



## 2N60K

Power MOSFET

### 2A, 600V N-CHANNEL POWER MOSFET

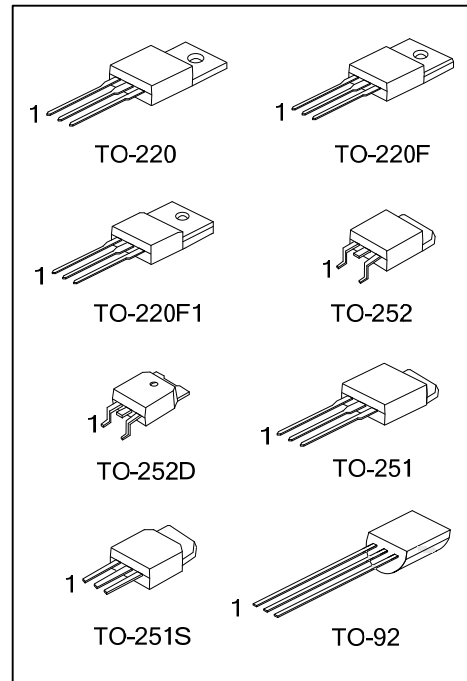
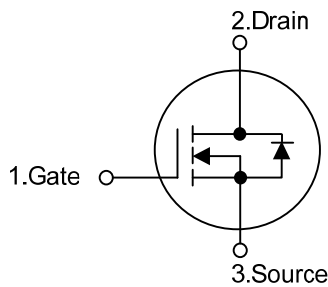
#### DESCRIPTION

The UTC **2N60K** is a high voltage power MOSFET and is designed to have better characteristics, such as fast switching time, low gate charge, low on-state resistance and have a high rugged avalanche characteristics. This power MOSFET is usually used at high speed switching applications in power supplies, PWM motor controls, high efficient DC to DC converters and bridge circuits.

#### FEATURES

- \*  $R_{DS(ON)} < 5\Omega$  @  $V_{GS} = 10V, I_D = 1A$
- \* Fast switching capability
- \* Avalanche energy specified
- \* Improved dv/dt capability, high ruggedness

#### SYMBOL



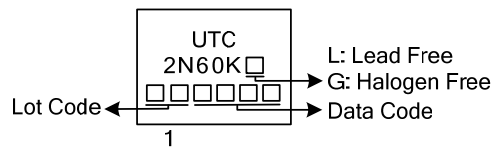
### ORDERING INFORMATION

Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
2N60KL-TA3-T	2N60KG-TA3-T	TO-220	G	D	S	Tube
2N60KL-TF3-T	2N60KG-TF3-T	TO-220F	G	D	S	Tube
2N60KL-TF1-T	2N60KG-TF1-T	TO-220F1	G	D	S	Tube
2N60KL-TM3-T	2N60KG-TM3-T	TO-251	G	D	S	Tube
2N60KL-TMS-T	2N60KG-TMS-T	TO-251S	G	D	S	Tube
2N60KL-TN3-R	2N60KG-TN3-R	TO-252	G	D	S	Tape Reel
2N60KL-TND-R	2N60KG-TND-R	TO-252D	G	D	S	Tape Reel
2N60KL-T92-B	2N60KG-T92-B	TO-92	G	D	S	Tape Box
2N60KL-T92-K	2N60KG-T92-K	TO-92	G	D	S	Bulk

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

<p>2N60KL-TA3-T</p> <p>(1) Packing Type (2) Package Type (3) Green Package</p>	<p>(1) T: Tube, R: Tape Reel, K: Bulk, B: Tape Box (2) TA3: TO-220, TF3: TO-220F, TF1: TO-220F1 TM3: TO-251, TMS: TO-251S, TN3: TO-252, TND: TO-252D, T92: TO-92 (3) L: Lead Free, G: Halogen Free and Lead Free</p>
--	--

### 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)		$I_{AR}$	2.0	A
Drain Current	Continuous	$I_D$	2.0	A
	Pulsed (Note 2)	$I_{DM}$	8.0	A
Avalanche Energy	Single Pulsed (Note 3)	$E_{AS}$	50	mJ
	Repetitive (Note 2)	$E_{AR}$	4.5	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	4.5	V/ns
Power Dissipation ( $T_C=25^\circ\text{C}$ )	TO-220	$P_D$	54	W
	TO-220F/TO-220F1		23	W
	TO-251/TO-251S		44	W
	TO-252/TO-252D			
	TO-92		2.3	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  $T_J$

3.  $L=25\text{mH}$ ,  $I_{AS}=2.0\text{A}$ ,  $V_{DD}=50\text{V}$ ,  $R_G=25\ \Omega$ , Starting  $T_J = 25^\circ\text{C}$

4.  $I_{SD}\leq 2.4\text{A}$ ,  $di/dt\leq 200\text{A}/\mu\text{s}$ ,  $V_{DD}\leq BV_{DSS}$ , Starting  $T_J = 25^\circ\text{C}$

■ THERMAL DATA

PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Ambient	TO-220/TO-220F TO-220F1	$\theta_{JA}$	62.5	$^\circ\text{C}/\text{W}$
	TO-251/TO-251S TO-252/TO-252D		100	$^\circ\text{C}/\text{W}$
	TO-92		85	$^\circ\text{C}/\text{W}$
Junction to Case	TO-220	$\theta_{Jc}$	2.32	$^\circ\text{C}/\text{W}$
	TO-220F1/TO-220F		5.5	$^\circ\text{C}/\text{W}$
	TO-251/TO-251S TO-252/TO-252D		2.87	$^\circ\text{C}/\text{W}$
	TO-92		54	$^\circ\text{C}/\text{W}$

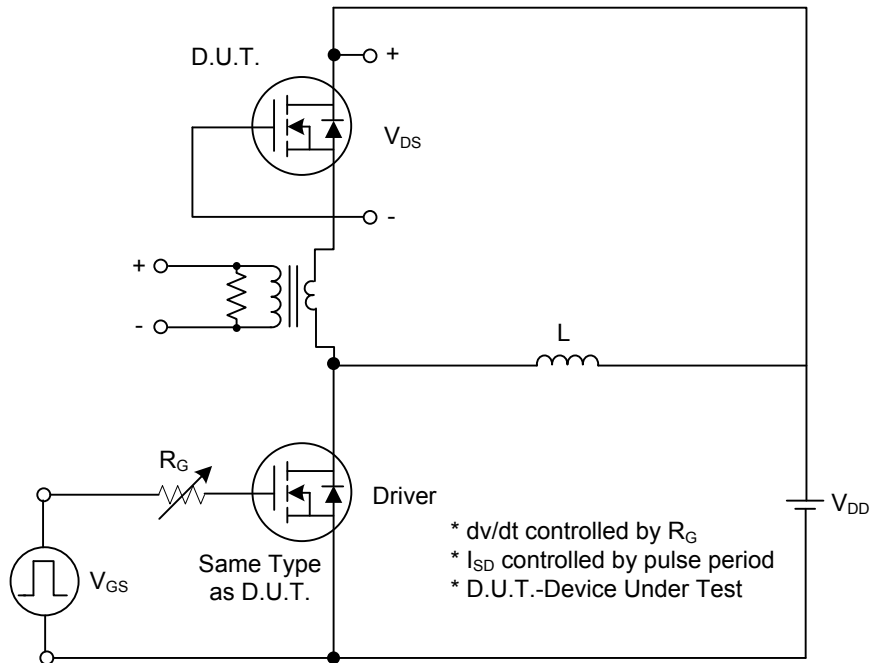
■ ELECTRICAL CHARACTERISTICS (T<sub>C</sub>=25°C, unless otherwise specified)

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	600			V	
Drain-Source Leakage Current	I <sub>DSS</sub>	V <sub>DS</sub> = 600V, V <sub>GS</sub> = 0V			10	μA	
		V <sub>DS</sub> = 480V, T <sub>C</sub> = 125°C			100	μA	
Gate-Source Leakage Current	Forward	I <sub>GSS</sub>				nA	
	Reverse						V <sub>GS</sub> = 30V, V <sub>DS</sub> = 0V
		V <sub>GS</sub> = -30V, V <sub>DS</sub> = 0V			-100	nA	
Breakdown Voltage Temperature Coefficient	ΔBV <sub>DSS</sub> /ΔT <sub>J</sub>	I <sub>D</sub> =250μA, Referenced to 25°C		0.4		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		4.5	V	
Static Drain-Source On-State Resistance	R <sub>DS(ON)</sub>	V <sub>GS</sub> = 10V, I <sub>D</sub> = 1A			5	Ω	
<b>DYNAMIC CHARACTERISTICS</b>							
Input Capacitance	C <sub>ISS</sub>	V <sub>DS</sub> = 25V, V <sub>GS</sub> = 0V, f = 1MHz		320		pF	
Output Capacitance	C <sub>OSS</sub>				32		pF
Reverse Transfer Capacitance	C <sub>RSS</sub>				4.6		pF
<b>SWITCHING CHARACTERISTICS</b>							
Total Gate Charge	Q <sub>G</sub>	V <sub>DS</sub> =50V, V <sub>GS</sub> =10V, I <sub>D</sub> =1.3A, I <sub>g</sub> = 100μA (Note 1, 2)		11	21	nC	
Gate-Source Charge	Q <sub>GS</sub>				4.3		nC
Gate-Drain Charge	Q <sub>GD</sub>				1.5		nC
Turn-On Delay Time	t <sub>D(ON)</sub>	V <sub>GS</sub> = 10V, V <sub>DD</sub> = 30V, I <sub>D</sub> = 0.5A, R <sub>G</sub> = 25Ω (Note 1, 2)		45		ns	
Turn-On Rise Time	t <sub>R</sub>				25		ns
Turn-Off Delay Time	t <sub>D(OFF)</sub>				65		ns
Turn-Off Fall Time	t <sub>F</sub>				15		ns
<b>DRAIN-SOURCE DIODE CHARACTERISTICS</b>							
Drain-Source Diode Forward Voltage	V <sub>SD</sub>	V <sub>GS</sub> = 0 V, I <sub>SD</sub> = 2.0 A			1.4	V	
Continuous Drain-Source Current	I <sub>SD</sub>				2.0	A	
Pulsed Drain-Source Current	I <sub>SM</sub>				8.0	A	
Reverse Recovery Time	t <sub>rr</sub>	V <sub>GS</sub> = 0 V, I <sub>SD</sub> = 2.4A,		180		ns	
Reverse Recovery Charge	Q <sub>RR</sub>	di/dt = 100 A/μs (Note1)		0.72		μC	

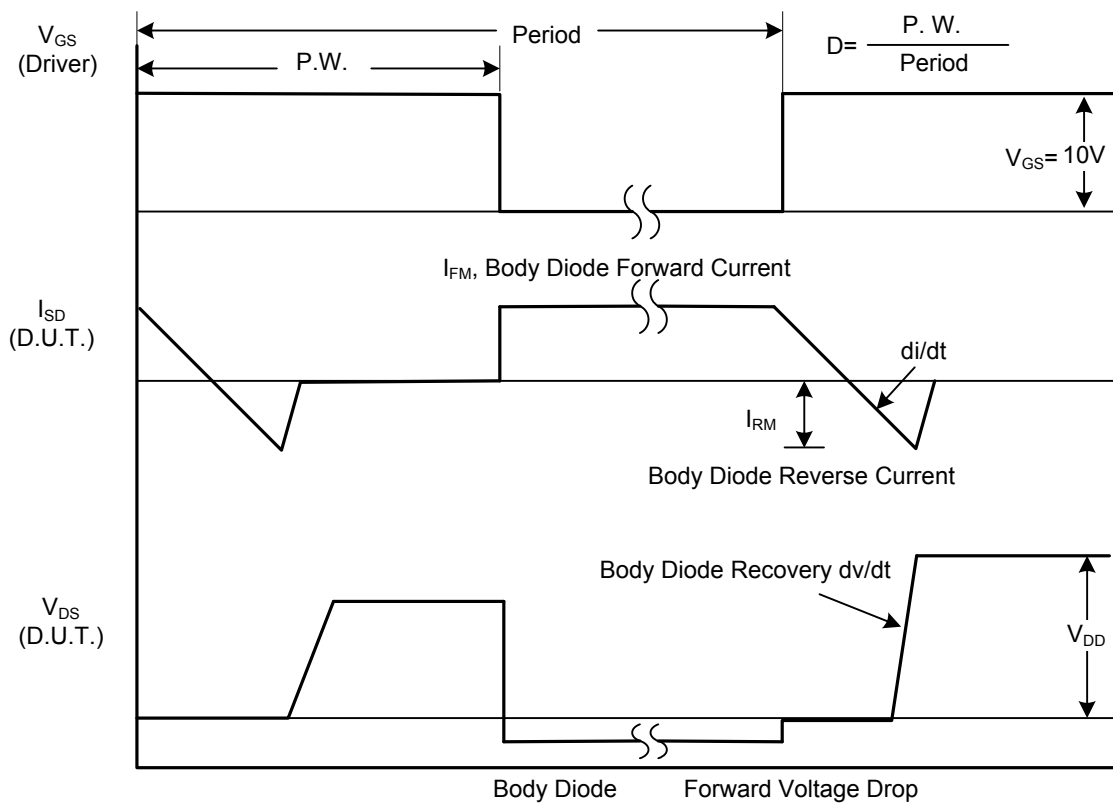
Notes: 1. Pulse Test: Pulse width ≤ 300μs, Duty cycle ≤ 2%

2. Essentially independent of operating temperature

■ TEST CIRCUITS AND WAVEFORMS

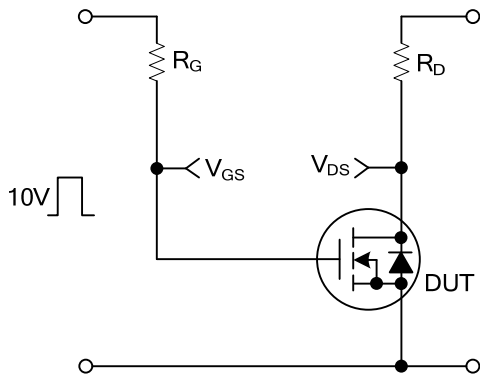


Peak Diode Recovery  $dv/dt$  Test Circuit

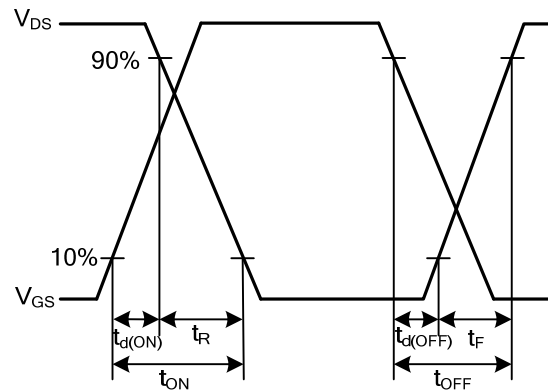


Peak Diode Recovery  $dv/dt$  Waveforms

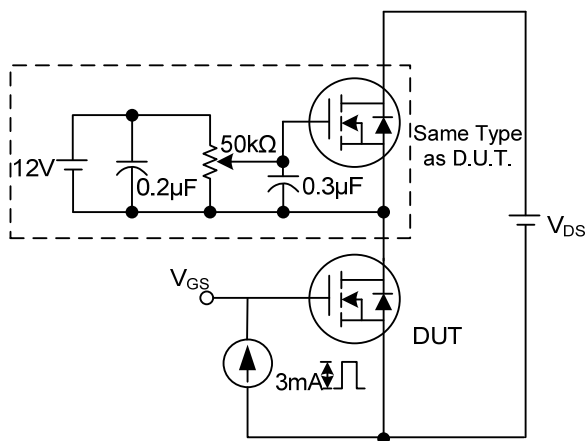
### TEST CIRCUITS AND WAVEFORMS (Cont.)



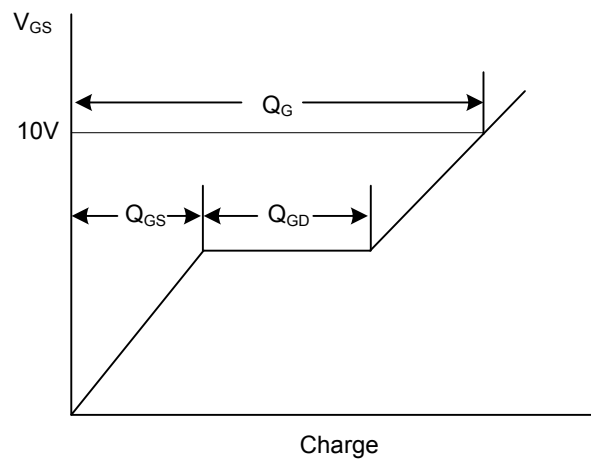
Switching Test Circuit



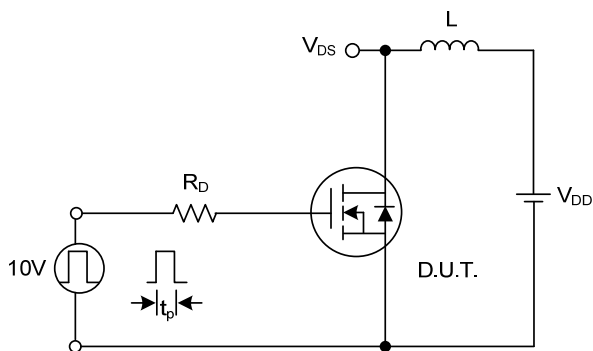
Switching Waveforms



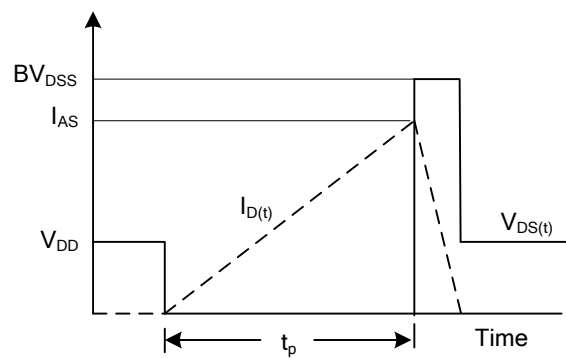
Gate Charge Test Circuit



Gate Charge Waveform

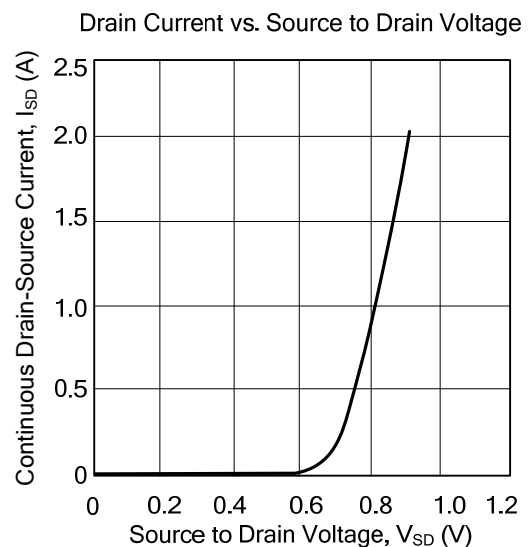
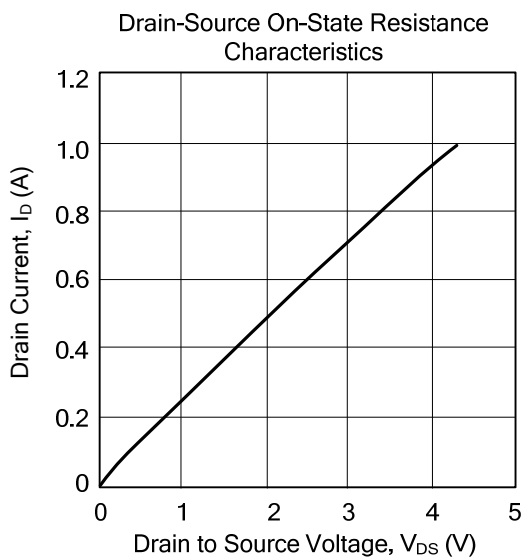
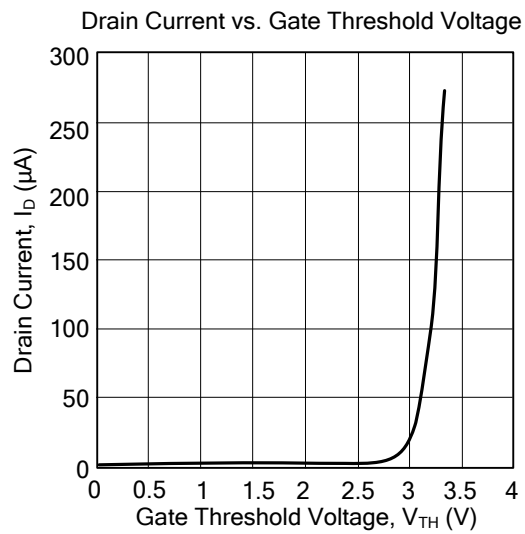
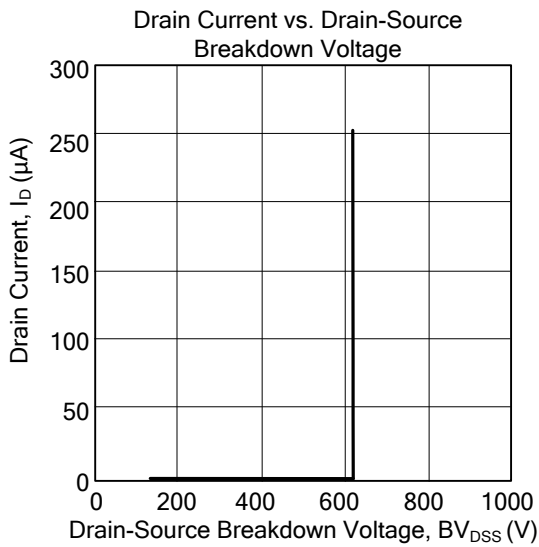


Unclamped Inductive Switching Test Circuit



Unclamped Inductive Switching Waveforms

### ■ TYPICAL CHARACTERISTICS



UTC assumes no responsibility for equipment failures that result from using products at values that exceed, even momentarily, rated values (such as maximum ratings, operating condition ranges, or other parameters) listed in products specifications of any and all UTC products described or contained herein. UTC products are not designed for use in life support appliances, devices or systems where malfunction of these products can be reasonably expected to result in personal injury. Reproduction in whole or in part is prohibited without the prior written consent of the copyright owner. The information presented in this document does not form part of any quotation or contract, is believed to be accurate and reliable and may be changed without notice.