

N-Channel Super Junction Power MOSFET IV

General Description

The series of devices use advanced trench gate super junction technology and design to provide excellent $R_{DS(ON)}$ with low gate charge. This super junction MOSFET fits the industry's AC-DC SMPS requirements for PFC, AC/DC power conversion, and industrial power applications.

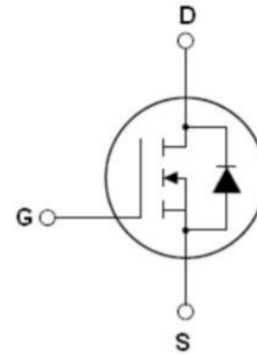
Features

- Optimized body diode reverse recovery performance
- Low on-resistance and low conduction losses
- Small package
- Ultra Low Gate Charge cause lower driving requirements
- 100% Avalanche Tested
- ROHS compliant

Application

- Power factor correction (PFC)
- Switched mode power supplies(SMPS)
- Uninterruptible Power Supply (UPS)
- LLC Half-bridge

| | | |
|------------------------|-----|----|
| $V_{DS\ min@T_{jmax}}$ | 710 | V |
| $R_{DS(ON)TYP.}$ | 790 | mΩ |
| I_D | 5.1 | A |
| Q_g | 9 | nC |



Schematic diagram

Package Marking And Ordering Information

| Device | Device Package | Marking |
|-----------|----------------|-----------|
| NCE65N900 | TO-220-3L | NCE65N900 |

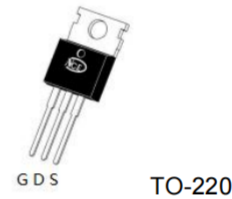


Table 1. Absolute Maximum Ratings ($T_c=25^\circ\text{C}$)

| Parameter | Symbol | Value | Unit |
|--|-----------------|------------|------|
| Drain-Source Voltage ($V_{GS}=0V$) | V_{DS} | 650 | V |
| Gate-Source Voltage ($V_{DS}=0V$), AC ($f>1\text{ Hz}$) | V_{GS} | ± 30 | V |
| Gate-Source Voltage ($V_{DS}=0V$), DC | V_{GS} | ± 20 | V |
| Continuous Drain Current at $T_c=25^\circ\text{C}$ | $I_{D(DC)}$ | 5.1 | A |
| Continuous Drain Current at $T_c=100^\circ\text{C}$ | $I_{D(DC)}$ | 3.57 | A |
| Pulsed drain current (Note 1) | $I_{DM(pluse)}$ | 15.3 | A |
| Maximum Power Dissipation($T_c=25^\circ\text{C}$) | P_D | 59 | W |
| Derate above 25°C | | 0.39 | W/°C |
| Single pulse avalanche current (Note 2) | I_{AS} | 1.5 | A |
| Reverse diode dv/dt , $V_{DS} \leq 480\text{ V}, I_{SD} < I_D$ | dv/dt | 15 | V/ns |
| Drain Source voltage slope, $V_{DS} \leq 480\text{ V}$ | dv/dt | 50 | V/ns |
| Operating Junction and Storage Temperature Range | T_J, T_{STG} | -55...+175 | °C |

Table 2. Thermal Characteristic

| Parameter | Symbol | Value | Unit |
|---|------------|-------|-----------------------------|
| Thermal Resistance, Junction-to-Case (Maximum) | R_{thJC} | 2.54 | $^{\circ}\text{C}/\text{W}$ |
| Thermal Resistance, Junction-to-Ambient (Maximum) | R_{thJA} | 62 | $^{\circ}\text{C}/\text{W}$ |

Table 3. Electrical Characteristics (TA=25°C unless otherwise noted)

| Parameter | Symbol | Condition | Min | Typ | Max | Unit |
|--|--------------|---|-----|------|-----------|---------------|
| On/off states | | | | | | |
| Drain-Source Breakdown Voltage | BV_{DSS} | $V_{GS}=0V, I_D=250\mu A$ | 650 | | | V |
| Zero Gate Voltage Drain Current(Tc=25°C) | I_{DSS} | $V_{DS}=650V, V_{GS}=0V$ | | | 1 | μA |
| Zero Gate Voltage Drain Current(Tc=125°C) | I_{DSS} | $V_{DS}=650V, V_{GS}=0V$ | | | 50 | μA |
| Gate-Body Leakage Current | I_{GSS} | $V_{GS}=\pm 20V, V_{DS}=0V$ | | | ± 200 | nA |
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{DS}=V_{GS}, I_D=250\mu A$ | 3 | | 4 | V |
| Drain-Source On-State Resistance | $R_{DS(on)}$ | $V_{GS}=10V, I_D=2.5A$ | | 790 | 900 | m Ω |
| Dynamic Characteristics | | | | | | |
| Gate Resistance | R_g | F=1MHZ, D-S short | | 36 | | Ω |
| Input Capacitance | C_{iss} | $V_{DS}=50V, V_{GS}=0V,$ F=1MHz | | 296 | | pF |
| Output Capacitance | C_{oss} | | | 12 | | pF |
| Reverse Transfer Capacitance | C_{rss} | | | 4 | | pF |
| Total Gate Charge | Q_g | $V_{DS}=480V, I_D=2.5A,$ $V_{GS}=10V$ | | 9 | | nC |
| Gate-Source Charge | Q_{gs} | | | 2.3 | | nC |
| Gate-Drain Charge | Q_{gd} | | | 3.2 | | nC |
| Gate plateau voltage | V_{gp} | | | 5.7 | | V |
| Switching times | | | | | | |
| Turn-on Delay Time | $t_{d(on)}$ | $V_{DD}=480V, I_D=2.5A,$ $R_G=4\Omega, V_{GS}=10V$ | | 7 | | nS |
| Turn-on Rise Time | t_r | | | 3 | | nS |
| Turn-Off Delay Time | $t_{d(off)}$ | | | 50 | | nS |
| Turn-Off Fall Time | t_f | | | 9 | | nS |
| Source- Drain Diode Characteristics | | | | | | |
| Source-drain current(Body Diode) | I_{SD} | $T_C=25^{\circ}\text{C}$ | | | 5.1 | A |
| Pulsed-Source-drain current(Body Diode) | I_{SDM} | | | | 15.3 | A |
| Forward on voltage | V_{SD} | $T_j=25^{\circ}\text{C}, I_{SD}=5.1A, V_{GS}=0V$ | | 0.9 | 1.1 | V |
| Reverse Recovery Time | t_{rr} | $T_j=25^{\circ}\text{C}, I_F=2.5A,$ $di/dt=100A/\mu s$ | | 190 | | nS |
| Reverse Recovery Charge | Q_{rr} | | | 0.57 | | μC |
| Peak reverse recovery current | I_{rrm} | | | 6 | | A |

Notes: 1. Repetitive Rating: Pulse width limited by maximum junction temperature
 2. $T_j=25^{\circ}\text{C}, V_{DD}=50V, V_G=10V, R_G=25\Omega$

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS (curves)

Figure1. Safe operating area

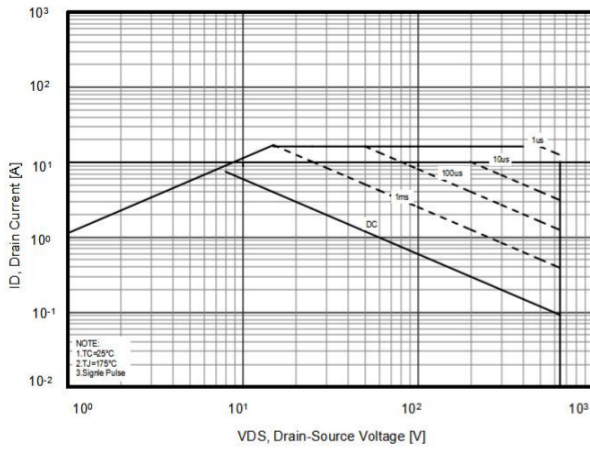


Figure2. Source-Drain Diode Forward Voltage

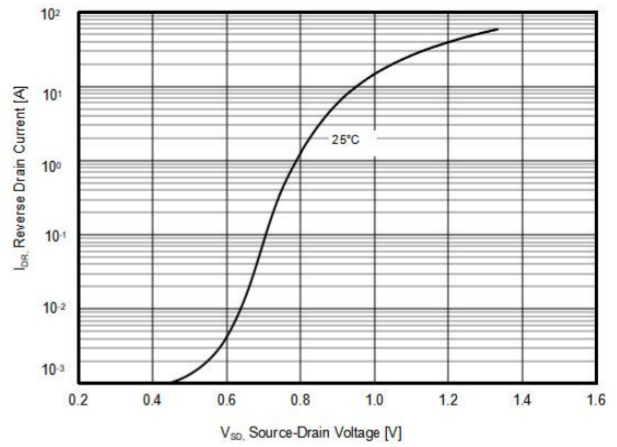


Figure3. Output characteristics

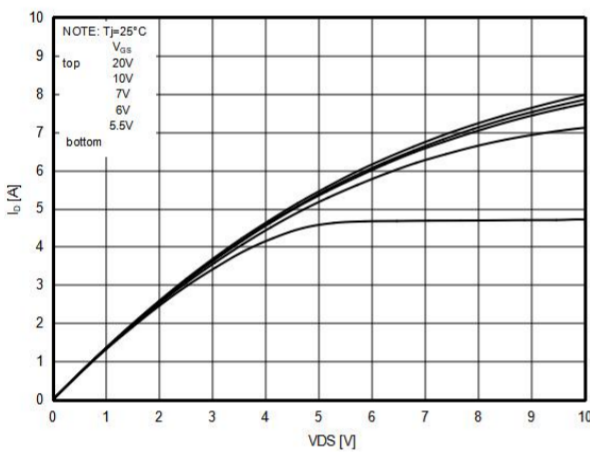


Figure4. Transfer characteristics

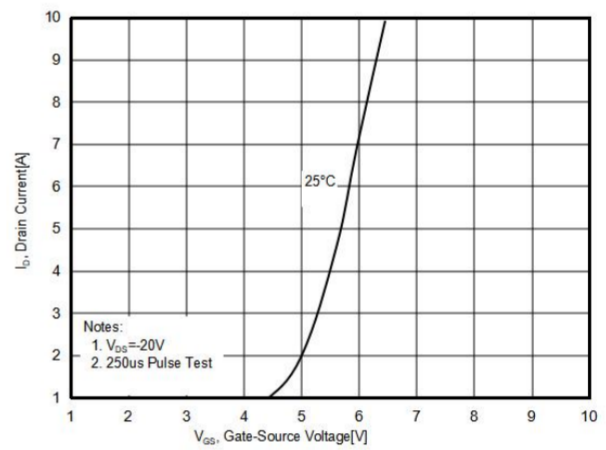


Figure5. Static drain-source on resistance

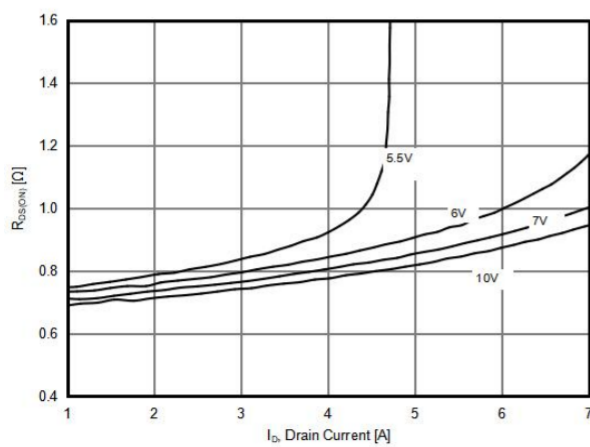


Figure6. $R_{DS(ON)}$ vs Junction Temperature

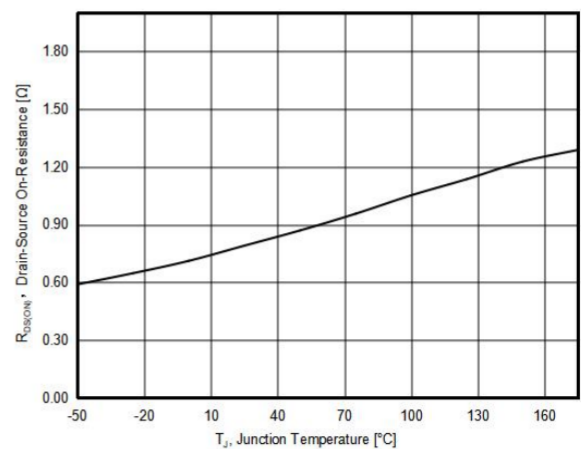


Figure7. BV_{DSS} vs Junction Temperature

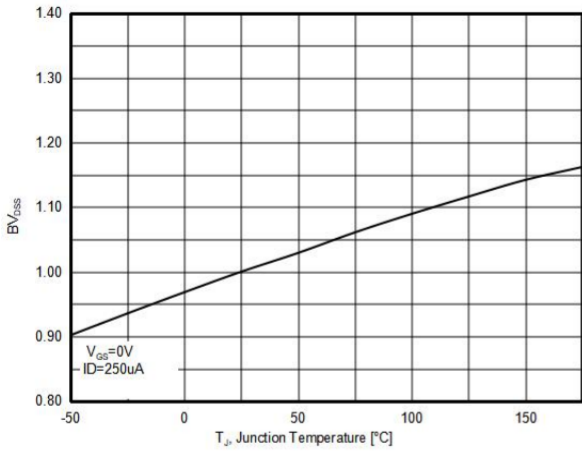


Figure8. Maximum I_D vs Junction Temperature

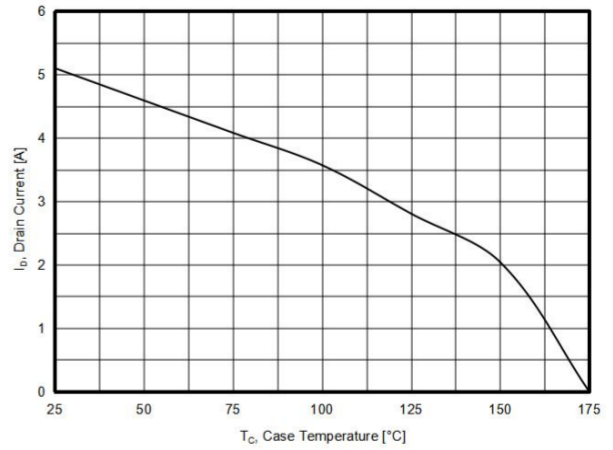


Figure9. Gate charge waveforms

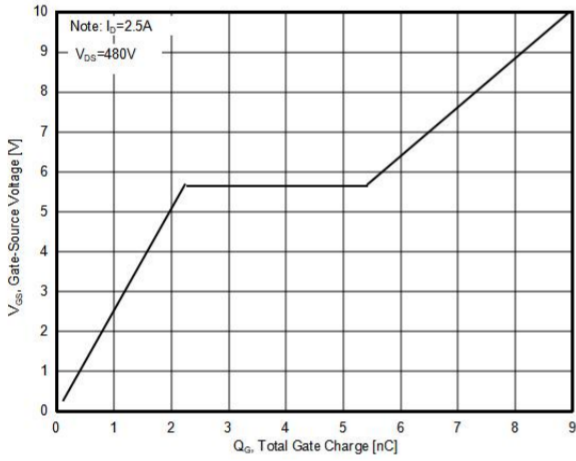
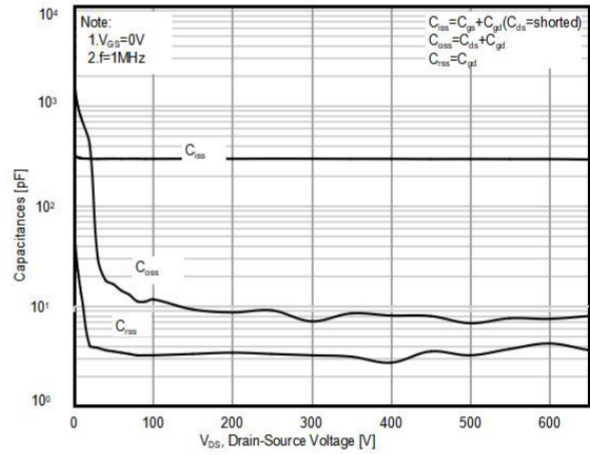
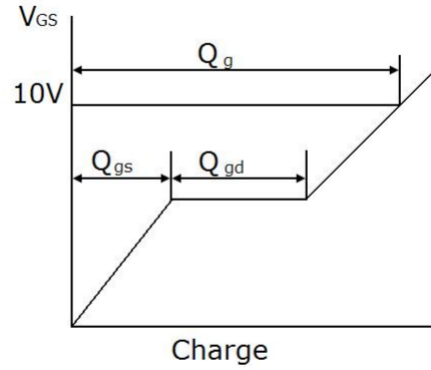
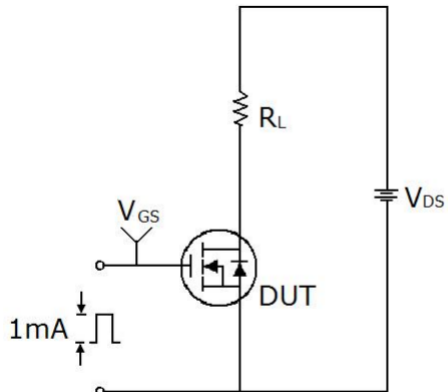


Figure10. Capacitance

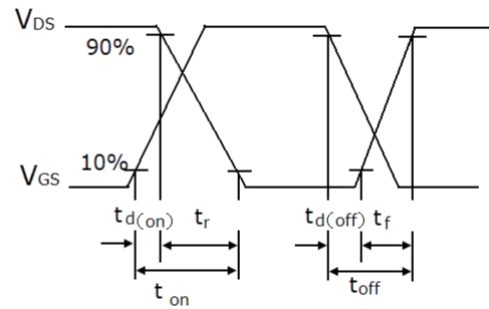
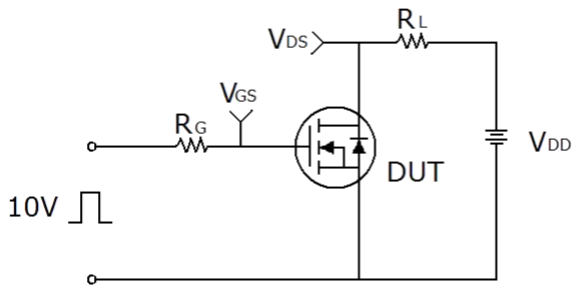


Test circuit

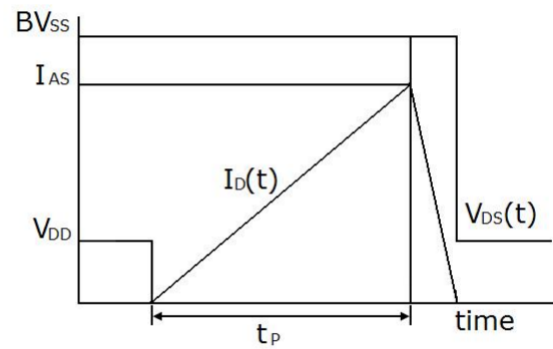
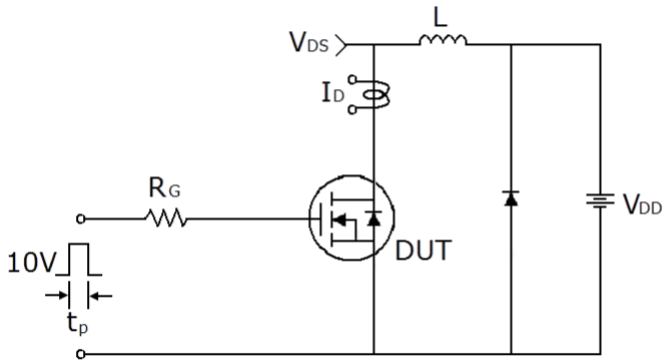
1) Gate charge test circuit & Waveform



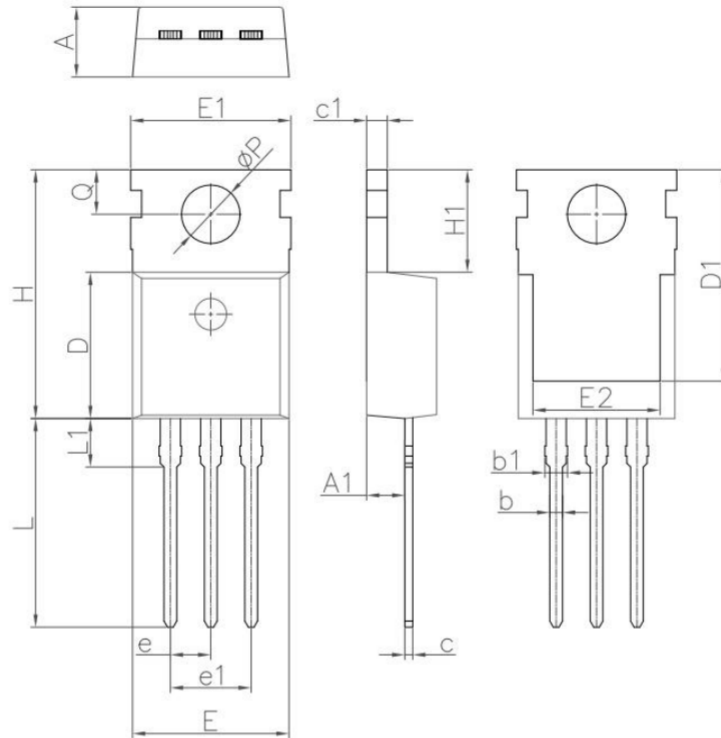
2) Switch Time Test Circuit:



3) Unclamped Inductive Switching Test Circuit & Waveforms



TO-220-3L-E Package Information



| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|--------|---------------------------|-------|----------------------|-------|
| | Min. | Max. | Min. | Max. |
| A | 4.20 | 4.60 | 0.165 | 0.181 |
| A1 | 2.25 | 2.55 | 0.089 | 0.100 |
| b | 0.70 | 0.90 | 0.028 | 0.035 |
| b1 | 1.17 | 1.37 | 0.046 | 0.054 |
| c | 0.33 | 0.65 | 0.013 | 0.026 |
| c1 | 1.20 | 1.40 | 0.047 | 0.055 |
| D | 8.95 | 9.75 | 3.524 | 3.839 |
| D1 | 13.10 | 13.50 | 5.157 | 5.315 |
| E | 9.74 | 10.04 | 3.835 | 3.953 |
| E1 | 9.91 | 10.25 | 3.902 | 4.035 |
| E2 | 7.90 | 8.10 | 3.110 | 3.189 |
| e | 2.54BSC | | 0.100BSC | |
| e1 | 5.08BSC | | 0.200BSC | |
| H | 15.45 | 15.85 | 6.083 | 6.240 |
| H1 | 6.30 | 6.60 | 2.480 | 2.598 |
| L | 12.90 | 13.40 | 5.079 | 5.276 |
| L1 | 2.85 | 3.25 | 1.122 | 1.280 |
| Q | 2.65 | 2.95 | 1.043 | 1.161 |
| ΦP | 3.40 | 3.80 | 1.339 | 1.496 |

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