



# 3N90

*Power MOSFET*

## 3 Amps, 900 Volts N-CHANNEL POWER MOSFET

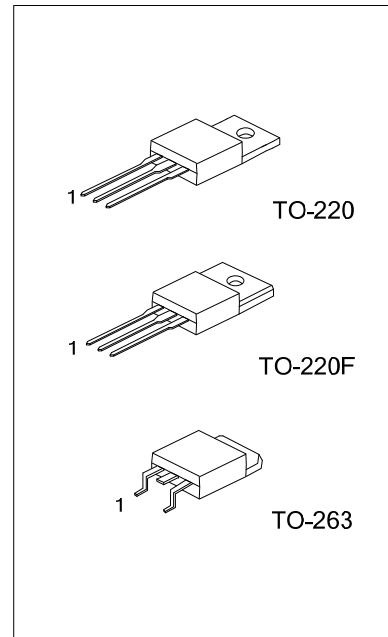
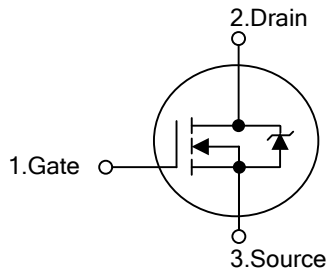
■ DESCRIPTION

The UTC **3N90** provides 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

- \*  $R_{DS(ON)}=4.1\Omega @V_{GS}=10 V$
- \* Ultra Low Gate Charge ( typical 22.7 nC )
- \* Low Reverse Transfer Capacitance (  $C_{RSS}$ = Typical 13 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	
3N90L-TA3-T	3N90G-TA3-T	TO-220	G	D	S	Tube
3N90L-TF3-T	3N90G-TF3-T	TO-220F	G	D	S	Tube
3N90L-TQ2-T	3N90G-TQ2-T	TO-263	G	D	S	Tube
3N90L-TQ2-R	3N90G-TQ2-R	TO-263	G	D	S	Tape Reel

<p>3N90L-TA3-T</p> <p>(1)Packing Type</p> <p>(2)Package Type</p> <p>(3)Lead Free</p>	<p>(1) T: Tube</p> <p>(2) TA3: TO-220, TF3: TO-220F, TQ2: TO-263</p> <p>(3) G: Halogen Free, L: Lead Free</p>
--	---

■ ABSOLUTE MAXIMUM RATINGS ( $T_C=25^\circ\text{C}$ , unless otherwise specified)

PARAMETER	SYMBOL	RATINGS	UNIT
Drain-Source Voltage ( $V_{GS}=0V$ )	$V_{DSS}$	900	V
Drain-Gate Voltage ( $R_G=20k\Omega$ )	$V_{DGR}$	900	V
Gate-Source Voltage	$V_{GSS}$	$\pm 30$	V
Gate-Source Breakdown Voltage ( $I_{GS}=\pm 1mA$ )	$BV_{GSO}$	30(MIN)	V
Insulation Withstand Voltage (DC)	TO-220F $V_{ISO}$	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)	$E_{AS}$	180	mJ
Peak Diode Recovery $dv/dt$ (Note 4)	$dv/dt$	4.5	V/ns
Power Dissipation	TO-220/ TO-263	90	W
	TO-220F	25	
Junction Temperature	$T_J$	+150	$^\circ\text{C}$
Storage Temperature	$T_{STG}$	-55 ~ +150	$^\circ\text{C}$

Note: 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  $T_J=25^\circ\text{C}$ ,  $I_D=I_{AR}$ ,  $V_{DD}=50V$

4.  $I_{SD} \leq 3A$ ,  $di/dt \leq 200A/\mu s$ ,  $V_{DD} \leq BV_{DSS}$ ,  $T_J \leq T_{J(MAX)}$ .

■ THERMAL DATA

PARAMETER	SYMBOL	RATING	UNIT
Junction to Ambient	TO-220/ TO-263	62.5	$^\circ\text{C/W}$
	TO-220F	62.5	
Junction to Case	TO-220/ TO-263	1.38	$^\circ\text{C/W}$
	TO-220F	5	

■ ELECTRICAL CHARACTERISTICS ( $T_C=25^\circ\text{C}$ , unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
<b>OFF CHARACTERISTICS</b>						
Drain-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS}=0V$ , $I_D=250\mu A$	900			V
Drain-Source Leakage Current	$I_{DSS}$	$V_{DS}=900V$ , $V_{GS}=0V$			1	$\mu A$
Gate-Source Leakage Current	$I_{GSS}$	$V_{GS}=\pm 30V$ , $V_{DS}=0V$			$\pm 10$	$\mu A$
<b>ON CHARACTERISTICS</b>						
Gate Threshold Voltage	$V_{GS(TH)}$	$V_{DS}=V_{GS}$ , $I_D=250\mu A$	3	3.75	4.5	V
Static Drain-Source On-State Resistance	$R_{DS(ON)}$	$V_{GS}=10V$ , $I_D=1.5A$		4.1	4.8	$\Omega$
Forward Transconductance (Note 1)	$g_{FS}$	$V_{DS}=15V$ , $I_D=1.5A$		2.1		S
<b>DYNAMIC CHARACTERISTICS</b>						
Input Capacitance	$C_{ISS}$	$V_{DS}=25V$ , $V_{GS}=0V$ , $f=1MHz$		590		pF
Output Capacitance	$C_{OSS}$			63		pF
Reverse Transfer Capacitance	$C_{RSS}$			13		pF
Equivalent Output Capacitance (Note 2)	$C_{OSS(EQ)}$	$V_{GS}=0V$ , $V_{DS}=0V\sim 400V$		34		pF
<b>SWITCHING CHARACTERISTICS</b>						
Turn-On Delay Time	$t_{D(ON)}$	$V_{DD}=450V$ , $I_D=1.5A$ , $R_G=4.7\Omega$		18		ns
Turn-On Rise Time	$t_R$	$V_{GS}=10V$		7		ns
Turn-Off Delay Time	$t_{D(OFF)}$	$V_{DD}=720V$ , $I_D=1.5A$ , $R_G=4.7\Omega$		45		ns
Turn-Off Fall Time	$t_F$	$V_{GS}=10V$		18		ns
Total Gate Charge	$Q_G$	$V_{DD}=720V$ , $I_D=3A$ , $V_{GS}=10V$		22.7		nC
Gate-Source Charge	$Q_{GS}$			4.2		nC
Gate-Drain Charge	$Q_{DD}$			12		nC

■ ELECTRICAL CHARACTERISTICS(Cont.)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
<b>SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS</b>						
Diode Forward Voltage(Note 1)	$V_{SD}$	$I_{SD}=3A, V_{GS}=0V$			1.6	V
Source-Drain Current	$I_{SD}$				3	A
Source-Drain Current (Pulsed)	$I_{SDM}$				12	A
Reverse Recovery Current	$I_{RRM}$	$I_{SD}=3A, di/dt=100A/\mu s,$ $V_{DD}=100V, T_J=25^\circ C$		8.7		A
Body Diode Reverse Recovery Time	$t_{RR}$			510		ns
Body Diode Reverse Recovery Charge	$Q_{RR}$			2.2		nC

Note: 1.Pulse width=300 $\mu$ s, Duty cycle  $\leq$  1.5%

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

TEST CIRCUITS AND WAVEFORMS

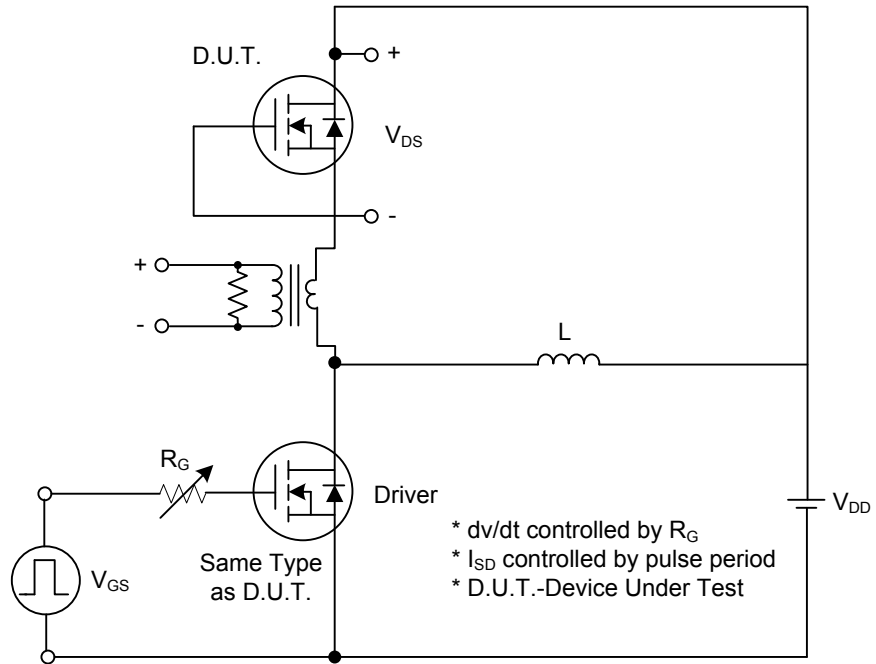


Fig. 1A Peak Diode Recovery  $dv/dt$  Test Circuit

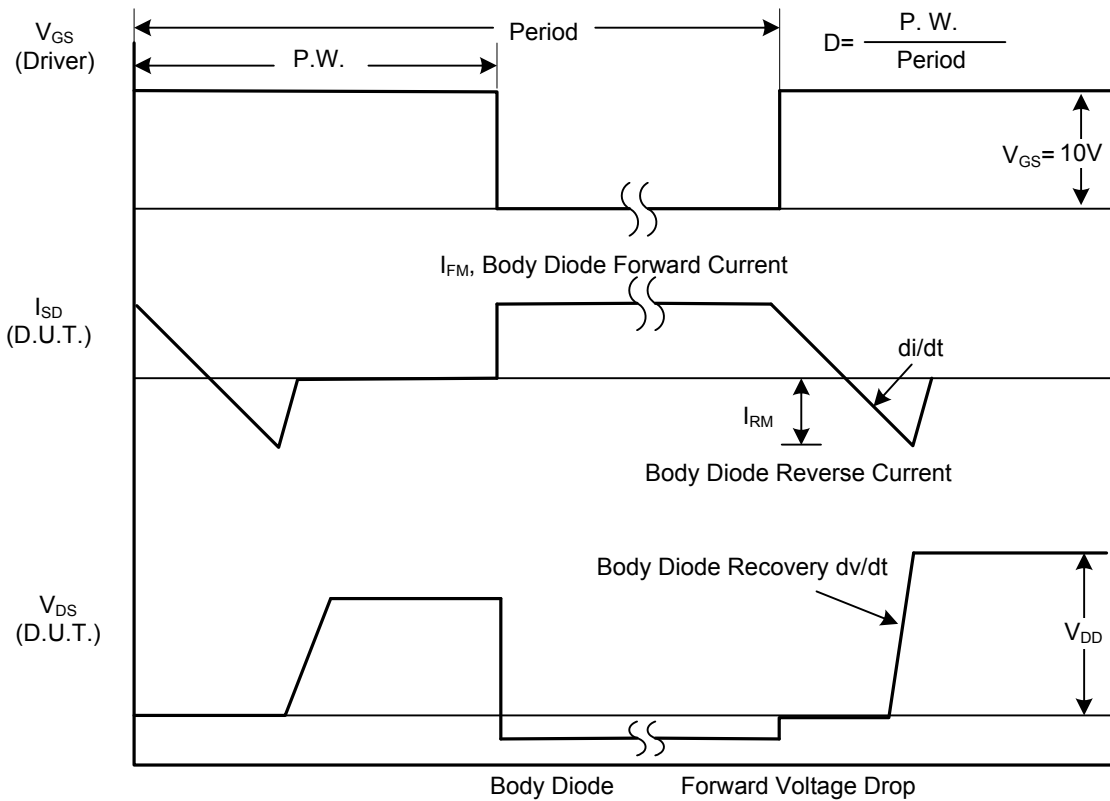


Fig. 1B Peak Diode Recovery  $dv/dt$  Waveforms

TEST CIRCUITS AND WAVEFORMS (Cont.)

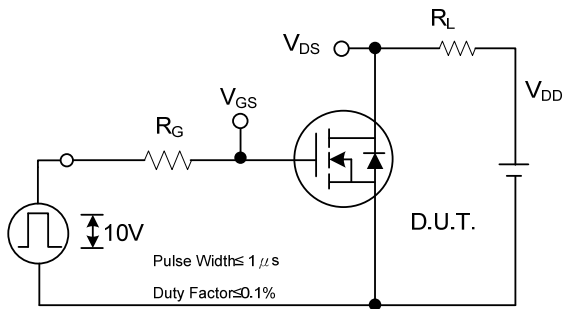


Fig. 2A Switching Test Circuit

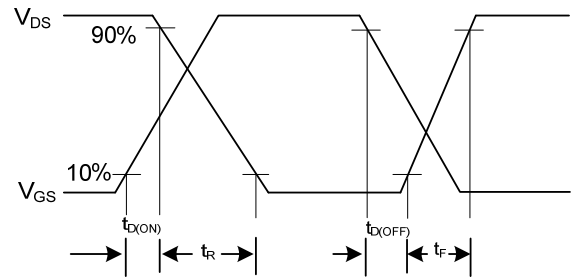


Fig. 2B Switching Waveforms

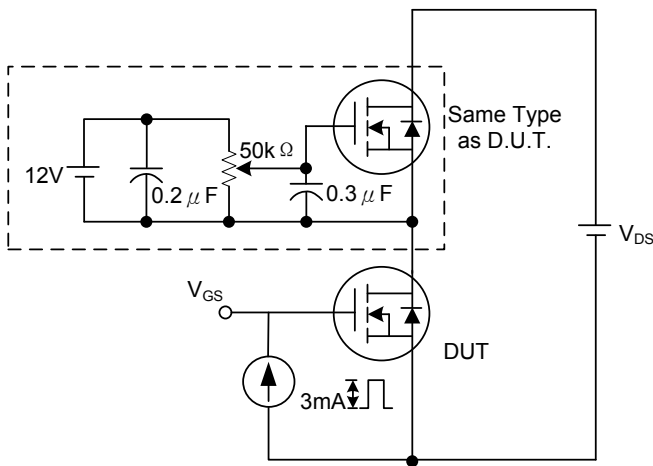


Fig. 3A Gate Charge Test Circuit

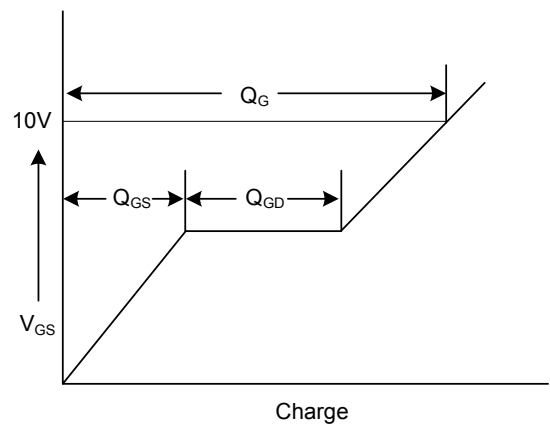


Fig. 3B Gate Charge Waveform

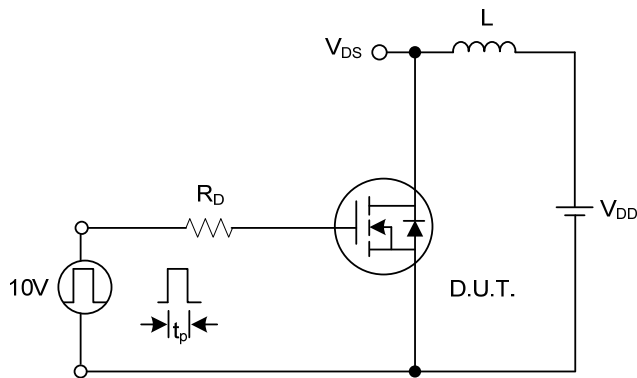


Fig. 4A Unclamped Inductive Switching Test Circuit

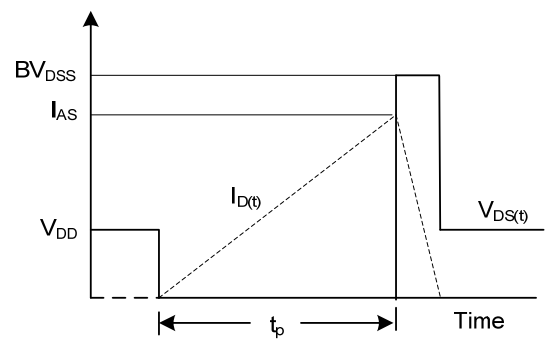
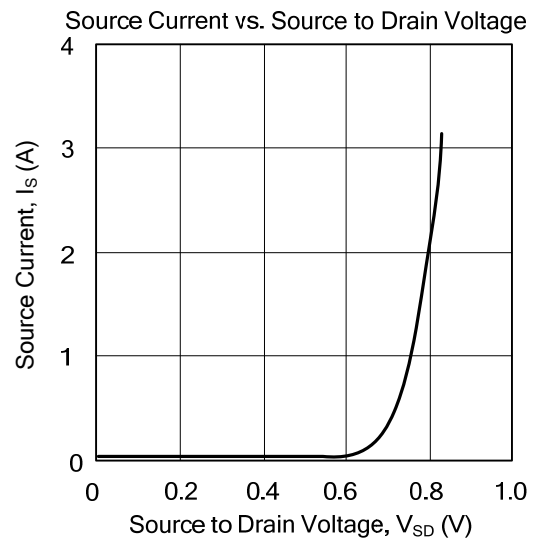
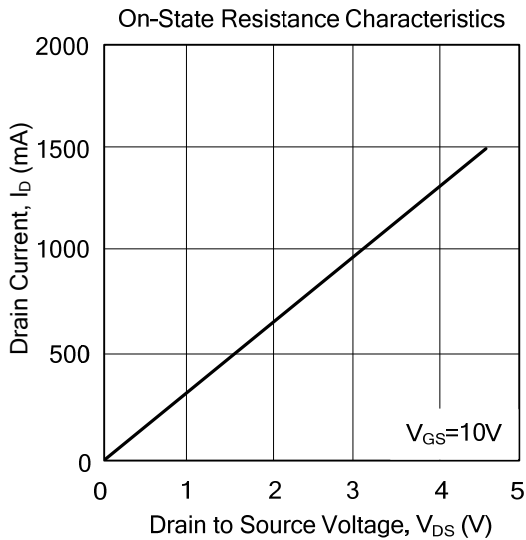
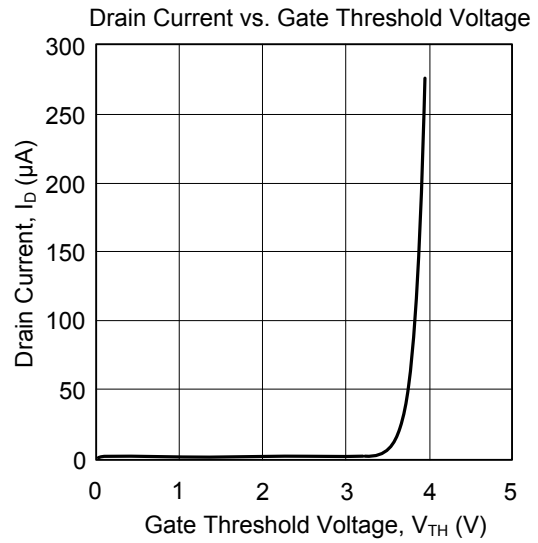
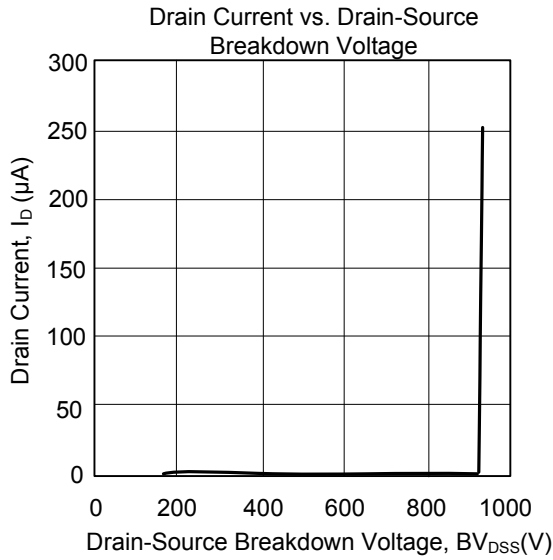


Fig. 4B Unclamped Inductive Switching Waveforms

### TYPICAL CHARACTERISTICS



UTC assumes no responsibility for equipment failures that result from using products at values that exceed, even momentarily, rated values (such as maximum ratings, operating condition ranges, or other parameters) listed in products specifications of any and all UTC products described or contained herein. UTC products are not designed for use in life support appliances, devices or systems where malfunction of these products can be reasonably expected to result in personal injury. Reproduction in whole or in part is prohibited without the prior written consent of the copyright owner. The information presented in this document does not form part of any quotation or contract, is believed to be accurate and reliable and may be changed without notice.