

## Advanced Power MOSFET

## SSH4N90AS

## FEATURES

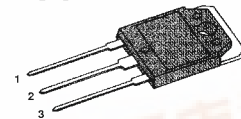
- Avalanche Rugged Technology
- Rugged Gate Oxide Technology
- Lower Input Capacitance
- Improved Gate Charge
- Extended Safe Operating Area
- Lower Leakage Current : 25  $\mu$ A (Max.) @  $V_{DS} = 900V$
- Low  $R_{DS(ON)}$  : 3.054  $\Omega$  (Typ.)

$$BV_{DSS} = 900 V$$

$$R_{DS(on)} = 3.7 \Omega$$

$$I_D = 4.5 A$$

## TO-3P



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 ( $T_C=25^\circ C$ )                           | 4.5          | A          |
|                | Continuous Drain Current ( $T_C=100^\circ C$ )                          | 2.8          |            |
| $I_{DM}$       | Drain Current-Pulsed ①                                                  | 18           | A          |
| $V_{GS}$       | Gate-to-Source Voltage                                                  | $\pm 30$     | V          |
| $E_{AS}$       | Single Pulsed Avalanche Energy ②                                        | 536          | mJ         |
| $I_{AR}$       | Avalanche Current ①                                                     | 4.5          | A          |
| $E_{AR}$       | Repetitive Avalanche Energy ①                                           | 14           | mJ         |
| $dv/dt$        | Peak Diode Recovery $dv/dt$ ③                                           | 1.5          | V/ns       |
| $P_D$          | Total Power Dissipation ( $T_C=25^\circ C$ )                            | 140          | W          |
|                | Linear Derating Factor                                                  | 1.12         |            |
| $T_J, T_{STG}$ | 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    | --   | 0.89 | $^\circ C/W$ |
| $R_{\theta CS}$ | Case-to-Sink        | 0.24 | --   |              |
| $R_{\theta JA}$ | Junction-to-Ambient | --   | 40   |              |

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ELECTRONICS

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## 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.          | --   | 1.04 | --   | 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 | nA    | 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 | --   | --   | 3.7  | Ω     | V <sub>GS</sub> =10V, I <sub>D</sub> =2.25A ④*                                                            |
| g <sub>fs</sub>     | Forward Transconductance                | --   | 3.66 | --   | Ω     | V <sub>DS</sub> =50V, I <sub>D</sub> =2.25A ④                                                             |
| C <sub>iss</sub>    | Input Capacitance                       | --   | 910  | 1180 | 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                      | --   | 85   | 100  |       |                                                                                                           |
| C <sub>rss</sub>    | Reverse Transfer Capacitance            | --   | 34   | 40   |       |                                                                                                           |
| t <sub>d(on)</sub>  | Turn-On Delay Time                      | --   | 19   | 50   | ns    | V <sub>DD</sub> =450V, I <sub>D</sub> =4.5A,<br>R <sub>G</sub> =13.6 Ω<br><b>See Fig 13</b> ④ ⑤           |
| t <sub>r</sub>      | Rise Time                               | --   | 31   | 70   |       |                                                                                                           |
| t <sub>d(off)</sub> | Turn-Off Delay Time                     | --   | 68   | 145  |       |                                                                                                           |
| t <sub>f</sub>      | Fall Time                               | --   | 30   | 70   |       |                                                                                                           |
| Q <sub>g</sub>      | Total Gate Charge                       | --   | 42   | 55   | nC    | V <sub>DS</sub> =720V, V <sub>GS</sub> =10V,<br>I <sub>D</sub> =4.5A<br><b>See Fig 6 &amp; Fig 12</b> ④ ⑤ |
| Q <sub>gs</sub>     | Gate-Source Charge                      | --   | 8.1  | --   |       |                                                                                                           |
| Q <sub>gd</sub>     | Gate-Drain( "Miller" ) Charge           | --   | 18.1 | --   |       |                                                                                                           |

## Source-Drain Diode Ratings and Characteristics

| Symbol          | Characteristic            | Min. | Typ. | Max. | Units | Test Condition                                                  |
|-----------------|---------------------------|------|------|------|-------|-----------------------------------------------------------------|
| I <sub>S</sub>  | Continuous Source Current | --   | --   | 4.5  | A     | Integral reverse pn-diode in the MOSFET                         |
| I <sub>SM</sub> | Pulsed-Source Current ①   | --   | --   | 18   |       |                                                                 |
| V <sub>SD</sub> | Diode Forward Voltage ④   | --   | --   | 1.4  | V     | T <sub>J</sub> =25°C, I <sub>S</sub> =4.5A, V <sub>GS</sub> =0V |
| t <sub>rr</sub> | Reverse Recovery Time     | --   | 490  | --   | ns    | T <sub>J</sub> =25°C, I <sub>F</sub> =4.5A                      |
| Q <sub>rr</sub> | Reverse Recovery Charge   | --   | 4.24 | --   | μC    | di <sub>F</sub> /dt=100A/μs ④                                   |

### Notes ;

- ✧ Repetitive Rating : Pulse Width Limited by Maximum Junction Temperature
- ✧ t<sub>L</sub>=50mH, I<sub>AS</sub>=4.5A, V<sub>DD</sub>=50V, R<sub>G</sub>=27Ω, Starting T<sub>J</sub>=25 °C
- ✧ Ø<sub>SD</sub> ≤ 4.5A, di/dt ≤ 110A/μs, V<sub>DD</sub> ≤ BV<sub>DSS</sub>, Starting T<sub>J</sub>=25 °C
- ✧ ① Pulse Test : Pulse Width = 250 μs, Duty Cycle ≤ 2%
- ✧ ° Essentially Independent of Operating Temperature

Fig 1. Output Characteristics

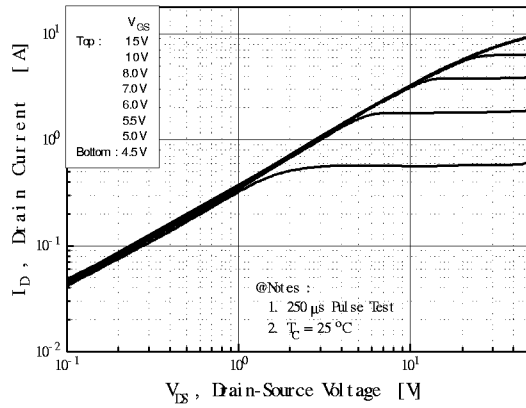


Fig 2. Transfer Characteristics

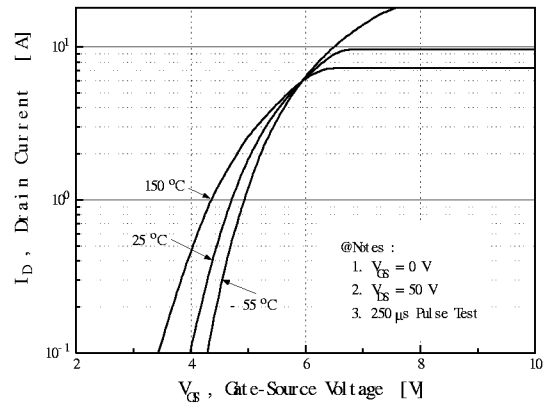


Fig 3. On-Resistance vs. Drain Current

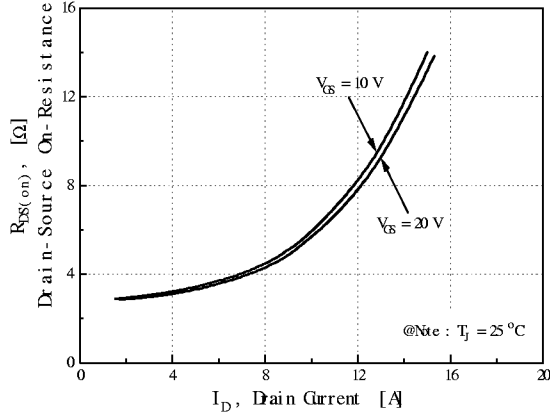


Fig 4. Source-Drain Diode Forward Voltage

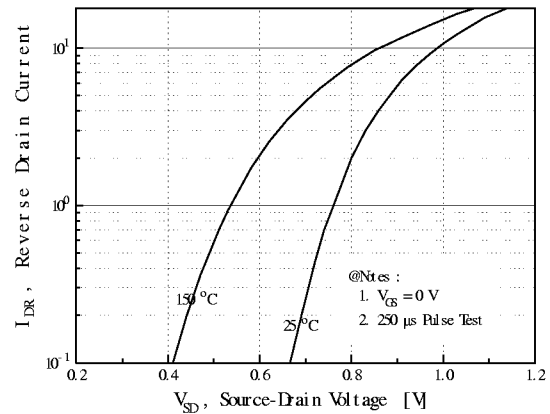


Fig 5. Capacitance vs. Drain-Source Voltage

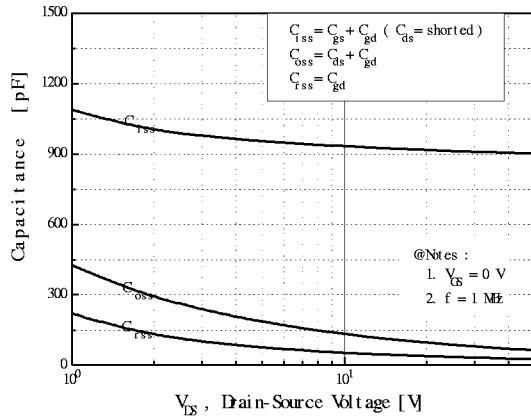
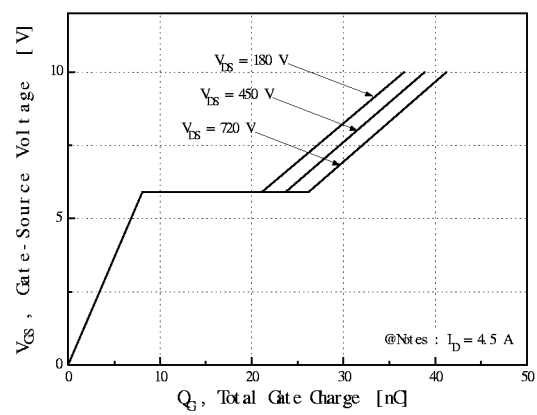


Fig 6. Gate Charge vs. Gate-Source Voltage



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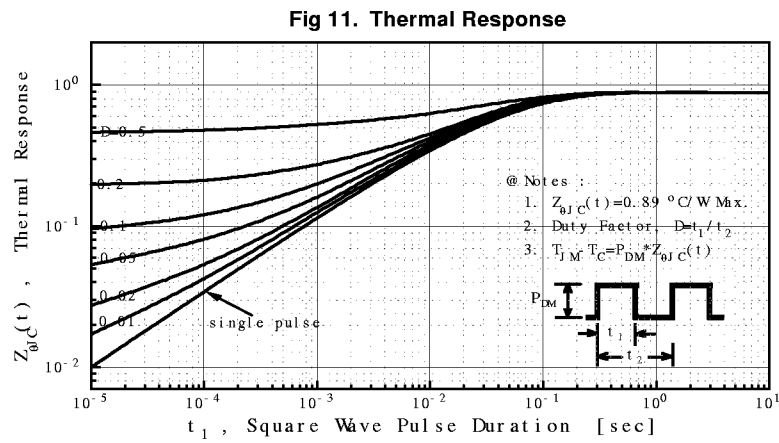
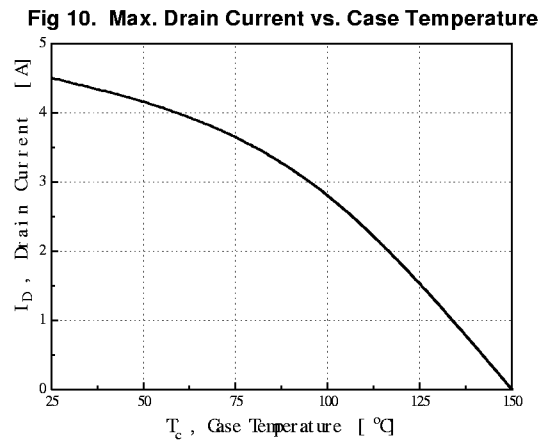
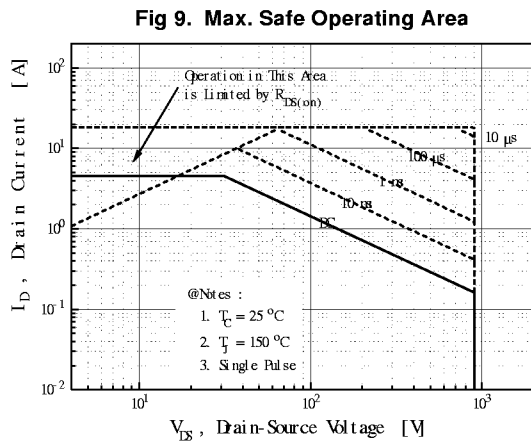
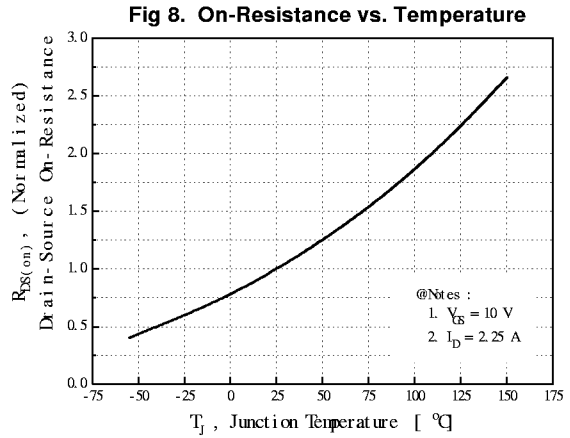
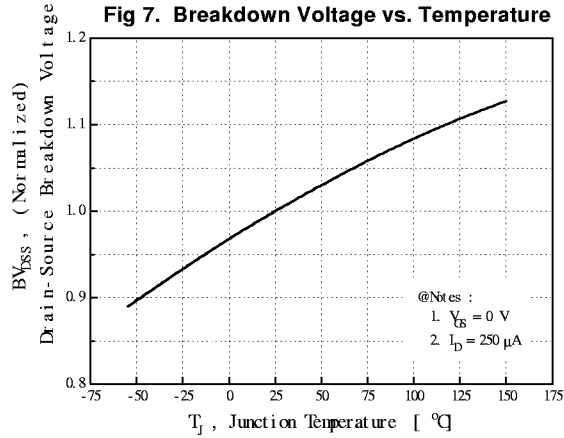


Fig 12. Gate Charge Test Circuit & Waveform

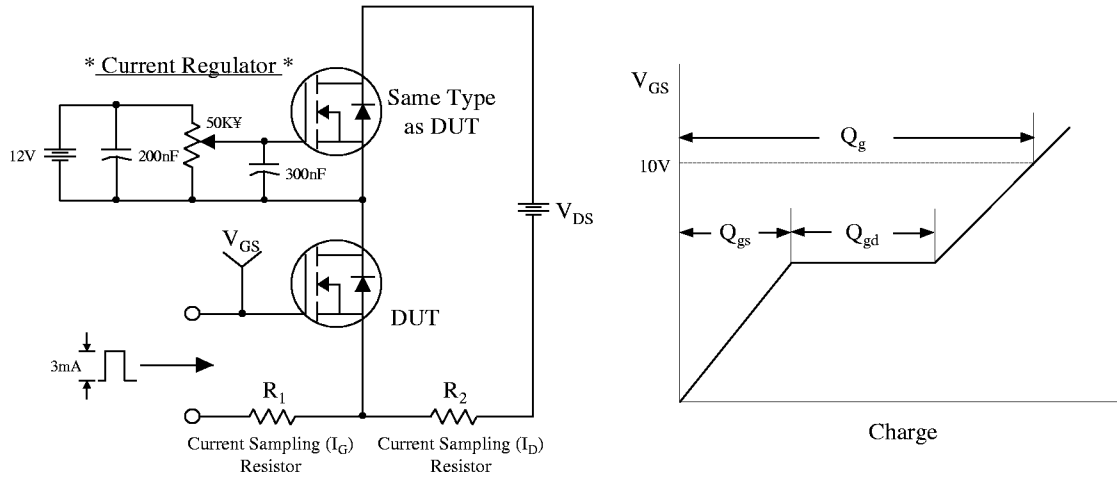


Fig 13. Resistive Switching Test Circuit & Waveforms

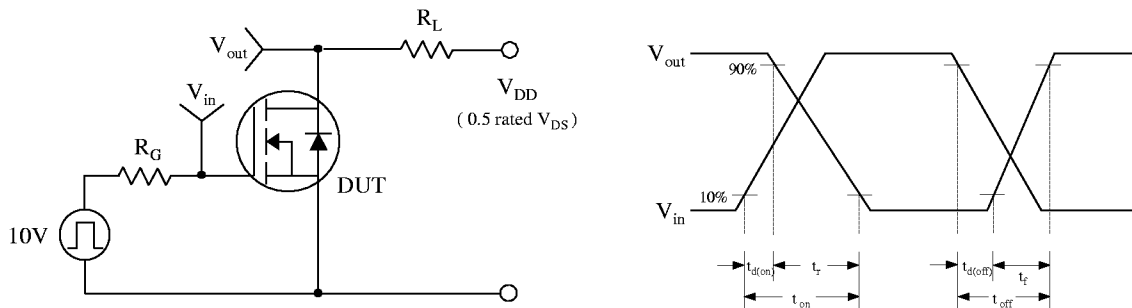


Fig 14. Unclamped Inductive Switching Test Circuit & Waveforms

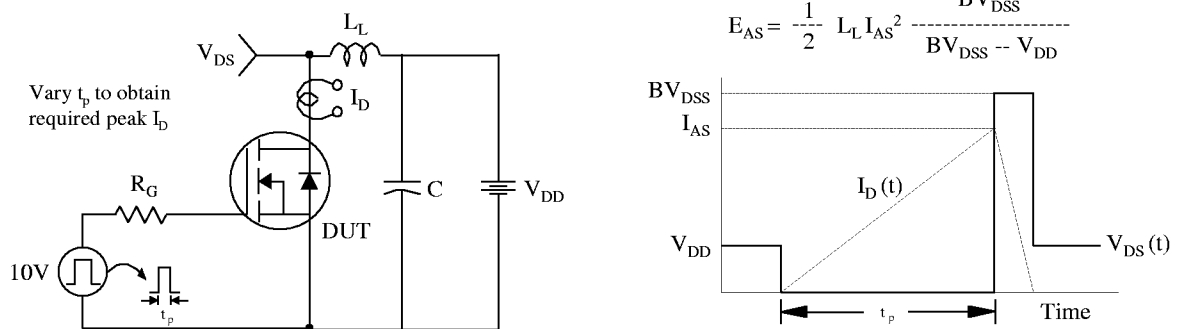


Fig 15. Peak Diode Recovery dv/dt Test Circuit &amp; Waveforms

