



**7N60K-MTQ**

Preliminary

**Power MOSFET**

**6.2A, 600V N-CHANNEL POWER MOSFET**

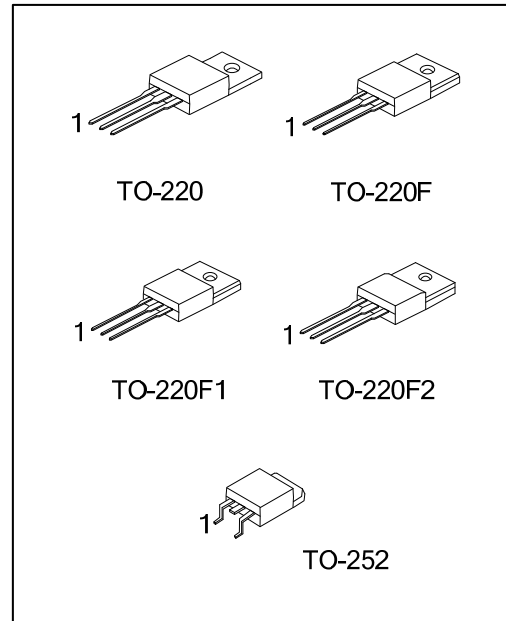
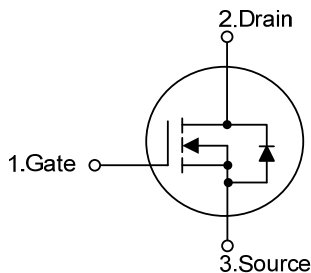
■ DESCRIPTION

The UTC **7N60K-MTQ** 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 switching power supplies and adaptors.

■ FEATURES

- \*  $R_{DS(ON)} < 1.4\Omega @ V_{GS} = 10V, I_D = 3.5A$
- \* Fast switching capability
- \* Avalanche energy tested
- \* Improved dv/dt capability, high ruggedness

■ SYMBOL



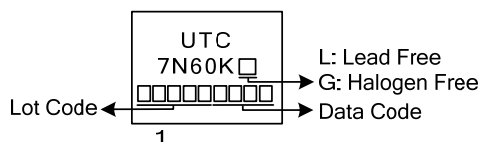
■ ORDERING INFORMATION

Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
7N60KL-TA3-T	7N60KG-TA3-T	TO-220	G	D	S	Tube
7N60KL-TF3-T	7N60KG-TF3-T	TO-220F	G	D	S	Tube
7N60KL-TF1-T	7N60KG-TF1-T	TO-220F1	G	D	S	Tube
7N60KL-TF2-T	7N60KG-TF2-T	TO-220F2	G	D	S	Tube
7N60KL-TN3-R	7N60KG-TN3-R	TO-252	G	D	S	Tape Reel

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

<p>7N60KL-TF1-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, TN3: TO-252</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		$V_{DSS}$	600	V
Gate-Source Voltage		$V_{GSS}$	$\pm 30$	V
Avalanche Current (Note 2)		$I_{AR}$	7	A
Continuous Drain Current		$I_D$	7	A
Pulsed Drain Current (Note 2)		$I_{DM}$	24.8	A
Avalanche Energy	Single Pulsed (Note 3)	$E_{AS}$	340	mJ
	Repetitive (Note 2)	$E_{AR}$	13	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	2.8	ns
Power Dissipation	TO-220	$P_D$	142	W
	TO-220F/TO-220F1		48	W
	TO-220F2		59	W
	TO-252			
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.  $L = 18.33\text{mH}$ ,  $I_{AS} = 7\text{A}$ ,  $V_{DD} = 90\text{V}$ ,  $R_G = 25\ \Omega$ , Starting  $T_J = 25^\circ\text{C}$

4.  $I_{SD} \leq 7\text{A}$ ,  $di/dt \leq 200\text{A}/\mu\text{s}$ ,  $V_{DD} \leq BV_{DSS}$ , Starting  $T_J = 25^\circ\text{C}$

■ THERMAL DATA

PARAMETER		SYMBOL	RATING	UNIT
Junction to Ambient	TO-220/TO-220F	$\theta_{JA}$	62.5	$^\circ\text{C}/\text{W}$
	TO-220F1/TO-220F2			
	TO-252		110	$^\circ\text{C}/\text{W}$
Junction to Case	TO-220	$\theta_{JC}$	0.88	$^\circ\text{C}/\text{W}$
	TO-220F/TO-220F1		2.6	$^\circ\text{C}/\text{W}$
	TO-220F2			
	TO-252		2.1	$^\circ\text{C}/\text{W}$

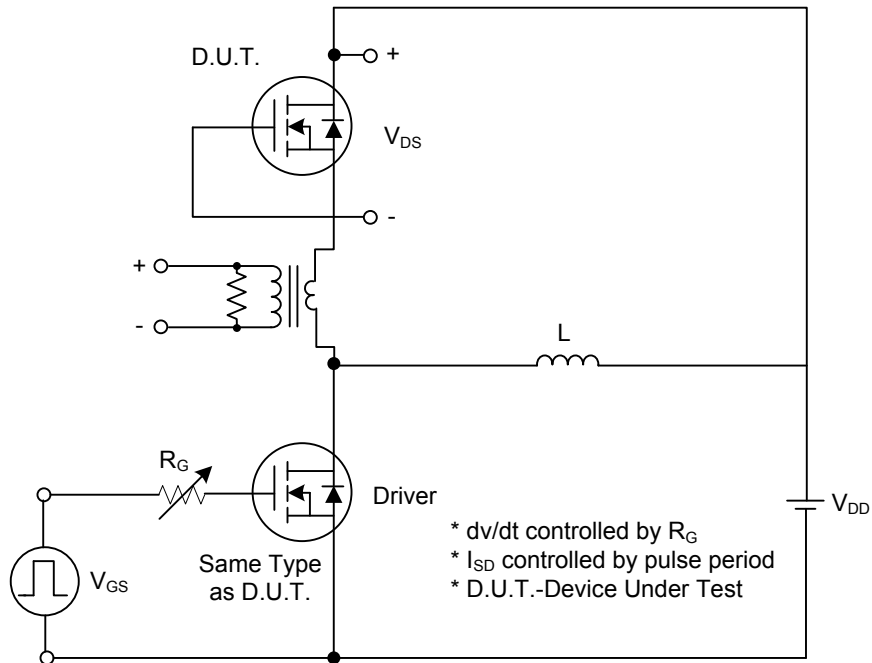
■ ELECTRICAL CHARACTERISTICS ( $T_J=25^\circ\text{C}$ , unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT	
<b>OFF CHARACTERISTICS</b>							
Drain-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS}=0V, I_D=250\mu A$	600			V	
Drain-Source Leakage Current	$I_{DSS}$	$V_{DS}=600V, V_{GS}=0V$			10	$\mu A$	
		$V_{DS}=480V, V_{GS}=0V, T_J=125^\circ C$			10	$\mu A$	
Gate- Source Leakage Current	Forward	$I_{GSS}$					
	Reverse						
		$V_{GS}=30V, V_{DS}=0V$			100	nA	
		$V_{GS}=-30V, V_{DS}=0V$			-100	nA	
Breakdown Voltage Temperature Coefficient	$\Delta BV_{DSS}/\Delta T_J$	$I_D=250\mu A$ , Referenced to $25^\circ C$		0.53		$V/^\circ C$	
<b>ON CHARACTERISTICS</b>							
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 Resistance	$R_{DS(ON)}$	$V_{GS}=10V, I_D=3.5A$			1.4	$\Omega$	
<b>DYNAMIC CHARACTERISTICS</b>							
Input Capacitance	$C_{ISS}$	$V_{DS}=25V, V_{GS}=0V, f=1.0\text{ MHz}$		540		pF	
Output Capacitance	$C_{OSS}$				97		pF
Reverse Transfer Capacitance	$C_{RSS}$				11		pF
<b>SWITCHING CHARACTERISTICS</b>							
Turn-On Delay Time	$t_{D(ON)}$	$V_{DD}=30V, I_D=0.5A, R_G=25\Omega$ (Note 1, 2)		60		ns	
Turn-On Rise Time	$t_R$			66		ns	
Turn-Off Delay Time	$t_{D(OFF)}$			120		ns	
Turn-Off Fall Time	$t_F$			64		ns	
Total Gate Charge	$Q_G$	$V_{DS}=50V, I_D=1.3A, V_{GS}=10V$ $I_G=100\mu A$ (Note 1, 2)		23	28	nC	
Gate-Source Charge	$Q_{GS}$			6.7		nC	
Gate-Drain Charge	$Q_{GD}$			5.7		nC	
<b>DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS</b>							
Drain-Source Diode Forward Voltage	$V_{SD}$	$V_{GS}=0V, I_S=7A$			1.4	V	
Maximum Continuous Drain-Source Diode Forward Current	$I_S$				7	A	
Maximum Pulsed Drain-Source Diode Forward Current	$I_{SM}$				28	A	
Body Diode Reverse Recovery Time	$t_{RR}$	$I_{SD}=7A, di_S/dt=100A/\mu s$		368		ns	
Body Diode Reverse Recovery Charge	$Q_{RR}$			3.5		nC	

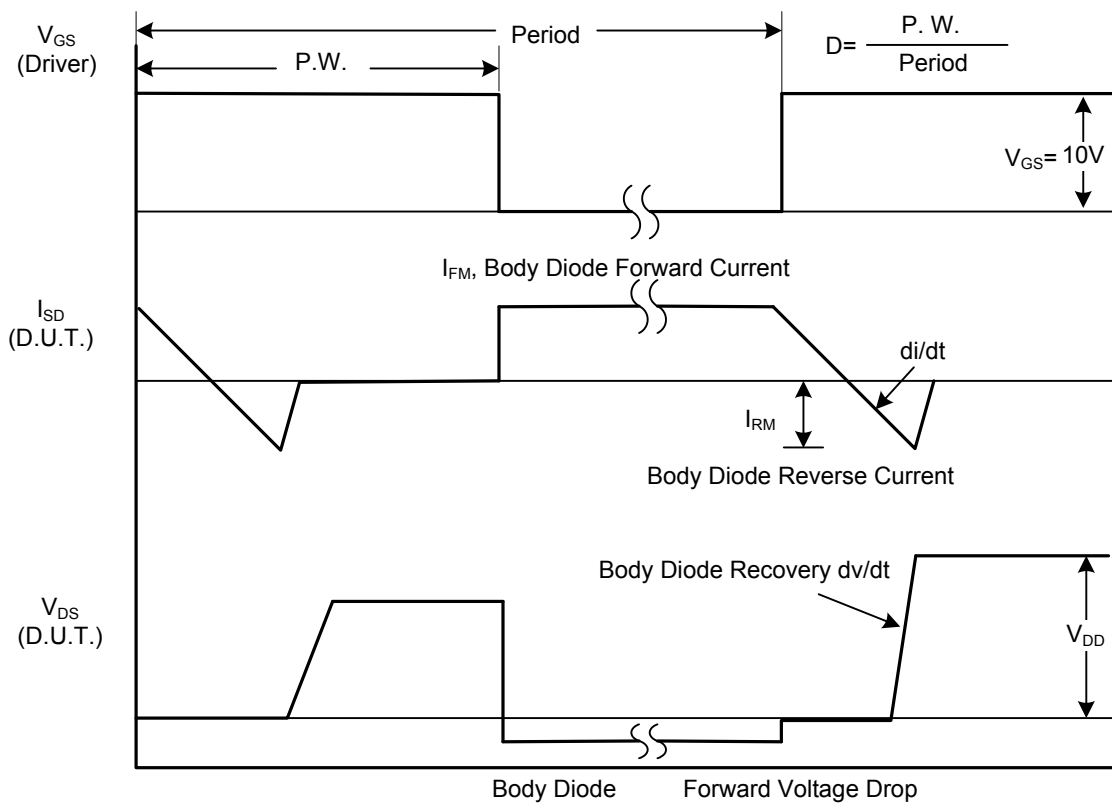
Notes: 1. Pulse Test: Pulse width  $\leq 300\mu s$ , Duty cycle  $\leq 2\%$ .

2. Essentially independent of operating temperature.

■ TEST CIRCUITS AND WAVEFORMS

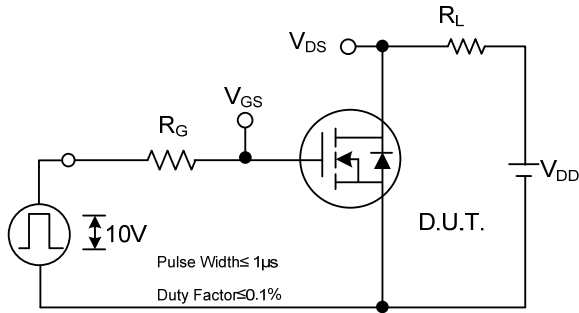


Peak Diode Recovery  $dv/dt$  Test Circuit

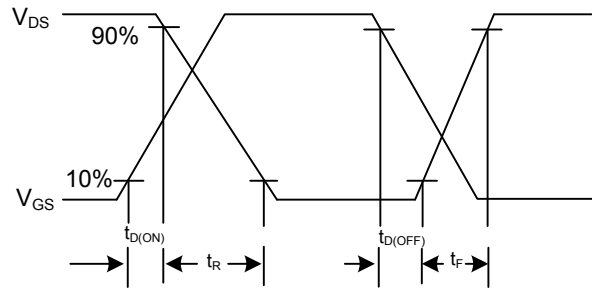


Peak Diode Recovery  $dv/dt$  Waveforms

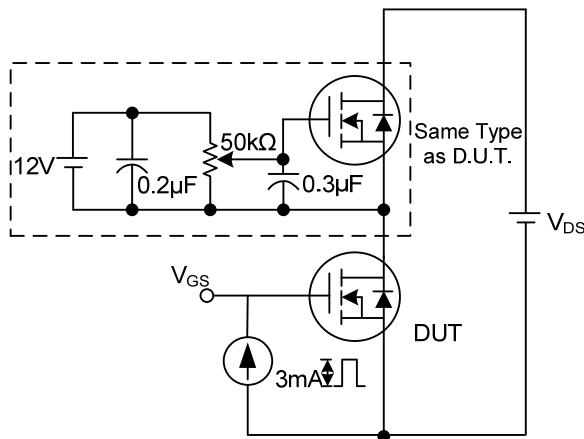
■ TEST CIRCUITS AND WAVEFORMS (Cont.)



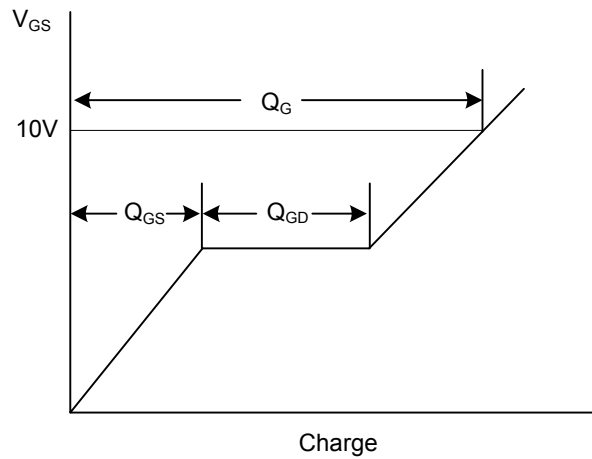
Switching Test Circuit



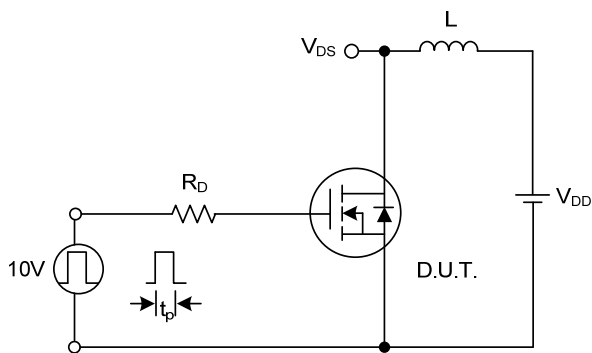
Switching Waveforms



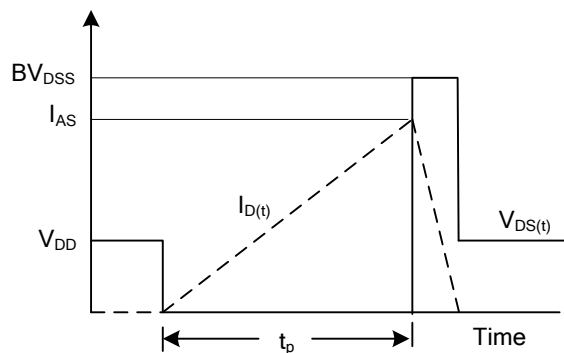
Gate Charge Test Circuit



Gate Charge Waveform



Unclamped Inductive Switching Test Circuit



Unclamped Inductive Switching Waveforms

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