

## Advanced Power MOSFET

## SFW/I2955

### FEATURES

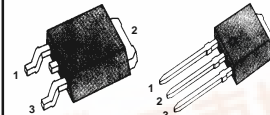
- Avalanche Rugged Technology
- Rugged Gate Oxide Technology
- Lower Input Capacitance
- Improved Gate Charge
- Extended Safe Operating Area
- 175°C Operating Temperature
- Lower Leakage Current : 10 μA (Max.) @  $V_{DS} = -60V$
- Low  $R_{DS(ON)}$  : 0.22 Ω (Typ.)

$$BV_{DSS} = -60 V$$

$$R_{DS(on)} = 0.3\Omega$$

$$I_D = -9.4 A$$

**D<sup>2</sup>-PAK I<sup>2</sup>-PAK**



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 ( $T_C=25^\circ C$ )                           | -9.4         | A     |
|                | Continuous Drain Current ( $T_C=100^\circ C$ )                          | -6.6         |       |
| $I_{DM}$       | Drain Current-Pulsed ①  | -38          | A     |
| $V_{GS}$       | Gate-to-Source Voltage  | $\pm 20$     | V     |
| $E_{AS}$       | Single Pulsed Avalanche Energy ②  | 151          | mJ    |
| $I_{AR}$       | Avalanche Current ①   | -9.4         | A     |
| $E_{AR}$       | Repetitive Avalanche Energy ①   | 4.9          | mJ    |
| dv/dt          | Peak Diode Recovery dv/dt ③   | -5.5         | V/ns  |
| $P_D$          | Total Power Dissipation ( $T_A=25^\circ C$ ) *                          | 3.8          | W     |
|                | Total Power Dissipation ( $T_C=25^\circ C$ )                            | 49           | W     |
|                | Linear Derating Factor  | 0.33         | 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      | --   | 3.06 | °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).

Rev. B

**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          | -60  | --    | --   | V                   | $V_{GS}=0V, I_D=-250\mu A$   |
| $\Delta BV/\Delta T_J$ | Breakdown Voltage Temp. Coeff.          | --   | -0.04 | --   | 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  | $\mu A$             | $V_{DS}=-60V$  |
|                        |   | --   | --    | -100 |                     | $V_{DS}=-48V, T_C=150^\circ\text{C}$   |
| $R_{DS(on)}$           | Static Drain-Source On-State Resistance | --   | --    | 0.3  | $\Omega$            | $V_{GS}=-10V, I_D=-4.7A$ ④   |
| $g_{fs}$               | Forward Transconductance                | --   | 4.0   | --   | $\Omega$            | $V_{DS}=-30V, I_D=-4.7A$ ④   |
| $C_{iss}$              | Input Capacitance                       | --   | 465   | 600  | pF                  | $V_{GS}=0V, V_{DS}=-25V, f=1\text{MHz}$<br><b>See Fig 5</b>                    |
| $C_{oss}$              | Output Capacitance                      | --   | 140   | 215  |                     |  |
| $C_{rss}$              | Reverse Transfer Capacitance            | --   | 40    | 60   |                     |  |
| $t_{d(on)}$            | Turn-On Delay Time                      | --   | 11    | 30   | ns                  | $V_{DD}=-30V, I_D=-9.4A,$<br>$R_G=18\Omega$<br><b>See Fig 13</b> ④⑤            |
| $t_r$                  | Rise Time                               | --   | 21    | 50   |                     |  |
| $t_{d(off)}$           | Turn-Off Delay Time                     | --   | 29    | 65   |                     |  |
| $t_f$                  | Fall Time                               | --   | 20    | 50   |                     |  |
| $Q_g$                  | Total Gate Charge                       | --   | 15    | 19   | nC                  | $V_{DS}=-48V, V_{GS}=-10V,$<br>$I_D=-9.4A$<br><b>See Fig 6 &amp; Fig 12</b> ④⑤ |
| $Q_{gs}$               | Gate-Source Charge                      | --   | 2.9   | --   |                     |  |
| $Q_{gd}$               | Gate-Drain("Miller") Charge             | --   | 6.0   | --   |                     |  |

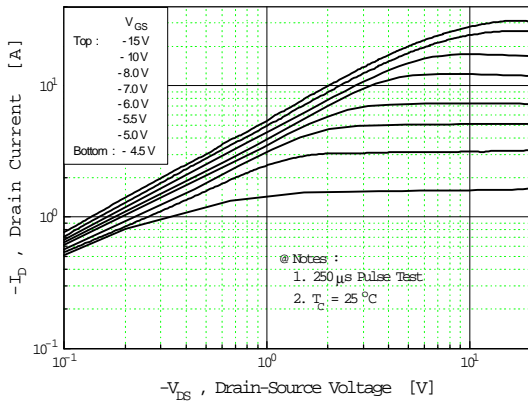
**Source-Drain Diode Ratings and Characteristics**

| Symbol   | Characteristic            | Min. | Typ. | Max. | Units         | Test Condition                               |
|----------|---------------------------|------|------|------|---------------|--|
| $I_S$    | Continuous Source Current | --   | --   | -9.4 | A             | Integral reverse pn-diode in the MOSFET      |
| $I_{SM}$ | Pulsed-Source Current ①   | --   | --   | -38  |               |  |
| $V_{SD}$ | Diode Forward Voltage ④   | --   | --   | -3.8 | V             | $T_J=25^\circ\text{C}, I_S=-9.4A, V_{GS}=0V$ |
| $t_{rr}$ | Reverse Recovery Time     | --   | 80   | --   | ns            | $T_J=25^\circ\text{C}, I_F=-9.4A$            |
| $Q_{rr}$ | Reverse Recovery Charge   | --   | 0.22 | --   | $\mu\text{C}$ | $di_F/dt=100A/\mu\text{s}$ ④                 |

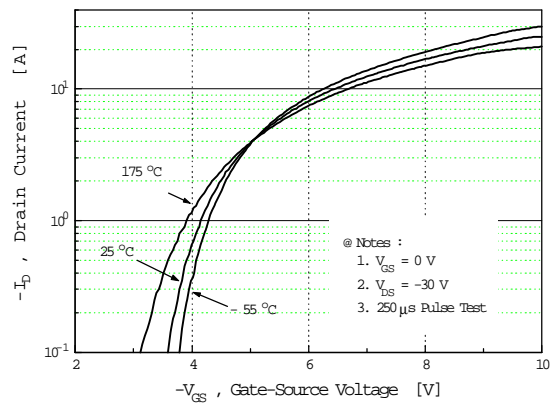
**Notes ;**

- ① Repetitive Rating : Pulse Width Limited by Maximum Junction Temperature
- ②  $L=2.0\text{mH}, I_{AS}=-9.4A, V_{DD}=-25V, R_G=27\Omega^*$ , Starting  $T_J=25^\circ\text{C}$
- ③  $I_{SD} \leq -9.4A, di/dt \leq 250A/\mu\text{s}, V_{DD} \leq BV_{DSS}$ , Starting  $T_J=25^\circ\text{C}$
- ④ Pulse Test : Pulse Width =  $250\mu\text{s}$ , Duty Cycle  $\leq 2\%$
- ⑤ Essentially Independent of Operating Temperature

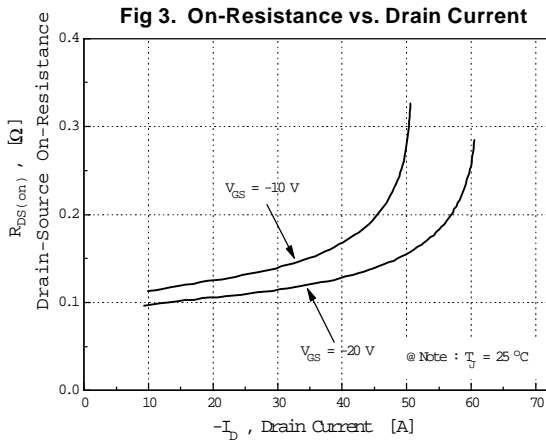
**Fig 1. Output Characteristics**



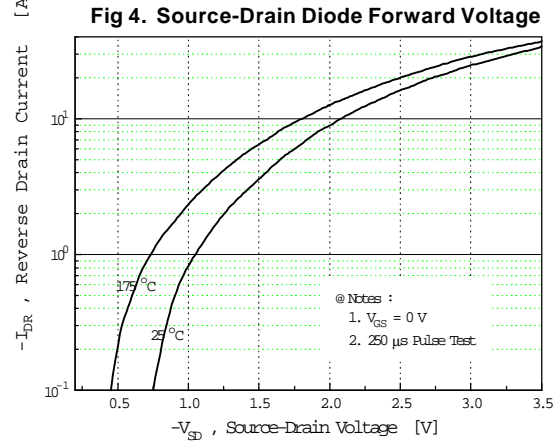
**Fig 2. Transfer Characteristics**



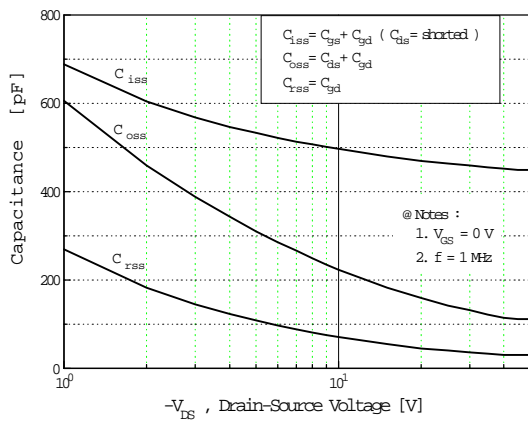
**Fig 3. On-Resistance vs. Drain Current**



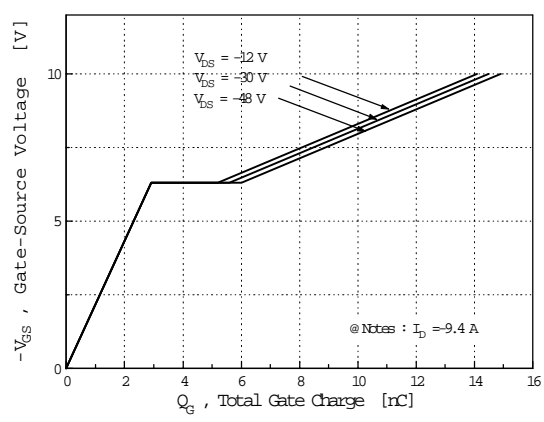
**Fig 4. Source-Drain Diode Forward Voltage**

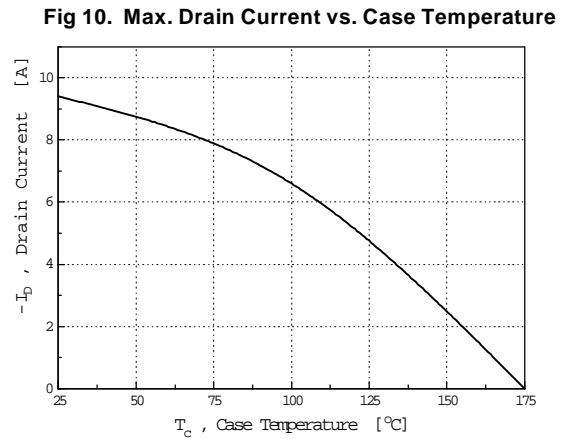
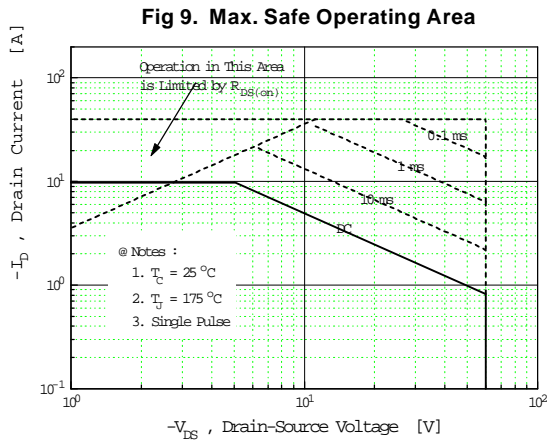
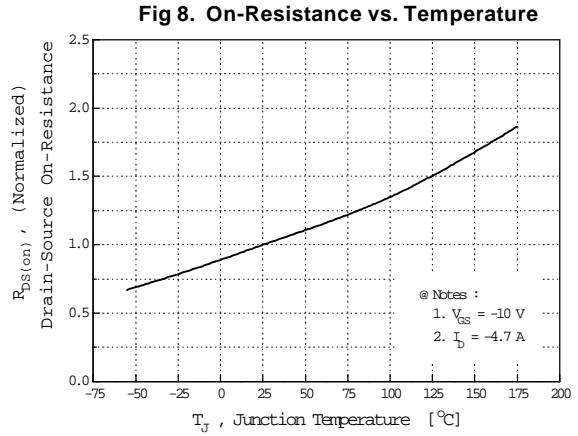
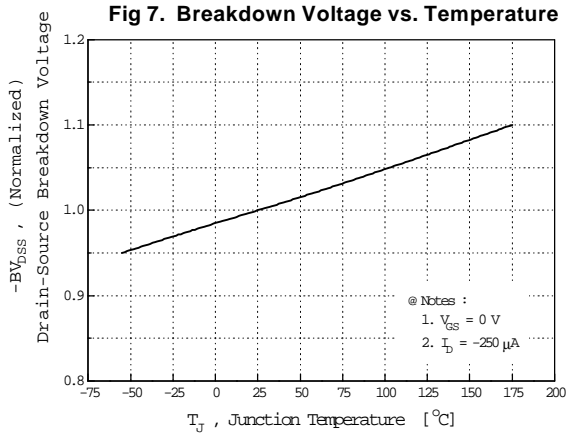


**Fig 5. Capacitance vs. Drain-Source Voltage**



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





**Fig 11. Thermal Response**

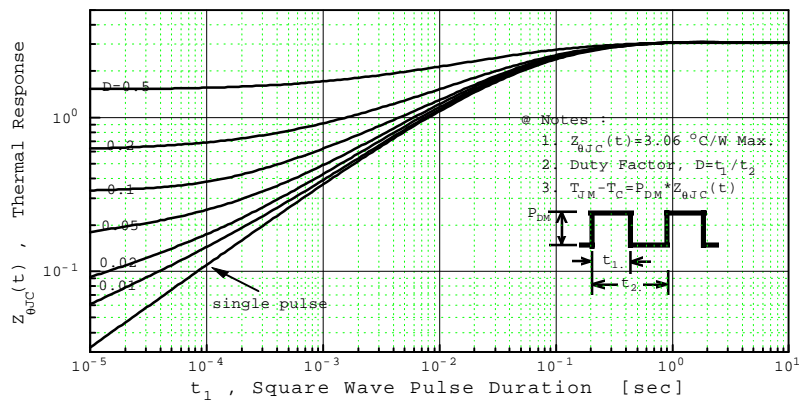


Fig 12. Gate Charge Test Circuit & Waveform

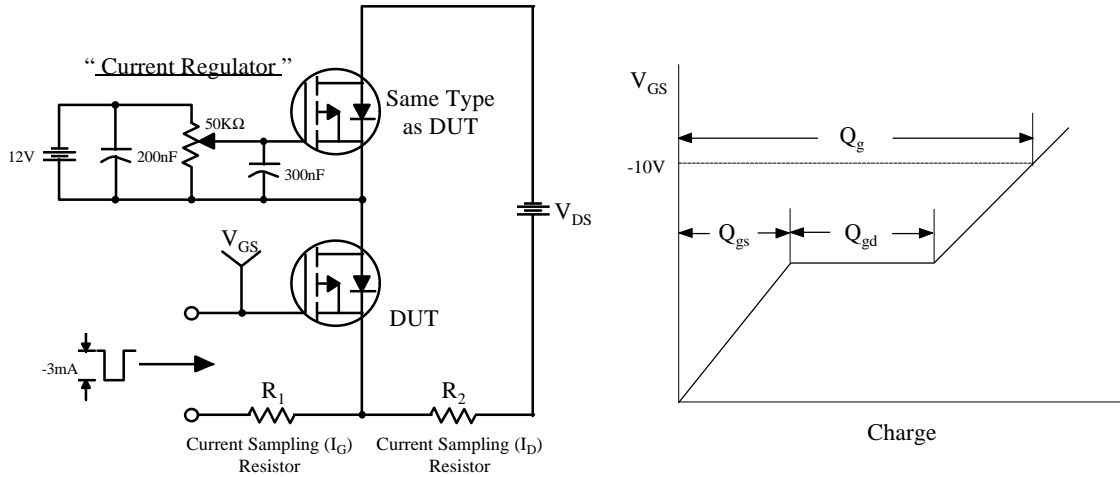


Fig 13. Resistive Switching Test Circuit & Waveforms

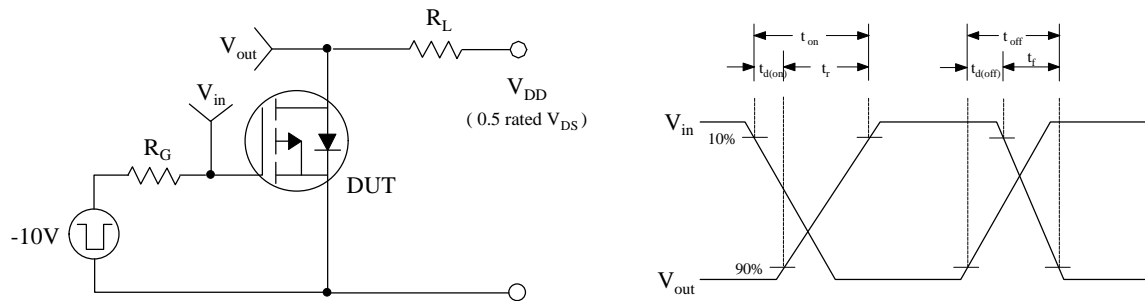


Fig 14. Unclamped Inductive Switching Test Circuit & Waveforms

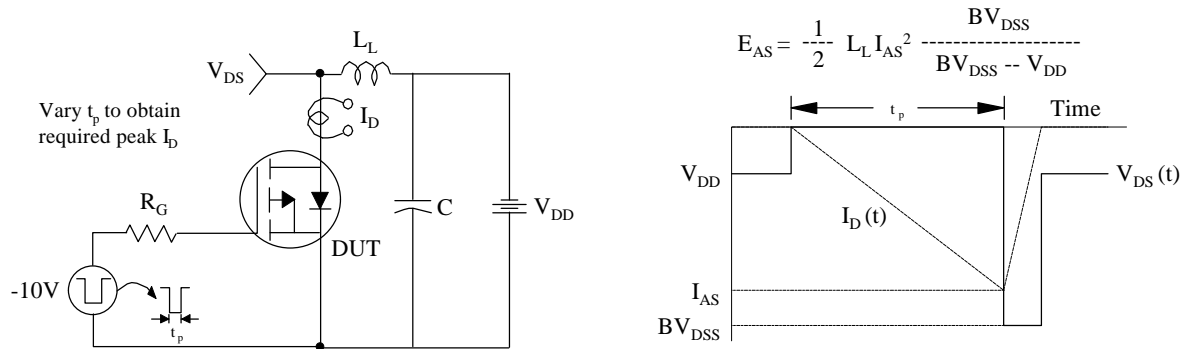
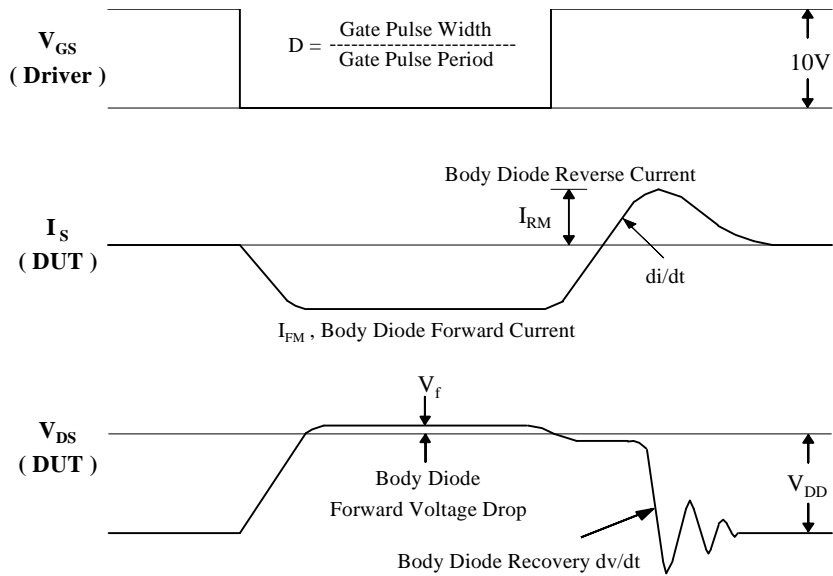
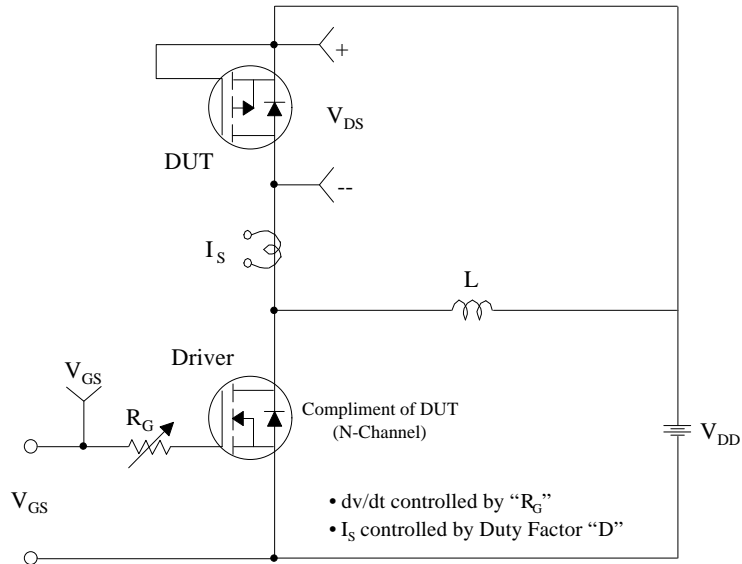


Fig 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms



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