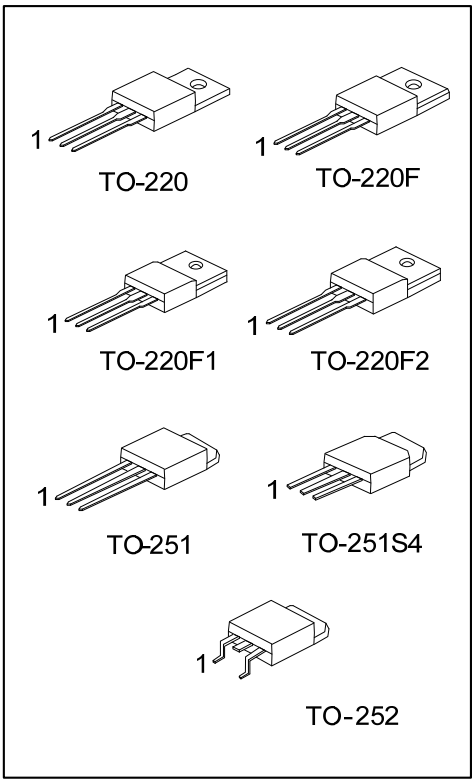
# 3N80

**Power MOSFET**

## 3.0A, 800V N-CHANNEL POWER MOSFET



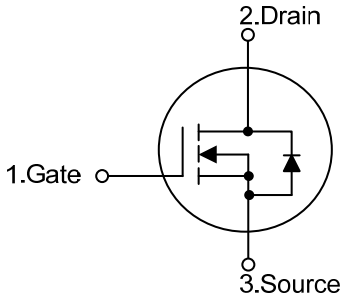

### ■ DESCRIPTION

The UTC **3N80** provide excellent $R_{DS(ON)}$, low gate charge and operation with low gate voltages. This device is suitable for use as a load switch or in PWM applications.

### ■ FEATURES

* $R_{DS(ON)}$ < 4.2Ω @$V_{GS}$ = 10 V
* Ultra Low Gate Charge ( typical 19 nC )
* Low Reverse Transfer Capacitance ( $C_{RSS}$ = Typical 11 pF )
* Fast Switching Capability
* Avalanche Energy Specified
* Improved dv/dt Capability, High Ruggedness

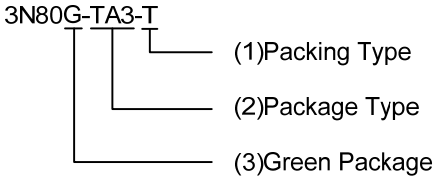
### ■ SYMBOL




### ■ ORDERING INFORMATION

| Ordering Number | | Package | Pin Assignment | | | Packing |
|---|---|---|---|---|---|---|
| Lead Free | Halogen Free | | 1 | 2 | 3 | |
| 3N80L-TA3-T | 3N80G-TA3-T | TO-220 | G | D | S | Tube |
| 3N80L-TF3-T | 3N80G-TF3-T | TO-220F | G | D | S | Tube |
| 3N80L-TF1-T | 3N80G-TF1-T | TO-220F1 | G | D | S | Tube |
| 3N80L-TF2-T | 3N80G-TF2-T | TO-220F2 | G | D | S | Tube |
| 3N80L-TM3-T | 3N80G-TM3-T | TO-251 | G | D | S | Tube |
| 3N80L-TMS4-T | 3N80G-TMS4-T | TO-251S4 | G | D | S | Tube |
| 3N80L-TN3-R | 3N80G-TN3-R | TO-252 | G | D | S | Tape Reel |

Note: Pin Assignment: G: Gate D: Drain S: Source

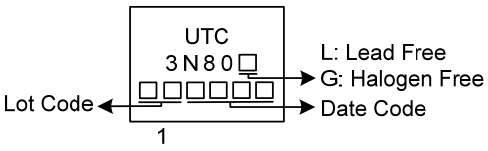



(1) T: Tube, R: Tape Reel

(2) TA3: TO-220, TF3: TO-220F, TF1: TO-220F1, TF2: TO-220F2, TM3: TO-251, TMS4: TO-251S4 TN3: TO-252

(3) G: Halogen Free and Lead Free, L: Lead Free

## ■ MARKING



## ■ ABSOLUTE MAXIMUM RATINGS ($T_C$=25°C, unless otherwise specified)

| PARAMETER | | SYMBOL | RATINGS | UNIT |
|---|---|---|---|---|
| Drain-Source Voltage ($V_{GS}$=0V) | | $V_{DSS}$ | 800 | V |
| Drain-Gate Voltage ($R_G$=20kΩ) | | $V_{DGR}$ | 800 | V |
| Gate-Source Voltage | | $V_{GSS}$ | ±30 | V |
| Gate-Source Breakdown Voltage ($I_{GS}$=±1mA) | | $BV_{GSO}$ | 30 (MIN) | V |
| Insulation Withstand Voltage (DC) | TO-220F/ TO-220F1 | $V_{ISO}$ | 2500 | V |
| Avalanche Current (Note 2) | | $I_{AR}$ | 3 | A |
| Continuous Drain Current | | $I_D$ | 3 | A |
| Pulsed Drain Current | | $I_{DM}$ | 10 | A |
| Single Pulse Avalanche Energy (Note 3) | | $E_{AS}$ | 170 | mJ |
| Peak Diode Recovery dv/dt (Note 4) | | dv/dt | 4.5 | V/ns |
| Power Dissipation | TO-220 | $P_D$ | 70 | W |
| | TO-220F/ TO-220F1<br>TO-220F2 | | 25 | W |
| | TO-251/TO-251S4<br>TO-252 | | 50 | 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. Pulse width limited by $T_{J(MAX)}$.
3. Starting $T_J$=25 °C, $I_D$=$I_{AR}$, $V_{DD}$=50V
4. $I_{SD}$≦2.5A, di/dt≦200A/μs, $V_{DD}$≦$BV_{DSS}$, $T_J$≦$T_{J(MAX)}$.

## ■ THERMAL DATA

| PARAMETER | | SYMBOL | RATING | UNIT |
|---|---|---|---|---|
| Junction to Ambient | TO-220TO-220F<br>TO-220F1/TO-220F2 | $θ_{JA}$ | 62.5 | °C/W |
| | TO-251/TO-251S4<br>TO-252 | | 110 | °C/W |
| Junction to Case | TO-220 | $θ_{JC}$ | 1.78 | °C/W |
| | TO-220F/ TO-220F1<br>TO-220F2 | | 5 | °C/W |
| | TO-251/TO-251S4<br>TO-252 | | 2.5 | °C/W |

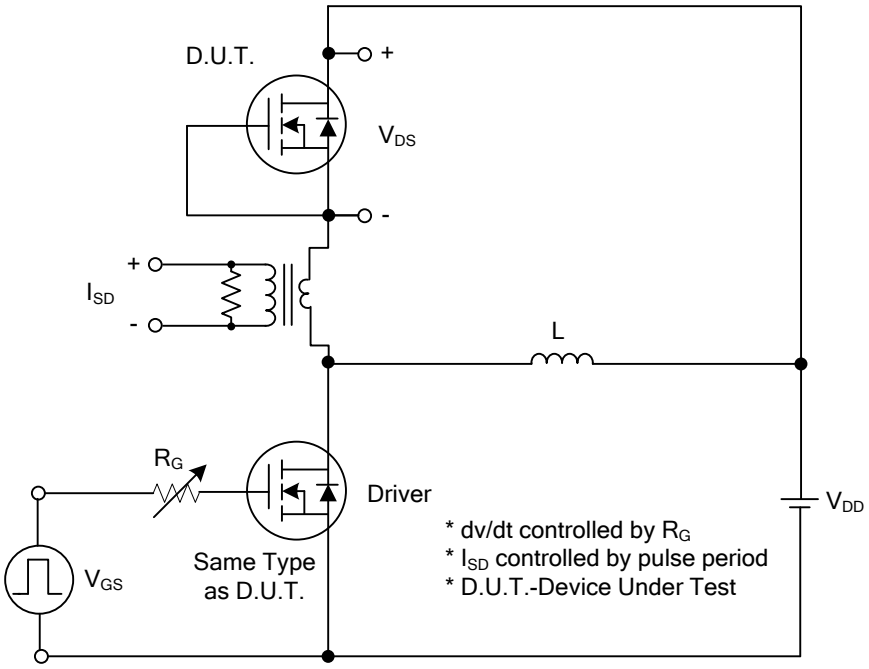
## ■ ELECTRICAL CHARACTERISTICS ($T_C$=25°C, unless otherwise specified)

| PARAMETER | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | | |
| Drain-Source Breakdown Voltage | $BV_{DSS}$ | $V_{GS}$=0V, $I_D$=250μA | 800 | | | V |
| Drain-Source Leakage Current | $I_{DSS}$ | $V_{DS}$=800V, $V_{GS}$=0V | | | 1 | μA |
| Gate-Source Leakage Current | $I_{GSS}$ | $V_{GS}$=±30V, $V_{DS}$=0V | | | ±10 | μA |
| **ON CHARACTERISTICS** | | | | | | |
| Gate Threshold Voltage | $V_{GS(TH)}$ | $V_{DS}$=$V_{GS}$, $I_D$=250μA | 3.0 | | 5.0 | V |
| Static Drain-Source On-State Resistance | $R_{DS(ON)}$ | $V_{GS}$=10V, $I_D$=1.5A | | 3.2 | 4.2 | Ω |
| Forward Transconductance (Note 1) | $g_{FS}$ | $V_{DS}$=15V, $I_D$=1.5A | | 2.1 | | S |
| **DYNAMIC CHARACTERISTICS** | | | | | | |
| Input Capacitance | $C_{ISS}$ | $V_{DS}$=25V, $V_{GS}$=0V, f=1MHz | | 485 | | pF |
| Output Capacitance | $C_{OSS}$ | | | 57 | | pF |
| Reverse Transfer Capacitance | $C_{RSS}$ | | | 11 | | pF |
| Equivalent Output Capacitance (Note 2) | $C_{OSS(EQ)}$ | $V_{GS}$=0V, $V_{DS}$=0V~640V | | 22 | | pF |
| **SWITCHING CHARACTERISTICS** | | | | | | |
| Total Gate Charge | $Q_G$ | $V_{DD}$=640V, $I_D$=3A, $V_{GS}$=10V | | 19 | | nC |
| Gate-Source Charge | $Q_{GS}$ | | | 3.2 | | nC |
| Gate-Drain Charge | $Q_{DD}$ | | | 10.8 | | nC |
| Turn-On Delay Time | $t_{D(ON)}$ | $V_{DD}$=400V, $I_D$=3 A, $R_G$=4.7Ω $V_{GS}$=10V | | 17 | | ns |
| Turn-On Rise Time | $t_R$ | | | 27 | | ns |
| Turn-Off Delay Time | $t_{D(OFF)}$ | | | 36 | | ns |
| Turn-Off Fall Time | $t_F$ | | | 40 | | ns |
| **SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS** | | | | | | |
| Source-Drain Current | $I_{SD}$ | | | | 2.5 | A |
| Source-Drain Current (Pulsed) | $I_{SDM}$ | | | | 10 | A |
| Reverse Recovery Current | $I_{RRM}$ | $I_{SD}$=3A, di/dt=100A/μs, $V_{DD}$=50V, $T_J$=25°C | | 8.4 | | A |
| Diode Forward Voltage(Note 1) | $V_{SD}$ | $I_{SD}$=3A ,$V_{GS}$=0V | | | 1.6 | V |
| Body Diode Reverse Recovery Time | $t_{rr}$ | | | 384 | | ns |
| Body Diode Reverse Recovery Charge | $Q_{rr}$ | | | 1600 | | nC |

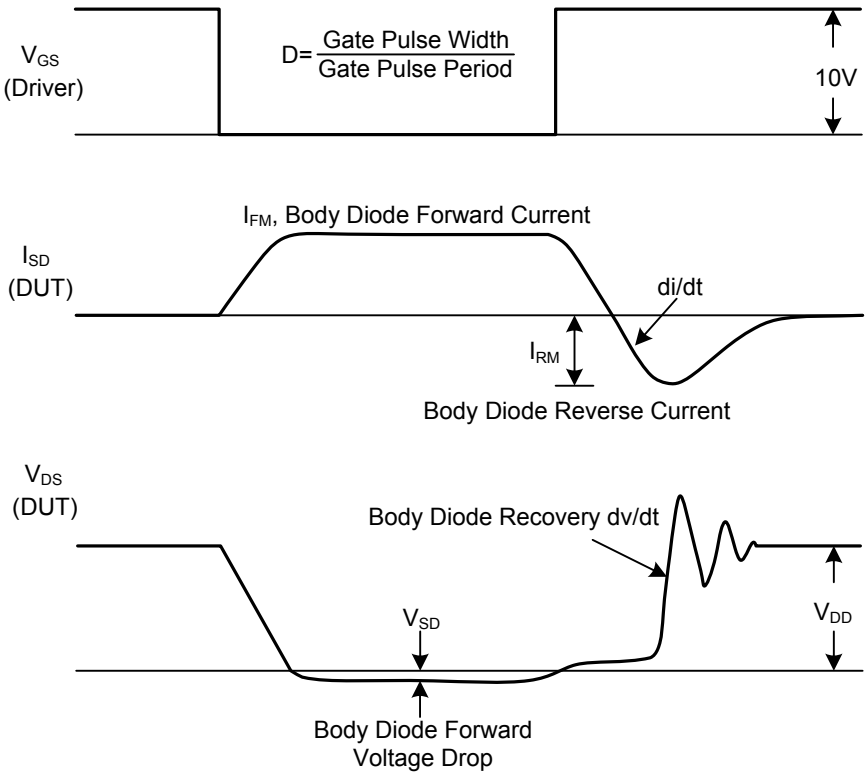
Note: 1. Pulse width = 300μs, Duty cycle≦1.5%.

2. $C_{OSS(EQ)}$ is defined as constant equivalent capacitance giving the same charging time as $C_{OSS}$ when $V_{DS}$ increases from 0to 80% $V_{DSS}$.

## ■ TEST CIRCUITS AND WAVEFORMS

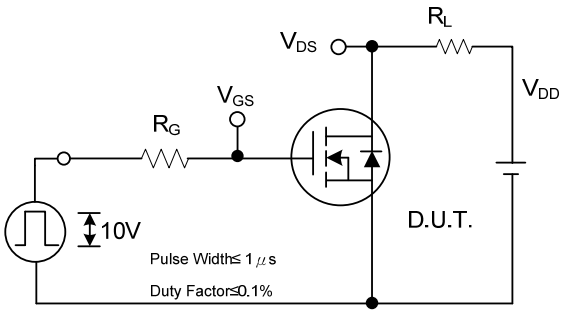



**Peak Diode Recovery dv/dt Test Circuit**

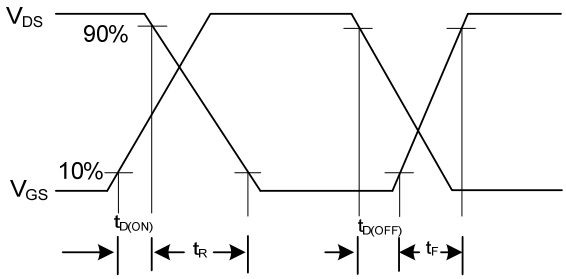



**Peak Diode Recovery dv/dt Waveforms**

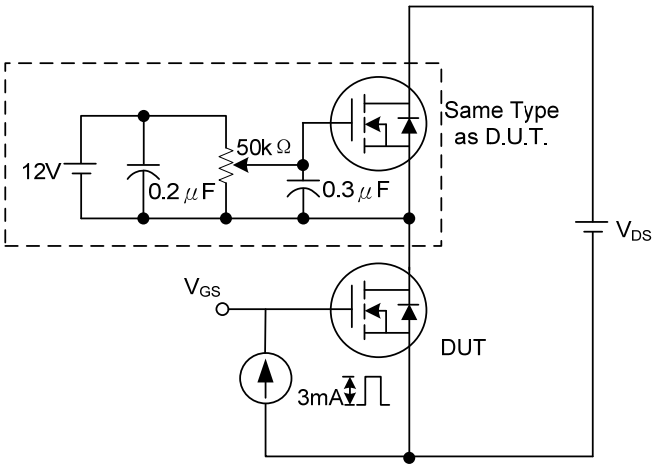
## ■ TEST CIRCUITS AND WAVEFORMS (Cont.)



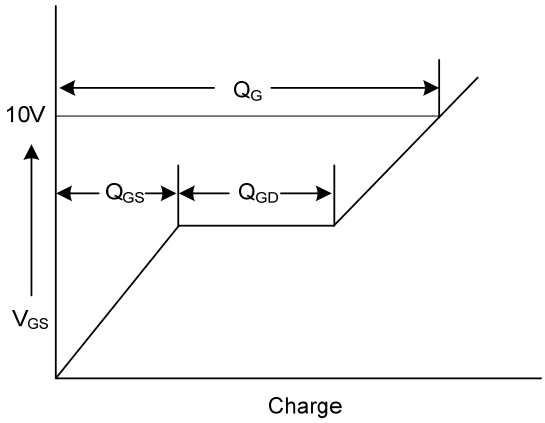

Switching Test Circuit



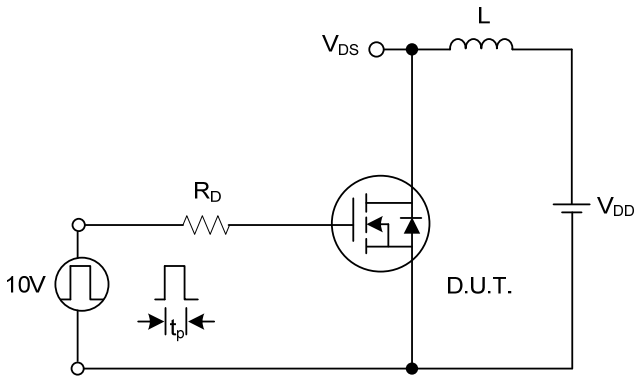

Switching Waveforms



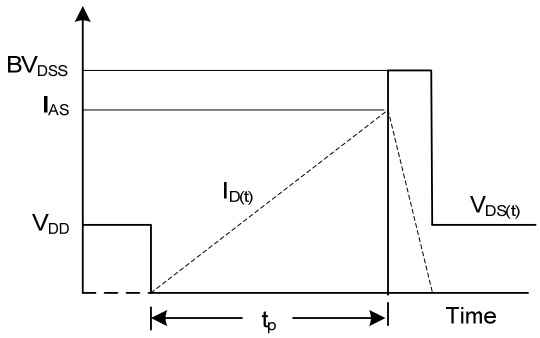

Gate Charge Test Circuit




Gate Charge Waveform



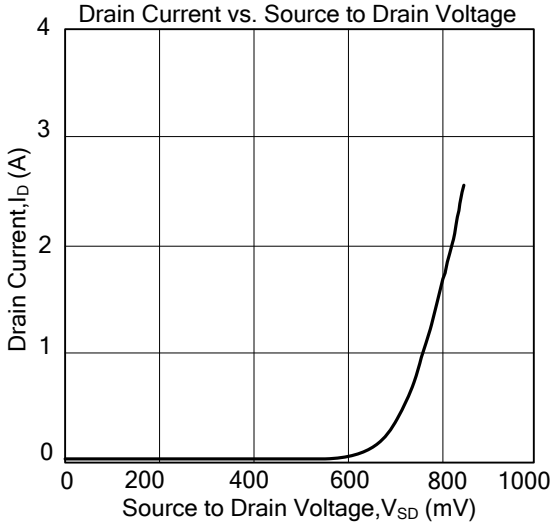

Unclamped Inductive Switching Test Circuit



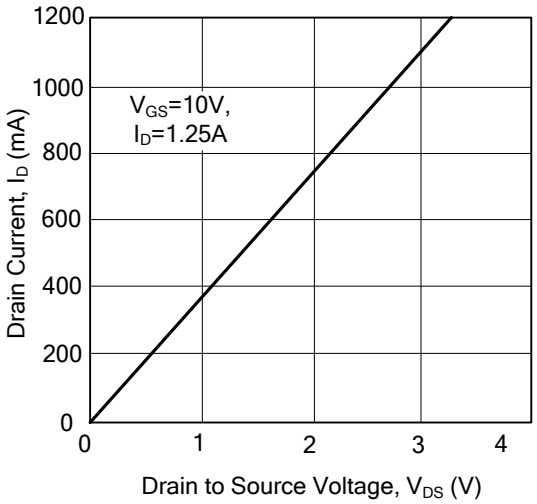

Unclamped Inductive Switching Waveforms

## ■ TYPICAL CHARACTERISTICS

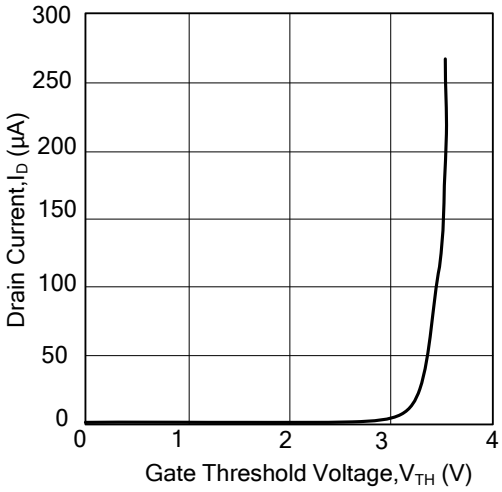
Drain Current vs. Source to Drain Voltage



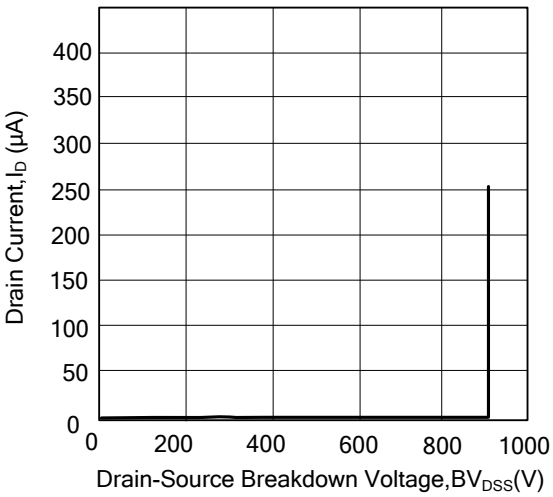

Drain-Source On-State Resistance Characteristics



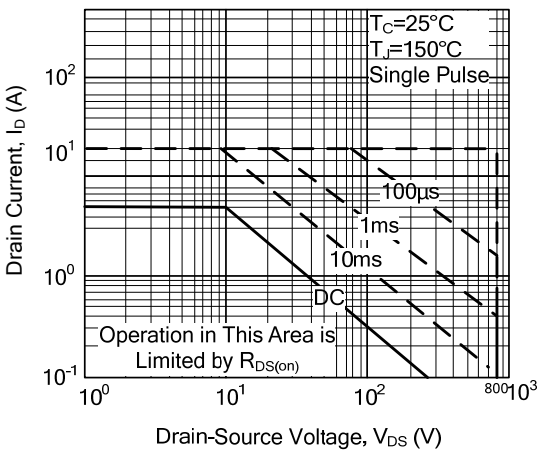

Drain Current vs. Gate Threshold Voltage




Drain Current vs. Drain-Source Breakdown Voltage




Max. Safe Operating Area



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