



**9N40**

Preliminary

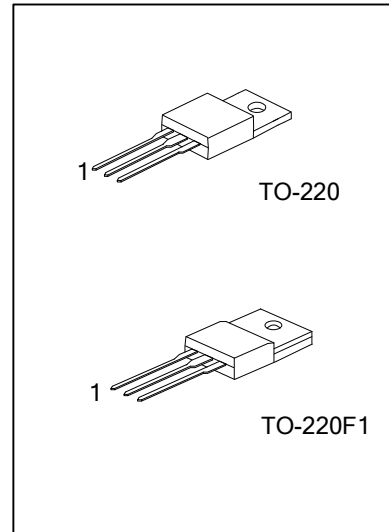
*Power MOSFET*

**9A, 400V N-CHANNEL  
POWER MOSFET**

■ DESCRIPTION

The UTC **9N40** is an N-channel mode power MOSFET using UTC's advanced technology to provide customers with planar stripe and DMOS technology. This technology specializes in allowing a minimum on-state resistance and superior switching performance. It also can withstand high energy pulse in the avalanche and commutation mode.

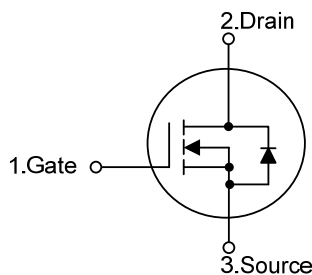
The UTC **9N40** is universally applied in electronic lamp ballast based on half bridge topology and high efficient switched mode power supply.



■ FEATURES

- \* High switching speed
- \*  $R_{DS(ON)} < 0.75\Omega @ V_{GS}=10V, I_D=4.5A$
- \* 100% avalanche tested

■ SYMBOL



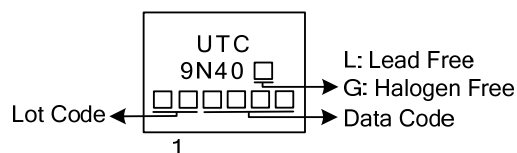
■ ORDERING INFORMATION

Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
9N40L-TA3-T	9N40G-TA3-T	TO-220	G	D	S	Tube
9N40L-TF1-T	9N40G-TF1-T	TO-220F1	G	D	S	Tube

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

<p>9N40L-TA3-T</p> <p>(1) Packing Type</p> <p>(2) Package Type</p> <p>(3) Green Package</p>	<p>(1) T: Tube</p> <p>(2) TA3: TO-220, TF1: TO-220F1</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		$V_{DSS}$	400	V	
Gate-Source Voltage		$V_{GSS}$	$\pm 30$	V	
Drain Current	Continuous ( $T_C=25^\circ\text{C}$ )	$I_D$	9	A	
	Pulsed (Note 2)	$I_{DM}$	36	A	
Avalanche Current (Note 2)		$I_{AR}$	9	A	
Avalanche Energy	Single Pulsed (Note 3)	$E_{AS}$	427	mJ	
	Repetitive (Note 2)	$E_{AR}$	4.0	mJ	
Peak Diode Recovery $dv/dt$ (Note 4)		$dv/dt$	4.5	V/ns	
Power Dissipation	TO-220	$P_D$	113	W	
	TO-220F1		40	W	
Derate above $25^\circ\text{C}$	TO-220		0.9	$W/^\circ\text{C}$	
	TO-220F1		0.32	$W/^\circ\text{C}$	
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.  $L = 10.5\text{mH}$ ,  $I_{AS} = 9\text{A}$ ,  $V_{DD} = 90\text{V}$ ,  $R_G = 25\Omega$ , Starting  $T_J = 25^\circ\text{C}$ .

4.  $I_{SD} \leq 9\text{A}$ ,  $di/dt \leq 200\text{A}/\mu\text{s}$ ,  $V_{DD} \leq BV_{DSS}$ , Starting  $T_J = 25^\circ\text{C}$ .

■ THERMAL DATA

PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Ambient		$\theta_{JA}$	62.5	$^\circ\text{C}/\text{W}$
Junction to Case	TO-220	$\theta_{JC}$	1.1	$^\circ\text{C}/\text{W}$
	TO-220F1		3.125	$^\circ\text{C}/\text{W}$

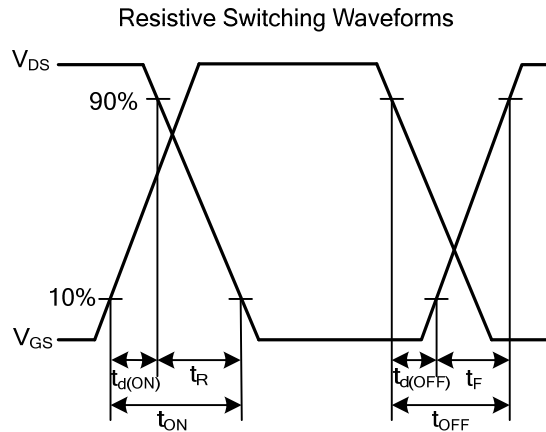
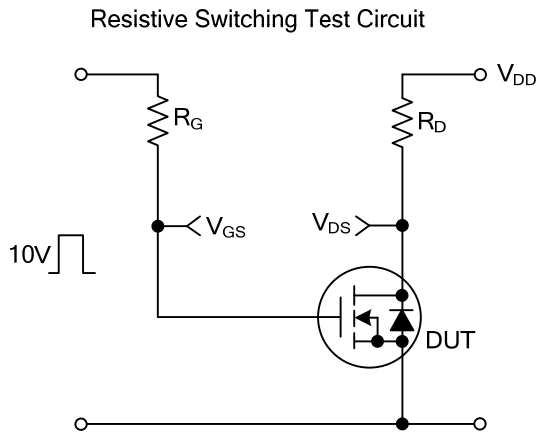
■ ELECTRICAL CHARACTERISTICS ( $T_c=25^\circ\text{C}$ , unless otherwise noted)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
<b>OFF CHARACTERISTICS</b>						
Drain-Source Breakdown Voltage	$BV_{DSS}$	$I_D=250\mu\text{A}$ , $V_{GS}=0\text{V}$	400			V
Drain-Source Leakage Current	$I_{DSS}$	$V_{DS}=400\text{V}$ , $V_{GS}=0\text{V}$			1	$\mu\text{A}$
Gate- Source Leakage Current	Forward	$V_{GS}=+30\text{V}$ , $V_{DS}=0\text{V}$ $V_{GS}=-30\text{V}$ , $V_{DS}=0\text{V}$			+100	nA
	Reverse				-100	nA
<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	$R_{DS(ON)}$	$V_{GS}=10\text{V}$ , $I_D=4.5\text{A}$		0.6	0.75	$\Omega$
<b>DYNAMIC PARAMETERS</b>						
Input Capacitance	$C_{ISS}$	$V_{GS}=0\text{V}$ , $V_{DS}=25\text{V}$ , $f=1.0\text{MHz}$		1340	1700	pF
Output Capacitance	$C_{OSS}$			490	520	pF
Reverse Transfer Capacitance	$C_{RSS}$			160	180	pF
<b>SWITCHING PARAMETERS</b>						
Total Gate Charge	$Q_G$	$V_{GS}=10\text{V}$ , $V_{DS}=320\text{V}$ , $I_D=9\text{A}$ (Note 1, 2)		34		nC
Gate to Source Charge	$Q_{GS}$			18		nC
Gate to Drain Charge	$Q_{GD}$			16		nC
Turn-ON Delay Time	$t_{D(ON)}$	$V_{DD}=200\text{V}$ , $I_D=9\text{A}$ , $R_G=25\Omega$ (Note 1, 2)		22		ns
Rise Time	$t_R$			60		ns
Turn-OFF Delay Time	$t_{D(OFF)}$			32		ns
Fall-Time	$t_F$			140		ns
<b>SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS</b>						
Maximum Body-Diode Continuous Current	$I_S$				9	A
Maximum Body-Diode Pulsed Current	$I_{SM}$				36	A
Drain-Source Diode Forward Voltage	$V_{SD}$	$I_S=9\text{A}$ , $V_{GS}=0\text{V}$			1.7	V
Body Diode Reverse Recovery Time	$t_{RR}$	$I_S=9\text{A}$ , $V_{GS}=0\text{V}$ , $dI_F/dt=100\text{A}/\mu\text{s}$ (Note 1)		350		ns
Body Diode Reverse Recovery Charge	$Q_{RR}$				2.6	

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

2. Essentially independent of operating temperature.

■ TEST CIRCUITS AND WAVEFORMS



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