



# 7NM60

*Power MOSFET*

## 7.4A, 600V N-CHANNEL SUPER-JUNCTION MOSFET

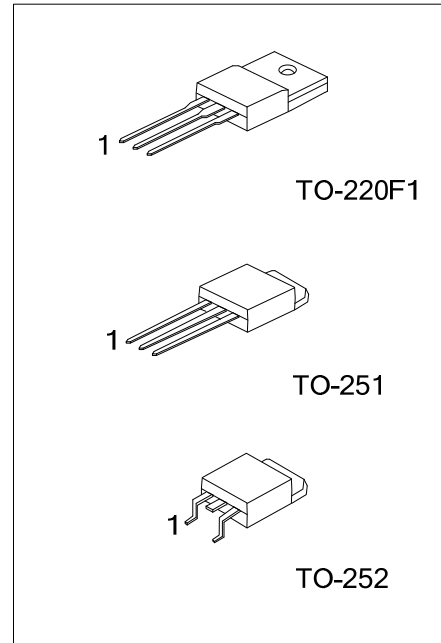
■ DESCRIPTION

The UTC **7NM60** is a high voltage super junction MOSFET and is designed to have better characteristics.

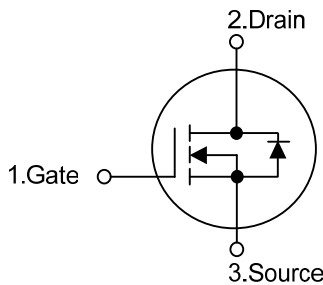
The UTC **7NM60** Utilizing an advanced charge-balance technology, enhance system efficiency, improve EMI and reliability. such as low gate charge, low on-state resistance and have a high power density and high rugged avalanche characteristics. This super junction MOSFET usually used at AC/DC power conversion, and industrial power applications.

■ FEATURES

- \*  $R_{DS(ON)} < 0.95\Omega$  @  $V_{GS} = 10V, I_D = 3.7A$
- \* Fast Switching Capability
- \* Avalanche Energy Tested
- \* Improved dv/dt Capability, High Ruggedness



■ SYMBOL



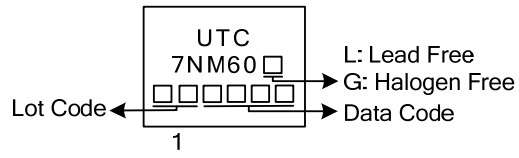
■ ORDERING INFORMATION

Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
7NM60L-TF1-T	7NM60G-TF1-T	TO-220F1	G	D	S	Tube
7NM60L-TM3-T	7NM60G-TM3-T	TO-251	G	D	S	Tube
7NM60L-TN3-R	7NM60G-TN3-R	TO-252	G	D	S	Tape Reel

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

<p>7NM60L-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) TF1: TO-220F1, TM3: TO-251, TN3: TO-252</p> <p>(3) L: Lead Free, G: Halogen Free and 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
Drain Current	Continuous	$I_D$	7.4	A
	Pulsed (Note 2)	$I_{DM}$	29.6	A
Avalanche Current (Note 2)		$I_{AR}$	2	A
Avalanche Energy	Single Pulsed (Note 3)	$E_{AS}$	65	mJ
	Repetitive (Note 2)	$E_{AR}$	0.1	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	3.7	V/ns
Power Dissipation	TO-220F1	$P_D$	48	W
	TO-251/TO-252		60	W
Derate above $25^\circ\text{C}$	TO-220F1		0.38	W/ $^\circ\text{C}$
	TO-251/TO-252		0.48	W/ $^\circ\text{C}$
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  $T_J$ .

3.  $L=32.5\text{mH}$ ,  $I_{AS}=2\text{A}$ ,  $V_{DD}=50\text{V}$ ,  $R_G=25\ \Omega$ , Starting  $T_J = 25^\circ\text{C}$

4.  $I_{SD}\leq 7.4\text{A}$ ,  $di/dt\leq 200\text{A}/\mu\text{s}$ ,  $V_{DD}\leq BV_{DSS}$ , Starting  $T_J = 25^\circ\text{C}$

■ THERMAL DATA

PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Ambient	TO-220F1	$\theta_{JA}$	62.5	$^\circ\text{C}/\text{W}$
	TO-251/TO-252		110	$^\circ\text{C}/\text{W}$
Junction to Case	TO-220F1	$\theta_{JC}$	2.6	$^\circ\text{C}/\text{W}$
	TO-251/TO-252		2.08	$^\circ\text{C}/\text{W}$

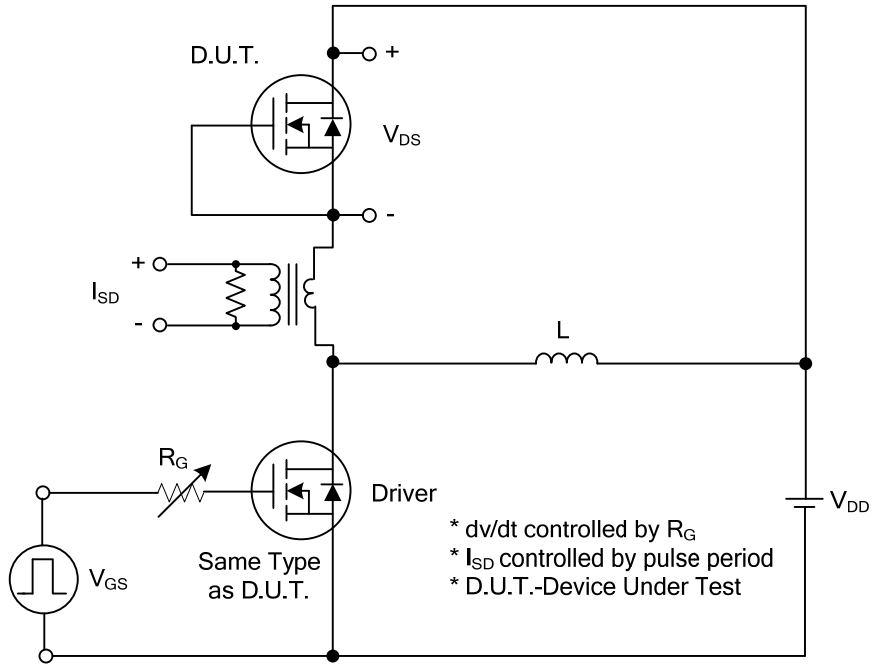
■ ELECTRICAL CHARACTERISTICS (T<sub>C</sub>=25°C, unless otherwise specified)

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			1	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
Breakdown Voltage Temperature Coefficient	ΔBV <sub>DSS</sub> /ΔT <sub>J</sub>	I <sub>D</sub> =250μA, Referenced to 25°C		0.67		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	2.5		4.5	V
Static Drain-Source On-State Resistance	R <sub>DS(ON)</sub>	V <sub>GS</sub> = 10V, I <sub>D</sub> = 3.7A			0.95	Ω
<b>DYNAMIC CHARACTERISTICS</b>						
Input Capacitance	C <sub>ISS</sub>	V <sub>DS</sub> =25V, V <sub>GS</sub> =0V, f=1.0MHz		300		pF
Output Capacitance	C <sub>OSS</sub>			120		pF
Reverse Transfer Capacitance	C <sub>RSS</sub>			13		pF
<b>SWITCHING CHARACTERISTICS</b>						
Total Gate Charge	Q <sub>G</sub>	V <sub>DS</sub> =50V, I <sub>D</sub> =1.3A, I <sub>G</sub> =100μA V <sub>GS</sub> =10V (Note 1, 2)		19		nC
Gate-Source Charge	Q <sub>GS</sub>			5		nC
Gate-Drain Charge	Q <sub>GD</sub>			5.5		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)		60		ns
Turn-On Rise Time	t <sub>R</sub>			100		ns
Turn-Off Delay Time	t <sub>D(OFF)</sub>			140		ns
Turn-Off Fall Time	t <sub>F</sub>			70		ns
<b>DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS</b>						
Maximum Continuous Drain-Source Diode Forward Current	I <sub>S</sub>				7.4	A
Maximum Pulsed Drain-Source Diode Forward Current	I <sub>SM</sub>				29.6	A
Drain-Source Diode Forward Voltage	V <sub>SD</sub>	V <sub>GS</sub> =0V, I <sub>S</sub> =7.4A			1.4	V
Body Diode Reverse Recovery Time	t <sub>rr</sub>	V <sub>GS</sub> =0V, I <sub>S</sub> =7.4A dI/dt=100A/μs		320		nS
Body Diode Reverse Recovery Charge	Q <sub>rr</sub>				3.2	

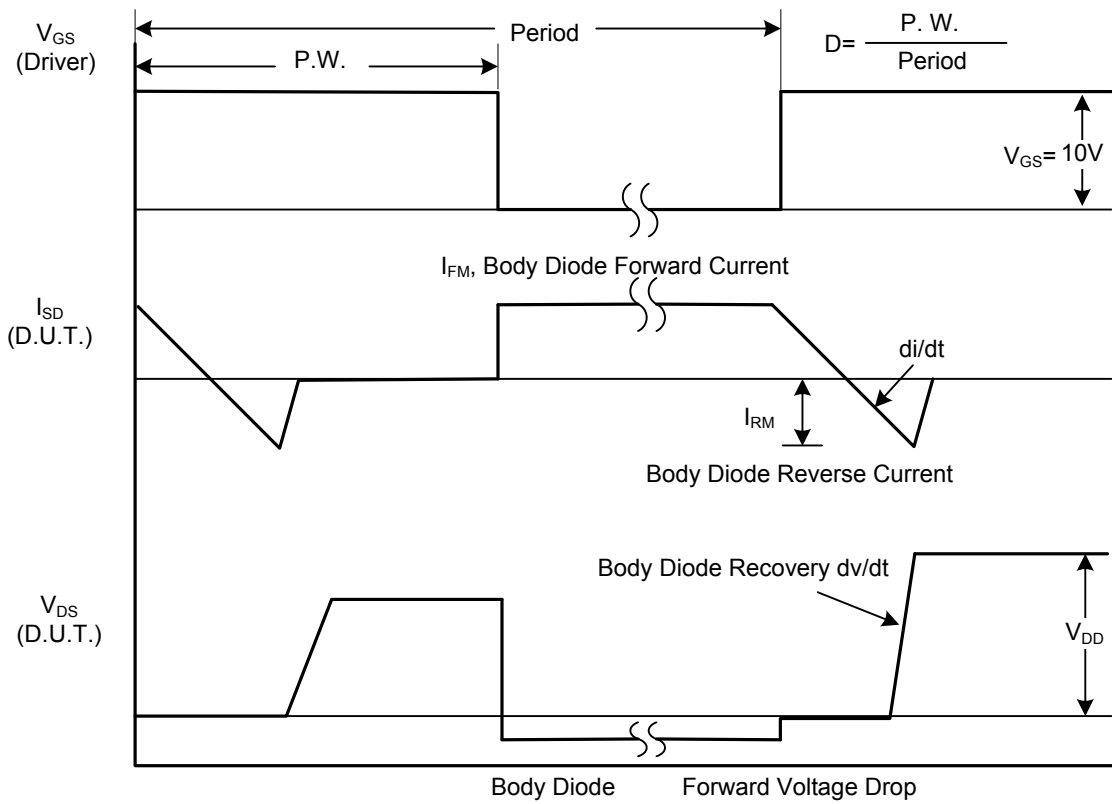
Notes: 1. Pulse Test: Pulse width ≤ 300μs, Duty cycle ≤ 2%.

2. Essentially independent of operating temperature.

■ TEST CIRCUITS AND WAVEFORMS

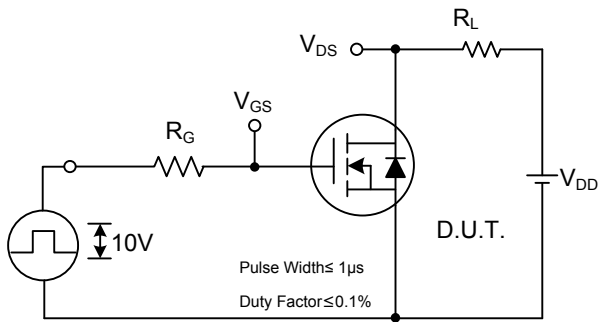


Peak Diode Recovery  $dv/dt$  Test Circuit

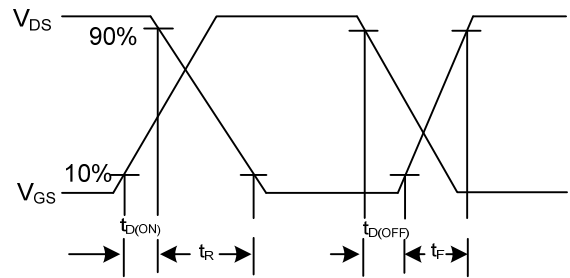


Peak Diode Recovery  $dv/dt$  Waveforms

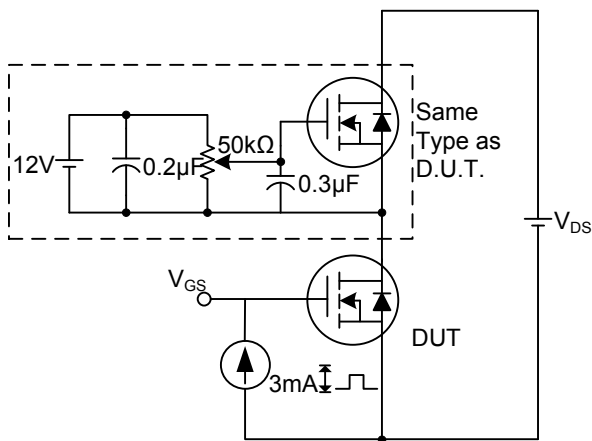
■ TEST CIRCUITS AND WAVEFORMS (Cont.)



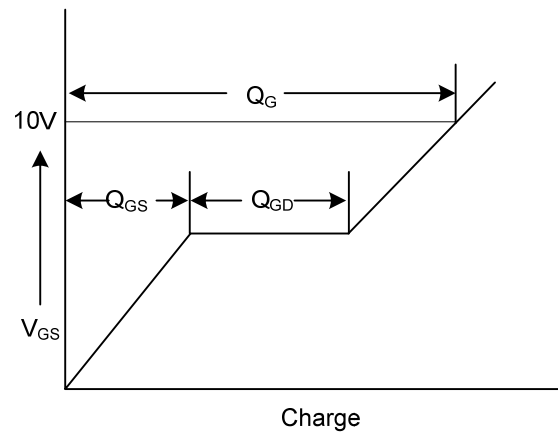
Switching Test Circuit



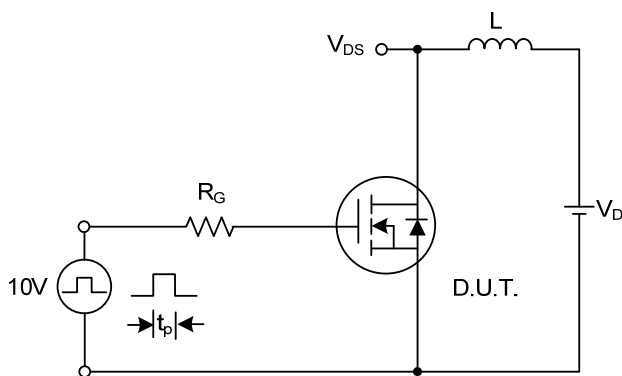
Switching Waveforms



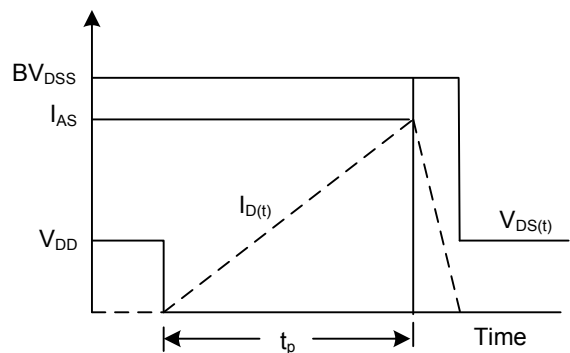
Gate Charge Test Circuit



Gate Charge Waveform



Unclamped Inductive Switching Test Circuit



Unclamped Inductive Switching Waveforms

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