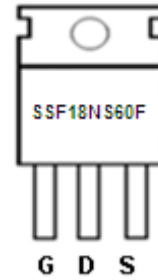
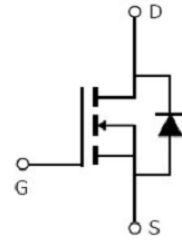


**Main Product Characteristics:**

|              |               |
|--------------|---------------|
| $V_{DS}$     | 610V          |
| $R_{DS(on)}$ | 0.27ohm(typ.) |
| $I_D$        | 15A ①         |


**TO220F**

**Marking and pin Assignment**

**Schematic diagram**
**Features and Benefits:**

- High dv/dt and avalanche capabilities
- 100% avalanche tested
- Low input capacitance and gate charge
- Low gate input resistance


**Description:**

The SSF18NS60F series MOSFETs is a new technology, which combines an innovative super junction technology and advance process. This new technology achieves low  $R_{ds(on)}$ , energy saving, high reliability and uniformity, superior power density and space saving.

**Absolute max Rating:**

| Symbol             | Parameter                                        | Max.         | Units |
|--------------------|--------------------------------------------------|--------------|-------|
| $I_D$ @ TC = 25°C  | Continuous Drain Current, $V_{GS}$ @ 10V         | 15 ①         | A     |
| $I_D$ @ TC = 100°C | Continuous Drain Current, $V_{GS}$ @ 10V         | 9.4 ①        |       |
| $I_{DM}$           | Pulsed Drain Current ②                           | 60           |       |
| $P_D$ @ TC = 25°C  | Power Dissipation ③                              | 32.8         | W     |
|                    | Linear Derating Factor                           | 0.26         | W/°C  |
| $V_{DS}$           | Drain-Source Voltage                             | 610          | V     |
| $V_{GS}$           | Gate-to-Source Voltage                           | ±30          | V     |
| $E_{AS}$           | Single Pulse Avalanche Energy @ L=22.5mH         | 180          | mJ    |
| $I_{AS}$           | Avalanche Current @ L=22.5mH                     | 4            | A     |
| $T_J$ $T_{STG}$    | Operating Junction and Storage Temperature Range | -55 to + 150 | °C    |

## Thermal Resistance

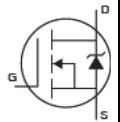
| Symbol          | Characterizes                          | Typ. | Max. | Units |
|-----------------|----------------------------------------|------|------|-------|
| $R_{\theta JC}$ | Junction-to-case ③                     | —    | 3.8  | °C/W  |
| $R_{\theta JA}$ | Junction-to-ambient ( $t \leq 10s$ ) ④ | —    | 80   | °C/W  |

## Electrical Characterizes @ $T_A=25^\circ\text{C}$ unless otherwise specified

| Symbol        | Parameter                            | Min. | Typ. | Max. | Units    | Conditions                                                                            |
|---------------|--------------------------------------|------|------|------|----------|---------------------------------------------------------------------------------------|
| $V_{(BR)DSS}$ | Drain-to-Source breakdown voltage    | 610  | —    | —    | V        | $V_{GS} = 0V, I_D = 250\mu A$                                                         |
| $R_{DS(on)}$  | Static Drain-to-Source on-resistance | —    | 0.27 | 0.35 | $\Omega$ | $V_{GS}=10V, I_D = 9.4A$                                                              |
|               |                                      | —    | 0.73 | —    |          | $T_J = 125^\circ\text{C}$                                                             |
| $V_{GS(th)}$  | Gate threshold voltage               | 2    | —    | 4    | V        | $V_{DS} = V_{GS}, I_D = 250\mu A$                                                     |
|               |                                      | —    | 2.66 | —    |          | $T_J = 125^\circ\text{C}$                                                             |
| $I_{DSS}$     | Drain-to-Source leakage current      | —    | —    | 1    | $\mu A$  | $V_{DS} = 600V, V_{GS} = 0V$                                                          |
|               |                                      | —    | —    | 50   |          | $T_J = 125^\circ\text{C}$                                                             |
| $I_{GSS}$     | Gate-to-Source forward leakage       | —    | —    | 100  | nA       | $V_{GS} = 30V$                                                                        |
|               |                                      | —    | —    | -100 |          | $V_{GS} = -30V$                                                                       |
| $Q_g$         | Total gate charge                    | —    | 27.0 | —    | nC       | $I_D = 10A,$<br>$V_{DS}=480V,$<br>$V_{GS} = 10V$                                      |
| $Q_{gs}$      | Gate-to-Source charge                | —    | 6.3  | —    |          |                                                                                       |
| $Q_{gd}$      | Gate-to-Drain("Miller") charge       | —    | 13.7 | —    |          |                                                                                       |
| $t_{d(on)}$   | Turn-on delay time                   | —    | 12.3 | —    | nS       | $V_{GS}=10V, V_{DS} = 480V,$<br>$R_L=40\Omega,$<br>$R_{GEN}=4.1\Omega$<br>$I_D = 12A$ |
| $t_r$         | Rise time                            | —    | 24.3 | —    |          |                                                                                       |
| $t_{d(off)}$  | Turn-Off delay time                  | —    | 27.1 | —    |          |                                                                                       |
| $t_f$         | Fall time                            | —    | 19.7 | —    |          |                                                                                       |
| $C_{iss}$     | Input capacitance                    | —    | 949  | —    | pF       | $V_{GS} = 0V$                                                                         |
| $C_{oss}$     | Output capacitance                   | —    | 783  | —    |          | $V_{DS} = 25V$                                                                        |
| $C_{rss}$     | Reverse transfer capacitance         | —    | 11   | —    |          | $f = 400KHz$                                                                          |

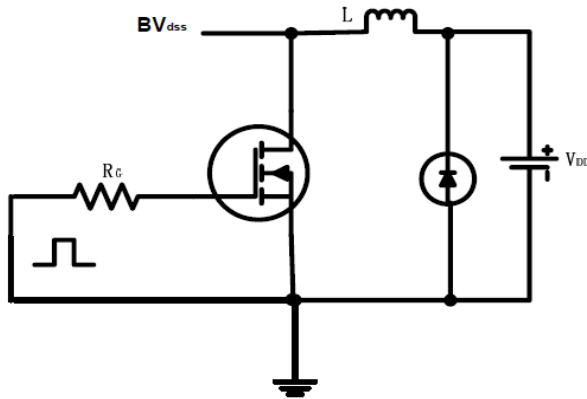
## Source-Drain Ratings and Characteristics

| Symbol   | Parameter                                 | Min. | Typ. | Max. | Units   | Conditions                                                              |
|----------|-------------------------------------------|------|------|------|---------|-------------------------------------------------------------------------|
| $I_S$    | Continuous Source Current<br>(Body Diode) | —    | —    | 15 ① | A       | MOSFET symbol<br>showing the<br>integral reverse<br>p-n junction diode. |
| $I_{SM}$ | Pulsed Source Current<br>(Body Diode)     | —    | —    | 60   | A       |                                                                         |
| $V_{SD}$ | Diode Forward Voltage                     | —    | 0.89 | 1.3  | V       | $I_S=15A, V_{GS}=0V$                                                    |
| $t_{rr}$ | Reverse Recovery Time                     | —    | 313  | —    | nS      | $T_J = 25^\circ\text{C}, I_F = 15A, di/dt = 100A/\mu s$                 |
| $Q_{rr}$ | Reverse Recovery Charge                   | —    | 3    | —    | $\mu C$ |                                                                         |

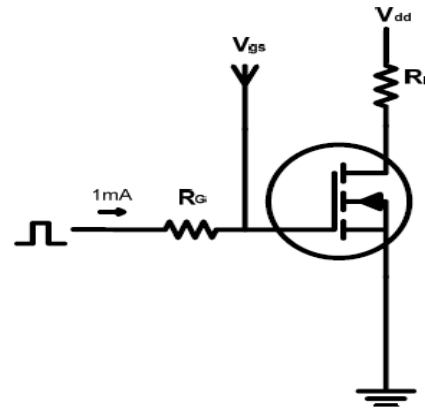


## Test circuits and Waveforms

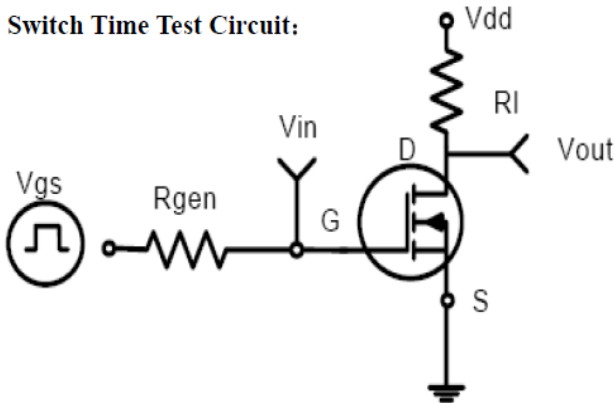
**EAS test circuits:**



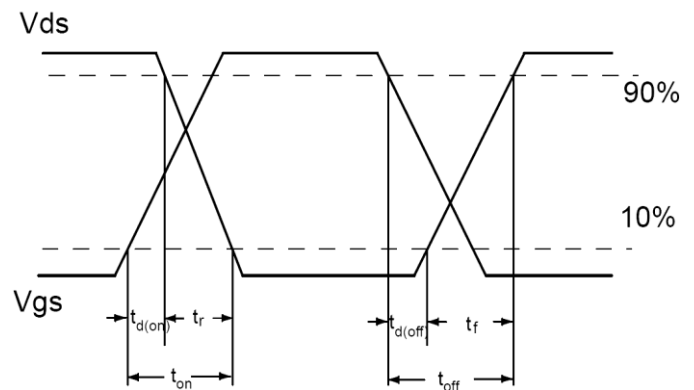
**Gate charge test circuit:**



**Switch Time Test Circuit:**



**Switch Waveforms:**



### Notes:

- ① Calculated continuous current based on maximum allowable junction temperature.
- ② Repetitive rating; pulse width limited by max. junction temperature.
- ③ The power dissipation PD is based on max. junction temperature, using junction-to-case thermal resistance.
- ④ The value of  $R_{\theta JA}$  is measured with the device mounted on 1 in 2 FR-4 board with 2oz. Copper, in a still air environment with  $T_A = 25^\circ\text{C}$
- ⑤ These curves are based on the junction-to-case thermal impedance which is measured with the device mounted to a large heatsink, assuming a maximum junction temperature of  $T_{J(MAX)} = 150^\circ\text{C}$ .

## Typical electrical and thermal characteristics

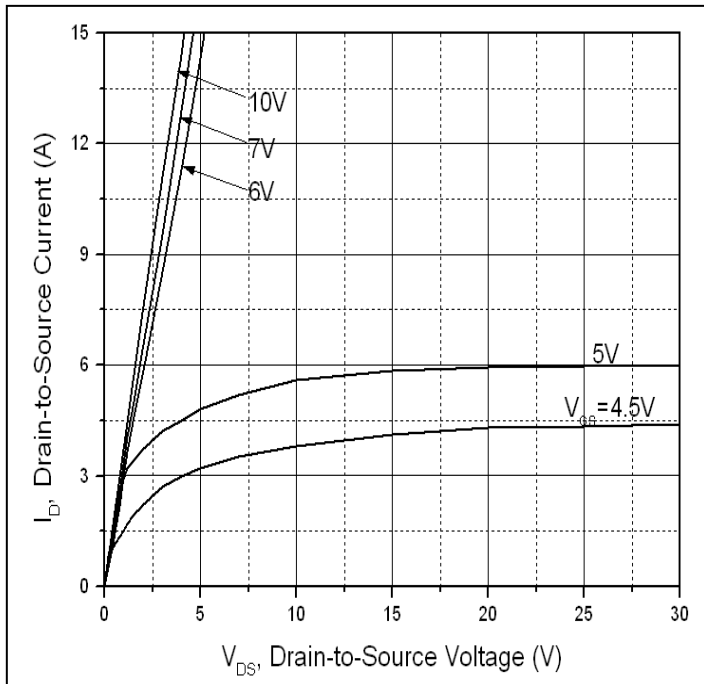


Figure 1: Typical Output Characteristics

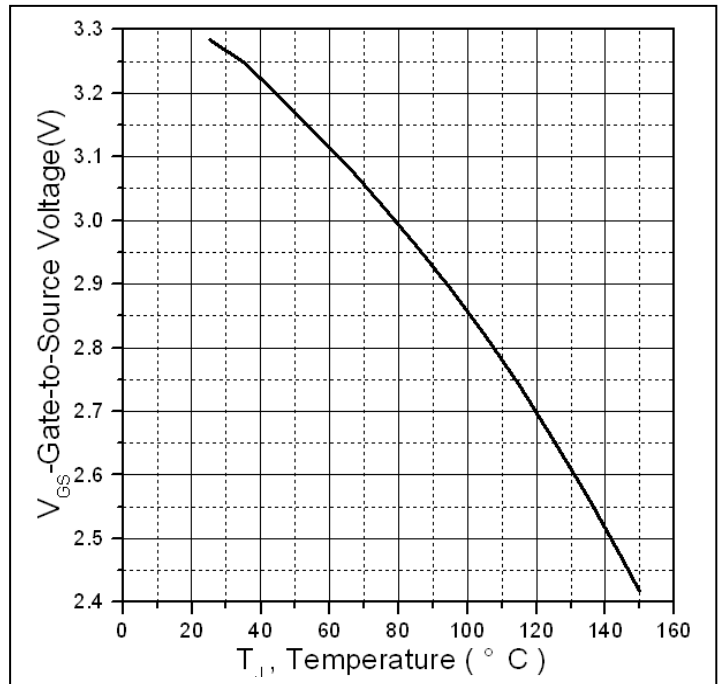


Figure 2. Gate to source cut-off voltage

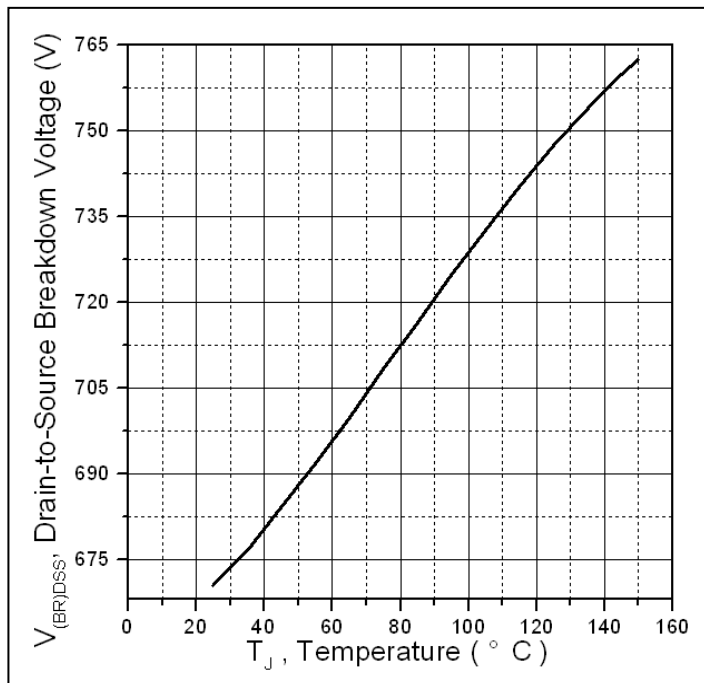


Figure 3. Drain-to-Source Breakdown Voltage vs. Temperature

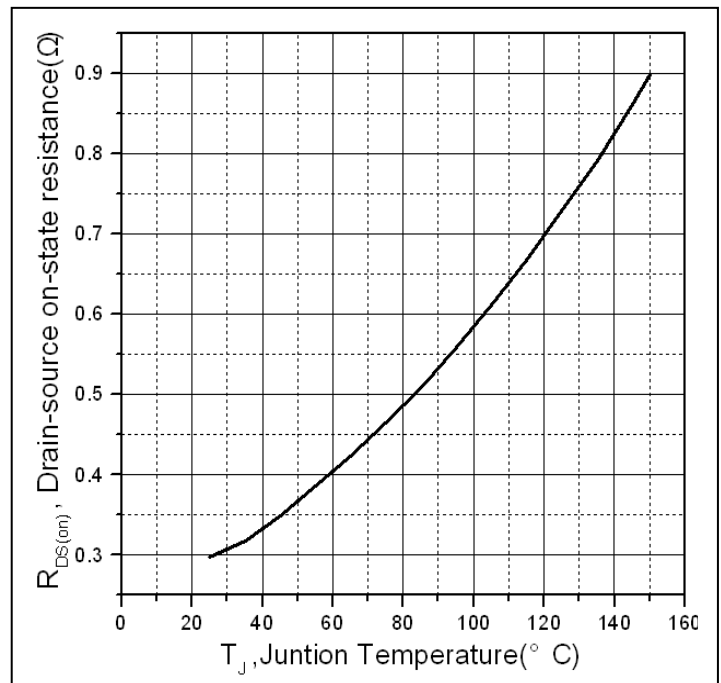
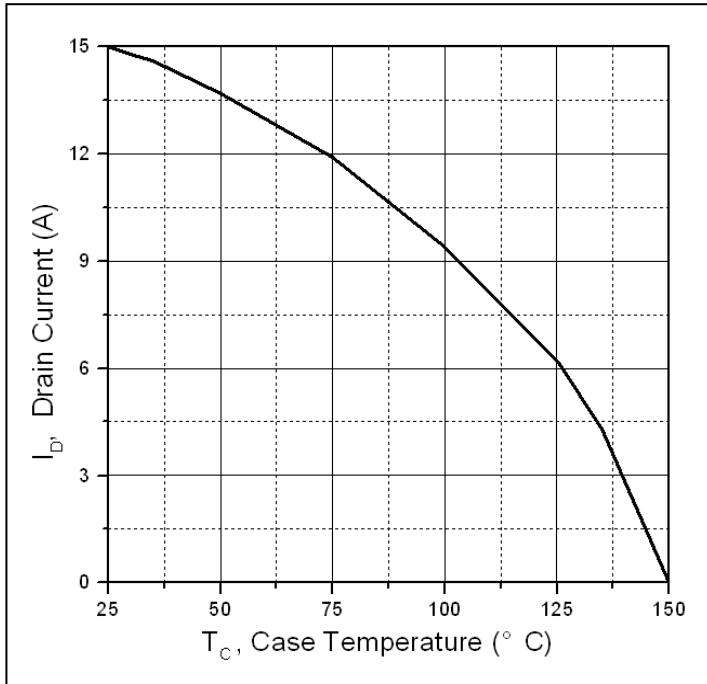
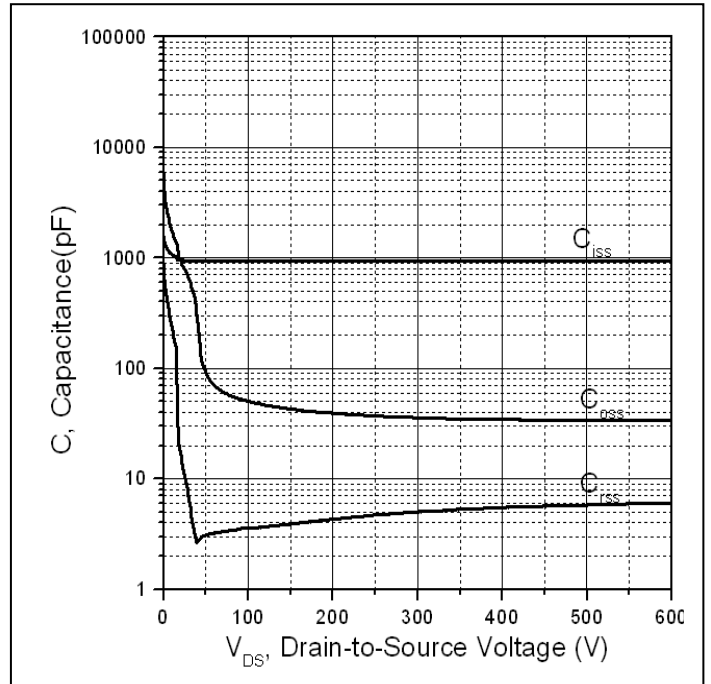


Figure 4: Normalized On-Resistance Vs. Case Temperature

## Typical electrical and thermal characteristics



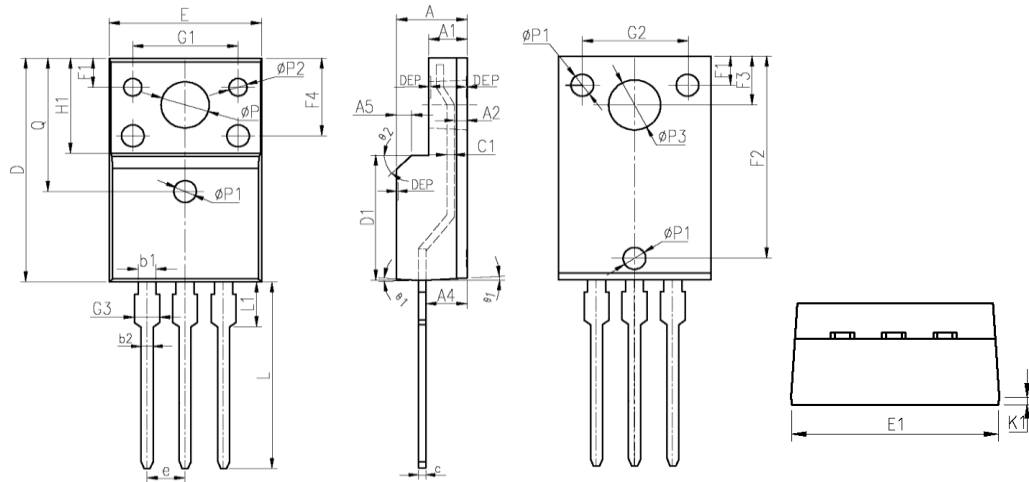
**Figure 5. Maximum Drain Current Vs. Case Temperature**



**Figure 6. Typical Capacitance Vs. Drain-to-Source Voltage**

### Mechanical Data:

### TO220F PACKAGE OUTLINE DIMENSION



| Symbol | Dimension In Millimeters |        |        | Dimension In Inches |       |       |
|--------|--------------------------|--------|--------|---------------------|-------|-------|
|        | Min                      | Nom    | Max    | Min                 | Nom   | Max   |
| E      | 10.040                   | 10.200 | 10.360 | 0.395               | 0.402 | 0.408 |
| A      | 4.500                    | 4.700  | 4.900  | 0.177               | 0.185 | 0.193 |
| A1     | 2.340                    | 2.540  | 2.740  | 0.092               | 0.100 | 0.108 |
| A2     | 0.950                    | 1.050  | 1.150  | 0.037               | 0.041 | 0.045 |
| A4     | 2.650                    | 2.750  | 2.850  | 0.104               | 0.108 | 0.112 |
| A5     | 1.00REF                  |        |        | 0.039REF            |       |       |
| c      | 0.420                    | 0.500  | 0.580  | 0.017               | 0.020 | 0.023 |
| c1     | 0.420                    | 0.500  | 0.580  | 0.017               | 0.020 | 0.023 |
| D      | 15.670                   | 15.870 | 16.070 | 0.617               | 0.625 | 0.633 |
| Q      | 9.20REF                  |        |        | 0.362REF            |       |       |
| H1     | 6.70REF                  |        |        | 0.264REF            |       |       |
| e      | 2.54BSC                  |        |        | 0.10BSC             |       |       |
| ΦP     | 3.183REF                 |        |        | 0.125REF            |       |       |
| L      | 12.780                   | 12.980 | 13.180 | 0.503               | 0.511 | 0.519 |
| L1     | 3.250                    | 3.450  | 3.650  | 0.128               | 0.136 | 0.144 |
| D1     | 9.17REF                  |        |        | 0.362REF            |       |       |
| ΦP1    | 1.400                    | 1.500  | 1.600  | 0.055               | 0.059 | 0.063 |
| ΦP2    | 1.150                    | 1.200  | 1.250  | 0.045               | 0.047 | 0.049 |
| ΦP3    | 3.45REF                  |        |        | 0.136REF            |       |       |
| Θ1     | 5°                       | 7°     | 9°     | 5°                  | 7°    | 9°    |
| Θ2     | -                        | 45°    | -      | -                   | 45°   | -     |
| DEP    | 0.050                    | 0.100  | 0.150  | 0.002               | 0.004 | 0.006 |
| F1     | 1.900                    | 2.000  | 2.100  | 0.075               | 0.079 | 0.083 |
| F2     | 13.800                   | 13.900 | 14.000 | 0.543               | 0.547 | 0.551 |
| F3     | 3.200                    | 3.300  | 3.400  | 0.126               | 0.130 | 0.134 |
| F4     | 5.300                    | 5.400  | 5.500  | 0.209               | 0.213 | 0.217 |
| G1     | 6.600                    | 6.700  | 6.800  | 0.260               | 0.264 | 0.268 |
| G2     | 6.900                    | 7.000  | 7.100  | 0.272               | 0.276 | 0.280 |
| G3     | 1.100                    | 1.300  | 1.500  | 0.043               | 0.051 | 0.059 |
| E1     | 9.900                    | 10.000 | 10.100 | 0.390               | 0.394 | 0.398 |
| K1     | 0.650                    | 0.700  | 0.750  | 0.026               | 0.028 | 0.030 |
| b1     | 1.050                    | 1.200  | 1.350  | 0.041               | 0.047 | 0.053 |
| b2     | 0.700                    | 0.800  | 0.850  | 0.028               | 0.031 | 0.033 |

**Ordering and Marking Information****Device Marking: SSF18NS60F**

Package (Available)

TO220F

Operating Temperature Range

C : -55 to 150 °C

**Devices per Unit**

| Package Type | Units/ Tube | Tubes/Inner Box | Units/Inner Box | InnerBoxes/ CartonBox | Units/Carton Box |
|--------------|-------------|-----------------|-----------------|-----------------------|------------------|
| TO220F       | 50          | 20              | 1000            | 6                     | 6000             |

**Reliability Test Program**

| Test Item                           | Conditions                                                                                                   | Duration                             | Sample Size         |
|-------------------------------------|--------------------------------------------------------------------------------------------------------------|--------------------------------------|---------------------|
| High Temperature Reverse Bias(HTRB) | $T_j=125^{\circ}\text{C}$ to $150^{\circ}\text{C}$ @ 80% of Max $V_{\text{DSS}}/V_{\text{CES}}/V_{\text{R}}$ | 168 hours<br>500 hours<br>1000 hours | 3 lots x 77 devices |
| High Temperature Gate Bias(HTGB)    | $T_j=150^{\circ}\text{C}$ @ 100% of Max $V_{\text{GSS}}$                                                     | 168 hours<br>500 hours<br>1000 hours | 3 lots x 77 devices |

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**Customer Service****Worldwide Sales and Service:**

Sales@silikron.com

**Technical Support:**

Technical@silikron.com

**Suzhou Silikron Semiconductor Corp.**

11A, 428 Xinglong Street, Suzhou Industrial Park, P.R.China

TEL: (86-512) 62560688

FAX: (86-512) 65160705

E-mail: Sales@silikron.com