# N-Channel Enhancement Mode Power MOSFET

## General Description

The series of Power MOSFETs use advanced technology and design.This high voltage MOSFET fits Switched applications.

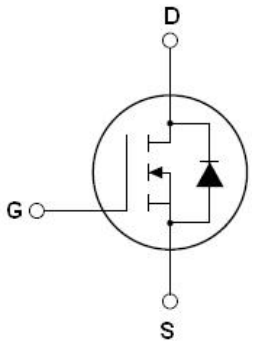
| | | |
|---|---|---|
| $V_{DS\ min@Tjmax}$ | 1850 | V |
| $R_{DS(ON)TYP}$ | 6 | Ω |
| ID | 2.9 | A |
| Qg | 33 | nC |

## Features

- High speed switching
- Intrinsic capacitances and Qg minimized
- 100% Avalanche Tested

## Application

- Switched applications




**Schematic diagram**

## Package Marking And Ordering Information

| Device | Device Package | Marking |
|---|---|---|
| NCE3N170PF | TO-3PF | NCE3N170PF |

TO-3PF

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

| Parameter | Symbol | NCE3N170PF | Unit |
|---|---|---|---|
| Drain-Source Voltage (VGS=0V） | $V_{DS}$ | 1700 | V |
| Gate-Source Voltage (VDS=0V) DC | $V_{GS}$ | ±30 | V |
| Continuous Drain Current at Tc=25°C | $I_{D\ (DC)}$ | 2.9 | A |
| Continuous Drain Current at Tc=100°C | $I_{D\ (DC)}$ | 2.03 | A |
| Pulsed drain current (Note 1) | $I_{DM\ (pluse)}$ | 8.7 | A |
| Maximum Power Dissipation(Tc=25°C)<br>Derate above 25°C | $P_D$ | 88<br>0.58 | W<br>W/°C |
| Single pulse avalanche energy (Note 2) | $E_{AS}$ | 210 | mJ |
| Single pulse avalanche current (Note 2) | $I_{AS}$ | 2.9 | A |
| Operating Junction and Storage Temperature Range | $T_J$,$T_{STG}$ | -55...+175 | °C |

* limited by maximum junction temperature

**Table 2. Thermal Characteristic**

| Parameter | Symbol | NCE3N170 | Unit |
|---|---|---|---|
| Thermal Resistance，Junction-to-Case（Maximum） | $R_{thJC}$ | 1.7 | °C /W |
| Thermal Resistance，Junction-to-Ambient （Maximum） | $R_{thJA}$ | 50 | °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 $I_D$=1mA | 1700 | | | V |
| Zero Gate Voltage Drain Current(Tc=25℃) | $I_{DSS}$ | $V_{DS}$=1700V,$V_{GS}$=0V | | | 1 | μA |
| Zero Gate Voltage Drain Current(Tc=125℃) | $I_{DSS}$ | $V_{DS}$=1700V,$V_{GS}$=0V | | | 100 | μA |
| Gate-Body Leakage Current | $I_{GSS}$ | $V_{GS}$=±30V,$V_{DS}$=0V | | | ±100 | nA |
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{DS}$=$V_{GS}$,$I_D$=250μA | 3 | 4 | 5 | V |
| Drain-Source On-State Resistance | $R_{DS(ON)}$ | $V_{GS}$=10V, $I_D$=1.45A | | 6 | 8 | Ω |
| **Dynamic Characteristics** | | | | | | |
| Input Capacitance | $C_{lss}$ | $V_{DS}$=40V,$V_{GS}$=0V, F=1.0MHz | | 1700 | | pF |
| Output Capacitance | $C_{oss}$ | | | 60 | | pF |
| Reverse Transfer Capacitance | $C_{rss}$ | | | 3.3 | | pF |
| Total Gate Charge | $Q_g$ | $V_{DS}$=1350V,$I_D$=1.45A, $V_{GS}$=10V | | 33 | | nC |
| Gate-Source Charge | $Q_{gs}$ | | | 7.7 | | nC |
| Gate-Drain Charge | $Q_{gd}$ | | | 14 | | nC |
| Intrinsic gate resistance | $R_G$ | f = 1 MHz open drain | | 2 | | Ω |
| **Switching times** | | | | | | |
| Turn-on Delay Time | $t_{d(on)}$ | $V_{DD}$=850V,$I_D$=1.45A, $R_G$=3Ω,$V_{GS}$=10V | | 22 | | nS |
| Turn-on Rise Time | $t_r$ | | | 8 | | nS |
| Turn-Off Delay Time | $t_{d(off)}$ | | | 48 | | nS |
| Turn-Off Fall Time | $t_f$ | | | 49 | | nS |
| **Source- Drain Diode Characteristics** | | | | | | |
| Source-drain current(Body Diode) | $I_{SD}$ | $T_C$=25°C | | | 2.9 | A |
| Pulsed Source-drain current(Body Diode) | $I_{SDM}$ | | | | 8.7 | A |
| Forward On Voltage | $V_{SD}$ | Tj=25°C,$I_{SD}$=2.9A,$V_{GS}$=0V | | 0.8 | 1.1 | V |
| Reverse Recovery Time | $t_{rr}$ | Tj=25°C,$I_F$=2.9A, di/dt=100A/μs | | 1500 | | nS |
| Reverse Recovery Charge | $Q_{rr}$ | | | 5.7 | | uC |
| Peak Reverse Recovery Current | $I_{rrm}$ | | | 7.5 | | 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)

**Figure1. Safe operating area**

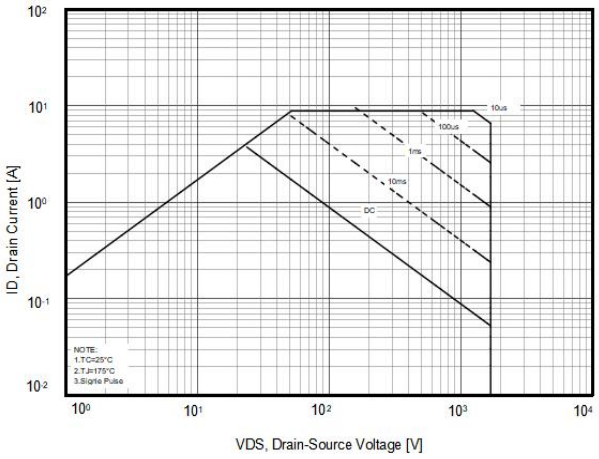



**Figure2. Source-Drain Diode Forward Voltage**

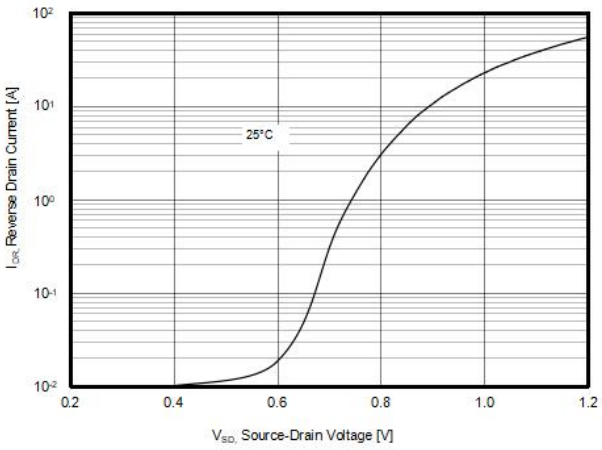



**Figure3. $R_{DS(ON)}$ vs Junction Temperature**

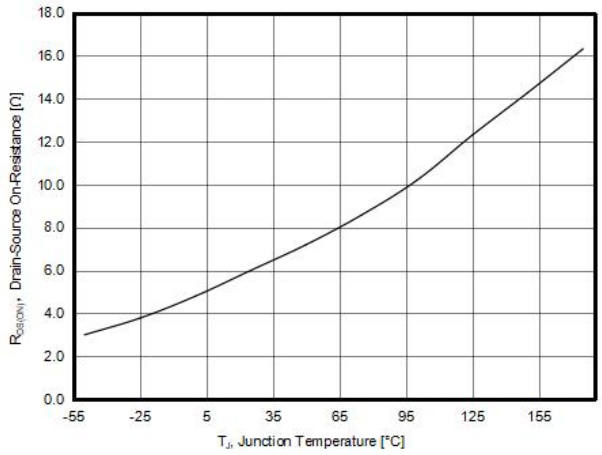



**Figure4. $BV_{DSS}$ vs Junction Temperature**

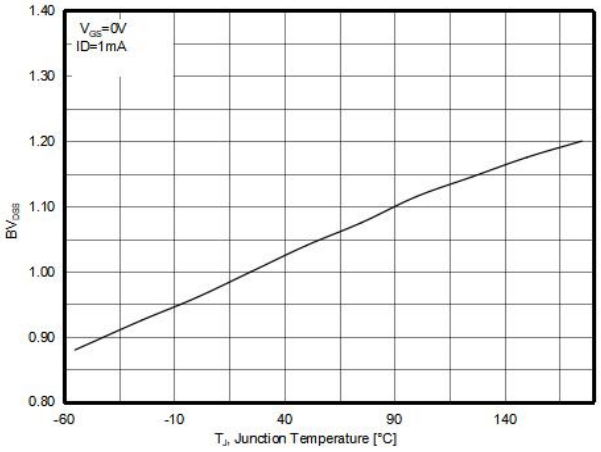



**Figure5. Maximum $I_D$ vs Junction Temperature**

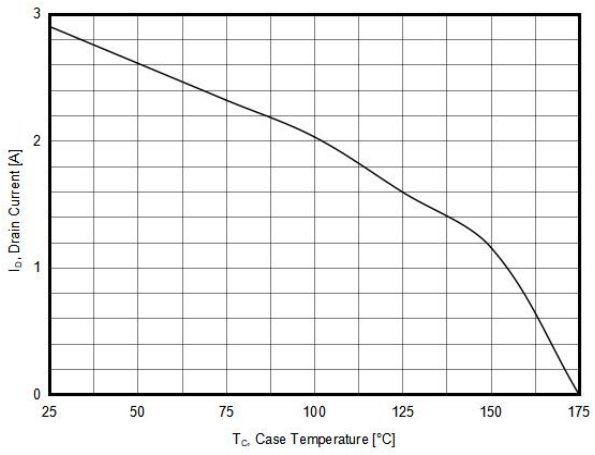



**Figure6. Output characteristics**

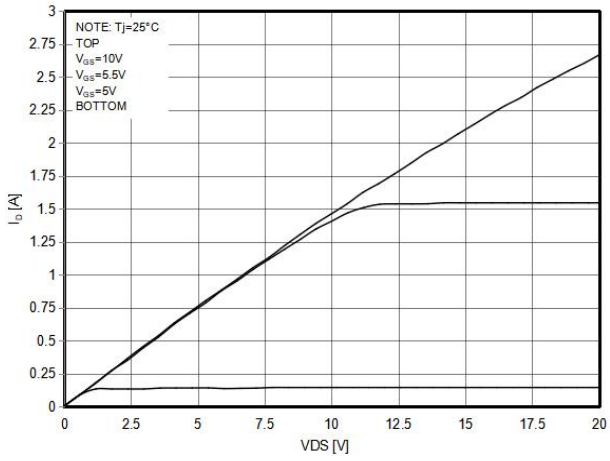


**Figure7. Capacitance**

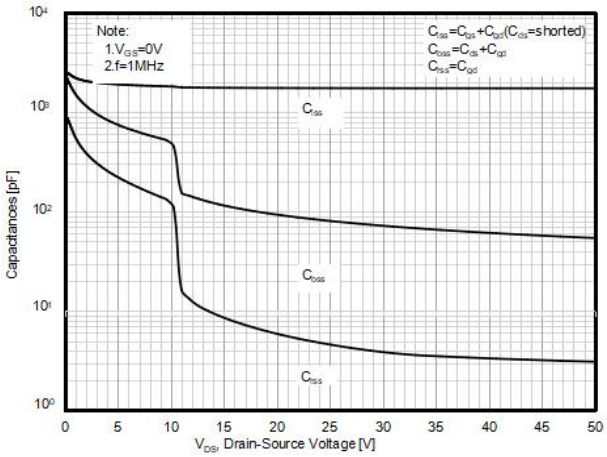



**Figure8. Transfer characteristics**

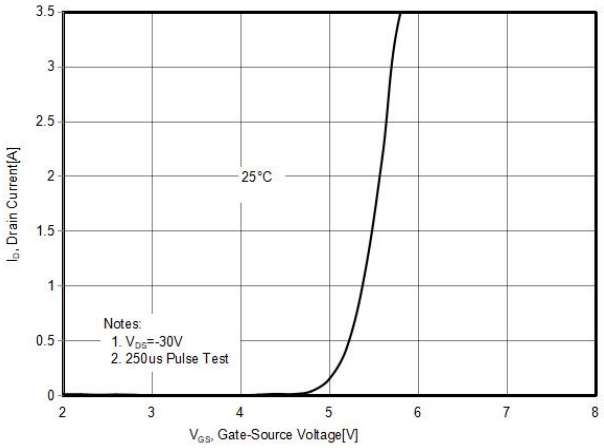



**Figure9. Static drain-source on resistance**

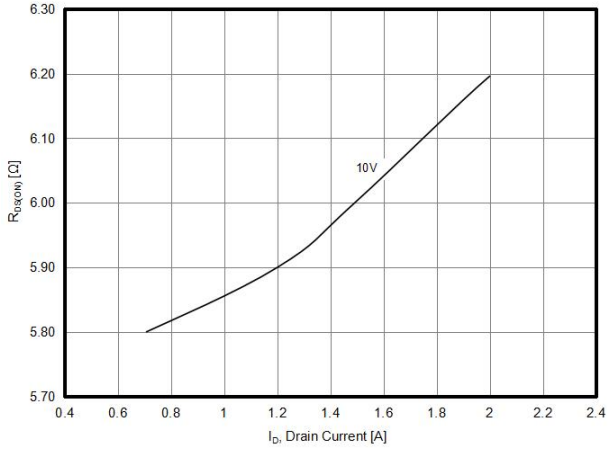
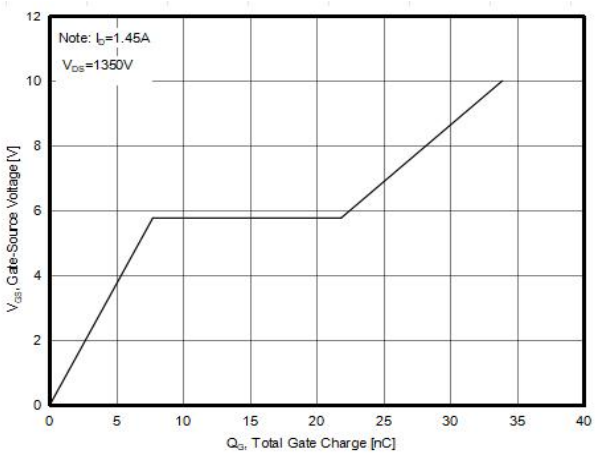
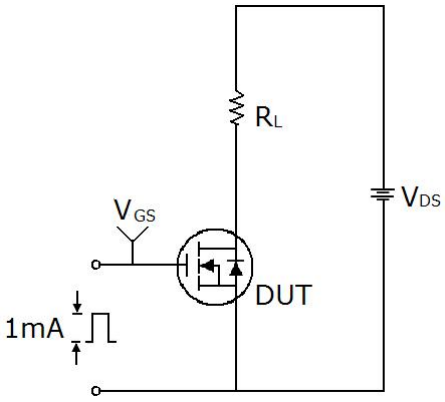


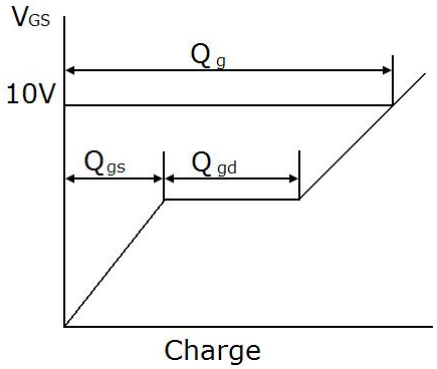

**Figure9. Gate charge waveforms**



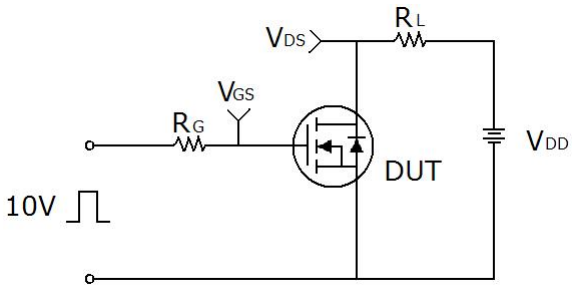
# Test circuit

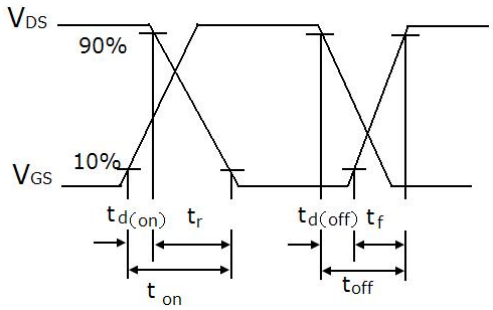
**1）Gate charge test circuit & Waveform**



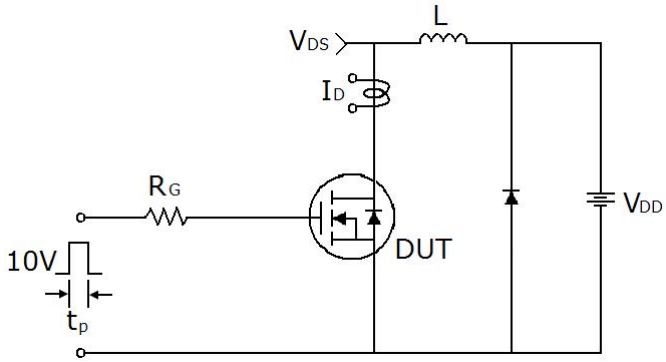



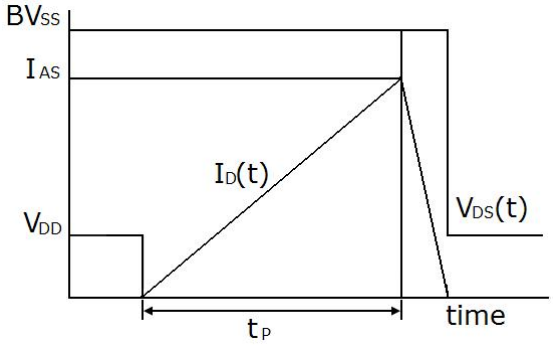

**2）Switch Time Test Circuit：**



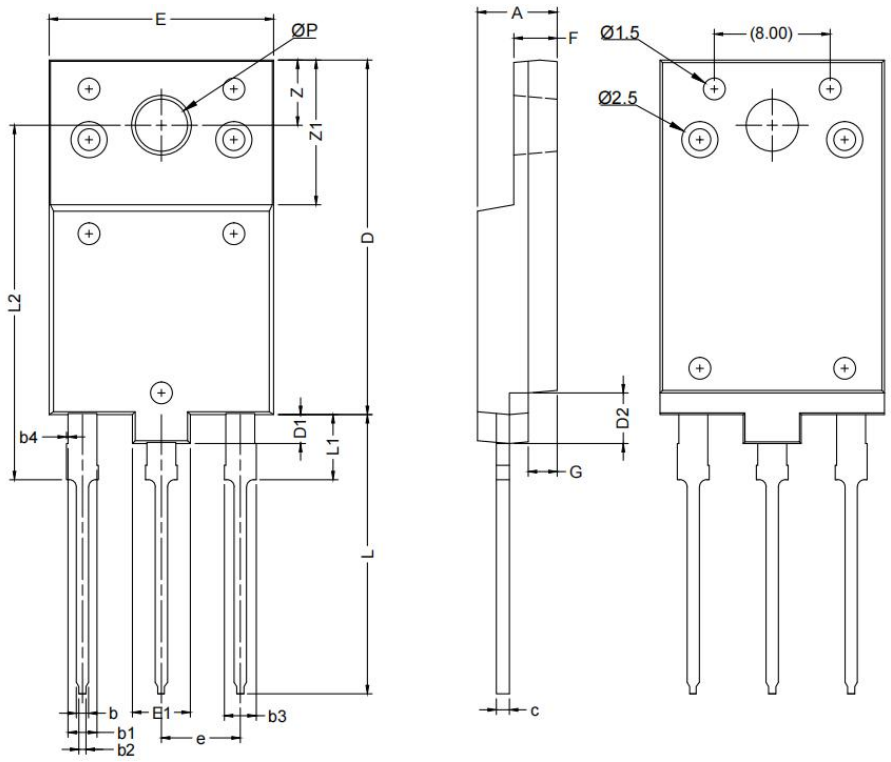




**3）Unclamped Inductive Switching Test Circuit & Waveforms**



# TO-3PF-B Package Information




| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | Min. | Max. | Min. | Max. |
| A | 5.300 | 5.700 | 0.209 | 0.224 |
| b | 0.650 | 0.950 | 0.026 | 0.037 |
| b4 | | 0.200 | | 0.008 |
| C | 0.800 | 1.000 | 0.031 | 0.039 |
| D | 24.200 | 24.800 | 0.953 | 0.976 |
| D1 | 1.800 | 2.200 | 0.071 | 0.087 |
| D2 | 3.300 | 3.700 | 0.130 | 0.146 |
| E | 15.300 | 15.700 | 0.602 | 0.618 |
| E1 | 3.800 | 4.200 | 0.150 | 0.165 |
| F | 2.800 | 3.200 | 0.110 | 0.126 |
| e | 5.450 BSC | | 0.215 BSC | |
| L | 19.000 | 19.600 | 0.748 | 0.772 |
| L1 | 4.200 | 4.800 | 0.165 | 0.189 |
| L2 | 24.200 | 24.800 | 0.953 | 0.976 |
| P | 3.400 | 3.800 | 0.134 | 0.150 |
| Z | 4.300 | 4.700 | 0.169 | 0.185 |
| Z1 | 9.700 | 10.300 | 0.382 | 0.406 |
| G | 1.800 | 2.200 | 0.071 | 0.087 |
| S | 3.100 | 3.500 | 0.122 | 0.138 |

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