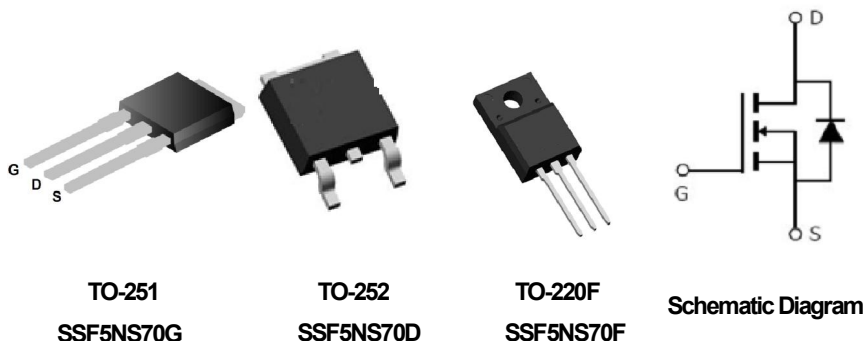


Main Product Characteristics

| | |
|--------------|----------------------|
| V_{DSS} | 700V |
| $R_{DS(on)}$ | 1.23 Ω (typ.) |
| I_D | 5A ① |



Features and Benefits

Features:

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



Description

The SSF5NS70G/D/F series MOSFETs is a new technology, which combines an innovative 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 | |
|--------------------------|--|---------------------------|-------|------|
| $I_D @ TC = 25^\circ C$ | Continuous Drain Current, $V_{GS} @ 10V$ | 5 ① | A | |
| $I_D @ TC = 100^\circ C$ | Continuous Drain Current, $V_{GS} @ 10V$ | 3.1 ① | | |
| I_{DM} | Pulsed Drain Current ② | 15 | | |
| $P_D @ TC = 25^\circ C$ | Power Dissipation ③ | For TO-251/TO-252 package | 50 | W |
| | | For TO-220F package | 31.2 | |
| | Linear Derating Factor | For TO-251/TO-252 package | 0.4 | W/°C |
| | | For TO-220F package | 0.25 | |
| V_{DS} | Drain-Source Voltage | 700 | V | |
| V_{GS} | Gate-to-Source Voltage | ± 30 | V | |
| E_{AS} | Single Pulse Avalanche Energy @ L=22.4mH | 54 | mJ | |
| I_{AR} | Avalanche Current @ L=22.4mH | 2.2 | A | |
| $T_J \quad T_{STG}$ | Operating Junction and Storage Temperature Range | -55 to +150 | °C | |

Thermal Resistance

| Symbol | Characteristics | Typ. | Max. | Units | |
|------------------|------------------------------------|---------------------------|------|-------|------|
| R _{θJC} | Junction-to-case ③ | For TO-251/TO-252 package | — | 2.5 | °C/W |
| | | For TO-220F package | — | 4 | |
| R _{θJA} | Junction-to-ambient (t ≤ 10s) ④ | For TO-251/TO-252 package | — | 75 | °C/W |
| | | For TO-220F package | — | 80 | |

Electrical Characteristics @T_A=25°C unless otherwise specified

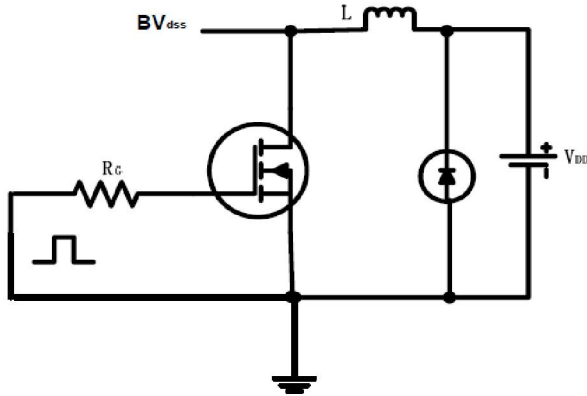
| Symbol | Parameter | Min. | Typ. | Max. | Units | Conditions |
|----------------------|--------------------------------------|------|------|------|-------|---|
| V _{(BR)DSS} | Drain-to-Source breakdown voltage | 700 | — | — | V | V _{GS} = 0V, I _D = 250μA |
| R _{DS(on)} | Static Drain-to-Source on-resistance | — | 1.23 | 1.4 | Ω | V _{GS} =10V, I _D = 1A |
| | | — | 2.9 | — | | T _J = 125°C |
| V _{GS(th)} | Gate threshold voltage | 2 | — | 4 | V | V _{DS} = V _{GS} , I _D = 250μA |
| | | — | 2.8 | — | | T _J = 125°C |
| I _{DSS} | Drain-to-Source leakage current | — | — | 1 | μA | V _{DS} = 700V, 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 | — | 8.3 | — | nC | I _D = 4A, |
| Q _{gs} | Gate-to-Source charge | — | 2.3 | — | | V _{DS} =100V, |
| Q _{gd} | Gate-to-Drain("Miller") charge | — | 2.6 | — | | V _{GS} = 10V |
| t _{d(on)} | Turn-on delay time | — | 10.1 | — | ns | V _{GS} =10V, V _{DS} =380V, R _{GEN} =18Ω, I _D =4.5A |
| t _r | Rise time | — | 18.4 | — | | |
| t _{d(off)} | Turn-Off delay time | — | 16.8 | — | | |
| t _f | Fall time | — | 14.8 | — | | |
| C _{iss} | Input capacitance | — | 272 | — | pF | V _{GS} = 0V V _{DS} = 25V f = 1MHz |
| C _{oss} | Output capacitance | — | 168 | — | | |
| C _{rss} | Reverse transfer capacitance | — | 3.14 | — | | |

Source-Drain Ratings and Characteristics

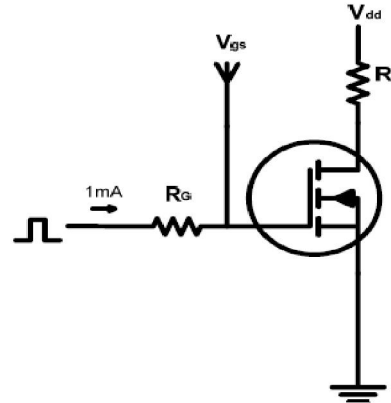
| Symbol | Parameter | Min. | Typ. | Max. | Units | Conditions |
|-----------------|---|------|------|------|-------|---|
| I _S | Continuous Source Current (Body Diode) | — | — | 5 ① | A | MOSFET symbol showing the integral reverse p-n junction diode. |
| I _{SM} | Pulsed Source Current (Body Diode) | — | — | 15 | A | |
| V _{SD} | Diode Forward Voltage | — | 0.84 | 1.2 | V | I _S =2.8A, V _{GS} =0V |
| t _{rr} | Reverse Recovery Time | — | 284 | — | nS | T _J = 25°C, I _F = I _S , di/dt = 100A/μs |
| Q _{rr} | Reverse Recovery Charge | — | 1395 | — | nC | |

Test Circuits and Waveforms

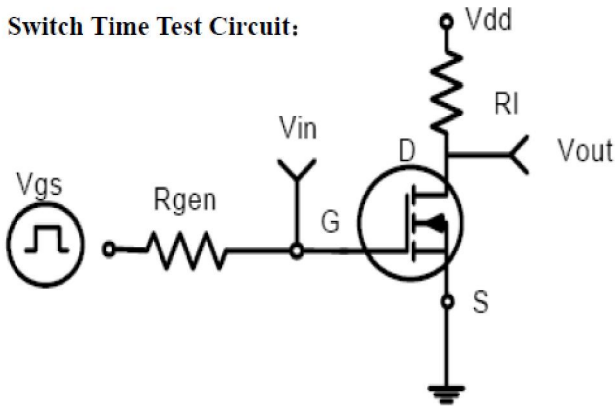
EAS test circuits:



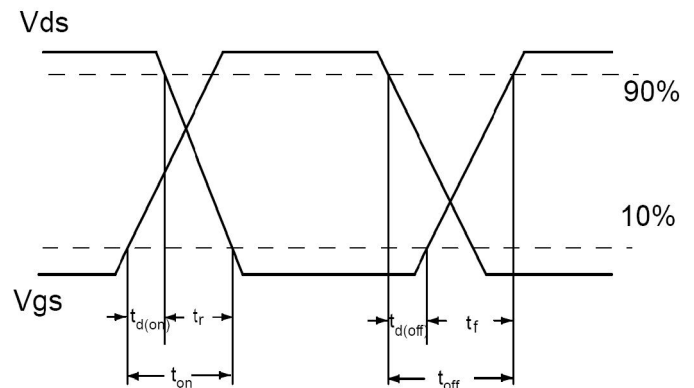
Gate charge test circuit:



Switch Time Test Circuit:



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 $T_A = 25^\circ\text{C}$

Typical Electrical and Thermal Characteristics

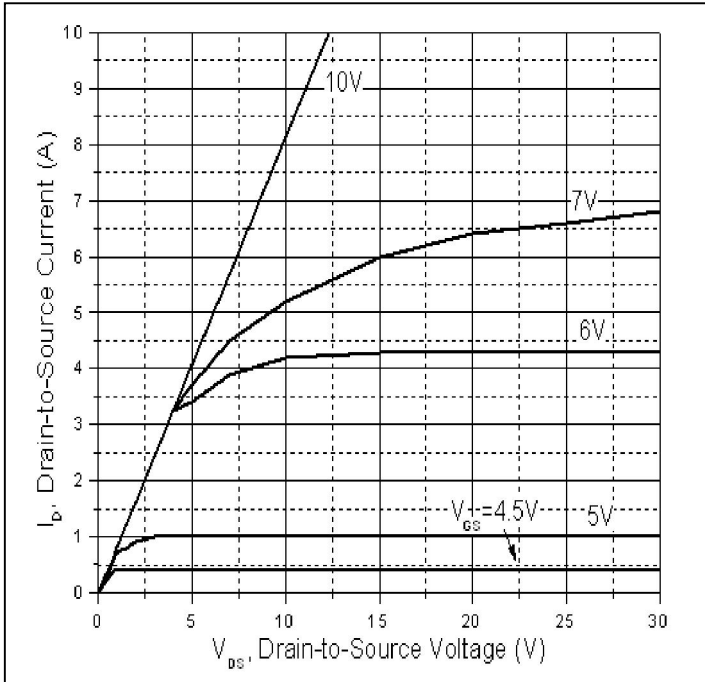


Figure 1: Typical Output Characteristics

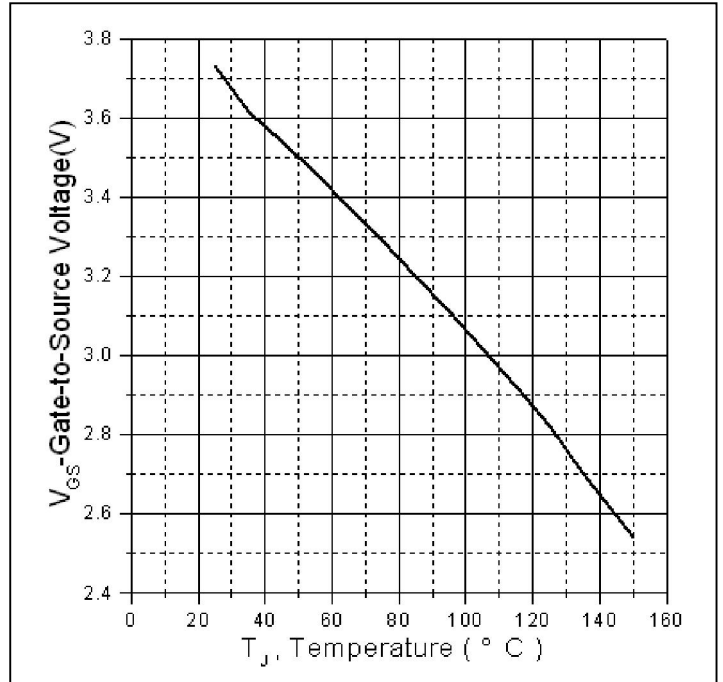


Figure 2: Gate to source cut-off voltage

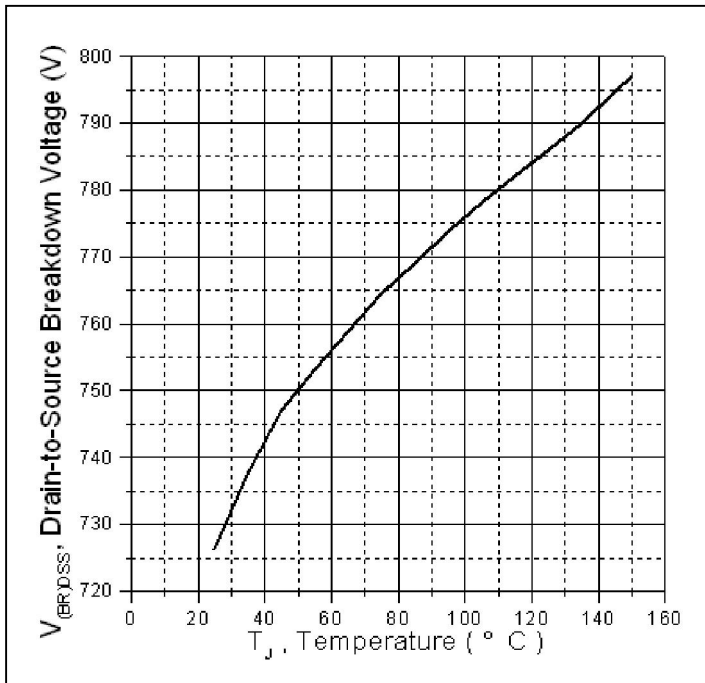


Figure 3: Drain-to-Source Breakdown Voltage Vs. Case Temperature

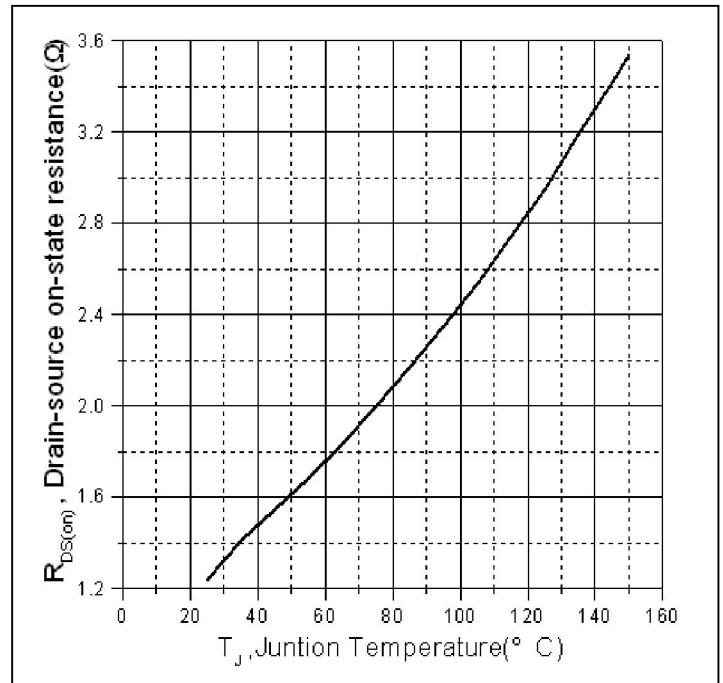


Figure 4: Normalized On-Resistance Vs. Case Temperature

Typical Electrical and Thermal Characteristics

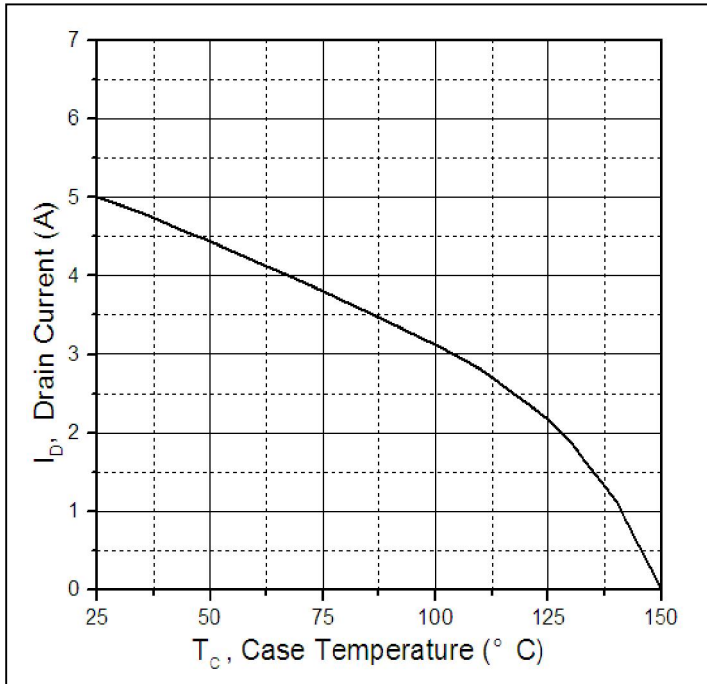


Figure 5. Maximum Drain Current Vs. Case Temperature

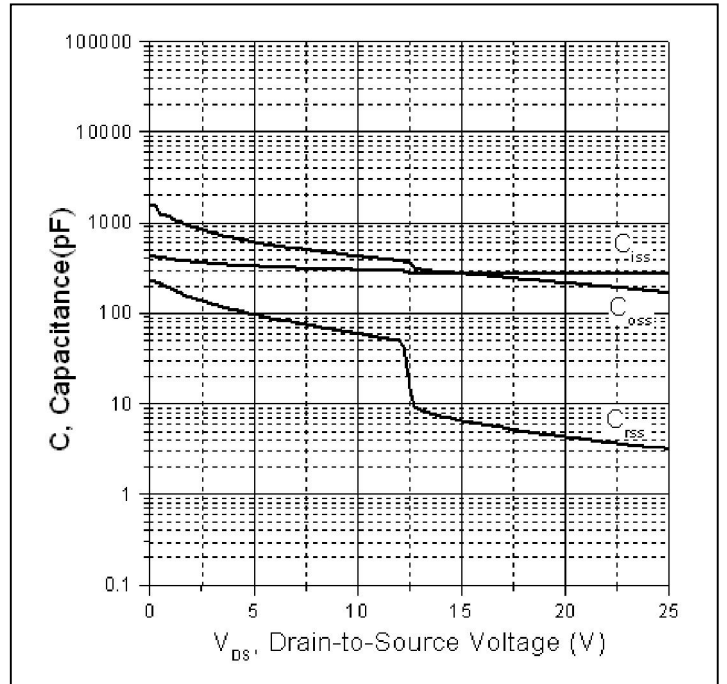
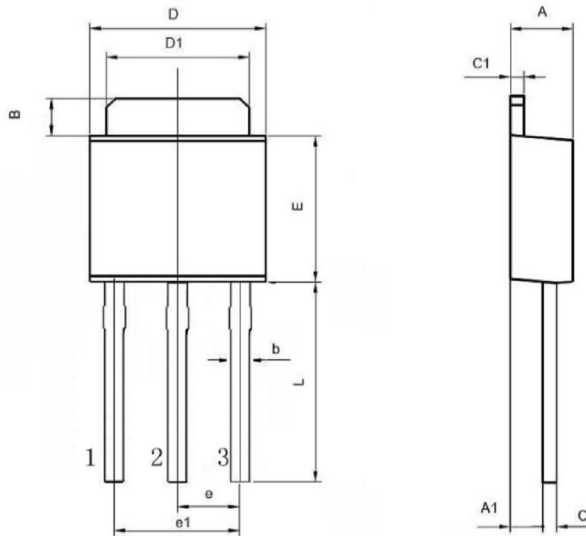


Figure 6. Typical Capacitance Vs. Drain-to-Source Voltage

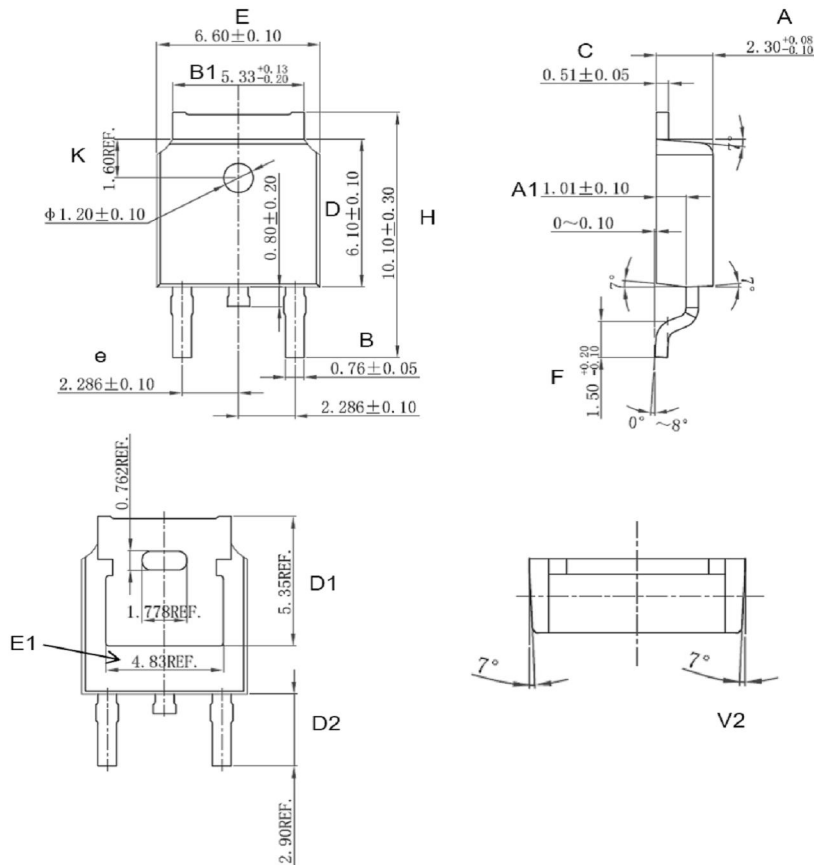
Mechanical Data

TO-251 PACKAGE OUTLINE DIMENSION



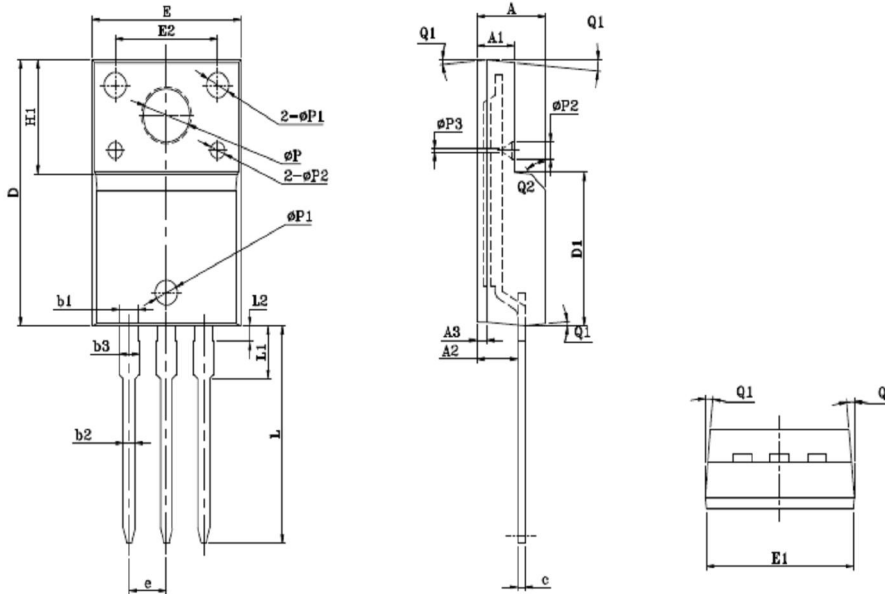
| Symbol | Dimension In Millimeters | | | Dimension In Inches | | |
|--------|--------------------------|-----|-------|---------------------|-----|-------|
| | Min | Nom | Max | Min | Nom | Max |
| A | 2.200 | - | 2.400 | 0.087 | - | 0.094 |
| A1 | 0.950 | - | 1.150 | 0.037 | - | 0.045 |
| B | 0.950 | - | 1.250 | 0.037 | - | 0.049 |
| b | 0.500 | - | 0.700 | 0.020 | - | 0.028 |
| c | 0.450 | - | 0.550 | 0.018 | - | 0.022 |
| c1 | 0.450 | - | 0.550 | 0.018 | - | 0.022 |
| D | 6.450 | - | 6.750 | 0.254 | - | 0.266 |
| D1 | 5.200 | - | 5.400 | 0.205 | - | 0.213 |
| E | 5.950 | - | 6.250 | 0.234 | - | 0.246 |
| e | 2.240 | - | 2.340 | 0.088 | - | 0.092 |
| e1 | 4.430 | - | 4.730 | 0.174 | - | 0.186 |
| L | 9.000 | - | 9.400 | 0.354 | - | 0.370 |

TO-252 PACKAGE OUTLINE DIMENSION



| Symbol | Dimension In Millimeters | | | Dimension In Inches | | |
|--------|--------------------------|--------|--------|---------------------|-------|-------|
| | Min | Nom | Max | Min | Nom | Max |
| A | 2.200 | 2.300 | 2.380 | 0.087 | 0.091 | 0.094 |
| A1 | 0.910 | 1.010 | 1.110 | 0.036 | 0.040 | 0.044 |
| B | 0.710 | 0.760 | 0.810 | 0.028 | 0.030 | 0.032 |
| B1 | 5.130 | 5.330 | 5.460 | 0.202 | 0.210 | 0.215 |
| C | 0.460 | 0.510 | 0.560 | 0.018 | 0.020 | 0.022 |
| D | 6.000 | 6.100 | 6.200 | 0.236 | 0.240 | 0.244 |
| D1 | 5.350 (REF) | | | 0.211 (REF) | | |
| D2 | 2.900 (REF) | | | 0.114 (REF) | | |
| E | 6.500 | 6.600 | 6.700 | 0.256 | 0.260 | 0.264 |
| E1 | 4.83 (REF) | | | 0.190 (REF) | | |
| e | 2.186 | 2.286 | 2.386 | 0.086 | 0.090 | 0.094 |
| H | 9.800 | 10.100 | 10.400 | 0.386 | 0.398 | 0.409 |
| F | 1.400 | 1.500 | 1.700 | 0.055 | 0.059 | 0.067 |
| K | 1.600 (REF) | | | 0.063 (REF) | | |
| V2 | 8° (REF) | | | 8° (REF) | | |

TO220F PACKAGE OUTLINE DIMENSION_GN



| Symbol | Dimension In Millimeters | | | Dimension In Inches | | |
|--------|--------------------------|--------|--------|---------------------|-------|-------|
| | Min | Nom | Max | Min | Nom | Max |
| E | 9.960 | 10.160 | 10.360 | 0.392 | 0.400 | 0.408 |
| E1 | 9.840 | 10.040 | 10.240 | 0.387 | 0.395 | 0.403 |
| E2 | 6.800 | 7.000 | 7.200 | 0.268 | 0.276 | 0.283 |
| A | 4.600 | 4.700 | 4.800 | 0.181 | 0.185 | 0.189 |
| A1 | 2.440 | 2.540 | 2.640 | 0.096 | 0.100 | 0.104 |
| A2 | 2.660 | 2.760 | 2.860 | 0.105 | 0.109 | 0.113 |
| A3 | 0.600 | 0.700 | 0.800 | 0.024 | 0.028 | 0.031 |
| c | - | 0.500 | - | - | 0.020 | - |
| D | 15.780 | 15.870 | 15.980 | 0.621 | 0.625 | 0.629 |
| D1 | 8.970 | 9.170 | 9.370 | 0.353 | 0.361 | 0.369 |
| H1 | 6.500 | 6.700 | 6.800 | 0.256 | 0.264 | 0.268 |
| e | 2.54BSC | | | 0.10BSC | | |
| φP | 3.080 | 3.180 | 3.280 | 0.121 | 0.125 | 0.129 |
| φP1 | 1.400 | 1.500 | 1.600 | 0.055 | 0.059 | 0.063 |
| φP2 | 0.900 | 1.000 | 1.100 | 0.035 | 0.039 | 0.043 |
| φP3 | 0.100 | 0.200 | 0.300 | 0.004 | 0.008 | 0.012 |
| L | 12.780 | 12.980 | 13.180 | 0.503 | 0.511 | 0.519 |
| L1 | 2.970 | 3.170 | 3.370 | 0.117 | 0.125 | 0.133 |
| L2 | 0.830 | 0.930 | 1.030 | 0.033 | 0.037 | 0.041 |
| Q 1 | 3° | 5° | 7° | 3° | 5° | 7° |
| Q 2 | 43° | 45° | 47° | 43° | 45° | 47° |
| b1 | 1.180 | 1.280 | 1.380 | 0.046 | 0.050 | 0.054 |
| b2 | 0.760 | 0.800 | 0.840 | 0.030 | 0.031 | 0.033 |
| b3 | - | - | 1.420 | - | - | 0.056 |



Ordering and Marking Information

Device Marking: SSF5NS70G/D/F
Package (Available)
TO-251(IPAK)/TO-252(DPAK)/TO-220F
Operating Temperature Range
C : -55 to 150 °C

Devices per Unit

| Package Type | Units/Tube | Tubes/Inner Box | Units/Inner Box | Inner Boxes/Carton Box | Units/Carton Box |
|--------------|------------|-----------------|-----------------|------------------------|------------------|
| TO-251 | 80 | 60 | 4800 | 5 | 24000 |
| TO-252 | 75 | 48 | 3600 | 5 | 18000 |
| TO-220F | 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°C @ 80% of Max $V_{DSS}/V_{CES}/V_R$ | 168 hours 500 hours 1000 hours | 3 lots x 77 devices |
| High Temperature Gate Bias(HTGB) | $T_j=150^{\circ}\text{C}$ @ 100% of Max V_{GSS} | 168 hours 500 hours 1000 hours | 3 lots x 77 devices |