



## 1NM60-Q

Power MOSFET

### 1.0A, 600V N-CHANNEL SUPER-JUNCTION MOSFET

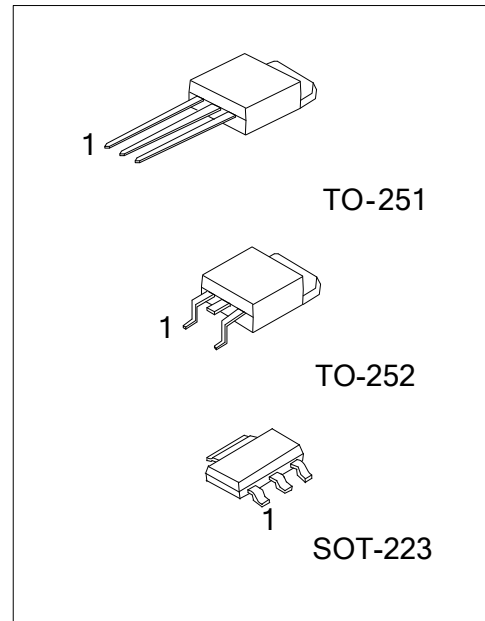
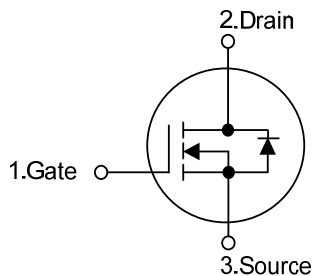
#### DESCRIPTION

The **UTC 1NM60-Q** is a Super Junction MOSFET Structure and is designed to have better characteristics, such as fast switching time, low gate charge, low on-state resistance and a high rugged avalanche characteristics. This power MOSFET is usually used at DC-DC, AC-DC converters for power applications.

#### FEATURES

- \*  $R_{DS(ON)} < 4.6\Omega$  @  $V_{GS} = 10V$ ,  $I_D = 0.5A$
- \* 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	
-	1NM60G-AA3-R	SOT-223	G	D	S	Tape Reel
1NM60L-TM3-T	1NM60G-TM3-T	TO-251	G	D	S	Tube
1NM60L-TN3-R	1NM60G-TN3-R	TO-252	G	D	S	Tape Reel

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

1NM60G-AA3-R	(1)Packing Type	(1) R: Tape Reel, T: Tube
	(2)Package Type	(2) AA3: SOT-223, TM3: TO-251, TN3: TO-252
	(3)Green Package	(3) L: Lead Free, G: Halogen Free and Lead Free

MARKING

SOT-223	TO-251 / TO-252
<div><div>1NM60G</div><div><div>Lot Code</div><div>1</div><div>Data Code</div></div></div>	<div><div>UTC</div><div>1NM60</div><div><div>Lot Code</div><div>1</div><div>Data Code</div></div><div>L: Lead Free G: Halogen Free</div></div>

■ 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)	$I_{DM}$	4.0	A
Avalanche Current (Note 2)		$I_{AR}$	1.3	A
Avalanche Energy		$E_{AS}$	8.5	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	5.5	V/ns
Power Dissipation	SOT-223	$P_D$	8.0	W
	TO-251/TO-252		28	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.  $L=10\text{mH}$ ,  $I_{AS}=1.3\text{A}$ ,  $V_{DD}=50\text{V}$ ,  $R_G=25\ \Omega$ , 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 CHARACTERISTICS

PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Ambient	SOT-223	$\theta_{JA}$	150	$^{\circ}\text{C}/\text{W}$
	TO-251/TO-252		110	$^{\circ}\text{C}/\text{W}$
Junction to Case	SOT-223	$\theta_{JC}$	15.6	$^{\circ}\text{C}/\text{W}$
	TO-251/TO-252		4.46	$^{\circ}\text{C}/\text{W}$

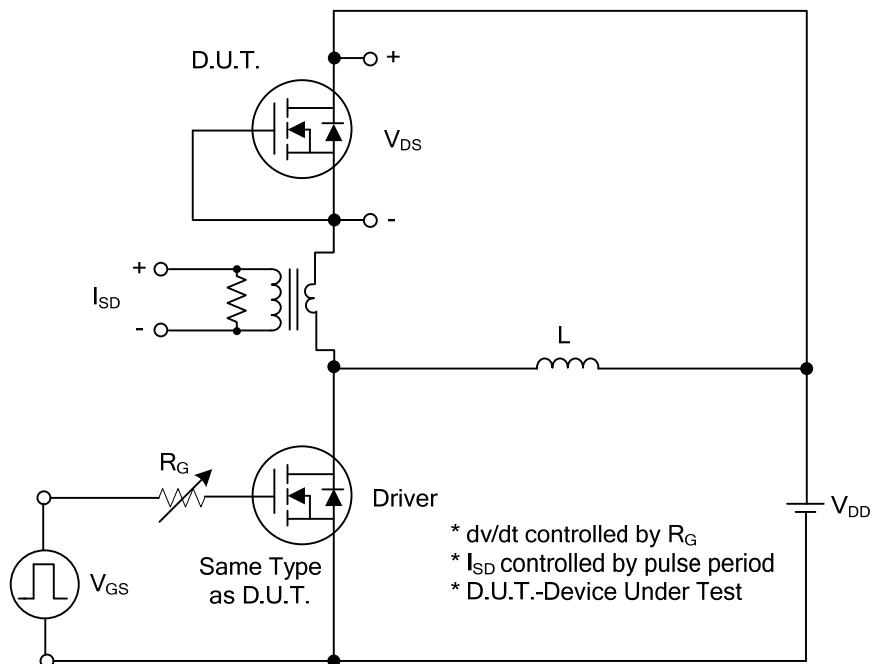
■ ELECTRICAL CHARACTERISTICS ( $T_J = 25^\circ\text{C}$ , unless otherwise specified)

PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS							
Drain-Source Breakdown Voltage		$BV_{DSS}$	$V_{GS} = 0V, I_D = 250\mu A$	600			V
Drain-Source Leakage Current		$I_{DSS}$	$V_{DS} = 600V, V_{GS} = 0V$			10	$\mu A$
Gate-Source Leakage Current	Forward	$I_{GSS}$	$V_{GS} = +30V, V_{DS} = 0V$			+100	nA
	Reverse		$V_{GS} = -30V, V_{DS} = 0V$			-100	nA
ON CHARACTERISTICS							
Gate Threold Voltage		$V_{GS(TH)}$	$V_{DS} = V_{GS}, I_D = 250\mu A$	2.5		4.5	V
Static Drain-Source On-State Resistance		$R_{DS(ON)}$	$V_{GS} = 10V, I_D = 0.5A$			4.6	$\Omega$
DYNAMIC CHARACTERISTICS							
Input Capacitance		$C_{ISS}$	$V_{GS} = 0V, V_{DS} = 25V, f = 1MHz$		83		pF
Output Capacitance		$C_{OSS}$			62		pF
Reverse Transfer Capacitance		$C_{RSS}$			8.0		pF
SWITCHING CHARACTERISTICS							
Total Gate Charge (Note 1)		$Q_G$	$V_{DS} = 50V, V_{GS} = 10V, I_D = 0.5A$ $I_G = 100\mu A$ (Note 1, 2)		19		nC
Gate to Source Charge		$Q_{GS}$			1.8		nC
Gate to Drain Charge		$Q_{GD}$			2.6		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)		43		ns
Rise Time		$t_R$			36		ns
Turn-OFF Delay Time		$t_{D(OFF)}$			59		ns
Fall-Time		$t_F$			25		ns
SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS							
Maximum Body-Diode Continuous Current		$I_S$				1.0	A
Maximum Body-Diode Pulsed Current		$I_{SM}$				4.0	A
Drain-Source Diode Forward Voltage (Note 1)		$V_{SD}$	$I_S = 1.0A, V_{GS} = 0V$			1.4	V
Body Diode Reverse Recovery Time (Note 1)		$t_{rr}$	$I_S = 1.0A, V_{GS} = 0V,$		160		nS
Body Diode Reverse Recovery Charge		$Q_{rr}$	$dI_F/dt = 100A/\mu s$		0.5		$\mu C$

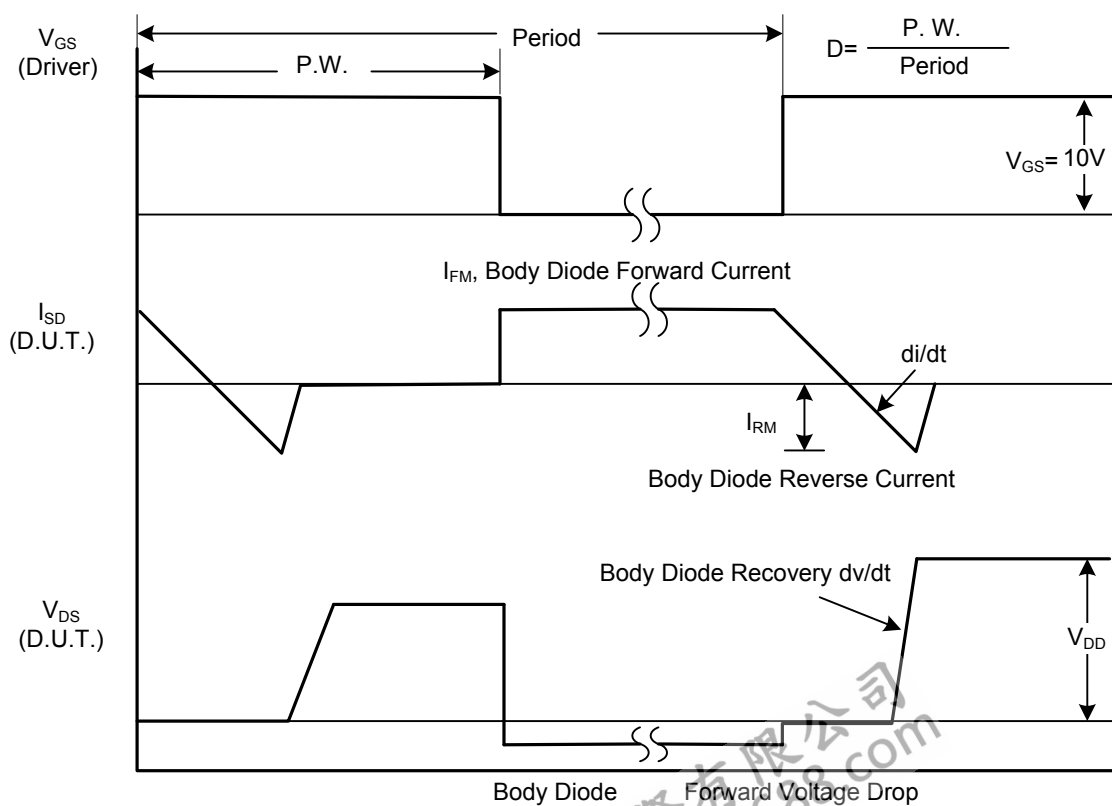
Notes: 1. Pulse Test: Pulse width  $\leq 300\mu s$ , Duty cycle  $\leq 2\%$ .

2. Essentially independent of operating temperature.

# ■ TEST CIRCUITS AND WAVEFORMS

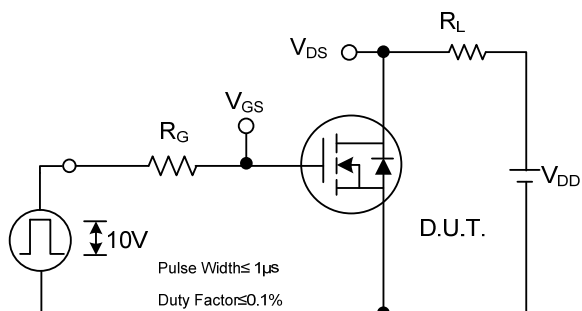


Peak Diode Recovery dv/dt Test Circuit

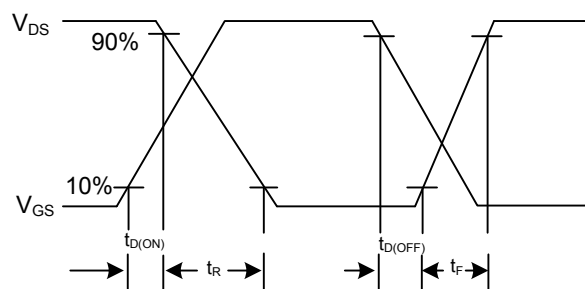


Peak Diode Recovery dv/dt Waveforms

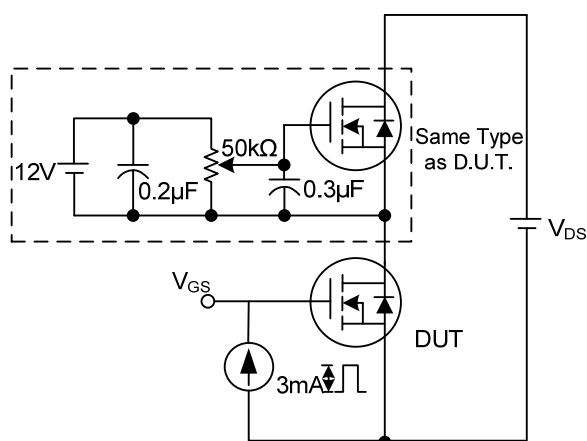
### ■ TEST CIRCUITS AND WAVEFORMS (Cont.)



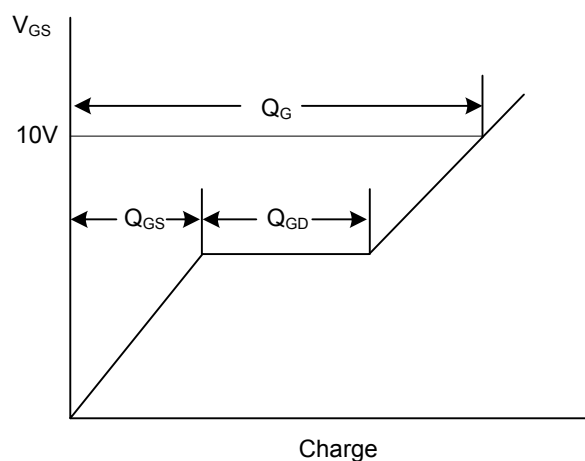
Switching Test Circuit



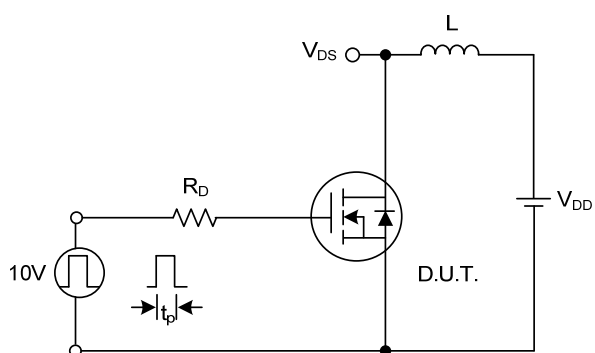
Switching Waveforms



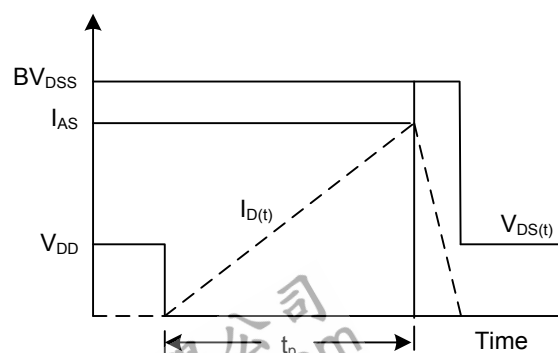
Gate Charge Test Circuit



Gate Charge Waveform



Unclamped Inductive Switching Test Circuit



Unclamped Inductive Switching Waveforms

UTC assumes no responsibility for equipment failures that result from using products at values that exceed, even momentarily, rated values (such as maximum ratings, operating condition ranges, or other parameters) listed in products specifications of any and all UTC products described or contained herein. UTC products are not designed for use in life support appliances, devices or systems where malfunction of these products can be reasonably expected to result in personal injury. Reproduction in whole or in part is prohibited without the prior written consent of the copyright owner. The information presented in this document does not form part of any quotation or contract, is believed to be accurate and reliable and may be changed without notice.