

# UNISONIC TECHNOLOGIES CO., LTD

## 10N60K

### Power MOSFET

## 10A, 600V N-CHANNEL POWER MOSFET

### DESCRIPTION

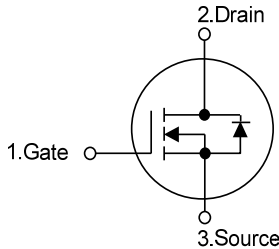
The UTC **10N60K** is an N-channel Power MOSFET using UTC's advanced technology to provide customers a minimum on-state resistance and superior switching performance, etc.

The UTC **10N60K** is generally applied in high efficient DC to DC converters, PWM motor controls and bridge circuits, etc.

### FEATURES

- \*  $R_{DS(ON)} < 1.2\Omega @ V_{GS} = 10V$
- \* Low Gate Charge (Typical 90nC)
- \* Low  $C_{RSS}$  ( typical 18 pF)
- \* High Switching Speed
- \* Improved dv/dt capability

### SYMBOL

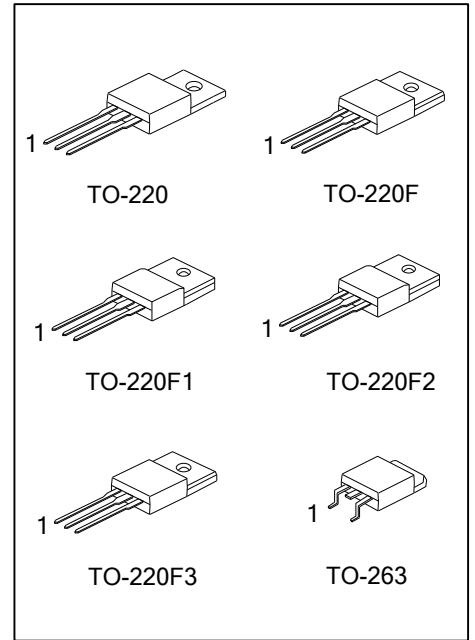


### ORDERING INFORMATION

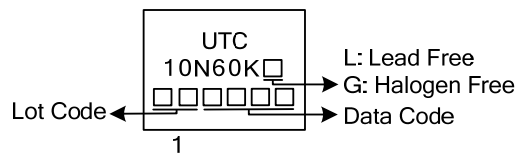
Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
10N60KL-TA3-T	10N60KG-TA3-T	TO-220	G	D	S	Tube
10N60KL-TF3-T	10N60KG-TF3-T	TO-220F	G	D	S	Tube
10N60KL-TF1-T	10N60KG-TF1-T	TO-220F1	G	D	S	Tube
10N60KL-TF2-T	10N60KG-TF2-T	TO-220F2	G	D	S	Tube
10N60KL-TF3T-T	10N60KG-TF3T-T	TO-220F3	G	D	S	Tube
10N60KL-TQ2-T	10N60KG-TQ2-T	TO-263	G	D	S	Tube
10N60KL-TQ2-R	10N60KG-TQ2-R	TO-263	G	D	S	Tape Reel

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

<p>10N60KL-TA3-T</p> <p>(1) Packing Type (2) Package Type (3) Green Package</p>	<p>(1) T: Tube (2) TA3: TO-220, TF3: TO-220F, TF1: TO-220F1 TF2: TO-220F2, TF3T: TO-220F3, TQ2: TO-263 (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		$V_{DSS}$	600	V
Gate-Source Voltage		$V_{GSS}$	$\pm 30$	V
Avalanche Current (Note 2)		$I_{AR}$	10	A
Drain Current	Continuous	$I_D$	10	A
	Pulsed (Note 2)	$I_{DM}$	38	A
Avalanche Energy	Single Pulsed (Note 3)	$E_{AS}$	300	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	4.5	V/ns
Power Dissipation	TO-220/TO-263	$P_D$	156	W
	TO-220F/TO-220F1		50	W
	TO-220F3			
	TO-220F2		52	W
Junction Temperature		$T_J$	+150	$^\circ\text{C}$
Operating 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. Repetitive Rating: Pulse width limited by maximum junction temperature

3.  $L=6\text{mH}$ ,  $I_{AS}=10\text{A}$ ,  $V_{DD}=50\text{V}$ ,  $R_G=25\ \Omega$ , Starting  $T_J = 25^\circ\text{C}$

4.  $I_{SD}\leq 9.5\text{A}$ ,  $di/dt\leq 200\text{A}/\mu\text{s}$ ,  $V_{DD}\leq BV_{DSS}$ , Starting  $T_J = 25^\circ\text{C}$

■ THERMAL DATA

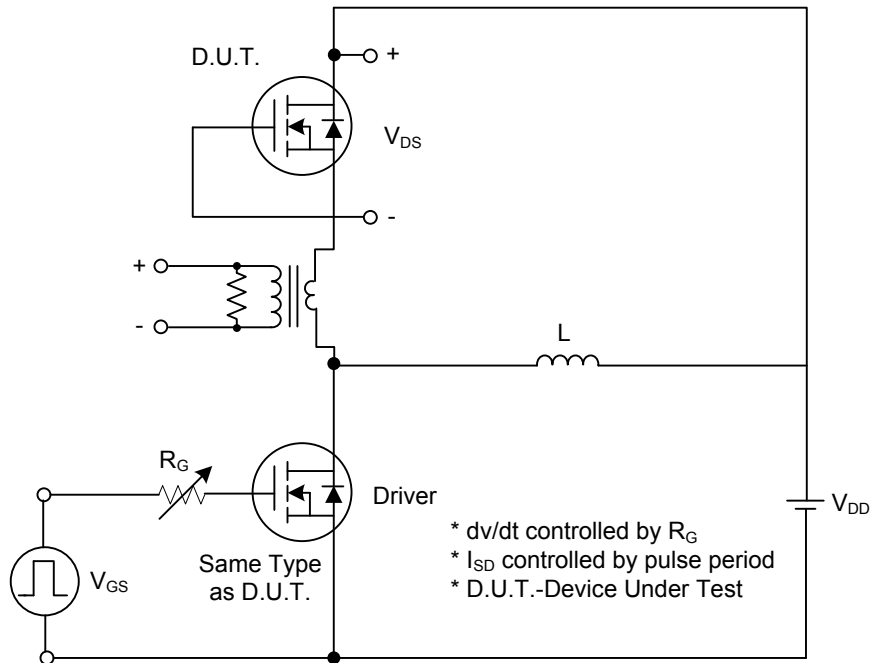
PARAMETER		SYMBOL	RATING	UNIT
Junction to Ambient		$\theta_{JA}$	62.5	$^\circ\text{C}/\text{W}$
Junction to Case	TO-220/TO-263	$\theta_{JC}$	0.8	$^\circ\text{C}/\text{W}$
	TO-220F/TO-220F1		2.5	$^\circ\text{C}/\text{W}$
	TO-220F3			
	TO-220F2		2.4	$^\circ\text{C}/\text{W}$

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

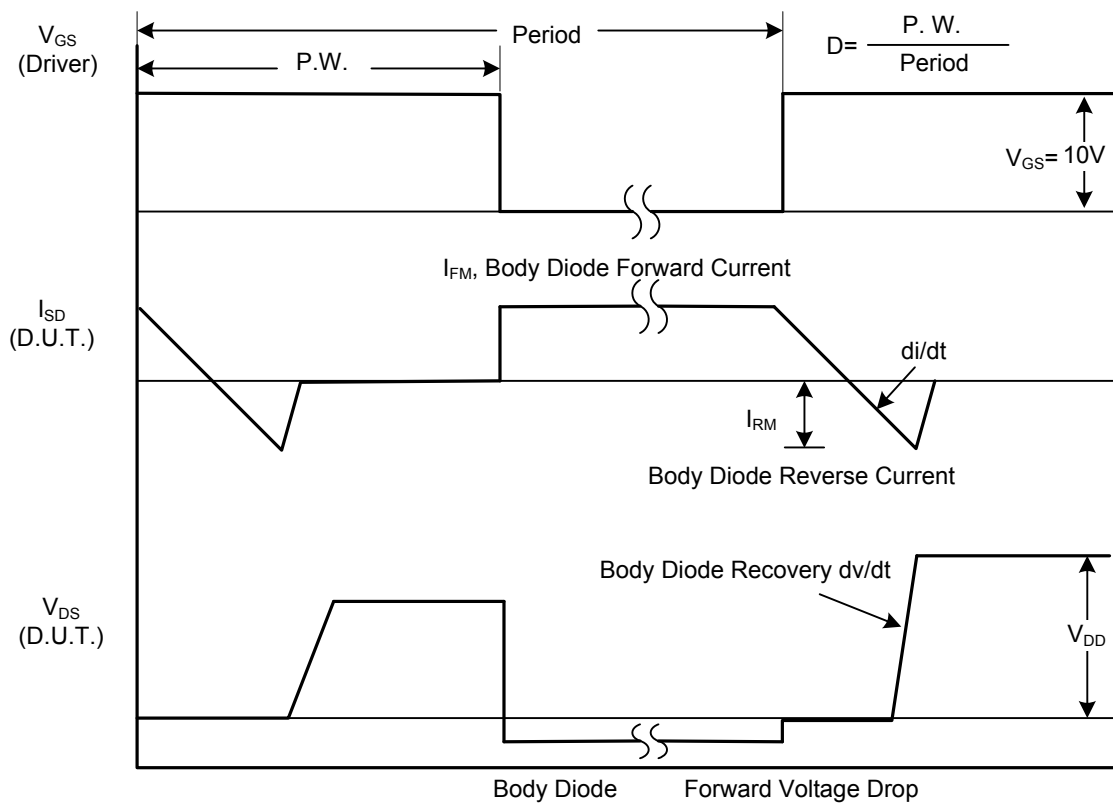
PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
<b>OFF CHARACTERISTICS</b>						
Drain-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS} = 0\text{V}, I_D = 250\mu\text{A}$	600			V
Drain-Source Leakage Current	$I_{DSS}$	$V_{DS} = 600\text{V}, V_{GS} = 0\text{V}$			1	$\mu\text{A}$
		$V_{DS} = 480\text{V}, V_{GS} = 0\text{V}, T_C=125^{\circ}\text{C}$			10	$\mu\text{A}$
Gate-Source Leakage Current	Forward	$I_{GSS}$			100	nA
	Reverse					
		$V_{GS} = -30\text{V}, V_{DS} = 0\text{V}$			-100	nA
Breakdown Voltage Temperature Coefficient	$\Delta BV_{DSS}/\Delta T_J$	$I_D=250\mu\text{A}$ , Referenced to $25^{\circ}\text{C}$		0.7		$\text{V}/^{\circ}\text{C}$
<b>ON CHARACTERISTICS</b>						
Gate Threshold Voltage	$V_{GS(TH)}$	$V_{DS} = V_{GS}, I_D = 250\mu\text{A}$	2.0		4.0	V
Static Drain-Source On-State Resistance	$R_{DS(ON)}$	$V_{GS} = 10\text{V}, I_D = 5\text{A}$	0.5	0.8	1.2	$\Omega$
<b>DYNAMIC CHARACTERISTICS</b>						
Input Capacitance	$C_{ISS}$	$V_{DS}=25\text{V}, V_{GS}=0\text{V}, f=1.0\text{MHz}$		1000	2040	pF
Output Capacitance	$C_{OSS}$			125	215	pF
Reverse Transfer Capacitance	$C_{RSS}$			18	24	pF
<b>SWITCHING CHARACTERISTICS</b>						
Total Gate Charge	$Q_G$	$V_{DS}=480\text{V}, I_D=10\text{A}, V_{GS}=10\text{V}$ (Note 1, 2)		90	120	nC
Gate-Source Charge	$Q_{GS}$			20		nC
Gate-Drain Charge	$Q_{GD}$			22		nC
Turn-On Delay Time	$t_{D(ON)}$	$V_{DD}=300\text{V}, I_D = 10\text{A}, R_G = 25\Omega$ (Note 1, 2)		50	70	ns
Turn-On Rise Time	$t_R$			69	150	ns
Turn-Off Delay Time	$t_{D(OFF)}$			230	260	ns
Turn-Off Fall Time	$t_F$			88	105	ns
<b>DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS</b>						
Drain-Source Diode Forward Voltage	$V_{SD}$	$V_{GS} = 0\text{V}, I_S = 10\text{A}$			1.4	V
Maximum Continuous Drain-Source Diode Forward Current	$I_S$				10	A
Maximum Pulsed Drain-Source Diode Forward Current	$I_{SM}$				38	A
Reverse Recovery Time	$t_{rr}$	$V_{GS} = 0\text{V}, I_S = 10\text{A},$		420		ns
Reverse Recovery Charge	$Q_{RR}$	$di_F / dt = 100\text{A}/\mu\text{s}$ (Note 1)		4.2		$\mu\text{C}$

Note: 1. Pulse Test: Pulse width  $\leq 300\mu\text{s}$ , Duty cycle  $\leq 2\%$   
 2. Essentially independent of operating temperature.

## TEST CIRCUITS AND WAVEFORMS

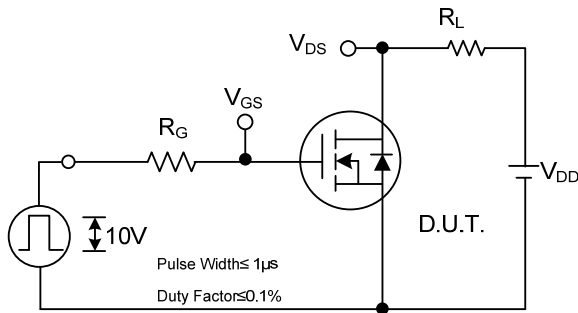


**Peak Diode Recovery  $dv/dt$  Test Circuit**

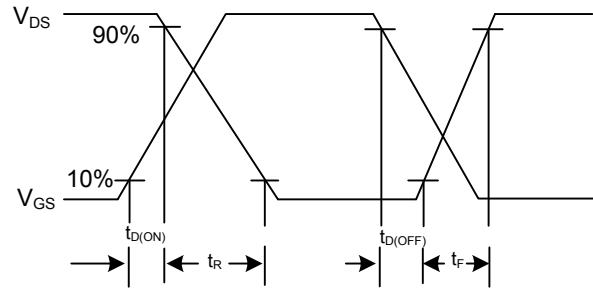


**Peak Diode Recovery  $dv/dt$  Waveforms**

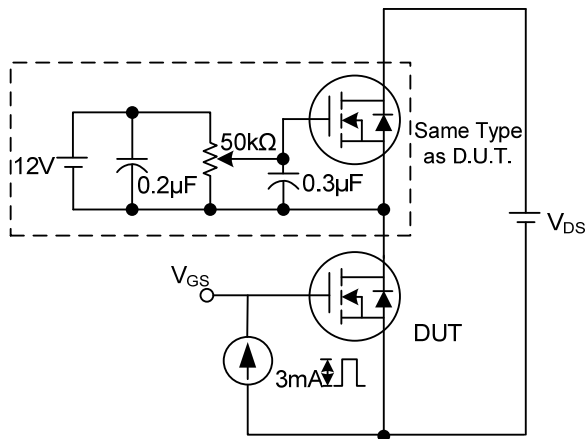
## TEST CIRCUITS AND WAVEFORMS (Cont.)



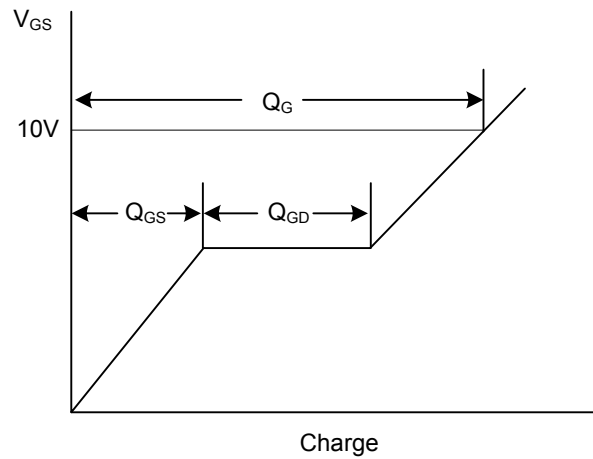
**Switching Test Circuit**



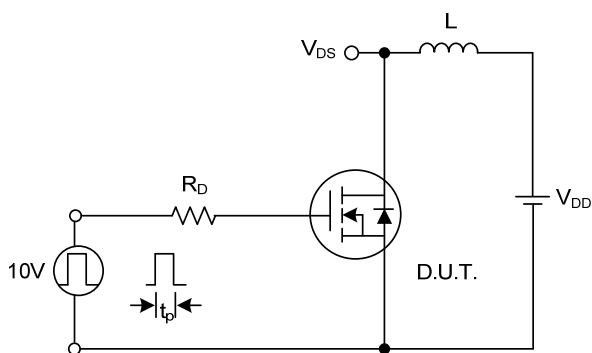
**Switching Waveforms**



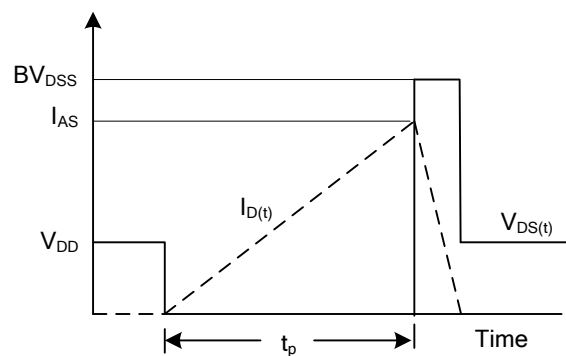
**Gate Charge Test Circuit**



**Gate Charge Waveform**

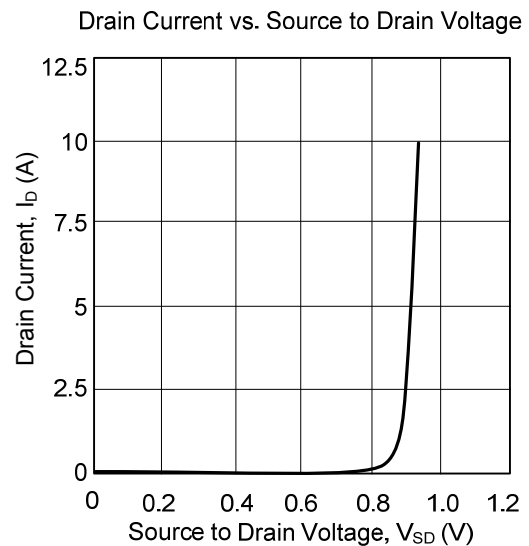
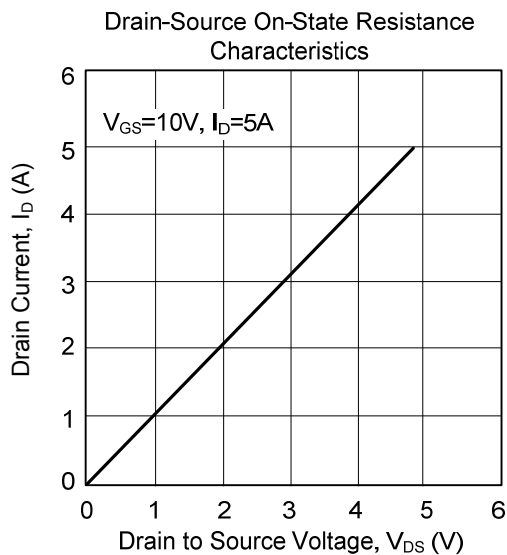
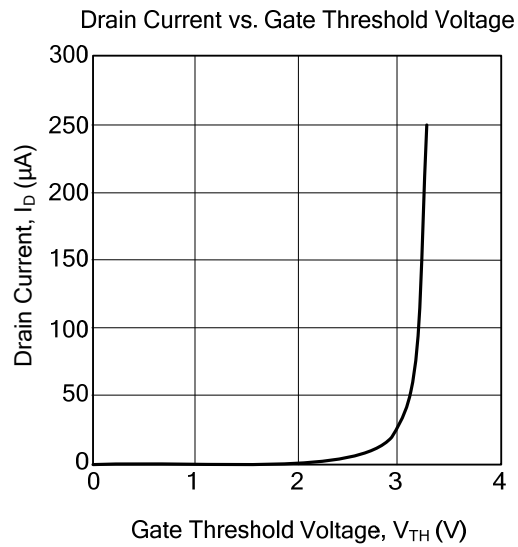
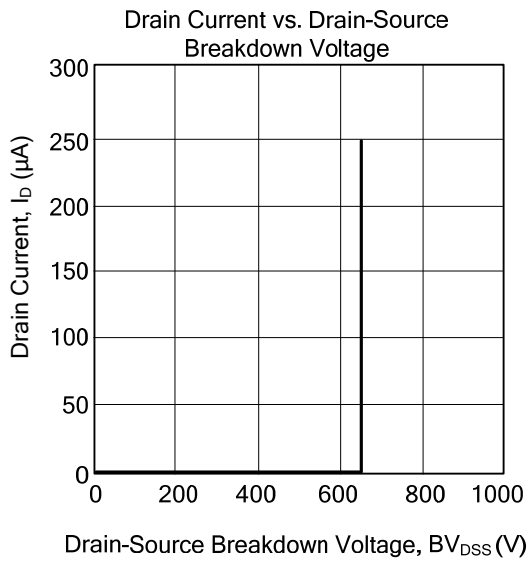


**Unclamped Inductive Switching Test Circuit**



**Unclamped Inductive Switching Waveforms**

### TYPICAL CHARACTERISTICS



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