

# Advanced Power MOSFET

# IRFW/I820A

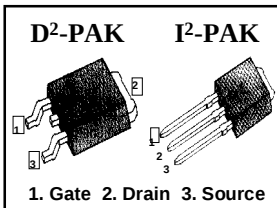
## FEATURES

- ◆ Avalanche Rugged Technology
- ◆ Rugged Gate Oxide Technology
- ◆ Lower Input Capacitance
- ◆ Improved Gate Charge
- ◆ Extended Safe Operating Area
- ◆ Lower Leakage Current: 10μA (Max.) @  $V_{DS} = 500V$
- ◆ Lower  $R_{DS(on)}$ : 2.000Ω (Typ.)

$$BV_{DSS} = 500 V$$

$$R_{DS(on)} = 3.0\Omega$$

$$I_D = 2.5 A$$



## Absolute Maximum Ratings

| Symbol         | Characteristic                                                          | Value        | Units         |
|----------------|-------------------------------------------------------------------------|--------------|---------------|
| $V_{DSS}$      | Drain-to-Source Voltage                                                 | 500          | V             |
| $I_D$          | Continuous Drain Current ( $T_C=25^\circ C$ )                           | 2.5          | A             |
|                | Continuous Drain Current ( $T_C=100^\circ C$ )                          | 1.6          |               |
| $I_{DM}$       | Drain Current-Pulsed (1)                                                | 8            | A             |
| $V_{GS}$       | Gate-to-Source Voltage                                                  | $\pm 30$     | V             |
| $E_{AS}$       | Single Pulsed Avalanche Energy (2)                                      | 208          | mJ            |
| $I_{AR}$       | Avalanche Current (1)                                                   | 2.5          | A             |
| $E_{AR}$       | Repetitive Avalanche Energy (1)                                         | 4.9          | mJ            |
| dv/dt          | Peak Diode Recovery dv/dt (3)                                           | 3.5          | V/ns          |
| $P_D$          | Total Power Dissipation ( $T_A=25^\circ C$ ) *                          | 3.1          | W             |
|                | Total Power Dissipation ( $T_C=25^\circ C$ )                            | 49           | W             |
|                | Linear Derating Factor                                                  | 0.39         | W/ $^\circ C$ |
| $T_J, T_{STG}$ | Operating Junction and Storage Temperature Range                        | - 55 to +150 | $^\circ C$    |
| $T_L$          | 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      | --   | 2.57 | $^\circ C/W$ |
| $R_{\theta JA}$ | Junction-to-Ambient * | --   | 40   |              |
| $R_{\theta JA}$ | Junction-to-Ambient   | --   | 62.5 |              |

\* When mounted on the minimum pad size recommended (PCB Mount).

**Electrical Characteristics** ( $T_C=25^\circ\text{C}$  unless otherwise specified)

| Symbol                 | Characteristic                          | Min. | Typ. | Max. | Units      | Test Condition                                                                    |
|------------------------|-----------------------------------------|------|------|------|------------|-----------------------------------------------------------------------------------|
| $BV_{DSS}$             | Drain-Source Breakdown Voltage          | 500  | --   | --   | V          | $V_{GS}=0V, I_D=250\mu A$                                                         |
| $\Delta BV/\Delta T_J$ | Breakdown Voltage Temp. Coeff.          | --   | 0.68 | --   | V/°C       | $I_D=250\mu A$ <b>See Fig 7</b>                                                   |
| $V_{GS(th)}$           | Gate Threshold Voltage                  | 2.0  | --   | 4.0  | V          | $V_{DS}=5V, I_D=250\mu A$                                                         |
| $I_{GSS}$              | 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   | $\mu A$    | $V_{DS}=500V$                                                                     |
|                        |                                         | --   | --   | 100  |            | $V_{DS}=400V, T_C=125^\circ\text{C}$                                              |
| $R_{DS(on)}$           | Static Drain-Source On-State Resistance | --   | --   | 3.0  | $\Omega$   | $V_{GS}=10V, I_D=1.25A$ (4)                                                       |
| $g_{fs}$               | Forward Transconductance                | --   | 2.06 | --   | $\text{S}$ | $V_{DS}=50V, I_D=1.25A$ (4)                                                       |
| $C_{iss}$              | Input Capacitance                       | --   | 390  | 510  | pF         | $V_{GS}=0V, V_{DS}=25V, f=1\text{MHz}$<br><b>See Fig 5</b>                        |
| $C_{oss}$              | Output Capacitance                      | --   | 50   | 60   |            |                                                                                   |
| $C_{rss}$              | Reverse Transfer Capacitance            | --   | 22   | 26   |            |                                                                                   |
| $t_{d(on)}$            | Turn-On Delay Time                      | --   | 12   | 35   | ns         | $V_{DD}=250V, I_D=2.5A,$<br>$R_G=18\Omega$<br><b>See Fig 13</b> (4) (5)           |
| $t_r$                  | Rise Time                               | --   | 15   | 40   |            |                                                                                   |
| $t_{d(off)}$           | Turn-Off Delay Time                     | --   | 55   | 120  |            |                                                                                   |
| $t_f$                  | Fall Time                               | --   | 17   | 45   |            |                                                                                   |
| $Q_g$                  | Total Gate Charge                       | --   | 19   | 26   | nC         | $V_{DS}=400V, V_{GS}=10V,$<br>$I_D=2.5A$<br><b>See Fig 6 &amp; Fig 12</b> (4) (5) |
| $Q_{gs}$               | Gate-Source Charge                      | --   | 2.6  | --   |            |                                                                                   |
| $Q_{gd}$               | Gate-Drain (. Miller. ) Charge          | --   | 10   | --   |            |                                                                                   |

**Source-Drain Diode Ratings and Characteristics**

| Symbol   | Characteristic            | Min. | Typ. | Max. | Units   | Test Condition                              |
|----------|---------------------------|------|------|------|---------|---------------------------------------------|
| $I_S$    | Continuous Source Current | --   | --   | 2.5  | A       | Integral reverse pn-diode in the MOSFET     |
| $I_{SM}$ | Pulsed-Source Current (1) | --   | --   | 8    |         |                                             |
| $V_{SD}$ | Diode Forward Voltage (4) | --   | --   | 1.4  | V       | $T_J=25^\circ\text{C}, I_S=2.5A, V_{GS}=0V$ |
| $t_{rr}$ | Reverse Recovery Time     | --   | 235  | --   | ns      | $T_J=25^\circ\text{C}, I_F=2.5A$            |
| $Q_{rr}$ | Reverse Recovery Charge   | --   | 1.2  | --   | $\mu C$ | $di_F/dt=100A/\mu s$ (4)                    |

**Notes;**

- (1) Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature
- (2)  $L=60\text{mH}, I_{AS}=2.5A, V_{DD}=50V, R_G=27\Omega$ , Starting  $T_J=25^\circ\text{C}$
- (3)  $I_{SD} \leq 2.5A, di/dt \leq 100A/\mu s, V_{DD} \leq BV_{DSS}$ , Starting  $T_J=25^\circ\text{C}$
- (4) Pulse Test: Pulse Width = 250 $\mu s$ , Duty Cycle  $\leq 2\%$
- (5) Essentially Independent of Operating Temperature

Fig 1. Output Characteristics

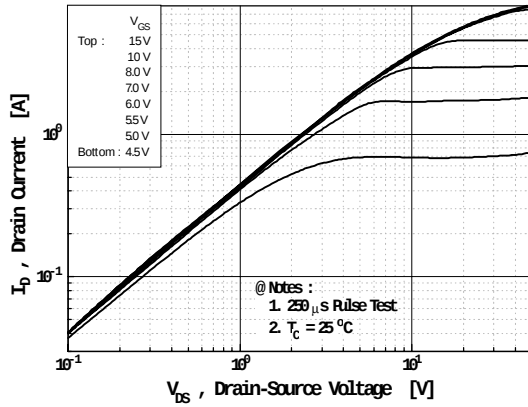


Fig 2. Transfer Characteristics

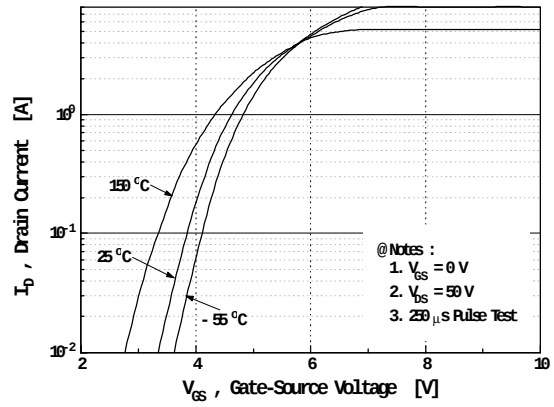


Fig 3. On-Resistance vs. Drain Current

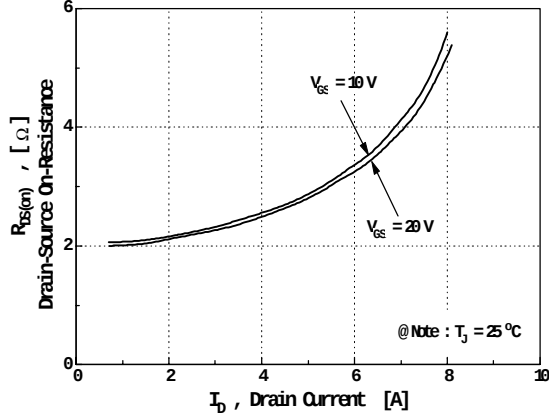


Fig 4. Source-Drain Diode Forward Voltage

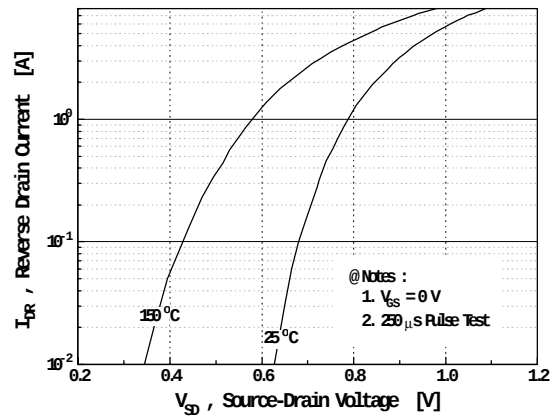


Fig 5. Capacitance vs. Drain-Source Voltage

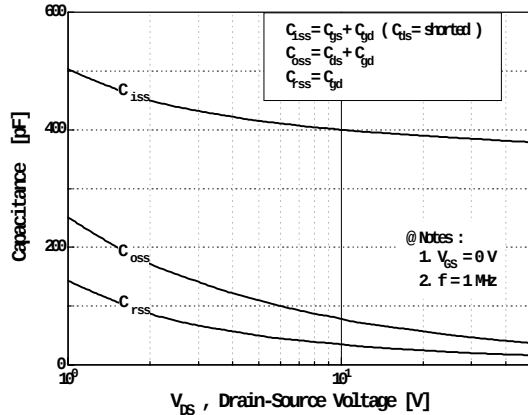


Fig 6. Gate Charge vs. Gate-Source Voltage

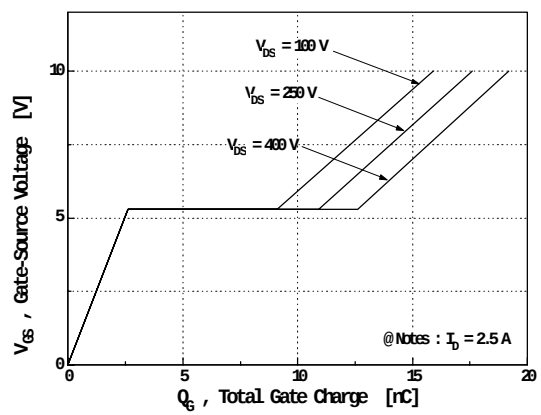


Fig 7. Breakdown Voltage vs. Temperature

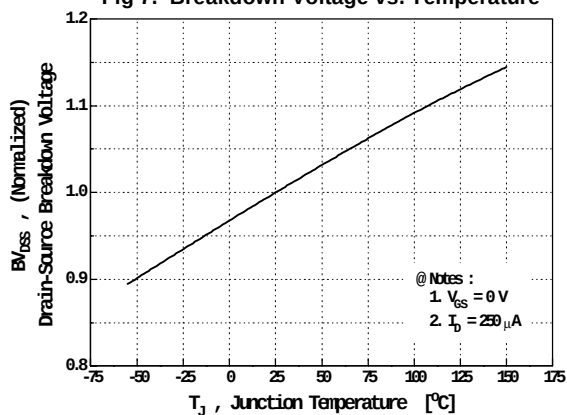


Fig 8. On-Resistance vs. Temperature

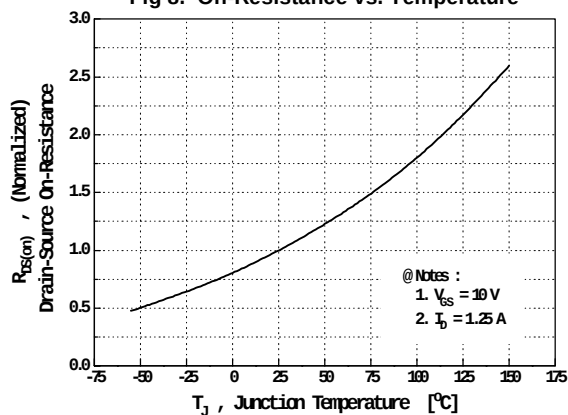


Fig 9. Max. Safe Operating Area

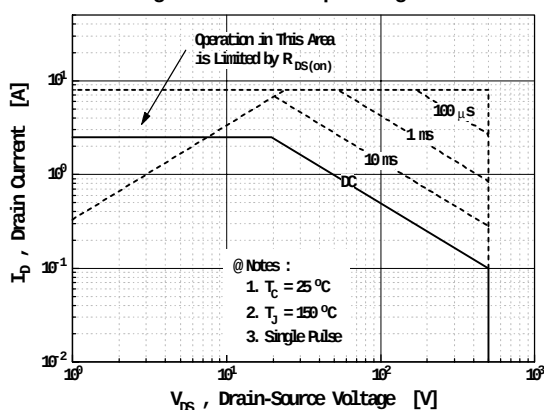


Fig 10. Max. Drain Current vs. Case Temperature

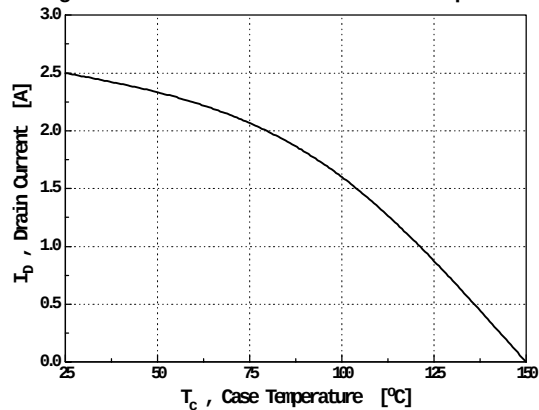
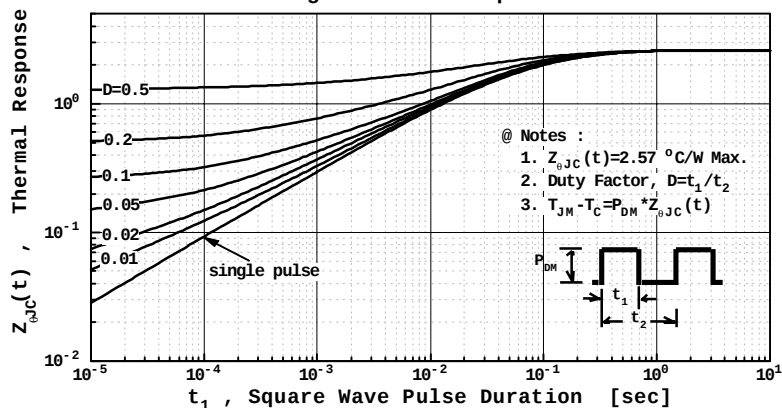
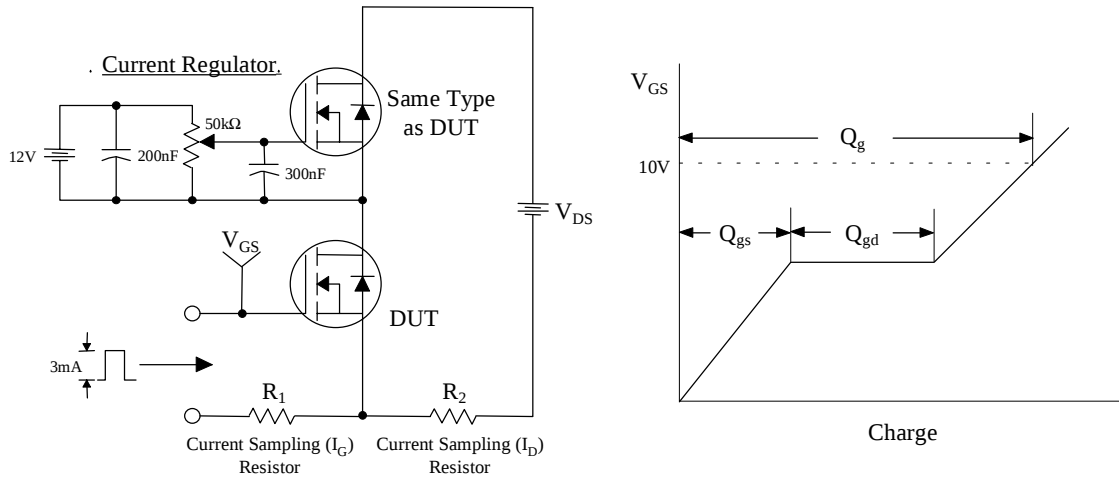


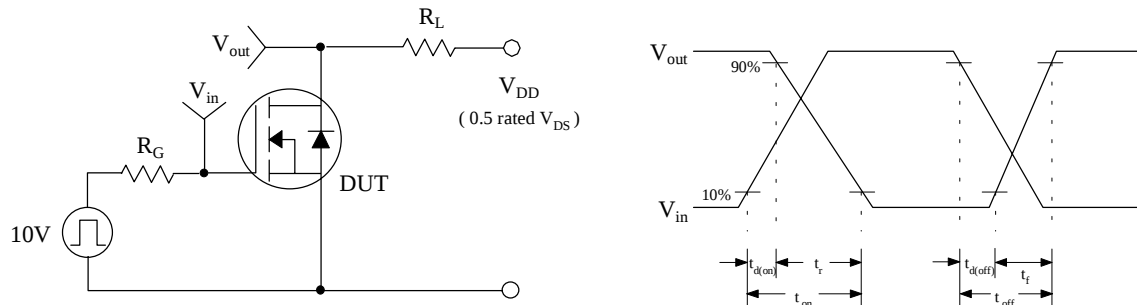
Fig 11. Thermal Response



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



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



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

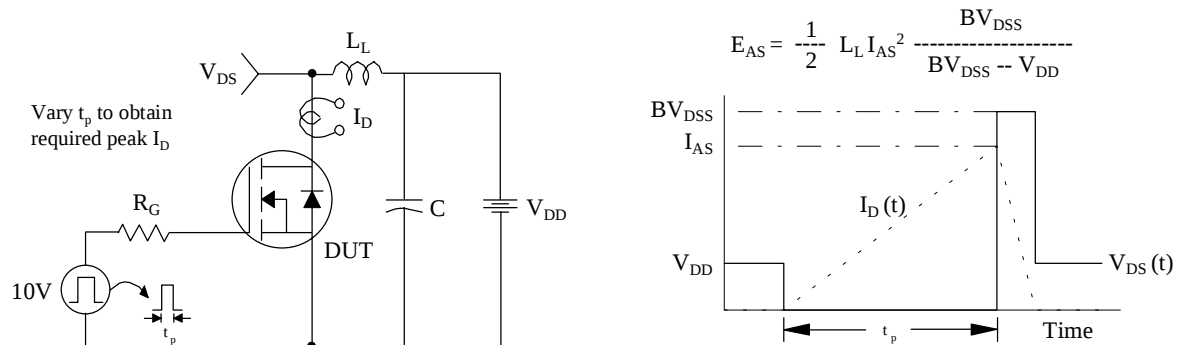
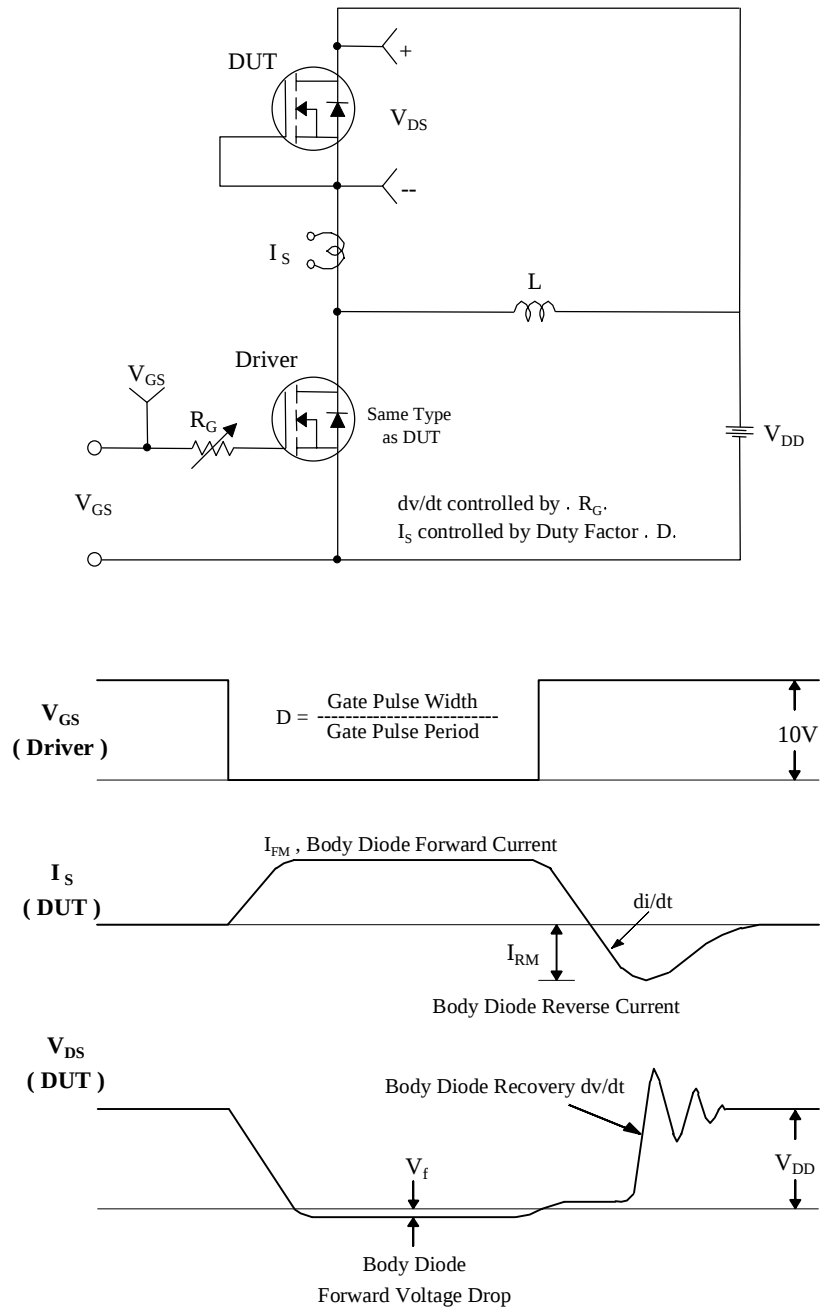


Fig 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms



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| FACT Quiet Series™   | Quiet Series™ |
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