# 5N65F

## 5A N-Channel Power MOSFET

### Features

New technology for high voltage device
Low on-resistance and low conduction losses
Small package
Ultra Low Gate Charge cause lower driving requirements
100% Avalanche Tested
ROHS compliant

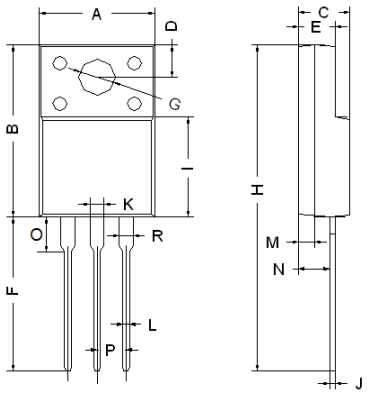
### Mechanical Data

**Case** : TO-220F
**Terminals** : Solder plated, solderable per MIL-STD-750, Method 2026
**Polarity** : As marked
**Mounting Position** : Any

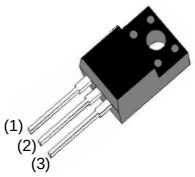
### Application

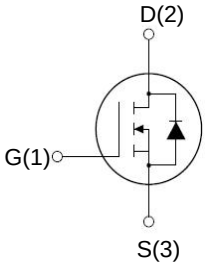
Power factor correction（PFC）
Switched mode power supplies(SMPS)
Uninterruptible Power Supply（UPS）

**TO-220F**




| TO-220F | | |
|---|---|---|
| Dim | Min | Max |
| A | 9.80 | 10.30 |
| B | 15.20 | 15.80 |
| C | 4.37 | 4.77 |
| D | 2.90 | 3.30 |
| E | 2.50 | 2.90 |
| F | 12.90 | 13.50 |
| G | 3.10 | 3.30 |
| H | 28.40 | 29.16 |
| I | 8.40 | 9.10 |
| J | 0.35 | 0.58 |
| L | 0.68 | 0.94 |
| M | 1.30 | 1.50 |
| N | 2.40 | 2.60 |
| O | 2.60 | 3.10 |
| P | 2.40 | 2.60 |
| K/R | 1.10 | 1.32 |
| All Dimensions in mm | | |




## Maximum Ratings And Electrical Characteristics

Ratings at 25℃ ambient temperature unless otherwise specified. Single phase half-wave 60Hz,resistive or inductive load, for capacitive load current derate by 20%.

**Table 1. Absolute Maximum Ratings ($T_C$=25℃)**

| Parameter | Symbol | 5N65F | Unit |
|---|---|---|---|
| Drain-Source Voltage ($V_{GS}$=0V） | $V_{DS}$ | 650 | V |
| Gate-Source Voltage ($V_{DS}$=0V) ,AC (f>1 Hz) | $V_{GS}$ | ±30 | V |
| Continuous Drain Current at Tc=25°C | $I_{D\ (DC)}$ | 5 | A |
| Continuous Drain Current at Tc=100°C | $I_{D\ (DC)}$ | 3.0 | A |
| Pulsed drain current **(Note 1)** | $I_{DM\ (pluse)}$ | 20 | A |
| Maximum Power Dissipation(Tc=25℃)<br>Derate above 25°C | $P_D$ | 29<br>0.23 | W<br>W/°C |
| Single pulse avalanche energy **(Note2)** | $E_{AS}$ | 52 | mJ |
| Avalanche current **(Note 1)** | $I_{AR}$ | 0.9 | A |
| Repetitive Avalanche energy ， $t_{AR}$ limited by $T_{jmax}$ **(Note 1)** | $E_{AR}$ | 0.14 | mJ |

| Parameter | Symbol | 5N65 | Unit |
|---|---|---|---|
| Drain Source voltage slope, $V_{DS}$ ≤480 V, | dv/dt | 50 | V/ns |
| Reverse diode dv/dt， $V_{DS}$ ≤480 V,$I_{SD}$<$I_D$ | dv/dt | 15 | V/ns |
| Operating Junction and Storage Temperature Range | $T_J$,$T_{STG}$ | -55...+150 | °C |

* limited by maximum junction temperature

## Table 2. Thermal Characteristic

| Parameter | Symbol | 5N65 | Unit |
|---|---|---|---|
| Thermal Resistance，Junction-to-Case（Maximum） | $R_{thJC}$ | 4.3 | °C /W |
| Thermal Resistance，Junction-to-Ambient （Maximum） | $R_{thJA}$ | 80 | °C /W |

## Table 3. Electrical Characteristics (TA=25℃unless otherwise noted)

| Parameter | Symbol | Condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **On/off states** | | | | | | |
| Drain-Source Breakdown Voltage | $BV_{DSS}$ | $V_{GS}$=0V $I_D$=250μA | 650 | | | V |
| Zero Gate Voltage Drain Current(Tc=25℃) | $I_{DSS}$ | $V_{DS}$=650V,$V_{GS}$=0V | | | 1 | μA |
| Zero Gate Voltage Drain Current(Tc=125℃) | $I_{DSS}$ | $V_{DS}$=650V,$V_{GS}$=0V | | | 50 | μA |
| Gate-Body Leakage Current | $I_{GSS}$ | $V_{GS}$=±20V,$V_{DS}$=0V | | | ±100 | nA |
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{DS}$=$V_{GS}$,$I_D$=250μA | 3 | | 4 | V |
| Drain-Source On-State Resistance | $R_{DS(ON)}$ | $V_{GS}$=10V, $I_D$=2.5A | | 750 | 900 | mΩ |
| **Dynamic Characteristics** | | | | | | |
| Input Capacitance | $C_{lss}$ | $V_{DS}$=50V,$V_{GS}$=0V, F=1.0MHz | | 370 | | pF |
| Output Capacitance | $C_{oss}$ | | | 25 | | pF |
| Reverse Transfer Capacitance | $C_{rss}$ | | | 0.5 | | pF |
| Total Gate Charge | $Q_g$ | $V_{DS}$=480V,$I_D$=5A, $V_{GS}$=10V | | 10.5 | 15 | |
| Gate-Source Charge | $Q_{gs}$ | | | 2.6 | | nC |
| Gate-Drain Charge | $Q_{gd}$ | | | 5.3 | | nC |
| **Switching times** | | | | | | |
| Turn-on Delay Time | $t_{d(on)}$ | $V_{DD}$=380V,$I_D$=3.0A, $R_G$=5Ω,$V_{GS}$=10V | | 7 | | nS |
| Turn-on Rise Time | $t_r$ | | | 3 | | nS |
| Turn-Off Delay Time | $t_{d(off)}$ | | | 52 | 62 | nS |
| Turn-Off Fall Time | $t_f$ | | | 10 | 16 | nS |
| **Source- Drain Diode Characteristics** | | | | | | |
| Source-drain current(Body Diode) | $I_{SD}$ | $T_C$=25°C | | | 5 | A |
| Pulsed Source-drain current(Body Diode) | $I_{SDM}$ | | | | 20 | A |
| Forward On Voltage | $V_{SD}$ | Tj=25°C,$I_{SD}$=5A,$V_{GS}$=0V | | 0.9 | 1.2 | V |
| Reverse Recovery Time | $t_{rr}$ | Tj=25°C,$I_F$=2.5A,di/dt=100A/μs | | 210 | | nS |
| Reverse Recovery Charge | $Q_{rr}$ | | | 0.66 | | uC |
| Peak reverse recovery current | $I_{rrm}$ | | | 6.5 | | A |

Notes: 1.Repetitive Rating: Pulse width limited by maximum junction temperature

2. Tj=25℃,VDD=50V,VG=10V, $R_G$=25Ω

## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS (curves) 5N65F

**Figure1. Safe operating area for TO-220F**

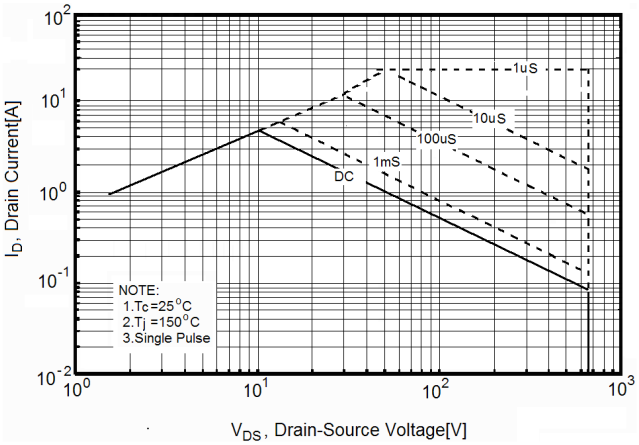



**Figure2. Source-Drain Diode Forward Voltage**

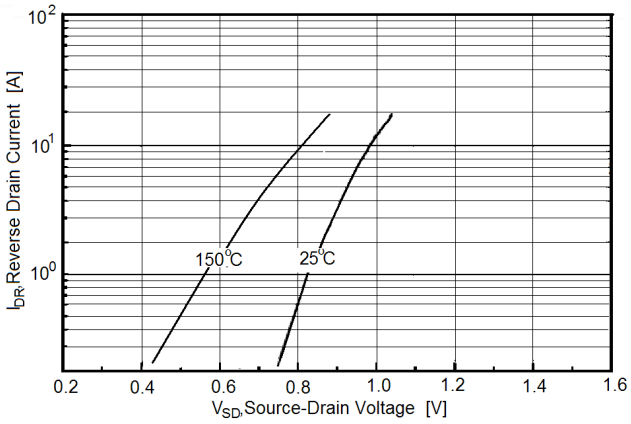



**Figure3. Output characteristics**

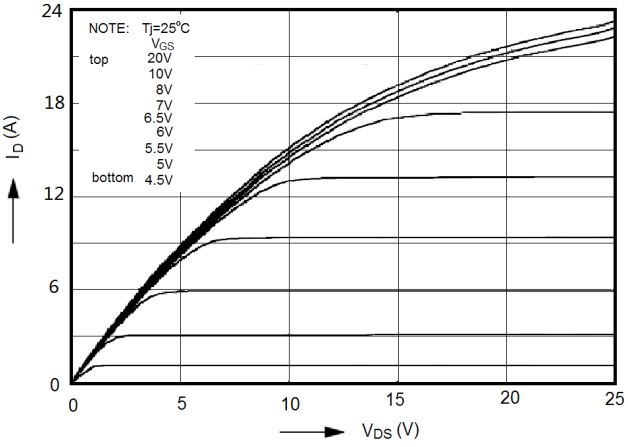



**Figure 4. Transfer characteristics**

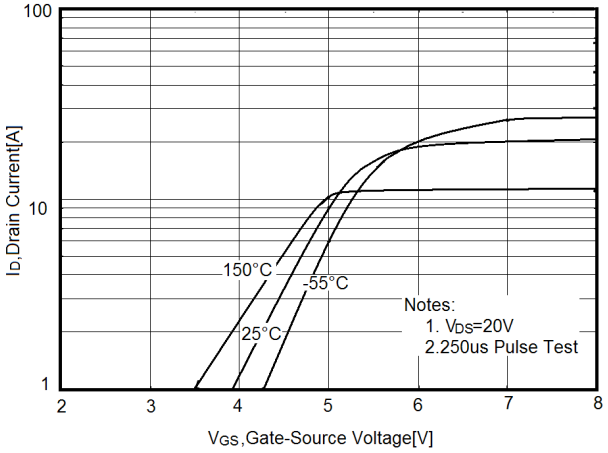
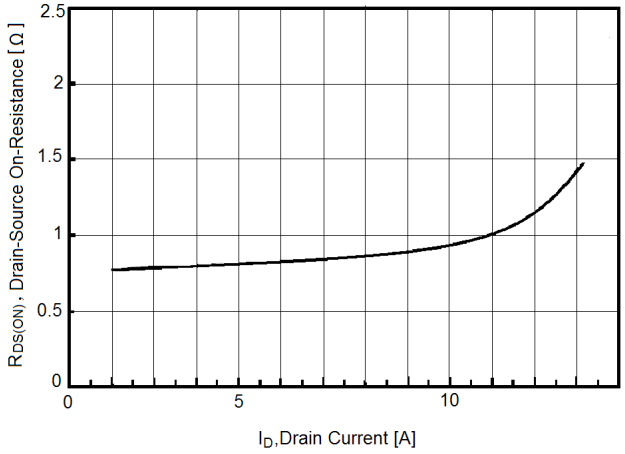
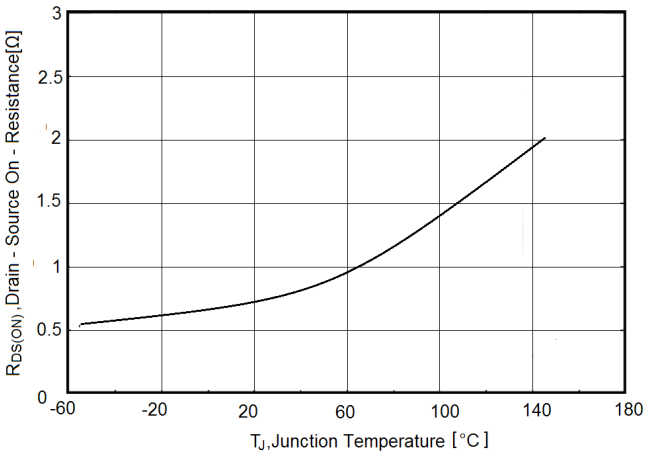



**Figure 5. Static drain-source on resistance**

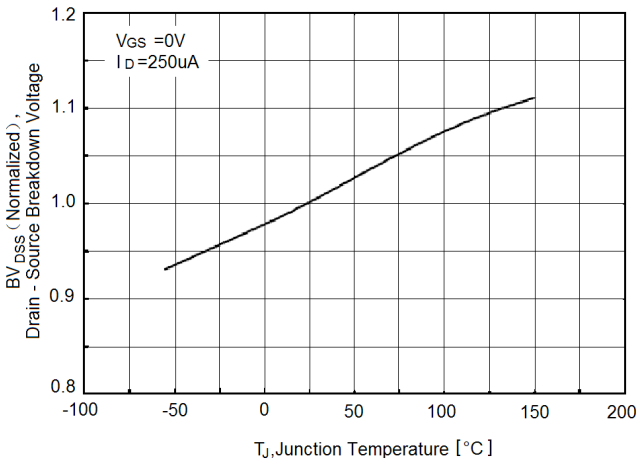


## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS (curves) 5N65F

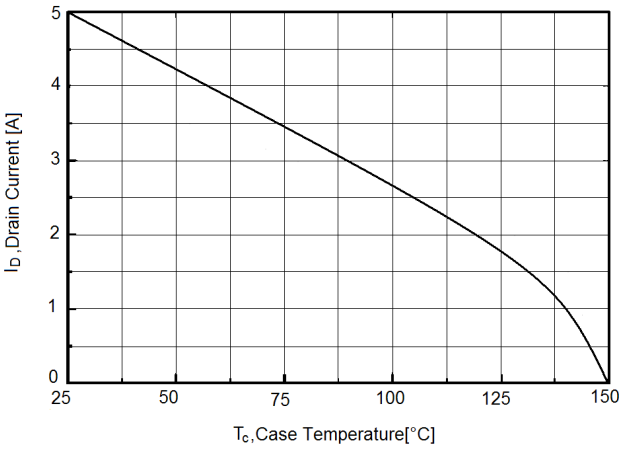
### Figure6. $R_{DS(ON)}$ vs Junction Temperature



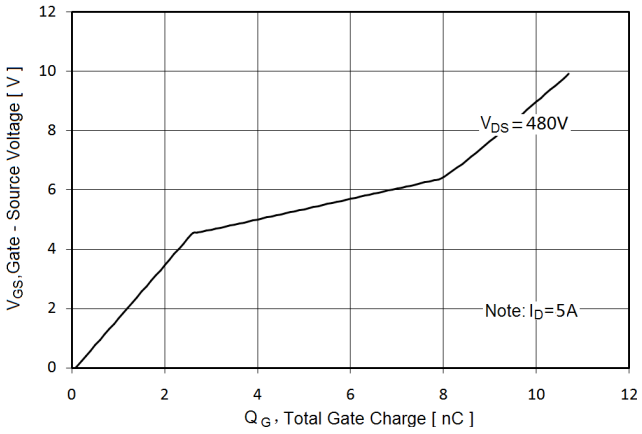

### Figure7. $BV_{DSS}$ vs Junction Temperature



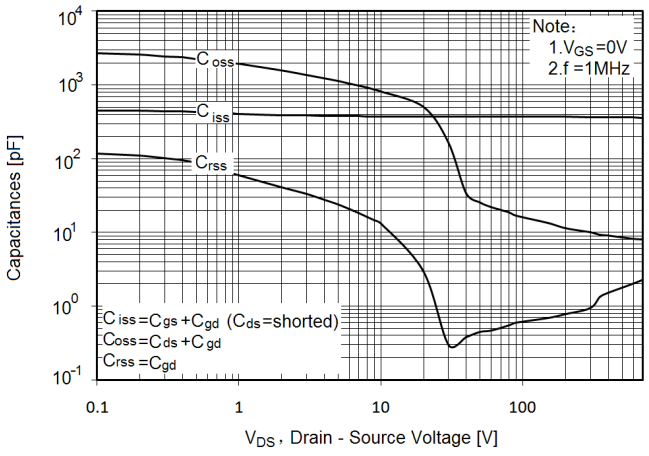

### Figure8 . Maximum $I_D$ vs Junction Temperature



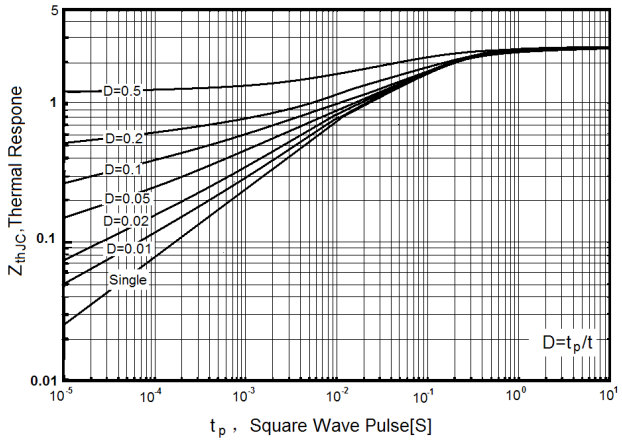

### Figure9. Gate charge waveforms




### Figure10. Capacitance




### Figure11. Transient Thermal Impedance



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>>ZG(中鑫半导体)