



**10NM60**

Preliminary

**Power MOSFET**

**10A, 600V N-CHANNEL  
SUPER-JUNCTION MOSFET**

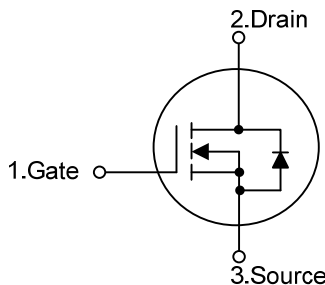
■ DESCRIPTION

The **UTC 10NM60** 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

- \*  $R_{DS(ON)} < 0.48\Omega @ V_{GS}=10V, I_D=5.0A$
- \* By using Super Junction Structure
- \* Fast Switching
- \* With 100% Avalanche Tested

■ SYMBOL

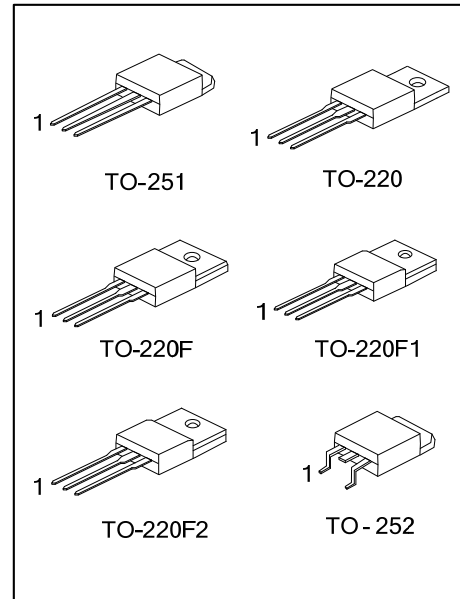


■ ORDERING INFORMATION

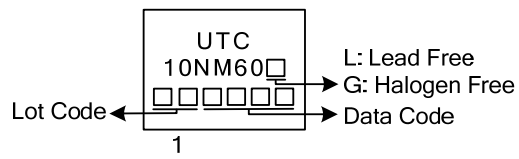
Order Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
10NM60L-TA3-T	10NM60G-TA3-T	TO-220	G	D	S	Tube
10NM60L-TF1-T	10NM60G-TF1-T	TO-220F1	G	D	S	Tube
10NM60L-TF2-T	10NM60G-TF2-T	TO-220F2	G	D	S	Tube
10NM60L-TF3-T	10NM60G-TF3-T	TO-220F	G	D	S	Tube
10NM60L-TM3-T	10NM60G-TM3-T	TO-251	G	D	S	Tube
10NM60L-TN3-R	10NM60G-TN3-R	TO-252	G	D	S	Tape Reel

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

<p>10NM60L-TA3-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) TA3: TO-220, TF1: TO-220F1, TF2: TO-220F2 TF3: TO-220F, 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	$I_D$	10	A
	Pulsed (Note 2)	$I_{DM}$	40	A
Avalanche Current (Note 2)		$I_{AR}$	2.4	A
Avalanche Energy	Single Pulsed (Note 3)	$E_{AS}$	29	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	5.2	V/ns
Power Dissipation	TO-220	$P_D$	60	W
	TO-220F/TO-220F1 TO-220F2		25	W
	TO-251/TO-252		90	W
Junction Temperature		$T_J$	+150	$^\circ\text{C}$
Storage Temperature Range		$T_{STG}$	-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.  $L=10\text{mH}$ ,  $I_{AS}=2.4\text{A}$ ,  $V_{DD}=50\text{V}$ ,  $R_G=25\Omega$ , Starting  $T_J=25^\circ\text{C}$

4.  $I_{SD}\leq 10\text{A}$ ,  $di/dt\leq 200\text{A}/\mu\text{s}$ ,  $V_{DD}\leq BV_{DSS}$ , Starting  $T_J=25^\circ\text{C}$

■ THERMAL DATA

PARAMETER		SYMBOL	RATING	UNIT
Junction to Ambient	TO-220/TO-220F TO-220F1/TO-220F2	$\theta_{JA}$	62.5	$^\circ\text{C}/\text{W}$
	TO-251/TO-252		110	
Junction to Case	TO-220	$\theta_{JC}$	2.08	$^\circ\text{C}/\text{W}$
	TO-220F/TO-220F1 TO-220F2		5.0	
	TO-251/TO-252		1.39	

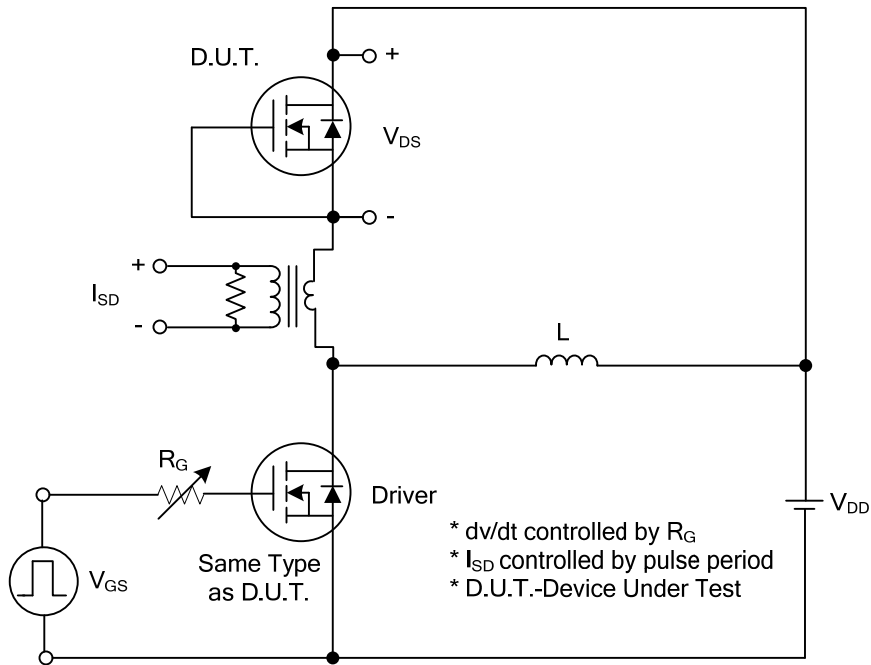
■ ELECTRICAL CHARACTERISTICS (T<sub>J</sub>=25°C, unless otherwise specified)

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
Gate-Source Leakage Current	Forward	I <sub>GSS</sub>	V <sub>DS</sub> =0V, V <sub>GS</sub> =30V			100	nA
	Reverse		V <sub>DS</sub> =0V, V <sub>GS</sub> =-30V			-100	nA
<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
Drain-Source On-State Resistance		R <sub>DS(ON)</sub>	V <sub>GS</sub> =10V, I <sub>D</sub> =5.0A			0.48	Ω
<b>DYNAMIC PARAMETERS</b>							
Input Capacitance		C <sub>ISS</sub>	V <sub>GS</sub> =0V, V <sub>DS</sub> =25V, f=1.0MHz		588		pF
Output Capacitance		C <sub>OSS</sub>			337		pF
Reverse Transfer Capacitance		C <sub>RSS</sub>			23		pF
<b>SWITCHING PARAMETERS</b>							
Total Gate Charge (Note 1)		Q <sub>G</sub>	V <sub>DS</sub> =50V, V <sub>GS</sub> =10V, I <sub>D</sub> =1.3A, I <sub>G</sub> =100μA (Note 1, 2)		80		nC
Gate to Source Charge		Q <sub>GS</sub>			6.0		nC
Gate to Drain Charge		Q <sub>GD</sub>			19		nC
Turn-ON Delay Time (Note 1)		t <sub>D(ON)</sub>	V <sub>DD</sub> =30V, V <sub>GS</sub> =10V, I <sub>D</sub> =0.5A, R <sub>G</sub> =25Ω (Note 1, 2)		62		ns
Rise Time		t <sub>R</sub>			88		ns
Turn-OFF Delay Time		t <sub>D(OFF)</sub>			207		ns
Fall-Time		t <sub>F</sub>			88		ns
<b>SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS</b>							
Maximum Body-Diode Continuous Current		I <sub>S</sub>				10	A
Maximum Body-Diode Pulsed Current		I <sub>SM</sub>				40	A
Drain-Source Diode Forward Voltage (Note 1)		V <sub>SD</sub>	I <sub>S</sub> =10A, V <sub>GS</sub> =0V			1.4	V
Body Diode Reverse Recovery Time (Note 1)		t <sub>rr</sub>	I <sub>S</sub> =10A, V <sub>GS</sub> =0V, dI <sub>F</sub> /dt=100A/μs		340		ns
Body Diode Reverse Recovery Charge		Q <sub>rr</sub>			4.2		μC

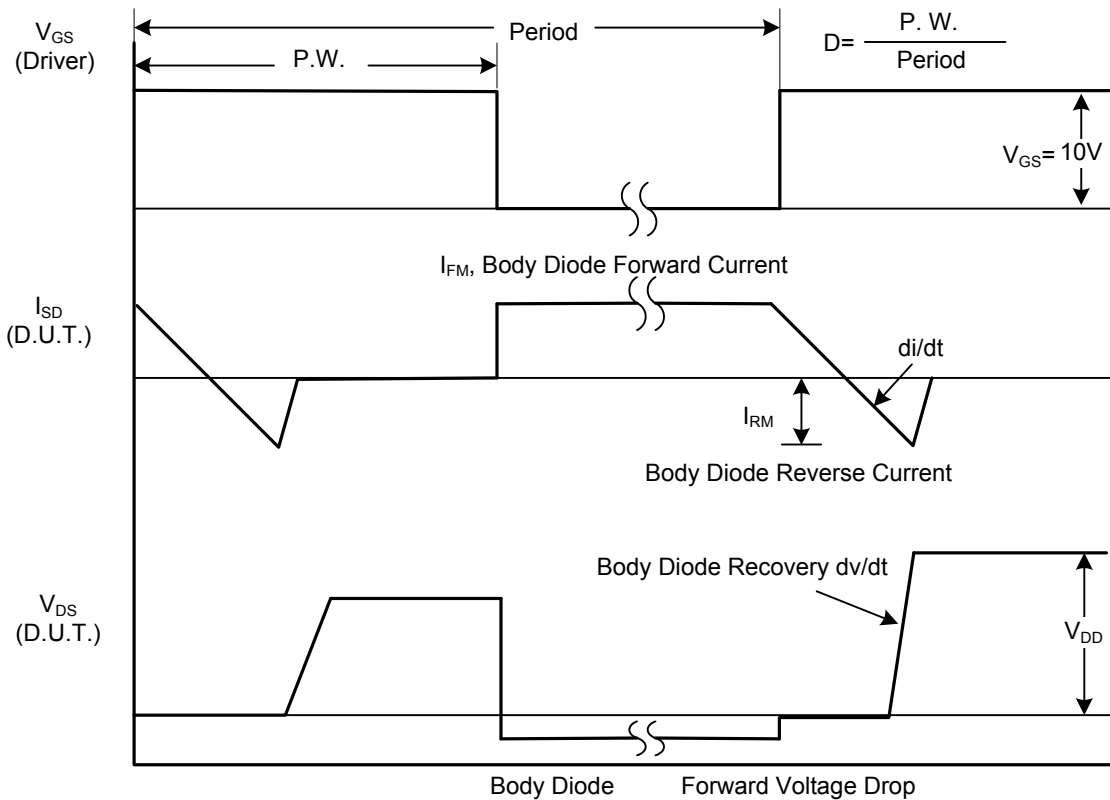
Notes: 1. Pulse Test : Pulse width ≤ 300μs, Duty cycle ≤ 2%.

2. Essentially independent of operating temperature.

■ TEST CIRCUITS AND WAVEFORMS

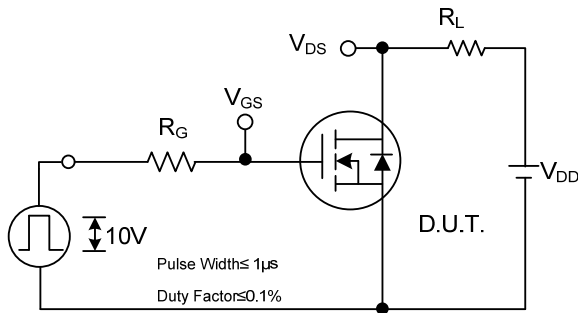


Peak Diode Recovery dv/dt Test Circuit

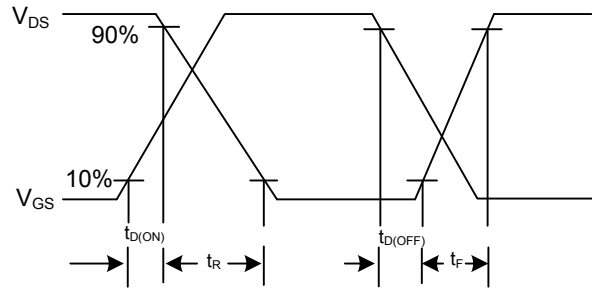


Peak Diode Recovery dv/dt Waveforms

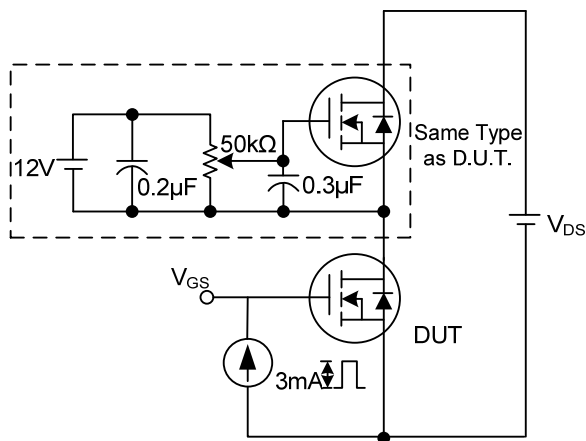
■ TEST CIRCUITS AND WAVEFORMS (Cont.)



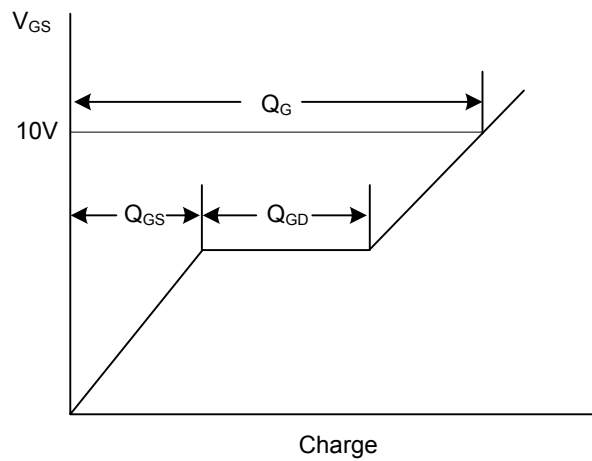
Switching Test Circuit



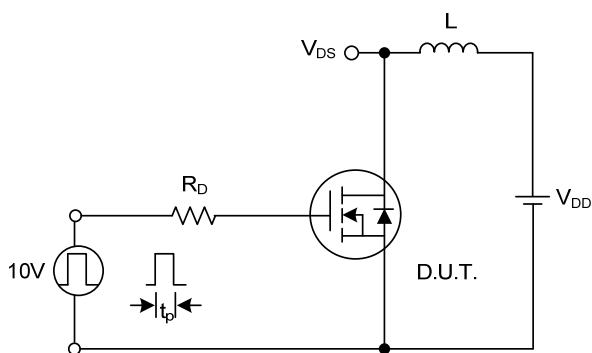
Switching Waveforms



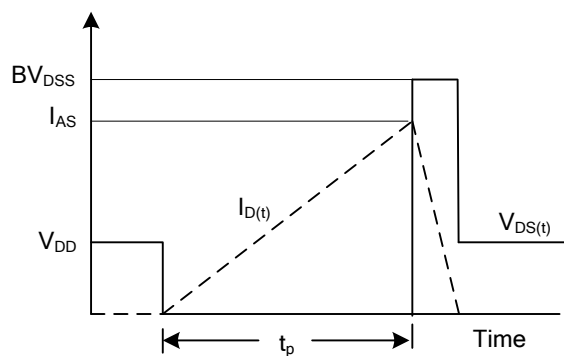
Gate Charge Test Circuit



Gate Charge Waveform



Unclamped Inductive Switching Test Circuit



Unclamped Inductive Switching Waveforms

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