

# UNISONIC TECHNOLOGIES CO., LTD

13N50 **Power MOSFET** 

# **13A, 500V N-CHANNEL POWER MOSFET**

#### DESCRIPTION

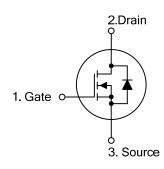
The UTC 13N50 is an N-Channel enhancement mode power MOSFET. The device adopts planar stripe and uses DMOS technology to minimize and provide lower on-state resistance and faster switching speed. It can also withstand high energy pulse under the avalanche and commutation mode conditions.

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**

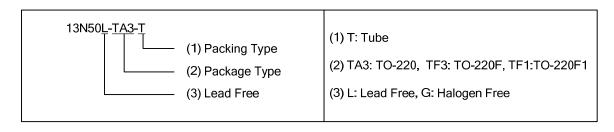
- \*  $R_{DS(ON)} = 0.48\Omega @V_{GS} = 10V$
- \* Ultra low gate charge (typical 43nC)
- \* Low reverse transfer Capacitance ( C<sub>RSS</sub> = typical 20pF )
- \* Fast switching capability
- \* Avalanche energy tested
- \* Improved dv/dt capability, high ruggedness

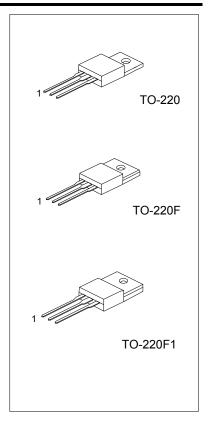
### **SYMBOL**



#### **ORDERING INFORMATION**

Ordering Number		Dookago	Pin Assignment			Dooking	
Lead Free	Halogen Free	Package	1	2	3	Packing	
13N50L-TA3-T	13N50G-TA3-T	TO-220	G	D	S	Tube	
13N50L-TF3-T	13N50G-TF3-T	TO-220F	G	D	S	Tube	
13N50L- TF1-T	13N50G-TF1-T	TO-220F1	G	D	S	Tube	





# ■ **ABSOLUTE MAXIMUM RATINGS** (T<sub>C</sub> = 25°C, unless otherwise specified)

PARAMETER		SYMBOL	RATINGS	UNIT	
Drain-Source Voltage		$V_{DSS}$	500	V	
Gate-Source Voltage		$V_{GSS}$	±30	V	
Continuous Drain Current		$I_D$	13	Α	
Pulsed Drain Current (Note 2)		I <sub>DM</sub>	52	Α	
Avalanche Current (Note 2)		I <sub>AR</sub>	13	Α	
Single Pulsed Avalanche Energy (Note 3)		E <sub>AS</sub>	810	mJ	
Repetitive Avalanche Energy (Note 2)		E <sub>AR</sub>	17	mJ	
Peak Diode Recovery dv/dt (Note 4)		dv/dt	4.5	V/ns	
Power Dissipation (T <sub>C</sub> =25°C)	TO-220	0	168	10/	
	TO-220F/TO-220F1	$P_D$	48	W	
Junction Temperature		Τ <sub>J</sub>	+150	°C	
Storage Temperature		T <sub>STG</sub>	-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 = 9.3mH,  $I_{AS}$  = 13A,  $V_{DD}$  = 50V,  $R_{G}$ = 25 $\Omega$  ,Starting  $T_{J}$  = 25 $^{\circ}$ C
- 4.  $I_{SD} \le 13.A$ , di/dt  $\le 200A/\mu s$ ,  $V_{DD} \le BV_{DSS}$ , Starting  $T_J = 25$ °C

#### **■ THERMAL DATA**

PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Ambient		$\theta_{JA}$	62.5	°C/W
Junction to Case	TO-220	0	0.74	°C/M
	TO-220F/TO-220F1	$\theta_{JC}$	2.58	°C/W

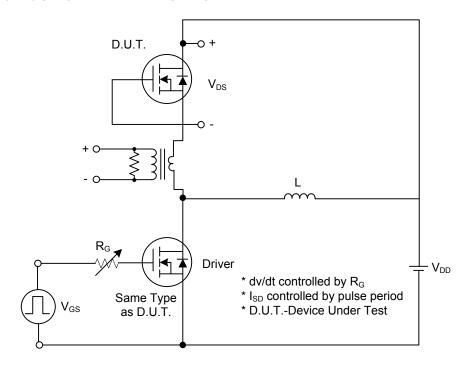
# ■ **ELECTRICAL CHARACTERISTICS** (T<sub>C</sub> =25°C, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT		
OFF CHARACTERISTICS								
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	$V_{GS} = 0V, I_D = 250\mu A$	500			V		
Drain-Source Leakage Current	I <sub>DSS</sub>	V <sub>DS</sub> = 500V, V <sub>GS</sub> = 0V			10	μA		
	I <sub>GSS</sub>	$V_{GS} = 30V, V_{DS} = 0V$			100	nA		
Gate-Source Leakage Current		V <sub>GS</sub> = -30V, V <sub>DS</sub> = 0V			-100	nA		
Breakdown Voltage Temperature Coefficient	$\triangle BV_{DSS}/\triangle T_{J}$	I <sub>D</sub> =250mA,Referenced to 25°C		0.5		V/°C		
ON CHARACTERISTICS								
Gate Threshold Voltage	V <sub>GS(TH)</sub>	$V_{DS} = V_{GS}, I_{D} = 250 \mu A$	2.0		4.0	V		
Static Drain-Source On-State Resistance	R <sub>DS(ON)</sub>	$V_{GS} = 10V, I_D = 6.5A$		0.42	0.48	Ω		
DYNAMIC CHARACTERISTICS								
Input Capacitance	C <sub>ISS</sub>	-V <sub>DS</sub> =25V, V <sub>GS</sub> =0V, -f=1.0MHz		1800	2300	pF		
Output Capacitance	Coss			245	320	pF		
Reverse Transfer Capacitance	C <sub>RSS</sub>			25	35	pF		
SWITCHING CHARACTERISTICS								
Turn-On Delay Time	t <sub>D(ON)</sub>			40	90	nS		
Turn-On Rise Time	t <sub>R</sub>	$V_{DD}$ =250V, $I_{D}$ =13A, $R_{G}$ =25 $\Omega$ (Note 1,2)		140	290	nS		
Turn-Off Delay Time	t <sub>D(OFF)</sub>			100	210	nS		
Turn-Off Fall Time	t <sub>F</sub>			85	180	nS		
Total Gate Charge	$Q_G$	-V <sub>DS</sub> =400V, I <sub>D</sub> =13A, -V <sub>GS</sub> =10 V (Note 1,2)		45	60	nC		
Gate-Source Charge	$Q_GS$			11		nC		
Gate-Drain Charge	$Q_GD$			22		nC		
DRAIN-SOURCE DIODE CHARACTERISTIC	CS AND MAXII	MUM RATINGS						
Drain-Source Diode Forward Voltage	$V_{SD}$	$V_{GS} = 0V, I_S = 13 A$			1.4	V		
Maximum Continuous Drain-Source Diode					13			
Forward Current	Is				13	Α		
Maximum Pulsed Drain-Source Diode	1				52	Α		
Forward Current	I <sub>SM</sub>				52	А		
Reverse Recovery Time	t <sub>rr</sub>	$V_{GS} = 0V, I_{S} = 13A,$		290		nS		
Reverse Recovery Charge	$Q_{RR}$	dI <sub>F</sub> / dt =100A/μs (Note 1)		2.6		μC		

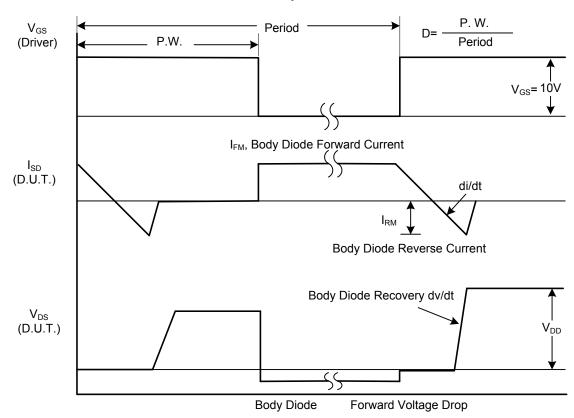
Note: 1. Pulse Test : Pulse width≤300µs, Duty cycle≤2%

<sup>2.</sup> Essentially independent of operating ambient temperature

#### **■ TEST CIRCUITS AND WAVEFORMS**

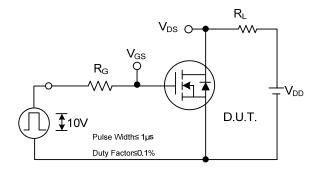


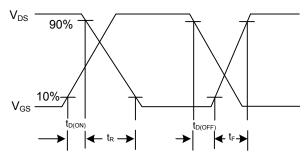
# Peak Diode Recovery dv/dt Test Circuit



Peak Diode Recovery dv/dt Waveforms

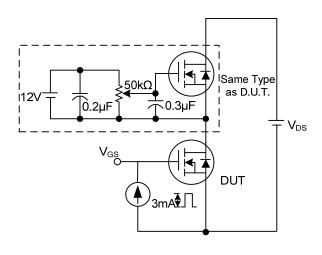
# ■ TEST CIRCUITS AND WAVEFORMS (Cont.)

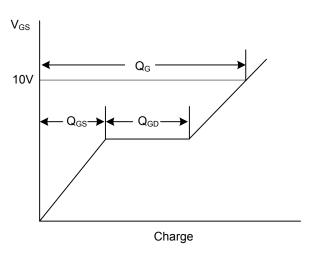




**Switching Test Circuit** 

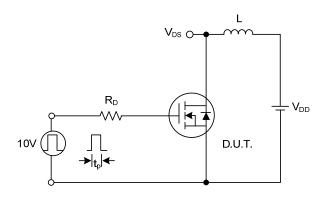
**Switching Waveforms** 

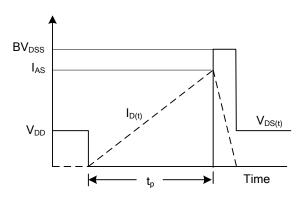




**Gate Charge Test Circuit** 

**Gate Charge Waveform** 

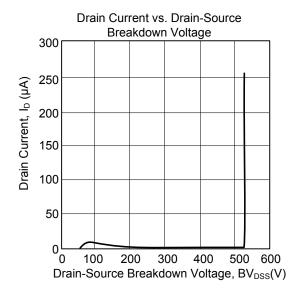


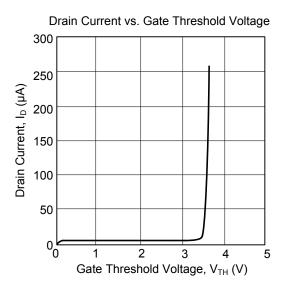


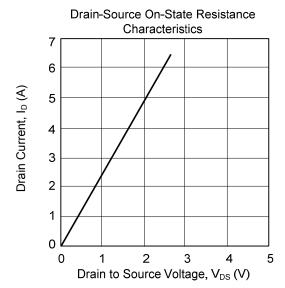
**Unclamped Inductive Switching Test Circuit** 

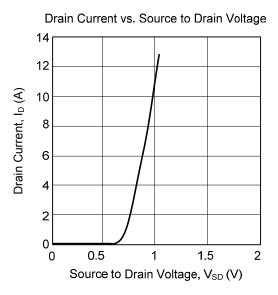
**Unclamped Inductive Switching Waveforms** 

#### **■ TYPICAL CHARACTERISTICS**









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