

# UNISONIC TECHNOLOGIES CO., LTD

4N60-TA5 Preliminary Power MOSFET

## 4.0A, 600V N-CHANNEL POWER MOSFET

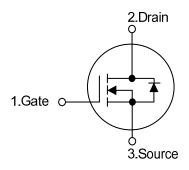
#### ■ DESCRIPTION

The UTC **4N60-TA5** is a high voltage and high current power MOSFET, designed to have better characteristics, such as fast switching time, low gate charge, low on-state resistance and have a high rugged avalanche characteristics. This power MOSFET is usually used at high speed switching applications in power supplies, PWM motor controls, high efficient DC to DC converters and bridge circuits.

## ■ FEATURES

- \*  $R_{DS(ON)}$  < 2.5 $\Omega$  @  $V_{GS}$  = 10 V,  $I_D$  = 2.0A
- \* Fast switching capability
- \* Avalanche energy specified
- \* Improved dv/dt capability, high ruggedness

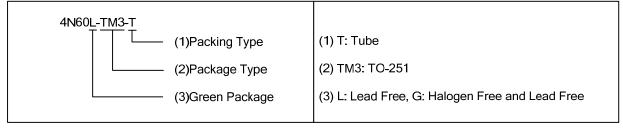
## ■ SYMBOL



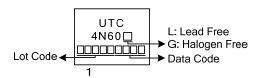
#### ■ ORDERING INFORMATION

Ordering Number		Dookogo	Pin Assignment			Dooking	
Lead Free	Halogen Free	Package	1	2	3	Packing	
4N60L-TM3-T	4N60G-TM3-T	TO-251	G	D	S	Tube	

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



### **■ MARKING**



1 TO-251

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

PARAMETER		SYMBOL	RATINGS	UNIT	
Drain-Source Voltage		$V_{DSS}$	600	V	
Gate-Source Voltage		$V_{GSS}$	±30	V	
Avalanche Current (Note 2)		$I_{AR}$	4.0	Α	
Continuous Drain Current		Ι <sub>D</sub>	4.0	Α	
Pulsed Drain Current (Note 2)		$I_{DM}$	12	Α	
Avalanche Energy	Single Pulsed (Note 3)	$E_AS$	67	mJ	
Peak Diode Recovery dv/dt (Note 4)		dv/dt	3.03	V/ns	
Power Dissipation (T <sub>C</sub> =25°C)		$P_{D}$	50	W	
Junction Temperature		$T_J$	+150	°C	
Operating Temperature		$T_OPR$	-55 ~ +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  $T_{\text{J}}$ .
- 3. L=15mH, I<sub>AS</sub>=3.0A, V<sub>DD</sub>=50V, R<sub>G</sub>=25  $\Omega$ , Starting T<sub>J</sub> = 25°C
- 4.  $I_{SD} \le 4.0A$ , di/dt  $\le 200A/\mu s$ ,  $V_{DD} \le BV_{DSS}$ , Starting  $T_J = 25^{\circ}C$

## ■ THERMAL DATA

PARAMETER	SYMBOL	RATINGS	UNIT	
Junction to Ambient	$\theta_{JA}$	110	°C/W	
Junction to Case	θ <sub>JC</sub>	2.5	°C/W	

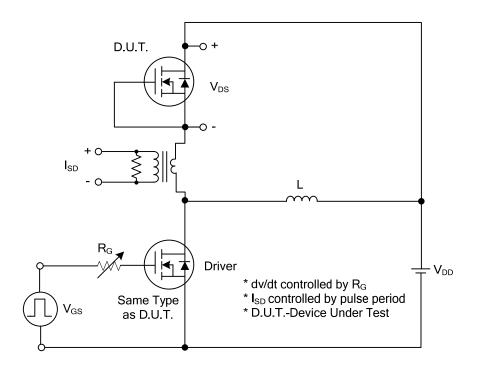
## ■ ELECTRICAL CHARACTERISTICS (T<sub>C</sub> =25°C, unless otherwise specified)

PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS							
Drain-Source Breakdown Voltage		BV <sub>DSS</sub>	$V_{GS} = 0 \text{ V}, I_D = 250 \mu\text{A}$	600			V
Drain-Source Leakage Current		I <sub>DSS</sub>	V <sub>DS</sub> = 600 V, V <sub>GS</sub> = 0 V			10	μΑ
Cata Source Lookage Current	Forward	GSS	$V_{GS} = 30 \text{ V}, V_{DS} = 0 \text{ V}$			100	nA
Gate-Source Leakage Current	Reverse		$V_{GS} = -30 \text{ V}, V_{DS} = 0 \text{ V}$			-100	nA
ON CHARACTERISTICS							
Gate Threshold Voltage		$V_{GS(TH)}$	$V_{DS} = V_{GS}, I_{D} = 250 \mu A$	2.0		4.0	V
Static Drain-Source On-State Resistance		R <sub>DS(ON)</sub>	$V_{GS} = 10 \text{ V}, I_D = 2.0 \text{A}$			2.5	Ω
DYNAMIC CHARACTERISTICS							
Input Capacitance		C <sub>ISS</sub>	V <sub>DS</sub> = 25 V, V <sub>GS</sub> = 0 V,		500		pF
Output Capacitance		Coss	$ V_{DS} - 25 V, V_{GS} - 0 V,$  f  = 1MHz		55		pF
Reverse Transfer Capacitance	Reverse Transfer Capacitance		1 – 11011 12		6		pF
SWITCHING CHARACTERISTICS	3						
Total Gate Charge		$Q_G$	-V <sub>DS</sub> =50V, V <sub>GS</sub> =10V, I <sub>D</sub> =1.3A , -I <sub>G</sub> =100μA (Note 1, 2)		35		nC
Gate-Source Charge		$Q_GS$			4.5		nC
Gate-Drain Charge		$Q_GD$	Ig-100μΑ (Note 1, 2)		5.5		nC
Turn-On Delay Time		$t_{D(ON)}$	$V_{DD}$ =30V, $V_{GS}$ =10V, $I_{D}$ =0.5A, $R_{G}$ =25 $\Omega$ (Note 1, 2)		44		ns
Turn-On Rise Time		$t_R$			50		ns
Turn-Off Delay Time		$t_{D(OFF)}$			120		ns
Turn-Off Fall Time		$t_{F}$			35		ns
SOURCE- DRAIN DIODE RATING	S AND C	HARACTER	ISTICS				
Maximum Continuous Drain-Source Diode		Is				4.0	Α
Forward Current						4.0	А
Maximum Pulsed Drain-Source Diode		I <sub>SM</sub>				12	Α
Forward Current						12	^
Drain-Source Diode Forward Voltage		$V_{\text{SD}}$	V <sub>GS</sub> = 0 V, I <sub>S</sub> = 4.0 A			1.4	V
Reverse Recovery Time		t <sub>rr</sub>	V <sub>GS</sub> =0V, I <sub>S</sub> =4.0A		390		ns
Reverse Recovery Charge		$Q_{RR}$	dI <sub>F</sub> /dt=100A/μs (Note 1)		2.08		μC

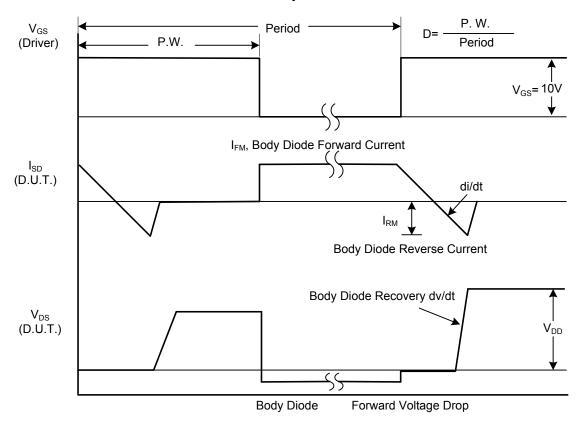
Notes: 1. Pulse Test: Pulse width ≤ 300µs, Duty cycle≤2%.

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

### **■ TEST CIRCUITS AND WAVEFORMS**

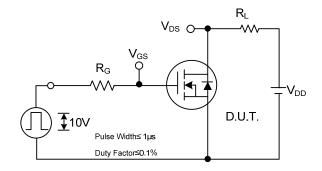


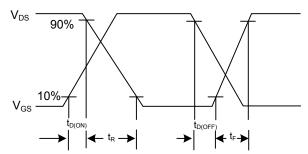
### Peak Diode Recovery dv/dt Test Circuit



Peak Diode Recovery dv/dt Waveforms

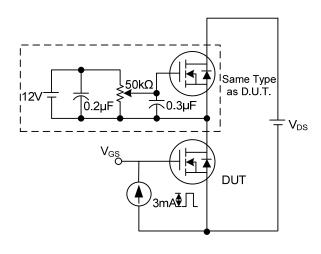
## ■ TEST CIRCUITS AND WAVEFORMS (Cont.)

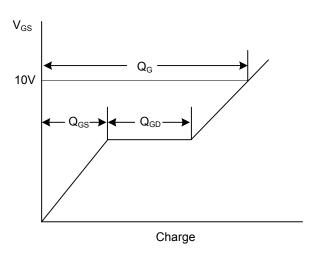




**Switching Test Circuit** 

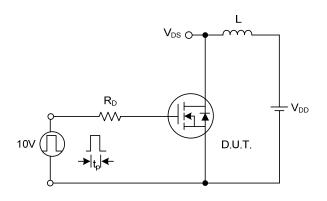
**Switching Waveforms** 

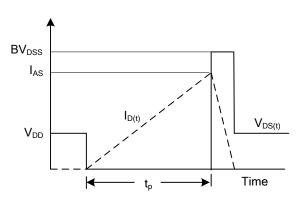




**Gate Charge Test Circuit** 

**Gate Charge Waveform** 





**Unclamped Inductive Switching Test Circuit** 

**Unclamped Inductive Switching Waveforms** 

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