



## 1N60-CB

Preliminary

Power MOSFET

### 1A, 600V N-CHANNEL POWER MOSFET

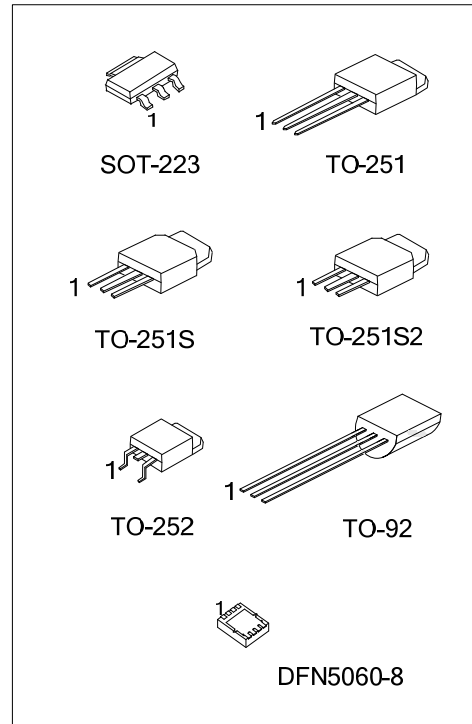
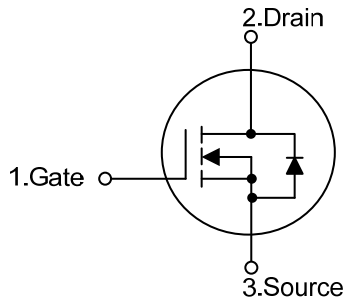
#### DESCRIPTION

The UTC **1N60-CB** is a high voltage power 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

- \*  $R_{DS(ON)} < 9.5\Omega @ V_{GS} = 10V, I_D = 0.5A$
- \* Fast switching capability
- \* Avalanche energy specified
- \* Improved dv/dt capability, high ruggedness

#### SYMBOL



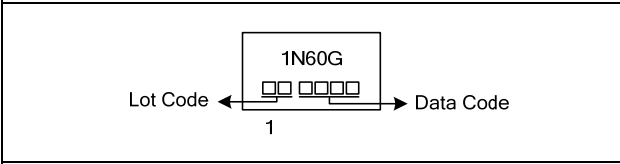
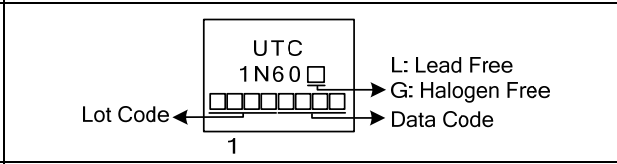
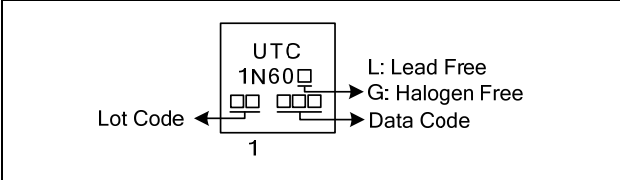
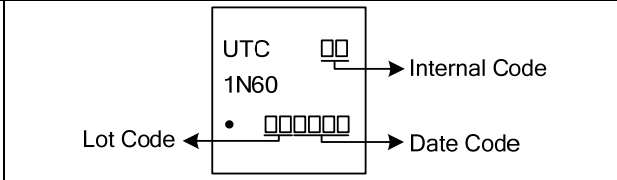
#### ORDERING INFORMATION

Ordering Number		Package	Pin Assignment								Packing	
Lead Free	Halogen Free		1	2	3	4	5	6	7	8		
1N60L-AA3-R	1N60G-AA3-R	SOT-223	G	D	S	-	-	-	-	-	-	Tape Reel
1N60L-TM3-T	1N60G-TM3-T	TO-251	G	D	S	-	-	-	-	-	-	Tube
1N60L-TMS-T	1N60G-TMS-T	TO-251S	G	D	S	-	-	-	-	-	-	Tube
1N60L-TMS2-T	1N60G-TMS2-T	TO-251S2	G	D	S	-	-	-	-	-	-	Tube
1N60L-TN3-R	1N60G-TN3-R	TO-252	G	D	S	-	-	-	-	-	-	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
1N60L-K08-5060-R	1N60G-K08-5060-R	DFN5060-8	S	S	S	G	D	D	D	D	D	Tape Reel

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

<p>1N60G-AA3-R</p> <p>(1)Packing Type</p> <p>(2)Package Type</p> <p>(3)Green Package</p>	<p>(1) R: Tape Reel, T: Tube, B: Tape Box, K: Bulk</p> <p>(2) AA3: SOT-223, TM3: TO-251, TO-251S, TMS2: TO-251S2, TM3: TO-252, T92: TO-92</p> <p>K08-5060: DFN5060-8</p> <p>(3) G: Halogen Free and Lead Free, L: Lead Free</p>
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### MARKING

SOT-223	TO-251 / TO-251S TO-251S2 / TO-252
 <p>1N60G</p> <p>Lot Code ← → Data Code</p> <p>1</p>	 <p>UTC 1N60</p> <p>Lot Code ← → Data Code</p> <p>1</p> <p>L: Lead Free G: Halogen Free</p>
TO-92	DFN5060-8
 <p>UTC 1N60</p> <p>Lot Code ← → Data Code</p> <p>1</p> <p>L: Lead Free G: Halogen Free</p>	 <p>UTC 1N60</p> <p>Lot Code ← → Date Code</p> <p>Internal Code</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		$V_{GSS}$	$\pm 30$	V
Avalanche Current (Note 2)		$I_{AR}$	1.0	A
Drain Current	Continuous	$I_D$	1.0	A
	Pulsed (Note 2)	$I_{DM}$	4.0	A
Avalanche Energy	Single Pulsed (Note 3)	$E_{AS}$	50	mJ
	Repetitive (Note 2)	$E_{AR}$	4.5	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	4.0	V/ns
Power Dissipation	SOT-223	$P_D$	10	W
	TO-251/TO-251S		30	W
	TO-251S2/TO-252		3	W
	TO-92		14	W
Junction Temperature		$T_J$	+150	$^\circ\text{C}$
Operating Temperature		$T_{OPR}$	-55 ~ +150	$^\circ\text{C}$
Storage Temperature		$T_{STG}$	-55 ~ +150	$^\circ\text{C}$

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  $T_J$

3.  $L=100\text{mH}$ ,  $I_{AS}=1.0\text{A}$ ,  $V_{DD}=50\text{V}$ ,  $R_G=25\ \Omega$ , Starting  $T_J = 25^\circ\text{C}$

4.  $I_{SD}\leq 1.0\text{A}$ ,  $di/dt\leq 200\text{A}/\mu\text{s}$ ,  $V_{DD}\leq BV_{DSS}$ , Starting  $T_J = 25^\circ\text{C}$

■ THERMAL DATA

PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Ambient	SOT-223	$\theta_{JA}$	150	$^\circ\text{C}/\text{W}$
	TO-251/TO-251S		110	$^\circ\text{C}/\text{W}$
	TO-251S2/TO-252		140	$^\circ\text{C}/\text{W}$
	TO-92		75	$^\circ\text{C}/\text{W}$
Junction to Case	DFN5060-8	$\theta_{JC}$	12.5	$^\circ\text{C}/\text{W}$
	SOT-223		4.2	$^\circ\text{C}/\text{W}$
	TO-251/TO-251S		80	$^\circ\text{C}/\text{W}$
	TO-251S2/TO-252		8.9	$^\circ\text{C}/\text{W}$

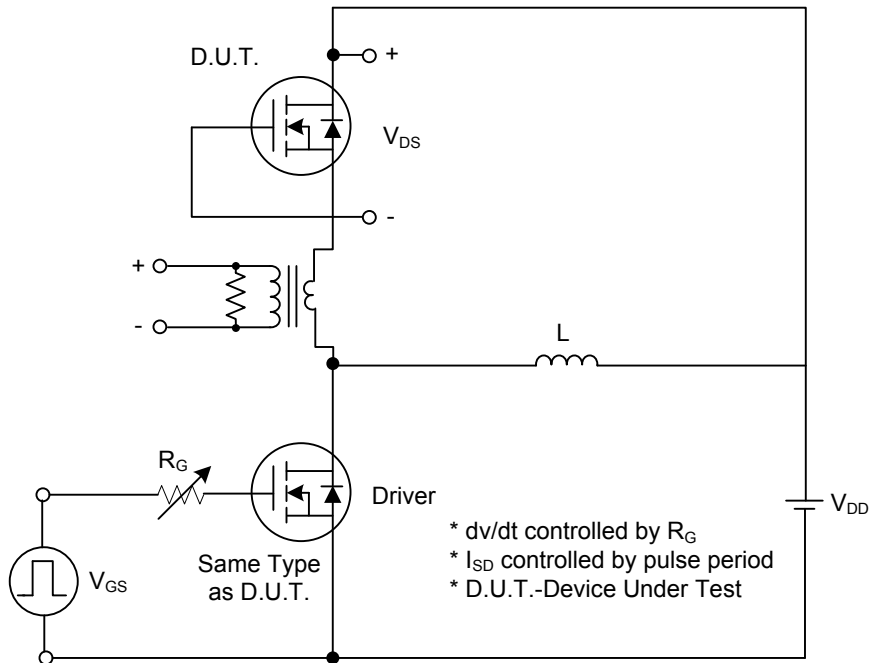
■ ELECTRICAL CHARACTERISTICS (T<sub>C</sub>=25°C, unless otherwise specified)

PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT	
<b>OFF CHARACTERISTICS</b>								
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	
			V <sub>DS</sub> = 480V, T <sub>C</sub> = 125°C			100	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	
Breakdown Voltage Temperature Coefficient		ΔBV <sub>DSS</sub> /ΔT <sub>J</sub>	I <sub>D</sub> =250μA, Referenced to 25°C		0.4		V/°C	
<b>ON CHARACTERISTICS</b>								
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		8.2	9.5	Ω	
<b>DYNAMIC CHARACTERISTICS</b>								
Input Capacitance		C <sub>ISS</sub>	V <sub>DS</sub> = 25V, V <sub>GS</sub> = 0V, f = 1MHz		130		pF	
Output Capacitance		C <sub>OSS</sub>				21		pF
Reverse Transfer Capacitance		C <sub>RSS</sub>				3.4		pF
<b>SWITCHING CHARACTERISTICS</b>								
Total Gate Charge		Q <sub>G</sub>	V <sub>DS</sub> = 50V, V <sub>GS</sub> = 10V, I <sub>D</sub> = 1.3A (Note 1, 2)		13		nC	
Gate-Source Charge		Q <sub>GS</sub>				1.5		nC
Gate-Drain Charge		Q <sub>GD</sub>				1.2		nC
Turn-On Delay Time		t <sub>D(ON)</sub>	V <sub>DD</sub> = 30V, I <sub>D</sub> = 0.5A, R <sub>G</sub> = 25Ω (Note 1, 2)		26		ns	
Turn-On Rise Time		t <sub>R</sub>				20		ns
Turn-Off Delay Time		t <sub>D(OFF)</sub>				50		ns
Turn-Off Fall Time		t <sub>F</sub>				23		ns
<b>DRAIN-SOURCE DIODE CHARACTERISTICS</b>								
Continuous Drain-Source Current		I <sub>S</sub>				1.0	A	
Pulsed Drain-Source Current		I <sub>SM</sub>				4.0	A	
Drain-Source Diode Forward Voltage		V <sub>SD</sub>	V <sub>GS</sub> = 0V, I <sub>SD</sub> = 1.0A			1.4	V	
Body Diode Reverse Recovery Time		t <sub>rr</sub>	I <sub>F</sub> = 1.0A, V <sub>DD</sub> = 100V,		280		ns	
Body Diode Reverse Recovery Charge		Q <sub>rr</sub>	dI/dt = 100A/μs		0.4		μC	

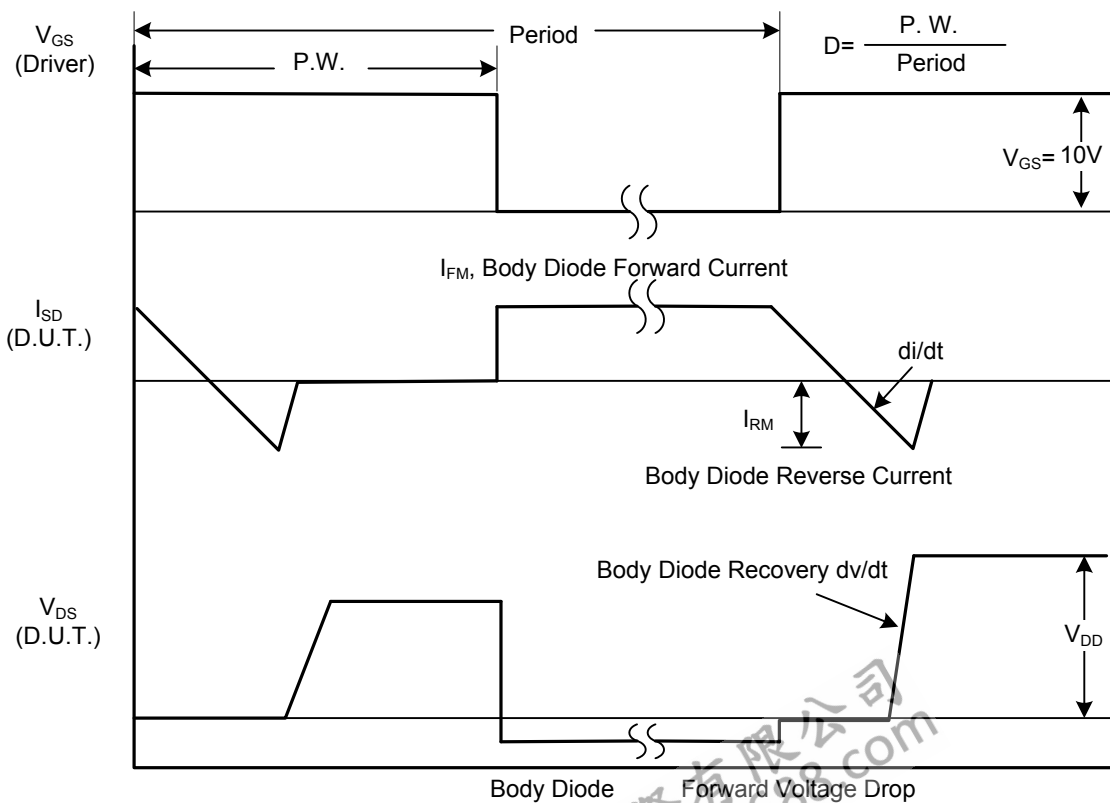
Notes: 1. Pulse Test: Pulse width ≤ 300μs, Duty cycle ≤ 2%.

2. Essentially independent of operating temperature.

■ TEST CIRCUITS AND WAVEFORMS

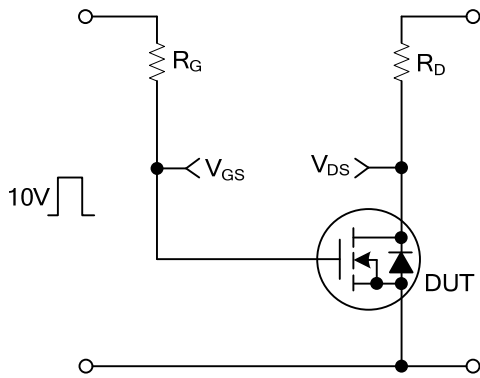


Peak Diode Recovery dv/dt Test Circuit

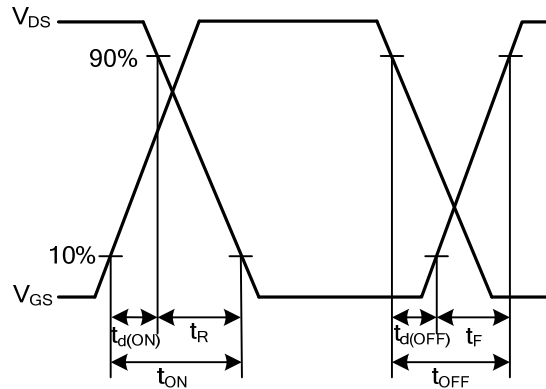


Peak Diode Recovery dv/dt Waveforms

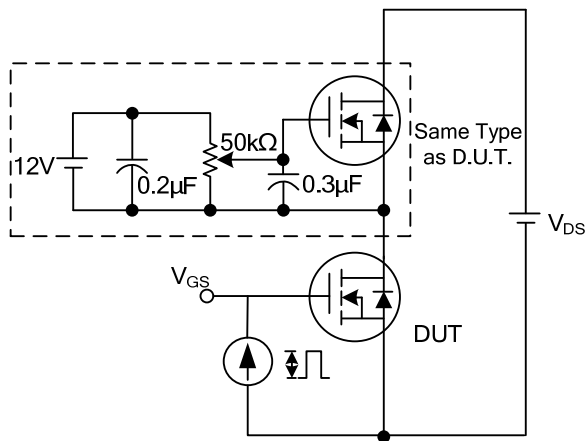
■ TEST CIRCUITS AND WAVEFORMS (Cont.)



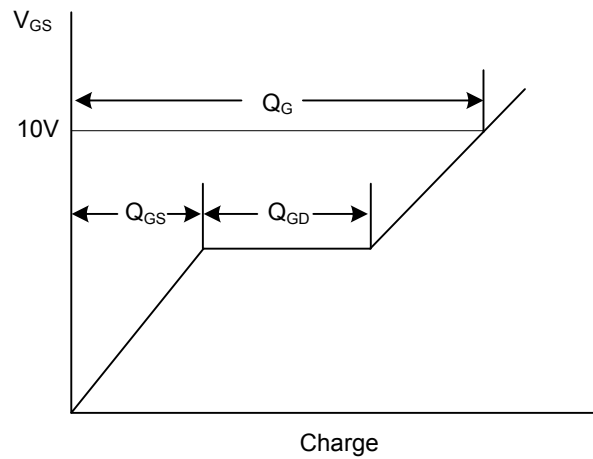
Switching Test Circuit



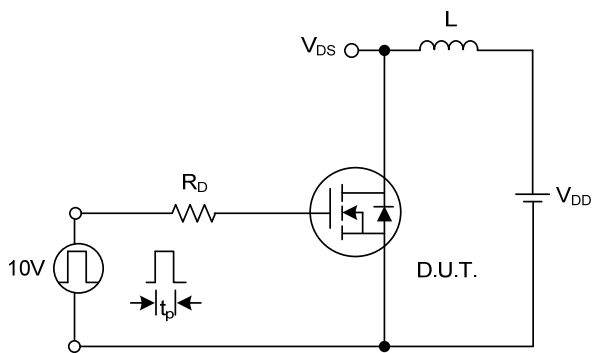
Switching Waveforms



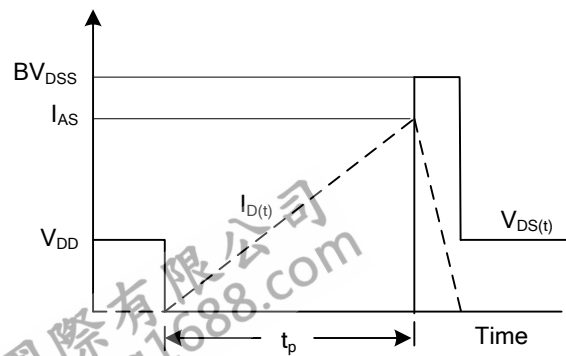
Gate Charge Test Circuit



Gate Charge Waveform



Unclamped Inductive Switching Test Circuit



Unclamped Inductive Switching Waveforms

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