# 5N65
## N-Channel Enhancement Mode MOSFET

| | |
|---|---|
| $V_{DSS}$ | 650 V |
| $I_D$ | 5 A |
| $R_{DS(ON)}$ | 1.8 Ω |

## Features

5A,650V,$R_{DS(ON)MAX}$=2.2 Ω @$V_{GS}$=10V/2.5A

Low gate charge

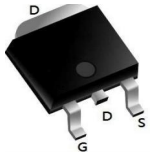
Low $C_{iss}$

Fast switching

100% avalanche tested

Improved dv/dt capability

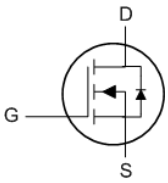
**TO-252**




GK xxx
5N65

LOGO — GK xxx — CODE
5 N 65
ID — VDSS

**Equivalent Circuit**




## MAXIMUM RATINGS AND ELECTRICAL CHARACTERISTICS

**Absolute Maximum Ratings** (@ $T_C$ = 25°C unless otherwise specified)

| PARAMETER | | SYMBOL | RATINGS | UNIT |
|---|---|---|---|---|
| Drain-Source Voltage | | $V_{DSS}$ | 650 | V |
| Gate-Source Voltage | | $V_{GSS}$ | ±30 | V |
| Drain Current | Continuous | $I_D$ | 5 | A |
| | Pulsed (Note 2) | $I_{DM}$ | 10 | A |
| Avalanche Energy | Single Pulsed (Note 3) | $E_{AS}$ | 112 | mJ |
| Peak Diode Recovery dv/dt (Note 4) | | dv/dt | 3.2 | V/ns |
| Power Dissipation | | $P_D$ | 36 | W |
| Junction Temperature | | $T_J$ | +150 | °C |
| Storage Temperature | | $T_{STG}$ | -55 ~ +150 | °C |

Notes: 1. Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.

2. Repetitive Rating: Pulse width limited by maximum junction temperature.

3. L = 10mH, $I_{AS}$ = 4.73A, $V_{DD}$ = 50V, $R_G$ = 25 Ω Starting $T_J$ = 25°C

4. $I_{SD}$ ≤ 7.0A, di/dt ≤200A/μs, $V_{DD}$ ≤$BV_{DSS}$, Starting $T_J$ = 25°C

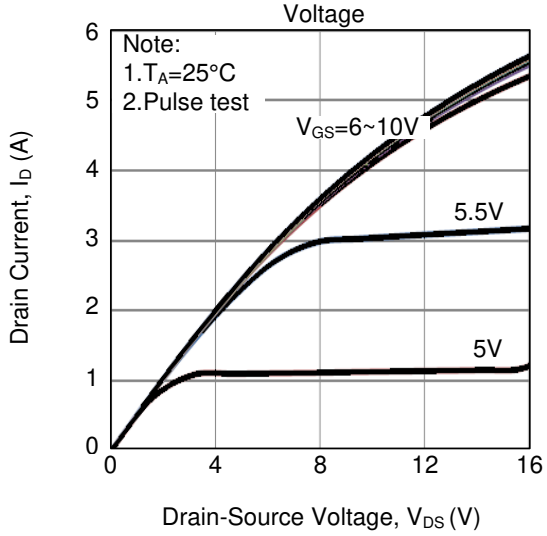
## Electrical Characteristics ($T_J$=25℃unless otherwise noted)

| PARAMETER | | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | | | |
| Drain-Source Breakdown Voltage | | $BV_{DSS}$ | $V_{GS}$=0V, $I_D$= 250μA | 650 | | | V |
| Drain-Source Leakage Current | | $I_{DSS}$ | $V_{DS}$=650V, $V_{GS}$=0V | | | 10 | μA |
| Gate-Source Leakage Current | Forward | $I_{GSS}$ | $V_{GS}$=30V, $V_{DS}$=0V | | | 100 | nA |
| | Reverse | | $V_{GS}$=-30V, $V_{DS}$=0V | | | -100 | nA |
| **ON CHARACTERISTICS** | | | | | | | |
| Gate Threshold Voltage | | $V_{GS(TH)}$ | $V_{DS}$=$V_{GS}$, $I_D$=250μA | 2.0 | | 4.0 | V |
| Static Drain-Source On-State Resistance | | $R_{DS(ON)}$ | $V_{GS}$=10V, $I_D$=2.5A | | 1.8 | 2.2 | Ω |
| **DYNAMIC CHARACTERISTICS** | | | | | | | |
| Input Capacitance | | $C_{ISS}$ | $V_{GS}$=0V, $V_{DS}$=25V, f=1.0 MHz | | 623 | | pF |
| Output Capacitance | | $C_{OSS}$ | | | 62 | | pF |
| Reverse Transfer Capacitance | | $C_{RSS}$ | | | 2.9 | | pF |
| **SWITCHING CHARACTERISTICS** | | | | | | | |
| Total Gate Charge (Note 1) | | $Q_G$ | $V_{DS}$=100V, $V_{GS}$=10V, $I_D$=2.0A $I_G$=1mA (Note 1, 2) | | 15 | | nC |
| Gateource Charge | | $Q_{GS}$ | | | 5.6 | | nC |
| Gate-Drain Charge | | $Q_{GD}$ | | | 2.5 | | nC |
| Turn-on Delay Time (Note 1) | | $t_{D(ON)}$ | $V_{DS}$=30V, $V_{GS}$=10V, $I_D$=0.5A, $R_G$=25Ω (Note 1, 2) | | 4.4 | | ns |
| Rise Time | | $t_R$ | | | 24 | | ns |
| Turn-off Delay Time | | $t_{D(OFF)}$ | | | 122 | | ns |
| Fall-Time | | $t_F$ | | | 25 | | ns |
| **SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS** | | | | | | | |
| Maximum Body-Diode Continuous Current | | $I_S$ | | | | 5 | A |
| Maximum Body-Diode Pulsed Current | | $I_{SM}$ | | | | 10 | A |
| Drain-Source Diode Forward Voltage (Note 1) | | $V_{SD}$ | $V_{GS}$=0V, $I_S$=5.0A | | | 1.4 | V |
| Reverse Recovery Time (Note 1) | | $t_{rr}$ | $V_{GS}$=0V, $I_S$=5.0A, $dI_F/dt$=100A/μs (Note1) | | 328 | | ns |
| Reverse Recovery Charge | | $Q_{rr}$ | | | 2.65 | | μC |

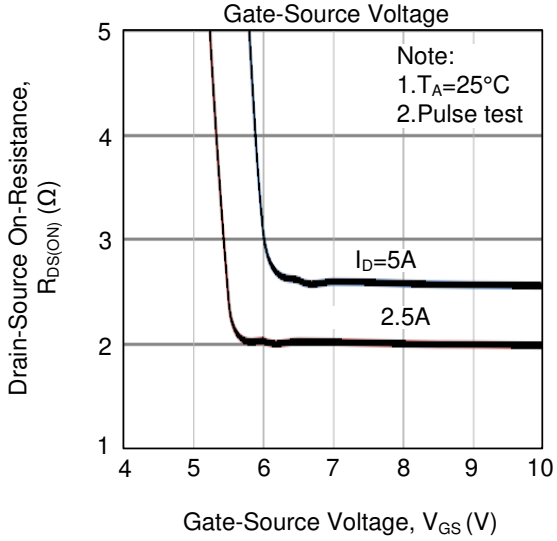
Notes: 1. Pulse Test : Pulse width ≤ 300μs, Duty cycle ≤ 2%.
2. Essentially independent of operating temperature.

## RATING AND CHARACTERISTIC CURVES

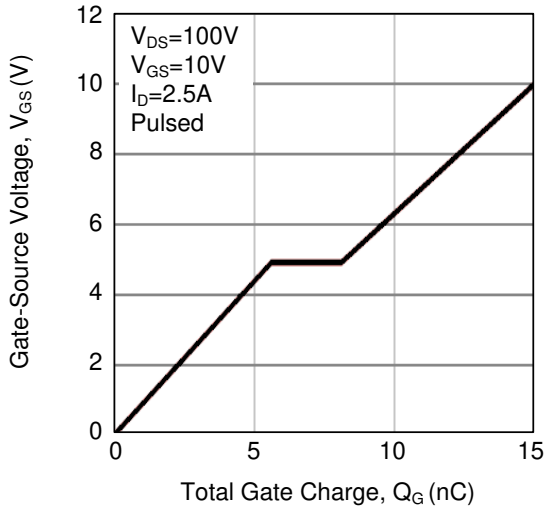
Drain Current vs. Drain-Source Voltage



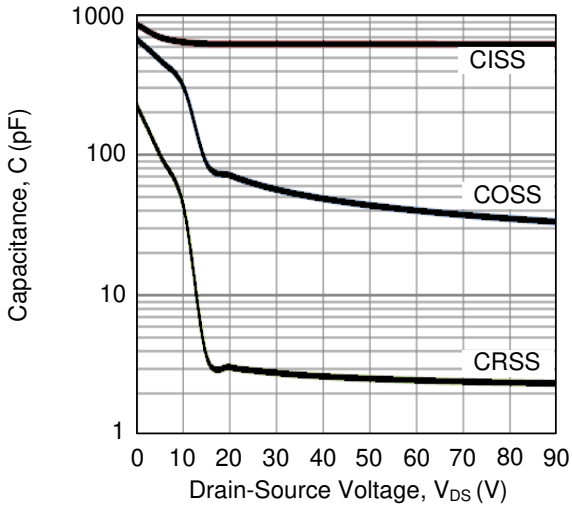

Drain-Source On-Resistance vs. Gate-Source Voltage



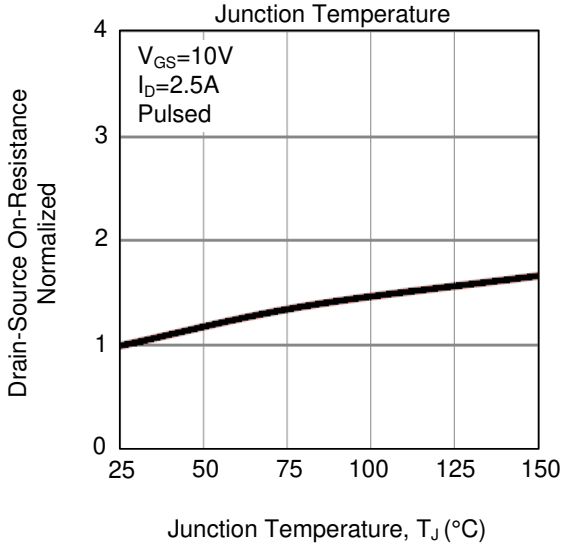

Gate Charge Characteristics



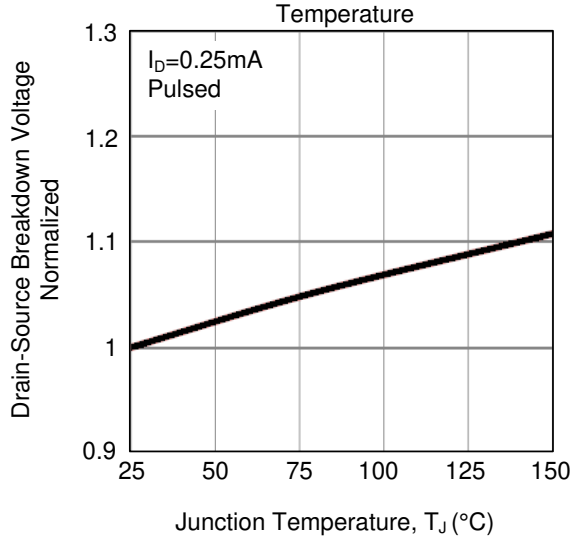

Capacitance Characteristics




Drain-Source On-Resistance vs. Junction Temperature

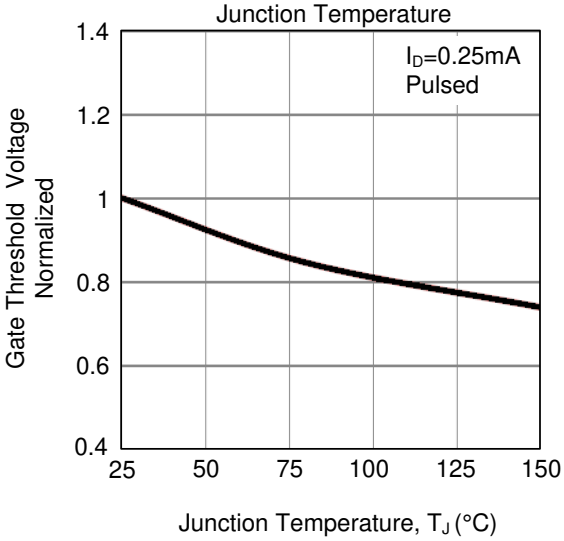



Breakdown Voltage vs. Junction Temperature

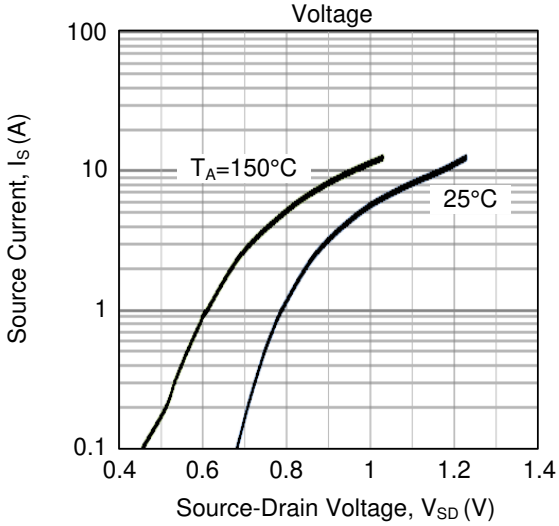


## RATING AND CHARACTERISTIC CURVES

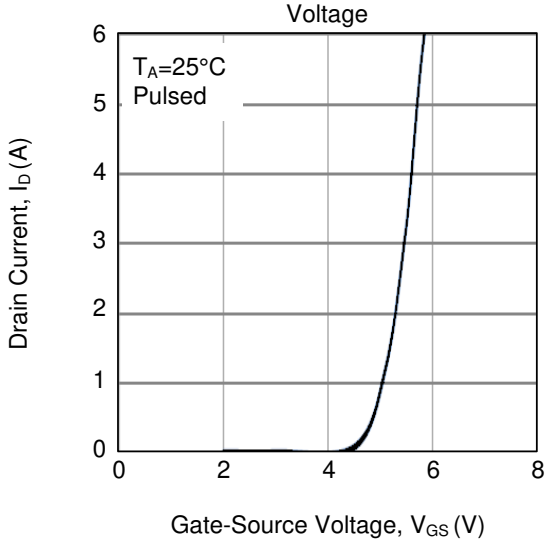
Gate Threshold Voltage vs. Junction Temperature



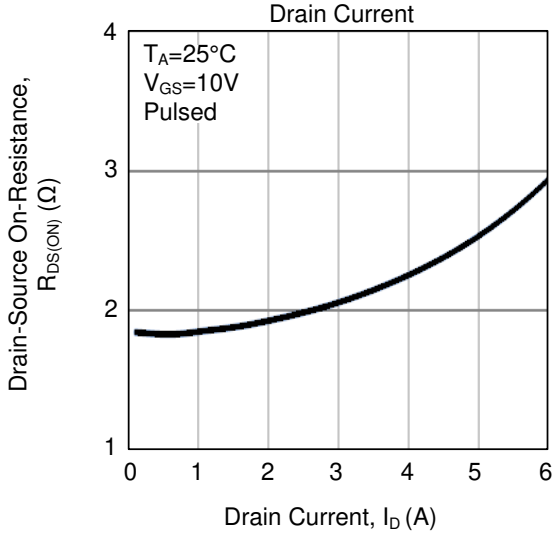

Source Current vs. Source-Drain Voltage



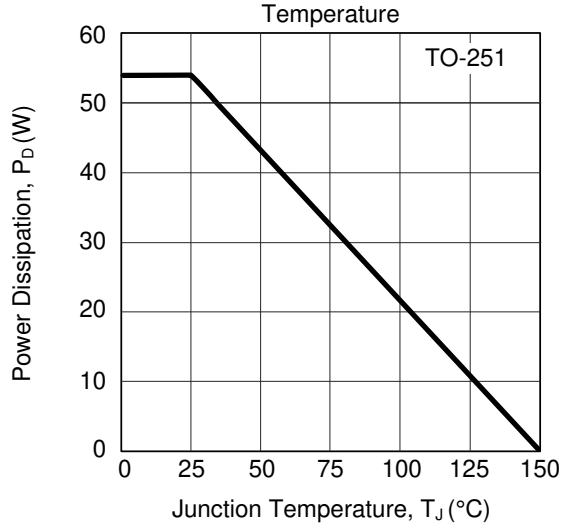

Drain Current vs. Gate-Source Voltage



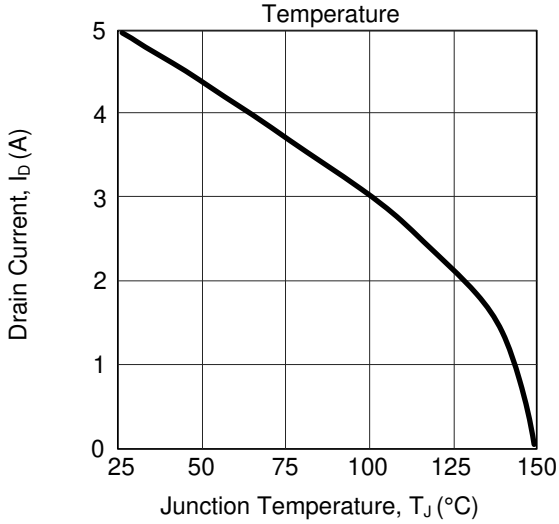

Drain-Source On-Resistance vs. Drain Current




Power Dissipation vs. Junction Temperature



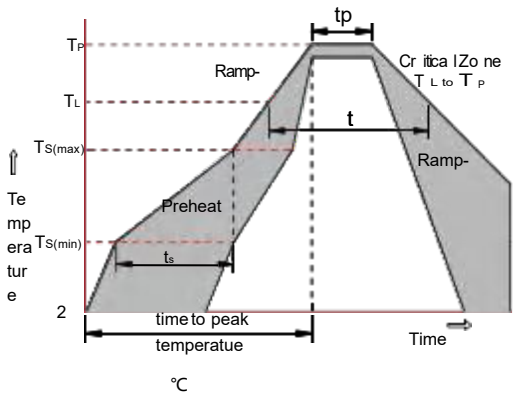

Drain Current vs. Junction Temperature



## Soldering parameters

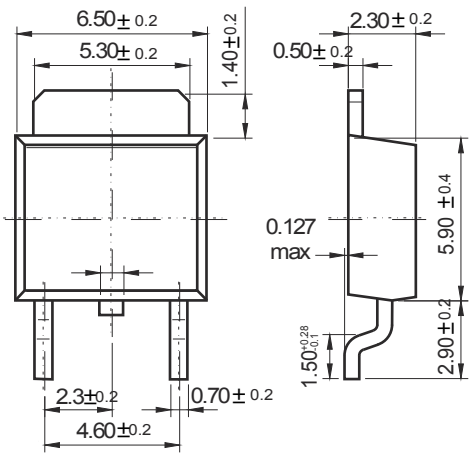
| Reflow Condition | | Pb-Free assembly (see as bellow) |
|---|---|---|
| Pre Heat | -Temperature Min ($T_{s(min)}$) | +150℃ |
| | -Temperature Max($T_{s(max)}$) | +200℃ |
| | -Time (Min to Max) (ts) | 60-180 secs. |
| Average ramp up rate (Liquid us Temp ($T_L$) to peak) | | 3℃/sec. Max |
| $T_{s(max)}$ to $T_L$ - Ramp-up Rate | | 3℃/sec. Max |
| Reflow | -Temperature($T_L$)(Liquid us) | +217℃ |
| | -Temperature($t_L$) | 60-150 secs. |
| Peak Temp ($T_p$) | | +260(+0/-5)℃ |
| Time within 5℃ of actual Peak Temp ($t_p$) | | 30 secs. Max |
| Ramp-down Rate | | 6℃/sec. Max |
| Time 25℃ to Peak Temp ($T_P$) | | 8 min. Max |
| Do not exceed | | +260℃ |

**FIG5:** Reflow condition

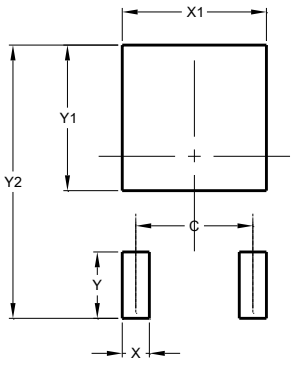



## Package Dimensions & Suggested Pad Layout

TO-252



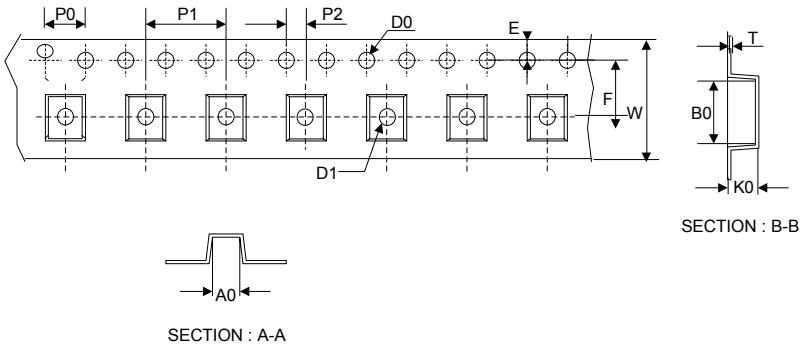

Dimensions in inches and (millimeters)



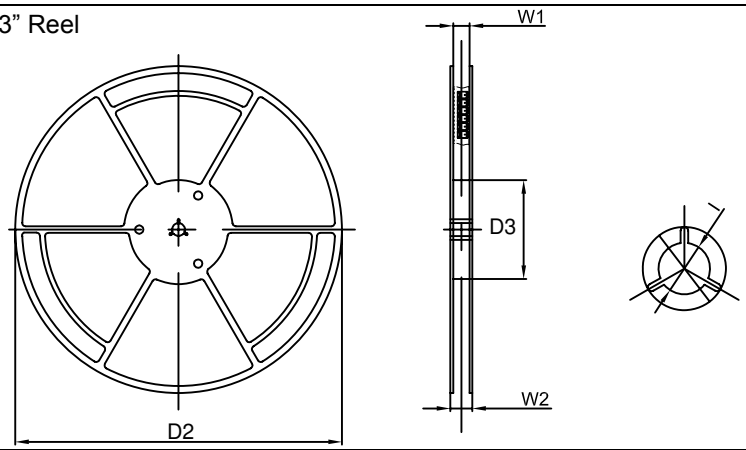

| Dimensions | Value (in mm) |
|---|---|
| C | 4.55 |
| X | 1.50 |
| X1 | 5.80 |
| Y | 2.70 |
| Y1 | 6.00 |
| Y2 | 10.90 |

## Tape & rell specification

Tape




13” Reel




| Symbol | Dimension (mm) |
|---|---|
| P0 | 4.00±0.20 |
| P1 | 8.00±0.20 |
| P2 | 2.00±0.20 |
| D0 | 1.55±0.15 |
| D1 | 1.55±0.20 |
| E | 1.75±0.20 |
| F | 7.50±0.20 |
| W | 16.00±0.20 |
| A0 | 7.10±0.20 |
| B0 | 10.50±0.20 |
| K0 | 2.70±0.20 |
| T | 0.30±0.10 |
| D2 | 330.0±5.0 |
| D3 | 100.0±4.0 |
| W1 | 20.0±5.0 |
| W2 | 25.0±5.0 |
| I | 13.0±2.0 |

Quantity: 2500PCS

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