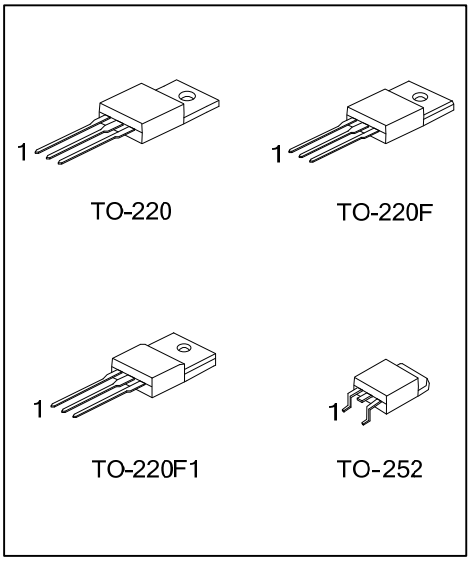
# 1.0A, 900V N-CHANNEL POWER MOSFET




## ■ DESCRIPTION

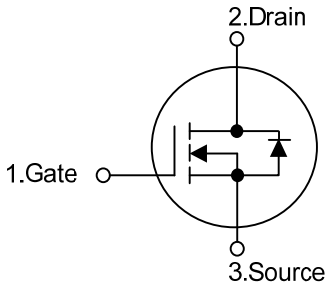
The UTC **1N90-MK6** is an N-channel mode power MOSFET using UTC's advanced technology to provide costumers with planar stripe and DMOS technology. This technology specializes in allowing a minimum on-state resistance and superior switching performance. It also can withstand high energy pulse in the avalanche and commutation mode.

The UTC **1N90-MK6** is universally applied in active power factor correction, electronic lamp ballast based on half bridge topology and high efficient switched mode power supply.

## ■ FEATURES

* High switching speed
* $R_{DS(ON)}$ < 16Ω @ $V_{GS}$=10V, $I_D$=0.5A
* 100% avalanche tested
* Improved dv/dt capability

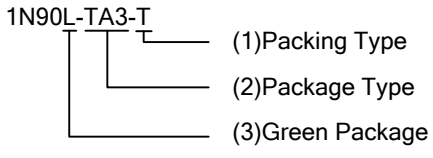
## ■ SYMBOL




## ■ ORDERING INFORMATION

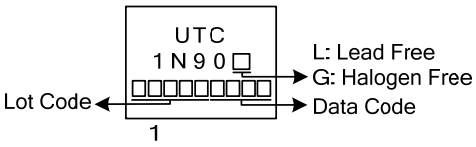
| Ordering Number | | Package | Pin Assignment | | | Packing |
|---|---|---|---|---|---|---|
| Lead Free | Halogen Free | | 1 | 2 | 3 | |
| 1N90L-TA3-T | 1N90G-TA3-T | TO-220 | G | D | S | Tube |
| 1N90L-TF1-T | 1N90G-TF1-T | TO-220F1 | G | D | S | Tube |
| 1N90L-TF3-T | 1N90G-TF3-T | TO-220F | G | D | S | Tube |
| 1N90L-TN3-T | 1N90G-TN3-T | TO-252 | G | D | S | Tube |

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




(1) T: Tube, R: Tape Reel
(2) TA3: TO-220, TF1: TO-220F1, TF3: TO-220F, TN3: TO-252
(3) L: Lead Free, G: Halogen Free and Lead Free

## ■ MARKING



## ■ ABSOLUTE MAXIMUM RATINGS

| PARAMETER | | SYMBOL | RATINGS | UNIT |
|---|---|---|---|---|
| Drain to Source Voltage | | $V_{DSS}$ | 900 | V |
| Gate to Source Voltage | | $V_{GSS}$ | ±30 | V |
| Continuous Drain Current | $T_C$=25°C | $I_D$ | 1.0 | A |
| Pulsed Drain Current (Note 2) | | $I_{DM}$ | 4.0 | A |
| Single Pulse Avalanche Energy Rating (Note 3) | | $E_{AS}$ | 48 | mJ |
| Peak Diode Recovery dv/dt (Note 4) | | dv/dt | 4.7 | V/ns |
| Power Dissipation | TO-220 | $P_D$ | 40 | W |
| | TO-220F/TO-220F1 | | 23 | W |
| | TO-252 | | 28 | 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. Repetitive Rating : Pulse width limited by maximum junction temperature
3. L = 150mH, $I_{AS}$ = 0.8A, $V_{DD}$ = 50V, $R_G$ = 25Ω, Starting $T_J$ = 25°C
4. $I_{SD}$ ≤1.0A, di/dt ≤200A/μs, $V_{DD}$ ≤$BV_{DSS}$, Starting $T_J$=25°C

## ■ THERMAL DATA

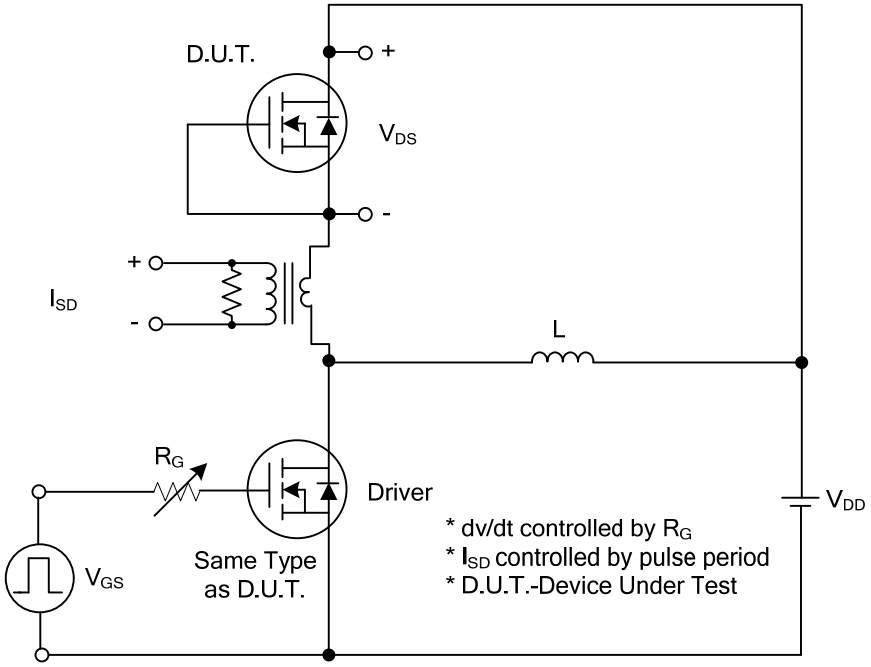
| PARAMETER | | SYMBOL | RATINGS | UNIT |
|---|---|---|---|---|
| Junction to Ambient | TO-220/TO-220F TO-220F1 | $\theta_{JA}$ | 62.5 | °C/W |
| | TO-252 | | 110 | °C/W |
| Junction to Case | TO-220 | $\theta_{JC}$ | 3.13 | °C/W |
| | TO-220F/TO-220F1 | | 5.4 | °C/W |
| | TO-252 | | 4.46 | °C/W |

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

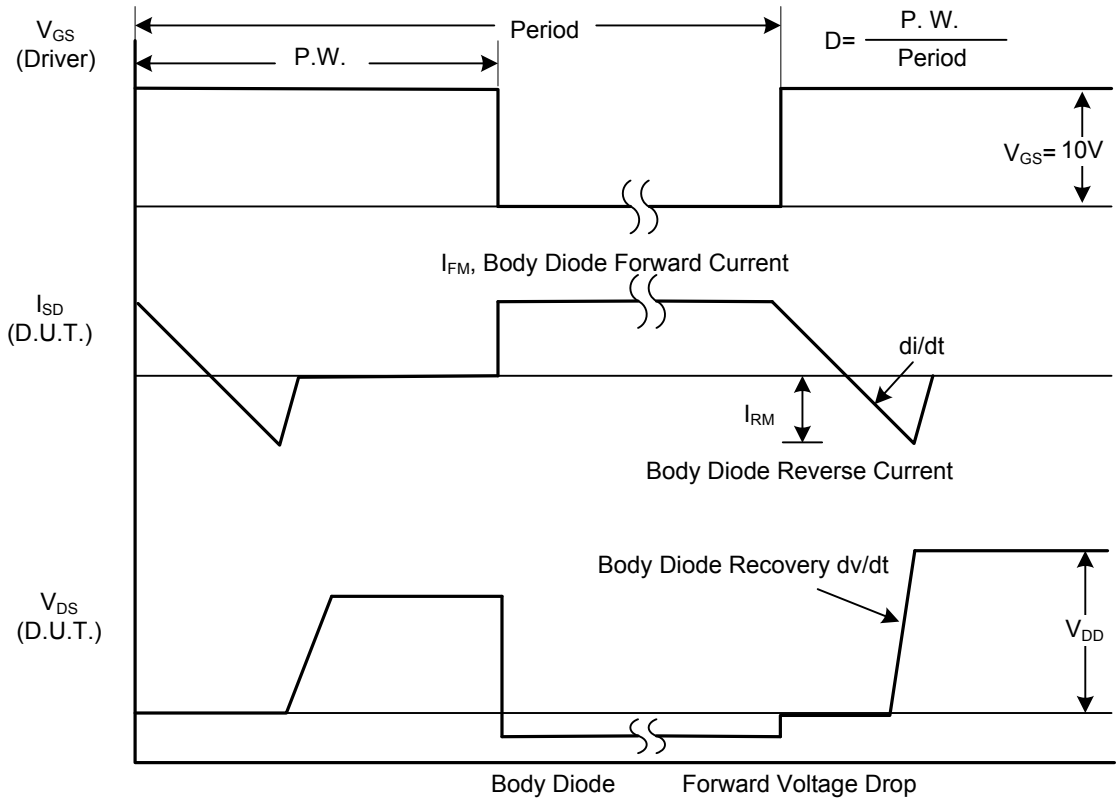
| PARAMETER | | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | | | |
| Drain-Source Breakdown Voltage | | $BV_{DSS}$ | $V_{GS}$=0V, $I_D$=250μA | 900 | | | V |
| Drain-Source Leakage Current | | $I_{DSS}$ | $V_{DS}$=900V, $V_{GS}$=0V | | | 10 | μA |
| Gate-Source Leakage Current | Forward | $I_{GSS}$ | $V_{DS}$=0V ,$V_{GS}$=30V | | | 100 | nA |
| | Reverse | $I_{GSS}$ | $V_{DS}$=0V ,$V_{GS}$=-30V | | | -100 | nA |
| **ON CHARACTERISTICS** | | | | | | | |
| Gate Threshold Voltage | | $V_{GS(TH)}$ | $V_{DS}$=$V_{GS}$, $I_D$=250μA | 2.0 | | 4.0 | V |
| Drain-Source On-State Resistance | | $R_{DS(ON)}$ | $V_{GS}$=10V, $I_D$=0.5A | | | 16 | Ω |
| **DYNAMIC PARAMETERS** | | | | | | | |
| Input Capacitance | | $C_{ISS}$ | $V_{DS}$=25V, $V_{GS}$=0V, f=1.0MHz | | 245 | | pF |
| Output Capacitance | | $C_{OSS}$ | | | 30 | | pF |
| Reverse Transfer Capacitance | | $C_{RSS}$ | | | 4 | | pF |
| **SWITCHING PARAMETERS** | | | | | | | |
| Total Gate Charge | | $Q_G$ | $V_{DS}$=50V, $V_{GS}$=10V, $I_D$=1.3A $I_G$=100μA (Note 1, 2) | | 16 | | nC |
| Gate-Source Charge | | $Q_{GS}$ | | | 2.6 | | nC |
| Gate-Drain Charge | | $Q_{GD}$ | | | 1 | | nC |
| Turn-ON Delay Time | | $t_{D(ON)}$ | $V_{DS}$=30V, $V_{GS}$=10V, $I_D$=0.5A, $R_G$=25Ω (Note 1, 2) | | 37 | | ns |
| Turn-ON Rise Time | | $t_R$ | | | 10 | | ns |
| Turn-OFF Delay Time | | $t_{D(OFF)}$ | | | 52 | | ns |
| Turn-OFF Fall Time | | $t_F$ | | | 23 | | ns |
| **SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS** | | | | | | | |
| Drain-Source Diode Forward Voltage | | $V_{SD}$ | $I_S$ =1.0A, $V_{GS}$=0V | | | 1.0 | V |
| Maximum Body-Diode Continuous Current | | $I_S$ | | | | 4.0 | A |
| Maximum Body-Diode Pulsed Current | | $I_{SM}$ | | | | 1.4 | A |
| Body Diode Reverse Recovery Time | | $t_{RR}$ | $V_{GS}$=0V, $I_S$=1.0A, $dI_F/dt$=100A/μs (Note 1) | | 4.95 | | ns |
| Body Diode Reverse Recovery Charge | | $Q_{RR}$ | | | 1.03 | | μC |

Notes: 1. Pulse Test : Pulse width ≤ 300μs, Duty cycle ≤ 2%.
2. Essentially independent of operating temperature.

## ■ TEST CIRCUITS AND WAVEFORMS

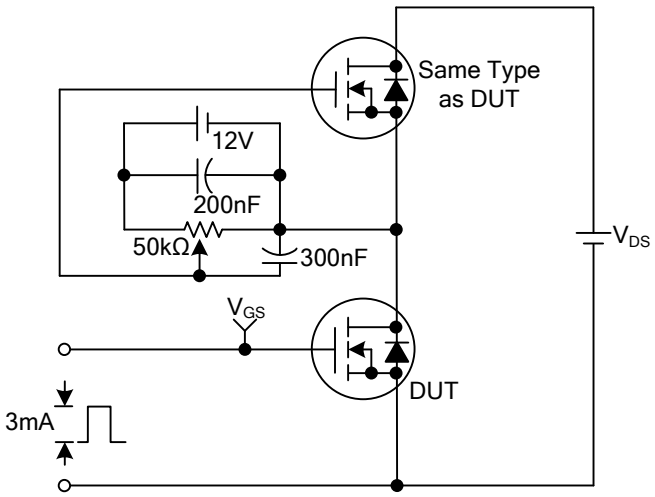



**Peak Diode Recovery dv/dt Test Circuit**

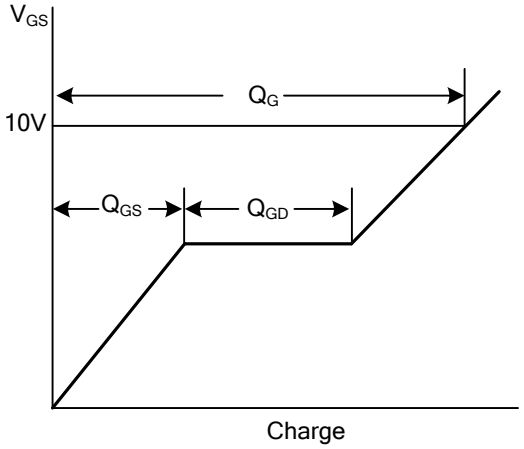



**Peak Diode Recovery dv/dt Waveforms**

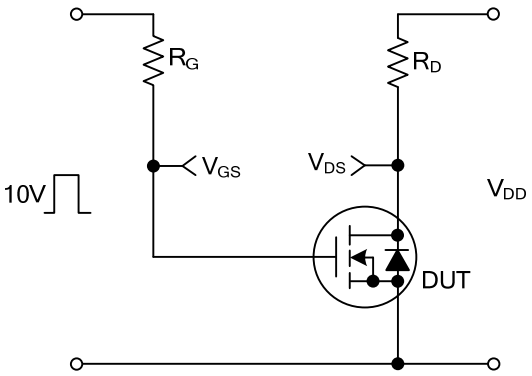
## ■ TEST CIRCUITS AND WAVEFORMS(Cont.)



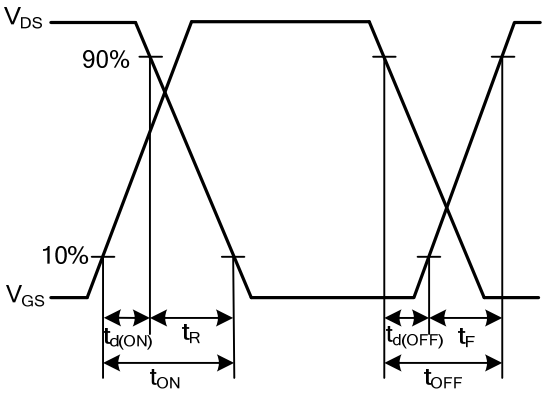

Gate Charge Test Circuit



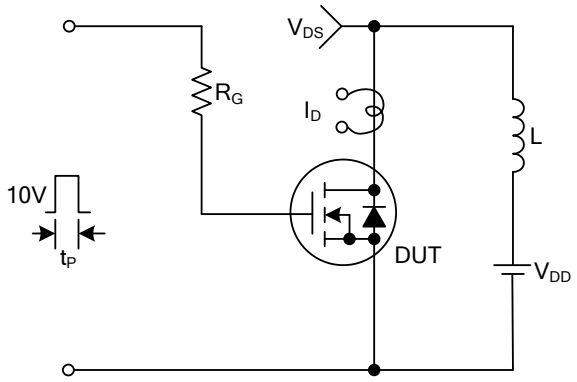

Gate Charge Waveforms



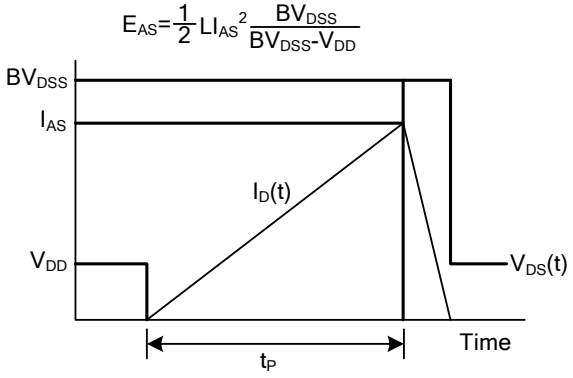

Resistive Switching Test Circuit




Resistive Switching Waveforms




Unclamped Inductive Switching Test Circuit




Unclamped Inductive Switching Waveforms