



1N60

Power MOSFET

1.2 Amps, 600/650 Volts N-CHANNEL MOSFET

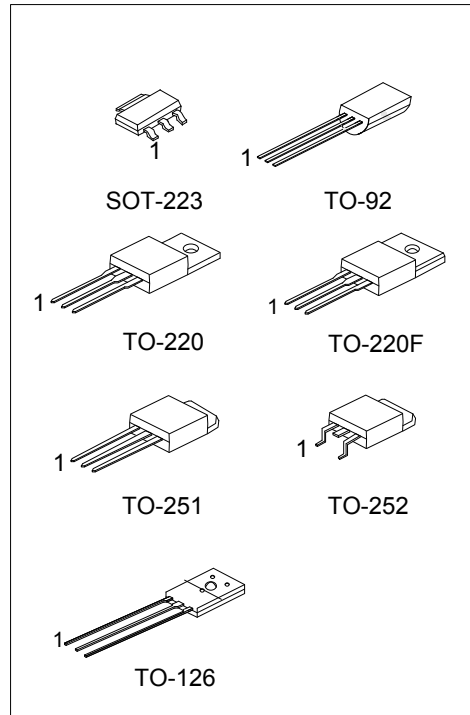
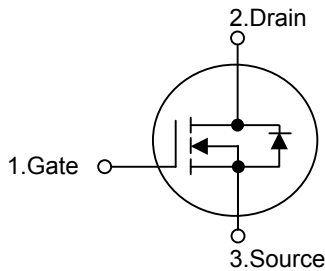
■ DESCRIPTION

The UTC **1N60** is a high voltage 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

- * $R_{DS(ON)} = 11.5\Omega @ V_{GS} = 10V$.
- * Ultra Low gate charge (typical 5.0nC)
- * Low reverse transfer capacitance ($C_{RSS} =$ typical 3.0 pF)
- * 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	
1N60L-x-AA3-R	1N60G-x-AA3-R	SOT-223	G	D	S	Tape Reel
1N60L-x-T92-B	1N60G-x-T92-B	TO-92	G	D	S	Tape Box
1N60L-x-T92-K	1N60G-x-T92-K	TO-92	G	D	S	Bulk
1N60L-x-TA3-T	1N60G-x-TA3-T	TO-220	G	D	S	Tube
1N60L-x-TF3-T	1N60G-x-TF3-T	TO-220F	G	D	S	Tube
1N60L-x-TM3-T	1N60G-x-TM3-T	TO-251	G	D	S	Tube
1N60L-x-TN3-R	1N60G-x-TN3-R	TO-252	G	D	S	Tape Reel
1N60L-x-TN3-T	1N60G-x-TN3-T	TO-252	G	D	S	Tube
1N60L-x-T60-K	1N60G-x-T60-K	TO-126	G	D	S	Bulk

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

<p>1N60L-x-AA3-B</p>	<p>(1) B: Tape Box, K: Bulk, T: Tube, R: Tape Reel (2) AA3: SOT-223, T92: TO-92, TA3: TO-220, TF3: TO-220F, TM3: TO-251, TN3: TO-252, T60: TO-126 (3) A: 600V, B: 650V (4) G: Halogen Free, L: Lead 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	1N60-A	V_{DSS}	600	V
	1N60-B		650	V
Gate-Source Voltage		V_{GSS}	± 30	V
Avalanche Current (Note 1)		I_{AR}	1.2	A
Continuous Drain Current		I_D	1.2	A
Pulsed Drain Current (Note 1)		I_{DM}	4.8	A
Avalanche Energy	Single Pulsed (Note 2)	E_{AS}	50	mJ
	Repetitive (Note 1)	E_{AR}	4.0	mJ
Peak Diode Recovery dv/dt (Note 3)		dv/dt	4.5	V/ns
Power Dissipation	SOT-223	P_D	1	W
	TO-251		28	W
	TO-252		28	W
	TO-220		40	W
	TO-220F		21	W
	TO-92($T_a=25^\circ\text{C}$)		1	W
	TO-126		12.5	W
Junction Temperature		T_J	+150	$^\circ\text{C}$
Operating Temperature		T_{OPR}	-55 ~ +150	$^\circ\text{C}$
Storage Temperature		T_{STG}	-55 ~ +150	$^\circ\text{C}$

Note: 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.

■ THERMAL DATA

PARAMETER		SYMBOL	RATINGS	UNIT
Junction-to-Ambient	SOT-223	θ_{JA}	150	$^\circ\text{C/W}$
	TO-251		110	
	TO-252		110	
	TO-220		62.5	
	TO-220F		62.5	
	TO-92		140	
	TO-126		132	
Junction-to-Case	SOT-223	θ_{JC}	14	$^\circ\text{C/W}$
	TO-251		4.53	
	TO-252		4.53	
	TO-220		3.13	
	TO-220F		5.95	
	TO-126		10	

■ ELECTRICAL CHARACTERISTICS (T_C=25°C, unless otherwise specified.)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT	
OFF CHARACTERISTICS							
Drain-Source Breakdown Voltage	1N60-A	BV _{DSS}	V _{GS} =0V, I _D =250μA	600			V
	1N60-B			650			V
Drain-Source Leakage Current		I _{DSS}	V _{DS} =600V, V _{GS} =0V			10	μA
Gate-Source Leakage Current	Forward	I _{GSS}	V _{GS} =30V, V _{DS} =0V			100	nA
	Reverse		V _{GS} =-30V, V _{DS} =0V			-100	nA
Breakdown Voltage Temperature Coefficient		ΔBV _{DSS} /ΔT _J	I _D =250μA		0.4		V/°C
ON CHARACTERISTICS							
Gate Threshold Voltage		V _{GS(TH)}	V _{DS} =V _{GS} , I _D =250μA	2.0		4.0	V
Static Drain-Source On-State Resistance		R _{DS(ON)}	V _{GS} =10V, I _D =0.6A		9.3	11.5	Ω
DYNAMIC CHARACTERISTICS							
Input Capacitance		C _{ISS}	V _{DS} =25V, V _{GS} =0V, f=1MHz		120	150	pF
Output Capacitance		C _{OSS}			20	25	pF
Reverse Transfer Capacitance		C _{RSS}			3.0	4.0	pF
SWITCHING CHARACTERISTICS							
Turn-On Delay Time		t _{D(ON)}	V _{DD} =300V, I _D =1.2A, R _G =50Ω (Note 4,5)		5	20	ns
Turn-On Rise Time		t _R			25	60	ns
Turn-Off Delay Time		t _{D(OFF)}			7	25	ns
Turn-Off Fall Time		t _F		25	60	ns	
Total Gate Charge		Q _G	V _{DS} =480V, V _{GS} =10V, I _D =1.2A (Note 4,5)		5.0	6.0	nC
Gate-Source Charge		Q _{GS}			1.0		nC
Gate-Drain Charge		Q _{GD}			2.6		nC
SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS							
Drain-Source Diode Forward Voltage		V _{SD}	V _{GS} =0V, I _S =1.2A			1.4	V
Maximum Continuous Drain-Source Diode Forward Current		I _S				1.2	A
Maximum Pulsed Drain-Source Diode Forward Current		I _{SM}				4.8	A
Reverse Recovery Time		t _{RR}	V _{GS} =0V, I _S =1.2A		160		ns
Reverse Recovery Charge		Q _{RR}	dI _F /dt=100A/μs (Note1)		0.3		μC

- Note:
1. Repetitive Rating: Pulse width limited by maximum junction temperature
 2. L = 60mH, I_{AS} = 1A, V_{DD} = 50V, R_G = 25Ω, Starting T_J = 25°C
 3. I_{SD} ≤ 1.2A, di/dt ≤ 200A/μs, V_{DD} ≤ BV_{DSS}, Starting T_J = 25°C
 4. Pulse Test: Pulse Width ≤ 300μs, Duty Cycle ≤ 2%
 5. Essentially Independent of Operating Temperature

■ TEST CIRCUITS AND WAVEFORMS

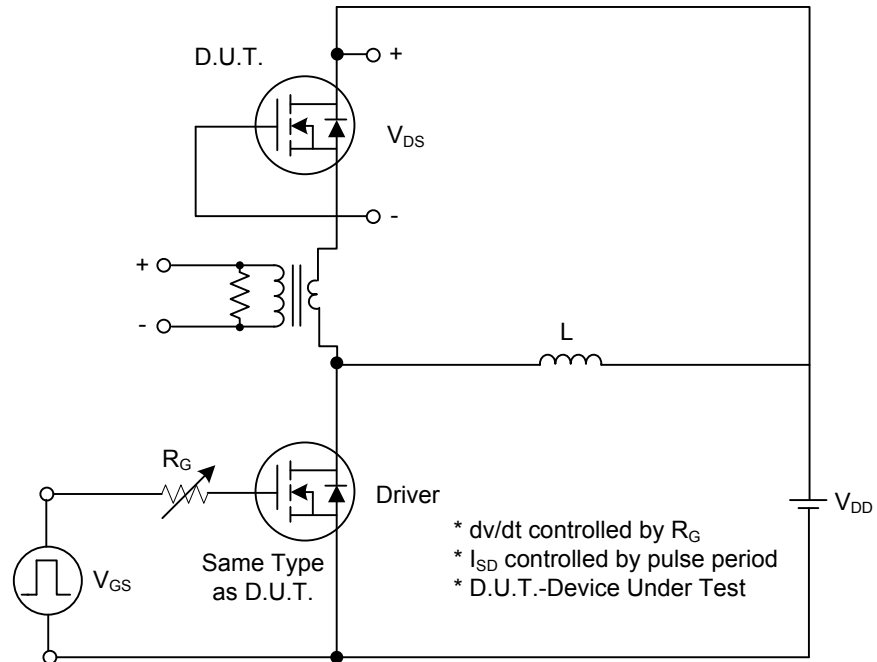


Fig. 1A Peak Diode Recovery dv/dt Test Circuit

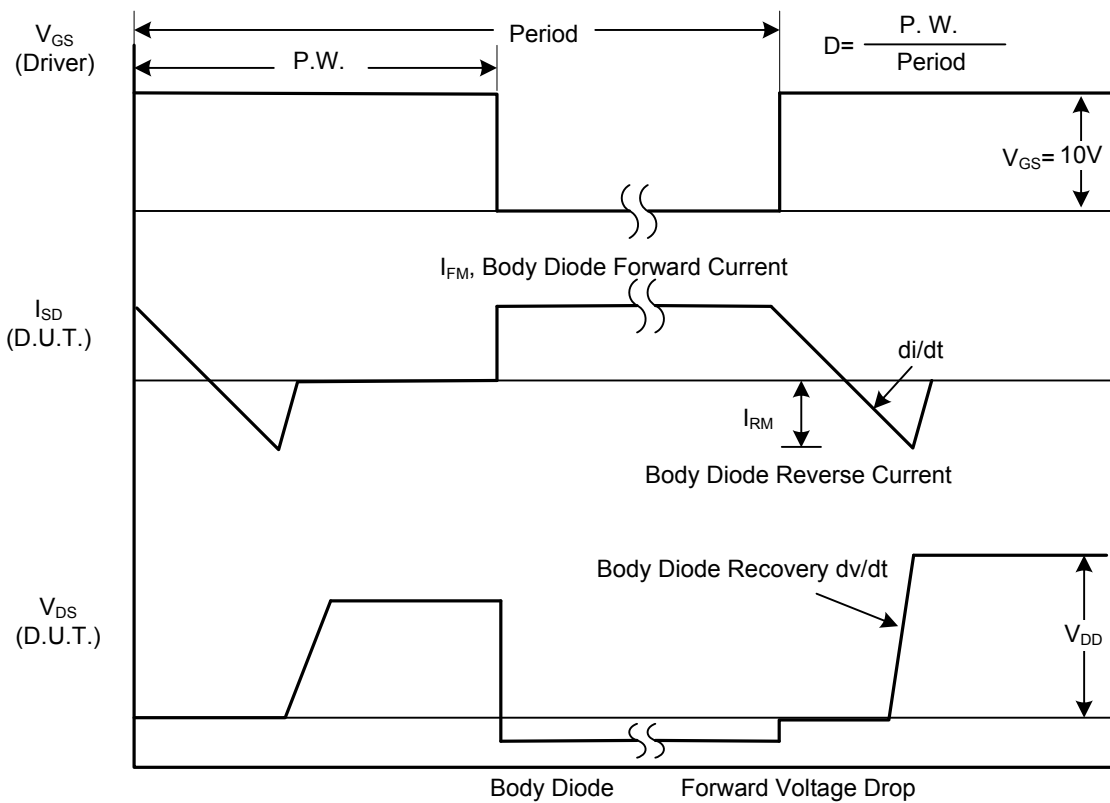


Fig. 1B Peak Diode Recovery dv/dt Waveforms

■ TEST CIRCUITS AND WAVEFORMS (Cont.)

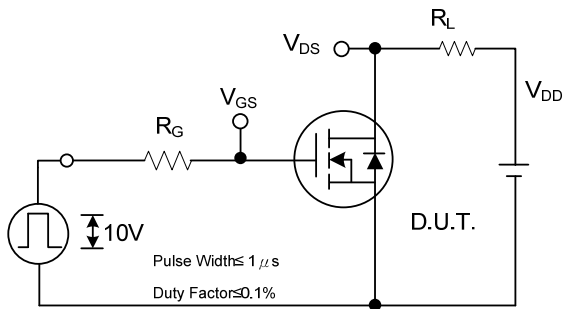


Fig. 2A Switching Test Circuit

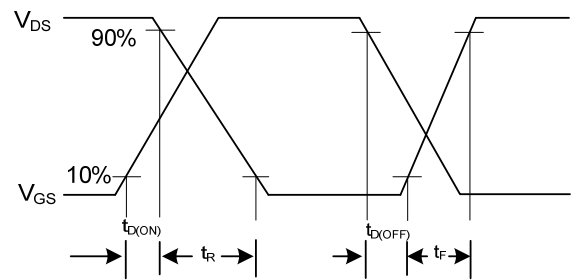


Fig. 2B Switching Waveforms

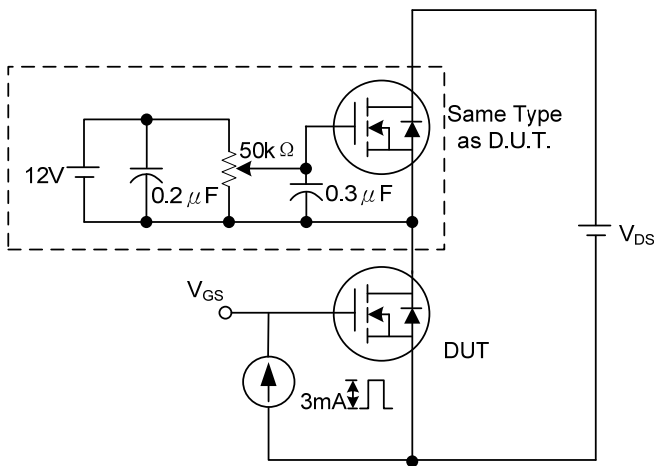


Fig. 3A Gate Charge Test Circuit

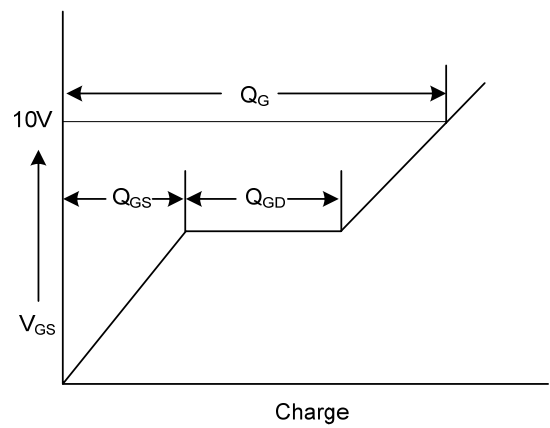


Fig. 3B Gate Charge Waveform

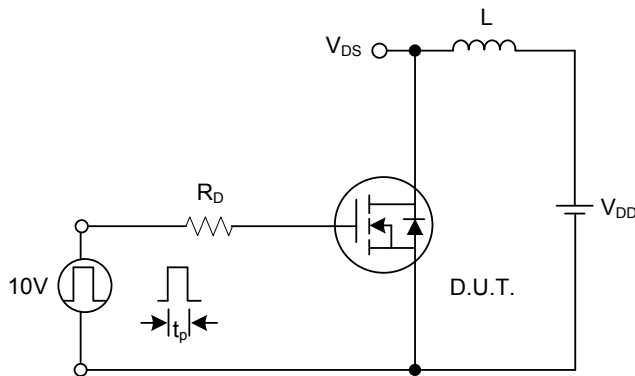


Fig. 4A Unclamped Inductive Switching Test Circuit

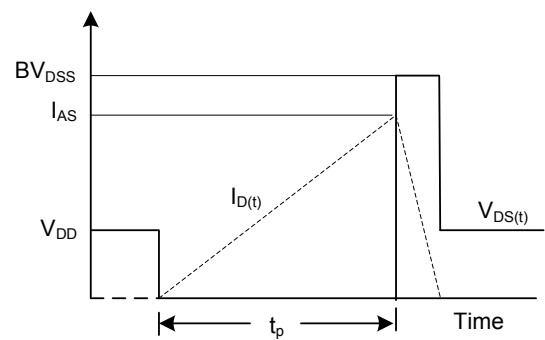
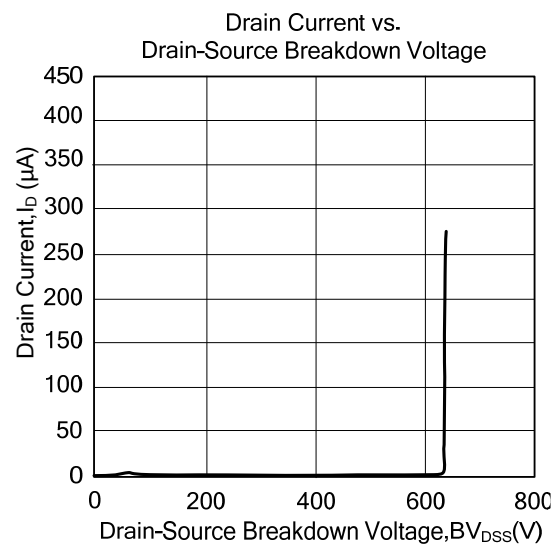
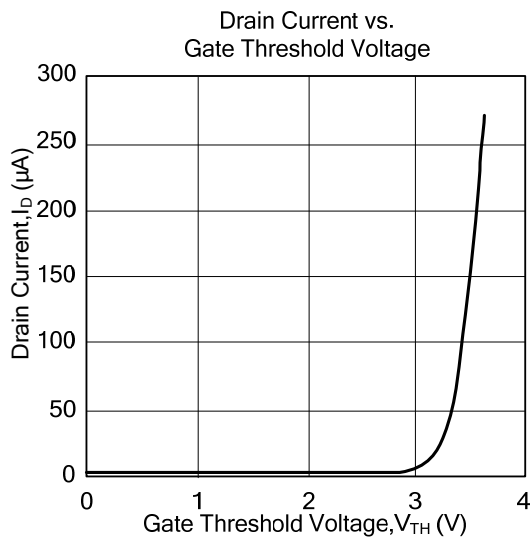
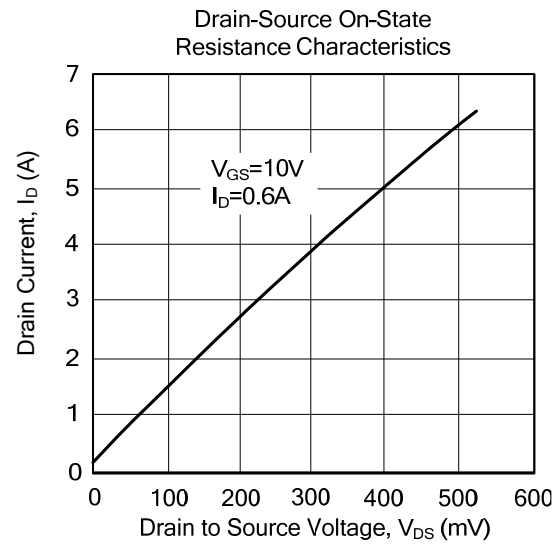
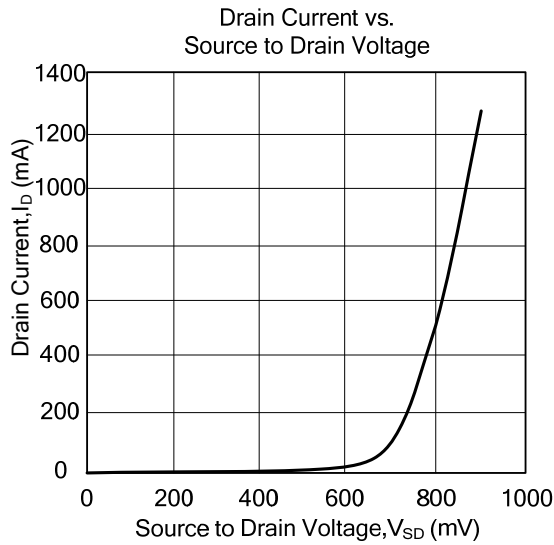


Fig. 4B Unclamped Inductive Switching Waveforms

TYPICAL CHARACTERISTICS



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