



## 1N60-SE

Preliminary

Power MOSFET

### 1.0A, 600V N-CHANNEL POWER MOSFET

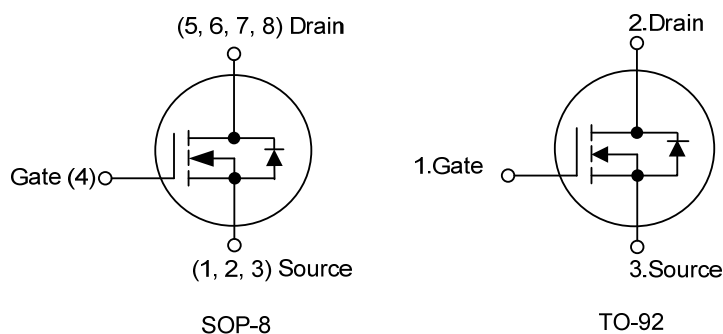
#### DESCRIPTION

The UTC **1N60-SE** 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 AC to DC converters and bridge circuits.

#### FEATURES

- \*  $R_{DS(ON)} \leq 17.5 \Omega @ V_{GS} = 10V, I_D = 0.5A$
- \* Fast switching capability
- \* Avalanche energy specified
- \* Improved dv/dt capability, high ruggedness

#### SYMBOL



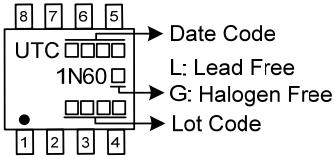
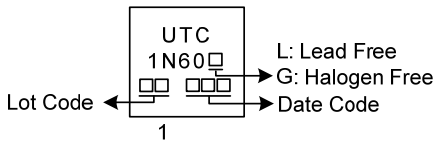
#### ORDERING INFORMATION

Ordering Number		Package	Pin Assignment								Packing
Lead Free	Halogen Free		1	2	3	4	5	6	7	8	
1N60L-S08-R	1N60G-S08-R	SOP-8	S	S	S	G	D	D	D	D	Tape Reel
1N60L-T92-B	1N60G-T92-B	TO-92	G	D	S	-	-	-	-	-	Tape Box
1N60L-T92-K	1N60G-T92-K	TO-92	G	D	S	-	-	-	-	-	Bulk

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

 (1)Packing Type (2)Package Type (3)Green Package		(1) R: Tape Reel, B: Tape Box, K: Bulk (2) S08: SOP-8, T92: TO-92 (3) G: Halogen Free and Lead Free, L: Lead Free
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## ■ MARKING

SOP-8	TO-92
 <p>Diagram of SOP-8 marking: A rectangular package with pins 1-4 on the bottom and 5-8 on the top. Markings include: UTC (top left), 1N60 (center), and a lot code (bottom right). Arrows point from the lot code to 'Lot Code', from the '1N60' to 'G: Halogen Free', and from the 'UTC' to 'L: Lead Free'.</p>	 <p>Diagram of TO-92 marking: A triangular package with pin 1 at the bottom. Markings include: UTC (top), 1N60 (center), and a lot code (bottom left). Arrows point from the lot code to 'Lot Code', from the '1N60' to 'G: Halogen Free', and from the 'UTC' to 'L: Lead Free'.</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		$V_{GSS}$	$\pm 30$	V
Drain Current	Continuous	$I_D$	1.0	A
	Pulsed (Note 2)	$I_{DM}$	2.0	A
Peak Diode Recovery $dv/dt$ (Note 3)		$dv/dt$	2.4	V/ns
Power Dissipation	SOP-8	$P_D$	1.5	W
	TO-92		1.35	W
Junction Temperature		$T_J$	+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.  $I_{SD} \leq 1.0\text{A}$ ,  $di/dt \leq 200\text{A}/\mu\text{s}$ ,  $V_{DD} \leq BV_{DSS}$ , Starting  $T_J = 25^\circ\text{C}$

■ THERMAL DATA

PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Ambient	SOP-8	$\theta_{JA}$	190	$^\circ\text{C}/\text{W}$
	TO-92		160	$^\circ\text{C}/\text{W}$
Junction to Case	SOP-8	$\theta_{JC}$	83.3	$^\circ\text{C}/\text{W}$
	TO-92		92.5	$^\circ\text{C}/\text{W}$

Note: Device mounted on FR-4 substrate PC board, 2oz copper, with 1inch square copper plate.

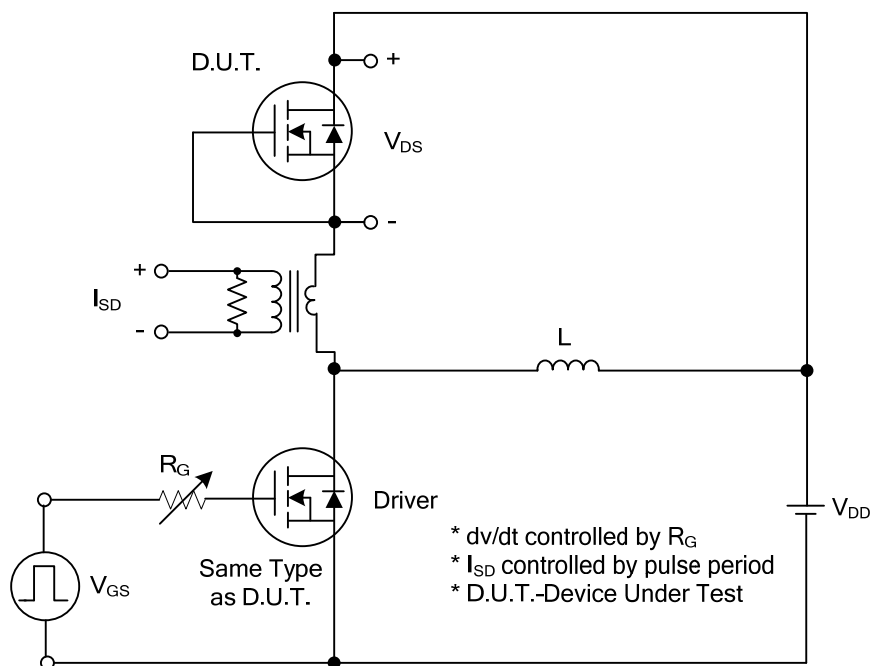
■ ELECTRICAL CHARACTERISTICS ( $T_J=25^{\circ}\text{C}$ , unless otherwise specified)

PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS							
Drain-Source Breakdown Voltage		BV <sub>DSS</sub>	V <sub>GS</sub> =0V, I <sub>D</sub> =250μA	600			V
Drain-Source Leakage Current		I <sub>DSS</sub>	V <sub>DS</sub> =600V, V <sub>GS</sub> =0V			10	μA
Gate-Source Leakage Current	Forward	I <sub>GSS</sub>	V <sub>GS</sub> =30V, V <sub>DS</sub> =0V			100	nA
	Reverse		V <sub>GS</sub> =-30V, V <sub>DS</sub> =0V			-100	nA
ON CHARACTERISTICS							
Gate Threshold Voltage		V <sub>GS(TH)</sub>	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA	2.0		4.0	V
Static Drain-Source On-State Resistance		R <sub>DS(ON)</sub>	V <sub>GS</sub> =10V, I <sub>D</sub> =0.5A			17.5	Ω
DYNAMIC CHARACTERISTICS							
Input Capacitance		C <sub>ISS</sub>	V <sub>DS</sub> =25V, V <sub>GS</sub> =0V, f=1MHz		110		pF
Output Capacitance		C <sub>OSS</sub>			35.7		pF
Reverse Transfer Capacitance		C <sub>RSS</sub>			12.4		pF
SWITCHING CHARACTERISTICS							
Total Gate Charge (Note 1)		Q <sub>G</sub>	V <sub>DS</sub> =480V, V <sub>GS</sub> =10V, I <sub>D</sub> =1.0A, I <sub>G</sub> =1mA (Note 1, 2)		7.2		nC
Gate to Source Charge		Q <sub>GS</sub>			2.8		nC
Gate to Drain Charge		Q <sub>GD</sub>			0.4		nC
Turn-ON Delay Time (Note 1)		t <sub>D(ON)</sub>	V <sub>DD</sub> =100V, V <sub>GS</sub> =10V, I <sub>D</sub> =1.0A, R <sub>G</sub> =25Ω (Note 1, 2)		7		ns
Rise Time		t <sub>R</sub>			15.2		ns
Turn-OFF Delay Time		t <sub>D(OFF)</sub>			18		ns
Fall-Time		t <sub>F</sub>			36		ns
DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS							
Maximum Body-Diode Continuous Current		I <sub>S</sub>				1.0	A
Maximum Body-Diode Pulsed Current (Note 1)		I <sub>SM</sub>				2.0	A
Drain-Source Diode Forward Voltage (Note 1)		V <sub>SD</sub>	I <sub>S</sub> =1.0A, V <sub>GS</sub> =0V			1.4	V
Body Diode Reverse Recovery Time		t <sub>rr</sub>	I <sub>S</sub> =1.0A, V <sub>GS</sub> =0V		169		ns
Body Diode Reverse Recovery Charge		Q <sub>rr</sub>	dl <sub>F</sub> /dt=100A/μs		0.7		μC

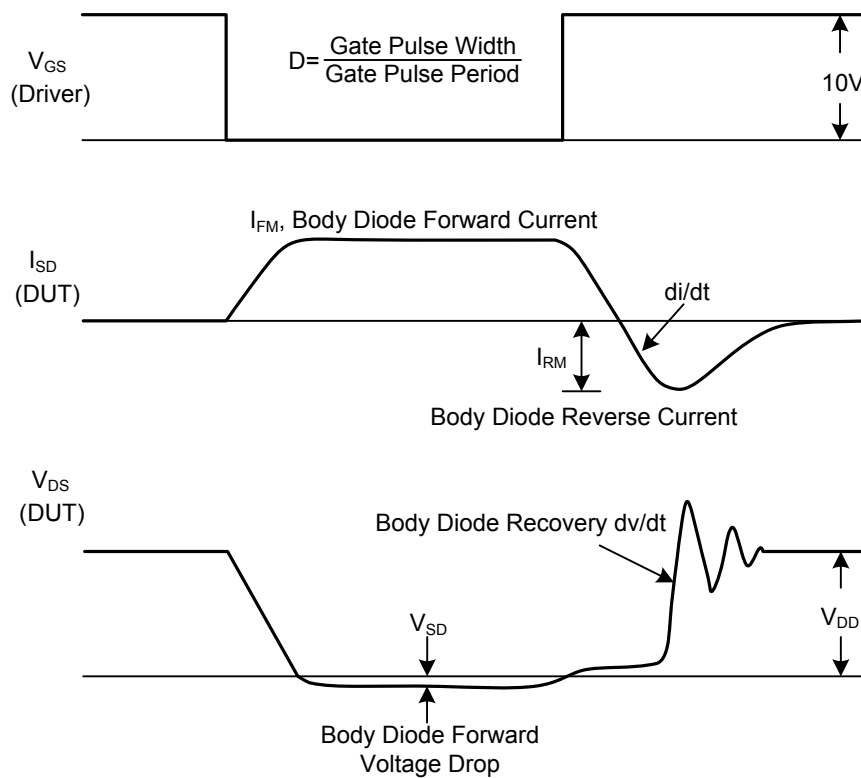
Notes: 1. Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$ .

2. Essentially independent of operating temperature.

■ TEST CIRCUITS AND WAVEFORMS

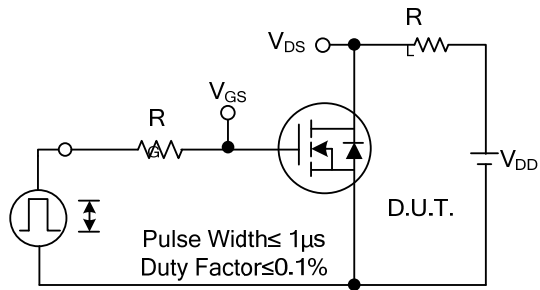


Peak Diode Recovery  $dv/dt$  Test Circuit

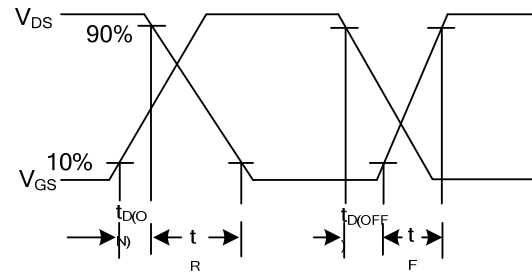


Peak Diode Recovery  $dv/dt$  Waveforms

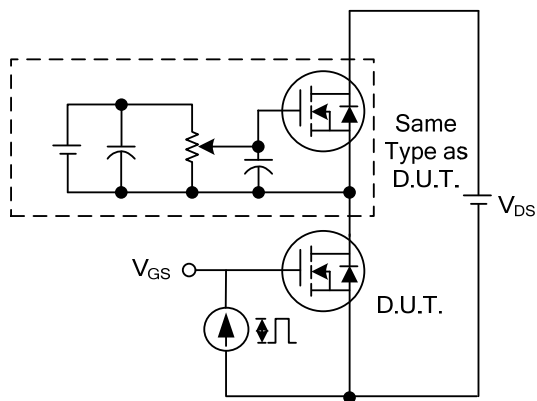
# ■ TEST CIRCUITS AND WAVEFORMS



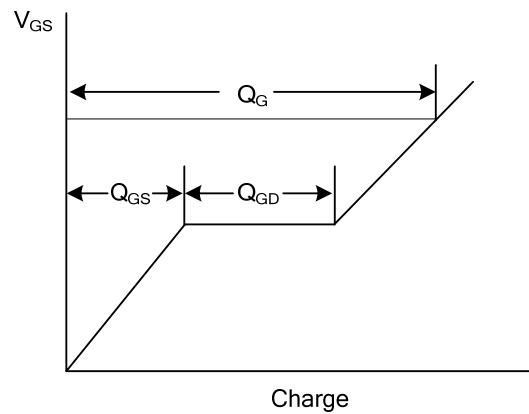
Switching Test Circuit



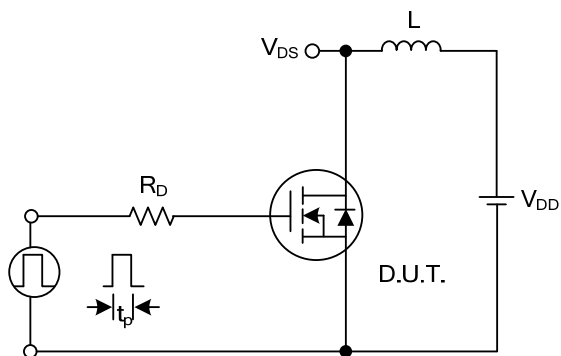
Switching Waveforms



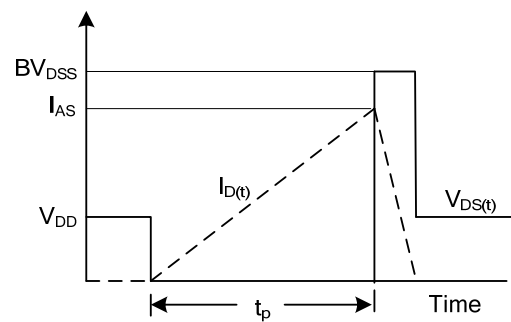
Gate Charge Test Circuit



Gate Charge Waveform



Unclamped Inductive Switching Test Circuit



Unclamped Inductive Switching Waveforms

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