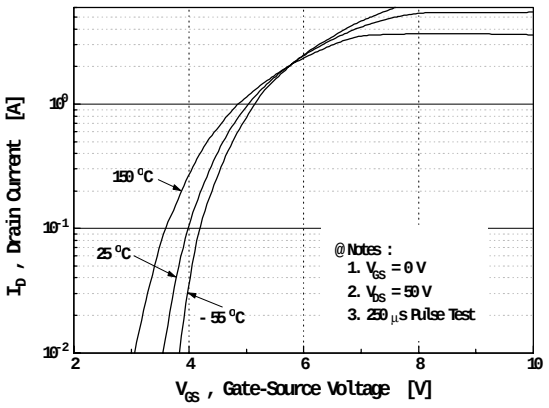



Fig 3. On-Resistance vs. Drain Current

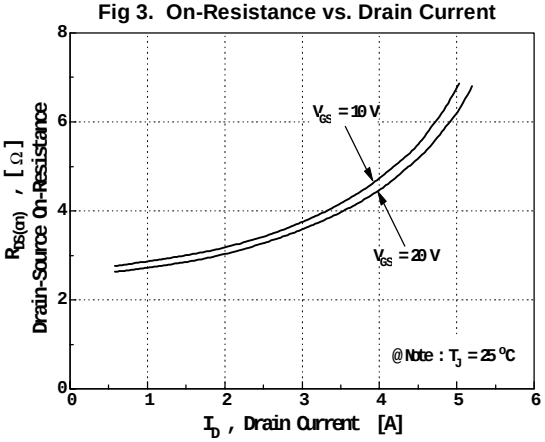



Fig 4. Source-Drain Diode Forward Voltage

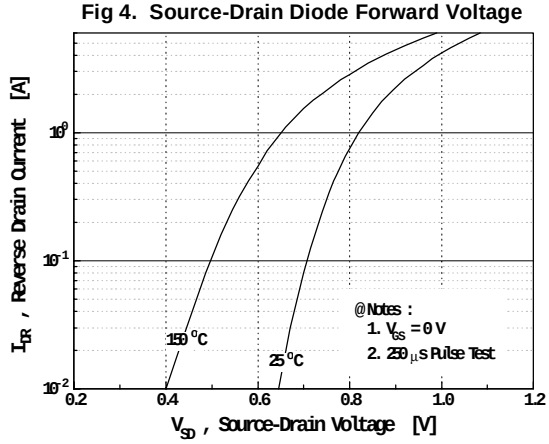



Fig 5. Capacitance vs. Drain-Source Voltage

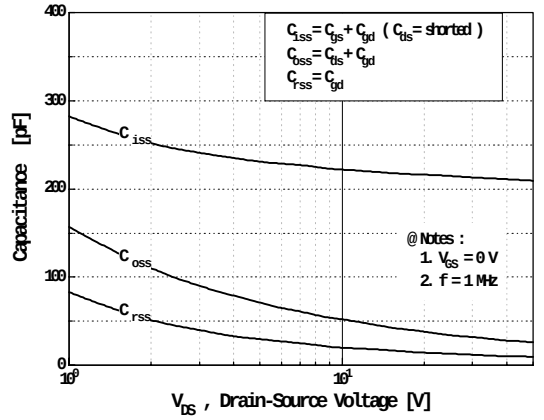



Fig 6. Gate Charge vs. Gate-Source Voltage

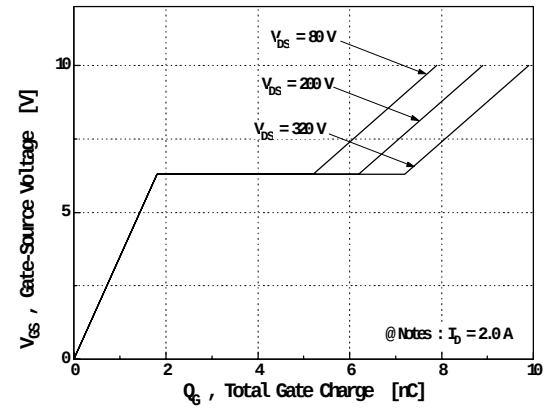


**Fig 7. Breakdown Voltage vs. Temperature**

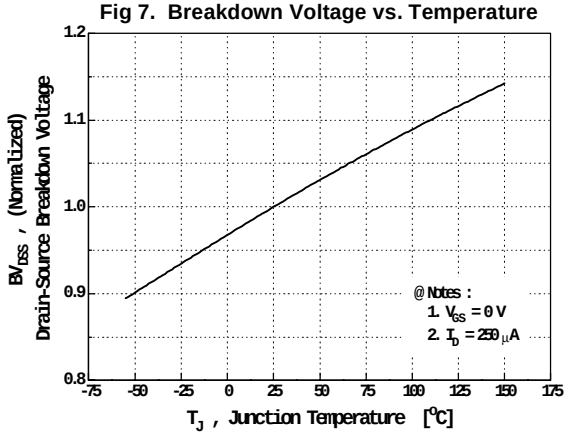



**Fig 8. On-Resistance vs. Temperature**

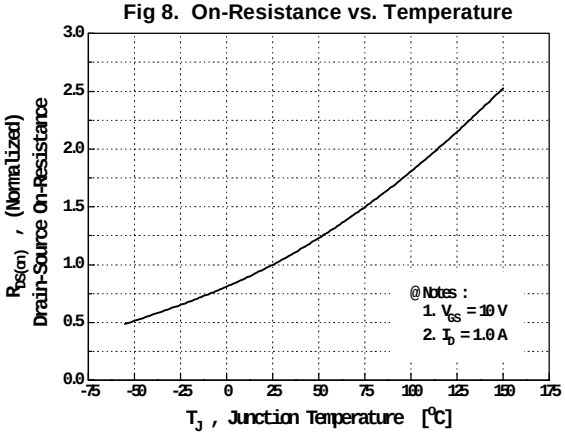



**Fig 9. Max. Safe Operating Area**

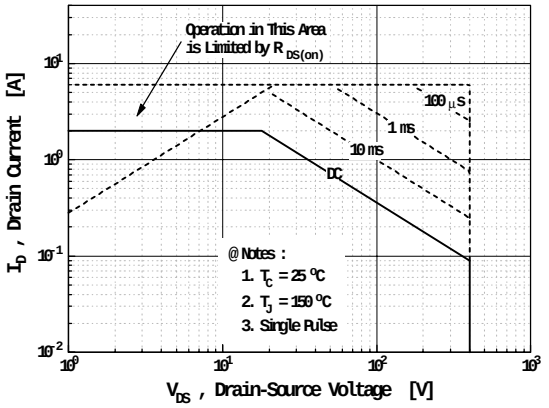



**Fig 10. Max. Drain Current vs. Case Temperature**

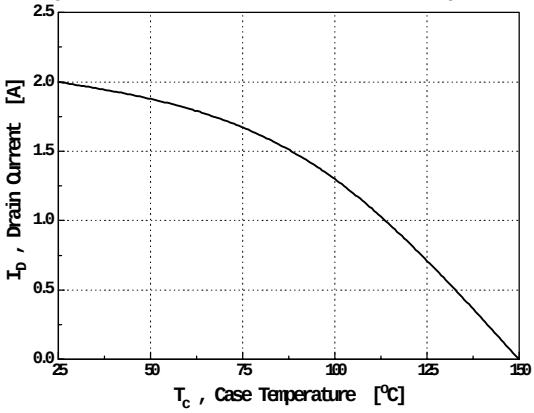



**Fig 11. Thermal Response**

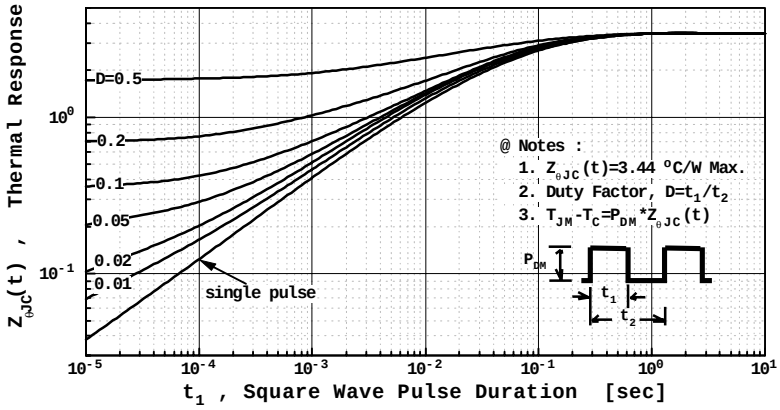


**Fig 12. Gate Charge Test Circuit & Waveform**

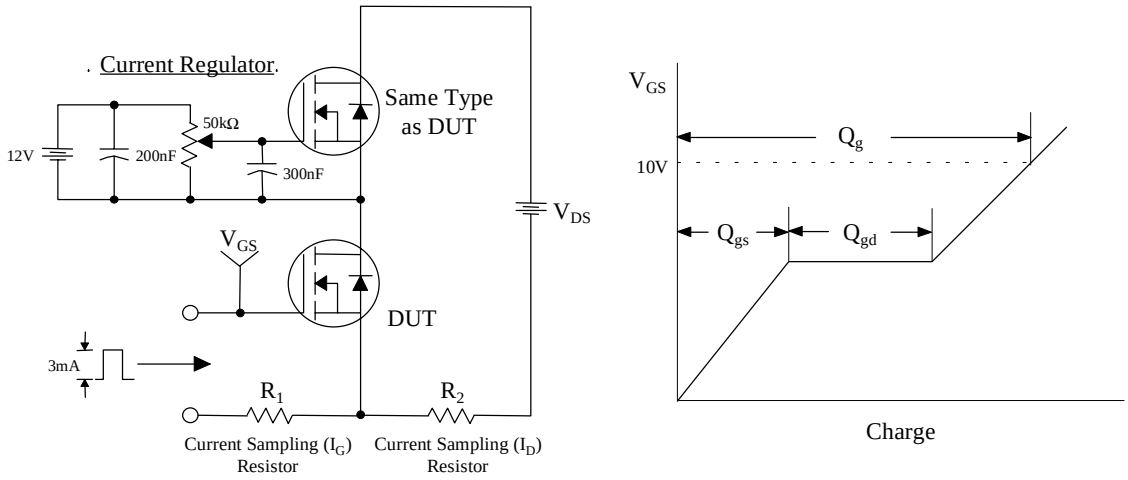



**Fig 13. Resistive Switching Test Circuit & Waveforms**

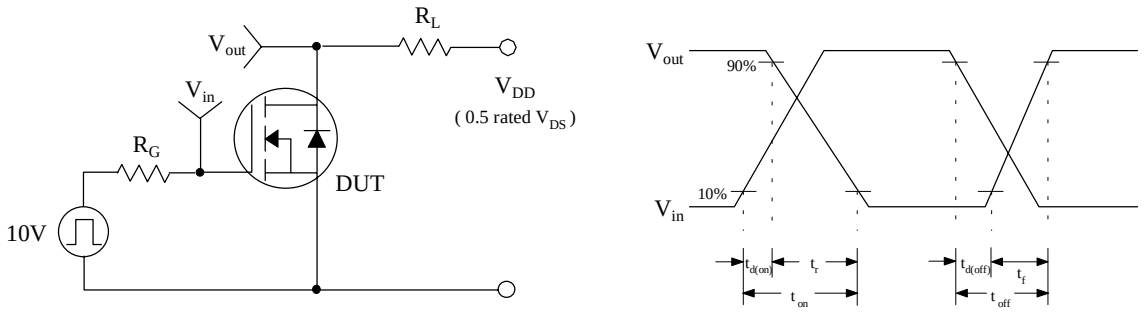



**Fig 14. Unclamped Inductive Switching Test Circuit & Waveforms**

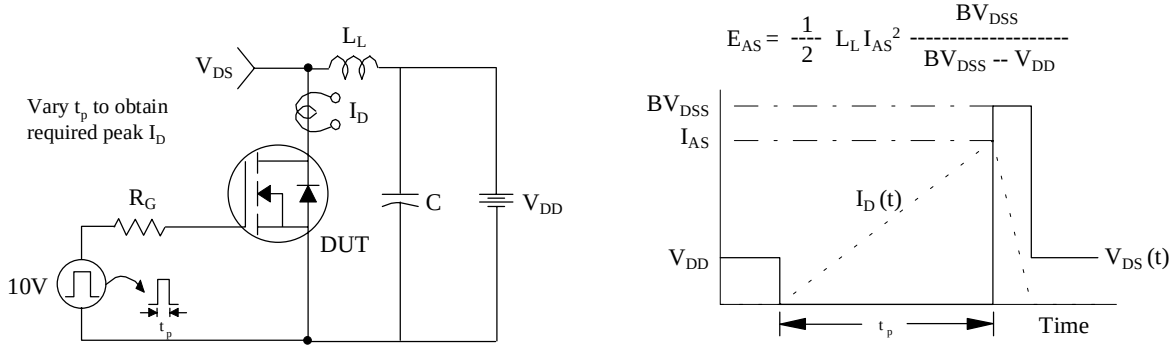
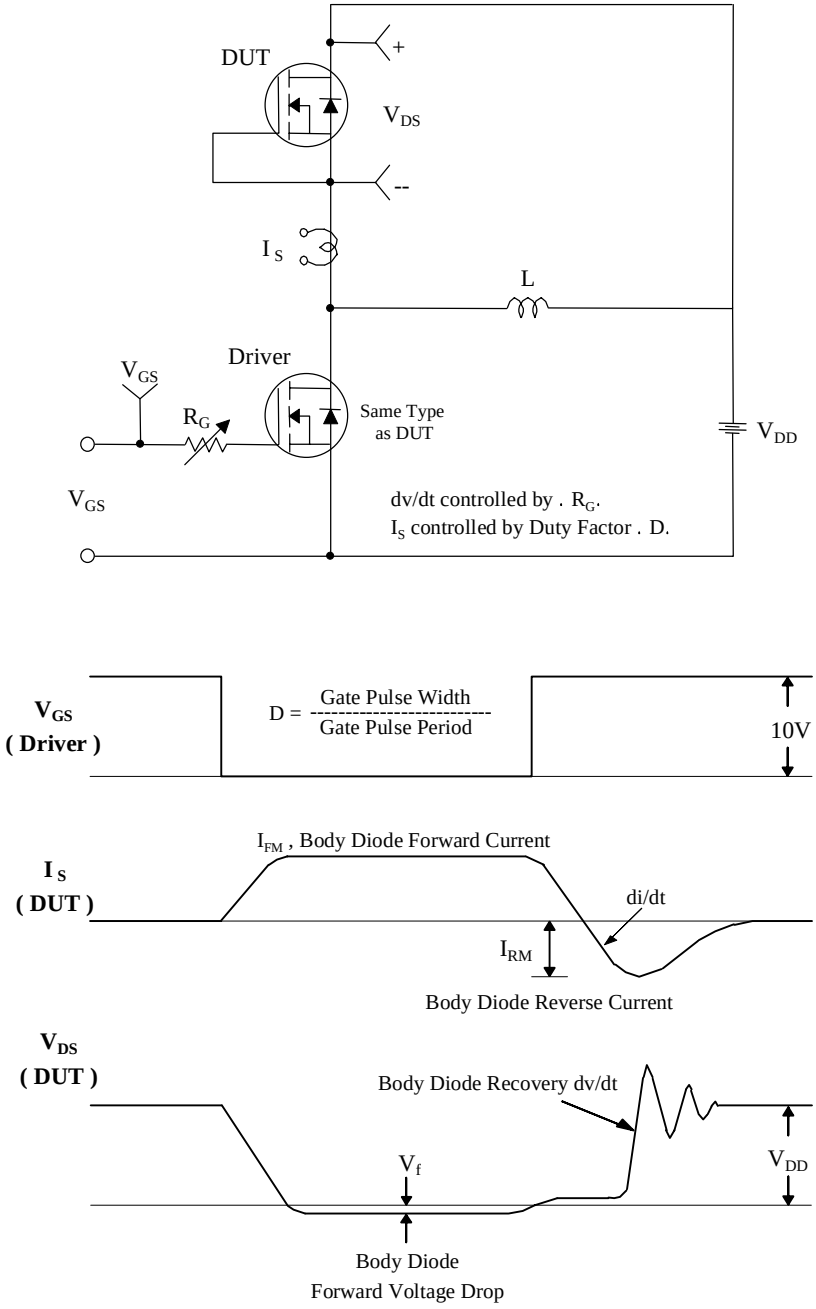


**Fig 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms**



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