

## Advanced Power MOSFET

## SSP10N60A

### FEATURES

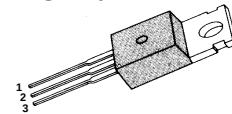
- Avalanche Rugged Technology
- Rugged Gate Oxide Technology
- Lower Input Capacitance
- Improved Gate Charge
- Extended Safe Operating Area
- Lower Leakage Current : 25  $\mu$ A (Max.) @  $V_{DS} = 600V$
- Low  $R_{DS(on)}$  : 0.646  $\Omega$  (Typ.)

$$BV_{DSS} = 600 V$$

$$R_{DS(on)} = 0.8 \Omega$$

$$I_D = 9 A$$

### TO-220



1. Gate 2. Drain 3. Source

### Absolute Maximum Ratings

| Symbol         | Characteristic                                                           | Value        | Units         |
|----------------|--------------------------------------------------------------------------|--------------|---------------|
| $V_{DSS}$      | Drain-to-Source Voltage                                                  | 600          | V             |
| $I_D$          | Continuous Drain Current ( $T_C=25^\circ C$ )                            | 9            | A             |
|                | Continuous Drain Current ( $T_C=100^\circ C$ )                           | 5.7          |               |
| $I_{DM}$       | Drain Current-Pulsed ①                                                   | 36           | A             |
| $V_{GS}$       | Gate-to-Source Voltage                                                   | $\pm 30$     | V             |
| $E_{AS}$       | Single Pulsed Avalanche Energy ②                                         | 442          | mJ            |
| $I_{AR}$       | Avalanche Current ①                                                      | 9            | A             |
| $E_{AR}$       | Repetitive Avalanche Energy ①                                            | 15.6         | mJ            |
| $dv/dt$        | Peak Diode Recovery $dv/dt$ ③                                            | 3.0          | V/ns          |
| $P_D$          | Total Power Dissipation ( $T_C=25^\circ C$ )                             | 156          | W             |
|                | Linear Derating Factor                                                   | 1.25         | 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    | --   | 0.8  | $^\circ C/W$ |
| $R_{\theta CS}$ | Case-to-Sink        | 0.5  | --   |              |
| $R_{\theta JA}$ | Junction-to-Ambient | --   | 62.5 |              |

# SSP10N60A

## N-CHANNEL POWER MOSFET

### 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          | 600  | --   | --   | V                     | $V_{GS}=0V, I_D=250\mu A$                                                   |
| $\Delta BV/\Delta T_J$ | Breakdown Voltage Temp. Coeff.          | --   | 0.66 | --   | 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                    | $V_{GS}=30V$                                                                |
|                        | Gate-Source Leakage, Reverse            | --   | --   | -100 |                       | $V_{GS}=-30V$                                                               |
| $I_{DSS}$              | Drain-to-Source Leakage Current         | --   | --   | 25   | $\mu A$               | $V_{DS}=600V$                                                               |
|                        |                                         | --   | --   | 250  |                       | $V_{DS}=480V, T_C=125^{\circ}\text{C}$                                      |
| $R_{DS(on)}$           | Static Drain-Source On-State Resistance | --   | --   | 0.8  | $\Omega$              | $V_{GS}=10V, I_D=4.5A$ ④                                                    |
| $g_{fs}$               | Forward Transconductance                | --   | 7.57 | --   | $\Omega$              | $V_{DS}=50V, I_D=4.5A$ ④                                                    |
| $C_{iss}$              | Input Capacitance                       | --   | 1750 | 2270 | pF                    | $V_{GS}=0V, V_{DS}=25V, f=1\text{MHz}$<br><b>See Fig 5</b>                  |
| $C_{oss}$              | Output Capacitance                      | --   | 190  | 220  |                       |                                                                             |
| $C_{rss}$              | Reverse Transfer Capacitance            | --   | 78   | 90   |                       |                                                                             |
| $t_{d(on)}$            | Turn-On Delay Time                      | --   | 20   | 50   | ns                    | $V_{DD}=300V, I_D=10A,$<br>$R_G=6.2\Omega$<br><b>See Fig 13</b> ④⑤          |
| $t_r$                  | Rise Time                               | --   | 23   | 55   |                       |                                                                             |
| $t_{d(off)}$           | Turn-Off Delay Time                     | --   | 85   | 180  |                       |                                                                             |
| $t_f$                  | Fall Time                               | --   | 30   | 70   |                       |                                                                             |
| $Q_g$                  | Total Gate Charge                       | --   | 74   | 95   | nC                    | $V_{DS}=480V, V_{GS}=10V,$<br>$I_D=10A$<br><b>See Fig 6 &amp; Fig 12</b> ④⑤ |
| $Q_{gs}$               | Gate-Source Charge                      | --   | 12   | --   |                       |                                                                             |
| $Q_{gd}$               | Gate-Drain( "Miller" ) Charge           | --   | 35.4 | --   |                       |                                                                             |

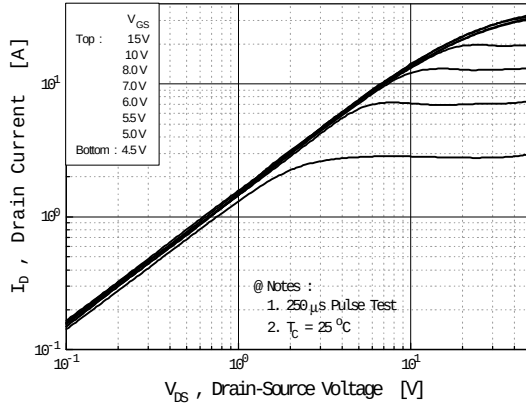
### Source-Drain Diode Ratings and Characteristics

| Symbol   | Characteristic            | Min. | Typ. | Max. | Units   | Test Condition                              |
|----------|---------------------------|------|------|------|---------|---------------------------------------------|
| $I_S$    | Continuous Source Current | --   | --   | 9    | A       | Integral reverse pn-diode in the MOSFET     |
| $I_{SM}$ | Pulsed-Source Current ①   | --   | --   | 36   |         |                                             |
| $V_{SD}$ | Diode Forward Voltage ④   | --   | --   | 1.4  | V       | $T_J=25^{\circ}\text{C}, I_S=9A, V_{GS}=0V$ |
| $t_{rr}$ | Reverse Recovery Time     | --   | 440  | --   | ns      | $T_J=25^{\circ}\text{C}, I_F=10A$           |
| $Q_{rr}$ | Reverse Recovery Charge   | --   | 4.7  | --   | $\mu C$ | $di_F/dt=100A/\mu s$ ④                      |

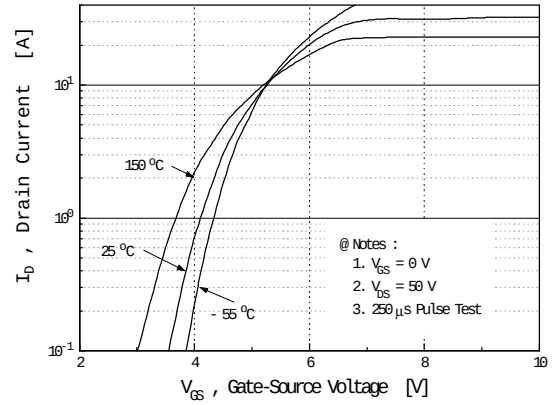
#### Notes ;

- ① Repetitive Rating : Pulse Width Limited by Maximum Junction Temperature
- ②  $L=10\text{mH}, I_{AS}=9A, V_{DD}=50V, R_G=27\Omega$ , Starting  $T_J=25^{\circ}\text{C}$
- ③  $I_{SD} \leq 10A, di/dt \leq 150A/\mu s, V_{DD} \leq BV_{DSS}$ , 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

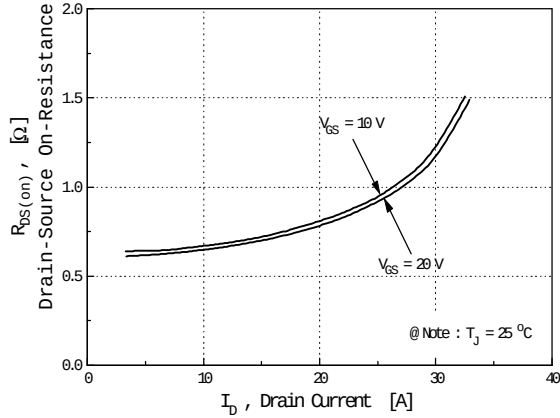
**Fig 1. Output Characteristics**



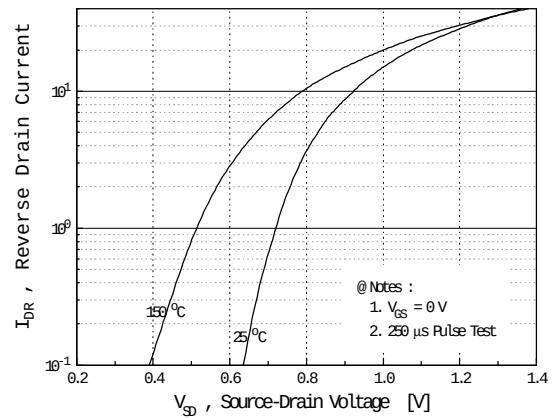
**Fig 2. Transfer Characteristics**



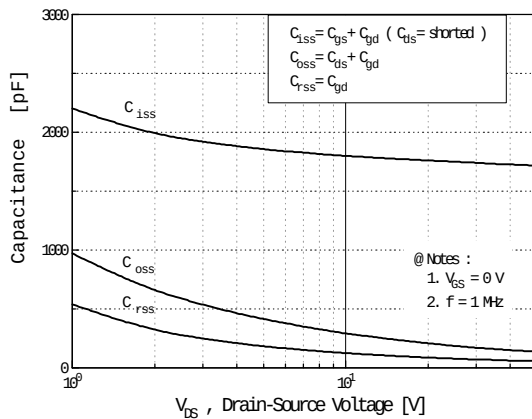
**Fig 3. On-Resistance vs. Drain Current**



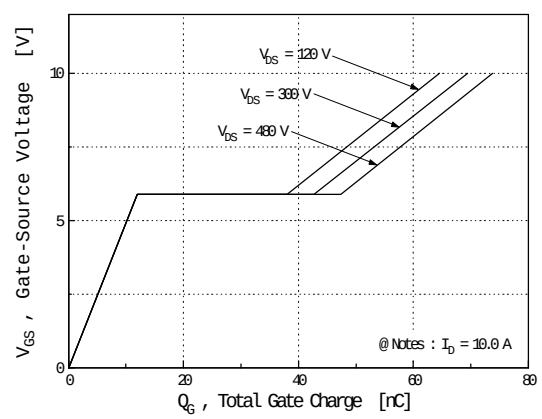
**Fig 4. Source-Drain Diode Forward Voltage**



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

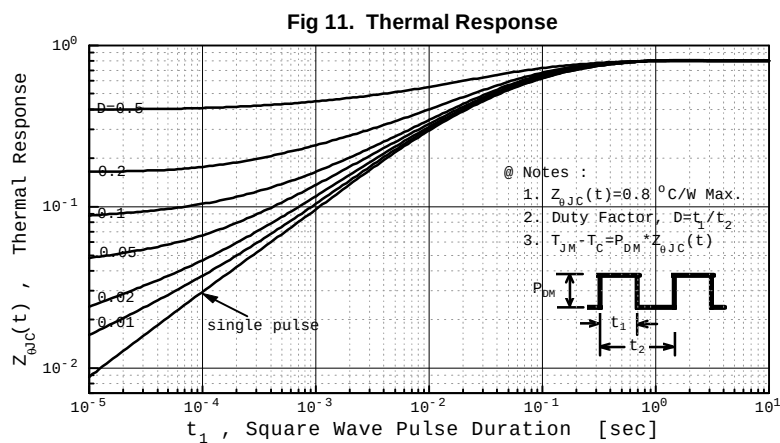
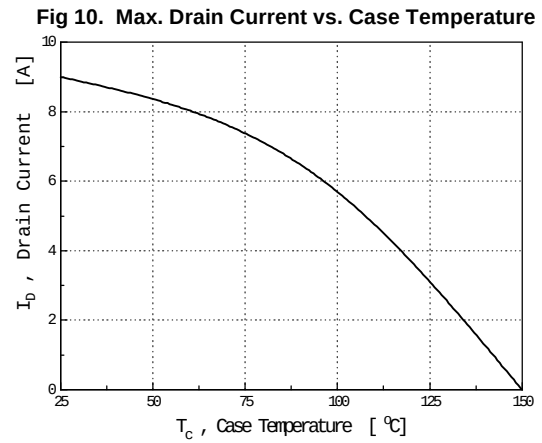
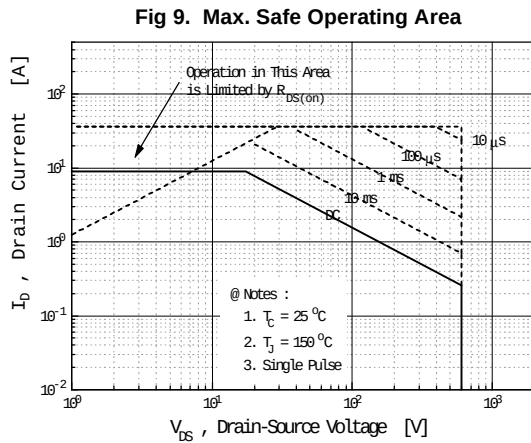
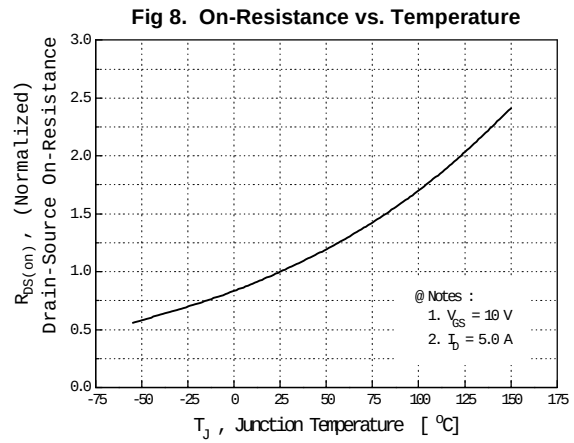
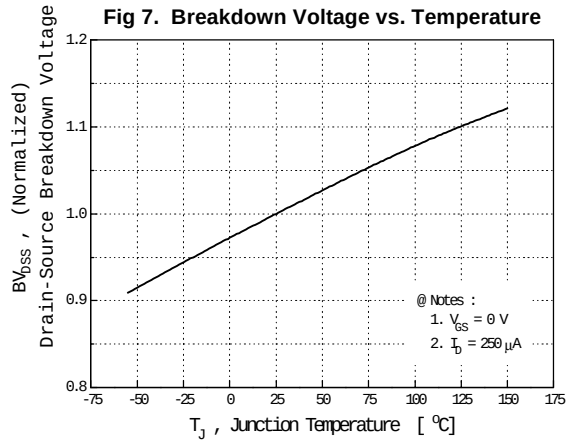


**Fig 6. Gate Charge vs. Gate-Source Voltage**

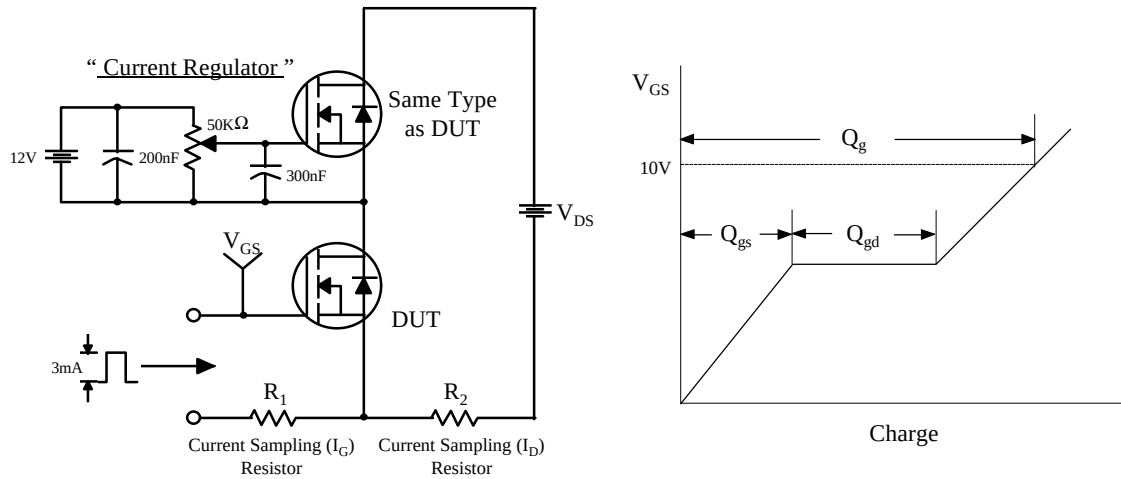


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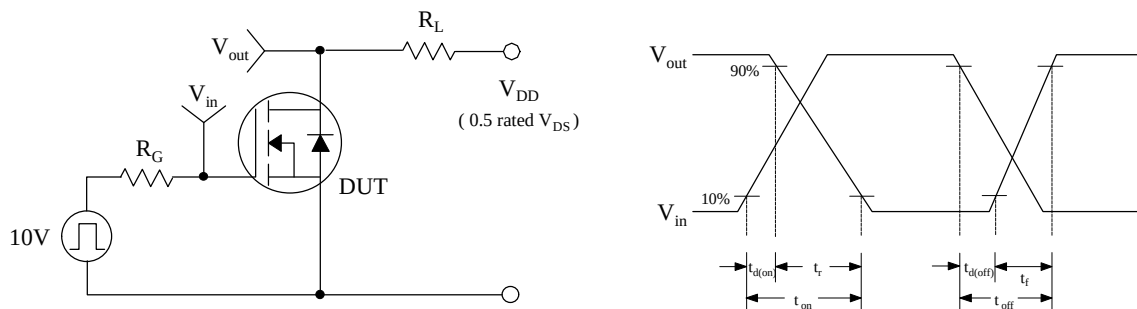
## N-CHANNEL POWER MOSFET



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



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



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

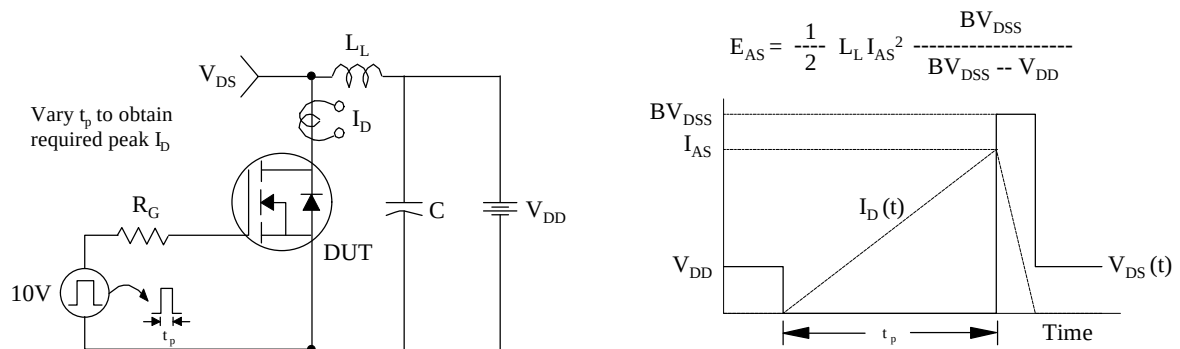
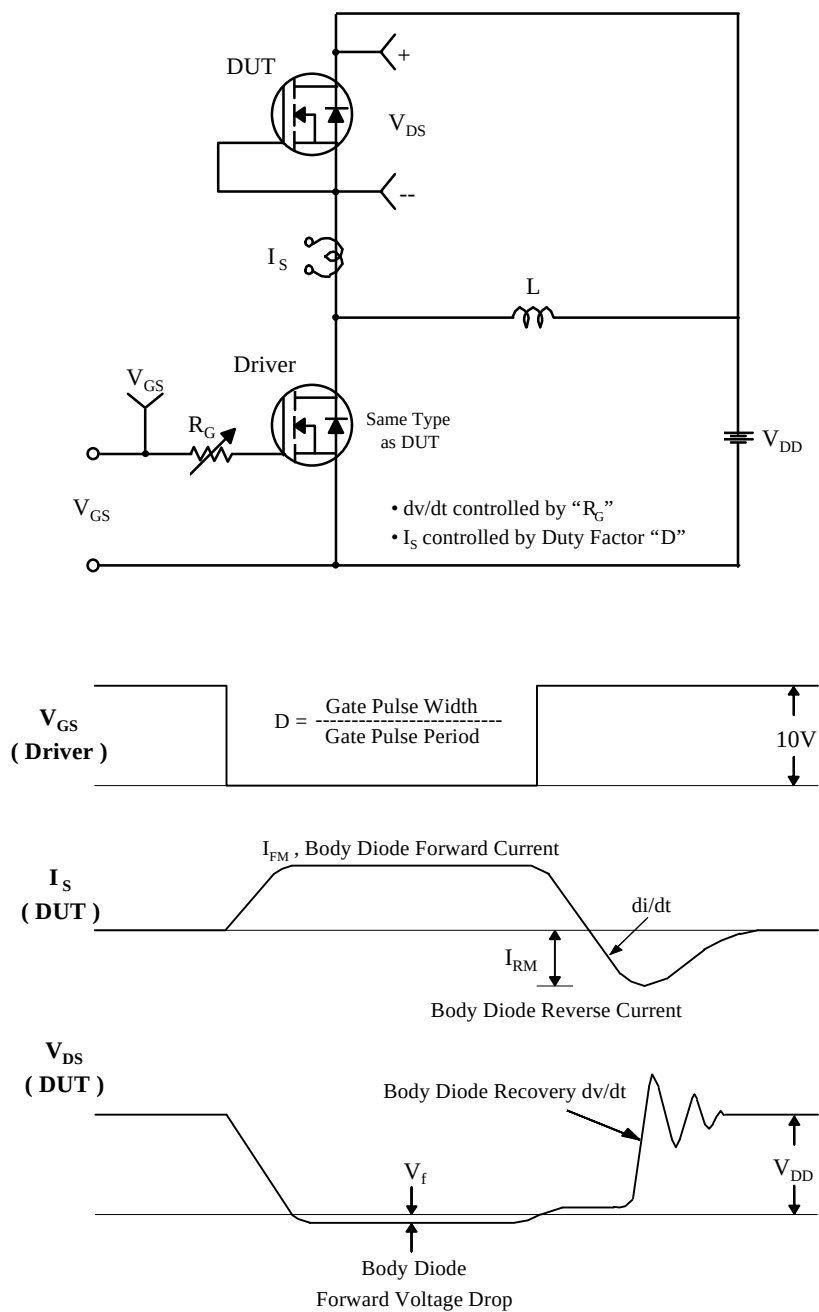


Fig 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms



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