

N-Channel Super Junction Power MOSFET III

General Description

The series of devices use advanced 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

- 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

Application

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

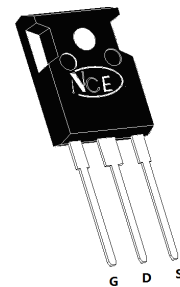
| | | |
|-------------------|-----|------------|
| V_{DS} | 650 | V |
| $R_{DS(ON) TYP.}$ | 36 | m Ω |
| I_D | 75 | A |



Schematic diagram

Package Marking And Ordering Information

| Device | Device Package | Marking |
|-------------|----------------|-------------|
| NCE65TF041T | TO-247 | NCE65TF041T |



TO-247

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 ($f>1$ Hz) | V_{GS} | ± 30 | V |
| Continuous Drain Current at $T_c=25^\circ\text{C}$ | $I_{D(DC)}$ | 75 | A |
| Continuous Drain Current at $T_c=100^\circ\text{C}$ | $I_{D(DC)}$ | 47 | A |
| Pulsed drain current (Note 1) | $I_{DM(pluse)}$ | 300 | A |
| Maximum Power Dissipation($T_c=25^\circ\text{C}$) | P_D | 510 | W |
| Derate above 25°C | | 4.08 | W/ $^\circ\text{C}$ |
| Single pulse avalanche energy (Note 2) | E_{AS} | 1936 | mJ |
| Avalanche current (Note 1) | I_{AR} | 28 | A |
| Repetitive Avalanche energy, t_{AR} limited by T_{Jmax} (Note 1) | E_{AR} | 2.5 | mJ |

| Parameter | Symbol | Value | Unit |
|---|----------------|------------|------|
| Drain Source voltage slope, $V_{DS} \leq 480V$, | dv/dt | 50 | V/ns |
| Reverse diode dv/dt, $V_{DS} \leq 480V, I_{SD} < I_D$ | dv/dt | 50 | 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 | Value | Unit |
|---|------------|-------|------|
| Thermal Resistance, Junction-to-Case (Maximum) | R_{thJC} | 0.245 | °C/W |
| Thermal Resistance, Junction-to-Ambient (Maximum) | R_{thJA} | 62 | °C/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} | $V_{GS}=0V, I_D=500\mu A$ | 650 | | | V |
| Zero Gate Voltage Drain Current($T_C=25^\circ C$) | I_{DSS} | $V_{DS}=650V, V_{GS}=0V$ | | | 5 | μA |
| Zero Gate Voltage Drain Current($T_C=125^\circ C$) | I_{DSS} | $V_{DS}=650V, V_{GS}=0V$ | | | 500 | μA |
| Gate-Body Leakage Current | I_{GSS} | $V_{GS}=\pm 20V, V_{DS}=0V$ | | | ± 100 | nA |
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{DS}=V_{GS}, I_D=500\mu A$ | 2.5 | 3.5 | 4.5 | V |
| Drain-Source On-State Resistance | $R_{DS(ON)}$ | $V_{GS}=10V, I_D=38A$ | | 36 | 41 | m Ω |
| Dynamic Characteristics | | | | | | |
| Input Capacitance | C_{ISS} | $V_{DS}=100V, V_{GS}=0V,$ $F=1.0MHz$ | | 7300 | 8500 | PF |
| Output Capacitance | C_{OSS} | | | 252 | | PF |
| Reverse Transfer Capacitance | C_{RSS} | | | 4 | | PF |
| Total Gate Charge | Q_g | $V_{DS}=480V, I_D=75A,$ $V_{GS}=10V$ | | 116 | 135 | nC |
| Gate-Source Charge | Q_{GS} | | | 40 | | nC |
| Gate-Drain Charge | Q_{GD} | | | 30 | | nC |
| Switching times | | | | | | |
| Turn-on Delay Time | $t_{d(on)}$ | $V_{DD}=380V, I_D=38A,$ $R_G=1.2\Omega, V_{GS}=10V$ | | 27 | | nS |
| Turn-on Rise Time | t_r | | | 22 | | nS |
| Turn-Off Delay Time | $t_{d(off)}$ | | | 118 | 180 | nS |
| Turn-Off Fall Time | t_f | | | 13 | 30 | nS |
| Source- Drain Diode Characteristics | | | | | | |
| Source-drain current(Body Diode) | I_{SD} | $T_C=25^\circ C$ | | 75 | | A |
| Pulsed Source-drain current(Body Diode) | I_{SDM} | | | 300 | | A |
| Forward on voltage | V_{SD} | $T_J=25^\circ C, I_{SD}=75A, V_{GS}=0V$ | | 1.3 | | V |
| Reverse Recovery Time | t_{rr} | $T_J=25^\circ C, I_F=38A, di/dt=100A/\mu s$ $V_{DD}=300V$ | | 230 | | nS |
| Reverse Recovery Charge | Q_{rr} | | | 3 | | μC |
| Peak Reverse Recovery Current | I_{rrm} | | | 26 | | A |

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

2. $T_J=25^\circ C, V_{DD}=50V, V_G=10V, R_G=25\Omega$

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS (curves)

Figure1. Safe Operating Area

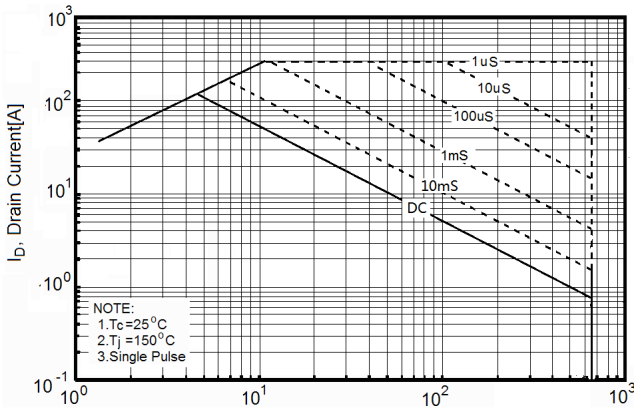


Figure3. Source-Drain Diode Forward Voltage

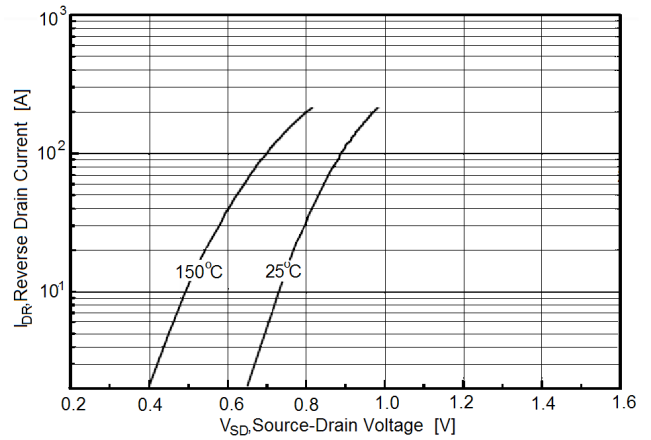


Figure4. Output Characteristics

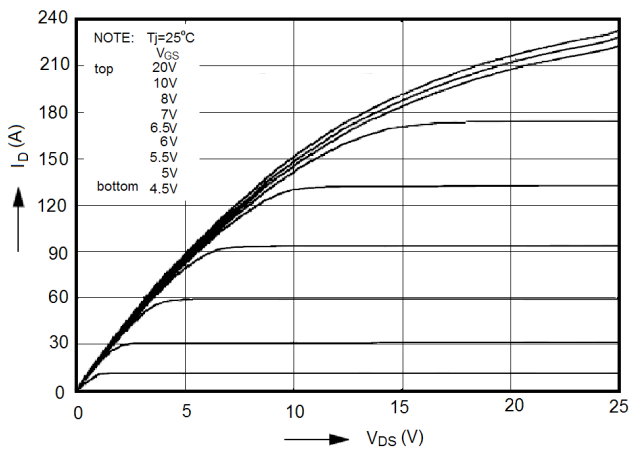


Figure5. Transfer Characteristics

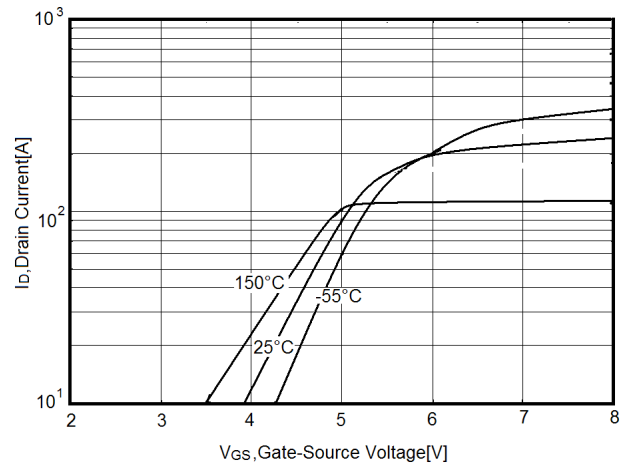


Figure6. Static drain-source on resistance

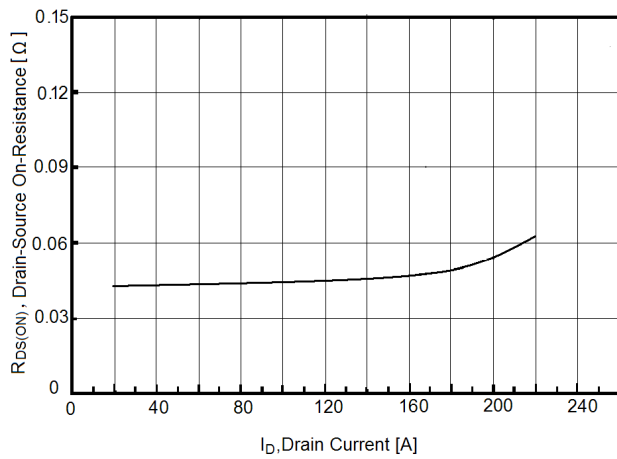


Figure7. $R_{DS(ON)}$ vs Junction Temperature

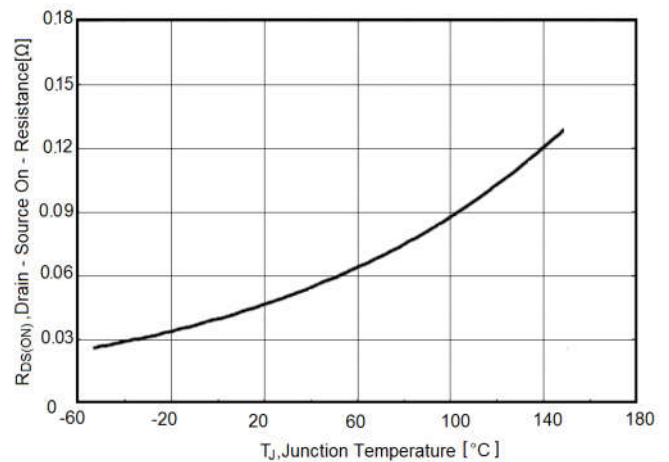


Figure8. BV_{DSS} vs Junction Temperature

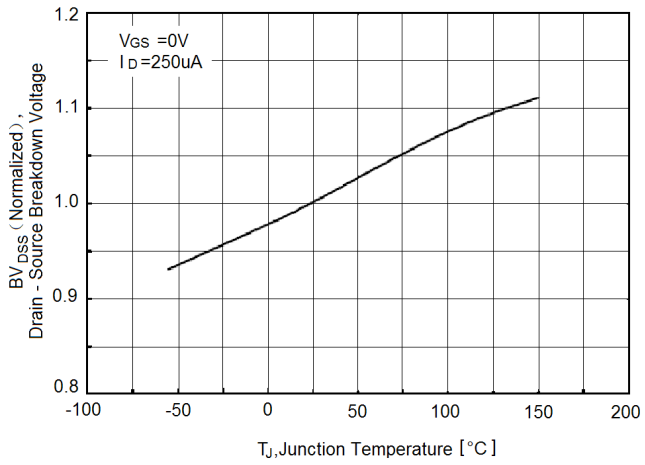
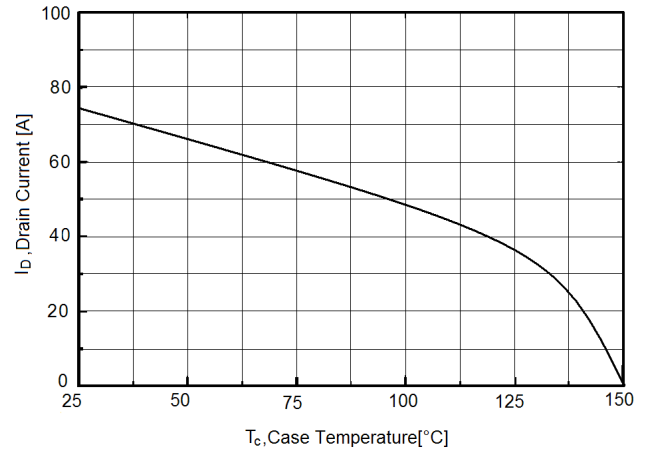
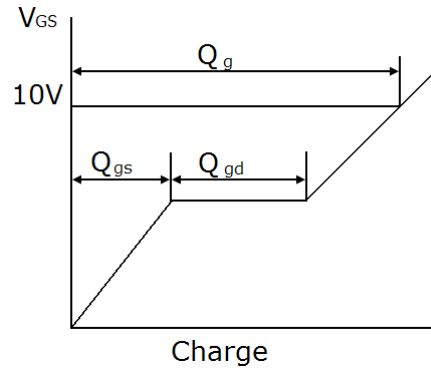
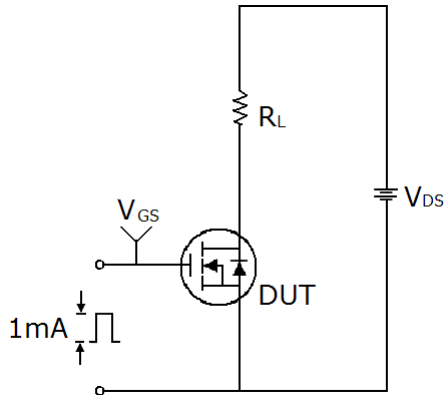


Figure9. Maximum I_D vs Junction Temperature

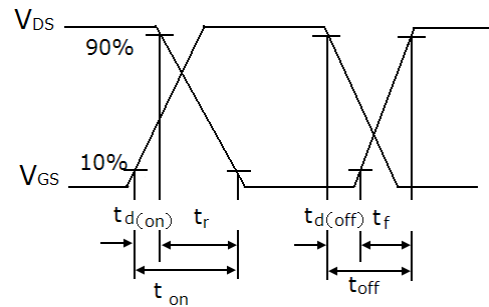
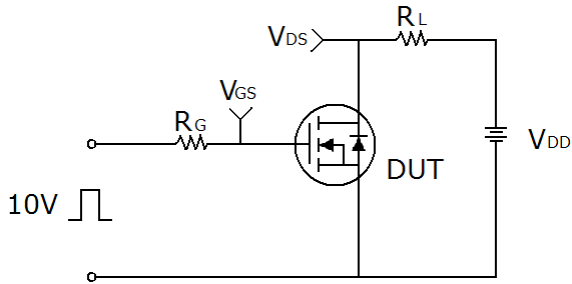


Test circuit

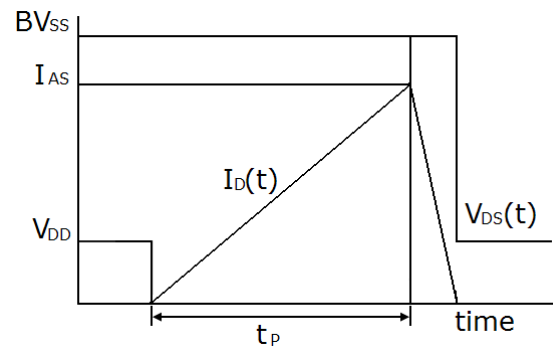
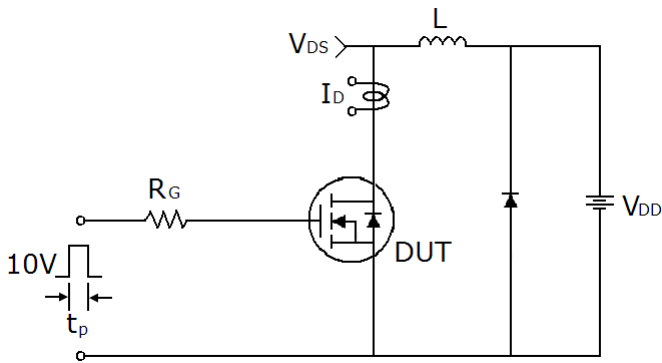
1) Gate charge test circuit & Waveform



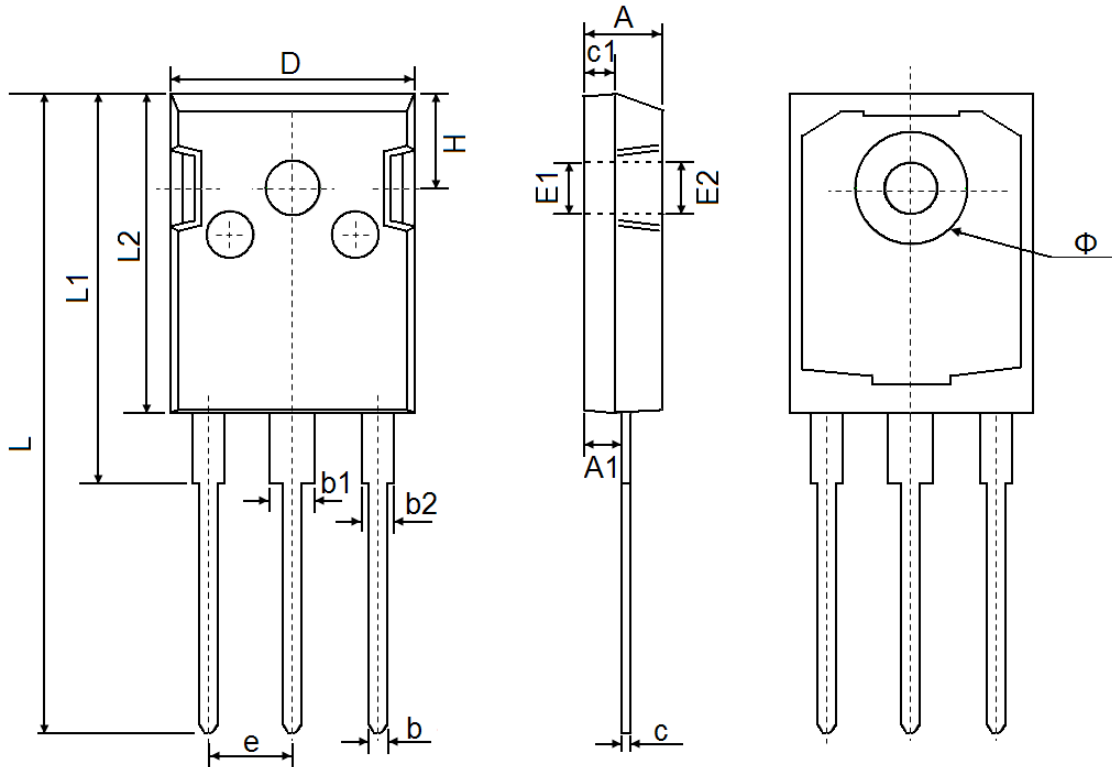
2) Switch Time Test Circuit:



3) Unclamped Inductive Switching Test Circuit & Waveforms



TO-247 Package Information



| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|--------|---------------------------|--------|----------------------|-------|
| | Min. | Max. | Min. | Max. |
| A | 4.850 | 5.150 | 0.191 | 0.200 |
| A1 | 2.200 | 2.600 | 0.087 | 0.102 |
| b | 1.000 | 1.400 | 0.039 | 0.055 |
| b1 | 2.800 | 3.200 | 0.110 | 0.126 |
| b2 | 1.800 | 2.200 | 0.071 | 0.087 |
| c | 0.500 | 0.700 | 0.020 | 0.028 |
| c1 | 1.900 | 2.100 | 0.075 | 0.083 |
| D | 15.450 | 15.750 | 0.608 | 0.620 |
| E1 | 3.500 REF | | 0.138 REF | |
| E2 | 3.600 REF | | 0.142 REF | |
| L | 40.900 | 41.300 | 1.610 | 1.626 |
| L1 | 24.800 | 25.100 | 0.976 | 0.988 |
| L2 | 20.300 | 20.600 | 0.799 | 0.811 |
| Φ | 7.100 | 7.300 | 0.280 | 0.287 |
| e | 5.450 TYP | | 0.215 TYP | |
| H | 5.980 REF | | 0.235 REF | |

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