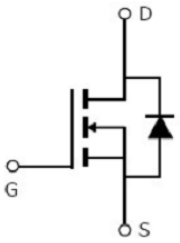
## Main Product Characteristics:

| | |
|---|---|
| $V_{DSS}$ | 600V |
| $R_{DS}$(on) | 0.54Ω(typ.) |
| $I_D$ | 7A ① |

TO220F


Marking and pin Assignment




Schematic diagram

## Features and Benefits:

**Feathers:**

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

## Description:

The SSF7NS60F series MOSFETs is a new technology, which combines an innovative super junction technology and advance process. This new technology achieves low Rdson, 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 | 7 ① | A |
| $I_D$ @ TC = 100°C | Continuous Drain Current, $V_{GS}$ @ 10V | 5 ① | |
| $I_{DM}$ | Pulsed Drain Current ② | 28 | |
| $P_D$ @TC = 25°C | Power Dissipation ③ | 32 | W |
| | Linear Derating Factor | 0.26 | W/°C |
| $V_{DS}$ | Drain-Source Voltage | 600 | V |
| $V_{GS}$ | Gate-to-Source Voltage | ± 30 | V |
| $E_{AS}$ | Single Pulse Avalanche Energy @ L=15.2mH | 68 | mJ |
| $I_{AR}$ | Avalanche Current @ L=15.2mH | 3 | A |
| $T_J$ $T_{STG}$ | Operating Junction and Storage Temperature Range | -55 to + 150 | °C |

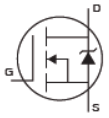
## Thermal Resistance

| Symbol | Characterizes | Typ. | Max. | Units |
|---|---|---|---|---|
| $R_{\theta JC}$ | Junction-to-case ③ | — | 3.9 | ℃/W |
| $R_{\theta JA}$ | Junction-to-ambient (t ≤ 10s) ④ | — | 80 | ℃/W |

## Electrical Characterizes @$T_A$=25℃ unless otherwise specified

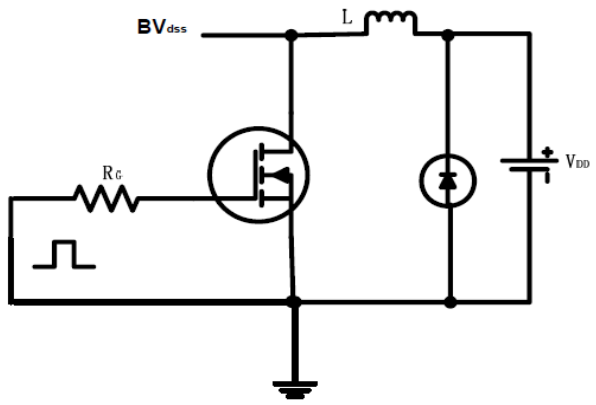
| Symbol | Parameter | Min. | Typ. | Max. | Units | Conditions |
|---|---|---|---|---|---|---|
| $V_{(BR)DSS}$ | Drain-to-Source breakdown voltage | 600 | — | — | V | $V_{GS}$ = 0V, $I_D$ = 250μA |
| $R_{DS(on)}$ | Static Drain-to-Source on-resistance | — | 0.54 | 0.65 | Ω | $V_{GS}$=10V,$I_D$ = 4.6A |
| | | — | 1.57 | — | | $T_J$ = 125℃ |
| $V_{GS(th)}$ | Gate threshold voltage | 2 | — | 4 | V | $V_{DS}$ = $V_{GS}$, $I_D$ = 350μA |
| | | — | 2.82 | — | | $T_J$ = 125℃ |
| $I_{DSS}$ | Drain-to-Source leakage current | — | — | 1 | μA | $V_{DS}$ = 600V,$V_{GS}$ = 0V |
| | | — | — | 50 | | $T_J$ = 125°C |
| $I_{GSS}$ | Gate-to-Source forward leakage | — | — | 100 | nA | $V_{GS}$ =30V |
| | | — | — | -100 | | $V_{GS}$ = -30V |
| $Q_g$ | Total gate charge | — | 15.1 | — | nC | $I_D$ = 7.3A, |
| $Q_{gs}$ | Gate-to-Source charge | — | 3.8 | — | | $V_{DS}$=300V, |
| $Q_{gd}$ | Gate-to-Drain("Miller") charge | — | 7.0 | — | | $V_{GS}$ = 10V |
| $t_{d(on)}$ | Turn-on delay time | — | 11.0 | — | ns | $V_{GS}$=10V, $V_{DS}$ =380V, |
| $t_r$ | Rise time | — | 22.2 | — | | $R_L$=52Ω, |
| $t_{d(off)}$ | Turn-Off delay time | — | 23.8 | — | | $R_{GEN}$=12Ω |
| $t_f$ | Fall time | — | 17.8 | — | | $I_D$ =7.3A |
| $C_{iss}$ | Input capacitance | — | 475 | — | pF | $V_{GS}$ = 0V |
| $C_{oss}$ | Output capacitance | — | 399 | — | | $V_{DS}$ = 25V |
| $C_{rss}$ | Reverse transfer capacitance | — | 4 | — | | $f$ = 1MHz |

## Source-Drain Ratings and Characteristics

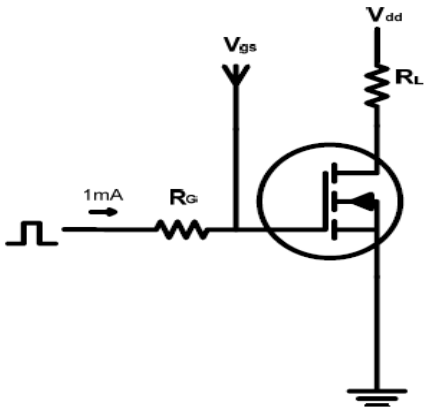
| Symbol | Parameter | Min. | Typ. | Max. | Units | Conditions |
|---|---|---|---|---|---|---|
| $I_S$ | Continuous Source Current (Body Diode) | — | — | 7 ① | A | MOSFET symbol showing the integral reverse p-n junction diode.  |
| $I_{SM}$ | Pulsed Source Current (Body Diode) | — | — | 28 | A | |
| $V_{sd}$ | Diode Forward Voltage | — | 0.95 | 1.3 | V | $I_S$=7.3A, $V_{GS}$=0V |
| $t_{rr}$ | Reverse Recovery Time | — | 123 | — | nS | $T_J$ = 25°C, $I_F$ =1A, di/dt = 100A/μs |
| $Q_{rr}$ | Reverse Recovery Charge | — | 638 | — | nC | |

## Test circuits and Waveforms

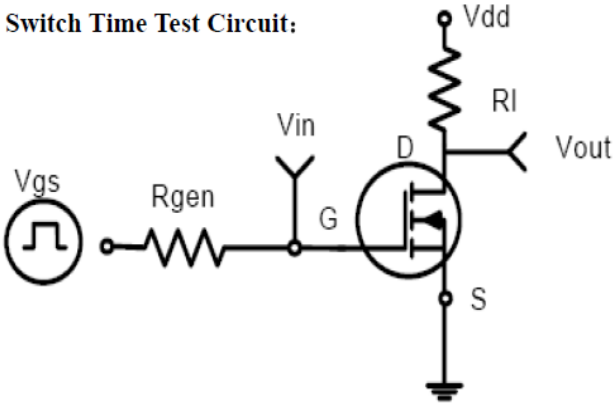
**EAS test circuits:**



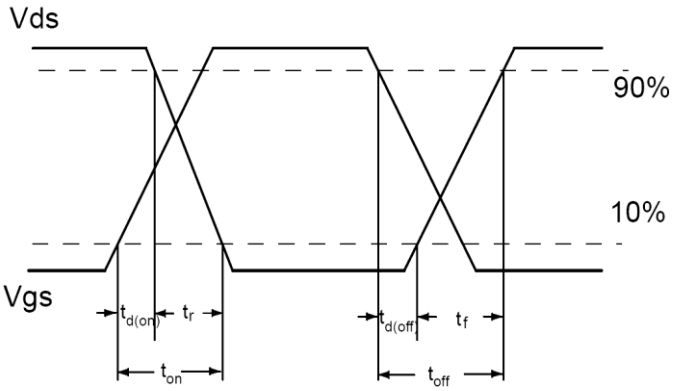

**Gate charge test circuit:**




**Switch Time Test Circuit:**




**Switch Waveforms:**




## Notes:

①Calculated continuous current based on maximum allowable junction temperature. Package limitation current is 75A.

②Repetitive rating; pulse width limited by max. junction temperature.

③The power dissipation PD is based on max. junction temperature, using junction-to-case thermal resistance.

④The 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 TA =25°C

⑤These curves are based on the junction-to-case thermal impedence which is measured with the device mounted to a large heatsink, assuming a maximum junction temperature of $T_{J(MAX)}$=175°C.

## Typical electrical and thermal characteristics

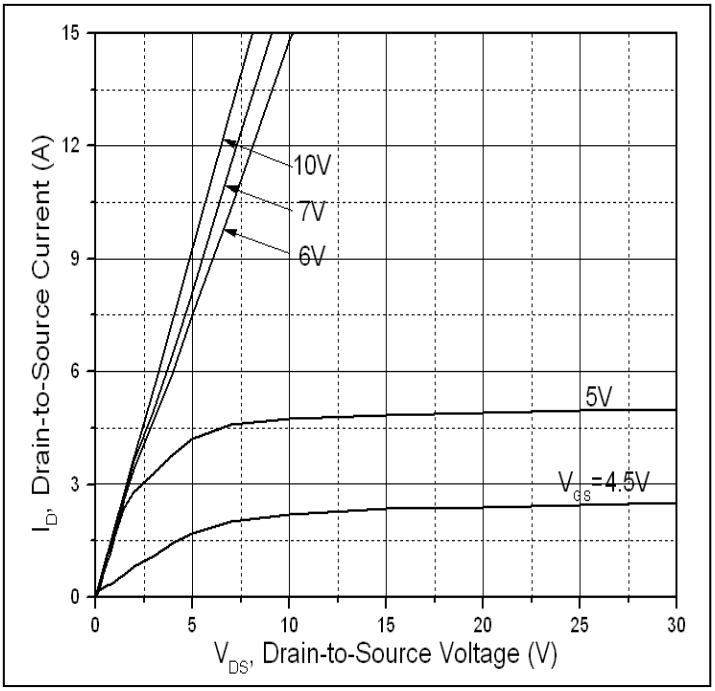



**Figure 1: Typical Output Characteristics**

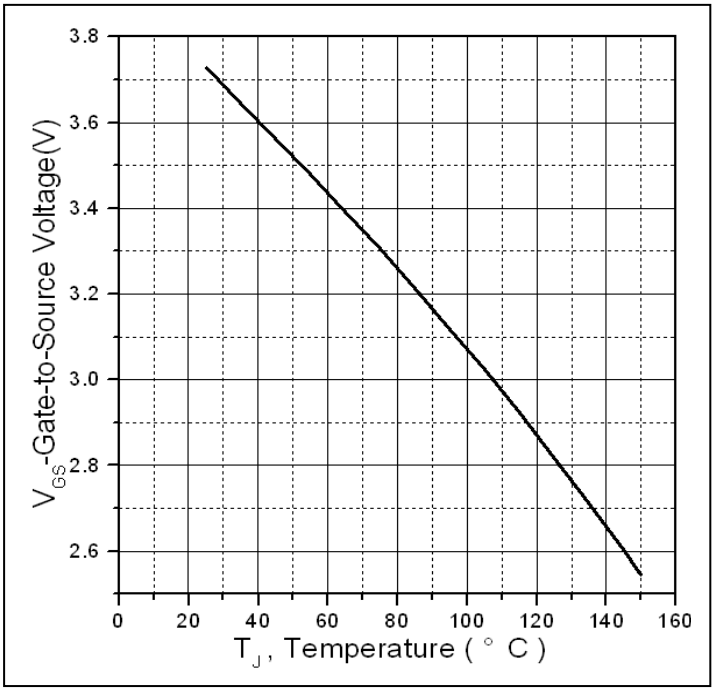



**Figure 2. Gate to source cut-off voltage**

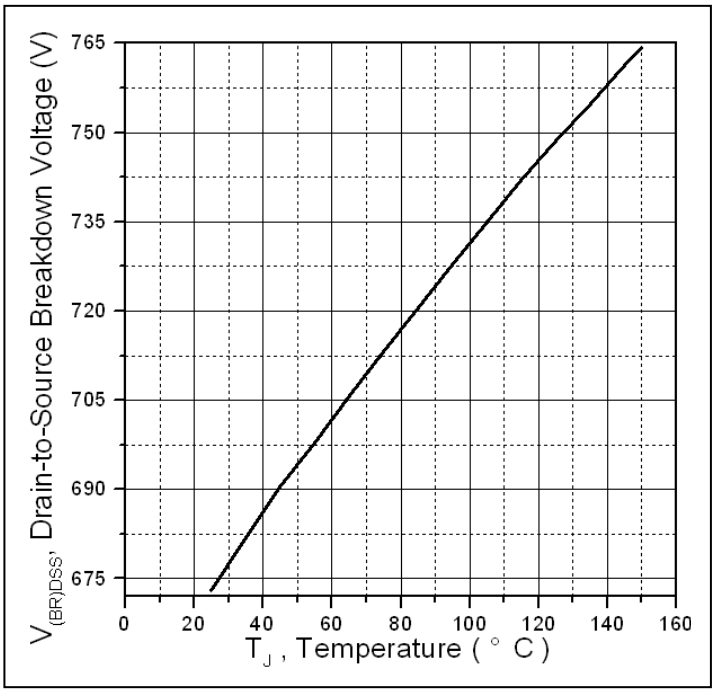



**Figure 3. Drain-to-Source Breakdown Voltage vs. Temperature**

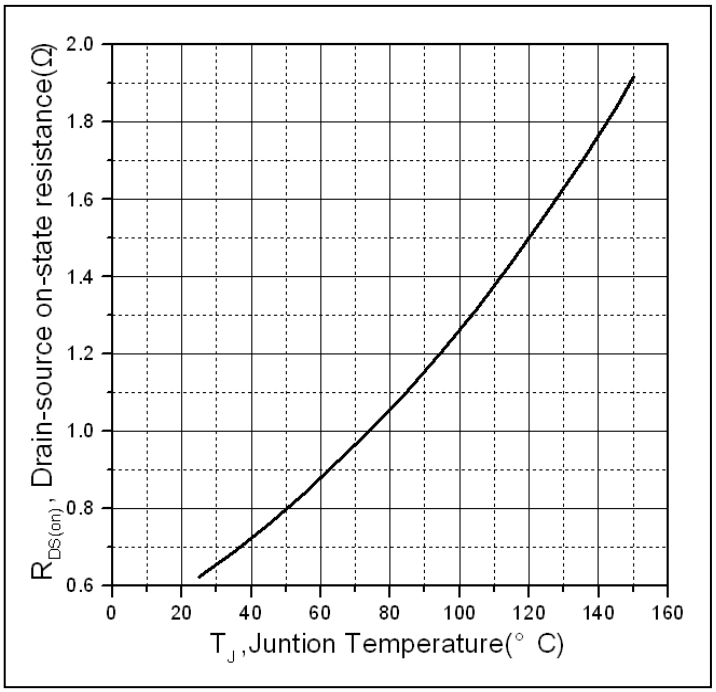



**Figure 4: Normalized On-Resistance Vs. Case Temperature**

## Typical electrical and thermal characteristics

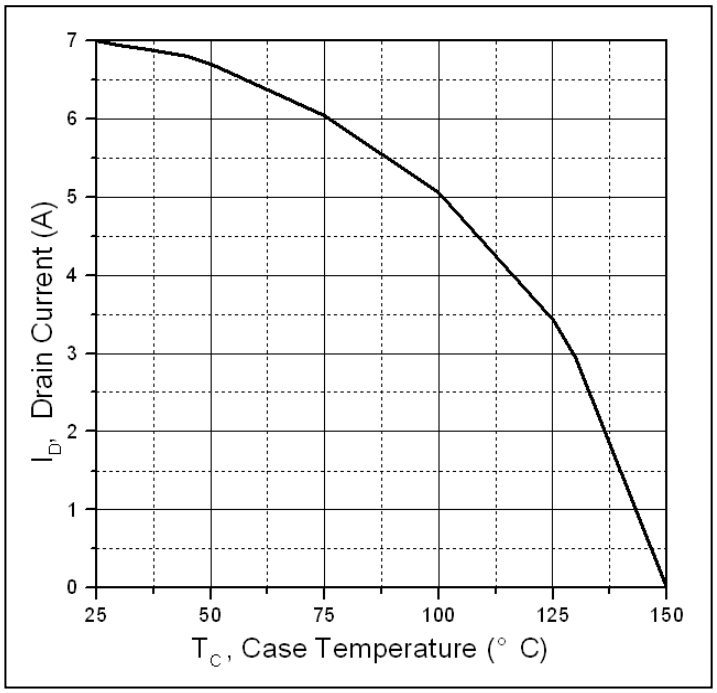



Figure 5. Maximum Drain Current Vs. Case Temperature

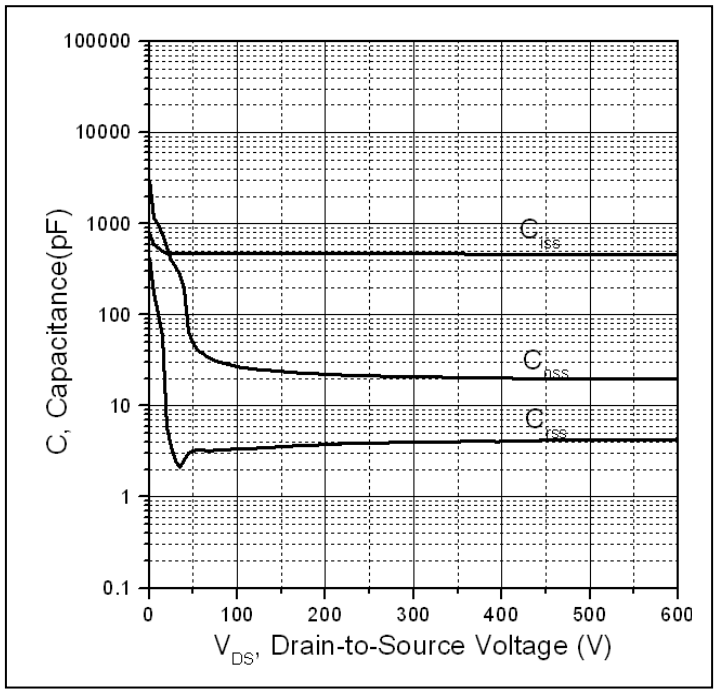



Figure 6. Typical Capacitance Vs. Drain-to-Source Voltage

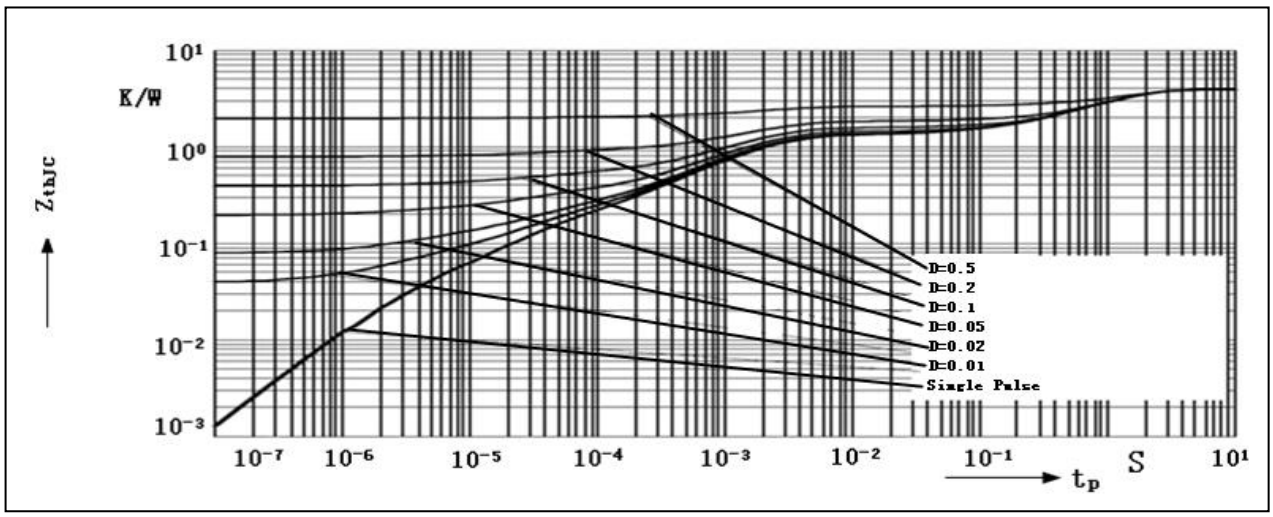
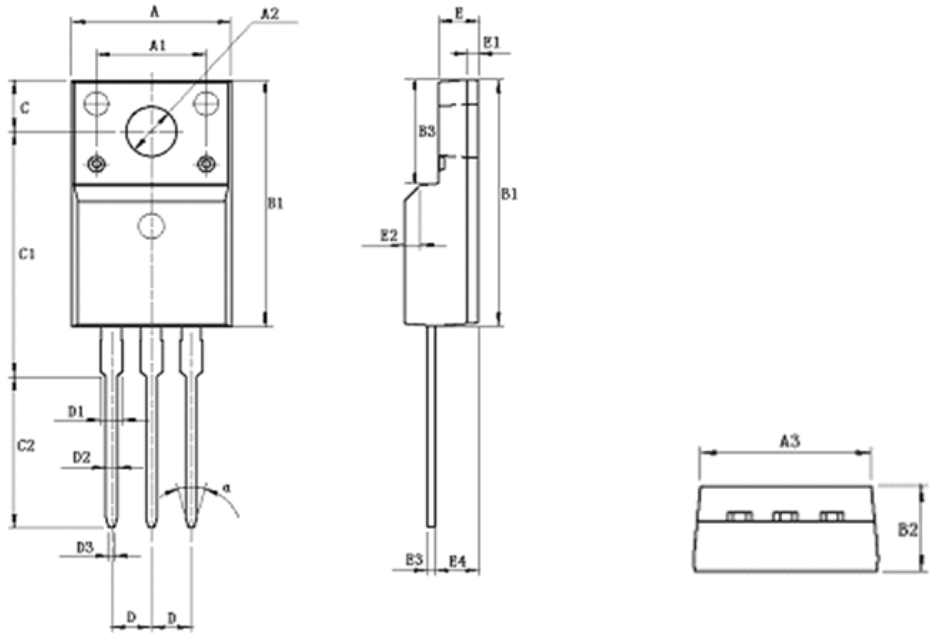



Figure7. Maximum Effective Transient Thermal Impedance, Junction-to-Case

## Mechanical Data：

**TO220F PACKAGE OUTLINE DIMENSION**




| Symbol | Dimension In Millimeters | | | Dimension In Inches | | |
|---|---|---|---|---|---|---|
| | Min | Nom | Max | Min | Nom | Max |
| A | 9.960 | 10.160 | 10.360 | 0.392 | 0.400 | 0.408 |
| A1 | | 7.000 | | 0.276 | 0.000 | 0.000 |
| A2 | 3.080 | 3.180 | 3.280 | 0.121 | 0.125 | 0.129 |
| A3 | 9.260 | 9.460 | 9.660 | 0.365 | 0.372 | 0.380 |
| B1 | 15.670 | 15.870 | 16.070 | 0.617 | 0.625 | 0.633 |
| B2 | 4.500 | 4.700 | 4.900 | 0.177 | 0.185 | 0.193 |
| B3 | 6.480 | 6.680 | 6.880 | 0.255 | 0.263 | 0.271 |
| C | 3.200 | 3.300 | 3.400 | 0.126 | 0.130 | 0.134 |
| C1 | 15.600 | 15.800 | 16.000 | 0.614 | 0.622 | 0.630 |
| C2 | 9.550 | 9.750 | 9.950 | 0.376 | 0.384 | 0.392 |
| D | | 2.54 (TYP) | | | 1.00 (TYP) | |
| D1 | - | - | 1.470 | - | - | 0.058 |
| D2 | 0.700 | 0.800 | 0.900 | 0.028 | 0.031 | 0.035 |
| D3 | 0.250 | 0.350 | 0.450 | 0.010 | 0.014 | 0.018 |
| E | 2.340 | 2.540 | 2.740 | 0.092 | 0.100 | 0.108 |
| E1 | | 0.700 | | | 0.028 | |
| E2 | | $1.0*45^0$ | | | $1.0*45^0$ | |
| E3 | 0.450 | 0.500 | 0.600 | 0.018 | 0.020 | 0.024 |
| E4 | 2.560 | 2.760 | 2.960 | 0.101 | 0.109 | 0.117 |
| Θ | | $30^0$ | | | $30^0$ | |

## Ordering and Marking Information

**Device Marking: SSF7NS60F**

**Package (Available)**

**TO220F**

**Operating Temperature Range**

**C : -55 to 150 ºC**

## Devices per Unit

| Package Type | Units/Tube | Tubes/Inner Box | Units/Inner Box | Inner Boxes/Carton Box | 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℃ to 150℃ @ 80% of Max $V_{DSS}$/$V_{CES}$/VR | 168 hours<br>500 hours<br>1000 hours | 3 lots x 77 devices |
| High Temperature Gate Bias(HTGB) | $T_j$=150℃ @ 100% of Max $V_{GSS}$ | 168 hours<br>500 hours<br>1000 hours | 3 lots x 77 devices |

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