

## Advanced Power MOSFET

## IRFW/I510A

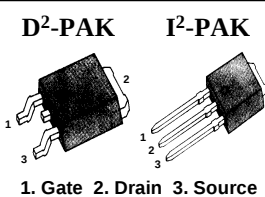
### FEATURES

- Avalanche Rugged Technology
- Rugged Gate Oxide Technology
- Lower Input Capacitance
- Improved Gate Charge
- Extended Safe Operating Area
- 175°C Operating Temperature
- Lower Leakage Current : 10  $\mu$ A (Max.) @  $V_{DS} = 100V$
- Lower  $R_{DS(ON)}$  : 0.289  $\Omega$  (Typ.)

$$BV_{DSS} = 100 V$$

$$R_{DS(on)} = 0.4 \Omega$$

$$I_D = 5.6 A$$



### Absolute Maximum Ratings

| Symbol         | Characteristic                                                          | Value        | Units         |
|----------------|-------------------------------------------------------------------------|--------------|---------------|
| $V_{DSS}$      | Drain-to-Source Voltage                                                 | 100          | V             |
| $I_D$          | Continuous Drain Current ( $T_C=25^\circ C$ )                           | 5.6          | A             |
|                | Continuous Drain Current ( $T_C=100^\circ C$ )                          | 4            |               |
| $I_{DM}$       | Drain Current-Pulsed ①                                                  | 20           | A             |
| $V_{GS}$       | Gate-to-Source Voltage                                                  | + 20         | V             |
| $E_{AS}$       | Single Pulsed Avalanche Energy ②                                        | 63           | mJ            |
| $I_{AR}$       | Avalanche Current ①                                                     | 5.6          | A             |
| $E_{AR}$       | Repetitive Avalanche Energy ①                                           | 3.3          | mJ            |
| dv/dt          | Peak Diode Recovery dv/dt ③                                             | 6.5          | V/ns          |
| $P_D$          | Total Power Dissipation ( $T_A=25^\circ C$ ) *                          | 3.8          | W             |
|                | Total Power Dissipation ( $T_C=25^\circ C$ )                            | 33           | W             |
|                | Linear Derating Factor                                                  | 0.22         | W/ $^\circ C$ |
| $T_J, T_{STG}$ | Operating Junction and Storage Temperature Range                        | - 55 to +175 | $^\circ C$    |
| $T_L$          | 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      | --   | 4.51 | $^\circ C/W$ |
| $R_{\theta JA}$ | 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          | 100  | --   | --   | V                   | $V_{GS}=0V, I_D=250\mu A$                                                   |
| $\Delta BV/\Delta T_J$ | Breakdown Voltage Temp. Coeff.          | --   | 0.11 | --   | V/ $^\circ\text{C}$ | $I_D=250\mu A$ <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                  | $V_{GS}=20V$                                                                |
|                        | Gate-Source Leakage, Reverse            | --   | --   | -100 |                     | $V_{GS}=-20V$                                                               |
| $I_{DSS}$              | Drain-to-Source Leakage Current         | --   | --   | 10   | $\mu A$             | $V_{DS}=100V$                                                               |
|                        |                                         | --   | --   | 100  |                     | $V_{DS}=80V, T_C=150^\circ\text{C}$                                         |
| $R_{DS(on)}$           | Static Drain-Source On-State Resistance | --   | --   | 0.4  | $\Omega$            | $V_{GS}=10V, I_D=2.8A$ ④                                                    |
| $g_{fs}$               | Forward Transconductance                | --   | 3.49 | --   | $\Omega$            | $V_{DS}=40V, I_D=2.8A$ ④                                                    |
| $C_{iss}$              | Input Capacitance                       | --   | 190  | 240  | pF                  | $V_{GS}=0V, V_{DS}=25V, f=1\text{MHz}$<br><b>See Fig 5</b>                  |
| $C_{oss}$              | Output Capacitance                      | --   | 55   | 65   |                     |                                                                             |
| $C_{rss}$              | Reverse Transfer Capacitance            | --   | 21   | 25   |                     |                                                                             |
| $t_{d(on)}$            | Turn-On Delay Time                      | --   | 10   | 30   | ns                  | $V_{DD}=50V, I_D=5.6A,$<br>$R_G=24\Omega$<br><b>See Fig 13</b> ④⑤           |
| $t_r$                  | Rise Time                               | --   | 14   | 40   |                     |                                                                             |
| $t_{d(off)}$           | Turn-Off Delay Time                     | --   | 28   | 70   |                     |                                                                             |
| $t_f$                  | Fall Time                               | --   | 18   | 50   |                     |                                                                             |
| $Q_g$                  | Total Gate Charge                       | --   | 8.5  | 12   | nC                  | $V_{DS}=80V, V_{GS}=10V,$<br>$I_D=5.6A$<br><b>See Fig 6 &amp; Fig 12</b> ④⑤ |
| $Q_{gs}$               | Gate-Source Charge                      | --   | 1.6  | --   |                     |                                                                             |
| $Q_{gd}$               | Gate-Drain("Miller") Charge             | --   | 4.1  | --   |                     |                                                                             |

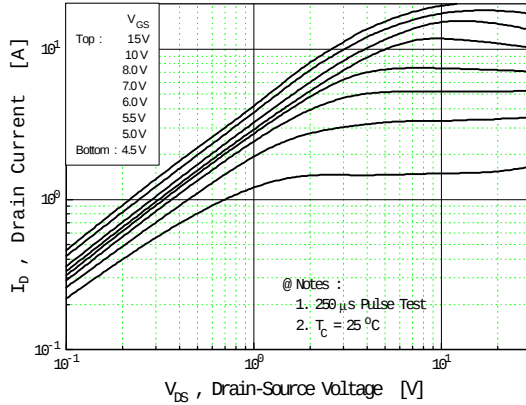
### Source-Drain Diode Ratings and Characteristics

| Symbol   | Characteristic            | Min. | Typ. | Max. | Units   | Test Condition                              |
|----------|---------------------------|------|------|------|---------|---------------------------------------------|
| $I_S$    | Continuous Source Current | --   | --   | 5.6  | A       | Integral reverse pn-diode in the MOSFET     |
| $I_{SM}$ | Pulsed-Source Current ①   | --   | --   | 20   |         |                                             |
| $V_{SD}$ | Diode Forward Voltage ④   | --   | --   | 1.5  | V       | $T_J=25^\circ\text{C}, I_S=5.6A, V_{GS}=0V$ |
| $t_{rr}$ | Reverse Recovery Time     | --   | 85   | --   | ns      | $T_J=25^\circ\text{C}, I_F=5.6A$            |
| $Q_{rr}$ | Reverse Recovery Charge   | --   | 0.23 | --   | $\mu C$ | $di_F/dt=100A/\mu s$ ④                      |

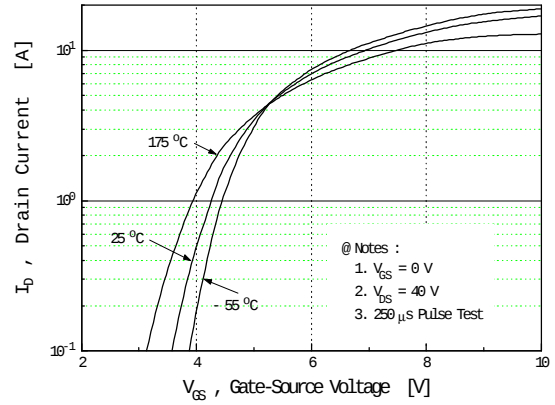
#### Notes ;

- ① Repetitive Rating : Pulse Width Limited by Maximum Junction Temperature
- ②  $L=3mH, I_{AS}=5.6A, V_{DD}=25V, R_G=27\Omega$ , Starting  $T_J=25^\circ\text{C}$
- ③  $I_{SD} \leq 5.6A, di/dt \leq 250A/\mu s, V_{DD} \leq BV_{DSS}$ , 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

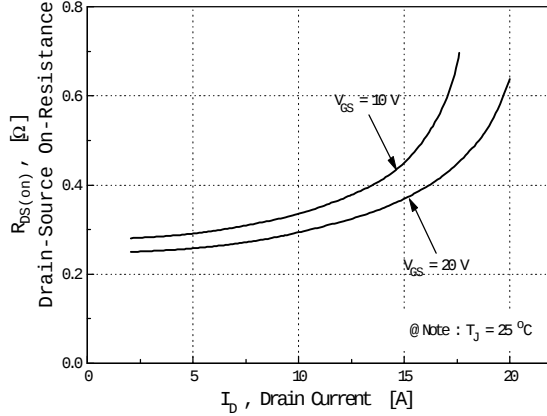
**Fig 1. Output Characteristics**



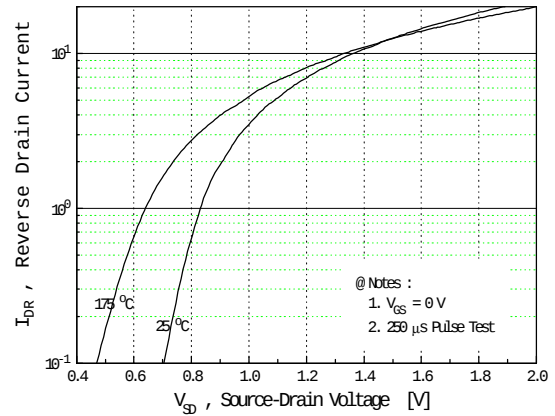
**Fig 2. Transfer Characteristics**



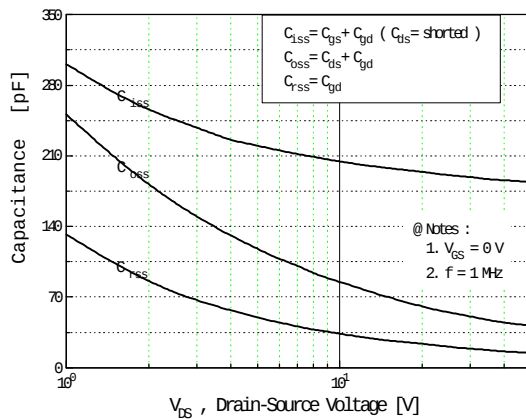
**Fig 3. On-Resistance vs. Drain Current**



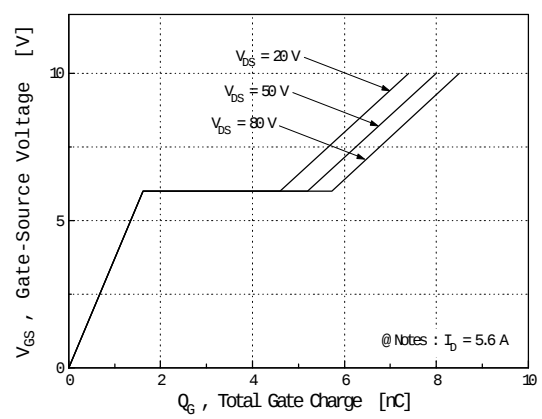
**Fig 4. Source-Drain Diode Forward Voltage**



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

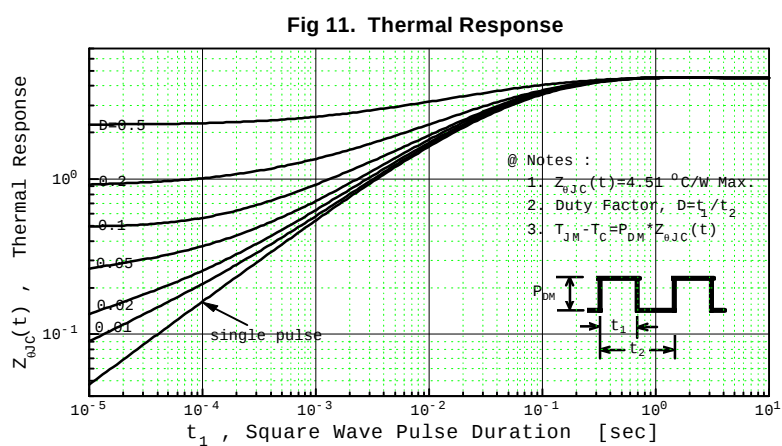
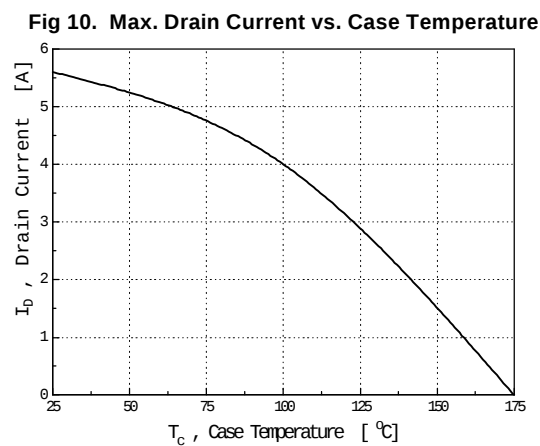
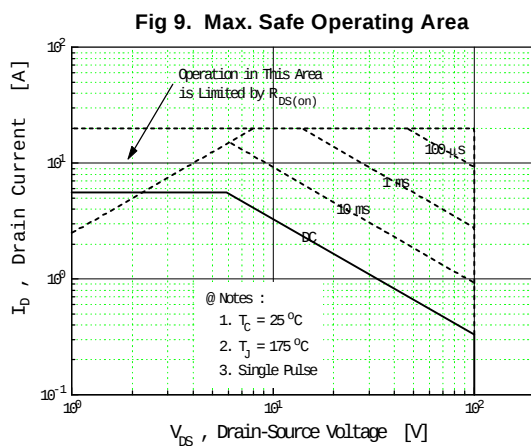
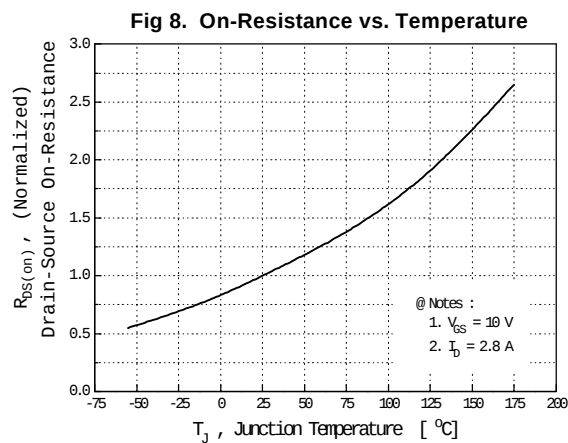
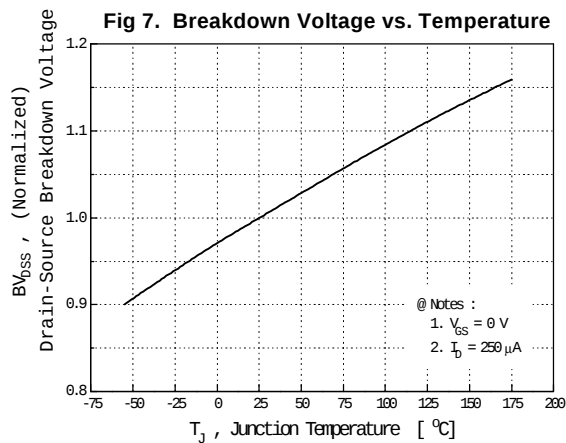


**Fig 6. Gate Charge vs. Gate-Source Voltage**

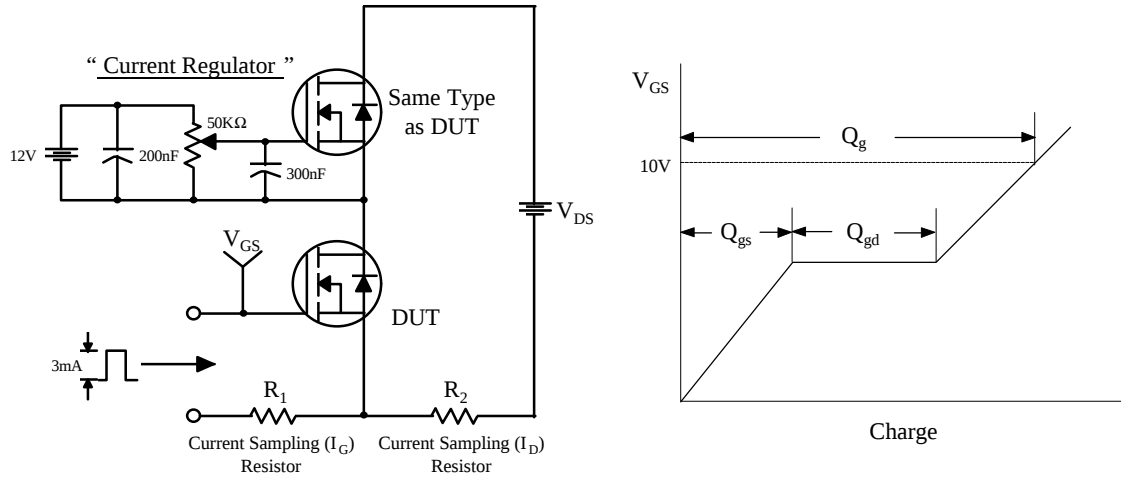


# IRFW/I510A

## N-CHANNEL POWER MOSFET



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



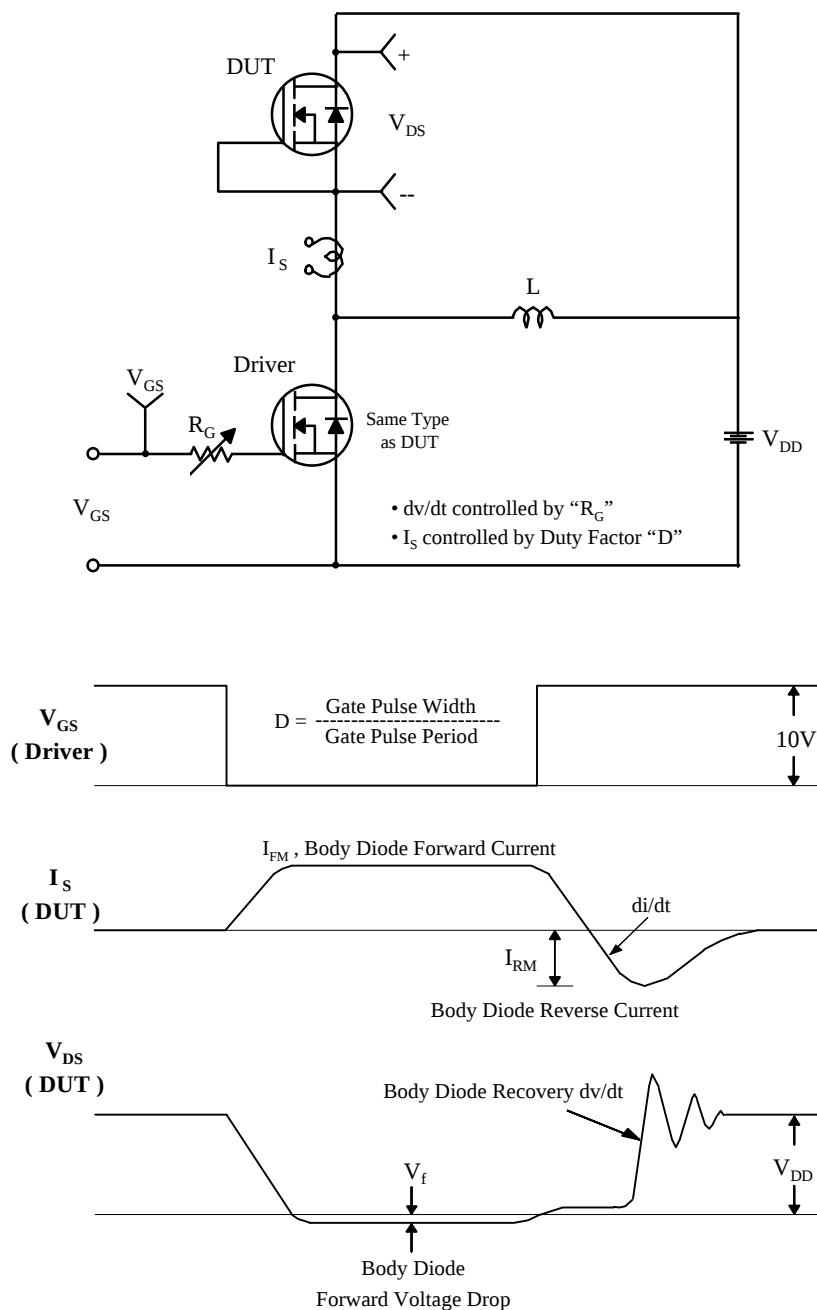
**Fig 13. Resistive Switching Test Circuit & Waveforms**



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



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



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