



## 21NM50

Preliminary

Power MOSFET

### 21A, 500V N-CHANNEL SUPER-JUNCTION MOSFET

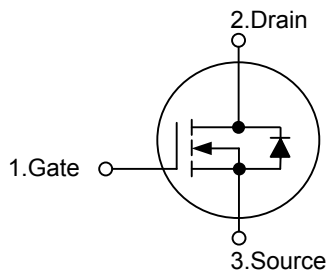
#### DESCRIPTION

The **UTC 21NM50** 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

- \*  $R_{DS(ON)} < 0.22\Omega$  @  $V_{GS}=10V$ ,  $I_D=10.5A$
- \* Fast Switching Capability
- \* Avalanche Energy Specified
- \* Improved  $dv/dt$  Capability, High Ruggedness

#### SYMBOL

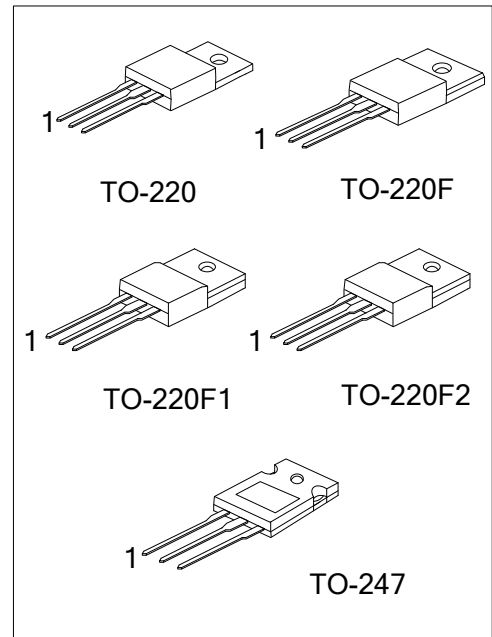


#### ORDERING INFORMATION

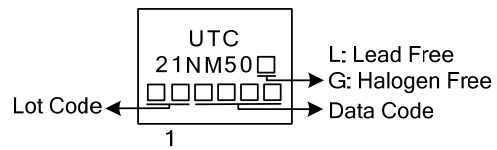
Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
21NM50L-TA3-T	21NM50G-TA3-T	TO-220	G	D	S	Tube
21NM50L-TF3-T	21NM50G-TF3-T	TO-220F	G	D	S	Tube
21NM50L-TF1-T	21NM50G-TF1-T	TO-220F1	G	D	S	Tube
21NM50L-TF2-T	21NM50G-TF2-T	TO-220F2	G	D	S	Tube
21NM50L-T47-T	21NM50G-T47-T	TO-247	G	D	S	Tube

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

21NM50G-TA3-T	(1) Packing Type	(1) T: Tube
	(2) Package Type	(2) TA3: TO-220, TF3: TO-220F, TF1: TO-220F1, TF2: TO-220F2, T47: TO-247
	(3) Green Package	(3) L: Lead Free, G: Halogen Free and Lead Free



## ■ MARKING



■ ABSOLUTE MAXIMUM RATINGS ( $T_c=25^\circ\text{C}$ , unless otherwise specified)

PARAMETER		SYMBOL	RATINGS	UNIT
Drain-Source Voltage		$V_{DSS}$	500	V
Gate-Source Voltage		$V_{GSS}$	$\pm 30$	V
Drain Current	Continuous	$I_D$	21	A
	Pulsed (Note 2)	$I_{DM}$	84	A
Avalanche Current (Note 2)		$I_{AR}$	6.6	A
Avalanche Energy	Single Pulsed (Note 3)	$E_{AS}$	370	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	10	V/ns
Power Dissipation	TO-220	$P_D$	235	W
	TO-220F/TO-220F1		390	W
	TO-220F2		400	W
	TO-247		400	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.  $L = 17\text{mH}$ ,  $I_{AS} = 6.6\text{A}$ ,  $V_{DD} = 50\text{V}$ ,  $R_G = 25\Omega$ , Starting  $T_J = 25^\circ\text{C}$

4.  $I_{SD} \leq 21\text{A}$ ,  $di/dt \leq 200\text{A}/\mu\text{s}$ ,  $V_{DD} \leq BV_{DSS}$ , Starting  $T_J = 25^\circ\text{C}$

■ THERMAL DATA

PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Ambient	TO-220/TO-220F	$\theta_{JA}$	62.5	$^\circ\text{C}/\text{W}$
	TO-220F1/TO-220F2			
	TO-247		40	$^\circ\text{C}/\text{W}$
Junction to Case	TO-220	$\theta_{JC}$	0.53	$^\circ\text{C}/\text{W}$
	TO-220F/TO-220F1		5	$^\circ\text{C}/\text{W}$
	TO-220F2			
	TO-247		0.31	$^\circ\text{C}/\text{W}$

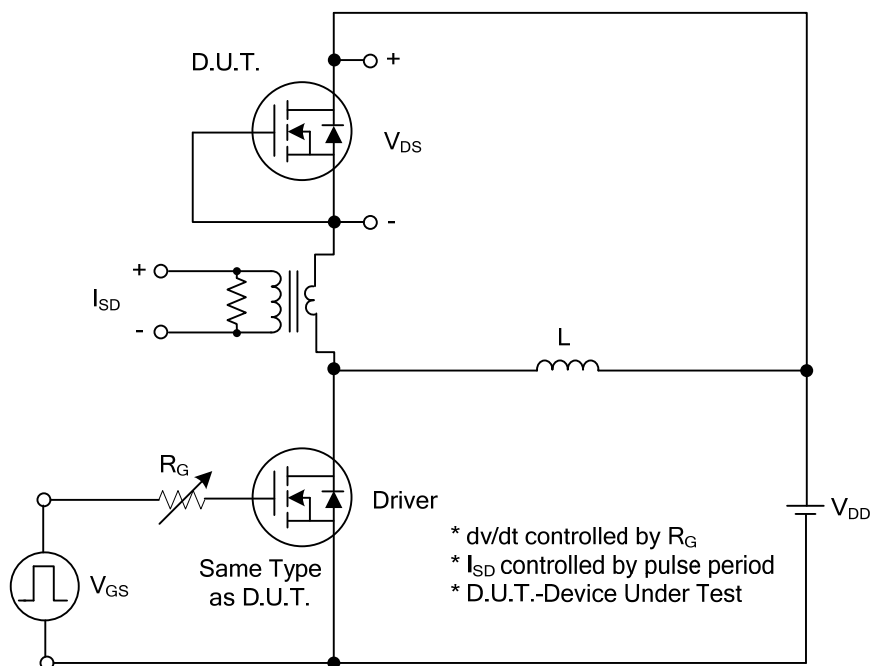
■ ELECTRICAL CHARACTERISTICS ( $T_J = 25^\circ\text{C}$ , unless otherwise specified)

PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS							
Drain-Source Breakdown Voltage		BV <sub>DSS</sub>	V <sub>GS</sub> =0V, I <sub>D</sub> =250μA	500			V
Drain-Source Leakage Current		I <sub>DSS</sub>	V <sub>DS</sub> =500V, V <sub>GS</sub> =0V			25	μA
Gate-Body 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
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-Resistance		R <sub>DS(ON)</sub>	V <sub>GS</sub> =10V, I <sub>D</sub> =10.5A			0.22	Ω
DYNAMIC PARAMETERS							
Input Capacitance		C <sub>ISS</sub>	V <sub>GS</sub> =0V, V <sub>DS</sub> =25V, f=1MHz		1030		pF
Output Capacitance		C <sub>OSS</sub>			850		pF
Reverse Transfer Capacitance		C <sub>RSS</sub>			78		pF
SWITCHING PARAMETERS							
Total Gate Charge (Note 1)		Q <sub>G</sub>	V <sub>GS</sub> =10V, V <sub>DS</sub> =50V, I <sub>D</sub> =1.3A, I <sub>G</sub> =100μA (Note 1, 2)		120		nC
Gate to Source Charge		Q <sub>GS</sub>			10		nC
Gate to Drain Charge		Q <sub>GD</sub>			40		nC
Turn-ON Delay Time (Note 1)		t <sub>D(ON)</sub>	V <sub>GS</sub> =10V, V <sub>DS</sub> =30V, I <sub>D</sub> =0.5A, R <sub>G</sub> =25Ω (Note 1, 2)		70		ns
Rise Time		t <sub>R</sub>			180		ns
Turn-OFF Delay Time		t <sub>D(OFF)</sub>			330		ns
Fall-Time		t <sub>F</sub>			200		ns
SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS							
Maximum Body-Diode Continuous Current		I <sub>S</sub>	V <sub>GS</sub> =0V			21	A
Maximum Body-Diode Pulsed Current		I <sub>SM</sub>	Repetitive			84	A
Drain-Source Diode Forward Voltage (Note 1)		V <sub>SD</sub>	I <sub>F</sub> =I <sub>S</sub> , V <sub>GS</sub> =0V			1.4	V
Body Diode Reverse Recovery Time (Note 1)		t <sub>rr</sub>	V <sub>GS</sub> =0V, dI <sub>F</sub> /dt=100A/μs,		420		ns
Body Diode Reverse Recovery Charge		Q <sub>rr</sub>	I <sub>S</sub> =21A, V <sub>R</sub> =100V		7.1		μC

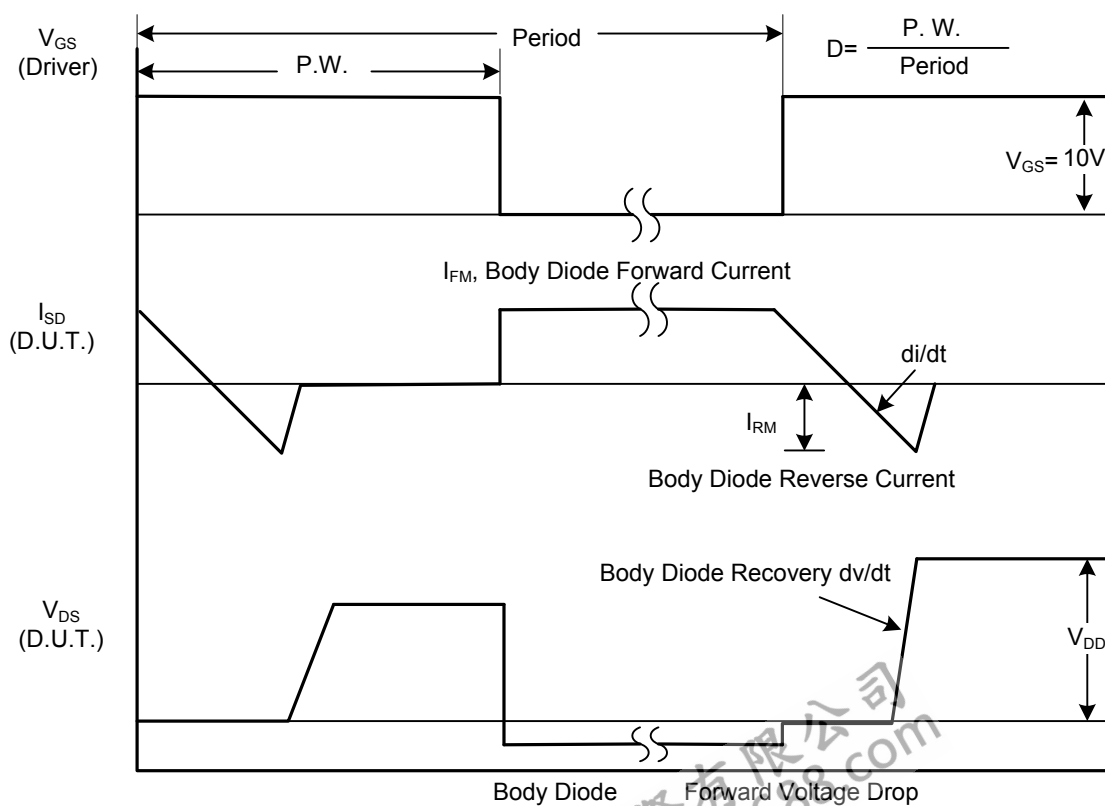
Notes: 1. Pulse Test : Pulse width  $\leq 300\mu s$ , Duty cycle  $\leq 2\%$ .

2. Essentially independent of operating ambient temperature.

# ■ TEST CIRCUITS AND WAVEFORMS

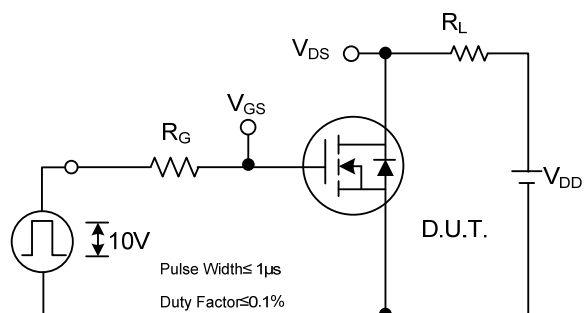


Peak Diode Recovery  $dv/dt$  Test Circuit

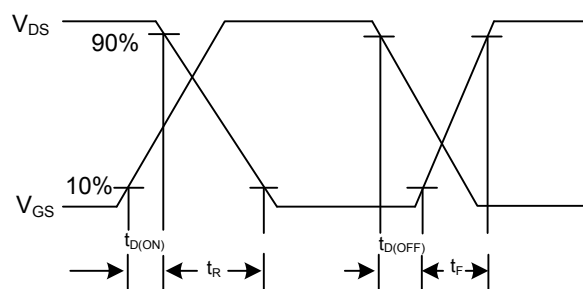


Peak Diode Recovery  $dv/dt$  Waveforms

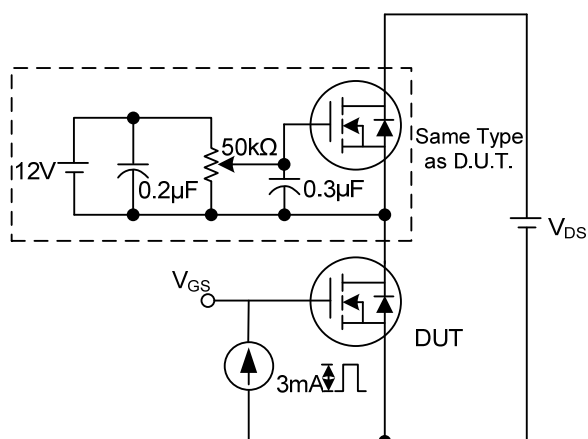
# ■ TEST CIRCUITS AND WAVEFORMS (Cont.)



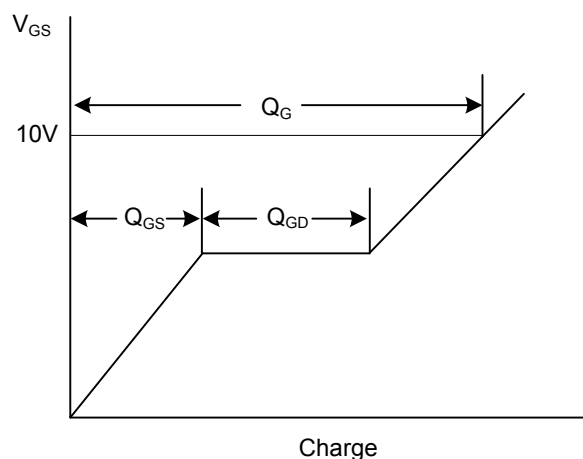
Switching Test Circuit



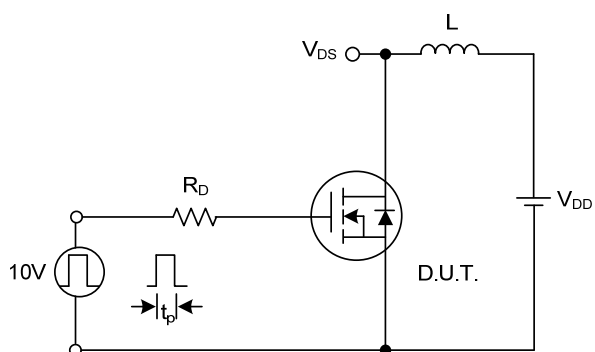
Switching Waveforms



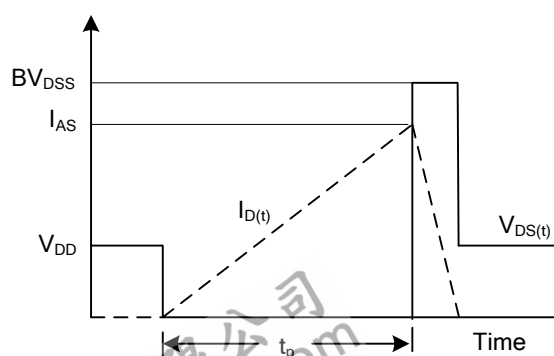
Gate Charge Test Circuit



Gate Charge Waveform



Unclamped Inductive Switching Test Circuit



Unclamped Inductive Switching Waveforms

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