



**20NM60**

Preliminary

**Power MOSFET**

**20A, 600V N-CHANNEL  
SUPER-JUNCTION MOSFET**

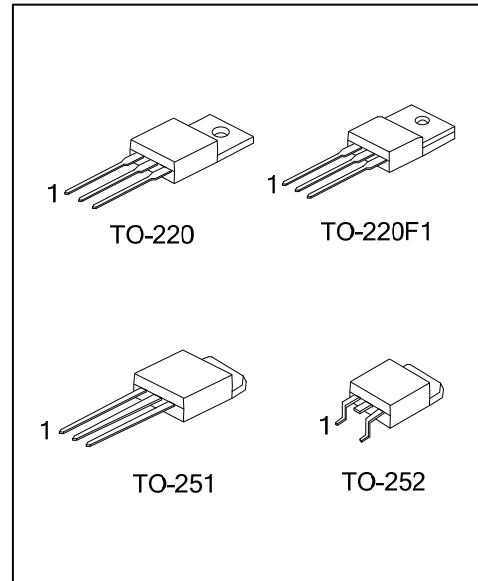
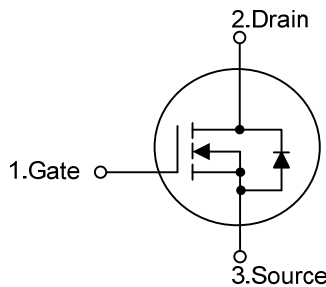
■ DESCRIPTION

The **UTC 20NM60** 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

- \*  $R_{DS(ON)} < 0.3\Omega @ V_{GS}=10V, I_D=10A$
- \* By using Super Junction Structure
- \* Fast Switching
- \* With 100% Avalanche Tested

■ SYMBOL



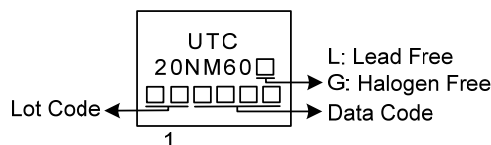
■ ORDERING INFORMATION

Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
20NM60L-TA3-T	20NM60G-TA3-T	TO-220	G	D	S	Tube
20NM60L-TF1-T	20NM60G-TF1-T	TO-220F1	G	D	S	Tube
20NM60L-TM3-T	20NM60G-TM3-T	TO-251	G	D	S	Tube
20NM60L-TN3-R	20NM60G-TN3-R	TO-252	G	D	S	Tape Reel

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

<p>20NM60G-TA3-T</p> <p>(1)Packing Type (2)Package Type (3)Green Package</p>	<p>(1) T: Tube, R: Tape Reel (2) TA3: TO-220, TF1: TO-220F1, TM3: TO-251, TN3: TO-252 (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	Continuous	$I_D$	20	A
Pulsed Drain Current	Pulsed (Note 2)	$I_{DM}$	80	A
Avalanche Current (Note 3)		$I_{AR}$	3.4	A
Avalanche energy	Single Pulsed (Note 3)	$E_{AS}$	572	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	6.4	V/nS
Power Dissipation	TO-220	$P_D$	240	W
	TO-220F1		58	W
	TO-251/TO-252		183	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.  $L=99\text{mH}$ ,  $I_{AS}=3.4\text{A}$ ,  $V_{DD}=50\text{V}$ ,  $R_G=25\Omega$ , Starting  $T_J = 25^\circ\text{C}$ .

4.  $I_{SD} \leq 20\text{A}$ ,  $di/dt \leq 200\text{A}/\mu\text{s}$ ,  $V_{DD} \leq V_{(BR)DSS}$ ,  $T_J = 25^\circ\text{C}$ .

■ THERMAL DATA

PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Ambient	TO-220/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-220	$\theta_{JC}$	0.52	$^\circ\text{C}/\text{W}$
	TO-220F1		2.16	$^\circ\text{C}/\text{W}$
	TO-251/TO-252		0.68	$^\circ\text{C}/\text{W}$

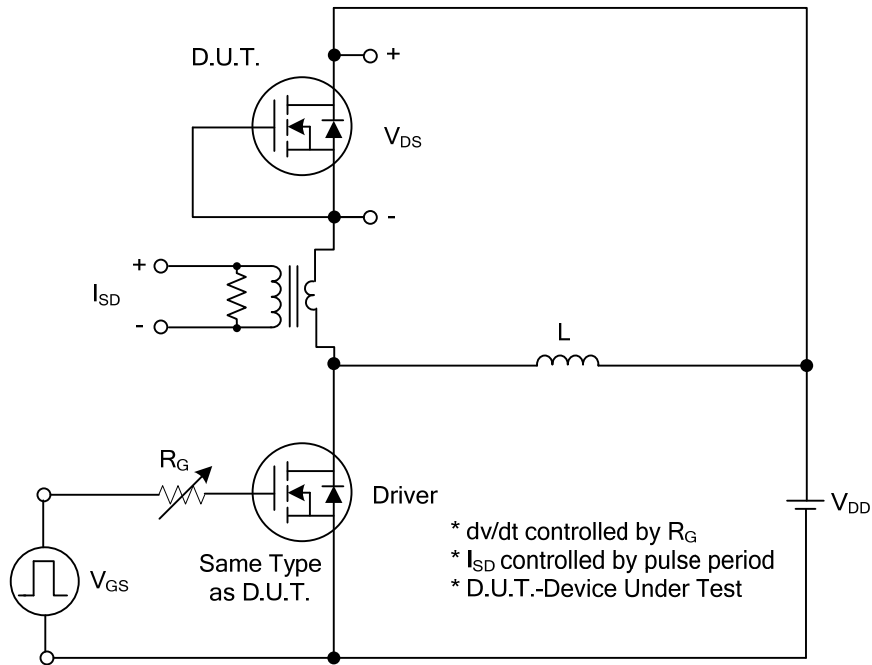
■ ELECTRICAL CHARACTERISTICS (T<sub>J</sub> =25°C, unless otherwise specified)

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> =10A			0.3	Ω
<b>DYNAMIC PARAMETERS</b>							
Input Capacitance		C <sub>ISS</sub>	V <sub>GS</sub> =0V, V <sub>DS</sub> =25V, f=1.0MHz		1075		pF
Output Capacitance		C <sub>OSS</sub>			804		pF
Reverse Transfer Capacitance		C <sub>RSS</sub>			54		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)		112		nC
Gate to Source Charge		Q <sub>GS</sub>			8		nC
Gate to Drain Charge		Q <sub>GD</sub>			33		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)		76		ns
Rise Time		t <sub>R</sub>			164		ns
Turn-off Delay Time		t <sub>D(OFF)</sub>			305		ns
Fall-Time		t <sub>F</sub>			200		ns
<b>SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS</b>							
Maximum Body-Diode Pulsed Current		I <sub>S</sub>				20	A
Drain-Source Diode Forward Voltage (Note 1)		I <sub>SM</sub>				80	A
Maximum Body-Diode Continuous Current		V <sub>SD</sub>	I <sub>S</sub> =20A, V <sub>GS</sub> =0V			1.4	V
Reverse Recovery Time (Note 1)		t <sub>rr</sub>	I <sub>S</sub> =20A, V <sub>GS</sub> =0V, di <sub>F</sub> /dt=100A/μs		435		ns
Reverse Recovery Charge		Q <sub>rr</sub>			7.42		μC

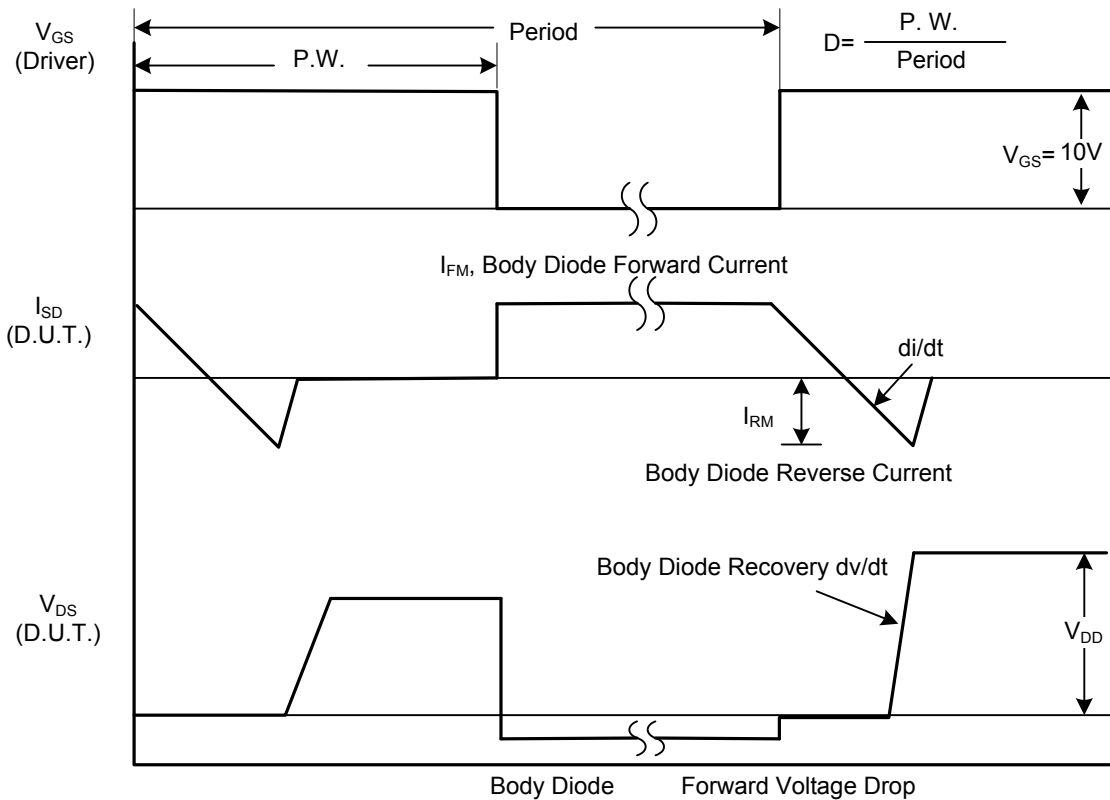
Note: 1. Pulse Test : Pulse width ≤ 300μs, Duty cycle ≤ 2%.

2. Essentially independent of operating temperature.

■ TEST CIRCUITS AND WAVEFORMS

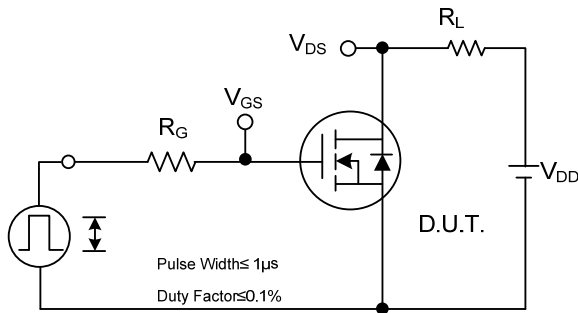


Peak Diode Recovery dv/dt Test Circuit

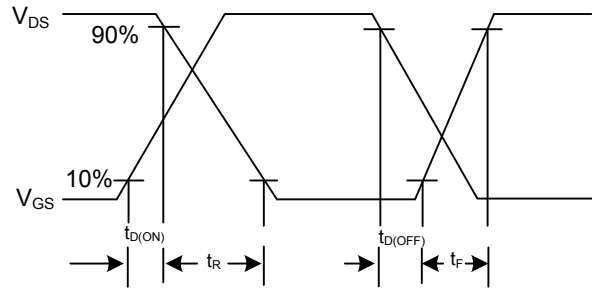


Peak Diode Recovery dv/dt Waveforms

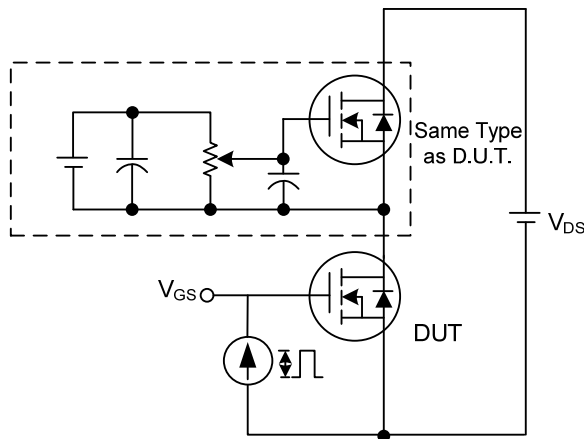
■ TEST CIRCUITS AND WAVEFORMS (Cont.)



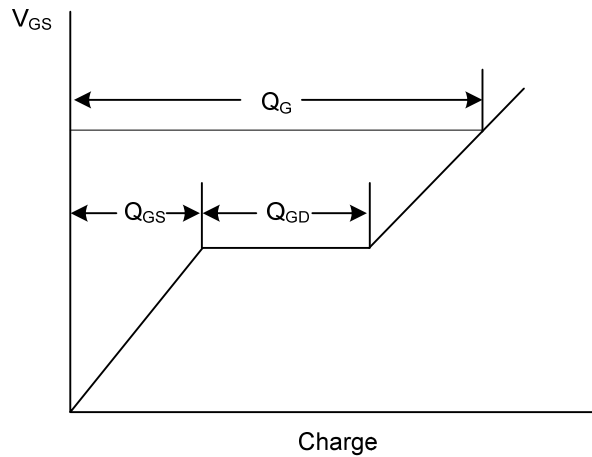
Switching Test Circuit



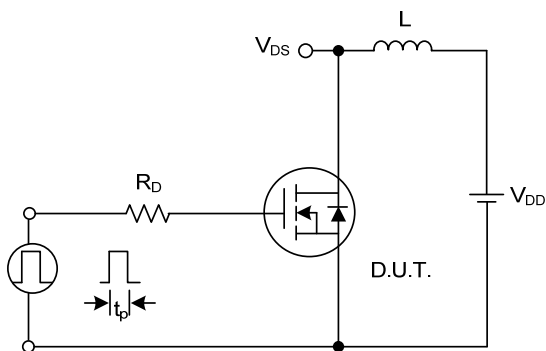
Switching Waveforms



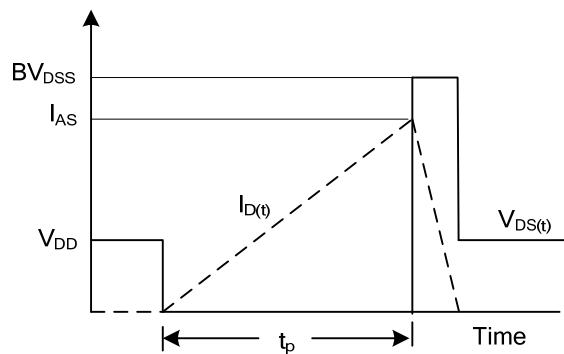
Gate Charge Test Circuit



Gate Charge Waveform



Unclamped Inductive Switching Test Circuit



Unclamped Inductive Switching Waveforms

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