



# 5N70K-MT

Power MOSFET

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

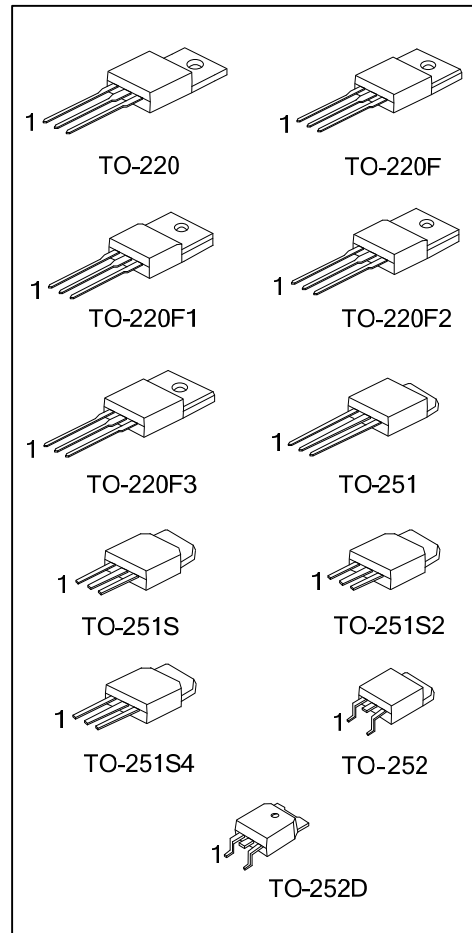
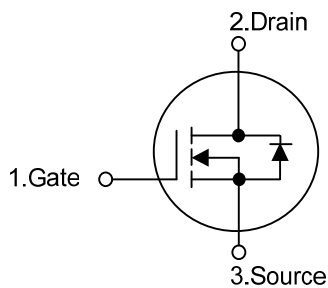
### DESCRIPTION

The UTC **5N70K-MT** 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

- \*  $R_{DS(ON)} < 2.4\Omega$  @  $V_{GS} = 10V, I_D = 2.5 A$
- \* Fast Switching Capability
- \* Improved  $dv/dt$  Capability, High Ruggedness

### SYMBOL



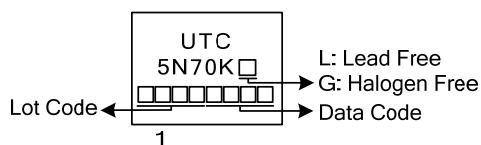
### ORDERING INFORMATION

Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
5N70KL-TA3-T	5N70KG-TA3-T	TO-220	G	D	S	Tube
5N70KL-TF3-T	5N70KG-TF3-T	TO-220F	G	D	S	Tube
5N70KL-TF1-T	5N70KG-TF1-T	TO-220F1	G	D	S	Tube
5N70KL-TF2-T	5N70KG-TF2-T	TO-220F2	G	D	S	Tube
5N70KL-TF3-T	5N70KG-TF3-T	TO-220F3	G	D	S	Tube
5N70KL-TM3-T	5N70KG-TM3-T	TO-251	G	D	S	Tube
5N70KL-TMS-T	5N70KG-TMS-T	TO-251S	G	D	S	Tube
5N70KL-TMS2-T	5N70KG-TMS2-T	TO-251S2	G	D	S	Tube
5N70KL-TMS4-T	5N70KG-TMS4-T	TO-251S4	G	D	S	Tube
5N70KL-TN3-R	5N70KG-TN3-R	TO-252	G	D	S	Tape Reel
5N70KL-TND-R	5N70KG-TND-R	TO-252D	G	D	S	Tape Reel

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

<p>5N70KL-TA3-T</p> <p>(1) Packing Type</p> <p>(2) Package Type</p> <p>(3) Green Package</p>	<p>(1) T: Tube, R: Tape Reel</p> <p>(2) TA3: TO-220, TF3: TO-220F, TF1: TO-220F1, TF2: TO-220F2, TF3: TO-220F3, TM3: TO-251 TMS: TO-251S, TMS2: TO-251S2, TMS4: TO-251S4, TN3: TO-252, TND: TO-252D</p> <p>(3) L: Lead Free, G: Halogen Free and Lead Free</p>
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### MARKING



■ ABSOLUTE MAXIMUM RATINGS ( $T_C = 25^\circ\text{C}$ , unless otherwise specified)

PARAMETER		SYMBOL	RATINGS	UNIT
Drain-Source Voltage		$V_{DSS}$	700	V
Gate-Source Voltage		$V_{GSS}$	$\pm 30$	V
Avalanche Current (Note 2)		$I_{AR}$	5	A
Continuous Drain Current		$I_D$	5	A
Pulsed Drain Current (Note 2)		$I_{DM}$	20	A
Avalanche Energy	Single Pulsed (Note 3)	$E_{AS}$	150	mJ
	Repetitive (Note 2)	$E_{AR}$	10	
Peak Diode Recovery dv/dt (Note 4)		dv/dt	4.5	V/ns
Power Dissipation	TO-220	$P_D$	108	W
	TO-220F/TO-220F1		36	W
	TO-220F3			
	TO-220F2		38	W
	TO-251/TO-251S TO-251S2/TO-251S4 TO-252/TO-252D		54	W
Junction Temperature		$T_J$	+150	$^\circ\text{C}$
Operation Temperature		$T_{OPR}$	-55~+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. Pulse width limited by  $T_{J(MAX)}$

3.  $L=12\text{mH}$ ,  $I_{AS}=5\text{A}$ ,  $V_{DD}=50\text{V}$ ,  $R_G=25\ \Omega$ , Starting  $T_J = 25^\circ\text{C}$

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

■ THERMAL DATA

PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Ambient	TO-220/TO-220F TO-220F1/TO-220F2 TO-220F3	$\theta_{JA}$	62.5	$^\circ\text{C}/\text{W}$
	TO-251/TO-251S TO-251S2/TO-251S4 TO-252/TO-252D		110	$^\circ\text{C}/\text{W}$
Junction to Case	TO-220	$\theta_{JC}$	1.15	$^\circ\text{C}/\text{W}$
	TO-220F/TO-220F1		3.47	$^\circ\text{C}/\text{W}$
	TO-220F3			
	TO-220F2		3.28	$^\circ\text{C}/\text{W}$
	TO-251/TO-251S TO-251S2/TO-251S4 TO-252/TO-252D		2.30	$^\circ\text{C}/\text{W}$

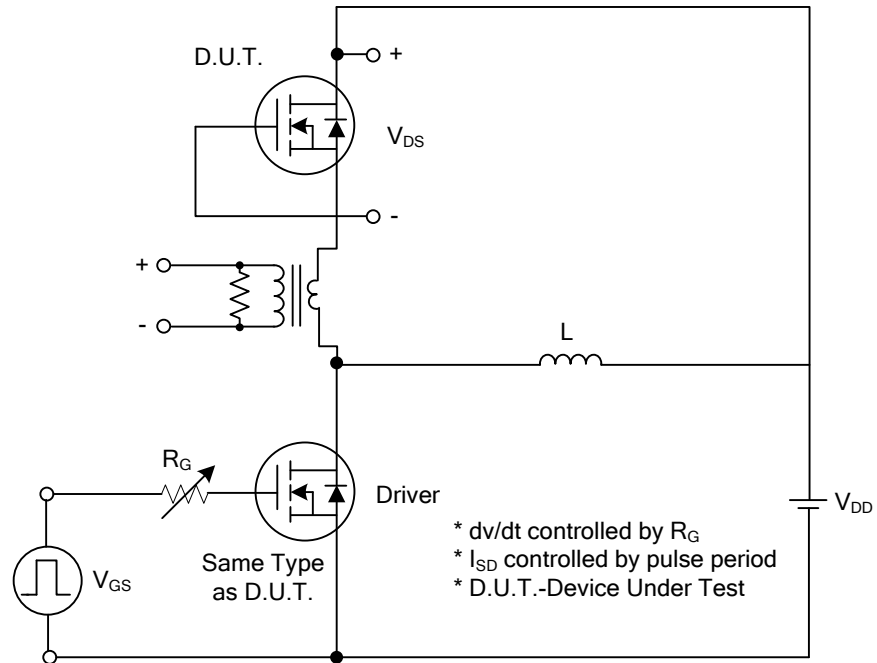
■ ELECTRICAL CHARACTERISTICS (T<sub>C</sub> = 25°C unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
<b>OFF CHARACTERISTICS</b>						
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	μA
Gate-Source Leakage Current	Forward	I <sub>GSS</sub> V <sub>GS</sub> = 30V, V <sub>DS</sub> = 0V V <sub>GS</sub> = -30V, V <sub>DS</sub> = 0V			100	nA
	Reverse				-100	
Breakdown Voltage Temperature Coefficient	ΔBV <sub>DSS</sub> /ΔT <sub>J</sub>	I <sub>D</sub> = 250μA, Referenced to 25°C		0.6		V/°C
<b>ON CHARACTERISTICS</b>						
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 Resistance	R <sub>DS(ON)</sub>	V <sub>GS</sub> = 10V, I <sub>D</sub> = 2.5A		1.86	2.4	Ω
<b>DYNAMIC CHARACTERISTICS</b>						
Input Capacitance	C <sub>ISS</sub>	V <sub>DS</sub> = 25V, V <sub>GS</sub> = 0V, f = 1.0MHz		515	670	pF
Output Capacitance	C <sub>OSS</sub>			55	72	pF
Reverse Transfer Capacitance	C <sub>RSS</sub>			6.5	8.5	pF
<b>SWITCHING CHARACTERISTICS</b>						
Turn-On Delay Time	t <sub>D(ON)</sub>	V <sub>DD</sub> = 30V, I <sub>D</sub> = 0.5A, R <sub>G</sub> = 25Ω (Note 1, 2)		50		ns
Turn-On Rise Time	t <sub>R</sub>			40		ns
Turn-Off Delay Time	t <sub>D(OFF)</sub>			180		ns
Turn-Off Fall Time	t <sub>F</sub>			52		ns
Total Gate Charge	Q <sub>G</sub>	V <sub>DS</sub> = 50 V, I <sub>D</sub> = 1.3A, V <sub>GS</sub> = 10 V (Note 1, 2)		18	23	nC
Gate-Source Charge	Q <sub>GS</sub>			6.7		nC
Gate-Drain Charge	Q <sub>GD</sub>			3.9		nC
<b>DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS</b>						
Drain-Source Diode Forward Voltage	V <sub>SD</sub>	V <sub>GS</sub> = 0 V, I <sub>S</sub> = 5A			1.4	V
Maximum Continuous Drain-Source Diode Forward Current	I <sub>S</sub>				5	A
Maximum Pulsed Drain-Source Diode Forward Current	I <sub>SM</sub>				20	A

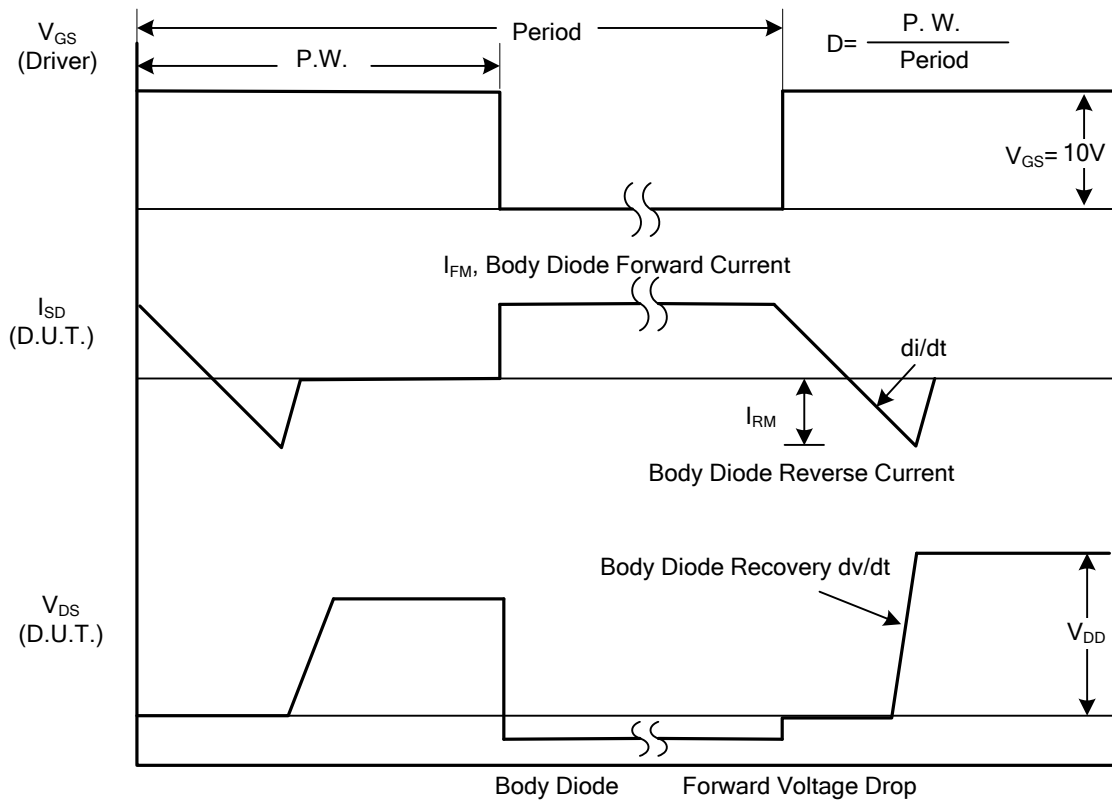
Notes: 1. Pulse Test: Pulse width ≤ 300μs, Duty cycle ≤ 2%

2. Essentially independent of operating temperature

## TEST CIRCUITS AND WAVEFORMS

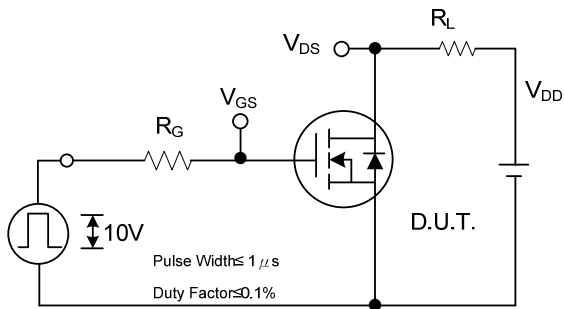


Peak Diode Recovery dv/dt Test Circuit

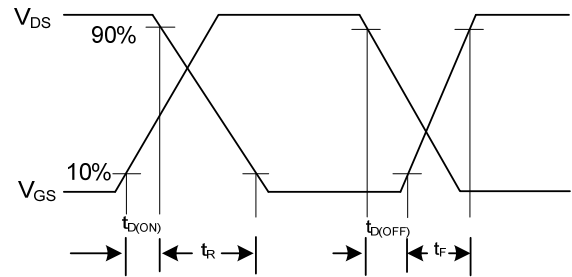


Peak Diode Recovery dv/dt Waveforms

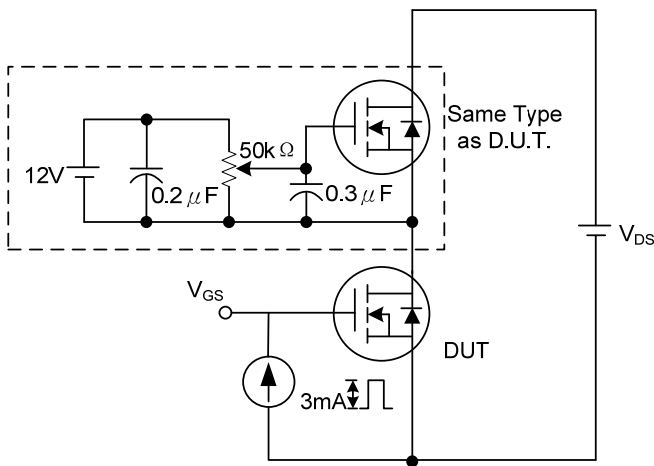
## TEST CIRCUITS AND WAVEFORMS (Cont.)



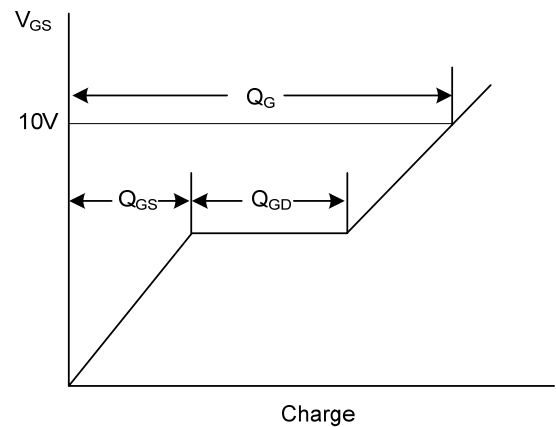
**Switching Test Circuit**



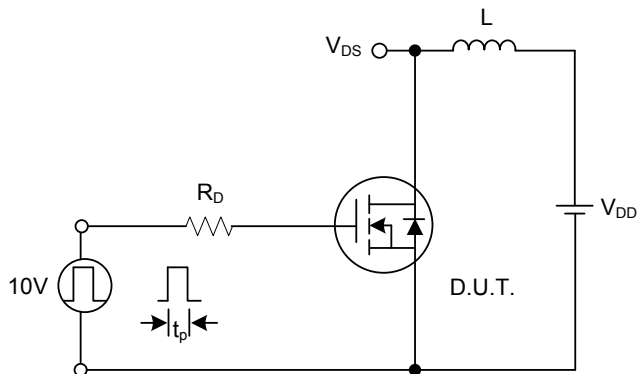
**Switching Waveforms**



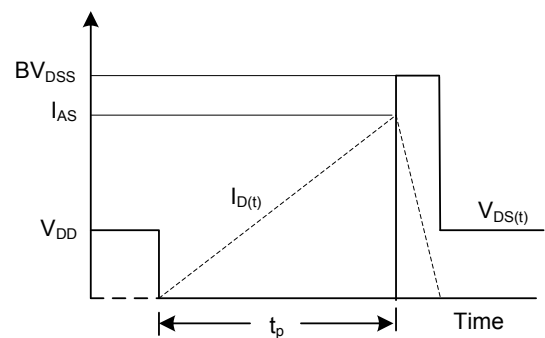
**Gate Charge Test Circuit**



**Gate Charge Waveform**



**Unclamped Inductive Switching Test Circuit**



**Unclamped Inductive Switching Waveforms**

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