



# 6N60-P

**Power MOSFET**

## 6A, 600V N-CHANNEL POWER MOSFET

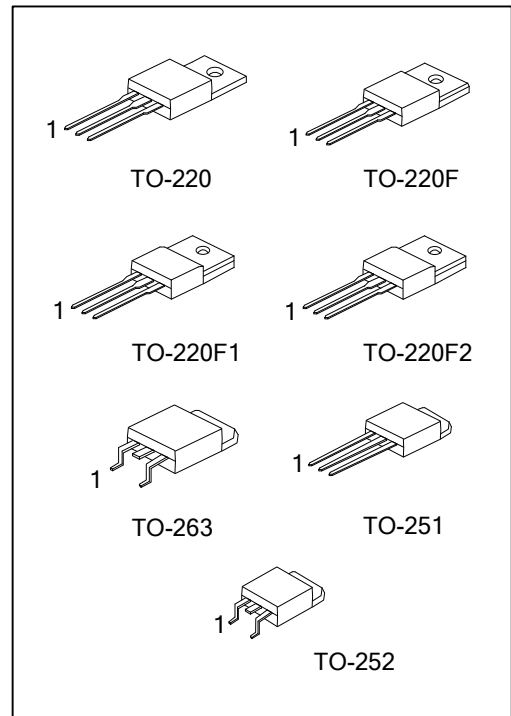
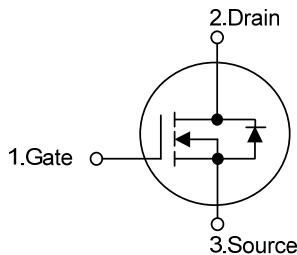
■ DESCRIPTION

The UTC **6N60-P** 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

- \*  $R_{DS(ON)} < 1.75\Omega @ V_{GS} = 10V, I_D = 3A$
- \* Fast switching capability
- \* Avalanche energy tested
- \* Improved dv/dt capability, high ruggedness

■ SYMBOL



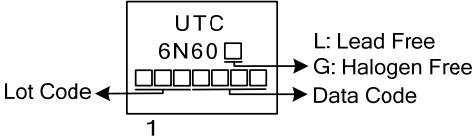
■ ORDERING INFORMATION

Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
6N60L-TA3-T	6N60G-TA3-T	TO-220	G	D	S	Tube
6N60L-TF1-T	6N60G-TF1-T	TO-220F1	G	D	S	Tube
6N60L-TF2-T	6N60G-TF2-T	TO-220F2	G	D	S	Tube
6N60L-TF3-T	6N60G-TF3-T	TO-220F	G	D	S	Tube
6N60L-TM3-T	6N60G-TM3-T	TO-251	G	D	S	Tube
6N60L-TN3-R	6N60G-TN3-R	TO-252	G	D	S	Tape Reel
6N60L-TQ2-T	6N60G-TQ2-T	TO-263	G	D	S	Tube
6N60L-TQ2-R	6N60G-TQ2-R	TO-263	G	D	S	Tape Reel

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

<p>6N60L-TA3-T</p> <p>(1)Packing Type (2)Package Type (3)Green Package</p>	<p>(1) T: Tube, R: Tape Reel (2) TA3: TO-220, TF3: TO-220F, TF1: TO-220F1, TF2: TO-220F2, TM3: TO-251, TN3: TO-252, 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)		$I_{AR}$	6	A
Continuous Drain Current		$I_D$	6	A
Pulsed Drain Current (Note 2)		$I_{DM}$	24	A
Avalanche Energy	Single Pulsed (Note 3)	$E_{AS}$	260	mJ
	Repetitive (Note 2)	$E_{AR}$	13	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	3.0	ns
Power Dissipation	TO-220/TO-263	$P_D$	125	W
	TO-220F/TO-220F1		40	W
	TO-220F2		42	W
	TO-251/TO-252		55	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.  $L = 14\text{mH}$ ,  $I_{AS} = 6\text{A}$ ,  $V_{DD} = 50\text{V}$ ,  $R_G = 25\ \Omega$ , Starting  $T_J = 25^\circ\text{C}$

4.  $I_{SD} \leq 6\text{A}$ ,  $di/dt \leq 200\text{A}/\mu\text{s}$ ,  $V_{DD} \leq BV_{DSS}$ , Starting  $T_J = 25^\circ\text{C}$

■ THERMAL DATA

PARAMETER		SYMBOL	RATING	UNIT
Junction to Ambient	TO-220/TO-220F2 TO-220F/TO-220F1 TO-263	$\theta_{JA}$	62.5	$^\circ\text{C}/\text{W}$
	TO-251/TO-252		110	
Junction to Case	TO-220/TO-263	$\theta_{JC}$	1.0	$^\circ\text{C}/\text{W}$
	TO-220F/TO-220F1		3.2	
	TO-220F2		2.97	
	TO-251/TO-252		2.27	

■ 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	$\mu A$	
Gate- Source Leakage Current	Forward	$I_{GSS}$			100	nA	
	Reverse						$V_{GS} = 30V, V_{DS} = 0V$
		$V_{GS} = -30V, V_{DS} = 0V$			-100	nA	
Breakdown Voltage Temperature Coefficient	$\Delta BV_{DSS}/\Delta T_J$	$I_D = 250\mu A$ , Referenced to $25^\circ\text{C}$		0.53		$V/^\circ\text{C}$	
<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	$R_{DS(ON)}$	$V_{GS} = 10V, I_D = 3A$		1.2	1.75	$\Omega$	
<b>DYNAMIC CHARACTERISTICS</b>							
Input Capacitance	$C_{ISS}$	$V_{DS} = 25V, V_{GS} = 0V, f = 1.0\text{ MHz}$		751		pF	
Output Capacitance	$C_{OSS}$				89		pF
Reverse Transfer Capacitance	$C_{RSS}$				17		pF
<b>SWITCHING CHARACTERISTICS</b>							
Total Gate Charge	$Q_G$	$V_{DS} = 50V, I_D = 1.3A, V_{GS} = 10V$ (Note 1, 2)		25		nC	
Gate-Source Charge	$Q_{GS}$			4.9		nC	
Gate-Drain Charge	$Q_{GD}$			9.4		nC	
Turn-On Delay Time	$t_{D(ON)}$	$V_{DD} = 30V, I_D = 0.5A, R_G = 25\Omega$ $I_G = 100\mu A$ (Note 1, 2)		60		ns	
Turn-On Rise Time	$t_R$			80		ns	
Turn-Off Delay Time	$t_{D(OFF)}$			230		ns	
Turn-Off Fall Time	$t_F$			90		ns	
<b>DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS</b>							
Drain-Source Diode Forward Voltage	$V_{SD}$	$V_{GS} = 0V, I_S = 6A$			1.4	V	
Maximum Continuous Drain-Source Diode Forward Current	$I_S$				6	A	
Maximum Pulsed Drain-Source Diode Forward Current	$I_{SM}$				24	A	
Reverse Recovery Time	$t_{rr}$	$V_{GS} = 0V, I_S = 6A,$		290		ns	
Reverse Recovery Charge	$Q_{RR}$	$di_F/dt = 100\text{ A}/\mu\text{s}$ (Note 1)		3.0		$\mu\text{C}$	

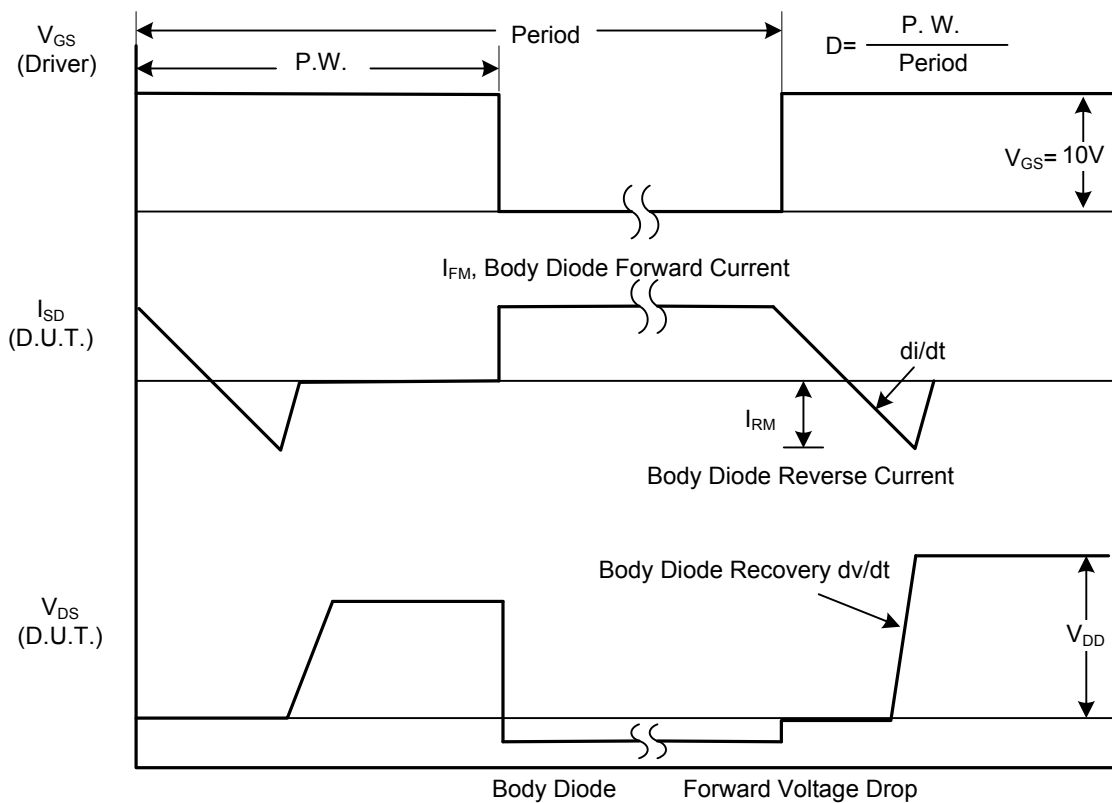
Notes: 1. Pulse Test: Pulse width  $\leq 300\mu\text{s}$ , Duty cycle  $\leq 2\%$ .

2. Essentially independent of operating temperature.

## TEST CIRCUITS AND WAVEFORMS

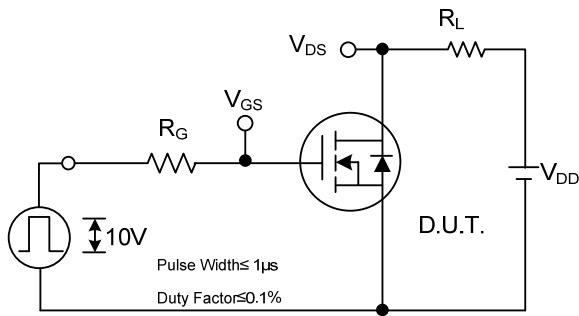


**Peak Diode Recovery  $dv/dt$  Test Circuit**

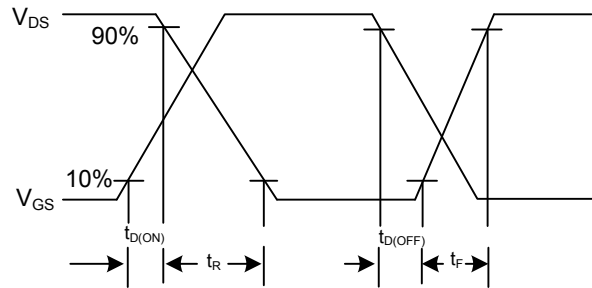


**Peak Diode Recovery  $dv/dt$  Waveforms**

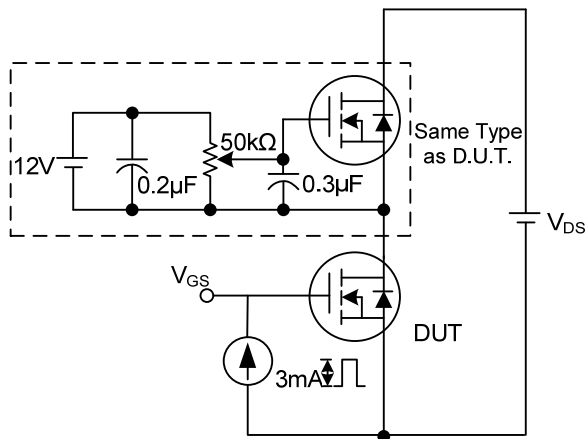
## TEST CIRCUITS AND WAVEFORMS (Cont.)



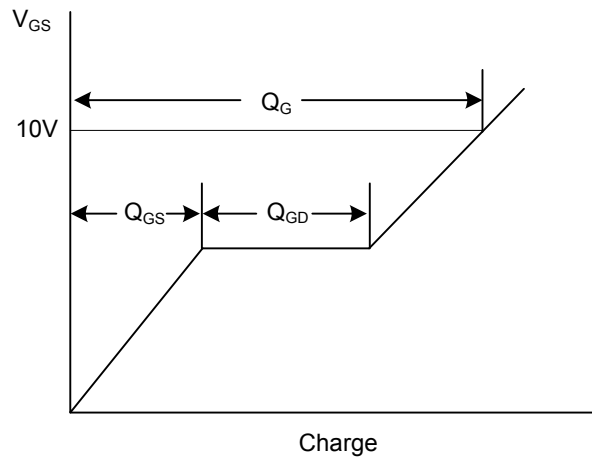
**Switching Test Circuit**



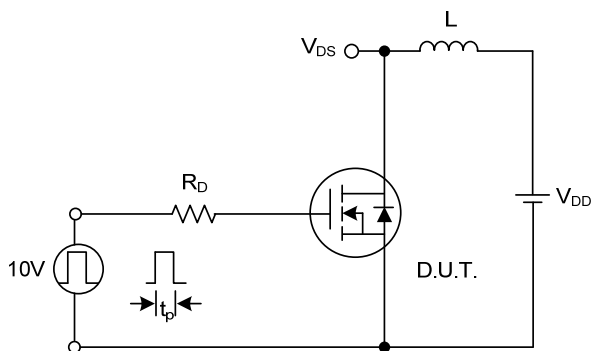
**Switching Waveforms**



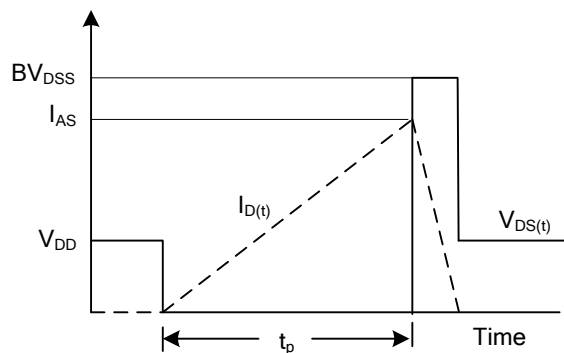
**Gate Charge Test Circuit**



**Gate Charge Waveform**

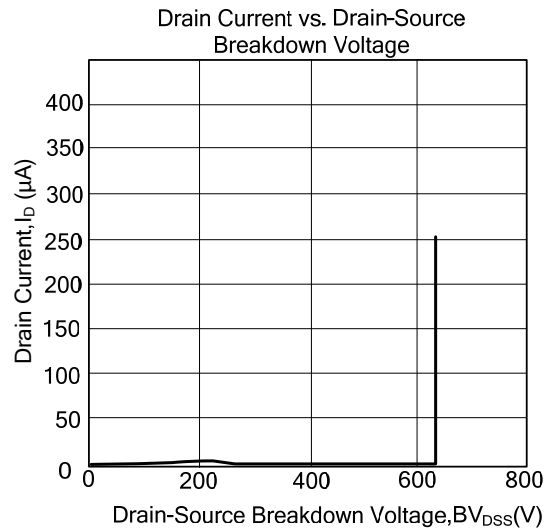
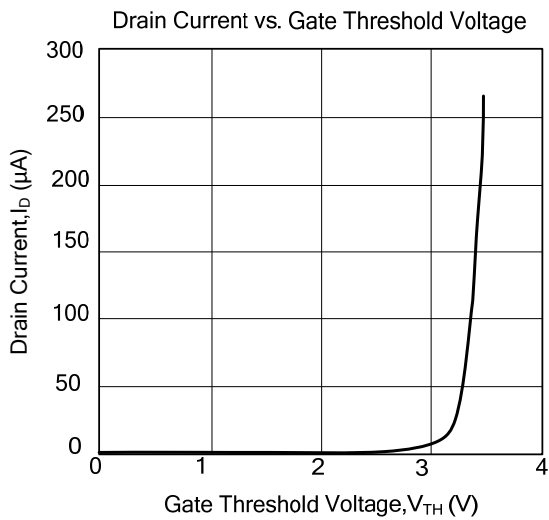
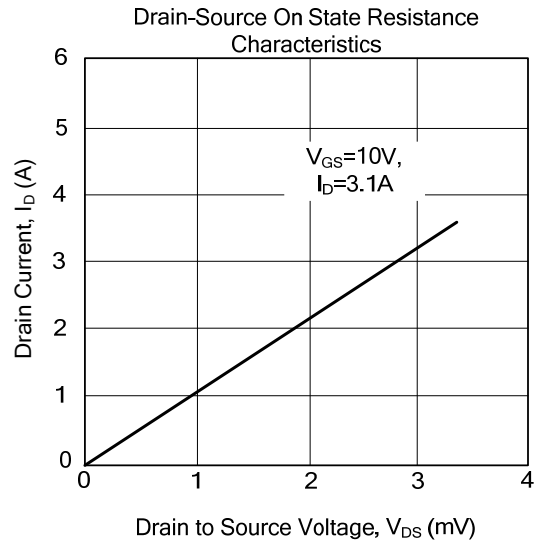
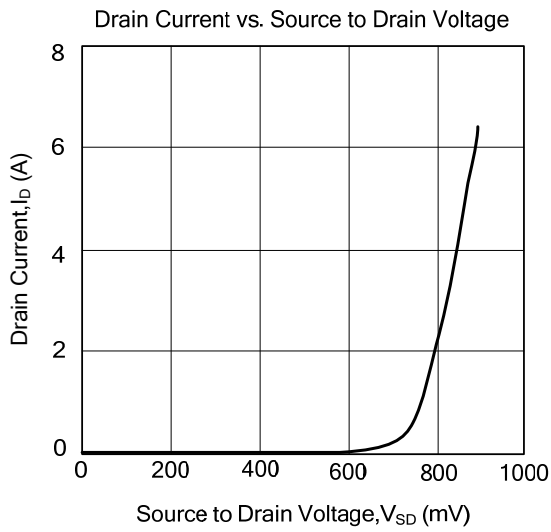


**Unclamped Inductive Switching Test Circuit**



**Unclamped Inductive Switching Waveforms**

### TYPICAL CHARACTERISTICS



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