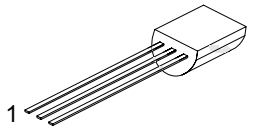
1N60A

Power MOSFET

0.5 Amps, 600/650 Volts N-CHANNEL MOSFET



TO-92

*Pb-free plating product number: 1N60AL

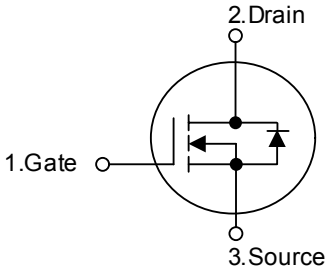
■ DESCRIPTION

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

* $R_{DS(ON)}$ =11Ω@V_{GS} = 10V.
* Ultra Low gate charge (typical 8.0nC)
* Low reverse transfer capacitance (C_{RSS} = 3.0 pF(max))
* Fast switching capability
* Avalanche energy specified
* Improved dv/dt capability, high ruggedness

■ SYMBOL



■ ORDERING INFORMATION

Order Number		Package	Pin Assignment			Packing
Normal	Lead Free Plating		1	2	3	
1N60A-x-T92-B	1N60AL-x-T92-B	TO-92	G	D	S	Tape Box
1N60A-x-T92-K	1N60AL-x-T92-K	TO-92	G	D	S	Bulk
1N60A-x-T92-R	1N60AL-x-T92-R	TO-92	G	D	S	Tape Reel

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

1N60AL-x-T92-B

(1)Packing Type
(2)Package Type
(3)Drain-Source Voltage
(4)Lead Plating

(1) B: Tape Box, K: Bulk, R: Tape Reel
(2) T92: TO-92
(3) A: 600V, B: 650V
(4) L: Lead Free Plating Blank: Pb/Sn

■ ABSOLUTE MAXIMUM RATINGS(T_C = 25°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
Continuous Drain Current	T_C = 25°C	I_D	0.5	A
	T_C = 100°C		0.4	
Drain Current-Pulsed (Note 2)		I_{DP}	2	A
Avalanche Energy	Repetitive(Note 1)	E_{AR}	3.6 | 4.0	mJ
	Single Pulse(Note 2)	E_{AS}	50	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	4.5	V/ns
Total Power Dissipation	T_C=25℃	P_D	3	W
	Derate above 25°C		25	mW/℃
Operation Junction Temperature		T_J	-55 ~ +150	℃
Storage Temperature		T_{STG}	-55 ~ +150	℃

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	MIN	TYP	MAX	UNIT
Thermal Resistance Junction-Ambient	θ_{JA}			120	℃/W
Thermal Resistance Junction-Case	θ_{CS}		0.5		

■ ELECTRICAL CHARACTERISTICS (T_J =25°C, Unless Otherwise Specified.)

PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Off Characteristics							
Drain-Source Breakdown Voltage	1N60A-A	BV_{DSS}	V_{GS} = 0V, I_D = 250μA	600			V
	1N60A-B			650			V
Breakdown Voltage Temperature Coefficient		$\triangle BV_{DSS}/\triangle T_J$	I_D = 250μA, referenced to 25℃		0.4		V/℃
Zero Gate Voltage Drain Current		I_{DSS}	V_{DS} = 600V, V_{GS} = 0V			1	μA
			V_{DS} = 480V, T_C = 125℃				
Gate-Body Leakage Current	Forward	I_{GSS}	V_{GS} = 20V, V_{DS} = 0V			10	μA
	Reverse		V_{GS} = -20V, V_{DS} = 0V			-10	μA
On Characteristics							
Gate Threshold Voltage		$V_{GS(TH)}$	V_{DS} = V_{GS}, I_D = 250μA	2.0		4.0	V
Static Drain-Source On-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 4,5)		12	34	ns
Rise Time		t_R			11	32	ns
Turn-Off Delay Time		$t_{D(OFF)}$			40	90	ns
Fall Time		t_F			18	46	ns
Total Gate Charge		Q_G	V_{DS}=480V, V_{GS}=10V, I_D=0.8A (Note 4,5)		8	10	nC
Gate-Source Charge		Q_{GS}			1.8		nC
Gate-Drain Charge		Q_{GD}			4.0		nC

■ ELECTRICAL CHARACTERISTICS(Cont.)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Drain-Source Diode Characteristics						
Drain-Source Diode Forward Voltage	V_{SD}	V_{GS}=0V, I_S = 0.8A,			1.6	V
Continuous Drain-Source Current	I_{SD}				1.2	A
Pulsed Drain-Source Current	I_{SM}				4.8	A
Reverse Recovery Time	t_{RR}	V_{GS}=0V, I_S = 0.8A		136		ns
Reverse Recovery Charge	Q_{RR}	di/dt = 100A/μs		0.3		μC

Note: 1. Repeativity rating: pulse width limited by junction temperature
2. L=92mH, I_{AS}=1.0A, V_{DD}=50V, R_G=0Ω, Starting T_J=25°C
3. I_{SD}≤1.0A, di/dt≤100A/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

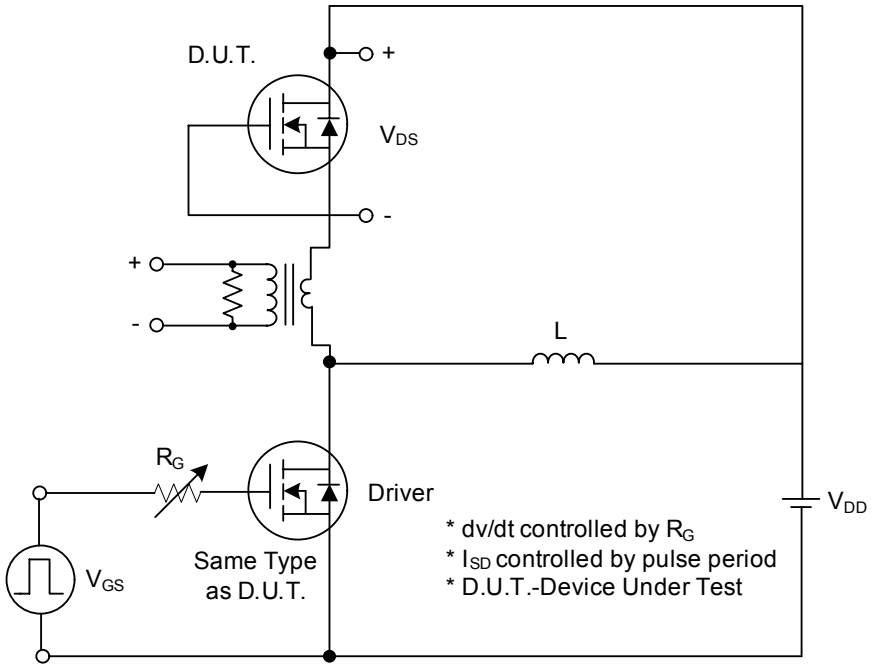


Fig. 1A Peak Diode Recovery dv/dt Test Circuit

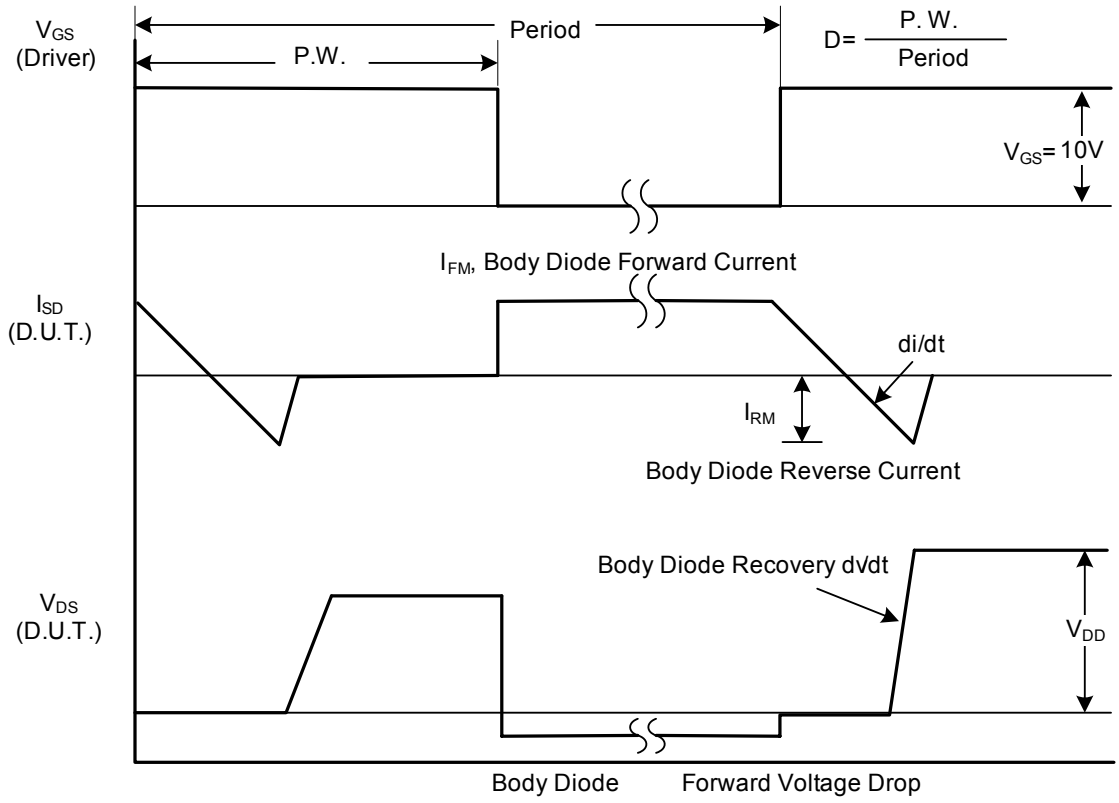


Fig. 1B Peak Diode Recovery dv/dt Waveforms

■ TEST CIRCUITS AND WAVEFORMS (Cont.)

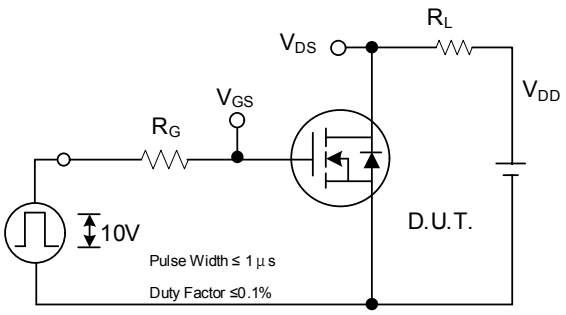


Fig. 2A Switching Test Circuit

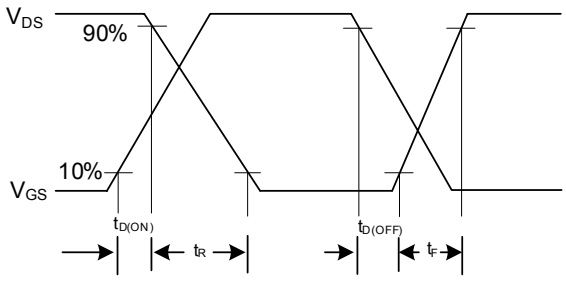


Fig. 2B Switching Waveforms

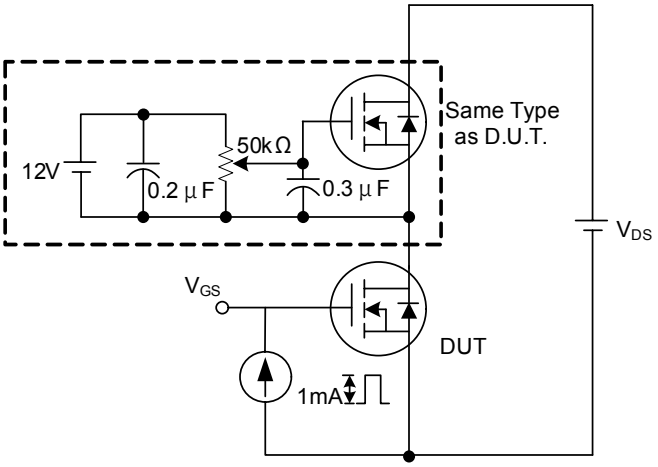


Fig. 3A Gate Charge Test Circuit

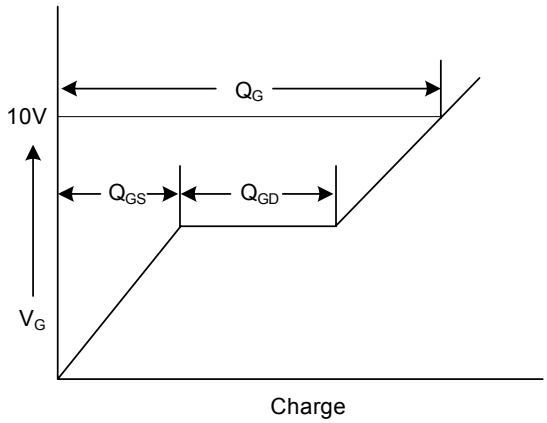


Fig. 3B Gate Charge Waveform

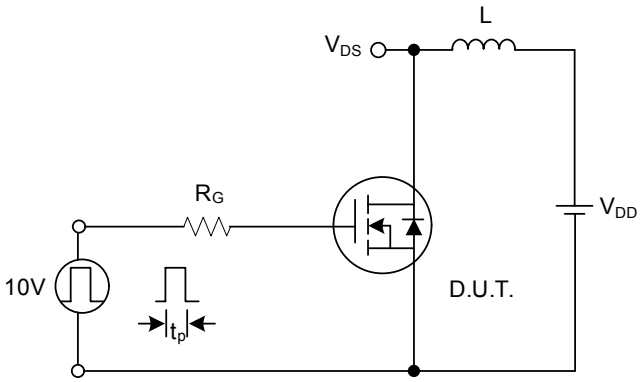


Fig. 4A Unclamped Inductive Switching Test Circuit

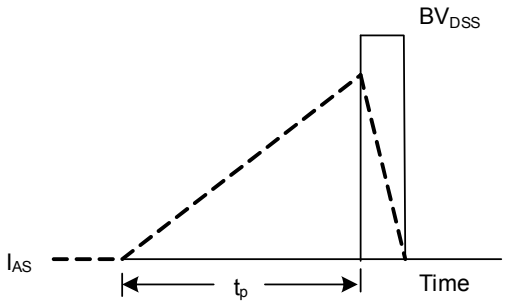
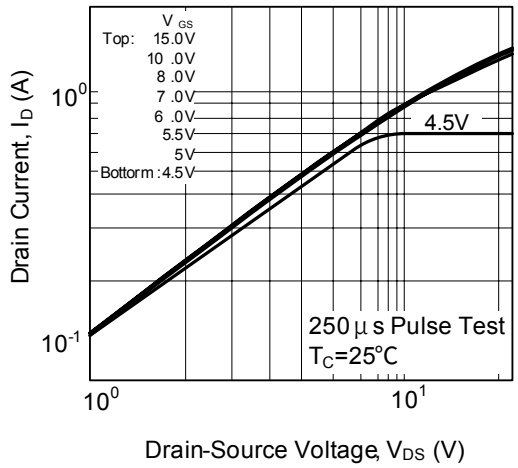


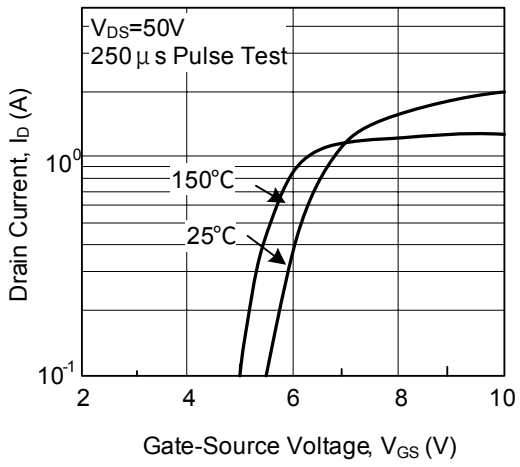
Fig. 4B Unclamped Inductive Switching Waveforms

■ TYPICAL PERFORMANCE CHARACTERISTICS

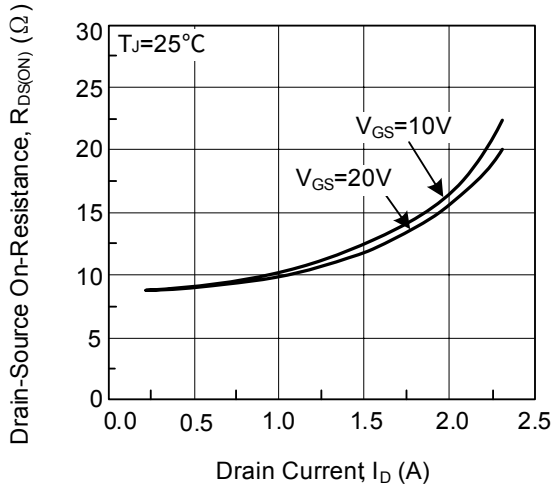
Output Characteristics



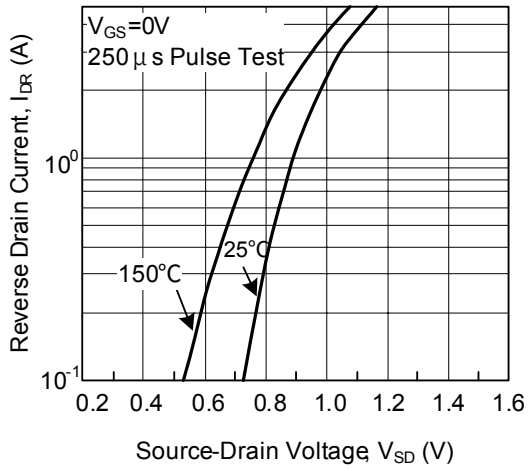
Transfer Characteristics



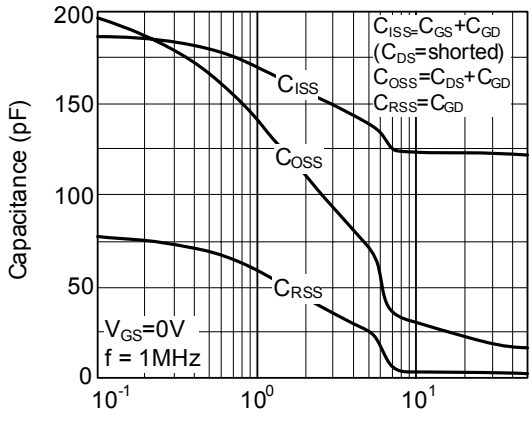
On-Resistance vs. Drain Current



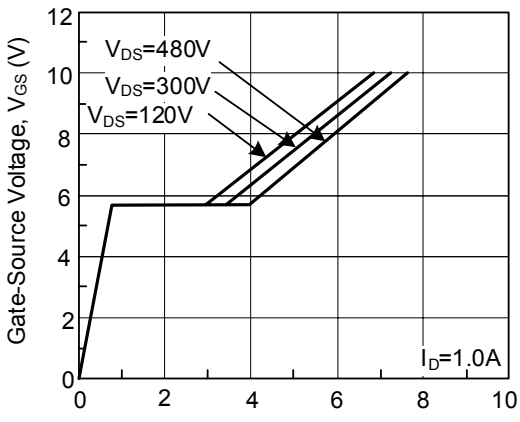
Source- Drain Diode Forward Voltage



Capacitance vs. Drain-Source Voltage

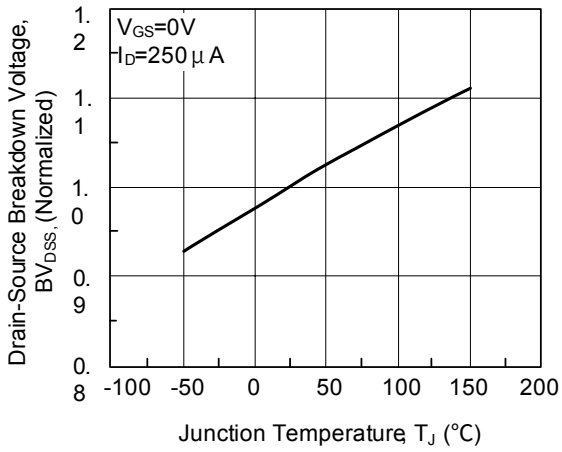


Gate Charge vs. Gate-Source Voltage

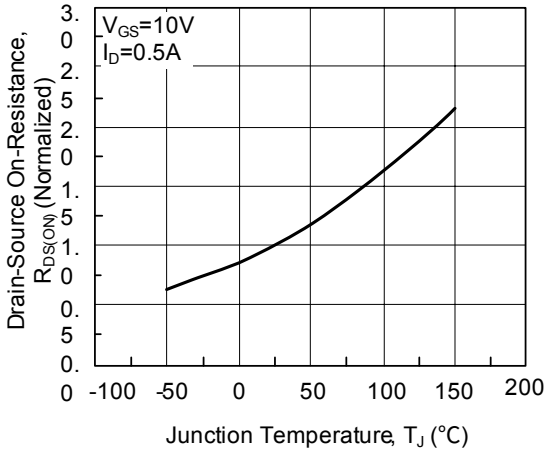


■ TYPICAL PERFORMANCE CHARACTERISTICS(Cont.)

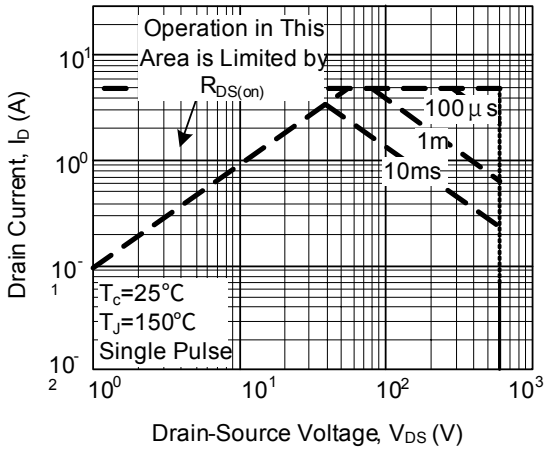
Breakdown Voltage vs. Temperature



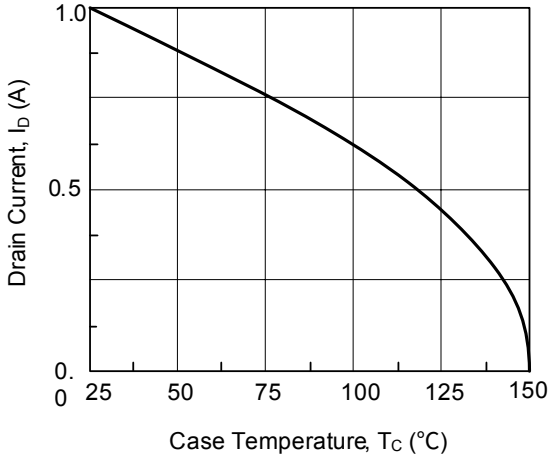
On-Resistance vs. Temperature



Max. Safe Operating Area



Max. Drain Current vs. Case Temperature



Thermal Response