

**UTC** UNISONIC TECHNOLOGIES CO., LTD

## 5N40

Preliminary

# 5 Amps, 400 Volts **N-CHANNEL POWER MOSFET**

#### DESCRIPTION

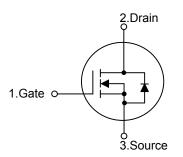
The UTC 5N40 is an N-channel mode power MOSFET using UTC's advanced technology to provide customers with planar stripe and DMOS technology. This technology specializes in allowing a minimum on-state resistance and superior switching performance. It also can withstand high energy pulse in the avalanche and commutation mode.

The UTC 5N40 is universally applied in electronic lamp ballast based on half bridge topology and high efficient switched mode power supply.

#### **FEATURES**

- \* V<sub>DS</sub> = 400V
- \* I<sub>D</sub>= 5A
- \*  $R_{DS(ON)}$ =1.4 $\Omega$  @ V<sub>GS</sub>=10V
- \* High switching speed
- \* 100% avalanche tested

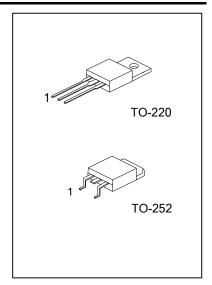
#### **SYMBOL**



#### **ORDERING INFORMATION**

	Ordering	Deekege	Pin Assignment			Deaking		
	Lead Free	Halogen Free	Package	1	2	3	Packing	
	5N40L-TA3-T	5N40G-TA3-T	TO-220	G	D	S	Tube	
	5N40L-TN3-R	5N40G-TN3-R	TO-252	G	D	S	Tape Reel	
Note: Pin Assignment: G: Gate D: Drain S: Source								
5N40L-TA3-T			(1) T: Tube, R:	Tape Re	el			

(I) I: Tube, R: Tape Reel
(2) TA3: TO-220, TN3: TO-252
(3) G: Halogen Free, L: Lead Free



### Preliminary

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

	PARAMETER	SYMBOL	RATINGS	UNIT	
Drain-Source Voltage		V <sub>DSS</sub>	400	V	
Gate-Source Voltage		V <sub>GSS</sub>	±30	V	
	Continuous (T <sub>C</sub> =25°C)	I <sub>D</sub>	5	А	
Drain Current	Pulsed (Note 2)	I <sub>DM</sub> 20		А	
Avalanche Current (No	te 2)	I <sub>AR</sub>	5	А	
Auglanska Francis	Single Pulsed (Note 3)	E <sub>AS</sub>	300	mJ	
Avalanche Energy	Repetitive (Note 2)	E <sub>AR</sub>	7.3	mJ	
Peak Diode Recovery	dv/dt (Note 4)	dv/dt			
TO-2		D	69	W	
Power Dissipation	TO-252	P <sub>D</sub>	54 W		
Junction Temperature	erature TJ +150			°C	
Storage Temperature I	Range	T <sub>STG</sub>	-55~+150	°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. Repetitive Rating: Pulse width limited by maximum junction temperature

3. L = 21.5mH,  $I_{AS}$  = 5A,  $V_{DD}$  = 50V,  $R_G$  = 25 $\Omega$ , Starting  $T_J$  = 25°C

4.  $I_{SD} \le 5A$ , di/dt  $\le 200A/\mu s$ ,  $V_{DD} \le BV_{DSS}$ , Starting  $T_J = 25^{\circ}C$ 

### THERMAL DATA

PARAMETER	SYMBOL	RATINGS	UNIT		
lunction to Ambient	TO-220	0	62.5	°C/W	
Junction to Ambient	TO-252	$\theta_{JA}$	110		
lunation to Coop	TO-220	0	1.8	°C/W	
Junction to Case	TO-252	θις	2.13		



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

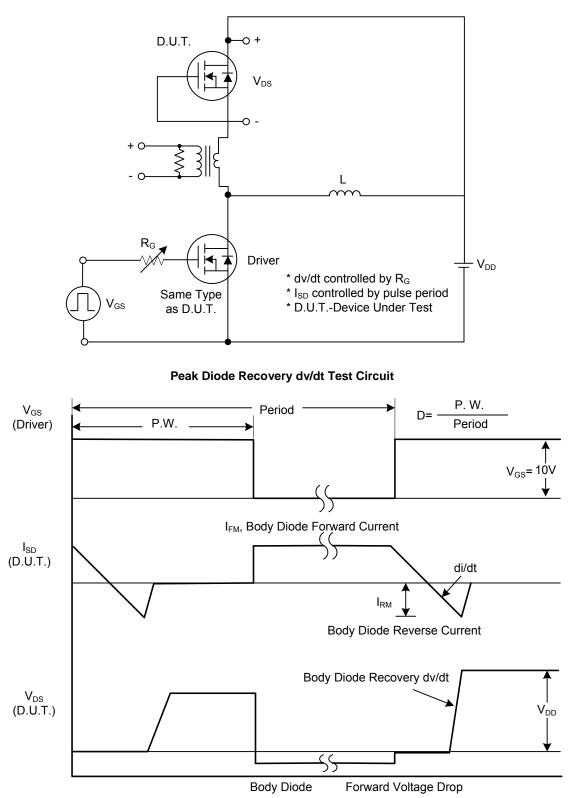
PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS							
Drain-Source Breakdown Voltage		BV <sub>DSS</sub>	I <sub>D</sub> =250μΑ, V <sub>GS</sub> =0V	400			V
Breakdown Voltage Temperature Coefficient		$\triangle BV_{DSS} / \triangle T_J$	Reference to 25°C, I <sub>D</sub> =250µA		0.4		V/°C
Drain-Source Leakage Current		I <sub>DSS</sub>	V <sub>DS</sub> =400V, V <sub>GS</sub> =0V			1	μA
Gate- Source Leakage Current	Forward	_	V <sub>GS</sub> =+30V, V <sub>DS</sub> =0V			+100	nA
Gale- Source Leakage Current	Reverse	I <sub>GSS</sub>	V <sub>GS</sub> =-30V, V <sub>DS</sub> =0V			-100	nA
ON CHARACTERISTICS							
Gate Threshold Voltage		V <sub>GS(TH)</sub>	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250µA	2.0		4.0	V
Static Drain-Source On-State Re	esistance	R <sub>DS(ON)</sub>	V <sub>GS</sub> =10V, I <sub>D</sub> =2.5A		1.14	1.4	Ω
DYNAMIC PARAMETERS		_					
Input Capacitance	nput Capacitance				480	625	pF
Output Capacitance		C <sub>ISS</sub> C <sub>OSS</sub>	V <sub>GS</sub> =0V, V <sub>DS</sub> =25V, f=1.0MHz		80	105	pF
Reverse Transfer Capacitance		C <sub>RSS</sub>			15	20	pF
SWITCHING PARAMETERS							
Total Gate Charge		$Q_{G}$			18	24	nC
Gate to Source Charge		Q <sub>GS</sub>	V <sub>GS</sub> =10V, V <sub>DS</sub> =320V, I <sub>D</sub> =5A (Note 1, 2)		2.2		nC
Gate to Drain Charge		Q <sub>GD</sub>	(Note 1, 2)		9.7		nC
Turn-ON Delay Time		t <sub>D(ON)</sub>			12	35	ns
Rise Time		t <sub>R</sub>	$V_{DD}$ =200V, $I_{D}$ =5A, $R_{G}$ =25 $\Omega$		46	100	ns
Turn-OFF Delay Time		t <sub>D(OFF)</sub>	(Note 1, 2)		50	110	ns
Fall-Time		t <sub>F</sub>			48	105	ns
SOURCE- DRAIN DIODE RATI	NGS AND	CHARACTERI	STICS				
Maximum Body-Diode Continuous Current		ls				5	Α
Maximum Body-Diode Pulsed Current		I <sub>SM</sub>				20	Α
Drain-Source Diode Forward Voltage		V <sub>SD</sub>	I <sub>S</sub> =5A, V <sub>GS</sub> =0V			1.4	V
Body Diode Reverse Recovery Time		t <sub>RR</sub>	I <sub>S</sub> =5A, V <sub>GS</sub> =0V, dI <sub>F</sub> /dt=100A/μs		263		ns
Body Diode Reverse Recovery (	Charge	Q <sub>RR</sub>	(Note 1)		1.9		μC
Notes: 1 Pulse Test: Pulse wir	1th < 200 up	Duty avala < 2					

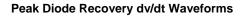
Notes: 1. Pulse Test: Pulse width  $\leq$  300µs, Duty cycle  $\leq$  2%

2. Essentially independent of operating temperature



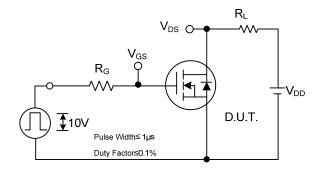
#### TEST CIRCUITS AND WAVEFORMS

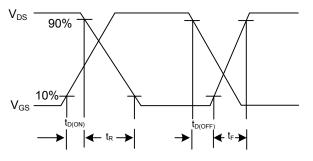


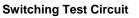




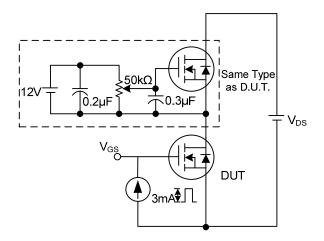
#### TEST CIRCUITS AND WAVEFORMS (Cont.)



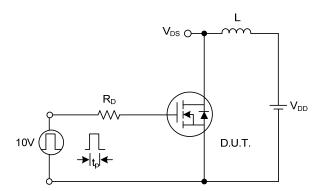




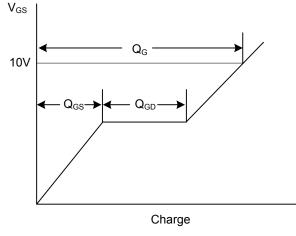




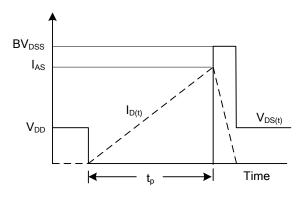
Gate Charge Test Circuit



**Unclamped Inductive Switching Test Circuit** 







**Unclamped Inductive Switching Waveforms** 



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