



## 4N50

Power MOSFET

### 4 A, 500 V N-CHANNEL POWER MOSFET

#### DESCRIPTION

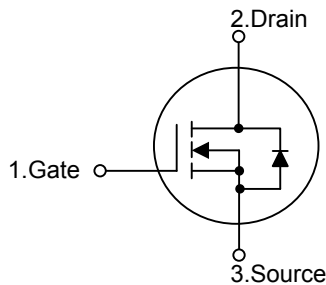
The UTC **4N50** is an N-channel mode power MOSFET using UTC's advanced technology to provide customers with planar stripe and DMOS technology. This technology allows a minimum on-state resistance and superior switching performance. It also can withstand high energy pulse in the avalanche and commutation mode.

The UTC **4N50** is generally applied in high efficiency switch mode power supplies, active power factor correction and electronic lamp ballasts based on half bridge topology.

#### FEATURES

- \*  $I_D = 4A$
- \*  $V_{DS} = 500V$
- \*  $R_{DS(ON)} = 2.0\Omega @ V_{GS} = 10V$
- \* High Switching Speed
- \* 100% Avalanche Tested

#### SYMBOL

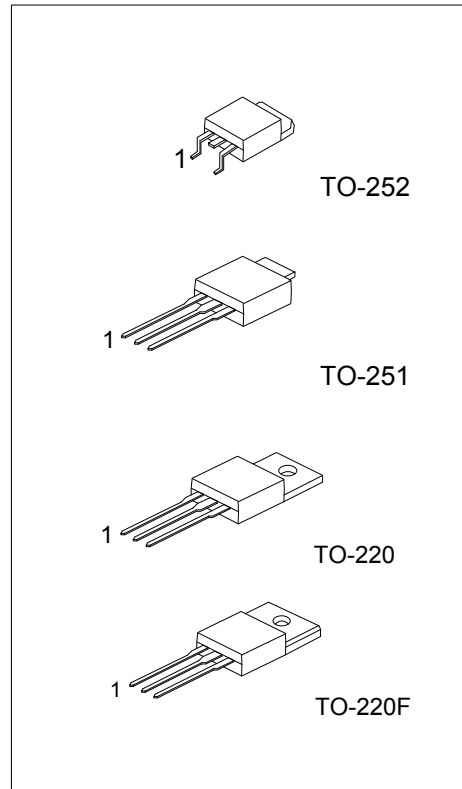


#### ORDERING INFORMATION

Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
4N50L-TA3-T	4N50G-TA3-T	TO-220	G	D	S	Tube
4N50L-TF3-T	4N50G-TF3-T	TO-220F	G	D	S	Tube
4N50L-TM3-T	4N50G-TM3-T	TO-251	G	D	S	Tube
4N50L-TN3-R	4N50G-TN3-R	TO-252	G	D	S	Tape Reel

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

<p>4N50L-TA3-T</p> <p>(1) Packing Type (2) Package Type (3) Lead Free</p>	<p>(1) R: Tape Reel, T: Tube (2) TA3: TO-220, TF3: TO-220F, TM3: TO-251 TN3: TO-252 (3) L: Lead Free, G: Halogen Free</p>
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■ 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 ( $T_C=25^\circ\text{C}$ )	$I_D$	4	A
	Pulsed (Note 3)	$I_{DM}$	16 (Note 2)	A
Avalanche Current (Note 3)		$I_{AR}$	4	A
Avalanche Energy	Single Pulsed (Note 4)	$E_{AS}$	216	mJ
	Repetitive (Note 3)	$E_{AR}$	8.5	mJ
Peak Diode Recovery dv/dt (Note 5)		dv/dt	4.5	V/ns
Power Dissipation	TO-220	$P_D$	85	W
	TO-220F		28	
	TO-251/TO-252		52	
Derate above $25^\circ\text{C}$	TO-220		0.67	W/ $^\circ\text{C}$
	TO-220F		0.22	
	TO-251/TO-252		0.41	
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. Drain current limited by maximum junction temperature  
 3. Repetitive Rating: Pulse width limited by maximum junction temperature  
 4.  $L = 27\text{mH}$ ,  $I_{AS} = 4\text{A}$ ,  $V_{DD} = 50\text{V}$ ,  $R_G = 25\Omega$ , Starting  $T_J = 25^\circ\text{C}$   
 5.  $I_{SD} \leq 4\text{A}$ ,  $di/dt \leq 200\text{A}/\mu\text{s}$ ,  $V_{DD} \leq BV_{DSS}$ , Starting  $T_J = 25^\circ\text{C}$

■ THERMAL DATA

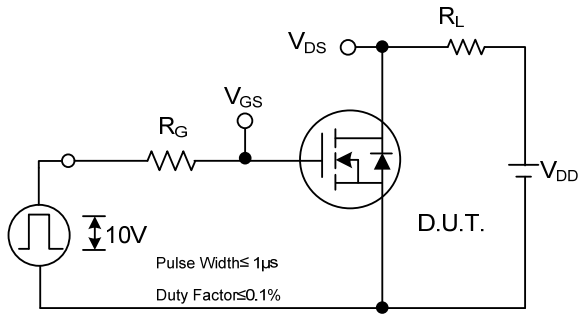
PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Ambient	TO-220	$\theta_{JA}$	62.5	$^\circ\text{C}/\text{W}$
	TO-220F		62.5	
	TO-251/TO-252		110	
Junction to Case	TO-220	$\theta_{JC}$	1.47	$^\circ\text{C}/\text{W}$
	TO-220F		4.5	
	TO-251/TO-252		2.4	

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

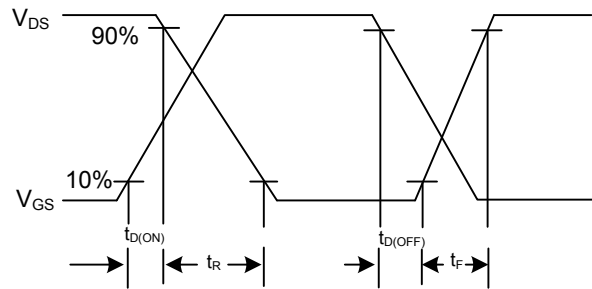
PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
<b>OFF CHARACTERISTICS</b>						
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	I <sub>D</sub> =250μA, V <sub>GS</sub> =0V	500			V
Drain-Source Leakage Current	I <sub>DSS</sub>	V <sub>DS</sub> =500V, V <sub>GS</sub> =0V			25	μA
Gate- Source Leakage Current	Forward	V <sub>GS</sub> =+30V, V <sub>DS</sub> =0V			+100	nA
	Reverse	V <sub>GS</sub> =-30V, V <sub>DS</sub> =0V			-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	2.0		4.0	V
Static Drain-Source On-State Resistance	R <sub>DS(ON)</sub>	V <sub>GS</sub> =10V, I <sub>D</sub> =2A		1.6	2.2	Ω
<b>DYNAMIC PARAMETERS</b>						
Input Capacitance	C <sub>ISS</sub>	V <sub>GS</sub> =0V, V <sub>DS</sub> =25V, f=1.0MHz		485	650	pF
Output Capacitance	C <sub>OSS</sub>			65	90	pF
Reverse Transfer Capacitance	C <sub>RSS</sub>			5	8	pF
<b>SWITCHING PARAMETERS</b>						
Total Gate Charge	Q <sub>G</sub>	V <sub>GS</sub> =10V, V <sub>DS</sub> =400V, I <sub>D</sub> =4A (Note 1, 2)		11	15	nC
Gate to Source Charge	Q <sub>GS</sub>			3		nC
Gate to Drain Charge	Q <sub>GD</sub>			5		nC
Turn-ON Delay Time	t <sub>D(ON)</sub>	V <sub>DD</sub> =250V, I <sub>D</sub> =4A, R <sub>G</sub> =25Ω (Note 1, 2)		14	38	ns
Rise Time	t <sub>R</sub>			21	52	ns
Turn-OFF Delay Time	t <sub>D(OFF)</sub>			27	64	ns
Fall-Time	t <sub>F</sub>			20	50	ns
<b>SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS</b>						
Maximum Body-Diode Continuous Current	I <sub>S</sub>				4	A
Maximum Body-Diode Pulsed Current	I <sub>SM</sub>				16	A
Drain-Source Diode Forward Voltage	V <sub>SD</sub>	I <sub>S</sub> =4A, V <sub>GS</sub> =0V			1.6	V
Body Diode Reverse Recovery Time	t <sub>RR</sub>	I <sub>S</sub> =4A, V <sub>GS</sub> =0V, dI <sub>F</sub> /dt=100A/μs (Note 1)		350		ns
Body Diode Reverse Recovery Charge	Q <sub>RR</sub>				33	

- Notes: 1. Pulse Test: Pulse width ≤ 300μs, Duty cycle ≤ 2%  
2. Essentially independent of operating temperature

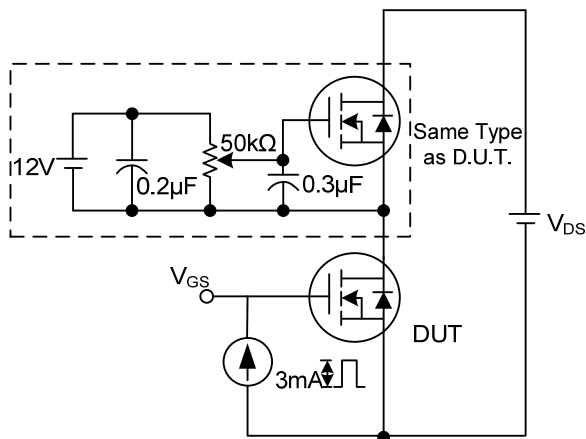
■ TEST CIRCUITS AND WAVEFORMS



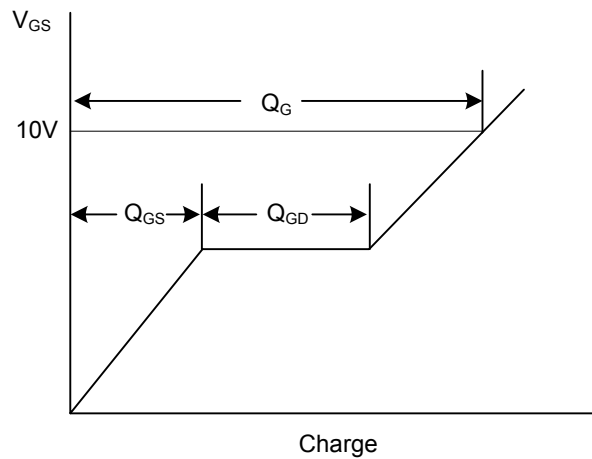
Switching Test Circuit



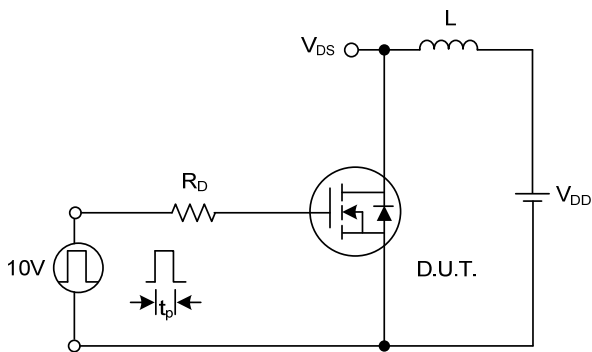
Switching Waveforms



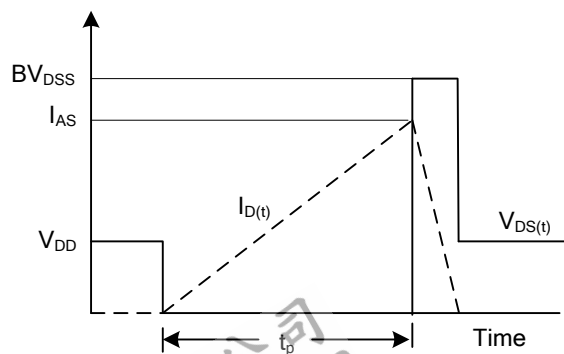
Gate Charge Test Circuit



Gate Charge Waveform

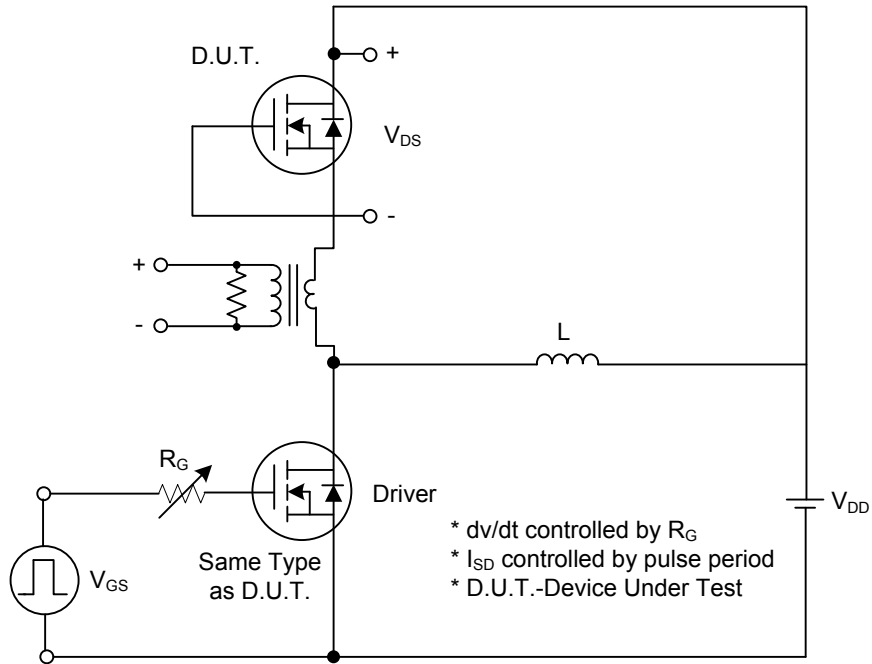


Unclamped Inductive Switching Test Circuit

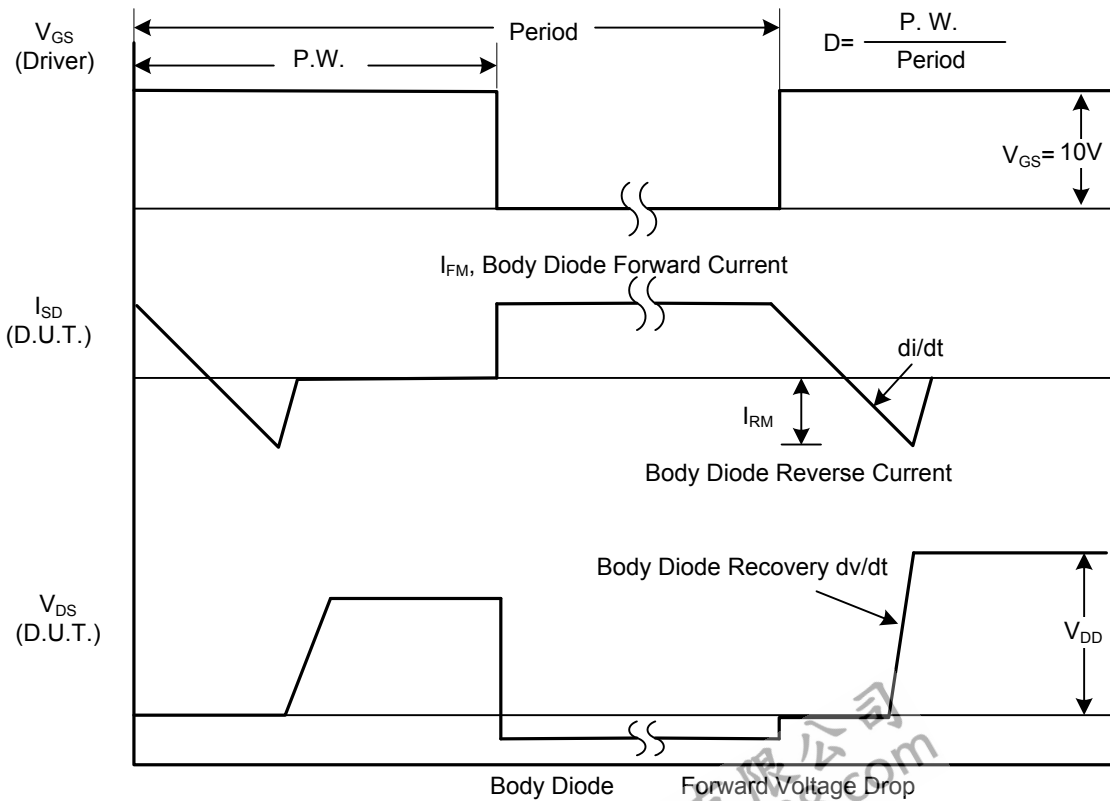


Unclamped Inductive Switching Waveforms

■ TEST CIRCUITS AND WAVEFORMS(Cont.)

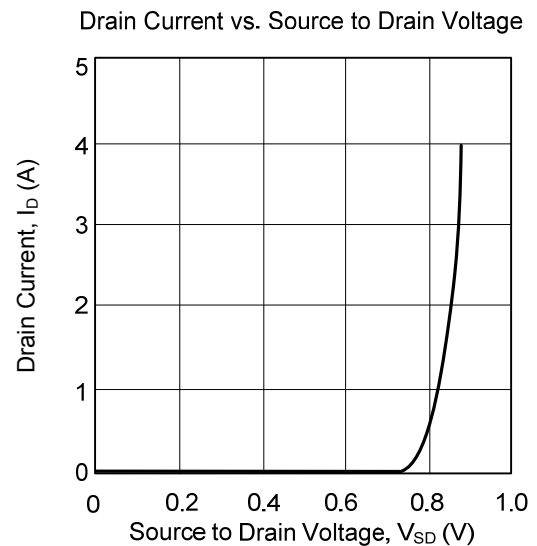
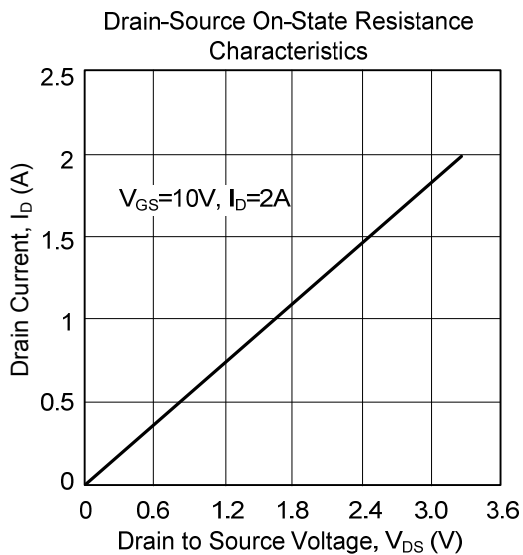
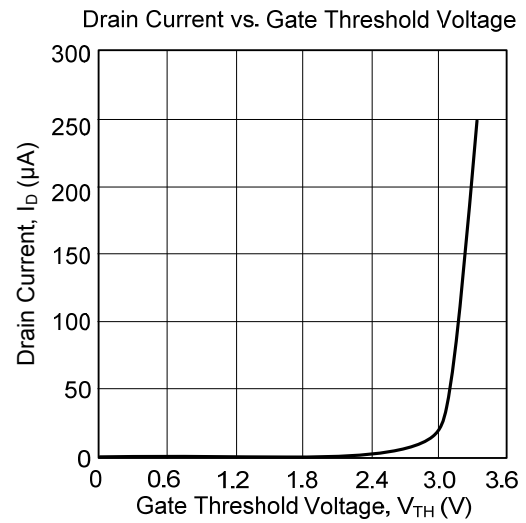
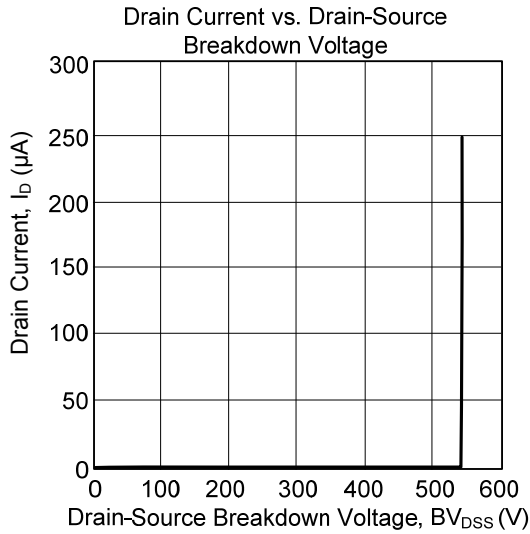


Peak Diode Recovery  $dv/dt$  Test Circuit



Peak Diode Recovery  $dv/dt$  Waveforms

## TYPICAL CHARACTERISTICS



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