

## 500V N-CHANNEL MOSFET

## ■ DESCRIPTION

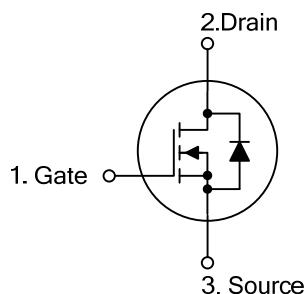
The UTC **13N50** is an N-Channel enhancement mode power MOSFET. The device adopts planar stripe and uses DMOS technology to minimize and provide lower on-state resistance and faster switching speed. It can also withstand high energy pulse under the avalanche and commutation mode conditions.

The UTC **13N50** is ideally suitable for high efficiency switch mode power supply, power factor correction, electronic lamp ballast based on half bridge topology.

## ■ FEATURES

- \*  $R_{DS(ON)} = 0.48\Omega$  @  $V_{GS} = 10\text{ V}$
- \* Ultra low gate charge (typical 43 nC )
- \* Low reverse transfer Capacitance (  $C_{RSS} = \text{typical } 20\text{pF}$  )
- \* Fast switching capability
- \* Avalanche energy tested
- \* Improved dv/dt capability, high ruggedness

## ■ SYMBOL



## ■ ORDERING INFORMATION

Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
13N50L-TA3-T	13N50G-TA3-T	TO-220	G	D	S	Tube
13N50L-TF3-T	13N50G-TF3-T	TO-220F	G	D	S	Tube

 (1) Packing Type (2) Package Type (3) Lead Plating	(1) T: Tube (2) TA3: TO-220, TF3: TO-220F (3) L: Lead Free, G: Halogen Free
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■ ABSOLUTE MAXIMUM RATINGS ( $T_c = 25^\circ\text{C}$ , unless otherwise specified)

PARAMETER	SYMBOL	RATINGS	UNIT
Drain-Source Voltage	$V_{DSS}$	500	V
Gate-Source Voltage	$V_{GSS}$	$\pm 30$	V
Continuous Drain Current	$I_D$	13	A
Pulsed Drain Current (Note 2)	$I_{DM}$	52	A
Avalanche Current (Note 2)	$I_{AR}$	13	A
Single Pulsed Avalanche Energy (Note 3)	$E_{AS}$	860	mJ
Repetitive Avalanche Energy (Note 2)	$E_{AR}$	19.5	mJ
Peak Diode Recovery dv/dt (Note 4)	dv/dt	4.5	V/ns
Power Dissipation ( $T_c=25^\circ\text{C}$ )	$P_D$	195	W
TO-220F		48	W
Junction Temperature	$T_J$	+150	$^\circ\text{C}$
Storage Temperature	$T_{STG}$	-55~+150	$^\circ\text{C}$

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.  $L = 6.0$ ,  $I_{AS} = 13\text{A}$ ,  $V_{DD} = 50\text{V}$ ,  $R_G = 25\Omega$ , Starting  $T_J = 25^\circ\text{C}$

4.  $I_{SD} \leq 13\text{A}$ ,  $dI/dt \leq 200\text{A}/\mu\text{s}$ ,  $V_{DD} \leq BV_{DSS}$ , Starting  $T_J = 25^\circ\text{C}$

■ THERMAL DATA

PARAMETER	SYMBOL	RATINGS	UNIT
Junction to Ambient	TO-220	$\theta_{JA}$	62.5
	TO-220F		62.5
Junction to Case	TO-220	$\theta_{JC}$	0.64
	TO-220F		2.58

■ 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	$BV_{DSS}$	$V_{GS} = 0\text{V}$ , $I_D = 250\mu\text{A}$	500			V
Drain-Source Leakage Current	$I_{DSS}$	$V_{DS} = 500\text{V}$ , $V_{GS} = 0\text{V}$		1		$\mu\text{A}$
Gate-Source Leakage Current	$I_{GSS}$	$V_{GS} = 30\text{V}$ , $V_{DS} = 0\text{V}$		100		nA
		$V_{GS} = -30\text{V}$ , $V_{DS} = 0\text{V}$		-100		nA
Breakdown Voltage Temperature Coefficient	$\Delta BV_{DSS}/\Delta T_J$	$I_D = 250\mu\text{A}$ Referenced to $25^\circ\text{C}$		0.5		$\text{V}/^\circ\text{C}$
<b>ON CHARACTERISTICS</b>						
Gate Threshold Voltage	$V_{GS(\text{TH})}$	$V_{DS} = V_{GS}$ , $I_D = 250\mu\text{A}$	2.0		4.0	V
Static Drain-Source On-State Resistance	$R_{DS(\text{ON})}$	$V_{GS} = 10\text{V}$ , $I_D = 6.5\text{A}$		0.39	0.48	$\Omega$
<b>DYNAMIC CHARACTERISTICS</b>						
Input Capacitance	$C_{iss}$	$V_{DS}=25\text{V}$ , $V_{GS}=0\text{V}$ , $f=1.0\text{MHz}$		1580	2055	pF
Output Capacitance	$C_{oss}$			180	235	pF
Reverse Transfer Capacitance	$C_{rss}$			20	25	pF
<b>SWITCHING CHARACTERISTICS</b>						
Turn-On Delay Time	$t_{D(\text{ON})}$	$V_{DD} = 250\text{V}$ , $I_D = 13\text{A}$ $R_G = 25\Omega$ (Note 1,2)		25	60	nS
Turn-On Rise Time	$t_R$			100	210	nS
Turn-Off Delay Time	$t_{D(\text{OFF})}$			130	270	nS
Turn-Off Fall Time	$t_F$			100	210	nS
Total Gate Charge	$Q_G$	$V_{DS}=400\text{V}$ , $I_D=13\text{A}$ , $V_{GS}=10\text{V}$ (Note 1, 2)		43	56	nC
Gate-Source Charge	$Q_{GS}$			7.5		nC
Gate-Drain Charge	$Q_{GD}$			18.5		nC

## ■ ELECTRICAL CHARACTERISTICS(Cont.)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
<b>DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS</b>						
Drain-Source Diode Forward Voltage	$V_{SD}$	$V_{GS} = 0V, I_S = 13A$			1.4	V
Maximum Continuous Drain-Source Diode Forward Current	$I_S$				13	A
Maximum Pulsed Drain-Source Diode Forward Current	$I_{SM}$				52	A
Reverse Recovery Time	$t_{RR}$	$V_{GS} = 0V, I_S = 13A,$ $dI_F / dt = 100A/\mu s$ (Note 1)		410		nS
Reverse Recovery Charge	$Q_{RR}$			4.5		$\mu C$

Notes: 1. Pulse Test : Pulse width  $\leq 300\mu s$ , Duty cycle  $\leq 2\%$

2. Essentially independent of operating ambient temperature

■ TEST CIRCUITS AND WAVEFORMS

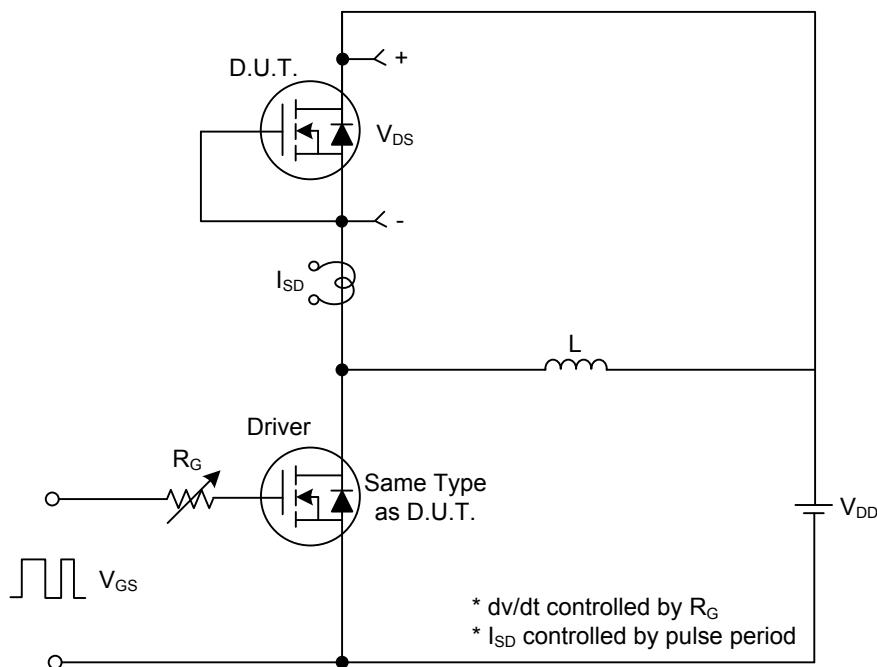


Fig. 1A Peak Diode Recovery  $dv/dt$  Test Circuit

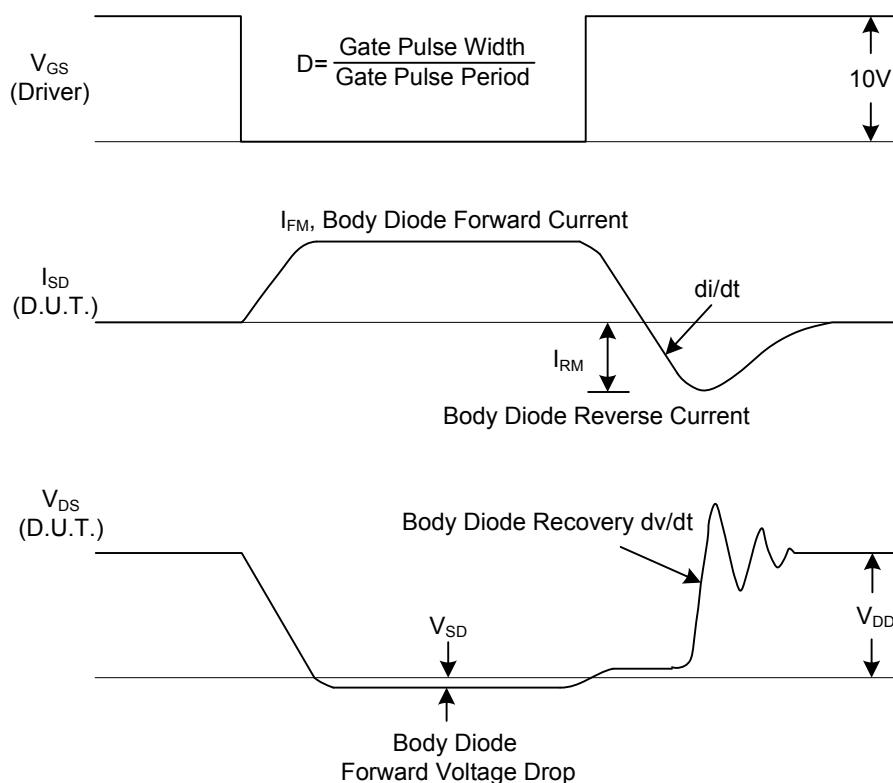


Fig. 1B Peak Diode Recovery  $dv/dt$  Waveforms

■ TEST CIRCUITS AND WAVEFORMS (Cont.)

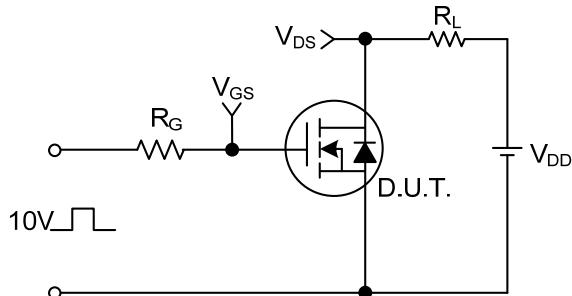


Fig. 2A Switching Test Circuit

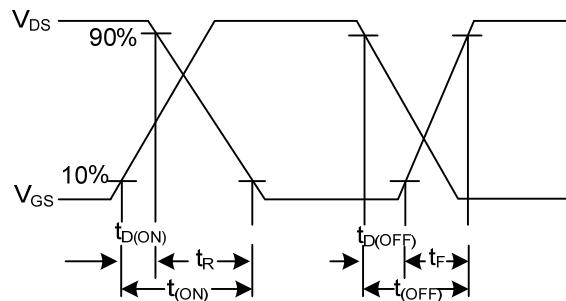


Fig. 2B Switching Waveforms

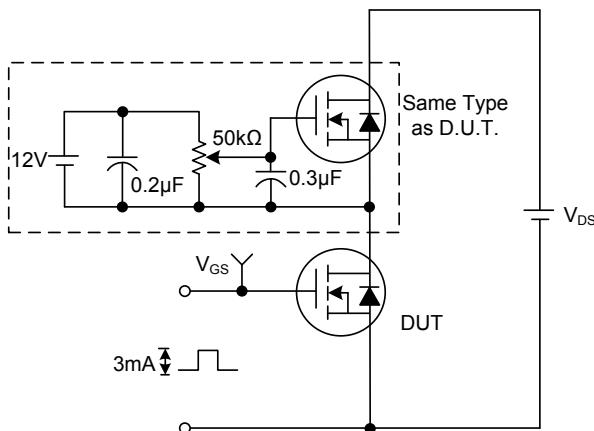


Fig. 3A Gate Charge Test Circuit

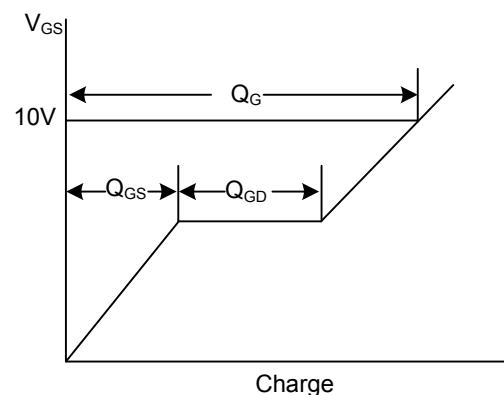


Fig. 3B Gate Charge Waveform

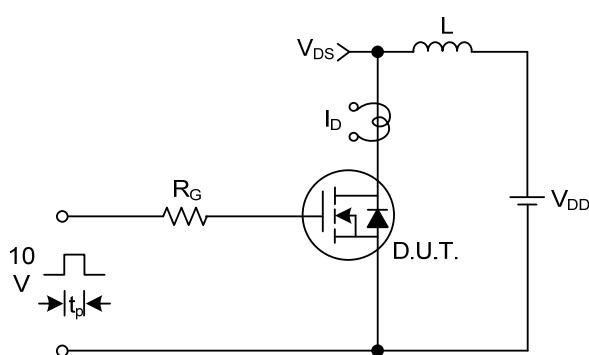


Fig. 4A Unclamped Inductive Switching Test Circuit

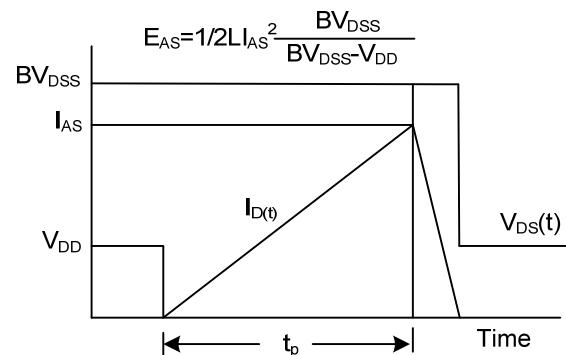


Fig. 4B Unclamped Inductive Switching Waveforms

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