



# 7N60-F

*Power MOSFET*

## 7.4A, 600V N-CHANNEL POWER MOSFET

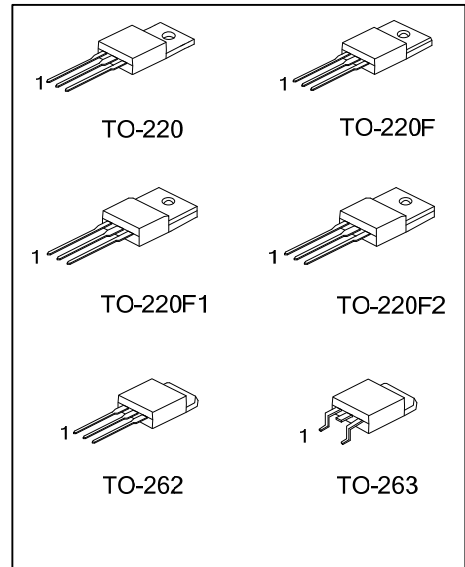
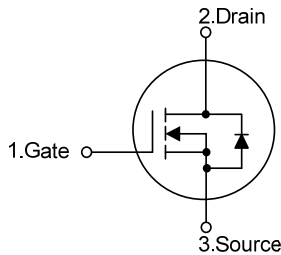
■ DESCRIPTION

The UTC **7N60-F** 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

- \*  $R_{DS(ON)} = 1.2\Omega @ V_{GS} = 10V, I_D = 3.7A$
- \* 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	
7N60L-TA3-T	7N60G-TA3-T	TO-220	G	D	S	Tube
7N60L-TF3-T	7N60G-TF3-T	TO-220F	G	D	S	Tube
7N60L-TF1-T	7N60G-TF1-T	TO-220F1	G	D	S	Tube
7N60L-TF2-T	7N60G-TF2-T	TO-220F2	G	D	S	Tube
7N60L-T2Q-T	7N60G-T2Q-T	TO-262	G	D	S	Tube
7N60L-TQ2-R	7N60G-TQ2-R	TO-263	G	D	S	Tape Reel
7N60L-TQ2-T	7N60G-TQ2-T	TO-263	G	D	S	Tube

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

<p>7N60L-TA3-T</p> <p>(1) Packing Type (2) Package Type (3) Lead Free</p>	<p>(1) R: Tape Reel, T: Tube (2) TA3: TO-220, TF1: TO-220F1, TF3: TO-220F T2Q: TO-262, TQ2: TO-263, TF2: TO-220F2 (3) L: Lead Free, G: Halogen Free</p>
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■ 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)		$I_{AR}$	7.4	A
Drain Current	Continuous	$I_D$	7.4	A
	Pulsed (Note 2)	$I_{DM}$	29.6	A
Avalanche Energy	Single Pulsed (Note 3)	$E_{AS}$	530	mJ
	Repetitive (Note 2)	$E_{AR}$	14.2	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	4.5	V/ns
Power Dissipation	TO-220/TO-262/TO-263	$P_D$	142	W
	TO-220F/TO-220F1		48	
	TO-220F2		50	
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.  $L = 19.5\text{mH}$ ,  $I_{AS} = 7.4\text{A}$ ,  $V_{DD} = 50\text{V}$ ,  $R_G = 25\ \Omega$ , Starting  $T_J = 25^\circ\text{C}$

4.  $I_{SD} \leq 7.4\text{A}$ ,  $di/dt \leq 200\text{A}/\mu\text{s}$ ,  $V_{DD} \leq BV_{DSS}$ , Starting  $T_J = 25^\circ\text{C}$

■ THERMAL DATA

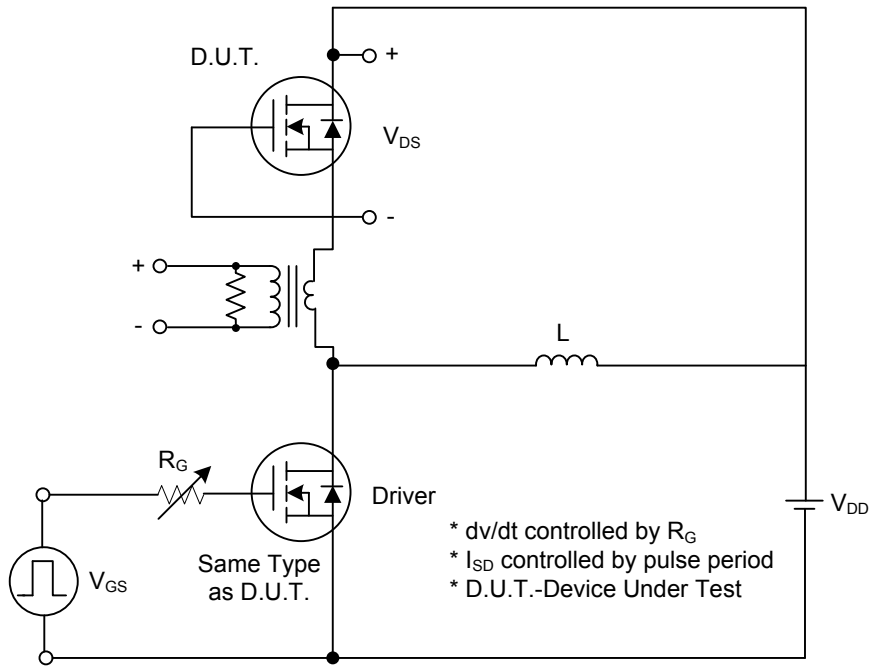
PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Ambient		$\theta_{JA}$	62.5	$^\circ\text{C}/\text{W}$
Junction to Case	TO-220/TO-262/TO-263	$\theta_{JC}$	0.88	$^\circ\text{C}/\text{W}$
	TO-220F/TO-220F1		2.6	
	TO-220F2		2.5	

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

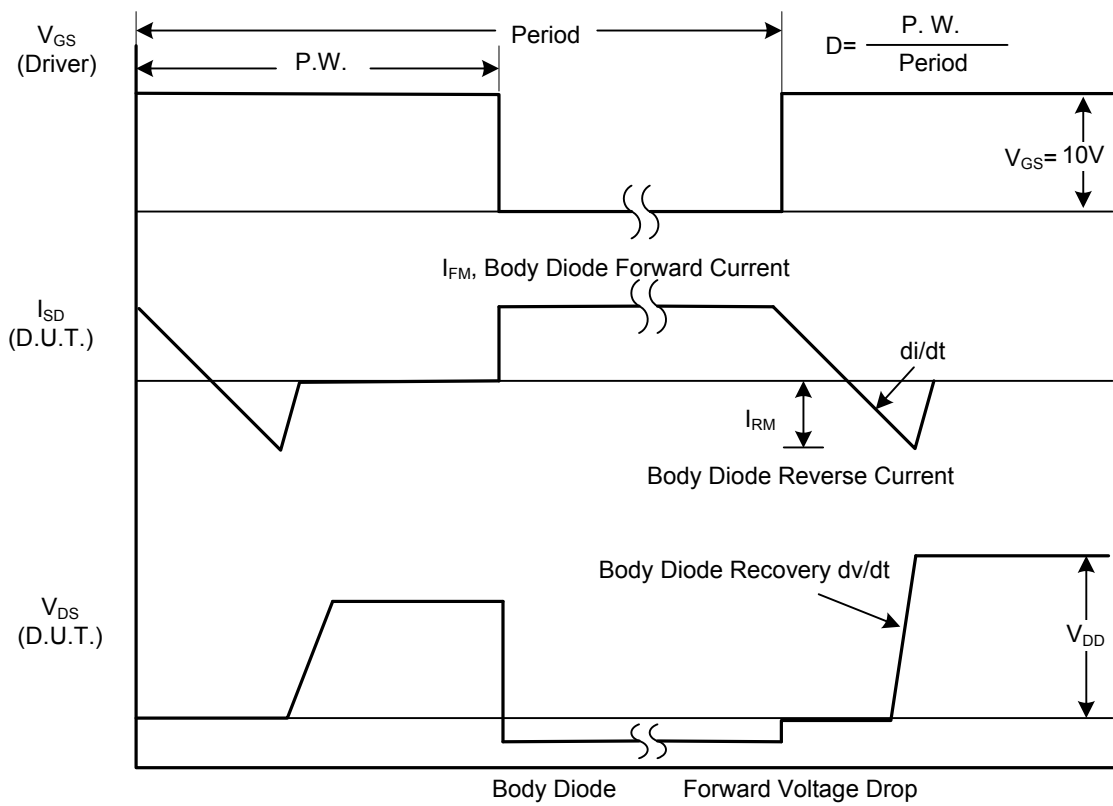
PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
<b>OFF CHARACTERISTICS</b>						
Drain-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS} = 0V, I_D = 250\mu A$	600			V
Drain-Source Leakage Current	$I_{DSS}$	$V_{DS} = 600V, V_{GS} = 0V$			1	$\mu A$
Gate- Source Leakage Current	Forward	$I_{GSS}$			100	nA
	Reverse				-100	nA
Breakdown Voltage Temperature Coefficient	$\Delta BV_{DSS}/\Delta T_J$	$I_D=250\mu A$ , Referenced to $25^\circ\text{C}$		0.67		$V/^\circ\text{C}$
<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	$R_{DS(ON)}$	$V_{GS} = 10V, I_D = 3.7A$		1.1	1.2	$\Omega$
<b>DYNAMIC CHARACTERISTICS</b>						
Input Capacitance	$C_{ISS}$	$V_{DS}=25V, V_{GS}=0V,$ $f=1.0\text{ MHz}$		1300	1500	pF
Output Capacitance	$C_{OSS}$			350	450	pF
Reverse Transfer Capacitance	$C_{RSS}$			200	300	pF
<b>SWITCHING CHARACTERISTICS</b>						
Turn-On Delay Time	$t_{D(ON)}$	$V_{DD} = 300V, I_D = 7.4A,$ $R_G = 25\Omega$ (Note 1, 2)		55	80	ns
Turn-On Rise Time	$t_R$			240	270	ns
Turn-Off Delay Time	$t_{D(OFF)}$			260	290	ns
Turn-Off Fall Time	$t_F$			300	350	ns
<b>SWITCHING CHARACTERISTICS</b>						
Total Gate Charge	$Q_G$	$V_{DS}=480V, I_D=7.4A,$ $V_{GS}=10V$ (Note 1, 2)		190	230	nC
Gate-Source Charge	$Q_{GS}$			13		nC
Gate-Drain Charge	$Q_{GD}$			52		nC
<b>DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS</b>						
Drain-Source Diode Forward Voltage	$V_{SD}$	$V_{GS} = 0V, I_S = 7.4\text{ A}$			1.4	V
Maximum Continuous Drain-Source Diode Forward Current	$I_S$				7.4	A
Maximum Pulsed Drain-Source Diode Forward Current	$I_{SM}$				29.6	A
Reverse Recovery Time	$t_{rr}$	$V_{GS} = 0V, I_S = 7.4\text{ A},$		320		ns
Reverse Recovery Charge	$Q_{RR}$	$di_F / dt = 100A/\mu s$ (Note 1)		2.4		$\mu C$

- Notes: 1. Pulse Test: Pulse width  $\leq 300\mu s$ , Duty cycle  $\leq 2\%$   
2. Essentially independent of operating temperature

■ TEST CIRCUITS AND WAVEFORMS

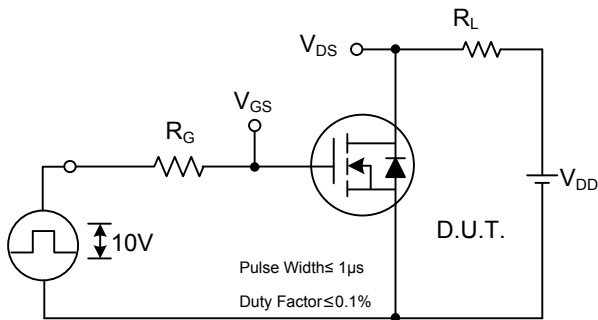


Peak Diode Recovery  $dv/dt$  Test Circuit

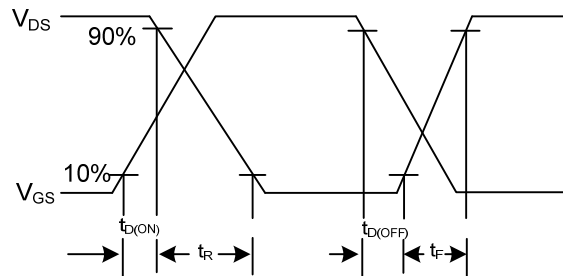


Peak Diode Recovery  $dv/dt$  Waveforms

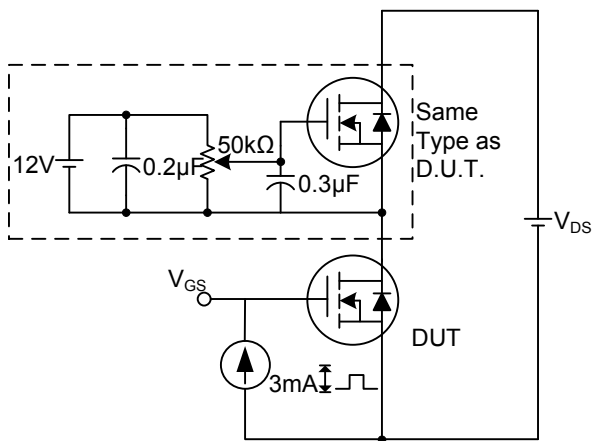
## TEST CIRCUITS AND WAVEFORMS (Cont.)



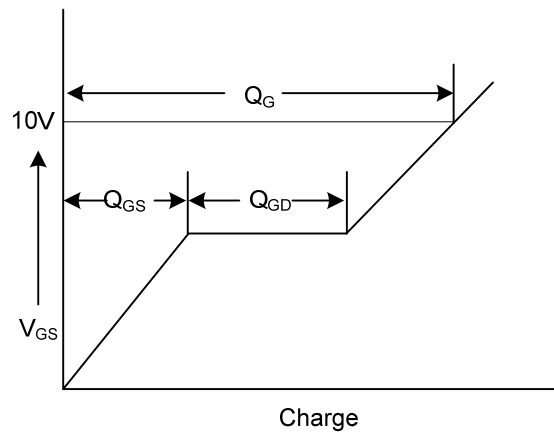
**Switching Test Circuit**



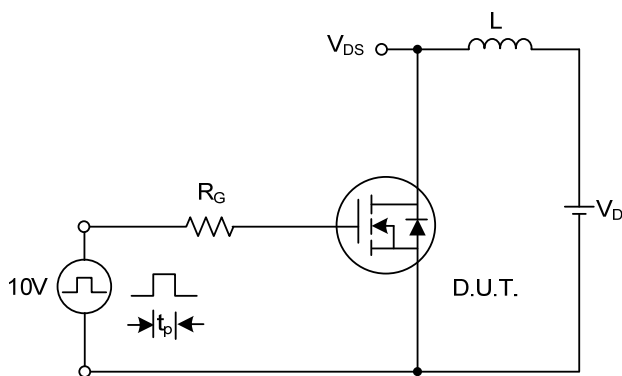
**Switching Waveforms**



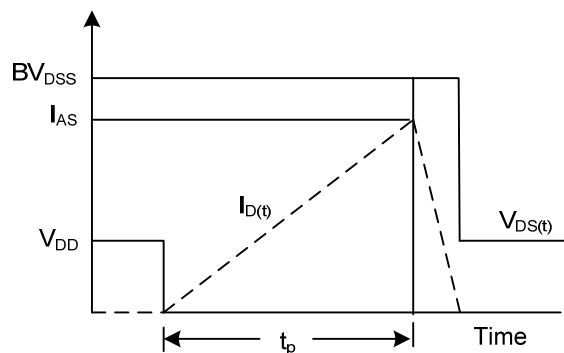
**Gate Charge Test Circuit**



**Gate Charge Waveform**



**Unclamped Inductive Switching Test Circuit**



**Unclamped Inductive Switching Waveforms**

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