



## 5N40-CB

Preliminary

Power MOSFET

### 5.0A, 400V N-CHANNEL POWER MOSFET

#### DESCRIPTION

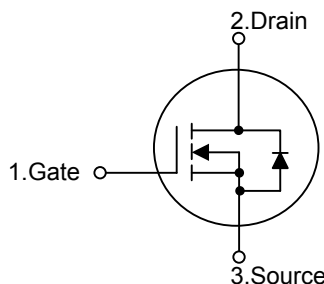
The UTC **5N40** is an N-channel mode power MOSFET using UTC's advanced technology to provide customers with planar stripe and DMOS technology. This technology specializes in allowing a minimum on-state resistance and superior switching performance. It also can withstand high energy pulse in the avalanche and commutation mode.

The UTC **5N40** is universally applied in electronic lamp ballast based on half bridge topology and high efficient switched mode power supply.

#### FEATURES

- \*  $R_{DS(ON)} < 1.0\Omega @ V_{GS} = 10V, I_D = 2.5A$
- \* High Switching Speed
- \* 100% Avalanche Tested

#### SYMBOL

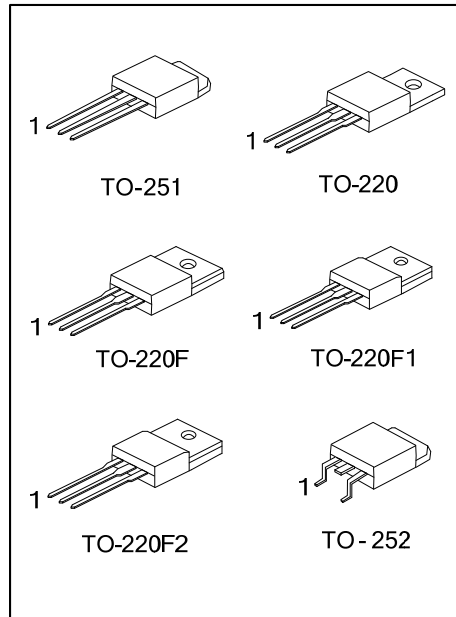


#### ORDERING INFORMATION

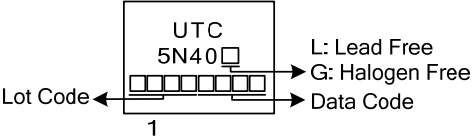
Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
5N40L-TA3-T	5N40G-TA3-T	TO-220	G	D	S	Tube
5N40L-TF1-T	5N40G-TF1-T	TO-220F1	G	D	S	Tube
5N40L-TF2-T	5N40G-TF2-T	TO-220F2	G	D	S	Tube
5N40L-TF3-T	5N40G-TF3-T	TO-220F	G	D	S	Tube
5N40L-TM3-R	5N40G-TM3-R	TO-251	G	D	S	Tape Reel
5N40L-TN3-R	5N40G-TN3-R	TO-252	G	D	S	Tape Reel

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

<p>5N40L-TA3-T</p>	<p>(1) T: Tube, R: Tape Reel  (2) TA3: TO-220, TF3: TO-220F, TF1: TO-220F1, TF2: TO-220F2, TM3: TO-251, TN3: TO-252  (3) L: Lead Free, G: Halogen Free and Lead Free</p>
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MARKING



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

PARAMETER		SYMBOL	RATINGS	UNIT
Drain-Source Voltage		$V_{DSS}$	400	V
Gate-Source Voltage		$V_{GSS}$	$\pm 30$	V
Drain Current ( $T_C=25^\circ\text{C}$ )	Continuous	$I_D$	5	A
	Pulsed (Note 2)	$I_{DM}$	20	A
Avalanche Current (Note 2)		$I_{AR}$	4.5	A
Avalanche Energy	Single Pulsed (Note 3)	$E_{AS}$	131	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	4.5	V/ns
Power Dissipation ( $T_C=25^\circ\text{C}$ )	TO-220	$P_D$	69	W
	TO-220F/TO-220F1		38	W
	TO-220F2			
	TO-251/TO-252		54	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.  $L = 13 \text{ mH}$ ,  $I_{AS} = 4.5 \text{ A}$ ,  $V_{DD} = 50 \text{ V}$ ,  $R_G = 25 \Omega$ , Starting  $T_J = 25^\circ\text{C}$

4.  $I_{SD} \leq 5.0 \text{ A}$ ,  $di/dt \leq 200 \text{ A}/\mu\text{s}$ ,  $V_{DD} \leq BV_{DSS}$ , Starting  $T_J = 25^\circ\text{C}$

■ THERMAL DATA

PARAMETER	PACKAGE	SYMBOL	RATINGS	UNIT
Junction to Ambient	TO-220/TO-220F	$\theta_{JA}$	62.5	$^\circ\text{C}/\text{W}$
	TO-220F1/TO-220F2			
	TO-251/TO-252			
Junction to Case	TO-220	$\theta_{JC}$	1.8	$^\circ\text{C}/\text{W}$
	TO-220F/TO-220F1		3.3	$^\circ\text{C}/\text{W}$
	TO-220F2			
	TO-251/TO-252		2.3	$^\circ\text{C}/\text{W}$

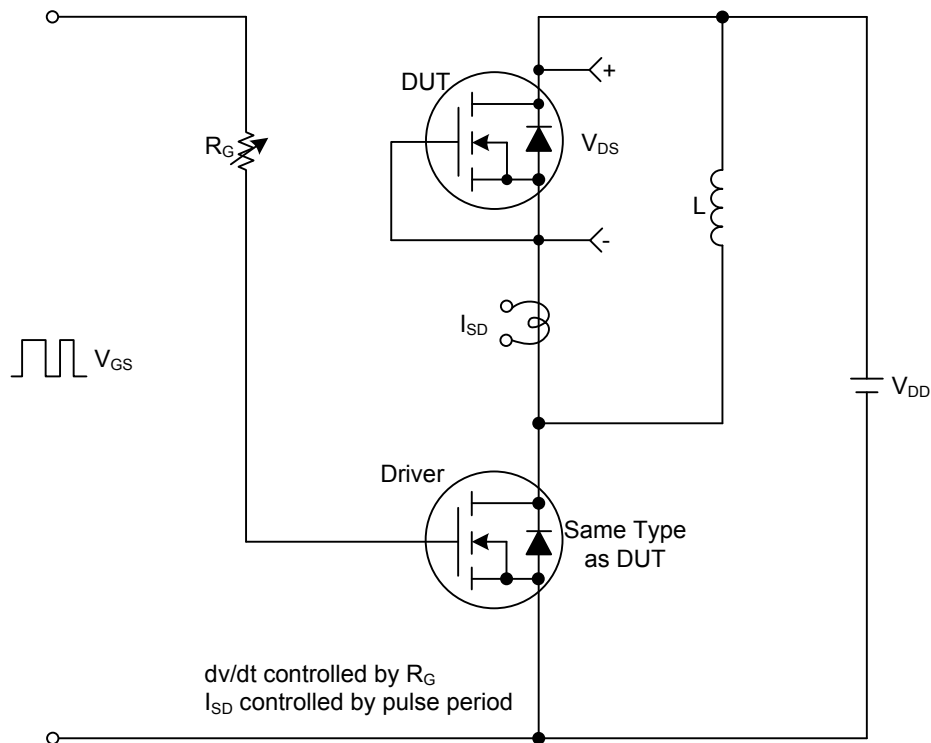
■ ELECTRICAL CHARACTERISTICS ( $T_c=25^\circ\text{C}$ , unless otherwise noted)

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	$I_{GSS}$			+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	$R_{DS(ON)}$	$V_{GS}=10\text{V}$ , $I_D=2.5\text{A}$			1.0	$\Omega$
<b>DYNAMIC PARAMETERS</b>						
Input Capacitance	$C_{ISS}$	$V_{GS}=0\text{V}$ , $V_{DS}=25\text{V}$ , $f=1.0\text{MHz}$		550		pF
Output Capacitance	$C_{OSS}$			68		pF
Reverse Transfer Capacitance	$C_{RSS}$			38		pF
<b>SWITCHING PARAMETERS</b>						
Total Gate Charge	$Q_G$	$V_{DS}=50\text{V}$ , $V_{GS}=10\text{V}$ , $I_D=1.3\text{A}$ , $I_G=100\mu\text{A}$ (Note 1, 2)		22		nC
Gate to Source Charge	$Q_{GS}$			2.6		nC
Gate to Drain Charge	$Q_{GD}$			2.9		nC
Turn-ON Delay Time	$t_{D(ON)}$	$V_{DD}=30\text{V}$ , $V_{GS}=10\text{V}$ , $I_D=0.5\text{A}$ , $R_G=25\Omega$ (Note 1, 2)		43		ns
Rise Time	$t_R$			28		ns
Turn-OFF Delay Time	$t_{D(OFF)}$			90		ns
Fall-Time	$t_F$			25		ns
<b>SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS</b>						
Maximum Body-Diode Continuous Current	$I_S$				5	A
Maximum Body-Diode Pulsed Current	$I_{SM}$				20	A
Drain-Source Diode Forward Voltage	$V_{SD}$	$V_{GS}=0\text{V}$ , $I_S=5.0\text{A}$			1.4	V
Reverse Recovery Time	$t_{rr}$	$V_{GS}=0\text{V}$ , $I_S=5.0\text{A}$		240		ns
Reverse Recovery Charge	$Q_{rr}$	$di_F/dt=100\text{A}/\mu\text{s}$ (Note 1)		1.0		$\mu\text{C}$

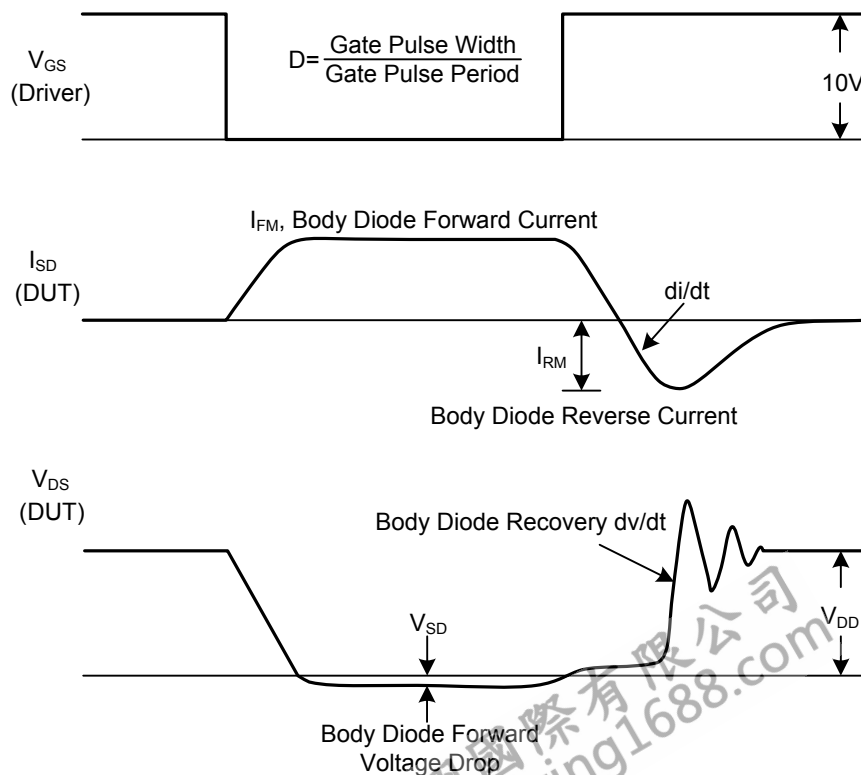
Notes: 1. Pulse Test: Pulse width  $\leq 300\mu\text{s}$ , Duty cycle  $\leq 2\%$ .

2. Essentially independent of operating temperature.

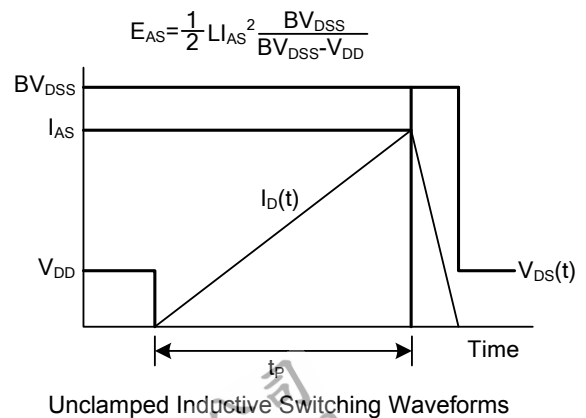
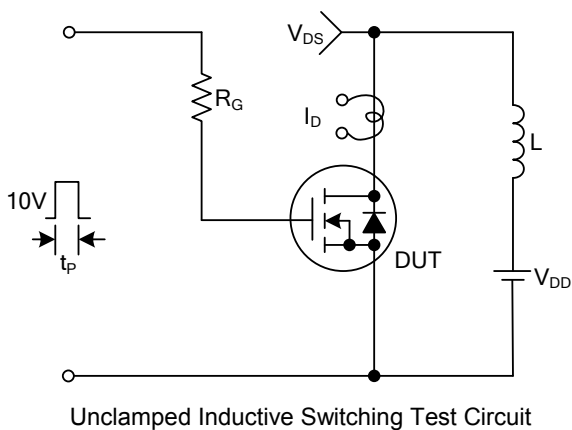
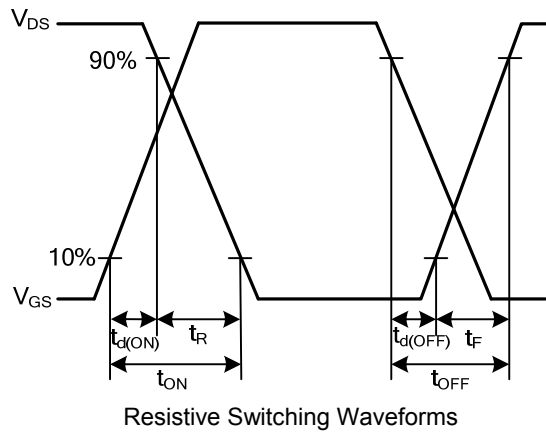
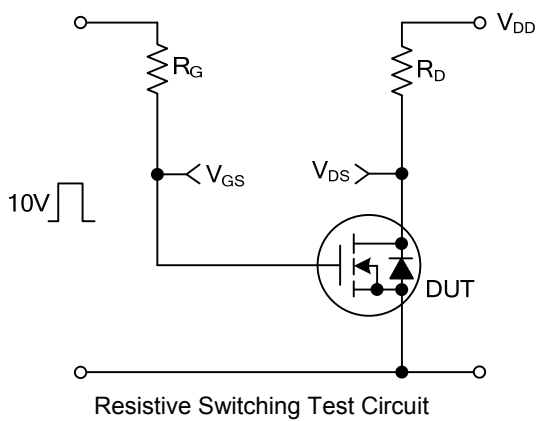
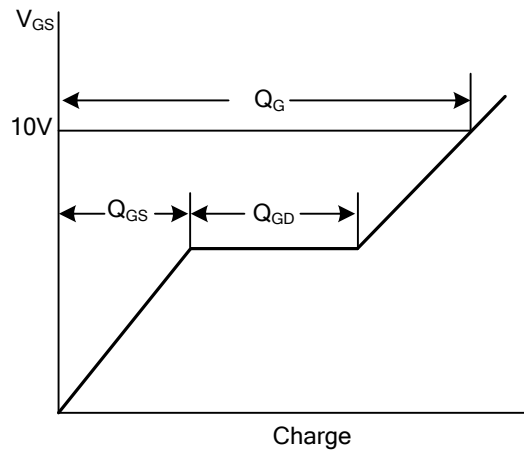
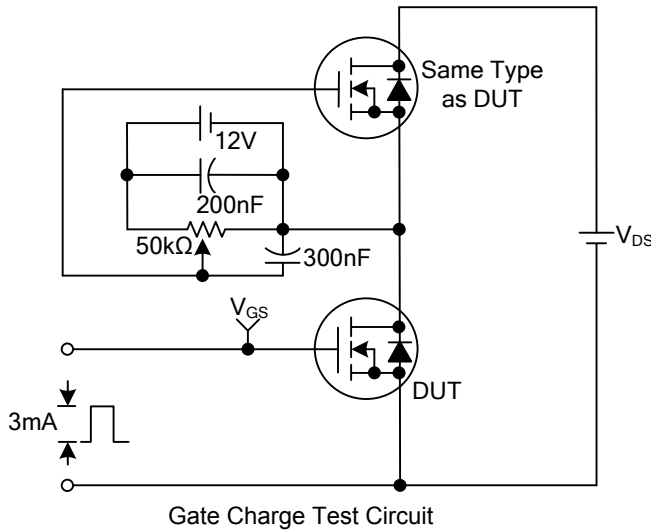
■ TEST CIRCUITS AND WAVEFORMS



Peak Diode Recovery dv/dt Test Circuit & Waveforms



■ TEST CIRCUITS AND WAVEFORMS (Cont.)



$$E_{AS} = \frac{1}{2} L I_{AS}^2 \frac{BV_{DSS}}{BV_{DSS} - V_{DD}}$$

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