



1N60Z

Power MOSFET

1.2A, 600V N-CHANNEL POWER MOSFET

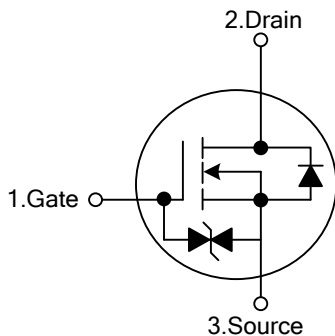
■ DESCRIPTION

The UTC **1N60Z** 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 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 ($C_{RSS} = \text{typical } 3.0 \text{ pF}$)
- * Fast switching capability
- * Avalanche energy specified
- * Improved dv/dt capability, high ruggedness

■ SYMBOL

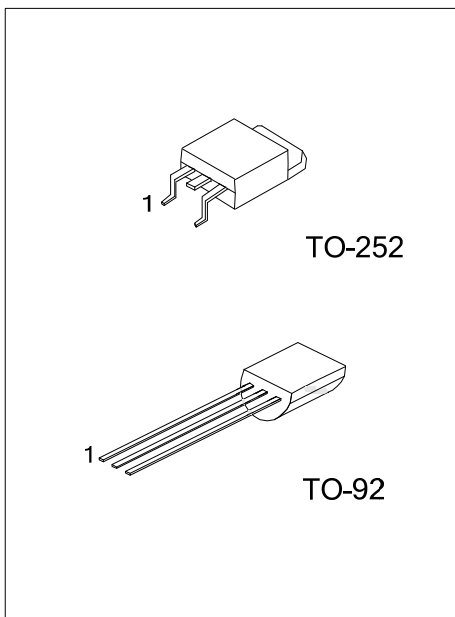


■ ORDERING INFORMATION

Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
1N60ZL-T92-B	1N60ZG-T92-B	TO-92	G	D	S	Tape Box
1N60ZL-T92-K	1N60ZG-T92-K	TO-92	G	D	S	Bulk
1N60ZL-T92-R	1N60ZG-T92-R	TO-92	G	D	S	Tape Reel
1N60ZL-TN3-R	1N60ZG-TN3-R	TO-252	G	D	S	Tape Reel
1N60ZL-TN3-T	1N60ZG-TN3-T	TO-252	G	D	S	Tube

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

<p>1N60ZL-T92-B</p> <p>(1) Packing Type (2) Package Type (3) Lead Free</p>	<p>(1) B: Tape Box, K: Bulk, R: Tape Reel, T: Tube (2) T92: TO-92, TN3: TO-252 (3) 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	V_{DSS}	600	V
Gate-Source Voltage	V_{GSS}	± 20	V
Avalanche Current (Note 2)	I_{AR}	1.2	A
Continuous Drain Current	I_D	1.2	A
Pulsed Drain Current (Note 2)	I_{DM}	4.8	A
Avalanche Energy	Single Pulsed (Note 3)	E_{AS}	50
	Repetitive (Note 2)	E_{AR}	4.0
Peak Diode Recovery dv/dt (Note 4)	dv/dt	4.5	V/ns
Power Dissipation ($T_A=25^\circ\text{C}$)	TO-92	P_D	1
	TO-252		1.5
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. $L = 60\text{mH}$, $I_{AS} = 1\text{A}$, $V_{DD} = 50\text{V}$, $R_G = 25\Omega$, Starting $T_J = 25^\circ\text{C}$

4. $I_{SD} \leq 1.2\text{A}$, $di/dt \leq 200\text{A}/\mu\text{s}$, $V_{DD} \leq BV_{DSS}$, Starting $T_J = 25^\circ\text{C}$

■ THERMAL DATA

PARAMETER	SYMBOL	RATINGS	UNIT
Junction to Ambient	TO-92	θ_{JA}	140
	TO-252		100

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

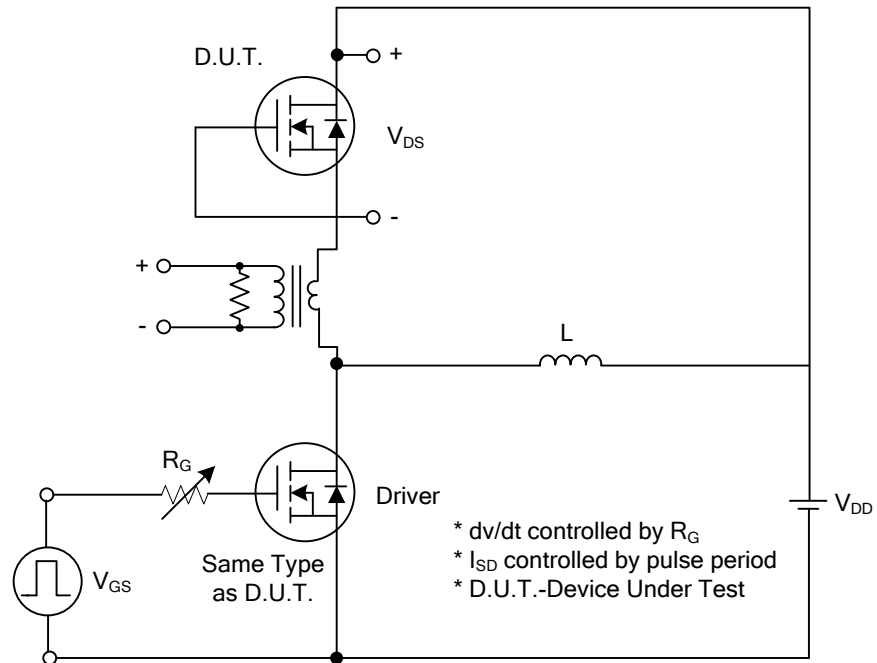
PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS						
Drain-Source Breakdown Voltage	BV_{DSS}	$V_{GS}=0\text{V}$, $I_D=250\mu\text{A}$	600			V
Drain-Source Leakage Current	I_{DSS}	$V_{DS}=600\text{V}$, $V_{GS}=0\text{V}$			10	μA
Gate-Source Leakage Current	I_{GSS}	Forward			+5	μA
		Reverse			-5	μA
Breakdown Voltage Temperature Coefficient	$\Delta BV_{DSS}/\Delta T_J$	$I_D=250\mu\text{A}$		0.4		$\text{V}/^\circ\text{C}$
ON CHARACTERISTICS						
Gate Threshold Voltage	$V_{GS(TH)}$	$V_{DS}=V_{GS}$, $I_D=250\mu\text{A}$	2.0		4.0	V
Static Drain-Source On-State Resistance	$R_{DS(ON)}$	$V_{GS}=10\text{V}$, $I_D=0.6\text{A}$		9.3	11.5	Ω
DYNAMIC CHARACTERISTICS						
Input Capacitance	C_{ISS}	$V_{DS}=25\text{V}$, $V_{GS}=0\text{V}$, $f=1\text{MHz}$		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	$t_{D(ON)}$	$V_{DD}=300\text{V}$, $I_D=1.2\text{A}$, $R_G=50\Omega$ (Note 2,3)		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	$V_{DS}=480\text{V}$, $V_{GS}=10\text{V}$, $I_D=1.2\text{A}$ (Note 2,3)		5.0	6.0	nC
Gate-Source Charge	Q_{GS}			1.0		nC
Gate-Drain Charge	Q_{GD}			2.6		nC

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

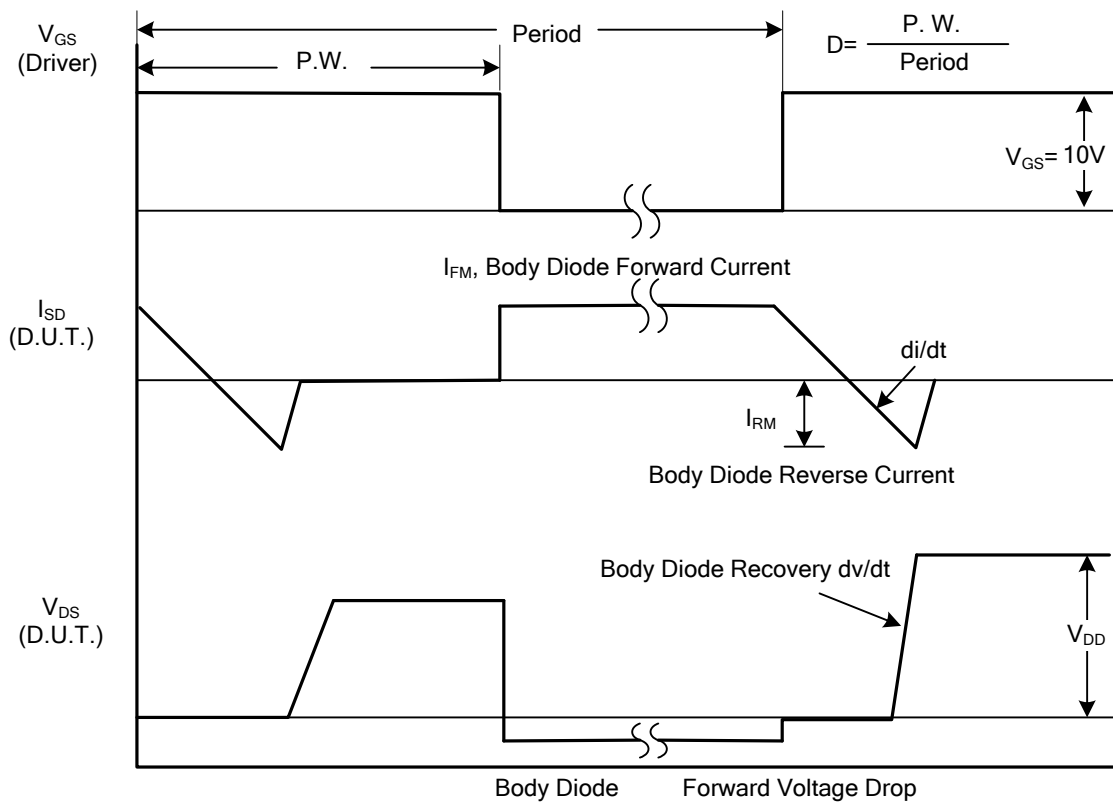
PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS						
Drain-Source Diode Forward Voltage	V_{SD}	$V_{GS}=0V, I_S=1.2A$			1.4	V
Maximum Continuous Drain-Source Diode Forward Current	I_S				1.2	A
Maximum Pulsed Drain-Source Diode Forward Current	I_{SM}				4.8	A
Reverse Recovery Time	t_{rr}	$V_{GS}=0V, I_S=1.2A$		160		ns
Reverse Recovery Charge	Q_{RR}	$dI_F/dt=100A/\mu s$ (Note 1)		0.3		μC

- Note:
1. Repetitive Rating: Pulse width limited by maximum junction temperature
 2. Pulse Test: Pulse Width $\leq 300\mu s$, Duty Cycle $\leq 2\%$
 3. Essentially Independent of Operating Temperature

■ TEST CIRCUITS AND WAVEFORMS

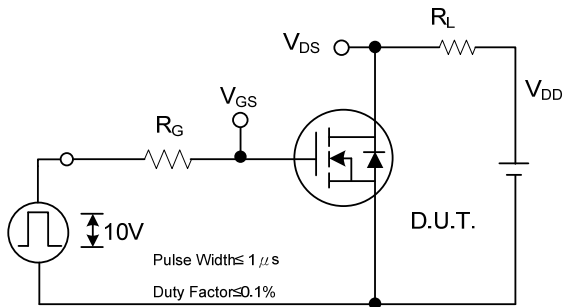


Peak Diode Recovery dv/dt Test Circuit

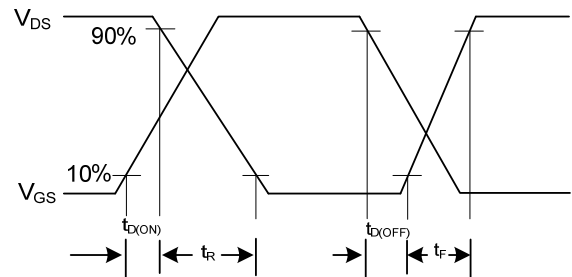


Peak Diode Recovery dv/dt Waveforms

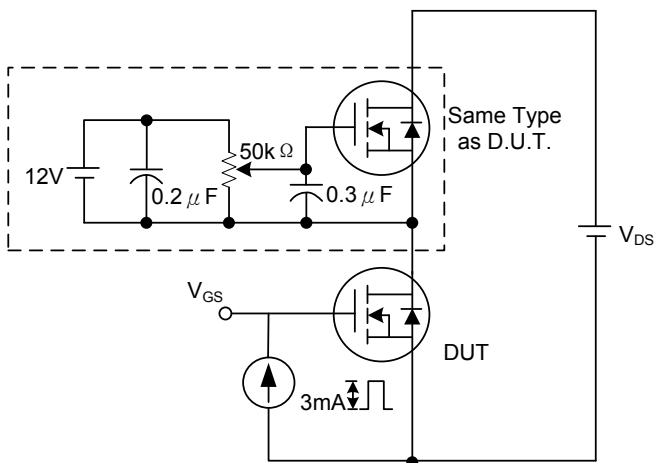
TEST CIRCUITS AND WAVEFORMS (Cont.)



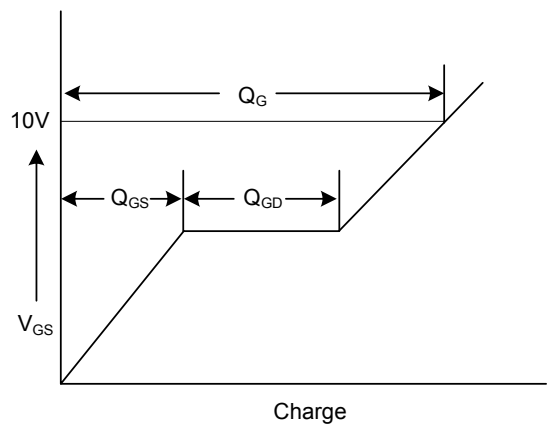
Switching Test Circuit



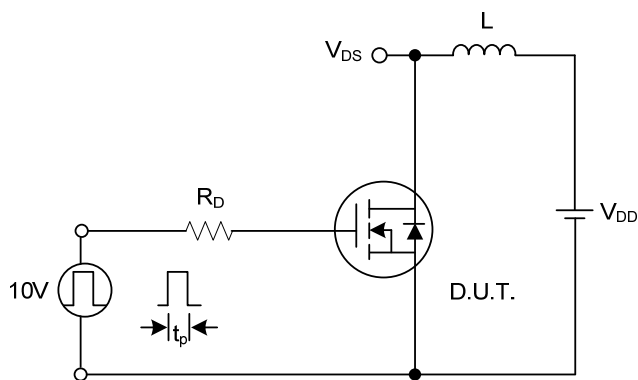
Switching Waveforms



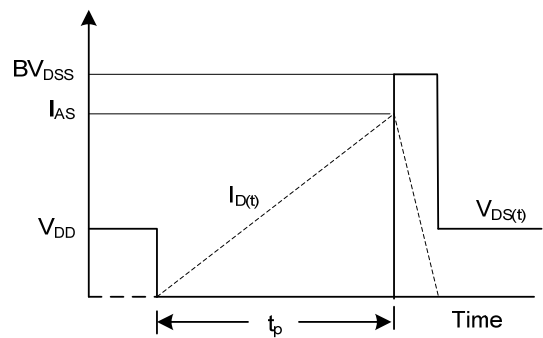
Gate Charge Test Circuit



Gate Charge Waveform

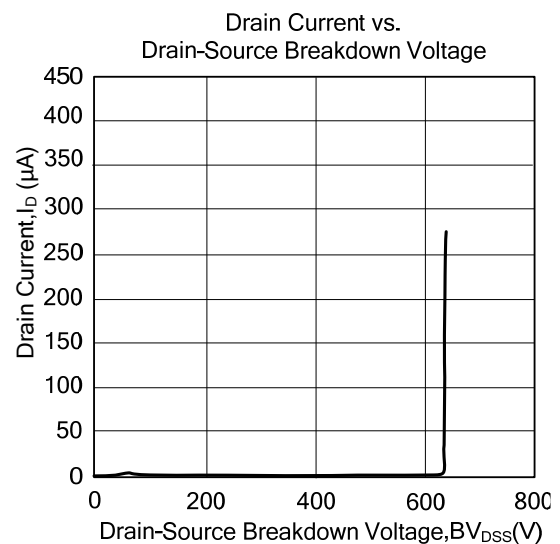
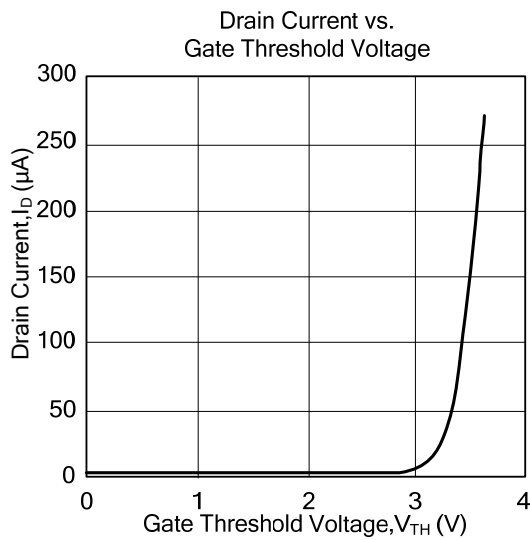
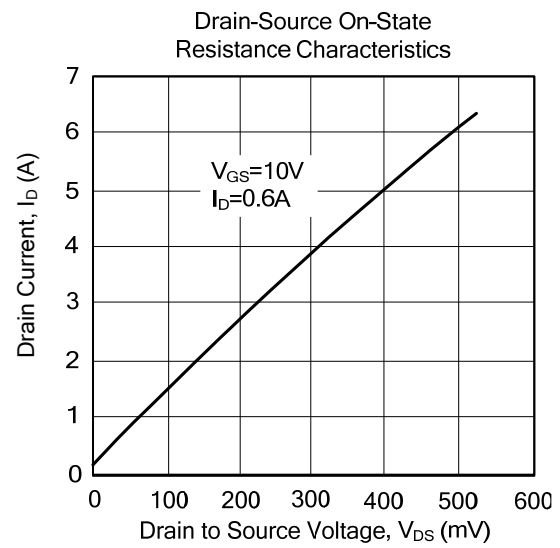
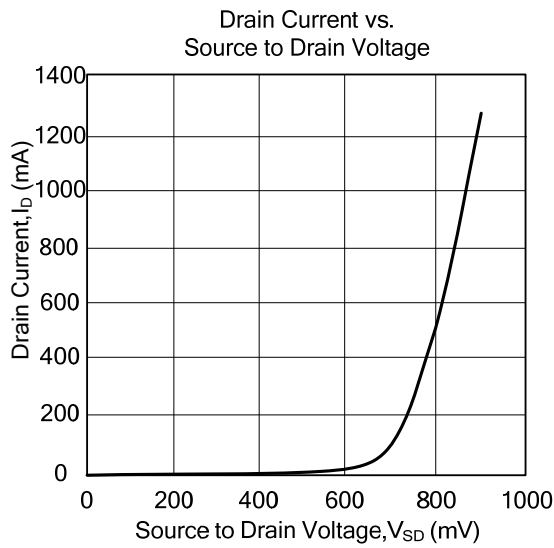


Unclamped Inductive Switching Test Circuit



Unclamped Inductive Switching Waveforms

TYPICAL CHARACTERISTICS



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