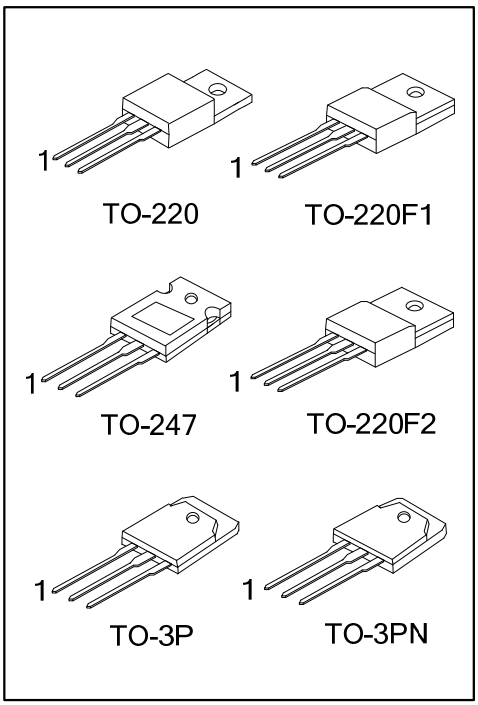
# 11A, 900V N-CHANNEL POWER MOSFET




## ■ DESCRIPTION

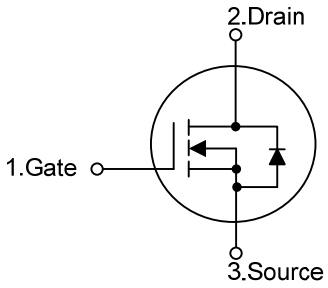
The UTC **11N90** is a N-channel enhancement mode Power FET using UTC's advanced technology to provide customers with planar stripe and DMOS technology. This technology specializes in allowing a minimum on-state resistance and superior switching performance. It also can withstand high energy pulse in the avalanche and commutation mode.

The UTC **11N90** is universally applied in high efficiency switch mode power supply,

## ■ FEATURES

* $R_{DS(on)}$ < 1.1Ω @ $V_{GS}$ = 10V, $I_D$ = 5.5A
* High switching speed
* Improved dv/dt capability
* 100% avalanche tested

## ■ SYMBOL




## ■ ORDERING INFORMATION

| Ordering Number | | Package | Pin Assignment | | | Packing |
|---|---|---|---|---|---|---|
| Lead Free | Halogen Free | | 1 | 2 | 3 | |
| 11N90L-TA3-T | 11N90G-TA3-T | TO-220 | G | D | S | Tube |
| 11N90L-TF1-T | 11N90G-TF1-T | TO-220F1 | G | D | S | Tube |
| 11N90L-TF2-T | 11N90G-TF2-T | TO-220F2 | G | D | S | Tube |
| 11N90L-T3P-T | 11N90G-T3P-T | TO-3P | G | D | S | Tube |
| 11N90L-T3N-T | 11N90G-T3N-T | TO-3PN | G | D | S | Tube |
| 11N90L-T47-T | 11N90G-T47-T | TO-247 | G | D | S | Tube |

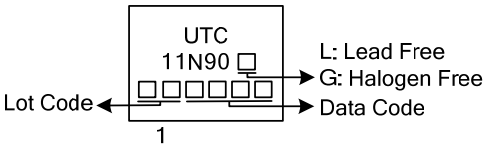
Note: Pin Assignment: G: Gate D: Drain S: Source

11N90G-TA3-T

(1) Packing Type
(2) Package Type
(3) Green Package

(1) T: Tube
(2) TA3: TO-220, TF1: TO-220F1, TF2: TO-220F2
T3P: TO-3P, T3N: TO-3PN, T47: TO-247
(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 | | $V_{DSS}$ | 900 | V |
| Gate-Source Voltage | | $V_{GSS}$ | ±30 | V |
| Drain Current | Continuous | $I_D$ | 11 | A |
| | Pulsed (Note 1) | $I_{DM}$ | 44 | A |
| Avalanche Energy | Single Pulsed (Note 2) | $E_{AS}$ | 1000 | mJ |
| Peak Diode Recovery dv/dt (Note 3) | | dv/dt | 4.0 | V/ns |
| Power Dissipation | TO-220 | $P_D$ | 160 | W |
| | TO-220F1/TO-220F2 | | 50 | W |
| | TO-3P/TO-3PN | | 215 | W |
| | TO-247 | | 190 | W |
| Junction Temperature | | $T_J$ | +150 | °C |
| Storage Temperature | | $T_{STG}$ | -55 ~ +150 | °C |

Note: 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.

## ■ THERMAL CHARACTERISTICS

| PARAMETER | | SYMBOL | RATINGS | UNIT |
|---|---|---|---|---|
| Junction to Ambient | TO-220/TO-220F1 TO-220F2 | $\theta_{JA}$ | 62.5 | °C/W |
| | TO-3P/TO-3PN | | 40 | °C/W |
| | TO-247 | | 50 | °C/W |
| Junction to Case | TO-220 | $\theta_{JC}$ | 0.78 | °C/W |
| | TO-220F1/TO-220F2 | | 2.48 | °C/W |
| | TO-3P/TO-3PN | | 0.58 | °C/W |
| | TO-247 | | 0.65 | °C/W |

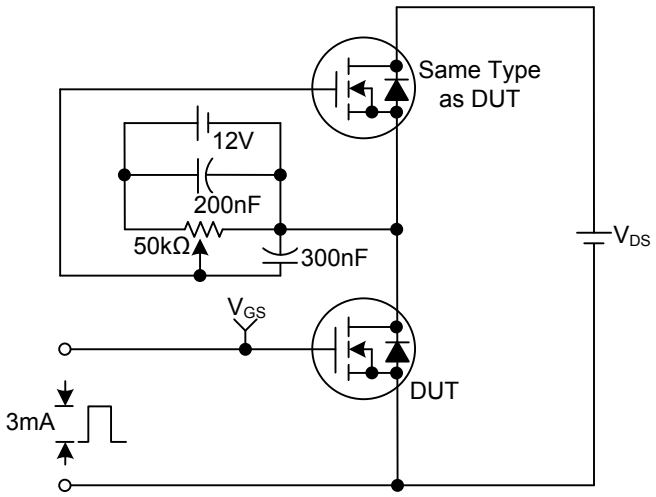
## ■ ELECTRICAL CHARACTERISTICS ($T_C$=25°C, unless otherwise noted)

| PARAMETER | | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | | | |
| Drain-Source Breakdown Voltage | | $BV_{DSS}$ | $I_D$=250μA, $V_{GS}$=0V | 900 | | | V |
| Breakdown Voltage Temperature Coefficient | | $\triangle BV_{DSS}/\triangle T_J$ | $I_D$=250μA, Referenced to 25°C | | 1.0 | | V/°C |
| Drain-Source Leakage Current | | $I_{DSS}$ | $V_{DS}$=900V, $V_{GS}$=0V | | | 10 | μA |
| | | | $V_{DS}$=720V, $T_C$=125°C | | | 100 | |
| 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 | 3.0 | | 5.0 | V |
| Static Drain-Source On-State Resistance | | $R_{DS(ON)}$ | $V_{GS}$=10V, $I_D$=5.5A | | 0.91 | 1.1 | Ω |
| **DYNAMIC PARAMETERS** | | | | | | | |
| Input Capacitance | | $C_{ISS}$ | $V_{GS}$=0V, $V_{DS}$=25V, f=1.0MHz | | 980 | 1380 | pF |
| Output Capacitance | | $C_{OSS}$ | | | 170 | 280 | pF |
| Reverse Transfer Capacitance | | $C_{RSS}$ | | | 18 | 25 | pF |
| **SWITCHING PARAMETERS** | | | | | | | |
| Total Gate Charge | | $Q_G$ | $V_{GS}$=10V, $V_{DS}$=50V, $I_D$=1.3A (Note 4, 5) | | 60 | 80 | nC |
| Gate to Source Charge | | $Q_{GS}$ | | | 14 | | nC |
| Gate to Drain Charge | | $Q_{GD}$ | | | 22 | | nC |
| Turn-ON Delay Time | | $t_{D(ON)}$ | $V_{DD}$=30V, $I_D$=0.5A, $R_G$=25Ω (Note 4, 5) | | 125 | 140 | ns |
| Rise Time | | $t_R$ | | | 260 | 320 | ns |
| Turn-OFF Delay Time | | $t_{D(OFF)}$ | | | 340 | 380 | ns |
| Fall-Time | | $t_F$ | | | 220 | 270 | ns |
| **SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS** | | | | | | | |
| Maximum Body-Diode Continuous Current | | $I_S$ | | | | 11 | A |
| Maximum Body-Diode Pulsed Current (Note1) | | $I_{SM}$ | | | | 44 | A |
| Drain-Source Diode Forward Voltage (Note 4) | | $V_{SD}$ | $I_S$=11A, $V_{GS}$=0V | | | 1.4 | V |

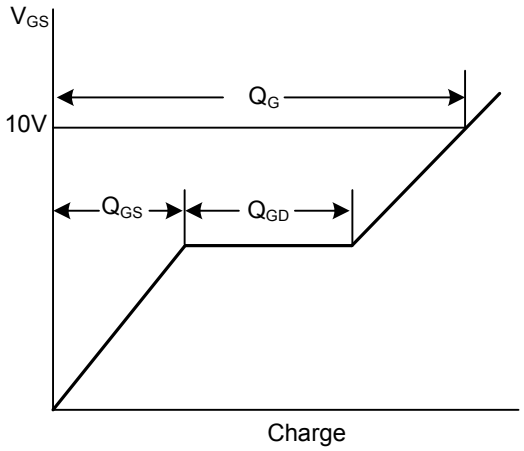
Notes: 1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. L = 15mH, $I_{AS}$ = 11A, $V_{DD}$ = 50V, $R_G$ = 25Ω, Starting $T_J$ = 25°C
3. $I_{SD}$ ≤ 11.0A, di/dt ≤ 200A/μs, $V_{DD}$ ≤ $BV_{DSS}$, Starting $T_J$ = 25°C
4. Pulse Test: Pulse width ≤ 300μs, Duty cycle ≤ 2%
5. Essentially independent of operating temperature

## ■ TEST CIRCUITS AND WAVEFORMS

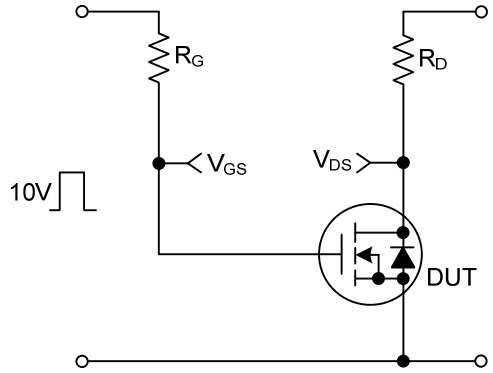
Gate Charge Test Circuit



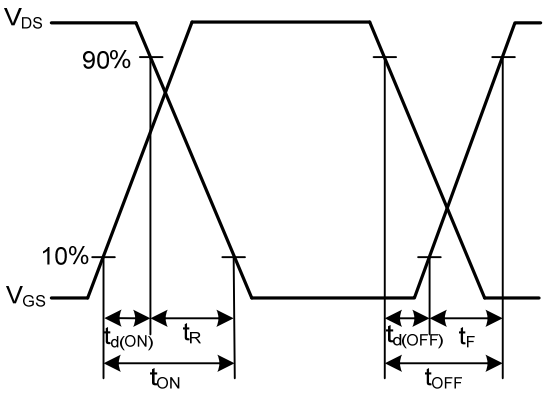

Gate Charge Waveforms



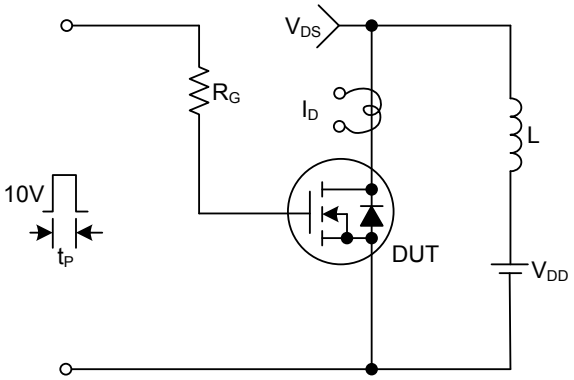

Resistive Switching Test Circuit




Resistive Switching Waveforms

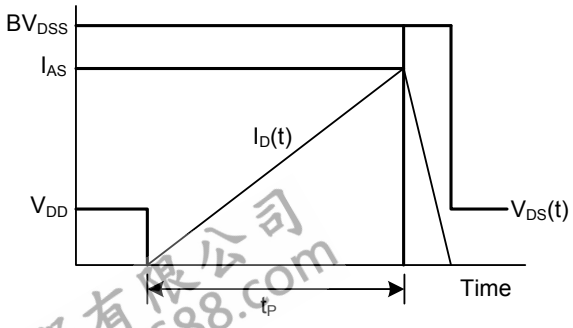



Unclamped Inductive Switching Test Circuit



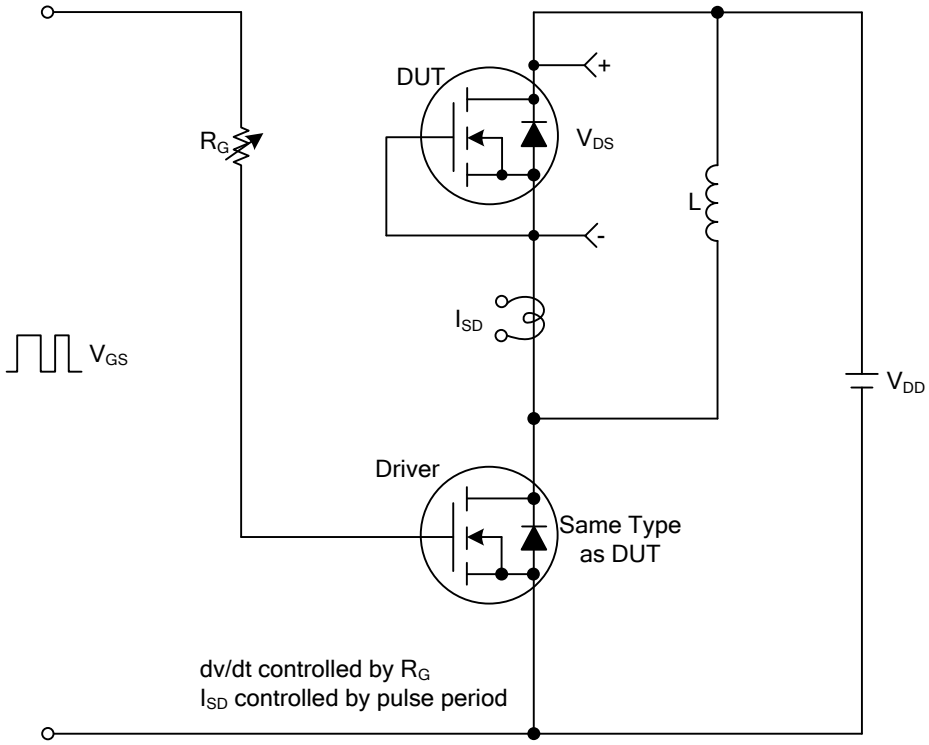

Unclamped Inductive Switching Waveforms

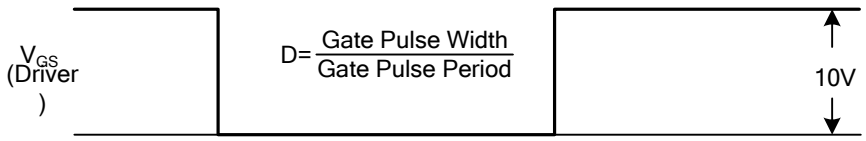
$$E_{AS}=\frac{1}{2}LI_{AS}^{2}\frac{BV_{DSS}}{BV_{DSS}-V_{DD}}$$

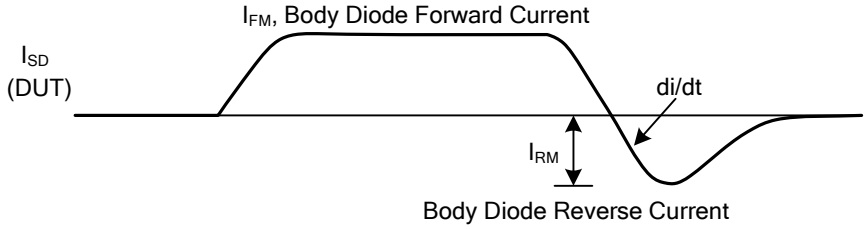


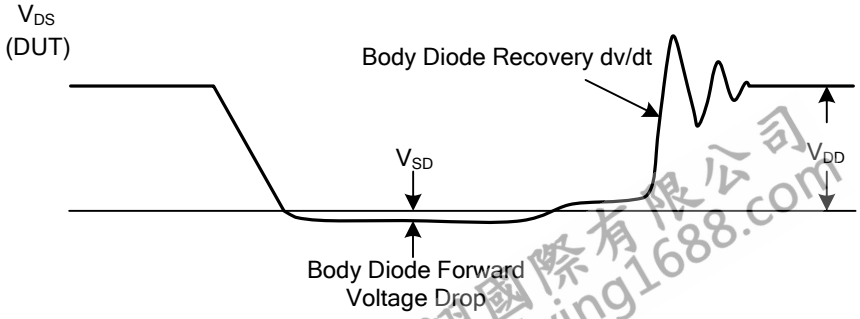
## ■ TEST CIRCUITS AND WAVEFORMS

Peak Diode Recovery dv/dt Test Circuit & Waveforms



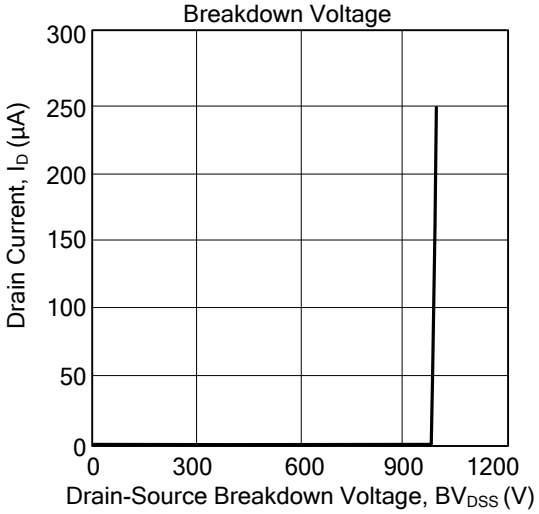



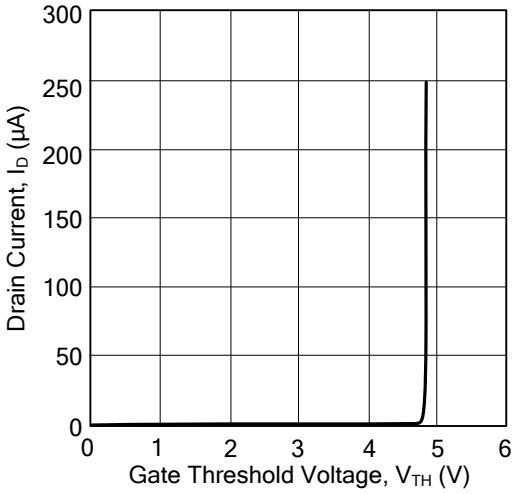



## ■ TYPICAL CHARACTERISTICS

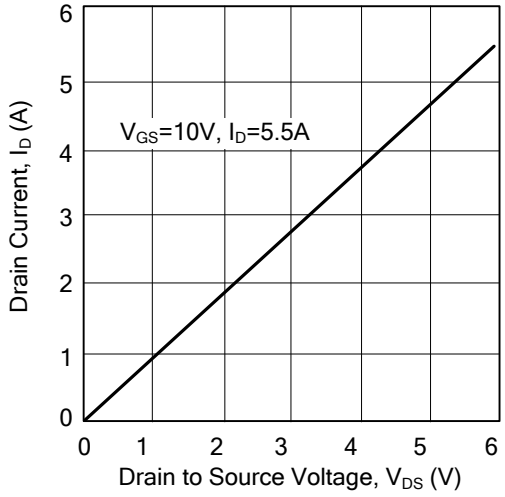
Drain Current vs. Drain-Source Breakdown Voltage




Drain Current vs. Gate Threshold Voltage




Drain-Source On-State Resistance Characteristics




Body-Diode Continuous Current vs. Source to Drain Voltage