# UNISONIC TECHNOLOGIES CO., LTD

5N70K Preliminary Power MOSFET

## **5A, 700V N-CHANNEL POWER MOSFET**

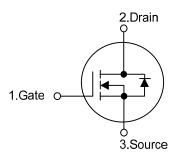
#### DESCRIPTION

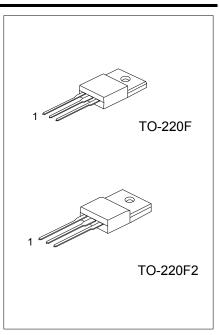
The UTC **5N70K** is a high voltage power MOSFET designed to have better characteristics, such as fast switching time, low gate charge, low on-state resistance and high rugged avalanche characteristics. This power MOSFET is usually used in high speed switching applications at power supplies, PWM motor controls, high efficient DC to DC converters and bridge circuits.

#### ■ FEATURES

- \*  $R_{DS(ON)}$  < 2.4 $\Omega$  @ $V_{GS}$  = 10 V
- \* Fast Switching Capability
- \* Improved dv/dt Capability, High Ruggedness

#### ■ SYMBOL

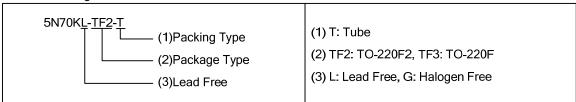




#### **■** ORDERING INFORMATION

Ordering Number		Doolsono	Pin Assignment			Doolsing	
Lead Free	Halogen Free	Package	1	2	3	Packing	
5N70KL-TF2-T	5N70KG-TF2-T	TO-220F2	G	D	S	Tube	
5N70KL-TF3-T	5N70KG-TF3-T	TO-220F	G	D	S	Tube	

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



#### ■ MARKING INFORMATION

PACKAGE	MARKING
TO-220F2 TO-220F	UTC 5N70K□ → G: Halogen Free  Lot Code  1

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

PARAMETER		SYMBOL	RATINGS	UNIT	
Drain-Source Voltage		$V_{DSS}$	700	V	
Gate-Source Voltage		$V_{GSS}$	±30	V	
Avalanche Current (Note	2)	I <sub>AR</sub>	5	Α	
Continuous Drain Current		I <sub>D</sub>	5	Α	
Pulsed Drain Current (Note 2)		$I_{DM}$	20	Α	
Avalanche Energy	Single Pulsed (Note 3)	E <sub>AS</sub>	150	1	
	Repetitive (Note 2)	E <sub>AR</sub>	10	mJ	
Peak Diode Recovery dv/dt (Note 4)		dv/dt	4.5	V/ns	
Power Dissipation	TO-220F2		36	14/	
	TO-220F	$P_D$	35	W	
Junction Temperature		$T_J$	+150	°C	
Operation Temperature		T <sub>OPR</sub>	-55~+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. Pulse width limited by  $T_{J(MAX)}$
- 3. L=12mH,  $I_{AS}$ =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
Junction to Ambient		$\theta_{JA}$	62.5	°C/W
Junction to Case	TO-220F2	0	3.47	9004
	TO-220F	θ <sub>JC</sub>	3.57	°C/W

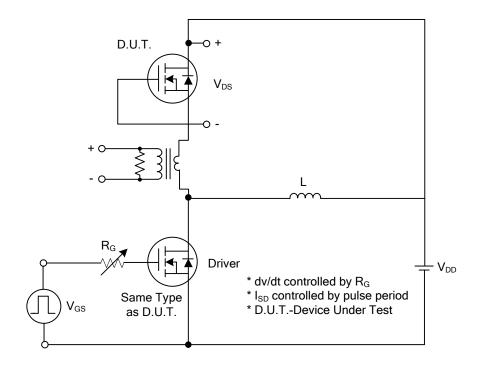
#### ■ **ELECTRICAL CHARACTERISTICS** (T<sub>C</sub> = 25°C unless otherwise specified)

PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT		
OFF CHARACTERISTICS									
Drain-Source Breakdown Voltage		BV <sub>DSS</sub>	V <sub>GS</sub> =0V, I <sub>D</sub> = 250μA	700			V		
Drain-Source Leakage Current		I <sub>DSS</sub>	V <sub>DS</sub> =700V, V <sub>GS</sub> = 0V			1	μΑ		
Gate-Source Leakage Current	Forward	I <sub>GSS</sub>	$V_{GS}$ =30V, $V_{DS}$ = 0V			100	A		
	Reverse		$V_{GS} = -30V, V_{DS} = 0V$		-100		nA		
Breakdown Voltage Temperature	Coefficient	$\Delta BV_{DSS}/\Delta T_{J}$	I <sub>D</sub> =250μA, Referenced to 25°C		0.6		V/°C		
ON CHARACTERISTICS	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 Res	istance	R <sub>DS(ON)</sub>	$V_{GS}$ =10V, $I_{D}$ = 2.5A		1.86	2.4	Ω		
DYNAMIC CHARACTERISTICS									
Input Capacitance		C <sub>ISS</sub>	.,		515	670	pF		
Output Capacitance	Output Capacitance		$V_{DS} = 25V, V_{GS} = 0V,$		55	72	pF		
Reverse Transfer Capacitance		C <sub>OSS</sub>	f = 1.0MHz		6.5	8.5	pF		
<b>SWITCHING CHARACTERISTIC</b>	S								
Turn-On Delay Time		t <sub>D(ON)</sub>	$V_{DD} = 30V, I_D = 0.5A,$ $R_G = 25\Omega$ (Note 1, 2)		50	60	ns		
Turn-On Rise Time		t <sub>R</sub>			40	60	ns		
Turn-Off Delay Time		t <sub>D(OFF)</sub>			180	210	ns		
Turn-Off Fall Time		$t_{F}$			52	100	ns		
Total Gate Charge		$Q_{G}$			18	23	nC		
Gate-Source Charge		$Q_{GS}$	$V_{DS} = 50 \text{ V}, I_D = 1.3\text{A},$		6.7		nC		
Gate-Drain Charge		$Q_GD$	V <sub>GS</sub> = 10 V (Note 1, 2)		3.9		nC		
DRAIN-SOURCE DIODE CHARA	CTERISTIC	S AND MAX	IMUM RATINGS	_			_		
Drain-Source Diode Forward Voltage		$V_{SD}$	$V_{GS} = 0 \text{ V}, I_{S} = 5\text{A}$			1.4	V		
Maximum Continuous Drain-Source Diode							۸		
Forward Current		Is				5	Α		
Maximum Pulsed Drain-Source Diode		I <sub>SM</sub>				20	Α		
Forward Current						20	А		
Reverse Recovery Time		t <sub>rr</sub>	$V_{GS} = 0V, I_S = 5A,$		300		ns		
Reverse Recovery Charge		$Q_{RR}$	d <sub>IF</sub> / dt = 100 A/μs (Note 1)		2.2		μC		

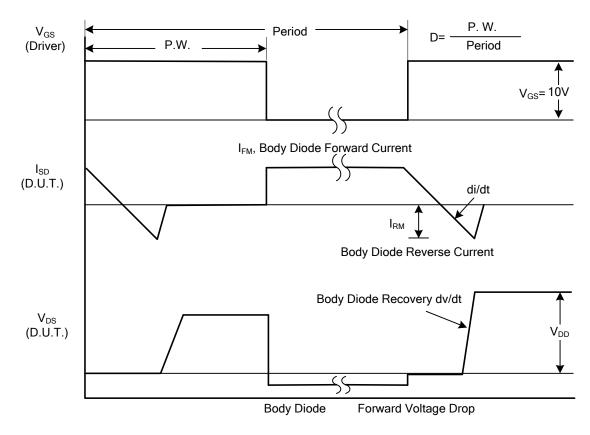
Notes: 1. Pulse Test: Pulse width ≤ 300µs, Duty cycle ≤ 2%

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

#### ■ TEST CIRCUITS AND WAVEFORMS

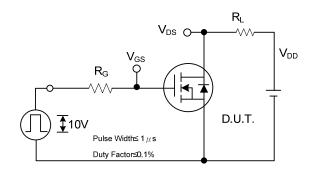


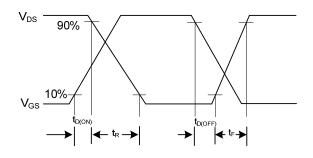
Peak Diode Recovery dv/dt Test Circuit



Peak Diode Recovery dv/dt Waveforms

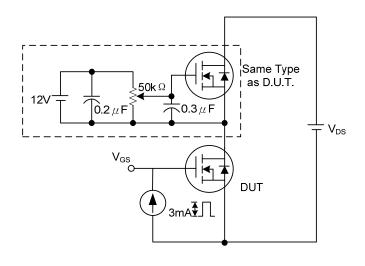
### ■ TEST CIRCUITS AND WAVEFORMS (Cont.)

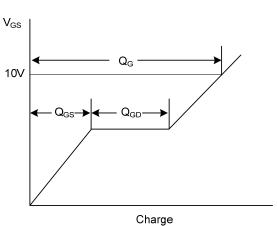




**Switching Test Circuit** 

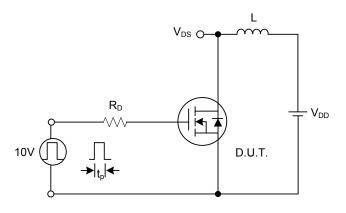
**Switching Waveforms** 

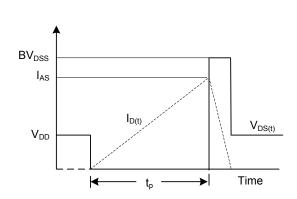




**Gate Charge Test Circuit** 

**Gate Charge Waveform** 





**Unclamped Inductive Switching Test Circuit** 

**Unclamped Inductive Switching Waveforms** 

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