



## 1N60Q-TA

Preliminary

Power MOSFET

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

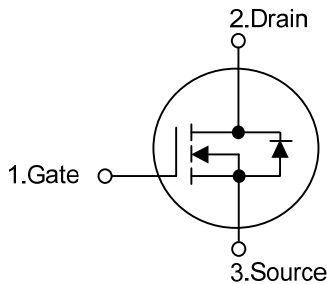
#### DESCRIPTION

The UTC **1N60Q-TA** 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

- \*  $R_{DS(ON)} < 9.0\Omega @ V_{GS}=10V, I_D=0.5A$
- \* Fast switching capability
- \* Avalanche energy specified
- \* Improved dv/dt capability, high ruggedness

#### SYMBOL

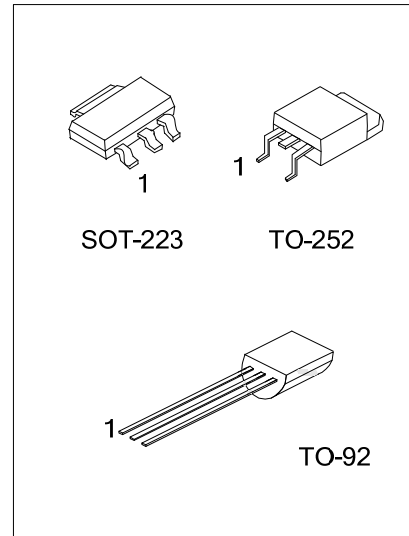


#### ORDERING INFORMATION

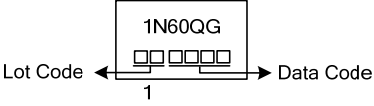
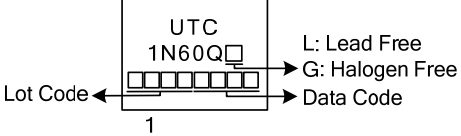
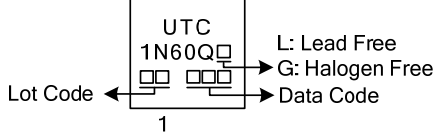
Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
-	1N60Q G-AA3-R	SOT-223	G	D	S	Tape Reel
1N60QL-TN3-R	1N60QG-TN3-R	TO-252	G	D	S	Tape Reel
1N60QL-T92-B	1N60QG-T92-B	TO-92	G	D	S	Tape Box
1N60QL-T92-K	1N60QG-T92-K	TO-92	G	D	S	Bulk

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

<p>1N60QG-AA3-R</p>	<p>(1) R: Tape Reel, B: Tape Box, K: Bulk</p> <p>(2) AA3: SOT-223, TN3: TO-252, T92: TO-92</p> <p>(3) L: Lead Free, G: Halogen Free and Lead Free</p>
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■ MARKING

PACKAGE	MARKING
SOT-223	 <p>1N60QG</p> <p>Lot Code ← [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] → Data Code</p> <p>1</p>
TO-252	 <p>UTC</p> <p>1N60Q [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ]</p> <p>Lot Code ← [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] → Data Code</p> <p>L: Lead Free</p> <p>G: Halogen Free</p> <p>1</p>
TO-92	 <p>UTC</p> <p>1N60Q [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ]</p> <p>Lot Code ← [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] → Data Code</p> <p>L: Lead Free</p> <p>G: Halogen Free</p> <p>1</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
Continuous Drain Current	Continuous ( $T_C=25^\circ\text{C}$ )	$I_D$	1.0	A
	Pulsed (Note 2)	$I_{DM}$	4.0	A
Avalanche Current (Note 2)		$I_{AR}$	1	A
Avalanche Energy	Single Pulsed (Note 2)	$E_{AS}$	60	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	3.5	V/ns
Power Dissipation	SOT-223	$P_D$	7.8	W
	TO-252		28	W
	TO-92		1.56	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.  $L = 120\text{mH}$ ,  $I_{AS} = 1\text{A}$ ,  $V_{DD} = 50\text{V}$ ,  $R_G = 25\Omega$ , Starting  $T_J = 25^\circ\text{C}$

4.  $I_{SD} \leq 1\text{A}$ ,  $di/dt \leq 200\text{A}/\mu\text{s}$ ,  $V_{DD} \leq BV_{DSS}$ , Starting  $T_J = 25^\circ\text{C}$

■ THERMAL RESISTANCES CHARACTERISTICS

PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Ambient	SOT-223	$\theta_{JA}$	150	$^\circ\text{C}/\text{W}$
	TO-252		140	$^\circ\text{C}/\text{W}$
	TO-92		110	$^\circ\text{C}/\text{W}$
Junction to Case	SOT-223	$\theta_{JC}$	16	$^\circ\text{C}/\text{W}$
	TO-252		4.46	$^\circ\text{C}/\text{W}$
	TO-92		80	$^\circ\text{C}/\text{W}$

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

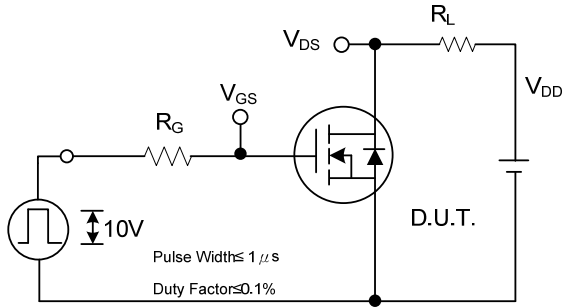
PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
<b>OFF CHARACTERISTICS</b>						
Drain-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS}=0V, I_D=250\mu A$	600			V
Drain-Source Leakage Current	$I_{DSS}$	$V_{DS}=600V, V_{GS}=0V$			10	$\mu A$
Gate-Source Leakage Current	Forward	$V_{GS}=30V, V_{DS}=0V$			100	nA
	Reverse	$V_{GS}=-30V, V_{DS}=0V$			-100	nA
<b>ON CHARACTERISTICS</b>						
Gate Threshold Voltage	$V_{GS(TH)}$	$V_{DS}=V_{GS}, I_D=250\mu A$	2.0		4.0	V
Static Drain-Source On-State Resistance	$R_{DS(ON)}$	$V_{GS}=10V, I_D=0.5A$			9.0	$\Omega$
<b>DYNAMIC CHARACTERISTICS</b>						
Input Capacitance	$C_{ISS}$	$V_{DS}=25V, V_{GS}=0V, f=1\text{MHz}$		195		pF
Output Capacitance	$C_{OSS}$			20		pF
Reverse Transfer Capacitance	$C_{RSS}$			3		pF
<b>SWITCHING CHARACTERISTICS</b>						
Total Gate Charge (Note 1)	$Q_G$	$V_{DS}=50V, V_{GS}=10V, I_D=1.3A, I_G=100\mu A$ (Note 1, 2)		13		nC
Gate-Source Charge	$Q_{GS}$			1.3		nC
Gate-Drain Charge	$Q_{GD}$			1		nC
Turn-On Delay Time (Note 1)	$t_{D(ON)}$	$V_{DD}=30V, V_{GS}=10V, I_D=0.5A, R_G=25\Omega$ (Note 1, 2)		28		ns
Turn-On Rise Time	$t_R$			19		ns
Turn-Off Delay Time	$t_{D(OFF)}$			53		ns
Turn-Off Fall Time	$t_F$			25		ns
<b>SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS</b>						
Maximum Continuous Drain-Source Diode Forward Current	$I_S$				1	A
Maximum Pulsed Drain-Source Diode Forward Current	$I_{SM}$				4	A
Drain-Source Diode Forward Voltage (Note 1)	$V_{SD}$	$V_{GS}=0V, I_S=1.0A$			1.4	V
Reverse Recovery Time (Note 1)	$t_{rr}$	$V_{GS}=0V, I_S=1.0A,$		200		nS
Reverse Recovery Charge	$Q_{rr}$	$di_F/dt=100A/\mu s$ (Note 1)		0.44		$\mu C$

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

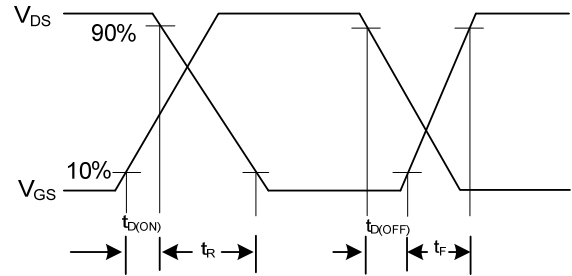
2. Essentially independent of operating temperature.



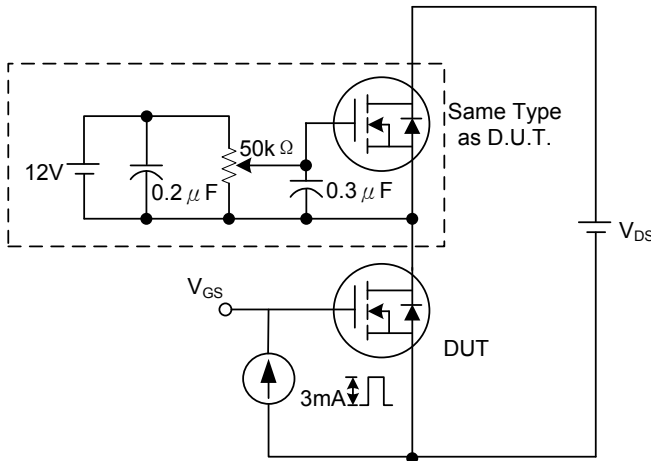
■ TEST CIRCUITS AND WAVEFORMS (Cont.)



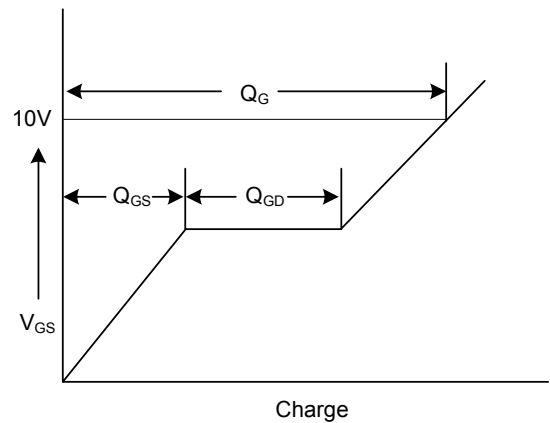
Switching Test Circuit



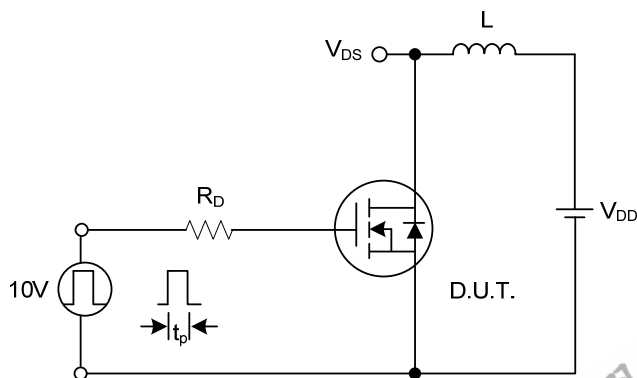
Switching Waveforms



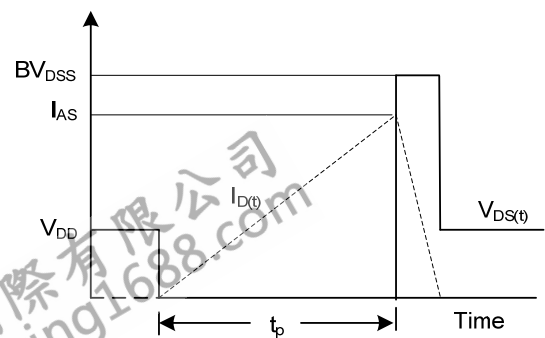
Gate Charge Test Circuit



Gate Charge Waveform



Unclamped Inductive Switching Test Circuit



Unclamped Inductive Switching Waveforms



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