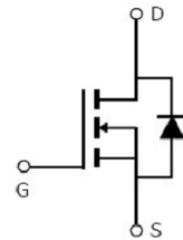


Main Product Characteristics:

| | |
|--------------|-------------|
| V_{DSS} | 650V |
| $R_{DS(on)}$ | 0.68Ω(typ.) |
| I_D | 12A |


TO220F

Marking and pin Assignment

Schematic diagram
Features and Benefits:

- Advanced MOSFET process technology
- Special designed for PWM, load switching and general purpose applications
- Ultra low on-resistance with low gate charge
- Fast switching and reverse body recovery
- 150°C operating temperature


Description:

These N-Channel enhancement mode power field effect transistors are produced using silikron proprietary MOSFET technology. This advanced technology has been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode. These devices are well suited for high efficiency switch mode power supplies.

Absolute max Rating:

| Symbol | Parameter | Max. | Units |
|--------------------------|--|--------------|-------|
| $I_D @ TC = 25^\circ C$ | Continuous Drain Current, $V_{GS} @ 10V$ ① | 12 | A |
| $I_D @ TC = 100^\circ C$ | Continuous Drain Current, $V_{GS} @ 10V$ ① | 7 | |
| I_{DM} | Pulsed Drain Current② | 48 | |
| $P_D @ TC = 25^\circ C$ | Power Dissipation③ | 200 | W |
| | Linear Derating Factor | 1.2 | W/°C |
| V_{DS} | Drain-Source Voltage | 650 | V |
| V_{GS} | Gate-to-Source Voltage | ± 30 | V |
| E_{AS} | Single Pulse Avalanche Energy @ L=19.5mH | 975 | mJ |
| I_{AS} | Avalanche Current @ L=19.5mH | 10 | A |
| $T_J T_{STG}$ | Operating Junction and Storage Temperature Range | -55 to + 150 | °C |

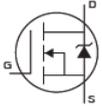
Thermal Resistance

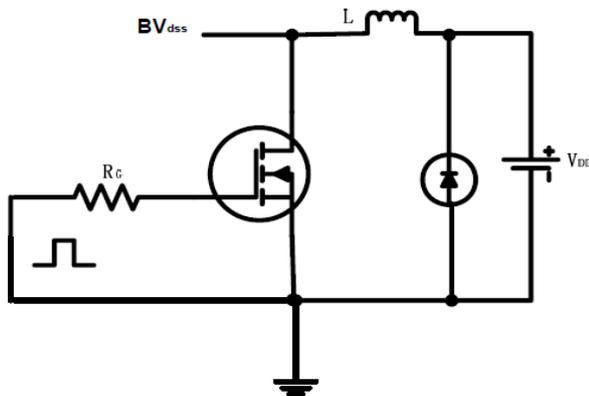
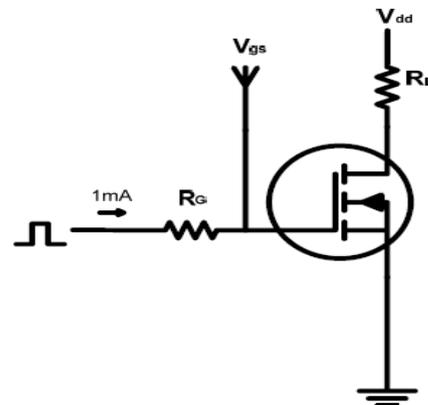
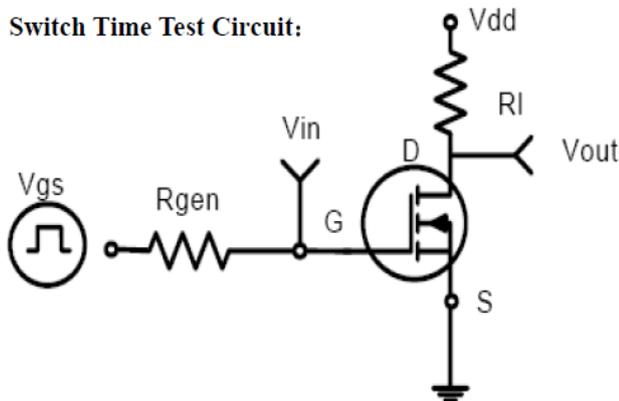
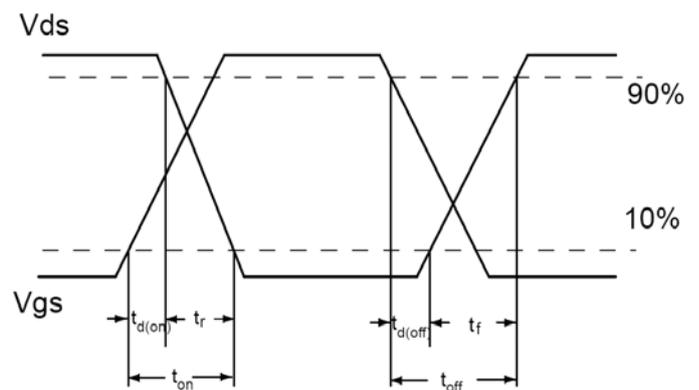
| Symbol | Characterizes | Typ. | Max. | Units |
|------------------|--|------|------|-------|
| R _{θJC} | Junction-to-case ^③ | — | 0.62 | °C/W |
| R _{θJA} | Junction-to-ambient (t ≤ 10s) ^④ | — | 62 | °C/W |
| | Junction-to-Ambient (PCB mounted, steady-state) ^④ | — | 40 | °C/W |

Electrical Characterizes @T_A=25°C unless otherwise specified

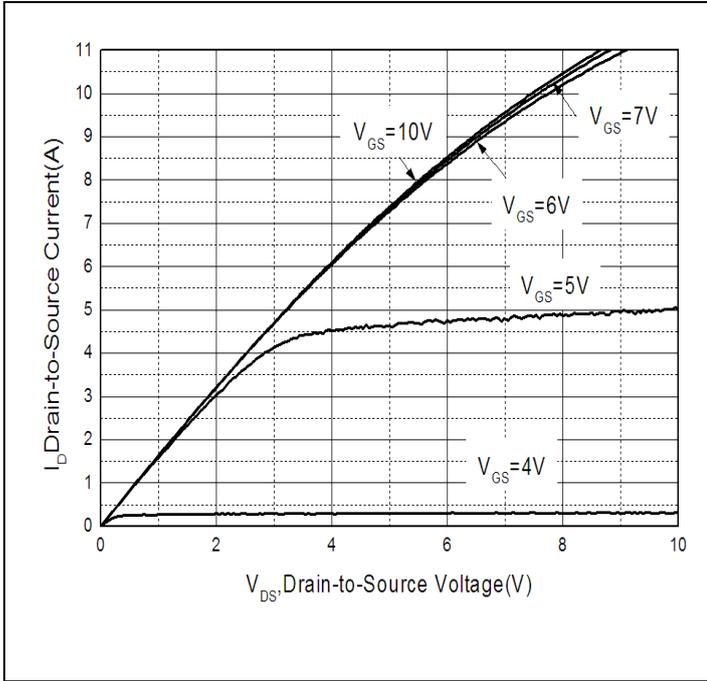
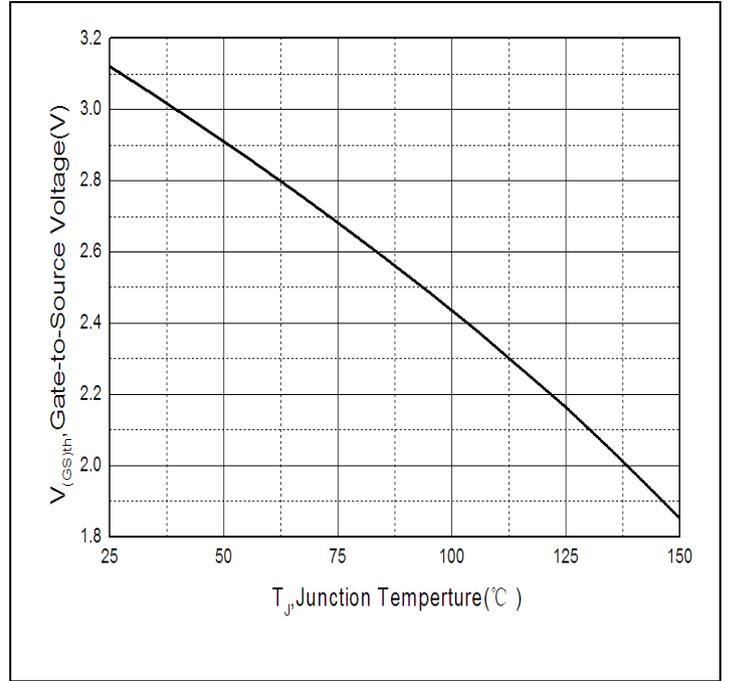
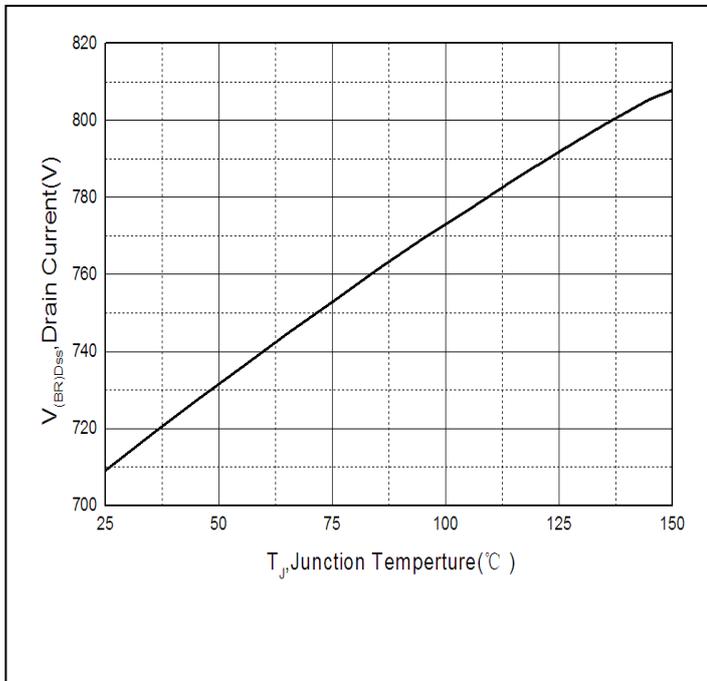
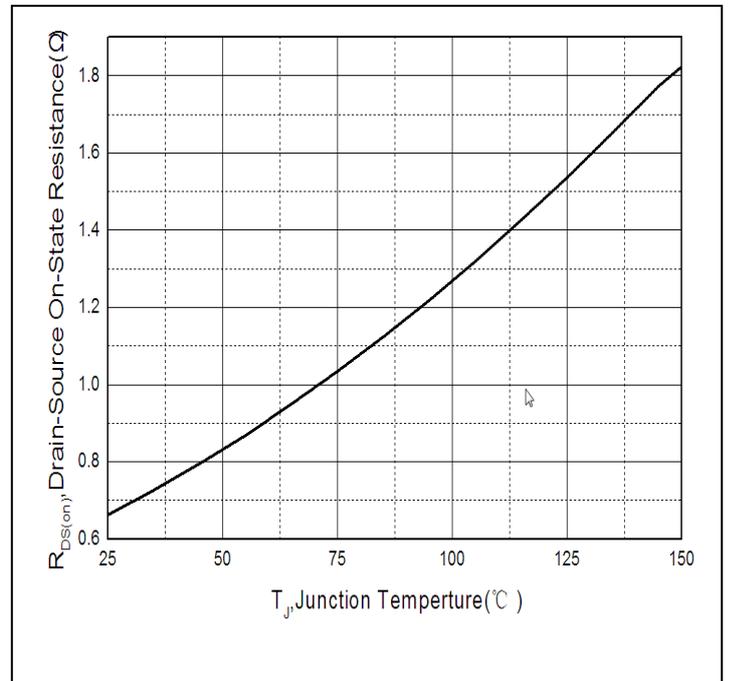
| Symbol | Parameter | Min. | Typ. | Max. | Units | Conditions |
|----------------------|--------------------------------------|------|-------|------|-------|--|
| V _{(BR)DSS} | Drain-to-Source breakdown voltage | 650 | — | — | V | V _{GS} = 0V, I _D = 250μA |
| R _{DS(on)} | Static Drain-to-Source on-resistance | — | 0.68 | 0.8 | Ω | V _{GS} =10V, I _D = 6A T _J = 125°C |
| | | — | 1.54 | — | | |
| V _{GS(th)} | Gate threshold voltage | 2 | — | 4 | V | V _{DS} = V _{GS} , I _D = 250μA T _J = 125°C |
| | | — | 2.15 | • | | |
| I _{DSS} | Drain-to-Source leakage current | — | — | 1 | μA | V _{DS} = 650V, 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 | — | 24.15 | — | nC | I _D = 12A, V _{DS} =520V, V _{GS} = 10V |
| Q _{gs} | Gate-to-Source charge | — | 7.86 | — | | |
| Q _{gd} | Gate-to-Drain("Miller") charge | — | 7.47 | — | | |
| t _{d(on)} | Turn-on delay time | — | 37.67 | — | ns | V _{GS} =10V, V _{DS} =325V, R _L =27Ω, R _G =25Ω I _D =12A |
| t _r | Rise time | — | 61.67 | — | | |
| t _{d(off)} | Turn-Off delay time | — | 80.33 | — | | |
| t _f | Fall time | — | 46.67 | — | | |
| C _{iss} | Input capacitance | — | 1560 | — | pF | V _{GS} = 0V V _{DS} = 25V f = 1MHz |
| C _{oss} | Output capacitance | — | 163 | — | | |
| C _{rss} | Reverse transfer capacitance | — | 3.71 | — | | |

Source-Drain Ratings and Characteristics

| Symbol | Parameter | Min. | Typ. | Max. | Units | Conditions |
|-----------------|---|------|------|------|-------|--|
| I _S | Continuous Source Current (Body Diode) | — | — | 12 | A | MOSFET symbol showing the integral reverse p-n junction diode.  |
| I _{SM} | Pulsed Source Current (Body Diode) | — | — | 48 | A | |
| V _{SD} | Diode Forward Voltage | — | 0.90 | 1.3 | V | I _S =10A, V _{GS} =0V |
| t _{rr} | Reverse Recovery Time | — | 450 | — | ns | T _J = 25°C, I _F = 12A, |
| Q _{rr} | Reverse Recovery Charge | — | 4200 | — | nC | 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. Junction Temperature

Figure 4: On-Resistance vs. Junction Temperature

Typical electrical and thermal characteristics

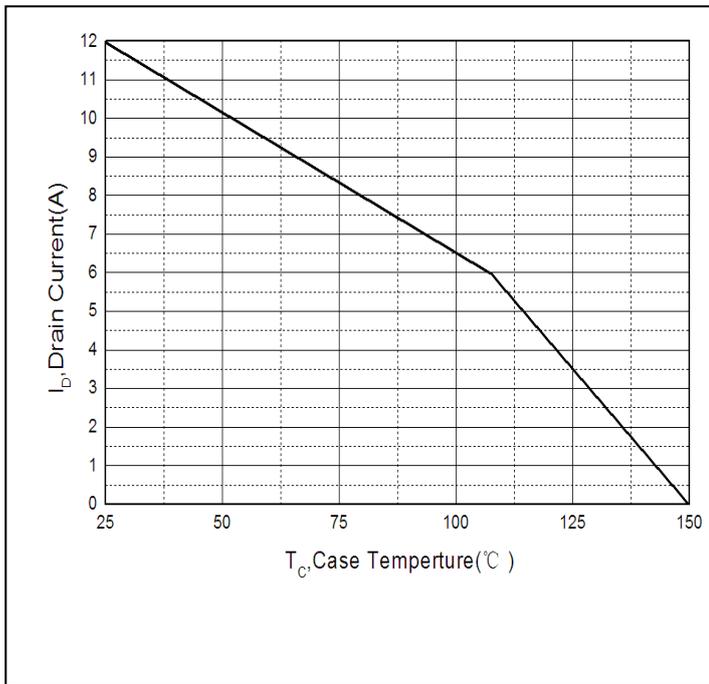


Figure5. Maximum Drain Current vs. Case Temperature

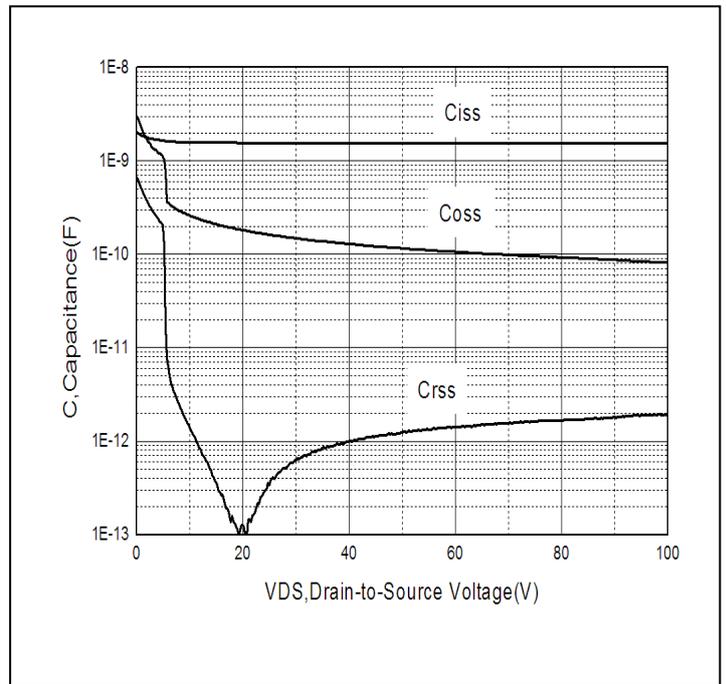


Figure 6. Typical Capacitance vs. Drain-to-Source Voltage

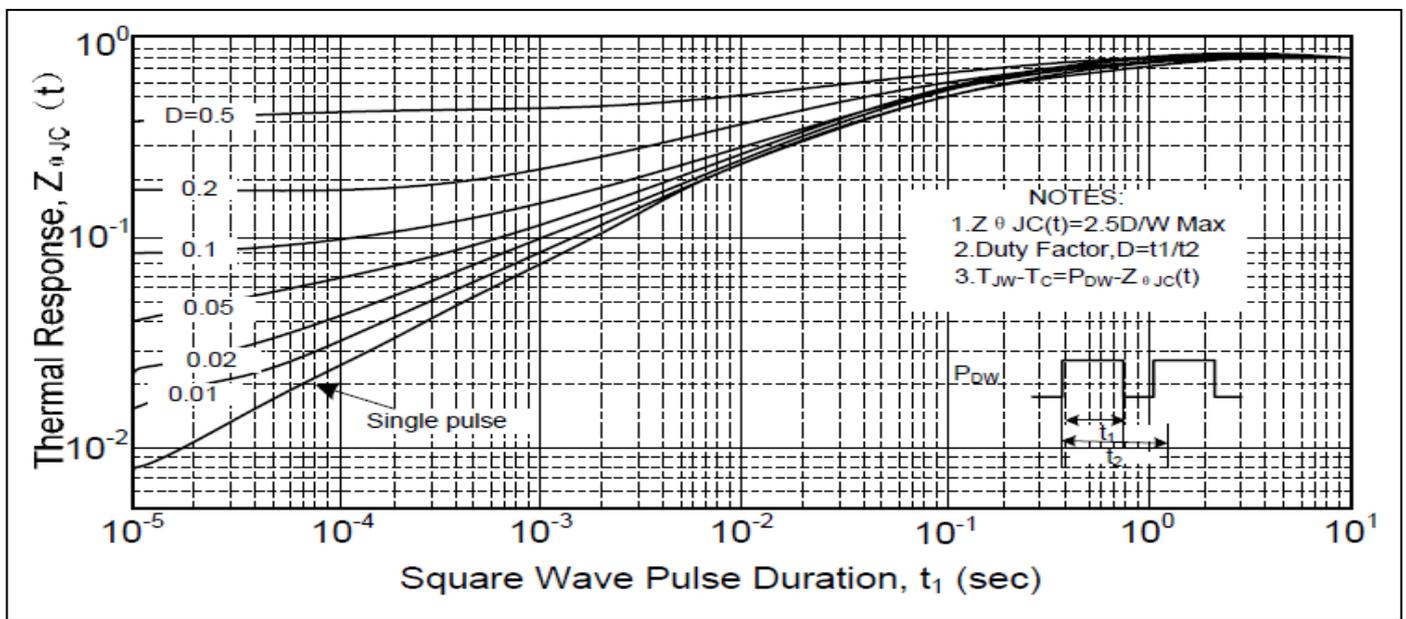
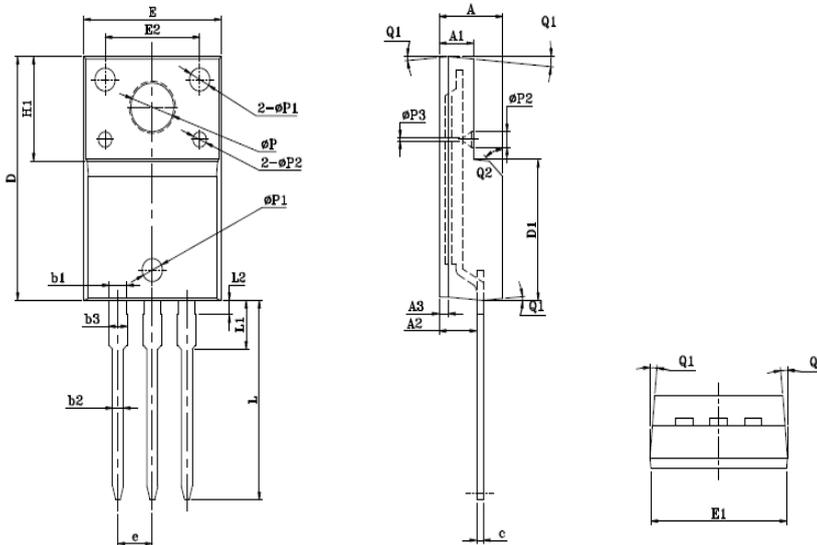


Figure7. Maximum Effective Transient Thermal Impedance, Junction-to-Case

Mechanical Data:
TO220F PACKAGE OUTLINE DIMENSION_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 | | |
| phi P | 3.080 | 3.180 | 3.280 | 0.121 | 0.125 | 0.129 |
| phi P1 | 1.400 | 1.500 | 1.600 | 0.055 | 0.059 | 0.063 |
| phi P2 | 0.900 | 1.000 | 1.100 | 0.035 | 0.039 | 0.043 |
| phi P3 | 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 |
| Q1 | 3° | 5° | 7° | 3° | 5° | 7° |
| Q2 | 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: SSF12N65F****Package (Available)****TO220F****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 |
|---------------------|-------------------|------------------------|------------------------|--------------------------------|--------------------------|
| TO220F | 50 | 20 | 1000 | 6 | 6000 |

Reliability Test Program

| Test Item | Conditions | Duration | Sample Size |
|--|--|---|----------------------------|
| High Temperature Reverse Bias(HTRB) | T_j=125°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°C @ 100% of Max V_{GSS} | 168 hours 500 hours 1000 hours | 3 lots x 77 devices |

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