



**9A, 650V N-CHANNEL  
POWER MOSFET**

■ DESCRIPTION

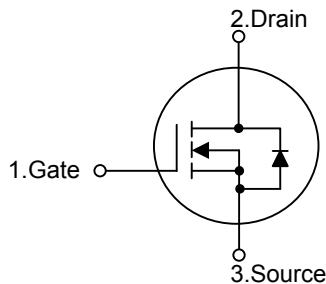
The UTC **9N65** is an N-channel mode power MOSFET using UTC's advanced technology to provide customers with planar stripe and DMOS technology. This technology allows a minimum on-state resistance and superior switching performance. It also can withstand high energy pulse in the avalanche and commutation mode.

The UTC **9N65** is generally applied in high efficiency switch mode power supplies and uninterruptible power supplies.

■ FEATURES

- \*  $R_{DS(ON)}=1.1\Omega @ V_{GS}=10V$
- \* High Switching Speed
- \* Improved dv/dt Capability
- \* 100% Avalanche Tested

■ SYMBOL

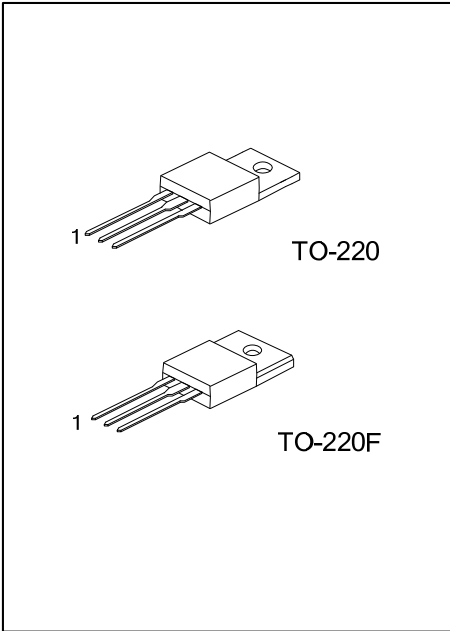


■ ORDERING INFORMATION

Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
9N65L-TA3-T	9N65G-TA3-T	TO-220	G	D	S	Tube
9N65L-TF3-T	9N65G-TF3-T	TO-220F	G	D	S	Tube

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

<p>9N65L-TA3-T</p> <p>(1)Packing Type</p> <p>(2)Package Type</p> <p>(3)Lead Free</p>	<p>(1) T: Tube</p> <p>(2) TA3: TO-220, TF3: TO-220F</p> <p>(3) G: Halogen Free, L: Lead Free</p>
--	--



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

PARAMETER		SYMBOL	RATINGS	UNIT
Drain-Source Voltage		$V_{DSS}$	650	V
Gate-Source Voltage		$V_{GSS}$	$\pm 30$	V
Drain Current	Continuous, $V_{GSS}@10\text{V}$	$I_D$	@ $T_C=25^\circ\text{C}$ 9	A
	@ $T_C=100^\circ\text{C}$ 5.4		A	
	Pulsed (Note 2)	$I_{DM}$	36	A
Avalanche Current (Note 2)		$I_{AR}$	5.2	A
Avalanche Energy	Single Pulsed (Note 2)	$E_{AR}$	16	mJ
	Repetitive (Note 3)	$E_{AS}$	375	mJ
Peak Diode Recovery dv/dt (Note 3)		dv/dt	2.8	V/ns
Power Dissipation(@ $T_C=25^\circ\text{C}$ )	TO-220	$P_D$	167	W
	TO-220F		44	
Linear Derating Factor	TO-220		1.3	W/ $^\circ\text{C}$
	TO-220F		0.35	
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 max. junction temperature.

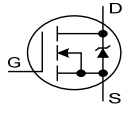
3. Starting  $T_J=25^\circ\text{C}$ ,  $L=9.25\text{mH}$ ,  $R_G=25\Omega$ ,  $I_{AS}=9\text{A}$ .

4.  $I_{SD}\leq 5.2\text{A}$ ,  $di/dt\leq 90\text{A}/\mu\text{s}$ ,  $V_{DD}\leq BV_{DSS}$ ,  $T_J\leq 150^\circ\text{C}$

■ THERMAL DATA

PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Ambient	TO-220	$\theta_{JA}$	62	$^\circ\text{C}/\text{W}$
	TO-220F		62.5	
Junction to Case	TO-220	$\theta_{JC}$	0.75	$^\circ\text{C}/\text{W}$
	TO-220F		2.86	

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

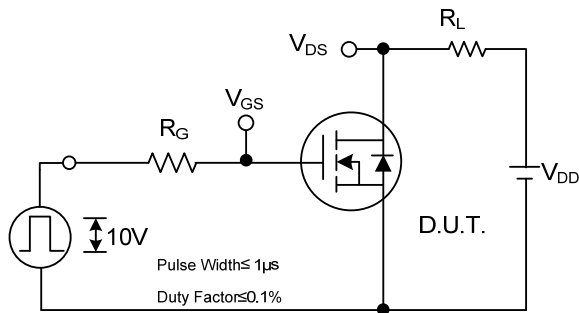
PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT	
<b>OFF CHARACTERISTICS</b>							
Drain-Source Breakdown Voltage	$BV_{DSS}$	$I_D=250\mu\text{A}$ , $V_{GS}=0\text{V}$	650			V	
Breakdown Voltage Temperature Coefficient	$\Delta BV_{DSS} / \Delta T_J$	Reference to $25^\circ\text{C}$ , $I_D=1\text{mA}$ (Note 3)		0.67		$\text{V}/^\circ\text{C}$	
Drain-Source Leakage Current	$I_{DSS}$	$V_{DS}=650\text{V}$ , $V_{GS}=0\text{V}$			25	$\mu\text{A}$	
		$V_{DS}=520\text{V}$ , $V_{GS}=0\text{V}$ , $T_J=125^\circ\text{C}$			250		
Gate- Source Leakage Current	Forward	$I_{GSS}$			+100	nA	
	Reverse				-100		
<b>ON CHARACTERISTICS</b>							
Gate Threshold Voltage	$V_{GS(TH)}$	$V_{DS}=V_{GS}$ , $I_D=250\mu\text{A}$	2.0		4.0	V	
Static Drain-Source On-State Resistance	$R_{DS(ON)}$	$V_{GS}=10\text{V}$ , $I_D=5.1\text{A}$		0.85	1.1	$\Omega$	
<b>DYNAMIC PARAMETERS</b>							
Input Capacitance	$C_{ISS}$	$V_{DS}=25\text{V}$ , $V_{GS}=0\text{V}$ , $f=1.0\text{MHz}$		1417		pF	
Output Capacitance	$C_{OSS}$				177		pF
Reverse Transfer Capacitance	$C_{RSS}$				7		pF
<b>SWITCHING PARAMETERS</b>							
Total Gate Charge	$Q_G$	$V_{DS}=520\text{V}$ , $V_{GS}=10\text{V}$ , $I_D=9\text{A}$ (Note 2)			48	nC	
Gate to Source Charge	$Q_{GS}$				12	nC	
Gate to Drain ("Miller") Charge	$Q_{GD}$				19	nC	
Turn-ON Delay Time	$t_{D(ON)}$	$V_{DD}=325\text{V}$ , $I_D=9\text{A}$ , $R_G=9.1\Omega$ , $R_D=62\Omega$ (Note 2)		14		ns	
Rise Time	$t_R$			20		ns	
Turn-OFF Delay Time	$t_{D(OFF)}$			34		ns	
Fall-Time	$t_F$			18		ns	
<b>SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS</b>							
Maximum Body-Diode Continuous Current	$I_S$	MOSFET symbol showing the integral reverse p-n junction diode. 			9	A	
Maximum Body-Diode Pulsed Current (Note 1)	$I_{SM}$				36	A	
Drain-Source Diode Forward Voltage	$V_{SD}$		$T_J=25^\circ\text{C}$ , $I_S=9\text{A}$ , $V_{GS}=0\text{V}$ (Note 2)			1.5	V

Notes: 1. Repetitive rating; pulse width limited by max. junction temperature.

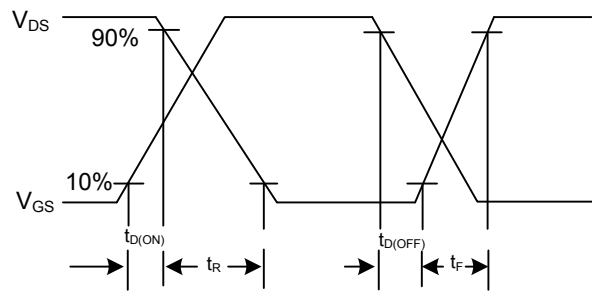
2. Pulse width  $\leq 300\mu\text{s}$ ; duty cycle  $\leq 2\%$ .

3. Uses IRFIB5N65A data and test conditions

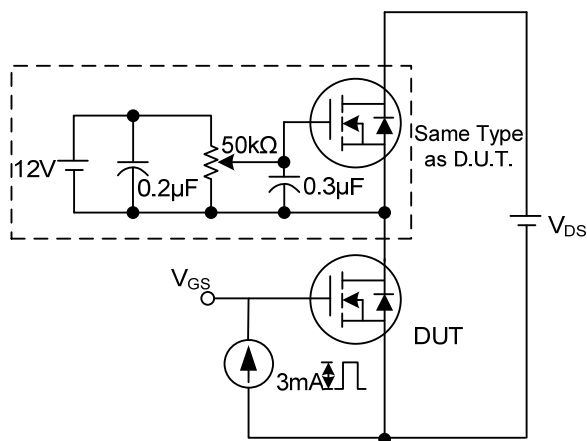
■ TEST CIRCUITS AND WAVEFORMS



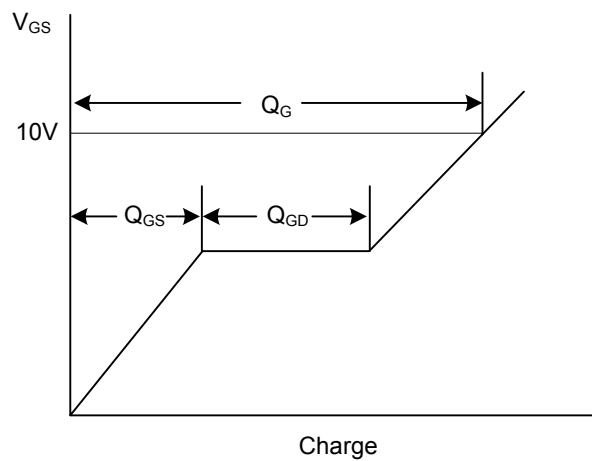
Switching Test Circuit



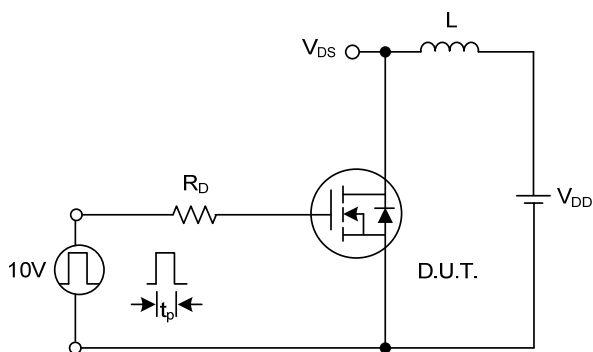
Switching Waveforms



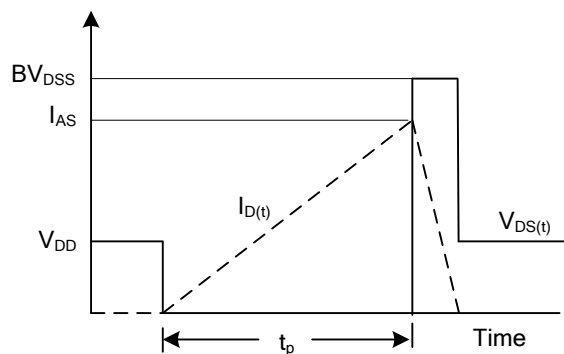
Gate Charge Test Circuit



Gate Charge Waveform



Unclamped Inductive Switching Test Circuit



Unclamped Inductive Switching Waveforms

UTC assumes no responsibility for equipment failures that result from using products at values that exceed, even momentarily, rated values (such as maximum ratings, operating condition ranges, or other parameters) listed in products specifications of any and all UTC products described or contained herein. UTC products are not designed for use in life support appliances, devices or systems where malfunction of these products can be reasonably expected to result in personal injury. Reproduction in whole or in part is prohibited without the prior written consent of the copyright owner. The information presented in this document does not form part of any quotation or contract, is believed to be accurate and reliable and may be changed without notice.