



## 6NM60-S

Power MOSFET

### 6A, 600V N-CHANNEL SUPER-JUNCTION MOSFET

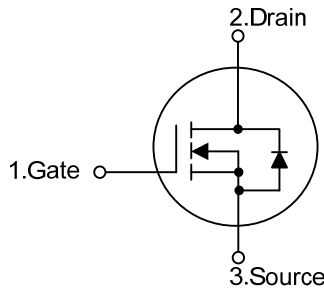
#### DESCRIPTION

The **UTC 6NM60-S** 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 AC-DC converters for power applications.

#### FEATURES

- \*  $R_{DS(on)} \leq 1.4\Omega$  @  $V_{GS}=10V$ ,  $I_D=3.0A$
- \* Improved dv/dt capability
- \* Fast switching
- \* 100% avalanche tested

#### SYMBOL

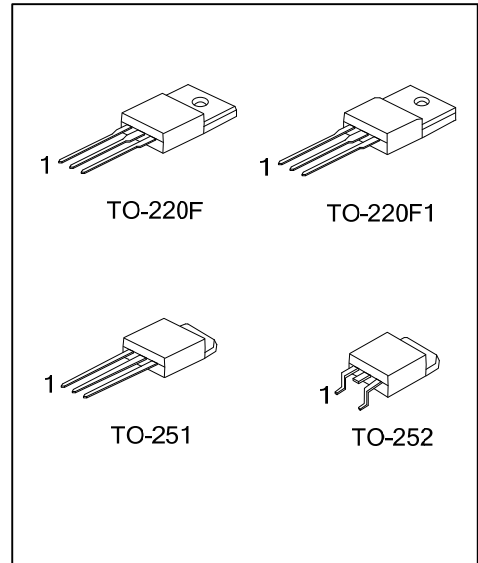


#### ORDERING INFORMATION

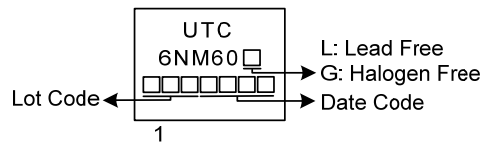
Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
6NM60L-TF1-T	6NM60G-TF1-T	TO-220F1	G	D	S	Tube
6NM60L-TF3-T	6NM60G-TF3-T	TO-220F	G	D	S	Tube
6NM60L-TM3-T	6NM60G-TM3-T	TO-251	G	D	S	Tube
6NM60L-TN3-R	6NM60G-TN3-R	TO-252	G	D	S	Tape Reel

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

<p>6NM60G-TF1-T</p> <p>(1) Packing Type</p> <p>(2) Package Type</p> <p>(3) Green Package</p>		<p>(1) T: Tube, R: Tape Reel</p> <p>(2) TF3: TO-220F, TF1: TO-220F1, TM3: TO-251, TN3: TO-252</p> <p>(3) G: Halogen Free and Lead Free, L: Lead Free</p>
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## MARKING



■ 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	$I_D$	6.0	A
Pulsed Drain Current (Note 2)	$I_{DM}$	24	A
Avalanche Current (Note 2)	$I_{AR}$	1.4	A
Single Pulsed Avalanche Energy (Note 3)	$E_{AS}$	141	mJ
Peak Diode Recovery dv/dt (Note 4)	dv/dt	4.5	V/ns
Power Dissipation	TO-220F/TO-220F1	$P_D$	40
	TO-251/TO-252		55
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.  $L = 144 \text{ mH}$ ,  $I_{AS} = 1.4 \text{ A}$ ,  $V_{DD} = 50 \text{ V}$ ,  $R_G = 25 \Omega$ , Starting  $T_J = 25^\circ\text{C}$

4.  $I_{SD} \leq 6.0 \text{ A}$ ,  $di/dt \leq 200 \text{ A}/\mu\text{s}$ ,  $V_{DD} \leq BV_{DSS}$ , Starting  $T_J = 25^\circ\text{C}$

■ THERMAL DATA

PARAMETER	SYMBOL	RATING	UNIT
Junction to Ambient	$\theta_{JA}$	TO-220F/TO-220F1	62.5
		TO-251/TO-252	110
Junction to Case	$\theta_{JC}$	TO-220F/TO-220F1	3.13
		TO-251/TO-252	2.27

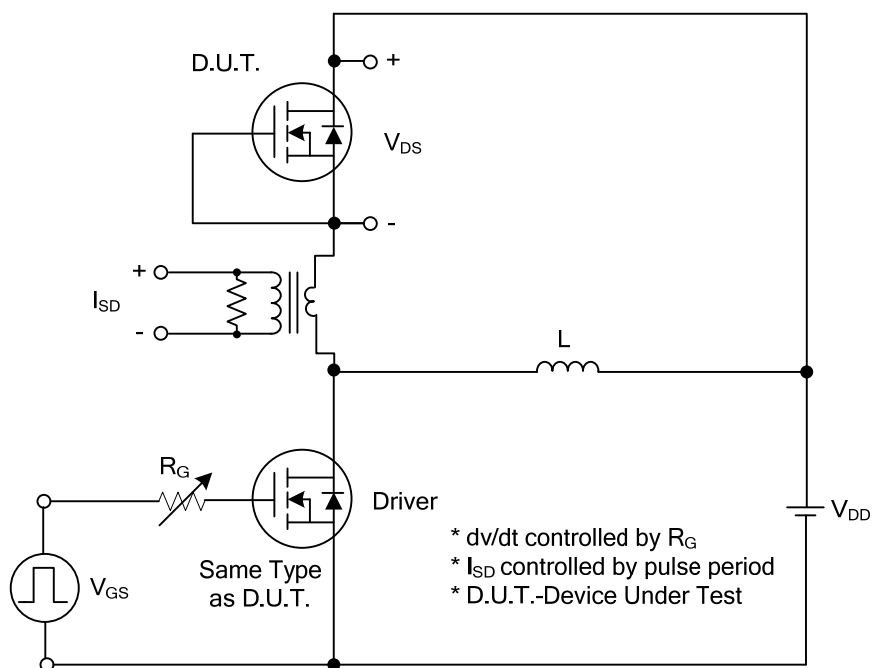
■ ELECTRICAL CHARACTERISTICS ( $T_C = 25^\circ\text{C}$ , unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS						
Drain-Source Breakdown Voltage	BV <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	I <sub>GSS</sub>	V <sub>GS</sub> = 30V, V <sub>DS</sub> = 0V			100	nA
		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	2.5		4.5	V
Static Drain-Source On-State Resistance	R <sub>DS(ON)</sub>	V <sub>GS</sub> = 10V, I <sub>D</sub> = 3.0A			1.4	Ω
DYNAMIC CHARACTERISTICS						
Input Capacitance	C <sub>ISS</sub>	V <sub>GS</sub> =0V, V <sub>DS</sub> =25V, f=1.0MHz		255		pF
Output Capacitance	C <sub>OSS</sub>			179		pF
Reverse Transfer Capacitance	C <sub>RSS</sub>			24		pF
SWITCHING CHARACTERISTICS						
Total Gate Charge (Note 1)	Q <sub>G</sub>	V <sub>DS</sub> =50V, I <sub>D</sub> =1.3A, V <sub>GS</sub> =10V I <sub>G</sub> =100μA (Note 1,2)		44		nC
Gate-Source Charge	Q <sub>GS</sub>			4.5		nC
Gate-Drain Charge	Q <sub>GD</sub>			7.8		nC
Turn-On Delay Time (Note 1)	t <sub>D(ON)</sub>	V <sub>DD</sub> =30V, I <sub>D</sub> =0.5A, R <sub>G</sub> =25Ω (Note 1,2)		43		nS
Turn-On Rise Time	t <sub>R</sub>			58		nS
Turn-Off Delay Time	t <sub>D(OFF)</sub>			120		nS
Turn-Off Fall Time	t <sub>F</sub>			50		nS
DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS						
Maximum Body-Diode Continuous Current	I <sub>S</sub>				6	A
Maximum Body-Diode Pulsed Current	I <sub>SM</sub>				24	A
Drain-Source Diode Forward Voltage (Note 1)	V <sub>SD</sub>	I <sub>S</sub> =6.0A, V <sub>GS</sub> =0V			1.4	V
Reverse Recovery Time (Note 1)	t <sub>rr</sub>	I <sub>S</sub> =6.0A, V <sub>GS</sub> =0V,		260		nS
Reverse Recovery Charge	Q <sub>rr</sub>	dI <sub>F</sub> /dt=100A/μs		2.1		μC

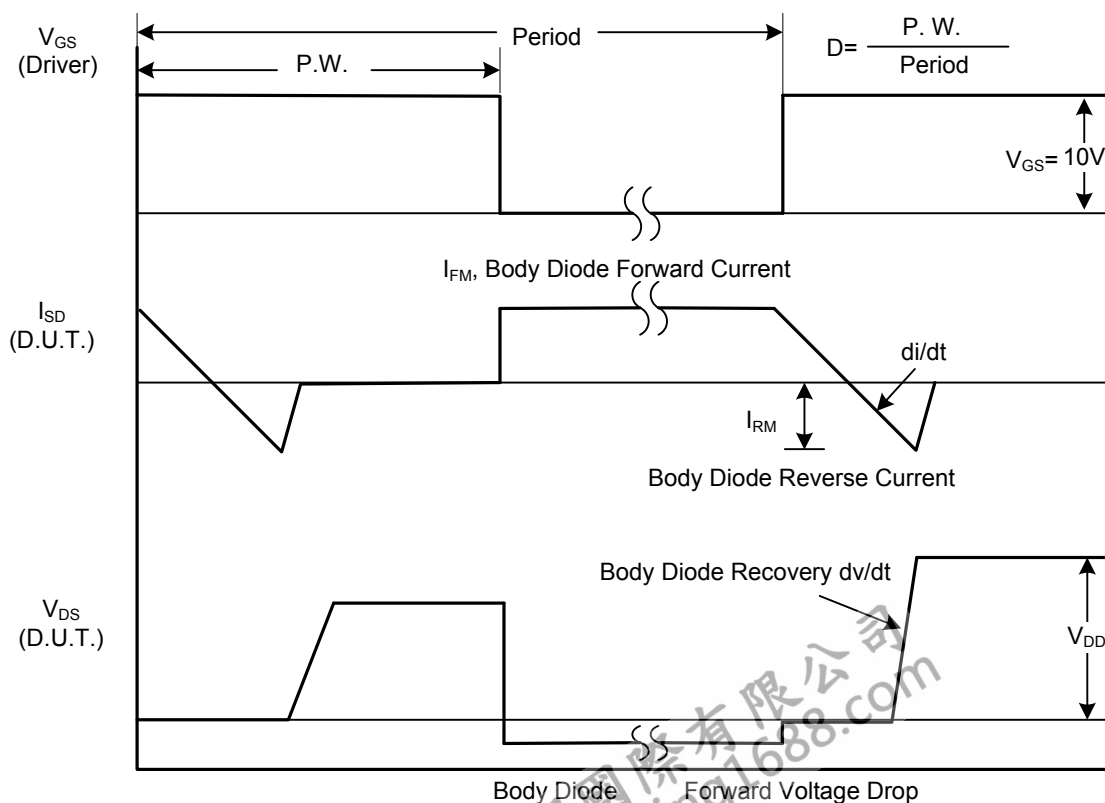
Notes: 1. Pulse Test : Pulse width  $\leq 300\mu s$ , Duty cycle  $\leq 2\%$ .

2. Essentially independent of operating ambient temperature.

# ■ TEST CIRCUITS AND WAVEFORMS

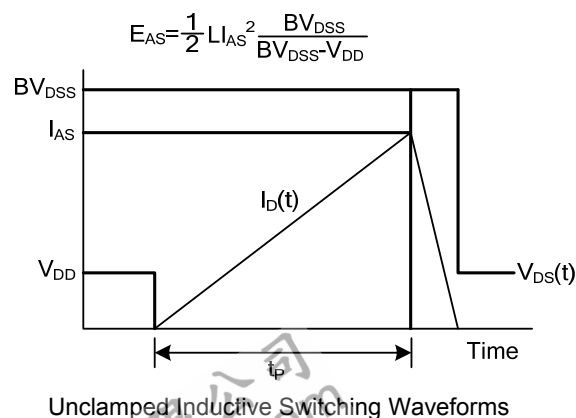
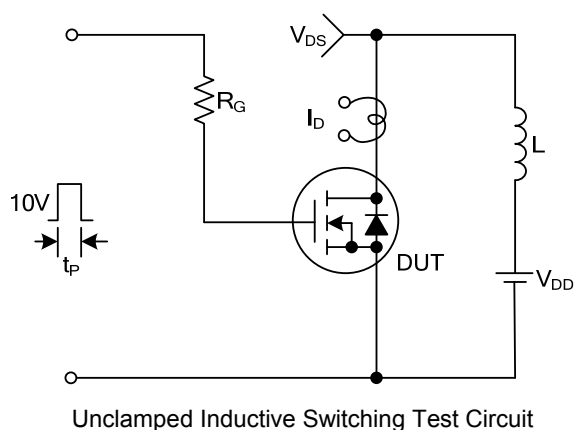
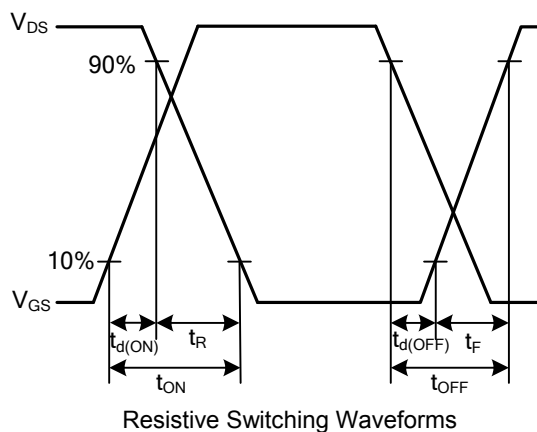
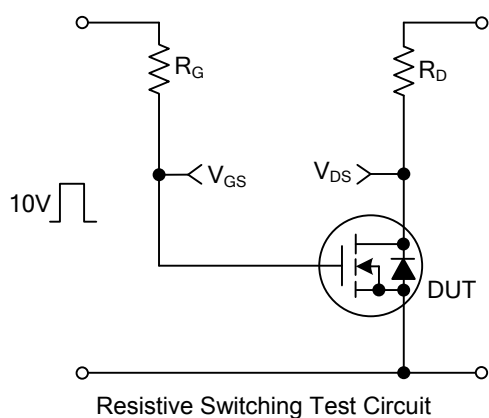
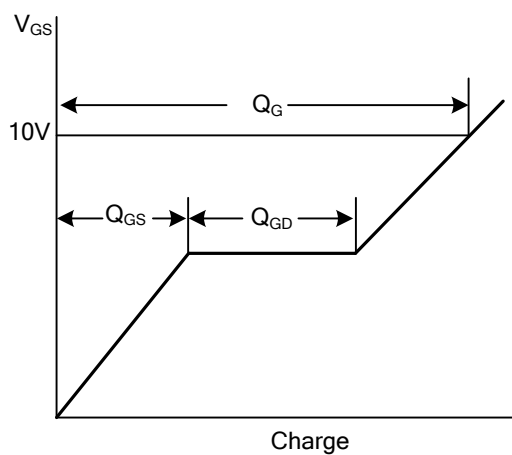
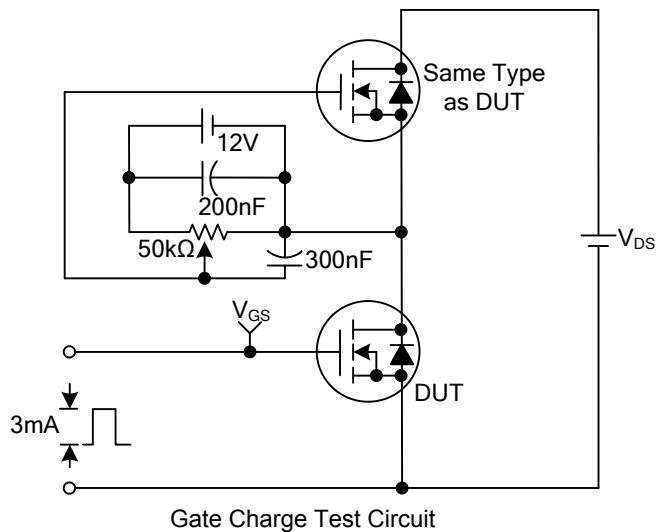


Peak Diode Recovery  $dv/dt$  Test Circuit



Peak Diode Recovery  $dv/dt$  Waveforms

# ■ TEST CIRCUITS AND WAVEFORMS (Cont.)



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