

# Advanced Power MOSFET

# SSP4N90A

## FEATURES

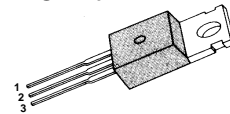
- Avalanche Rugged Technology
- Rugged Gate Oxide Technology
- Lower Input Capacitance
- Improved Gate Charge
- Extended Safe Operating Area
- Lower Leakage Current : 25  $\mu$ A (Max.) @  $V_{DS} = 900V$
- Low  $R_{DS(on)}$  : 4.181  $\Omega$  (Typ.)

$$BV_{DSS} = 900 V$$

$$R_{DS(on)} = 5.0 \Omega$$

$$I_D = 4 A$$

### TO-220



1.Gate 2. Drain 3. Source

## Absolute Maximum Ratings

| Symbol         | Characteristic  | Value        | Units      |
|----------------|---|--------------|------------|
| $V_{DSS}$      | Drain-to-Source Voltage   | 900          | V          |
| $I_D$          | Continuous Drain Current ( $T_C=25^\circ C$ )                           | 4            | A          |
|                | Continuous Drain Current ( $T_C=100^\circ C$ )                          | 2.5          |            |
| $I_{DM}$       | Drain Current-Pulsed ①  | 16           | A          |
| $V_{GS}$       | Gate-to-Source Voltage  | $\pm 30$     | V          |
| $E_{AS}$       | Single Pulsed Avalanche Energy ②  | 424          | mJ         |
| $I_{AR}$       | Avalanche Current ①   | 4            | A          |
| $E_{AR}$       | Repetitive Avalanche Energy ①   | 12           | mJ         |
| dv/dt          | Peak Diode Recovery dv/dt ③   | 1.5          | V/ns       |
| $P_D$          | Total Power Dissipation ( $T_C=25^\circ C$ )                            | 120          | W          |
|                | Linear Derating Factor  | 0.96         |            |
| $T_J, T_{STG}$ | 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    | --   | 1.04 | $^\circ C / W$ |
| $R_{\theta_{CS}}$ | Case-to-Sink        | 0.5  | --   |                |
| $R_{\theta_{JA}}$ | Junction-to-Ambient | --   | 62.5 |                |

Rev. B

### Electrical Characteristics (T<sub>C</sub>=25 °C unless otherwise specified)

| Symbol              | Characteristic                          | Min. | Typ. | Max. | Units | Test Condition   |
|---------------------|---|------|------|------|-------|--|
| BV <sub>DSS</sub>   | Drain-Source Breakdown Voltage          | 900  | --   | --   | V     | V <sub>GS</sub> =0V, I <sub>D</sub> =250μA   |
| ΔBV/ΔT <sub>J</sub> | Breakdown Voltage Temp. Coeff.          | --   | 1.14 | --   | V/ °C | I <sub>D</sub> =250μA <b>See Fig 7</b>   |
| V <sub>GS(th)</sub> | Gate Threshold Voltage                  | 2.0  | --   | 3.5  | V     | V <sub>DS</sub> =5V, I <sub>D</sub> =250μA   |
| I <sub>GSS</sub>    | Gate-Source Leakage , Forward           | --   | --   | 100  | nA    | V <sub>GS</sub> =30V   |
|                     | Gate-Source Leakage , Reverse           | --   | --   | -100 |       | V <sub>GS</sub> =-30V  |
| I <sub>DSS</sub>    | Drain-to-Source Leakage Current         | --   | --   | 25   | μA    | V <sub>DS</sub> =900V  |
|                     |   | --   | --   | 250  |       | V <sub>DS</sub> =720V, T <sub>C</sub> =125 °C  |
| R <sub>DS(on)</sub> | Static Drain-Source On-State Resistance | --   | --   | 5.0  | Ω     | V <sub>GS</sub> =10V, I <sub>D</sub> =2A <b>④*</b>   |
| g <sub>fs</sub>     | Forward Transconductance                | --   | 2.85 | --   | Ω     | V <sub>DS</sub> =50V, I <sub>D</sub> =2A <b>④</b>  |
| C <sub>iss</sub>    | Input Capacitance                       | --   | 730  | 950  | pF    | V <sub>GS</sub> =0V, V <sub>DS</sub> =25V, f =1MHz<br><b>See Fig 5</b>   |
| C <sub>oss</sub>    | Output Capacitance                      | --   | 65   | 75   |       |  |
| C <sub>rfs</sub>    | Reverse Transfer Capacitance            | --   | 24   | 30   |       |  |
| t <sub>d(on)</sub>  | Turn-On Delay Time                      | --   | 18   | 45   | ns    | V <sub>DD</sub> =450V, I <sub>D</sub> =4A,<br>R <sub>G</sub> =13.6 Ω<br><b>See Fig 13</b> <b>④ ⑤</b>           |
| t <sub>r</sub>      | Rise Time                               | --   | 29   | 70   |       |  |
| t <sub>d(off)</sub> | Turn-Off Delay Time                     | --   | 51   | 110  |       |  |
| t <sub>f</sub>      | Fall Time                               | --   | 28   | 65   |       |  |
| Q <sub>g</sub>      | Total Gate Charge                       | --   | 35   | 46   | nC    | V <sub>DS</sub> =720V, V <sub>GS</sub> =10V,<br>I <sub>D</sub> =4A<br><b>See Fig 6 &amp; Fig 12</b> <b>④ ⑤</b> |
| Q <sub>gs</sub>     | Gate-Source Charge                      | --   | 6.6  | --   |       |  |
| Q <sub>gd</sub>     | Gate-Drain( "Miller" ) Charge           | --   | 15.0 | --   |       |  |

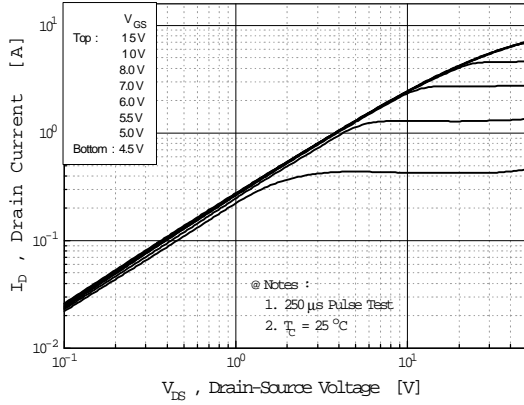
### Source-Drain Diode Ratings and Characteristics

| Symbol          | Characteristic                 | Min. | Typ. | Max. | Units | Test Condition   |
|-----------------|--------------------------------|------|------|------|-------|--|
| I <sub>S</sub>  | Continuous Source Current      | --   | --   | 4    | A     | Integral reverse pn-diode in the MOSFET                        |
| I <sub>SM</sub> | Pulsed-Source Current <b>①</b> | --   | --   | 16   |       |  |
| V <sub>SD</sub> | Diode Forward Voltage <b>④</b> | --   | --   | 1.4  | V     | T <sub>J</sub> =25 °C, I <sub>S</sub> =4A, V <sub>GS</sub> =0V |
| t <sub>rr</sub> | Reverse Recovery Time          | --   | 430  | --   | ns    | T <sub>J</sub> =25 °C, I <sub>F</sub> =4A                      |
| Q <sub>rr</sub> | Reverse Recovery Charge        | --   | 2.9  | --   | μC    | di <sub>F</sub> /dt=100A/μs <b>④</b>                           |

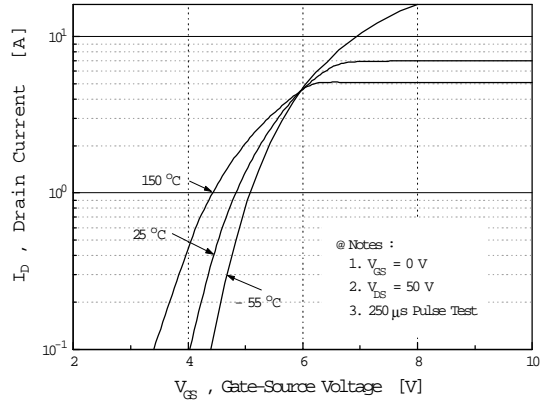
#### Notes ;

- ① Repetitive Rating : Pulse Width Limited by Maximum Junction Temperature
- ② L=50mH, I<sub>AS</sub>=4A, V<sub>DD</sub>=50V, R<sub>G</sub>=27Ω, Starting T<sub>J</sub>=25 °C
- ③ I<sub>SD</sub> ≤ 4A, di/dt ≤ 100A/μs, V<sub>DD</sub> ≤ BV<sub>DSS</sub>, Starting T<sub>J</sub>=25 °C
- ④ Pulse Test : Pulse Width = 250 μs, Duty Cycle ≤ 2%
- ⑤ Essentially Independent of Operating Temperature

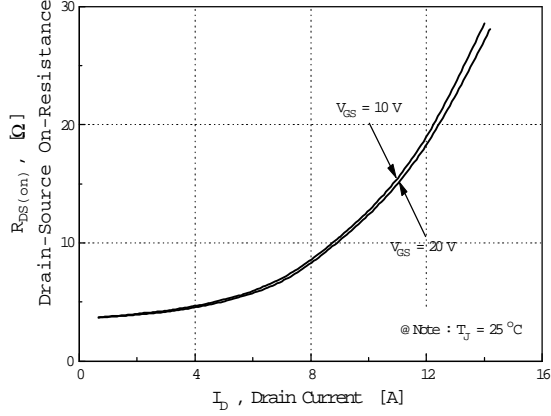
**Fig 1. Output Characteristics**



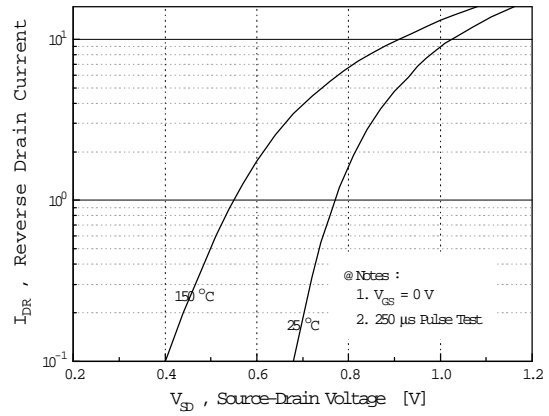
**Fig 2. Transfer Characteristics**



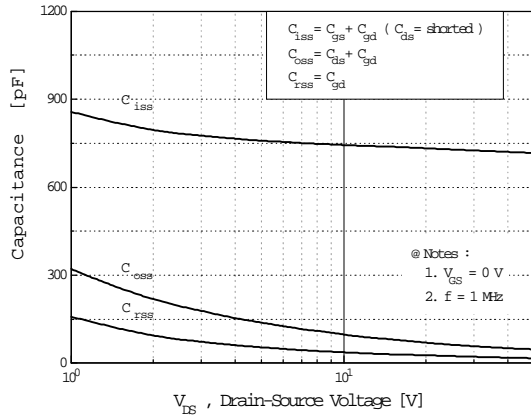
**Fig 3. On-Resistance vs. Drain Current**



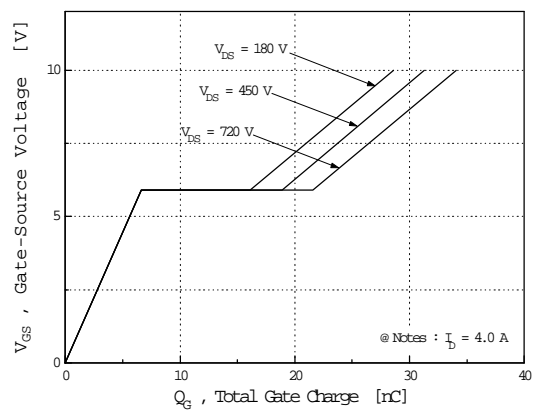
**Fig 4. Source-Drain Diode Forward Voltage**



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

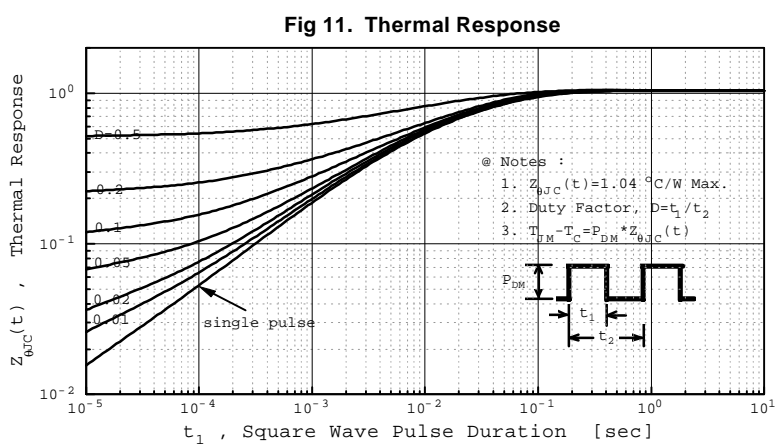
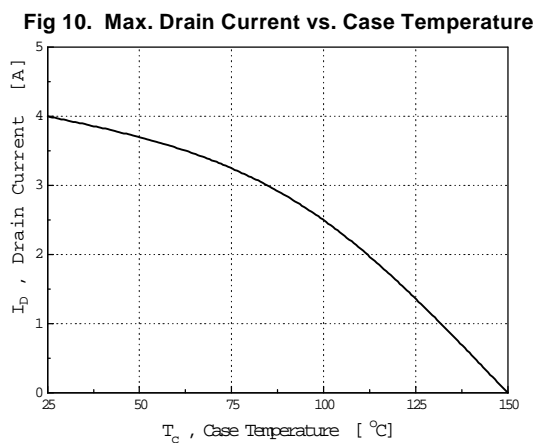
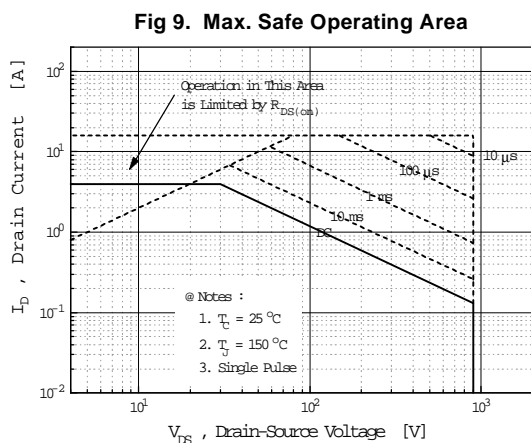
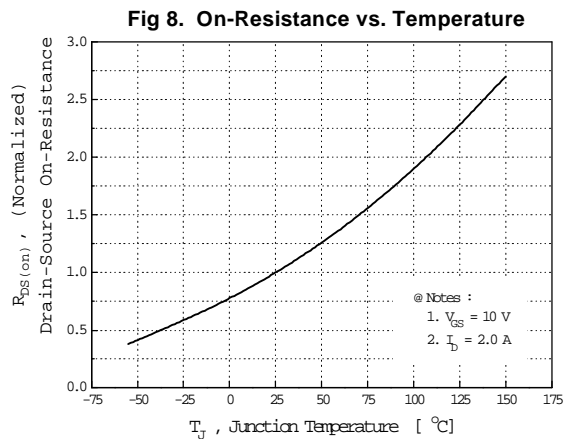
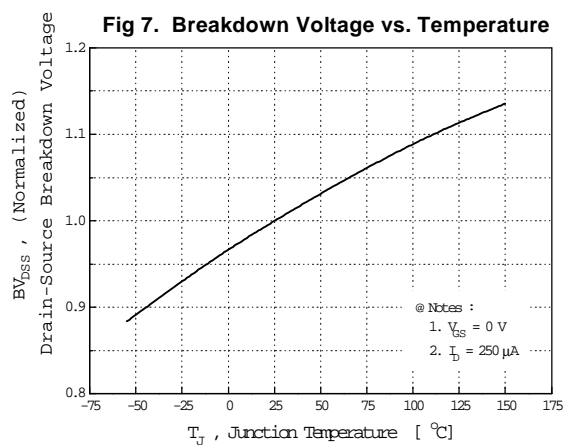


**Fig 6. Gate Charge vs. Gate-Source Voltage**

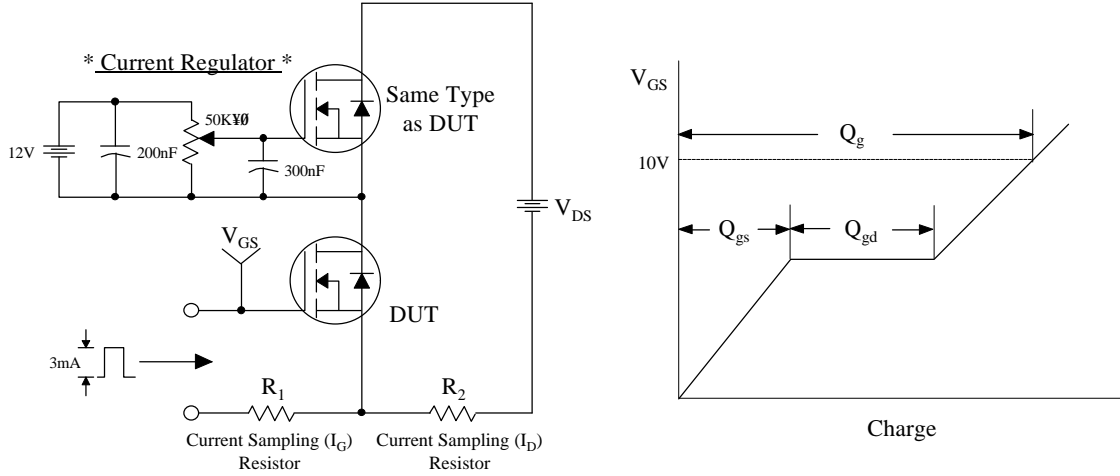


# SSP4N90A

## N-CHANNEL POWER MOSFET



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



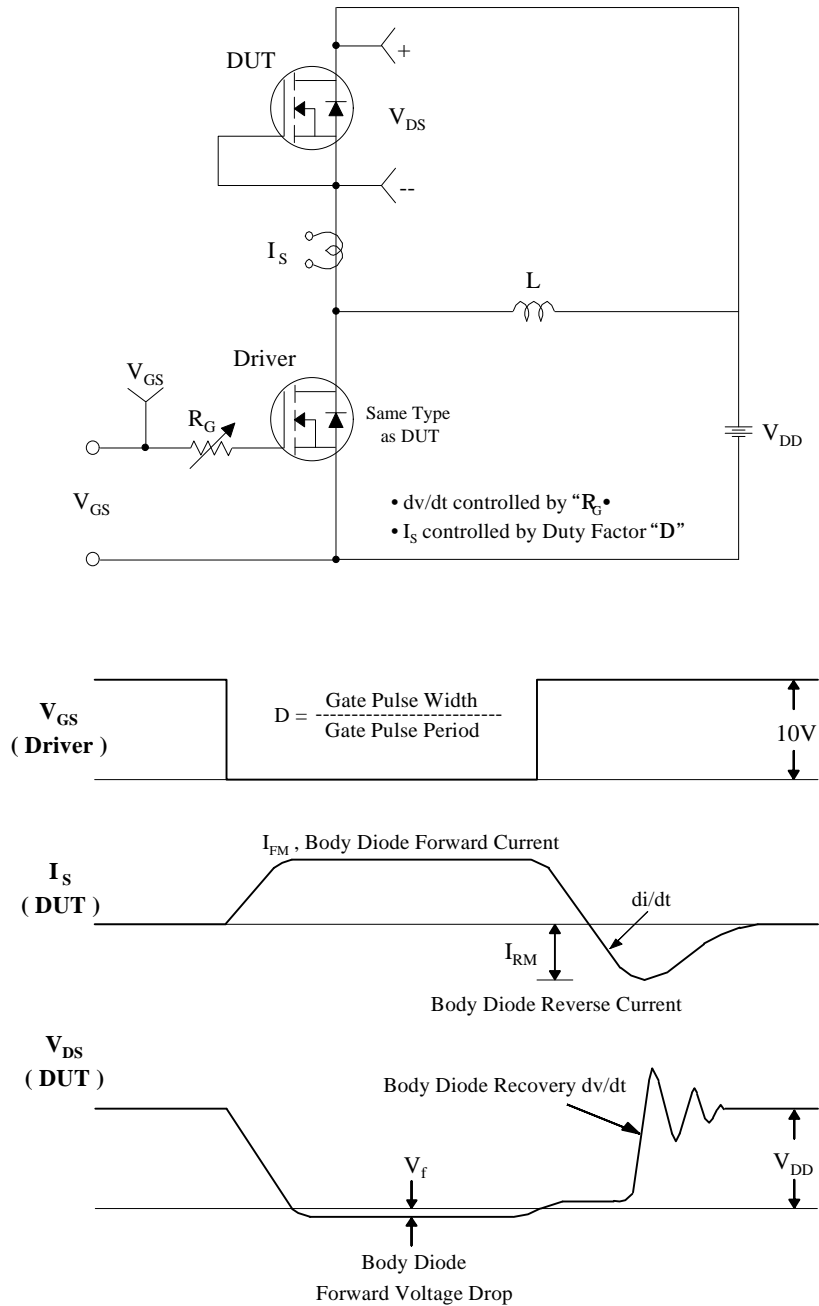
**Fig 13. Resistive Switching Test Circuit & Waveforms**



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



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



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| FACT Quiet Series™   | Quiet Series™ |      |
| FAST®                | SuperSOT™-3   |      |
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