



# 5N50K-MTQ

Power MOSFET

## 5A, 500V N-CHANNEL POWER MOSFET

### DESCRIPTION

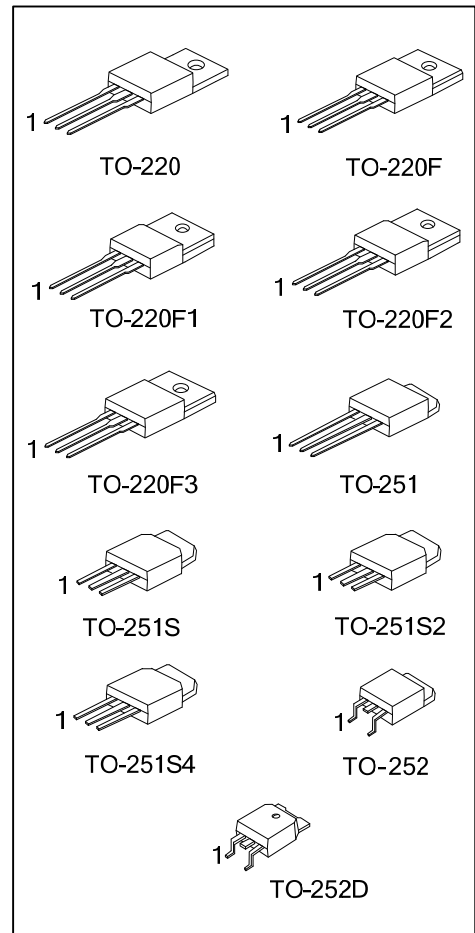
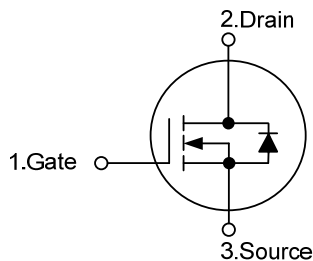
The UTC **5N50K-MTQ** is an N-channel power MOSFET adopting UTC's advanced technology to provide customers with DMOS, planar stripe technology. This technology is designed to meet the requirements of the minimum on-state resistance and perfect switching performance. It also can withstand high energy pulse in the avalanche and communication mode.

The UTC **5N50K-MTQ** can be used in applications, such as active power factor correction, high efficiency switched mode power supplies, electronic lamp ballasts based on half bridge topology.

### FEATURES

- \*  $R_{DS(ON)} < 1.5\Omega @ V_{GS}=10V, I_D=2.5A$
- \* 100% avalanche tested
- \* High switching speed

### SYMBOL



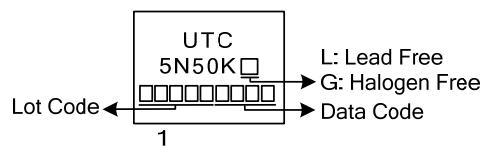
### ORDERING INFORMATION

Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
5N50KL-TA3-T	5N50KG-TA3-T	TO-220	G	D	S	Tube
5N50KL-TF3-T	5N50KG-TF3-T	TO-220F	G	D	S	Tube
5N50KL-TF1-T	5N50KG-TF1-T	TO-220F1	G	D	S	Tube
5N50KL-TF2-T	5N50KG-TF2-T	TO-220F2	G	D	S	Tube
5N50KL-TF3-T	5N50KG-TF3-T	TO-220F3	G	D	S	Tube
5N50KL-TM3-T	5N50KG-TM3-T	TO-251	G	D	S	Tube
5N50KL-TMS-T	5N50KG-TMS-T	TO-251S	G	D	S	Tube
5N50KL-TMS2-T	5N50KG-TMS2-T	TO-251S2	G	D	S	Tube
5N50KL-TMS4-T	5N50KG-TMS4-T	TO-251S4	G	D	S	Tube
5N50KL-TN3-R	5N50KG-TN3-R	TO-252	G	D	S	Tape Reel
5N50KL-TND-R	5N50KG-TND-R	TO-252D	G	D	S	Tape Reel

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

<p>5N50KL-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		$V_{DSS}$	500	V
Gate-Source Voltage		$V_{GSS}$	$\pm 30$	V
Drain Current	Continuous	$I_D$	5	A
	Pulsed (Note 2)	$I_{DM}$	20	A
Avalanche Current (Note 2)		$I_{AR}$	5	A
Avalanche Energy	Single Pulsed (Note 3)	$E_{AS}$	155	mJ
	Repetitive (Note 2)	$E_{AR}$	7.3	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	4.5	V/ns
Power Dissipation	TO-220	$P_D$	78	W
	TO-220F/TO-220F1		36	W
	TO-220F3			
	TO-220F2		29	W
	TO-251/TO-251S TO-251S2/TO-251S4 TO-252/TO-252D		54	W
Junction Temperature		$T_J$	+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. Repetitive Rating: Pulse width limited by maximum junction temperature

3.  $L = 12.4\text{mH}$ ,  $I_{AS} = 5\text{A}$ ,  $V_{DD} = 50\text{V}$ ,  $R_G = 25\Omega$ , 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	$\theta_{JC}$	1.16	$^\circ\text{C}/\text{W}$
	TO-220F/TO-220F1 TO-220F3		4.2	$^\circ\text{C}/\text{W}$
	TO-220F2		4.18	$^\circ\text{C}/\text{W}$
	TO-251/TO-251S TO-251S2/TO-251S4 TO-252/TO-252D		2.3	$^\circ\text{C}/\text{W}$

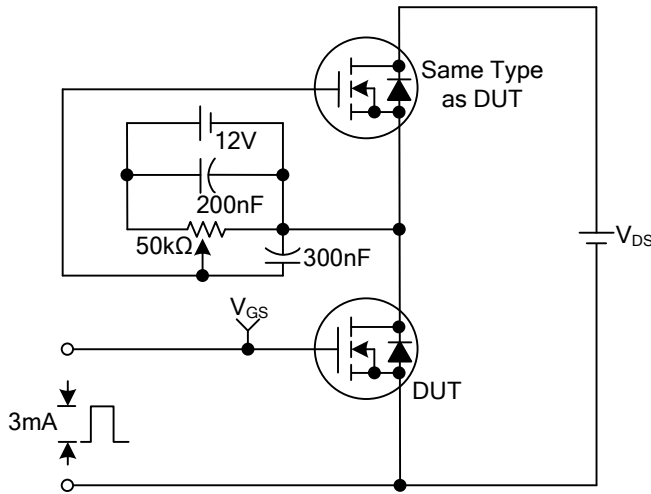
■ ELECTRICAL CHARACTERISTICS ( $T_C=25^\circ\text{C}$ , unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
<b>OFF CHARACTERISTICS</b>						
Drain-Source Breakdown Voltage	$BV_{DSS}$	$I_D=250\mu\text{A}$ , $V_{GS}=0\text{V}$	500			V
Breakdown Voltage Temperature Coefficient	$\Delta BV_{DSS}/\Delta T_J$	Reference to $25^\circ\text{C}$ , $I_D=250\mu\text{A}$		0.5		$\text{V}/^\circ\text{C}$
Drain-Source Leakage Current	$I_{DSS}$	$V_{DS}=500\text{V}$ , $V_{GS}=0\text{V}$			1	$\mu\text{A}$
		$V_{DS}=400\text{V}$ , $T_C=125^\circ\text{C}$			10	
Gate- Source Leakage Current	Forward	$V_{GS}=30\text{V}$ , $V_{DS}=0\text{V}$			100	nA
	Reverse	$V_{GS}=-30\text{V}$ , $V_{DS}=0\text{V}$			-100	nA
<b>ON CHARACTERISTICS</b>						
Gate Threshold Voltage	$V_{GS(TH)}$	$V_{DS}=V_{GS}$ , $I_D=250\mu\text{A}$	2.5		4.5	V
Static Drain-Source On-State Resistance	$R_{DS(ON)}$	$V_{GS}=10\text{V}$ , $I_D=2.5\text{A}$		1.2	1.5	$\Omega$
<b>DYNAMIC PARAMETERS</b>						
Input Capacitance	$C_{ISS}$	$V_{GS}=0\text{V}$ , $V_{DS}=25\text{V}$ , $f=1.0\text{MHz}$		400		pF
Output Capacitance	$C_{OSS}$			71		pF
Reverse Transfer Capacitance	$C_{RSS}$			7.9		pF
<b>SWITCHING PARAMETERS</b>						
Turn-ON Delay Time	$t_{D(ON)}$	$V_{DD}=30\text{V}$ , $I_D=0.5\text{A}$ , $R_G=25\Omega$ (Note 1, 2)		45		ns
Rise Time	$t_R$			50		ns
Turn-OFF Delay Time	$t_{D(OFF)}$			49		ns
Fall-Time	$t_F$			44		ns
Total Gate Charge	$Q_G$	$V_{GS}=10\text{V}$ , $V_{DS}=50\text{V}$ , $I_D=1.3\text{A}$ (Note 1, 2)		21.6		nC
Gate to Source Charge	$Q_{GS}$			5.4		nC
Gate to Drain Charge	$Q_{GD}$			5.2		nC
<b>SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS</b>						
Maximum Continuous Drain-Source Diode Forward Current	$I_S$				5	A
Maximum Pulsed Drain-Source Diode Forward Current	$I_{SM}$				20	A
Drain-Source Diode Forward Voltage	$V_{SD}$	$I_S=5\text{A}$ , $V_{GS}=0\text{V}$			1.4	V
Reverse Recovery Time	$t_{rr}$	$I_S=5\text{A}$ , $V_{GS}=0\text{V}$ ,		263		ns
Reverse Recovery Charge	$Q_{RR}$	$di_f/dt=100\text{A}/\mu\text{s}$ (Note 1)		1.9		$\mu\text{C}$

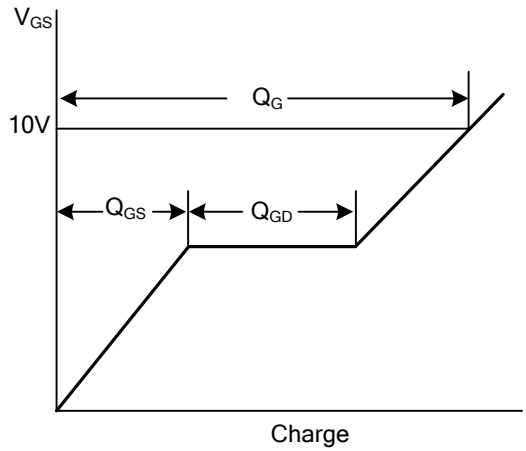
Notes: 1. Pulse Test: Pulse width  $\leq 300\mu\text{s}$ , Duty cycle  $\leq 2\%$

2. Essentially independent of operating temperature.

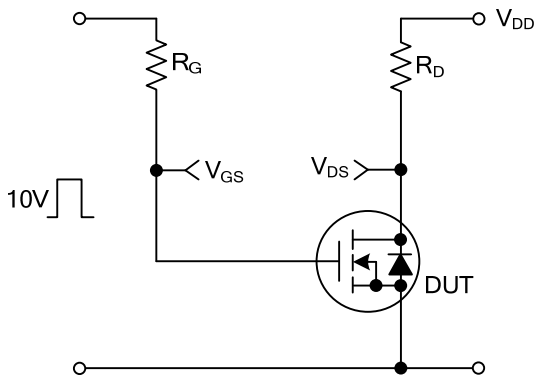
## TEST CIRCUITS AND WAVEFORMS



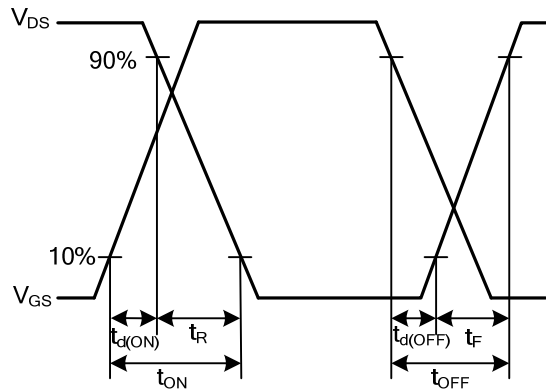
Gate Charge Test Circuit



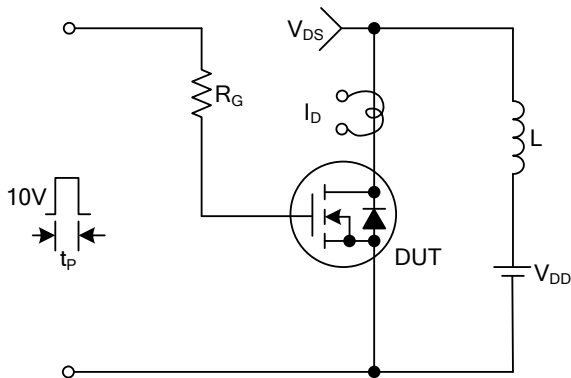
Gate Charge Waveforms



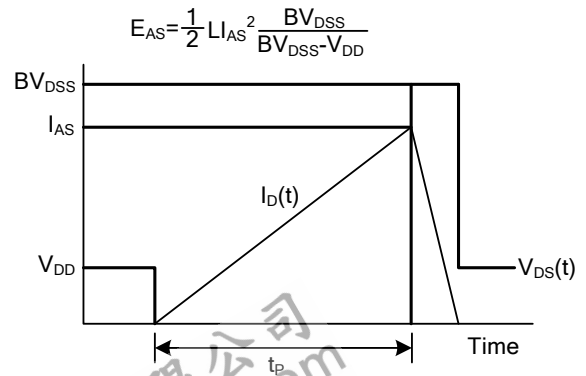
Resistive Switching Test Circuit



Resistive Switching Waveforms

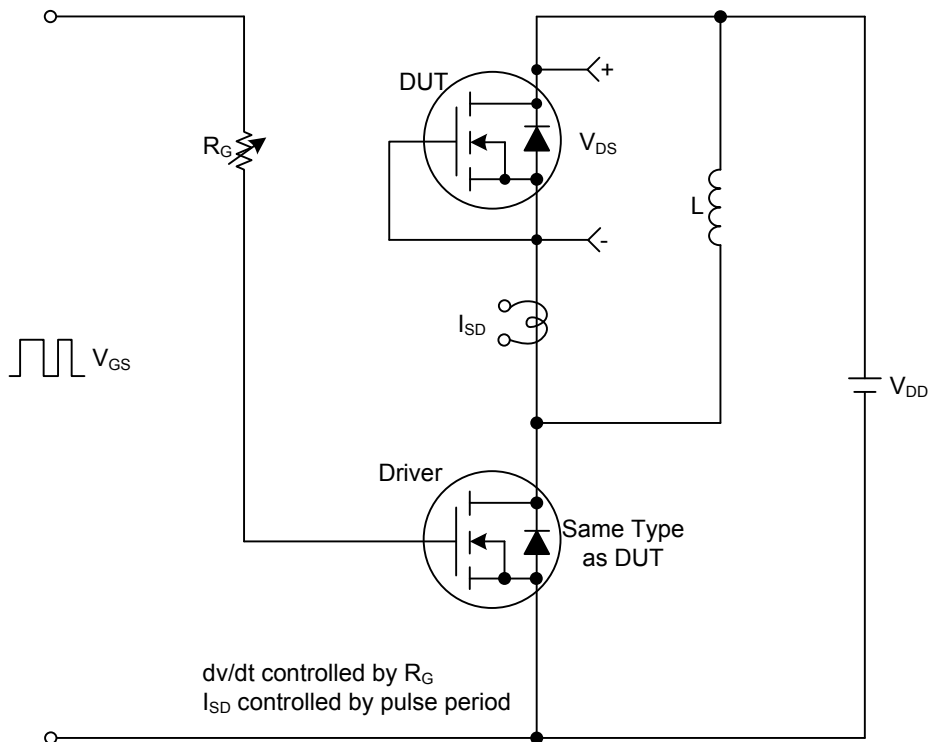


Unclamped Inductive Switching Test Circuit

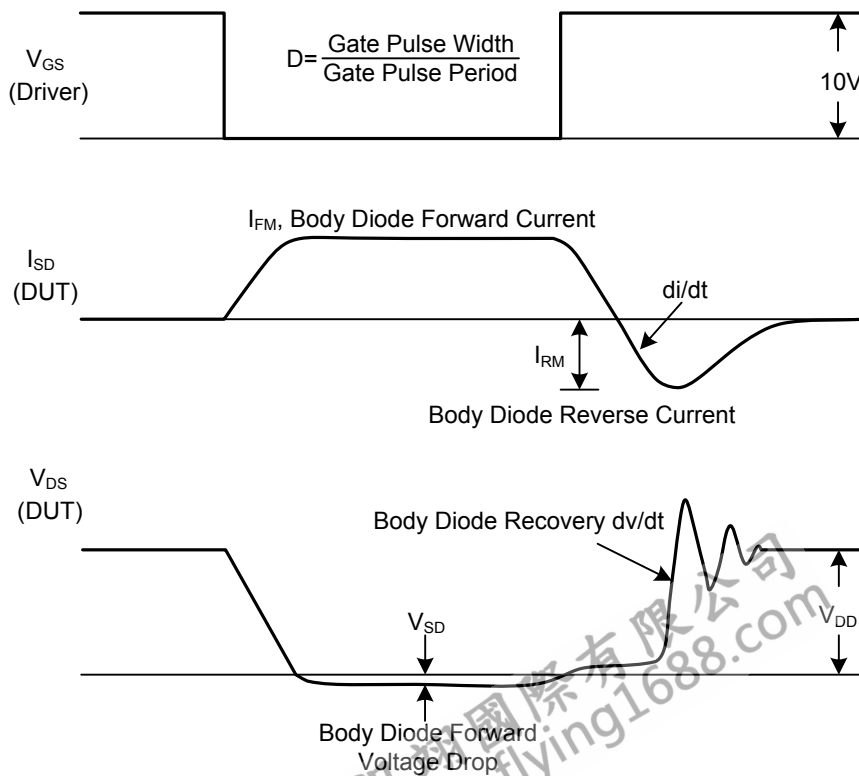


Unclamped Inductive Switching Waveforms

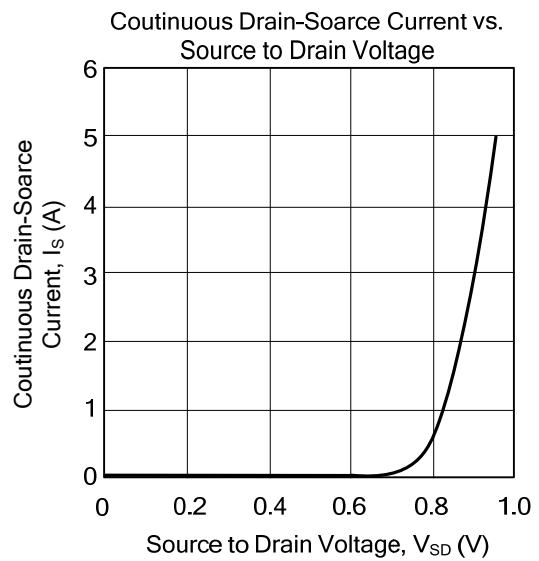
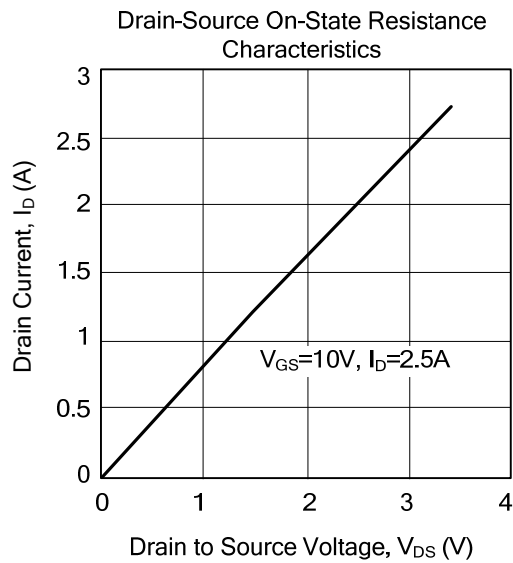
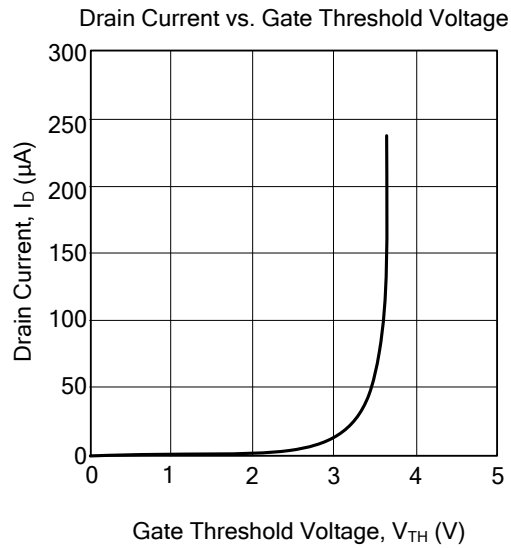
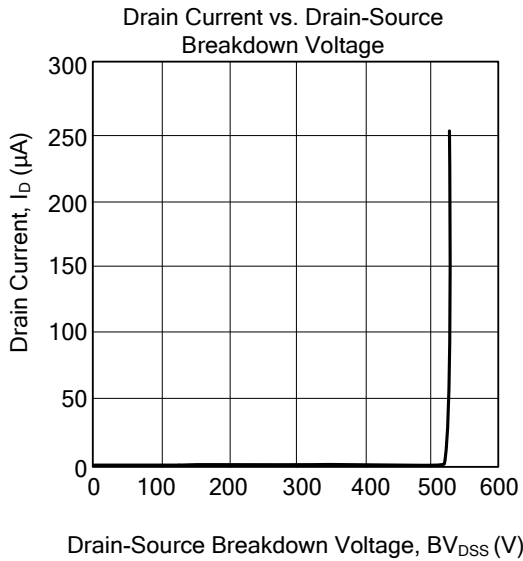
■ TEST CIRCUITS AND WAVEFORMS(Cont.)



Peak Diode Recovery dv/dt Test Circuit & Waveforms



### TYPICAL CHARACTERISTICS



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