



2N60-E

Power MOSFET

2A, 600V N-CHANNEL POWER MOSFET

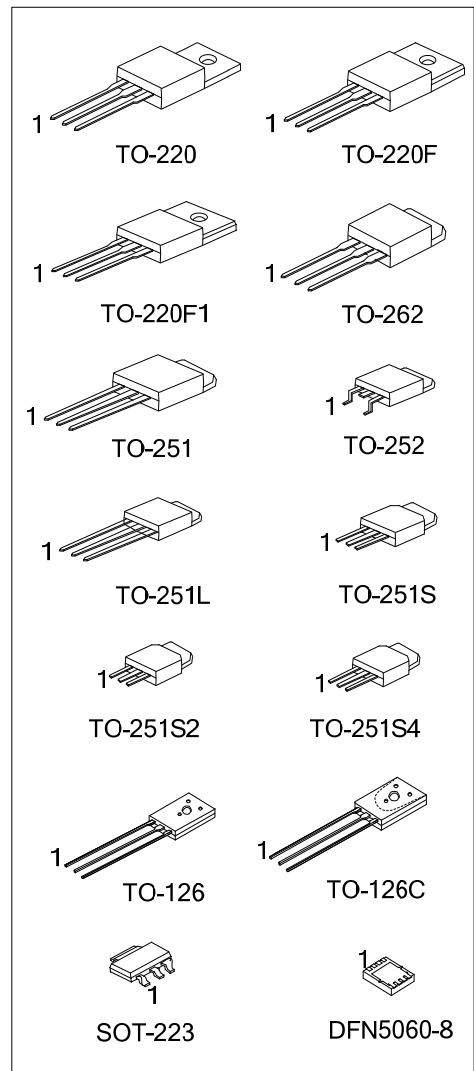
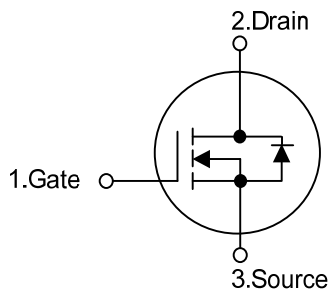
DESCRIPTION

The UTC **2N60-E** 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

- * $R_{DS(ON)} < 5.0\Omega @ V_{GS} = 10V, I_D = 1A$
- * 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	4	5	6	7	8	
2N60L-AA3-T	2N60G-AA3-T	SOT-223	G	D	S	-	-	-	-	-	Tube
2N60L-TA3-T	2N60G-TA3-T	TO-220	G	D	S	-	-	-	-	-	Tube
2N60L-TF1-T	2N60G-TF1-T	TO-220F1	G	D	S	-	-	-	-	-	Tube
2N60L-TF3-T	2N60G-TF3-T	TO-220F	G	D	S	-	-	-	-	-	Tube
2N60L-TM3-T	2N60G-TM3-T	TO-251	G	D	S	-	-	-	-	-	Tube
2N60L-TMA-T	2N60G-TMA-T	TO-251L	G	D	S	-	-	-	-	-	Tube
2N60L-TMS-T	2N60G-TMS-T	TO-251S	G	D	S	-	-	-	-	-	Tube
2N60L-TMS2-T	2N60G-TMS2-T	TO-251S2	G	D	S	-	-	-	-	-	Tube
2N60L-TMS4-T	2N60G-TMS4-T	TO-251S4	G	D	S	-	-	-	-	-	Tube
2N60L-TN3-R	2N60G-TN3-R	TO-252	G	D	S	-	-	-	-	-	Tape Reel
2N60L-T2Q-T	2N60G-T2Q-T	TO-262	G	D	S	-	-	-	-	-	Tube
2N60L-T60-K	2N60G-T60-K	TO-126	G	D	S	-	-	-	-	-	Bulk
2N60L-T6C-K	2N60G-T6C-K	TO-126C	G	D	S	-	-	-	-	-	Bulk
2N60L-K08-5060-R	2N60G-K08-5060-R	DFN5060-8	S	S	S	G	D	D	D	D	Tape Reel

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

<p>2N60G-AA3-R</p> <p>(1) Packing Type (2) Package Type (3) Green Package</p>	<p>(1) T: Tube, R: Tape Reel, K: Bulk (2) AA3: SOT-223, TA3: TO-220, TF1: TO-220F1, TF3: TO-220F, TM3: TO-251, TMA: TO-251L, TMS: TO-251S, TMS2: TO-251S2, TMS4: TO-251S4, TN3: TO-252, T2Q: TO-262, T60: TO-126, T6C: TO-126C, K08-5060: DFN5060-8 (3) G: Halogen Free and Lead Free, L: Lead Free</p>
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MARKING

PACKAGE	MARKING
SOT-223	<p>Lot Code ← 2N60G □□□□ → Data Code 1</p>
TO-220 TO-220F TO-220F1 TO-251 TO-251L TO-251S TO-251S2 TO-251S4 TO-252 TO-262	<p>Lot Code ← UTC 2N60 □□□□ → Data Code 1</p> <p>L: Lead Free G: Halogen Free</p>
TO-126 TO-126C	<p>Lot Code ← UTC 2N60 □□□□ → Data Code 1</p> <p>L: Lead Free G: Halogen Free</p>
DFN5060-8	<p>Lot Code ← UTC 2N60 □□□□ → Data Code</p>

■ 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}	± 30	V	
Avalanche Current (Note 2)	I_{AR}	2.0	A	
Drain Current	Continuous	I_D	2.0	
	Pulsed (Note 2)	I_{DM}	8.0	
Avalanche Energy	Single Pulsed (Note 3)	E_{AS}	100	
Power Dissipation ($T_C = 25^\circ\text{C}$)	SOT-223	P_D	1	
	TO-220/ TO-262		54	
	TO-220F/TO-220F1		23	
	TO-251/TO-251L		44	W
	TO-252/TO-251S			
	TO-251S2/TO-251S4			
	TO-126/TO-126C			
DFN5060-8	22	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. $L=50\text{mH}$, $I_{AS}=2\text{A}$, $V_{DD}=50\text{V}$, $R_G=25\ \Omega$, 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	PACKAGE	SYMBOL	RATINGS	UNIT
Junction to Ambient	SOT-223	θ_{JA}	150	$^\circ\text{C}/\text{W}$
	TO-220/ TO-262		62.5	$^\circ\text{C}/\text{W}$
	TO-220F/TO-220F1			
	TO-251/TO-251L		100	$^\circ\text{C}/\text{W}$
	TO-252/TO-251S			
	TO-251S2/TO-251S4			
	TO-126/TO-126C			
DFN5060-8	75 (Note)	$^\circ\text{C}/\text{W}$		
Junction to Case	SOT-223	θ_{JC}	14	$^\circ\text{C}/\text{W}$
	TO-220/ TO-262		2.32	$^\circ\text{C}/\text{W}$
	TO-220F/TO-220F1		5.5	$^\circ\text{C}/\text{W}$
	TO-251/TO-251L		2.87	$^\circ\text{C}/\text{W}$
	TO-252/TO-251S			
	TO-251S2/TO-251S4			
	TO-126/TO-126C		3.12	$^\circ\text{C}/\text{W}$
DFN5060-8	5.6 (Note)	$^\circ\text{C}/\text{W}$		

Note: Note: The data tested by surface mounted on a 1 inch² FR-4 board with 2OZ copper.

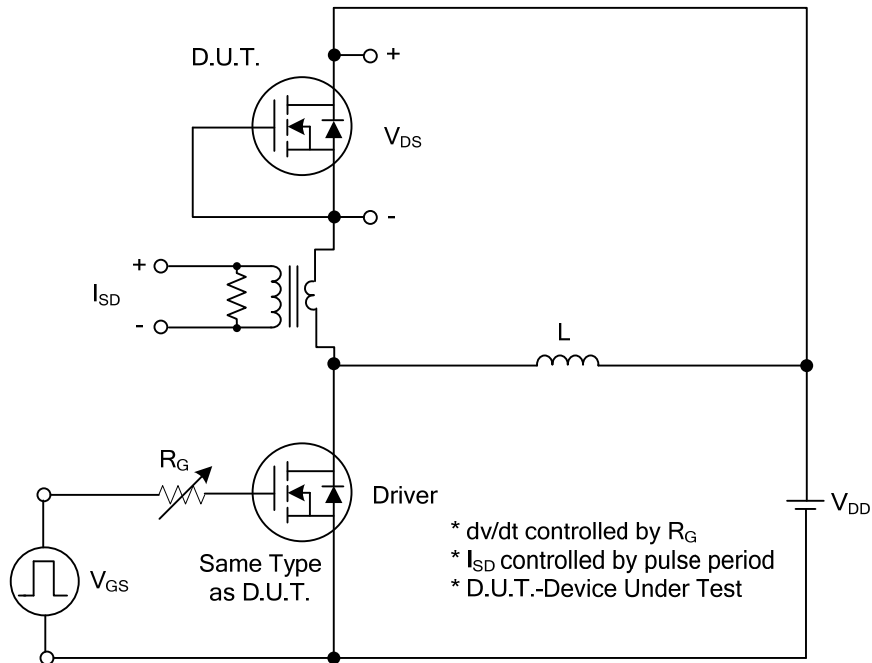
■ ELECTRICAL CHARACTERISTICS ($T_J=25^\circ\text{C}$, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS						
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	μA
Gate-Source Leakage Current	Forward	I_{GSS}			100	nA
	Reverse				$V_{GS} = -30V, V_{DS} = 0V$	-100
Breakdown Voltage Temperature Coefficient	$\Delta BV_{DSS}/\Delta T_J$	$I_D=250\mu A$, Referenced to 25°C		0.4		$V/^\circ\text{C}$
ON CHARACTERISTICS						
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	$R_{DS(ON)}$	$V_{GS} = 10V, I_D = 1A$		4.36	5.0	Ω
DYNAMIC CHARACTERISTICS						
Input Capacitance	C_{ISS}	$V_{DS}=25V, V_{GS}=0V,$ $f=1\text{MHz}$		260	300	pF
Output Capacitance	C_{OSS}			35	40	pF
Reverse Transfer Capacitance	C_{RSS}			9	13	pF
SWITCHING CHARACTERISTICS						
Total Gate Charge	Q_G	$V_{DS}=100V, V_{GS}=10V,$ $I_D=2.4A$ (Note 1, 2)		35	50	nC
Gate-Source Charge	Q_{GS}			3.5		nC
Gate-Drain Charge	Q_{GD}			8		nC
Turn-On Delay Time	$t_{D(ON)}$	$V_{DD}=30V, I_D=1A,$ $R_G=25\Omega$ (Note 1, 2)		40	60	ns
Turn-On Rise Time	t_R			35	55	ns
Turn-Off Delay Time	$t_{D(OFF)}$			70	90	ns
Turn-Off Fall Time	t_F			40	55	ns
DRAIN-SOURCE DIODE CHARACTERISTICS						
Drain-Source Diode Forward Voltage	V_{SD}	$V_{GS} = 0V, I_{SD} = 2.0A$			1.4	V
Continuous Drain-Source Current	I_{SD}				2.0	A
Pulsed Drain-Source Current	I_{SM}				8.0	A

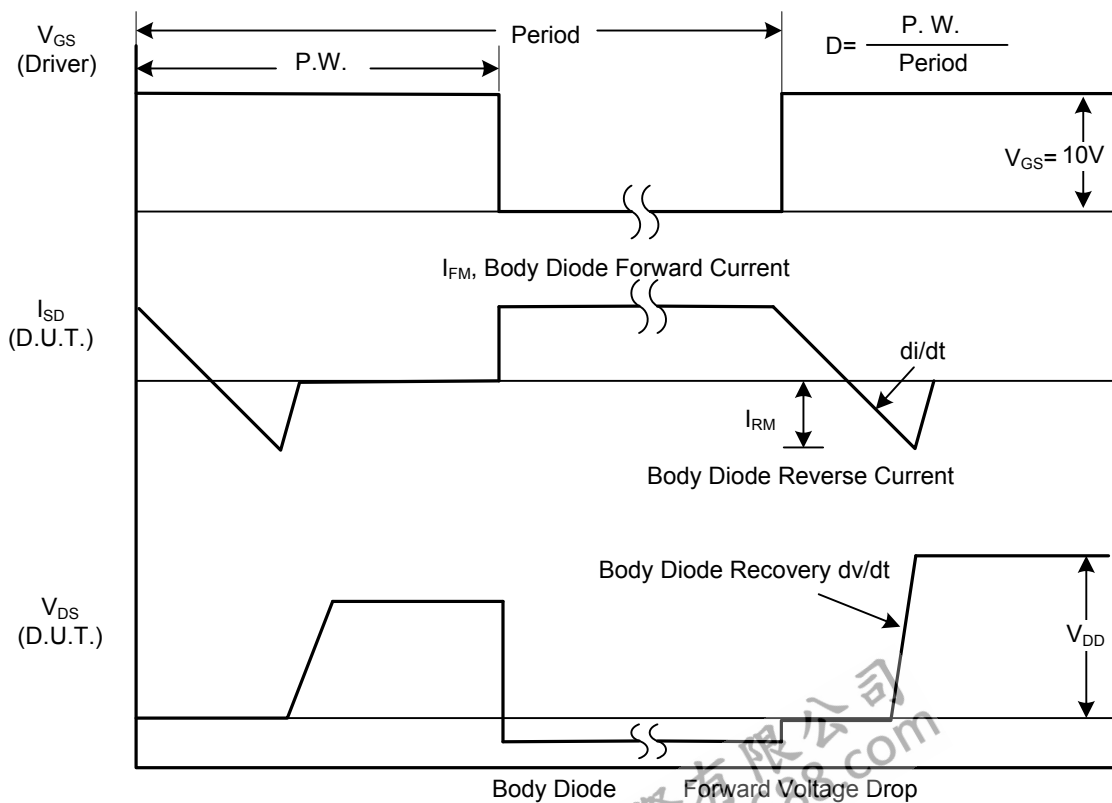
Notes: 1. Pulse Test: Pulse width $\leq 300\mu s$, Duty cycle $\leq 2\%$.

2. Essentially independent of operating temperature.

■ TEST CIRCUITS AND WAVEFORMS

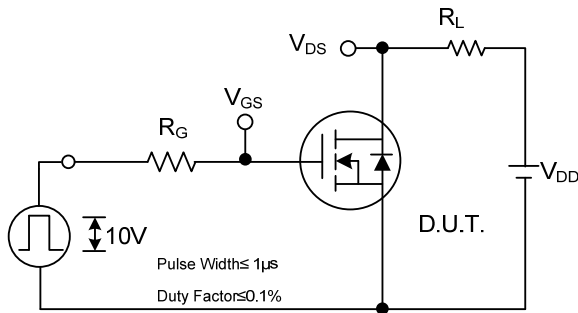


Peak Diode Recovery dv/dt Test Circuit

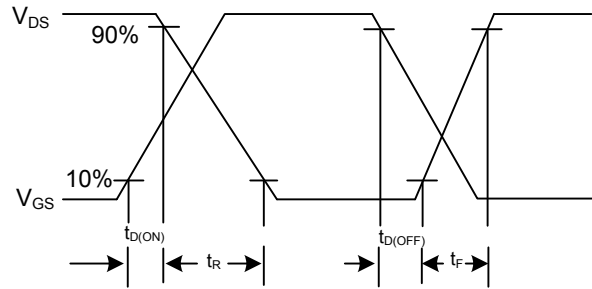


Peak Diode Recovery dv/dt Waveforms

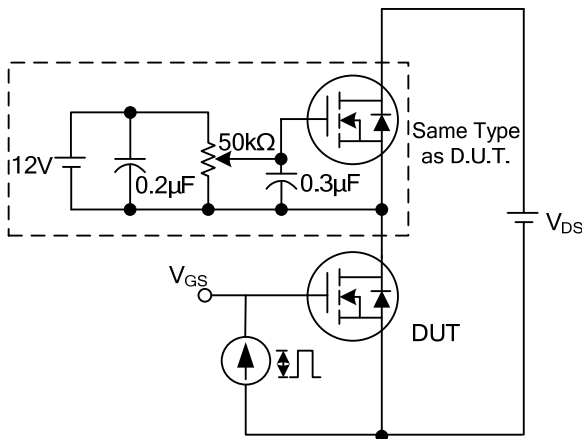
■ TEST CIRCUITS AND WAVEFORMS (Cont.)



Switching Test Circuit



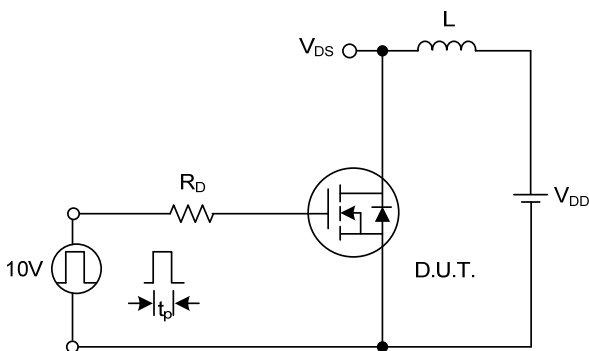
Switching Waveforms



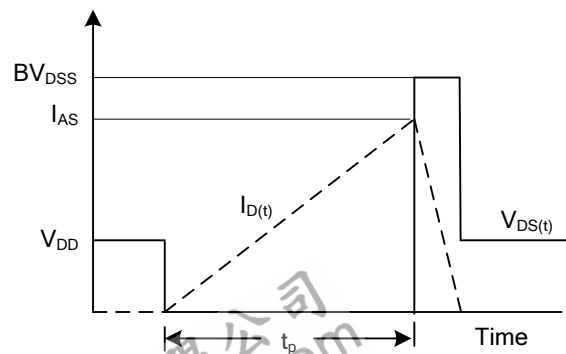
Gate Charge Test Circuit



Gate Charge Waveform

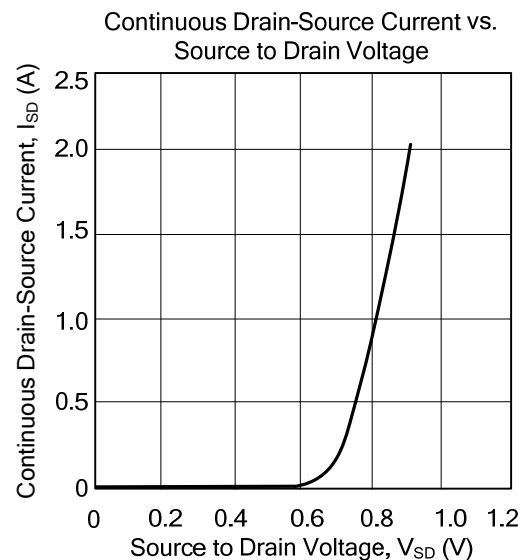
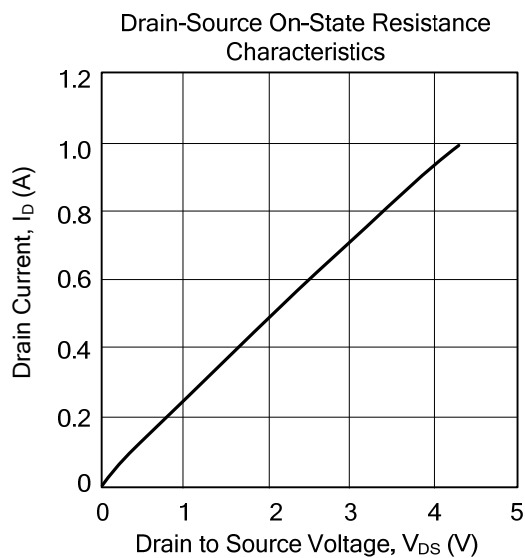
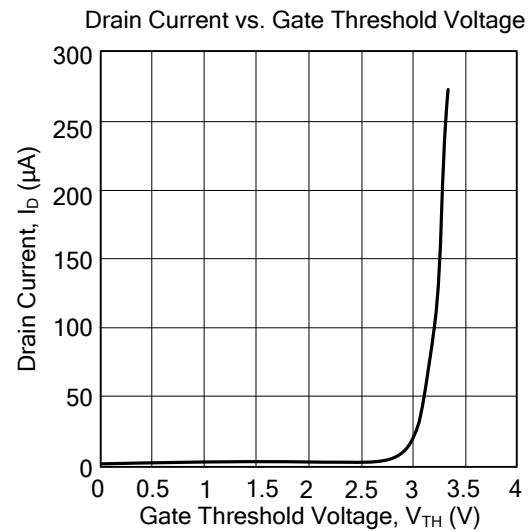
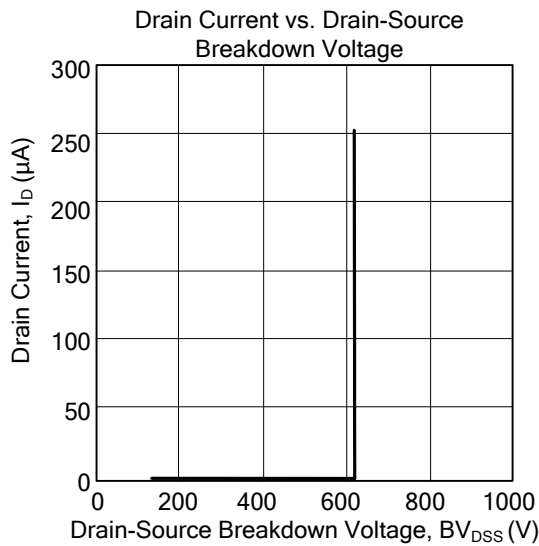


Unclamped Inductive Switching Test Circuit



Unclamped Inductive Switching Waveforms

■ TYPICAL CHARACTERISTICS



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