



1N60A

Power MOSFET

0.5A, 600V N-CHANNEL POWER MOSFET

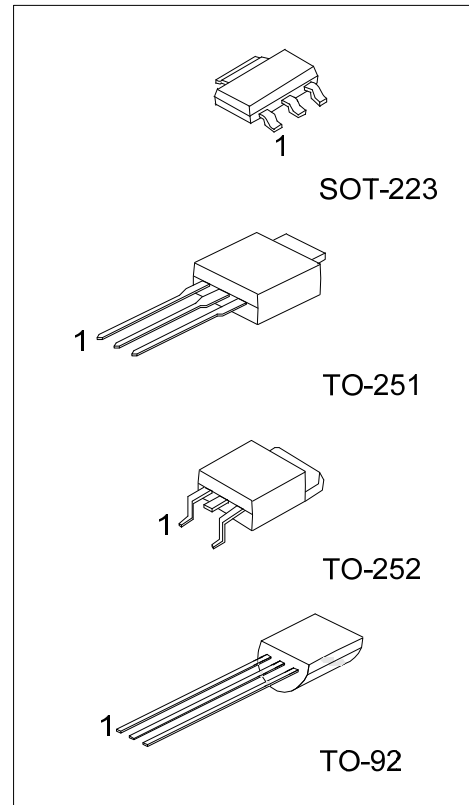
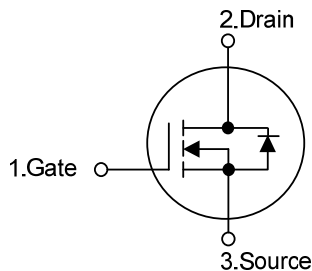
DESCRIPTION

The UTC **1N60A** 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

- * $R_{DS(ON)} < 15\Omega @ V_{GS} = 10V$.
- * Ultra Low gate charge (typical 8.0nC)
- * Low reverse transfer capacitance ($C_{RSS} = 3.0 \text{ pF(max)}$)
- * Fast switching capability
- * Avalanche energy specified
- * Improved dv/dt capability, high ruggedness

SYMBOL



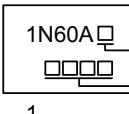
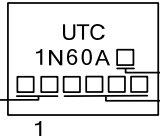
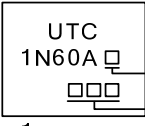
ORDERING INFORMATION

Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
1N60AL-AA3-R	1N60AG-AA3-R	SOT-223	G	D	S	Tape Reel
1N60AL-TM3-T	1N60AG-TM3-T	TO-251	G	D	S	Tube
1N60AL-TN3-R	1N60AG-TN3-R	TO-252	G	D	S	Tape Reel
1N60AL-T92-B	1N60AG-T92-B	TO-92	G	D	S	Tape Box
1N60AL-T92-K	1N60AG-T92-K	TO-92	G	D	S	Bulk

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

1N60AL-AA3-R	(1)Packing Type (2)Package Type (3)Lead Free	(1) B: Tape Box, K: Bulk, R: Tape Reel, T: Tube (2) AA3: SOT-223, TM3: TO-251, TN3: TO-252 T92: TO-92 (3) L: Lead Free, G: Halogen Free
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■ MARKING INFORMATION

PACKAGE	MARKING
SOT-223	 1 L: Lead Free G: Halogen Free Data Code
TO-251 TO-252	 Lot Code 1 UTC 1N60A L: Lead Free G: Halogen Free Data Code
TO-92	 1 UTC 1N60A L: Lead Free P: Halogen Free Data Code

■ **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
Continuous Drain Current		I_D	0.5	A
Pulsed Drain Current (Note 2)		I_{DM}	2	A
Avalanche Energy	Single Pulse(Note 3)	E_{AS}	50	mJ
	Repetitive(Note 2)	E_{AR}	3.6	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	4.5	V/ns
Power Dissipation ($T_C=25^\circ\text{C}$)	SOT-223	P_D	6.25	W
	TO-251/TO-252		34	
	TO-92		3	
Derate above 25°C	SOT-223		0.05	$\text{W}/^\circ\text{C}$
	TO-251/TO-252		0.27	
	TO-92		0.025	
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 maximum junction temperature

3. $L=92\text{mH}$, $I_{AS}=0.8\text{A}$, $V_{DD}=50\text{V}$, $R_G=0\Omega$, Starting $T_J=25^\circ\text{C}$

4. $I_{SD}\leq 1.0\text{A}$, $di/dt\leq 100\text{A}/\mu\text{s}$, $V_{DD}\leq BV_{DSS}$, Starting $T_J=25^\circ\text{C}$

■ **THERMAL DATA**

PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Ambient	SOT-223	θ_{JA}	150	$^\circ\text{C}/\text{W}$
	TO-251/TO-252		110	
	TO-92		160	
Junction to Case	SOT-223	θ_{JC}	20	$^\circ\text{C}/\text{W}$
	TO-251/TO-252		5	
	TO-92		80	

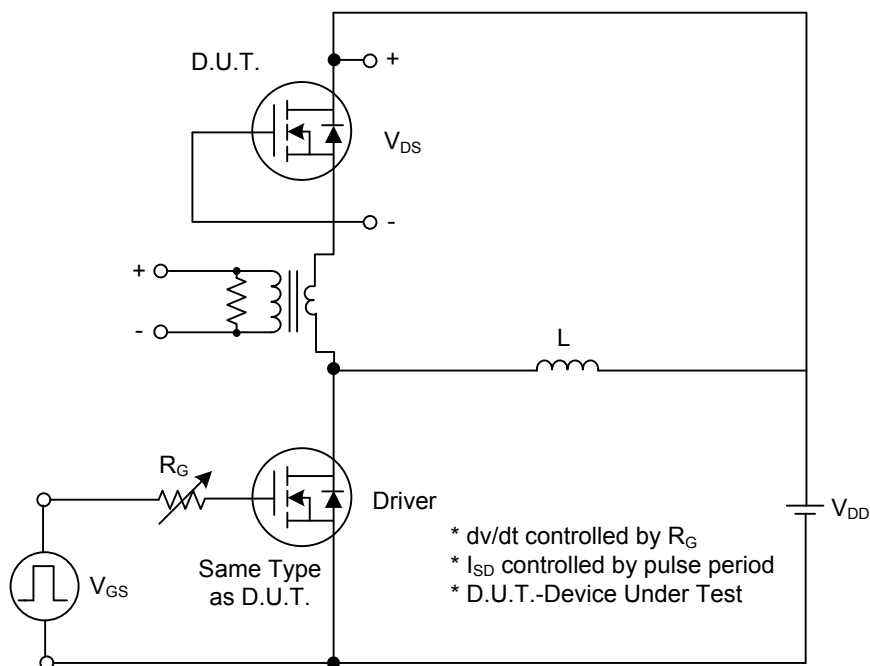
■ **ELECTRICAL CHARACTERISTICS** ($T_J = 25^\circ\text{C}$, unless otherwise specified.)

PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS							
Drain-Source Breakdown Voltage		BV _{DSS}	V _{GS} = 0V, I _D = 250μA	600			V
Drain-Source Leakage Current (T _J =25°C)		I _{DSS}	V _{DS} = 600V, V _{GS} = 0V			10	μA
Drain-Source Leakage Current (T _J =125°C)						10	
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 referenced to 25°C		0.4		V/°C
ON CHARACTERISTICS							
Gate Threshold Voltage		V _{GS(TH)}	V _{DS} = V _{GS} , I _D = 250μA	2.0		4.5	V
Static Drain-Source On-State Resistance		R _{DS(ON)}	V _{GS} = 10V, I _D = 0.5A		11	15	Ω
DYNAMIC CHARACTERISTICS							
Input Capacitance		C _{ISS}	V _{DS} =25V, V _{GS} =0V, f=1MHz			100	pF
Output Capacitance		C _{OSS}				20	pF
Reverse Transfer Capacitance		C _{RSS}				3	pF
SWITCHING CHARACTERISTICS							
Turn-On Delay Time		t _{D (ON)}	V _{DD} =300V, I _D =0.5A, R _G =5Ω (Note 1,2)		12	34	ns
Turn-On Rise Time		t _R			11	32	ns
Turn-Off Delay Time		t _{D (OFF)}			40	90	ns
Turn-Off Fall Time		t _F			18	46	ns
Total Gate Charge		Q _G	V _{DS} =480V, V _{GS} =10V, I _D =0.8A (Note 1,2)		8	10	nC
Gate-Source Charge		Q _{GS}			1.8		nC
Gate-Drain Charge		Q _{GD}			4.0		nC
SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS							
Drain-Source Diode Forward Voltage		V _{SD}	V _{GS} =0V, I _{SD} = 1.2A			1.6	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 _{SD} = 1.2A		136		ns
Reverse Recovery Charge		Q _{RR}	di/dt = 100A/μs		0.3		μC

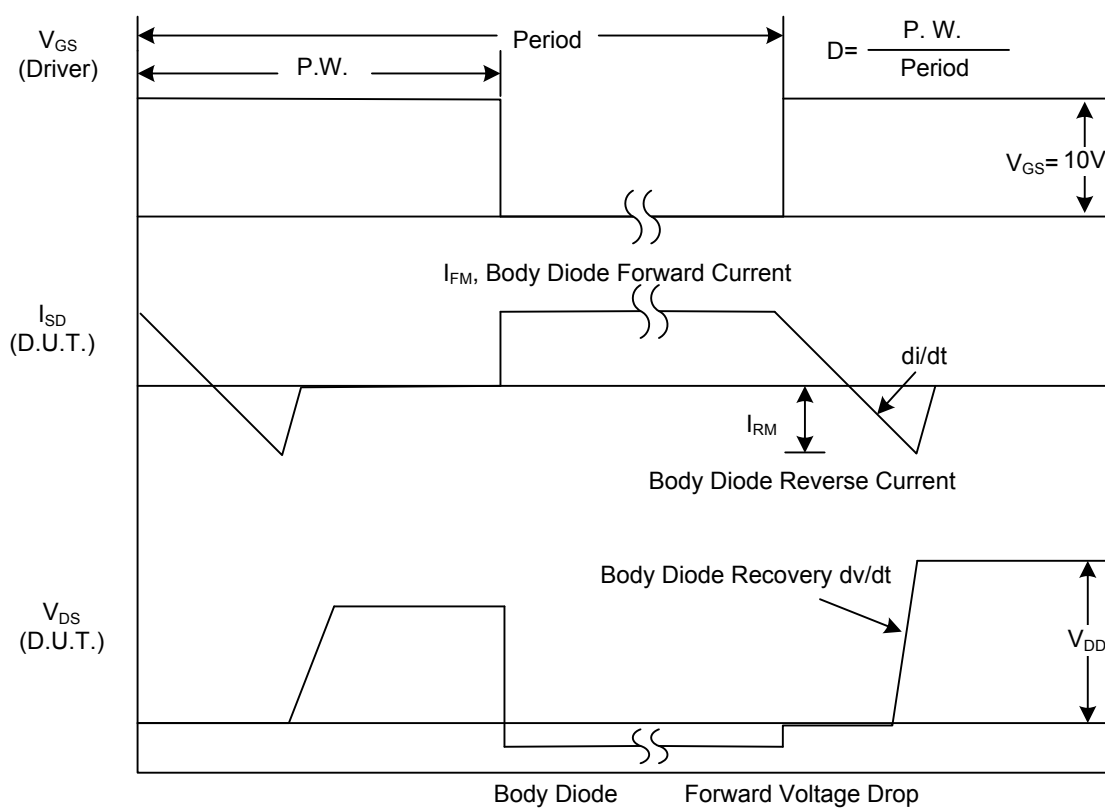
Notes: 1. Pulse Test: Pulse Width $\leq 300\mu s$, Duty Cycle $\leq 2\%$

2. Essentially independent of operating temperature.

■ TEST CIRCUITS AND WAVEFORMS

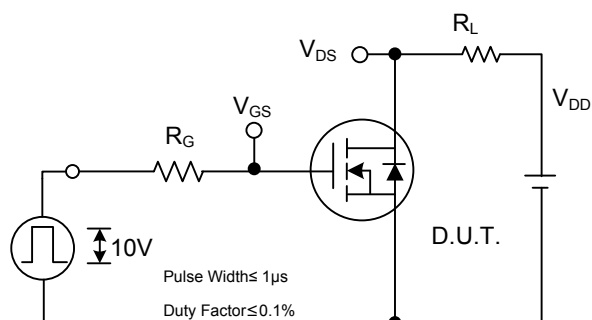


Peak Diode Recovery dv/dt Test Circuit

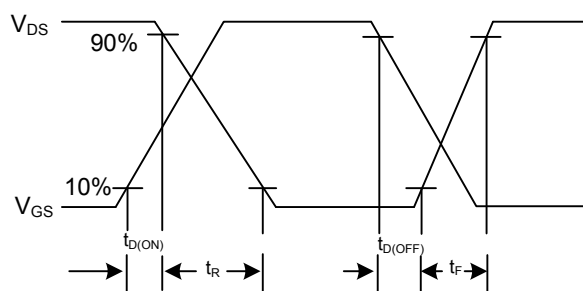


Peak Diode Recovery dv/dt Waveforms

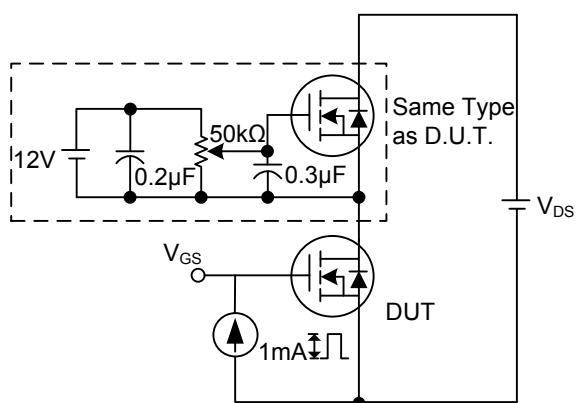
■ TEST CIRCUITS AND WAVEFORMS (Cont.)



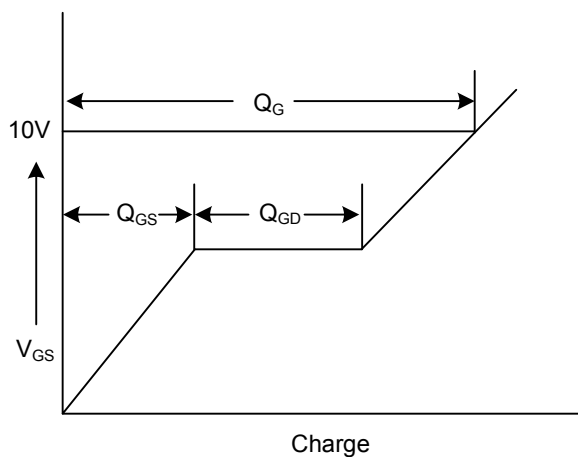
Switching Test Circuit



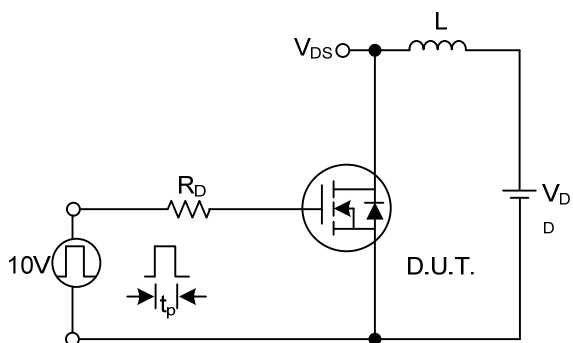
Switching Waveforms



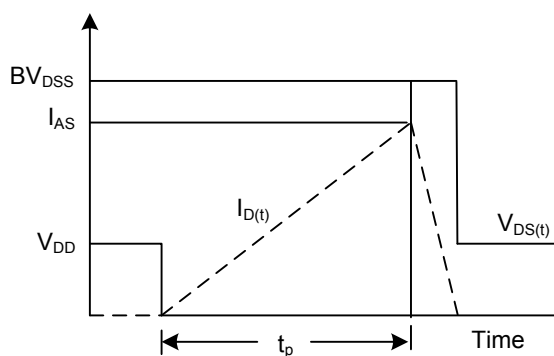
Gate Charge Test Circuit



Gate Charge Waveform

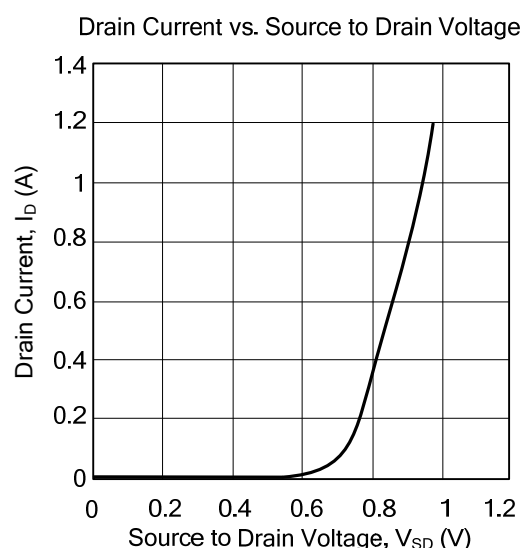
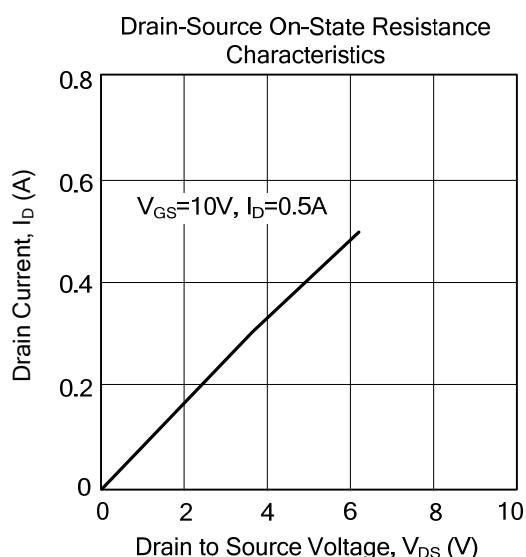
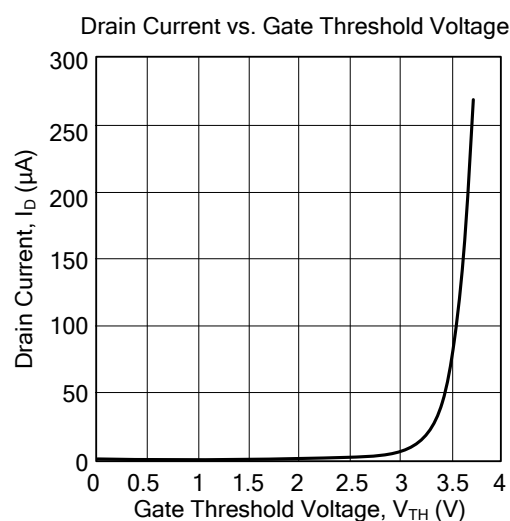
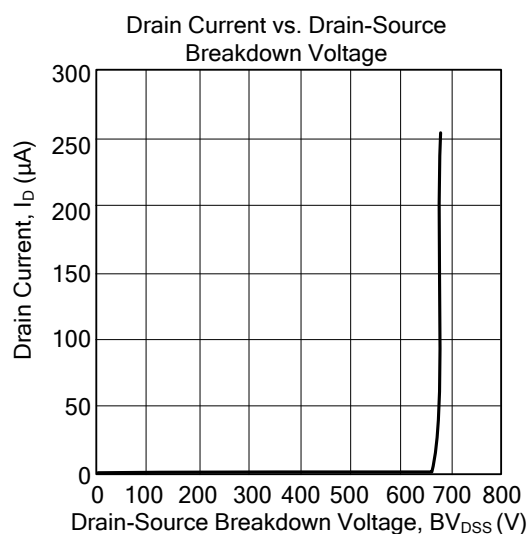


Unclamped Inductive Switching Test Circuit



Unclamped Inductive Switching Waveforms

■ TYPICAL CHARACTERISTICS



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