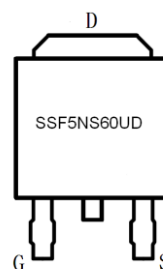
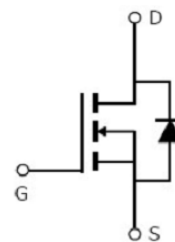


Main Product Characteristics:

| | |
|--------------|----------------------|
| V_{DSS} | 600V |
| $R_{DS(on)}$ | 0.73 Ω (typ.) |
| I_D | 5A ① |


TO-252 (D-PAK)

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 SSF5NS60UD 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 | 5 ① | A |
| I_D @ TC = 100°C | Continuous Drain Current, V_{GS} @ 10V | 3.2 ① | |
| I_{DM} | Pulsed Drain Current ② | 15 | |
| P_D @TC = 25°C | Power Dissipation ③ | 39 | W |
| | Linear Derating Factor | 0.31 | W/°C |
| V_{DS} | Drain-Source Voltage | 600 | V |
| V_{GS} | Gate-to-Source Voltage | ± 30 | V |
| E_{AS} | Single Pulse Avalanche Energy @ L=60.1mH | 101 | mJ |
| I_{AS} | Avalanche Current @ L=60.1mH | 1.84 | A |
| T_J T_{STG} | Operating Junction and Storage Temperature Range | -55 to +150 | °C |

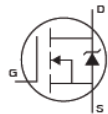
Thermal Resistance

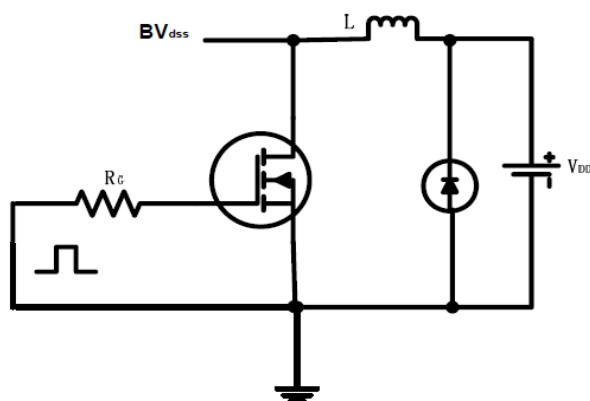
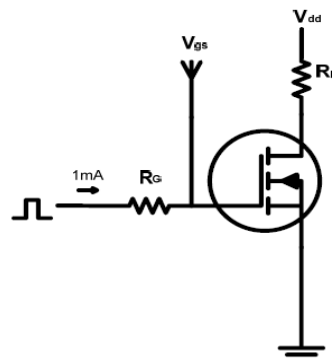
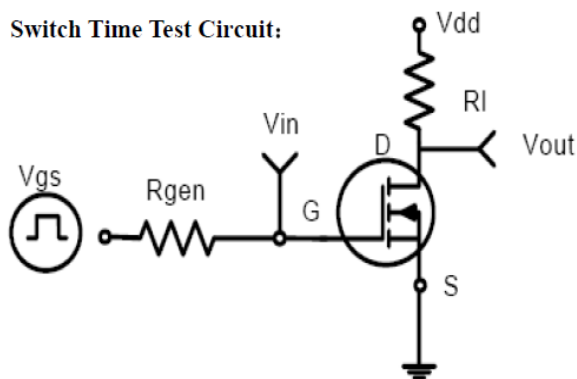
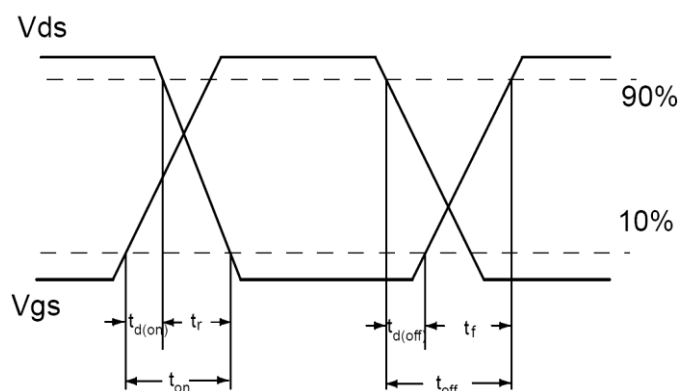
| Symbol | Characterizes | Typ. | Max. | Units |
|------------------|---------------------------------|------|------|-------|
| R _{θJC} | Junction-to-case ③ | — | 3.2 | °C/W |
| R _{θJA} | Junction-to-ambient (t ≤ 10s) ④ | — | 62 | °C/W |

Electrical Characterizes @T_A=25°C unless otherwise specified

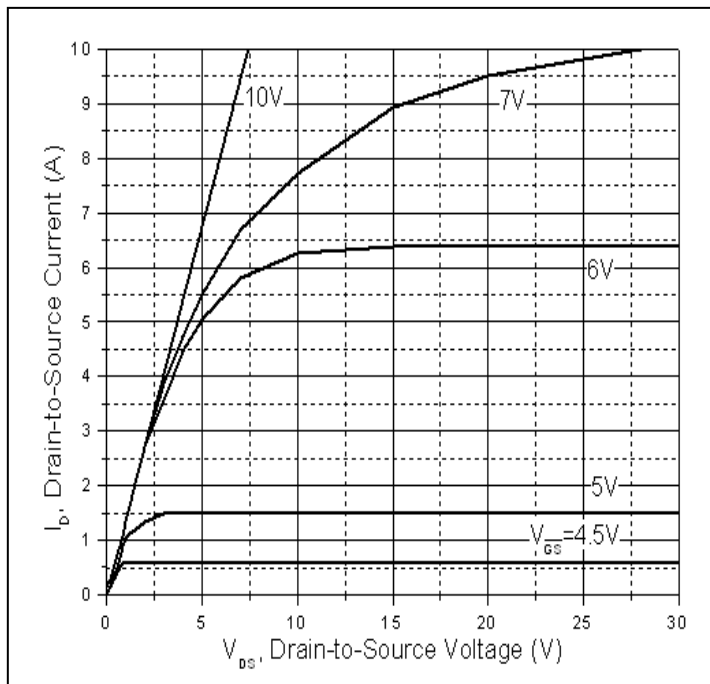
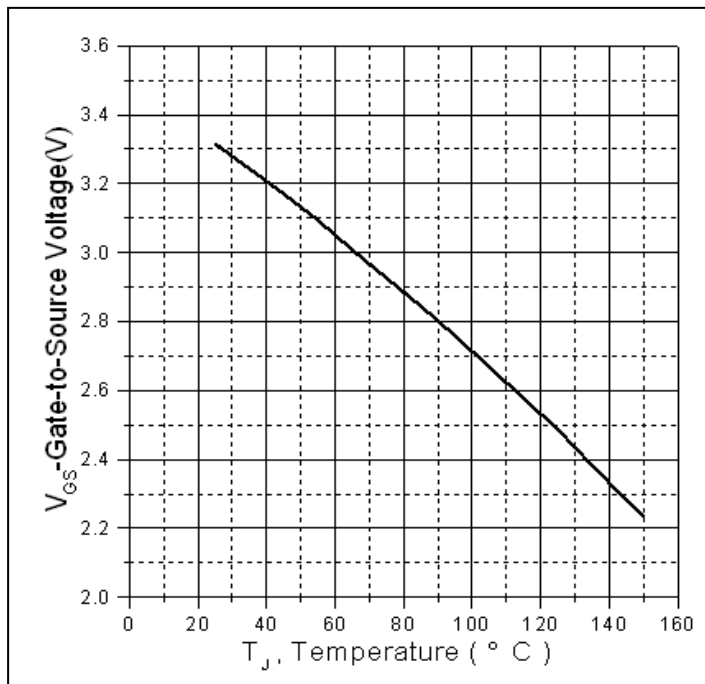
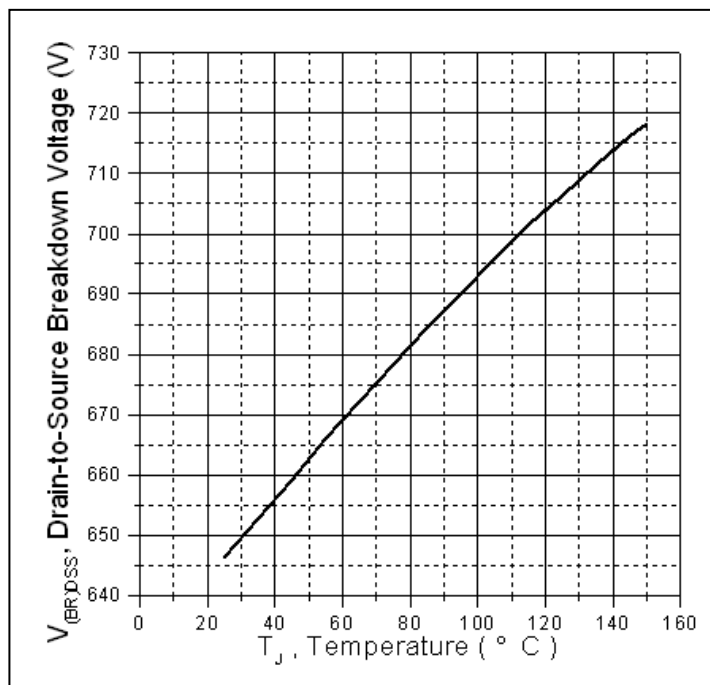
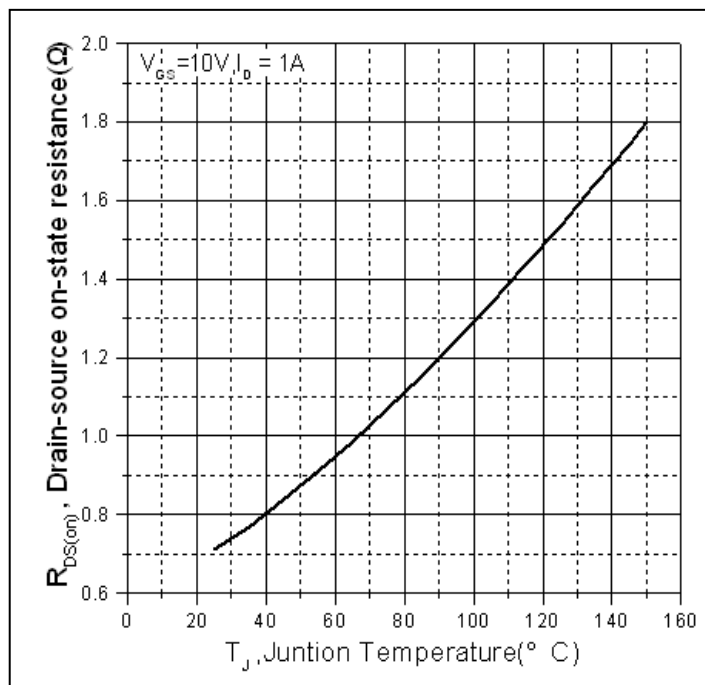
| Symbol | Parameter | Min. | Typ. | Max. | Units | Conditions |
|----------------------|--------------------------------------|------|------|------|-------|---|
| V _{(BR)DSS} | Drain-to-Source breakdown voltage | 600 | — | — | V | V _{GS} = 0V, I _D = 250μA |
| R _{DS(on)} | Static Drain-to-Source on-resistance | — | 0.73 | 0.85 | Ω | V _{GS} =10V, I _D = 1A T _J = 125°C |
| | | — | 1.54 | — | | |
| | | — | 0.79 | 1.0 | Ω | V _{GS} =10V, I _D = 2.8A T _J = 125°C |
| | | — | 1.77 | — | | |
| V _{GS(th)} | Gate threshold voltage | 2 | — | 4 | V | V _{DS} = V _{GS} , I _D = 250μA T _J = 125°C |
| | | — | 2.5 | — | | |
| I _{DSS} | Drain-to-Source leakage current | — | — | 1 | μA | V _{DS} = 600V, V _{GS} = 0V T _J = 125°C |
| | | — | — | 50 | | |
| I _{GSS} | Gate-to-Source forward leakage | — | — | 100 | nA | V _{GS} = 30V |
| | | — | — | -100 | | V _{GS} = -30V |
| Q _g | Total gate charge | — | 12 | — | nC | I _D = 4.6A, V _{DS} =480V, V _{GS} = 10V |
| Q _{gs} | Gate-to-Source charge | — | 2.1 | — | | |
| Q _{gd} | Gate-to-Drain("Miller") charge | — | 5.3 | — | | |
| t _{d(on)} | Turn-on delay time | — | 9.8 | — | ns | V _{GS} =10V, V _{DS} =300V, R _{GEN} =25Ω, I _D =4.6A |
| t _r | Rise time | — | 14 | — | | |
| t _{d(off)} | Turn-Off delay time | — | 29 | — | | |
| t _f | Fall time | — | 14 | — | | |
| C _{iss} | Input capacitance | — | 346 | — | pF | V _{GS} = 0V V _{DS} = 25V f = 1MHz |
| C _{oss} | Output capacitance | — | 320 | — | | |
| C _{rss} | Reverse transfer capacitance | — | 3.0 | — | | |

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 | — | 0.83 | 1.2 | V | I _S =2.8A, V _{GS} =0V |
| t _{rr} | Reverse Recovery Time | — | 181 | — | nS | T _J = 25°C, I _F =4.6A, |
| Q _{rr} | Reverse Recovery Charge | — | 1.0 | — | μC | di/dt = 100A/μs |

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 $T_A = 25^\circ C$

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

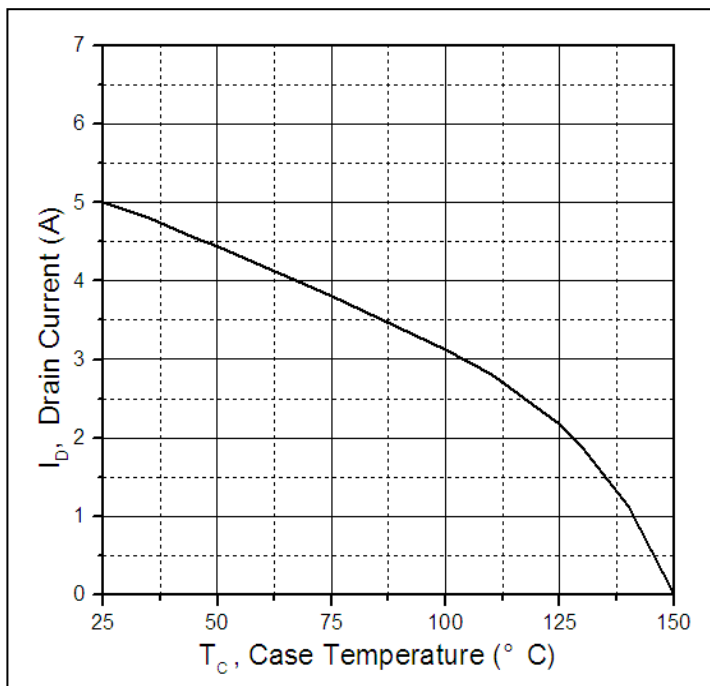


Figure 5. Maximum Drain Current Vs. Case Temperature

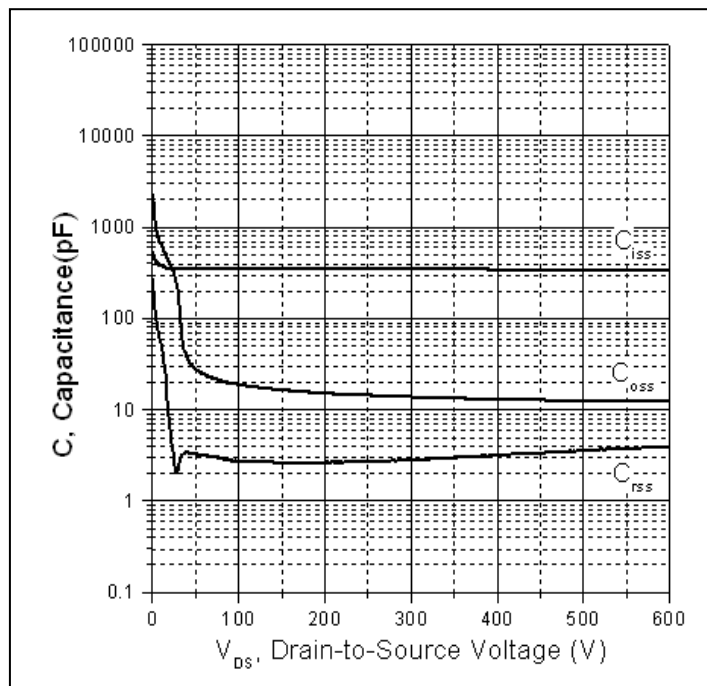


Figure 6. Typical Capacitance Vs. Drain-to-Source Voltage

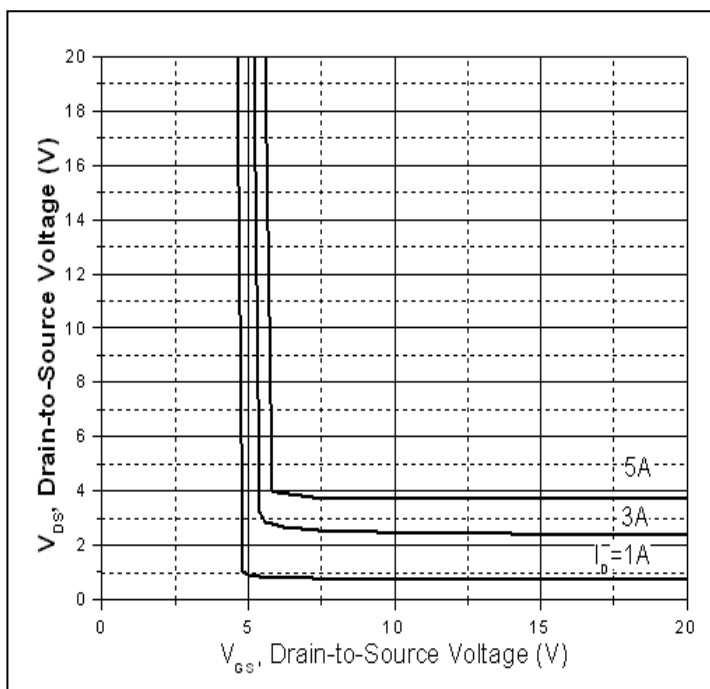


Figure 7. Drain-to-Source Voltage Vs. Gate-to-Source Voltage

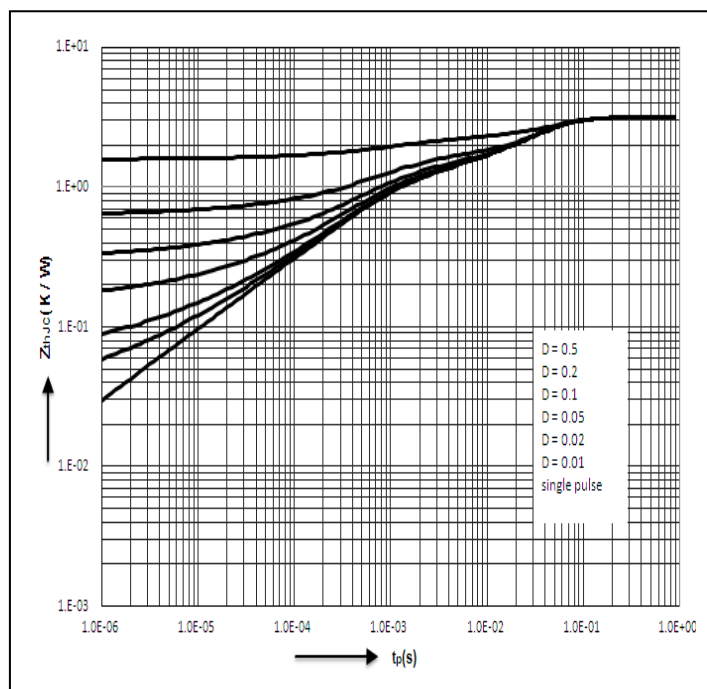
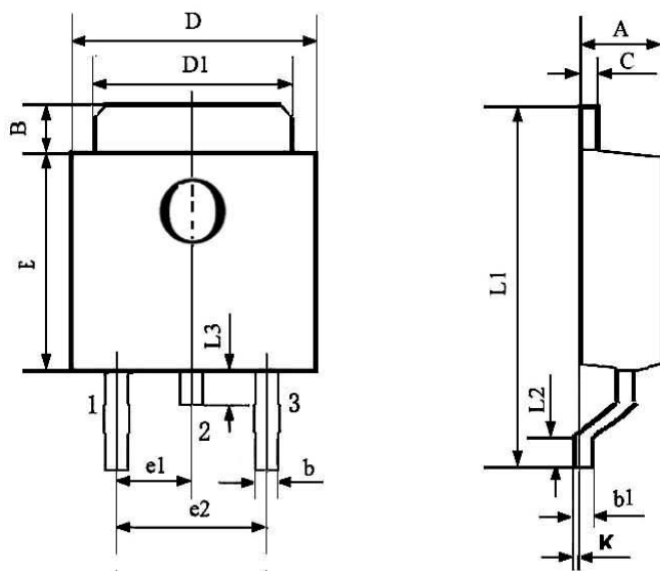


Figure 8. Maximum Effective Transient Thermal Impedance, Junction-to-Case

Mechanical Data:
TO-252 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 |
| B | 0.950 | - | 1.250 | 0.037 | - | 0.049 |
| b | 0.500 | - | 0.700 | 0.020 | - | 0.028 |
| b1 | 0.450 | - | 0.550 | 0.018 | - | 0.022 |
| C | 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 |
| e1 | 2.240 | - | 2.340 | 0.088 | - | 0.092 |
| e2 | 4.430 | - | 4.730 | 0.174 | - | 0.186 |
| L1 | 9.450 | - | 9.950 | 0.372 | - | 0.392 |
| L2 | 1.250 | - | 1.750 | 0.049 | - | 0.069 |
| L3 | 0.600 | - | 0.900 | 0.024 | - | 0.035 |
| K | 0.000 | - | 0.100 | 0.000 | - | 0.004 |

Ordering and Marking Information
Device Marking: SSF5NS60UD

Package (Available)
TO-252(D-PAK)
Operating Temperature Range
C : -55 to 150 °C

Devices per Unit (options)

| Package Type | Units/Tape | Tapes/Inner Box | Units/Inner Box | Inner Boxes/Carton Box | Units/Carton Box |
|--------------|------------|-----------------|-----------------|------------------------|------------------|
| TO-252 | 2500 | 2 | 5000 | 7 | 35000 |
| TO-252 | 2500 | 1 | 2500 | 10 | 25000 |
| TO-252 | 800 | 5 | 4000 | 8 | 32000 |

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 |

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