



## 24N40-HC

Preliminary

Power MOSFET

### 24A, 400V N-CHANNEL POWER MOSFET

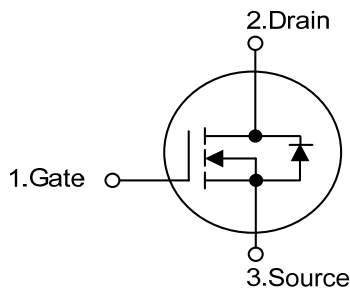
#### DESCRIPTION

The UTC **24N40-HC** is a high voltage power MOSFET combines advanced planar MOSFET designed to have better characteristics, such as fast switching time, low gate charge, low on-state resistance and high rugged avalanche characteristics. This power MOSFET is usually used in high speed switching applications of switching power supplies and adaptors.

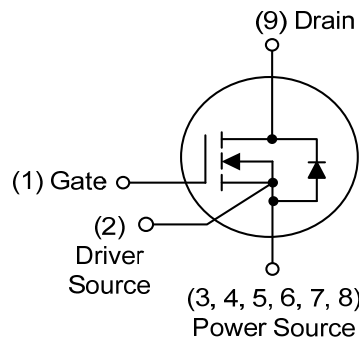
#### FEATURES

- \*  $R_{DS(ON)} \leq 0.18 \Omega @ V_{GS}=10V, I_D=12A$
- \* Fast switching capability
- \* Avalanche energy tested
- \* Improved dv/dt capability, high ruggedness

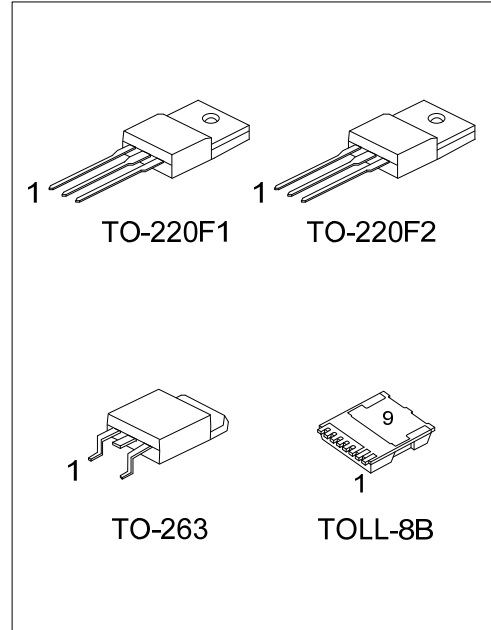
#### SYMBOL



TO-220F1 / TO-220F2 / TO-263



TOLL-8B



■ ORDERING INFORMATION

Ordering Number		Package	Pin Assignment									Packing
Lead Free	Halogen Free		1	2	3	4	5	6	7	8	9	
24N40L-TF1-T	24N40G-TF1-T	TO-220F1	G	D	S	-	-	-	-	-	-	Tube
24N40L-TF2-T	24N40G-TF2-T	TO-220F2	G	D	S	-	-	-	-	-	-	Tube
24N40L-TQ2-T	24N40G-TQ2-T	TO-263	G	D	S	-	-	-	-	-	-	Tube
24N40L-TQ2-R	24N40G-TQ2-R	TO-263	G	D	S	-	-	-	-	-	-	Tape Reel
24N40L-T8B-R	24N40G-T8B-R	TOLL-8B	G	S	S	S	S	S	S	S	D	Tape Reel

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

<p>24N40G-TF1-T</p> <p>(1) Packing Type (2) Package Type (3) Green Package</p>	<p>(1) T: Tube, R: Tape Reel (2) TF1: TO-220F1, TF2: TO-220F2, TQ2: TO-263 T8B: TOLL-8B (3) G: Halogen Free and Lead Free, L: Lead Free</p>
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■ MARKING

TO-220F1/TO-220F2/TO-263	TOLL-8B
<p>UTC 24N40</p> <p>L: Lead Free G: Halogen Free Date Code</p> <p>Lot Code ←</p> <p>1</p>	<p>UTC 24N40</p> <p>L: Lead Free G: Halogen Free Date Code</p> <p>Lot Code ←</p> <p>1</p>

■ 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
Continuous Drain Current		$I_D$	24	A
Pulsed Drain Current (Note 2)		$I_{DM}$	48	A
Avalanche Energy	Single Pulsed (Note 3)	$E_{AS}$	1440	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	4.2	V/ns
Power Dissipation	TO-220F1/TO-220F2	$P_D$	42	W
	TO-263		200	W
	TOLL-8B		260	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.  $L = 30\text{mH}$ ,  $I_{AS} = 9.8\text{A}$ ,  $V_{DD} = 50\text{V}$ ,  $R_G = 25\ \Omega$ , Starting  $T_J = 25^\circ\text{C}$

4.  $I_{SD} \leq 24\text{A}$ ,  $di/dt \leq 200\text{A}/\mu\text{s}$ ,  $V_{DD} \leq BV_{DSS}$ , Starting  $T_J = 25^\circ\text{C}$

■ THERMAL DATA

PARAMETER		SYMBOL	RATING	UNIT		
Junction to Ambient	TO-220F1/TO-220F2	$\theta_{JA}$	62.5	$^\circ\text{C}/\text{W}$		
	TO-263					
	TOLL-8B				40	$^\circ\text{C}/\text{W}$
Junction to Case	TO-220F1/TO-220F2	$\theta_{JC}$	2.97	$^\circ\text{C}/\text{W}$		
	TO-263				0.625	$^\circ\text{C}/\text{W}$
	TOLL-8B				0.48	$^\circ\text{C}/\text{W}$

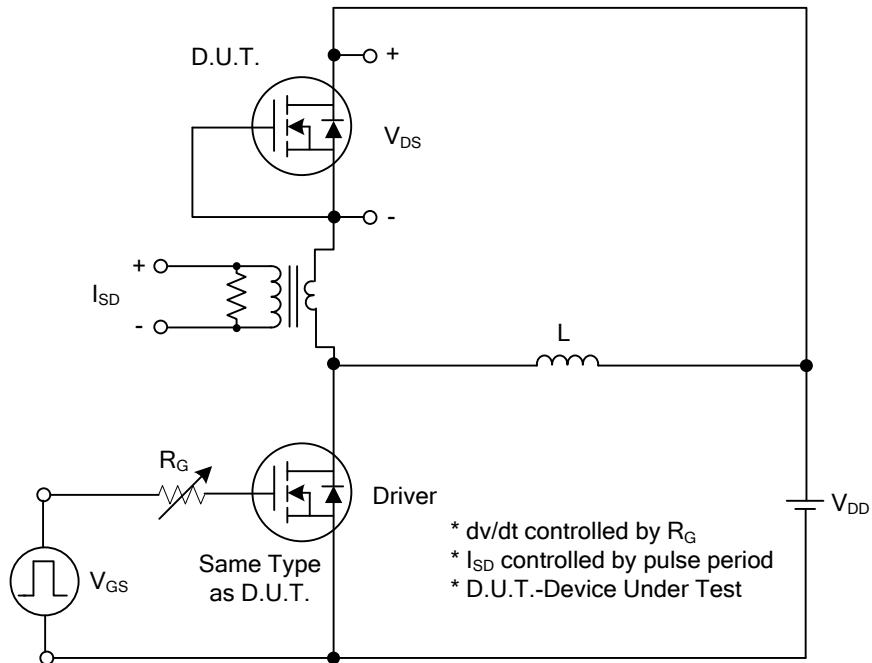
■ ELECTRICAL CHARACTERISTICS (T<sub>J</sub>=25°C, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
<b>OFF CHARACTERISTICS</b>						
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	V <sub>GS</sub> =0V, I <sub>D</sub> =250μA	400			V
Drain-Source Leakage Current	I <sub>DSS</sub>	V <sub>DS</sub> =400V, V <sub>GS</sub> =0V			10	μA
Gate- Source Leakage Current	Forward	I <sub>GSS</sub> V <sub>GS</sub> =30V, V <sub>DS</sub> =0V			100	nA
	Reverse		V <sub>GS</sub> =-30V, V <sub>DS</sub> =0V			-100
<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> =12A		0.155	0.18	Ω
<b>DYNAMIC CHARACTERISTICS</b>						
Input Capacitance	C <sub>ISS</sub>	V <sub>DS</sub> =25V, V <sub>GS</sub> =0V, f=1.0MHz		2800		pF
Output Capacitance	C <sub>OSS</sub>			345		pF
Reverse Transfer Capacitance	C <sub>RSS</sub>			28		pF
<b>SWITCHING CHARACTERISTICS</b>						
Total Gate Charge (Note 1)	Q <sub>G</sub>	V <sub>DS</sub> =560V, V <sub>GS</sub> =10V, I <sub>D</sub> =24A (Note 1, 2)		70		nC
Gate-Source Charge	Q <sub>GS</sub>			20		nC
Gate-Drain Charge	Q <sub>GD</sub>			22		nC
Turn-On Delay Time (Note 1)	t <sub>D(ON)</sub>	V <sub>DS</sub> =100V, V <sub>GS</sub> =10V, I <sub>D</sub> =24A, R <sub>G</sub> =25Ω (Note 1, 2)		36		ns
Turn-On Rise Time	t <sub>R</sub>			28		ns
Turn-Off Delay Time	t <sub>D(OFF)</sub>			210		ns
Turn-Off Fall Time	t <sub>F</sub>			42		ns
<b>DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS</b>						
Maximum Body-Diode Continuous Current	I <sub>S</sub>				24	A
Maximum Body-Diode Pulsed Current	I <sub>SM</sub>				48	A
Drain-Source Diode Forward Voltage (Note 1)	V <sub>SD</sub>	I <sub>S</sub> =24A, V <sub>GS</sub> =0V			1.4	V
Reverse Recovery Time (Note 1)	t <sub>rr</sub>	I <sub>S</sub> =24A, V <sub>GS</sub> =0V di/dt=100A/μs		390		ns
Reverse Recovery Charge	Q <sub>rr</sub>				11.5	

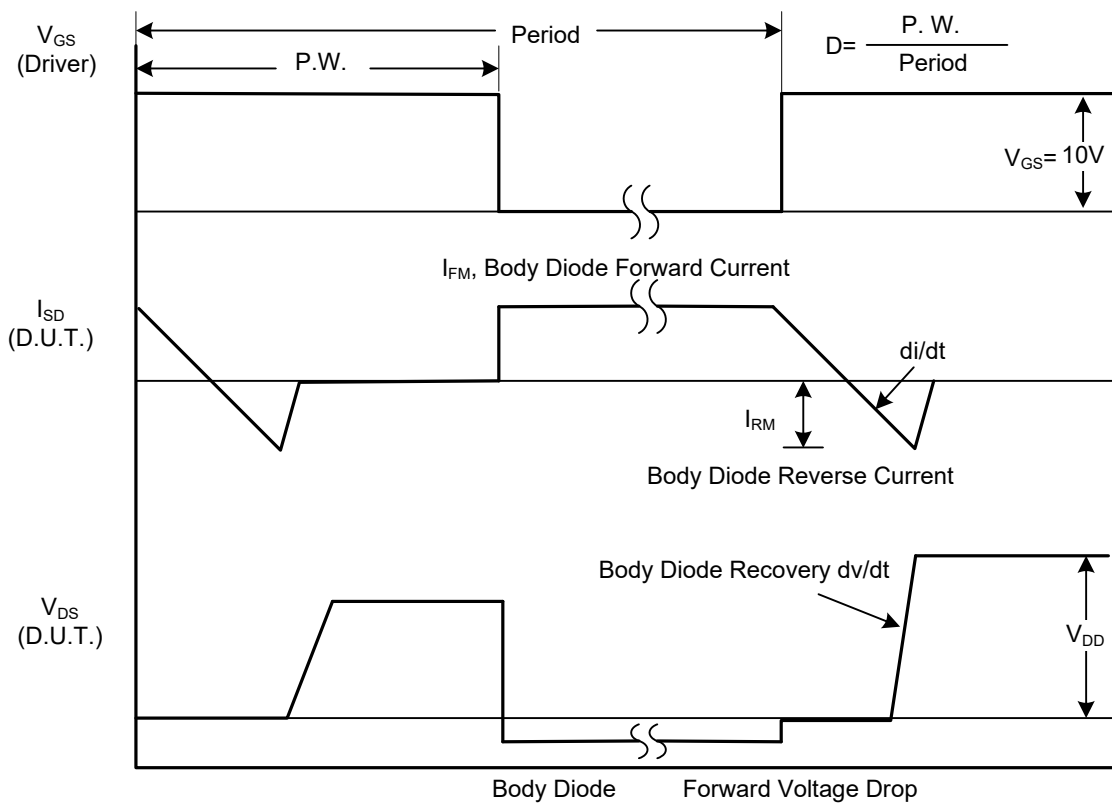
Notes: 1. Pulse Test: Pulse width ≤ 300μs, Duty cycle ≤ 2%.

2. Essentially independent of operating temperature.

■ TEST CIRCUITS AND WAVEFORMS

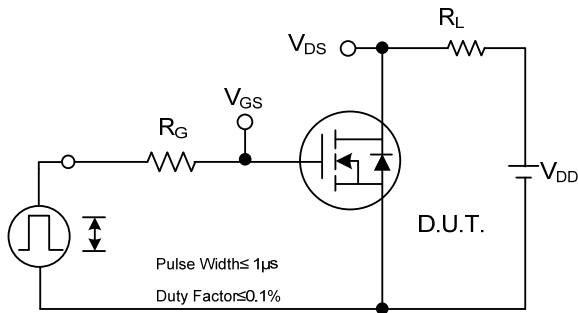


Peak Diode Recovery dv/dt Test Circuit

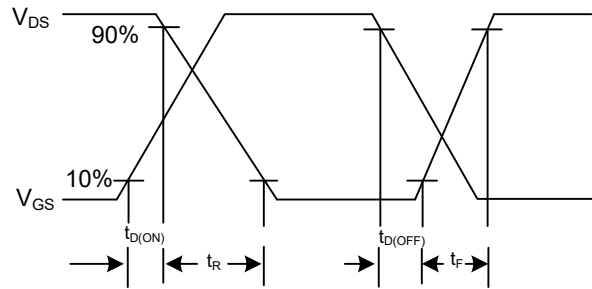


Peak Diode Recovery dv/dt Waveforms

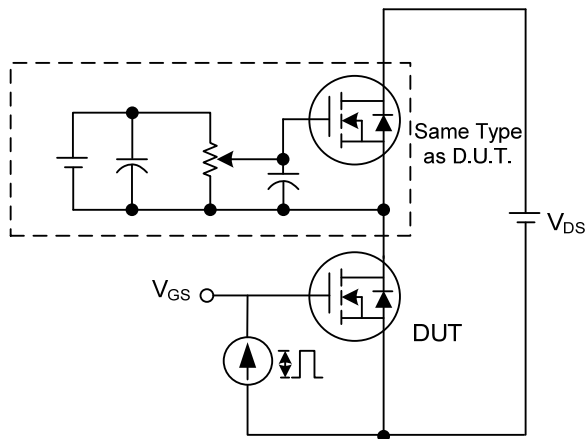
■ TEST CIRCUITS AND WAVEFORMS



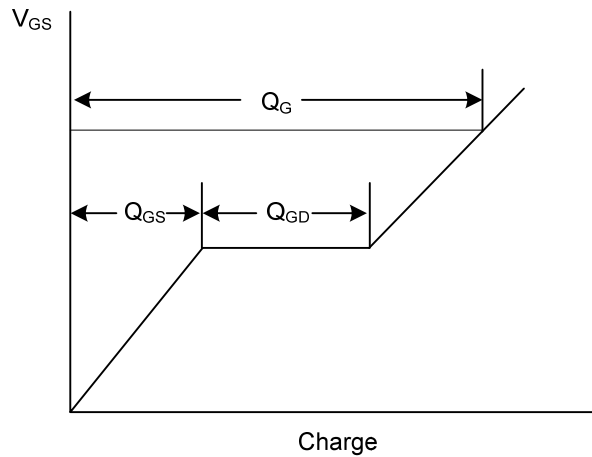
Switching Test Circuit



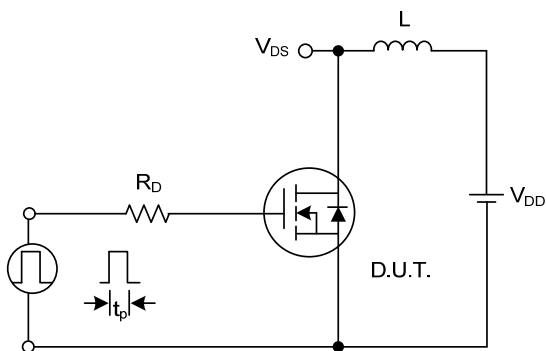
Switching Waveforms



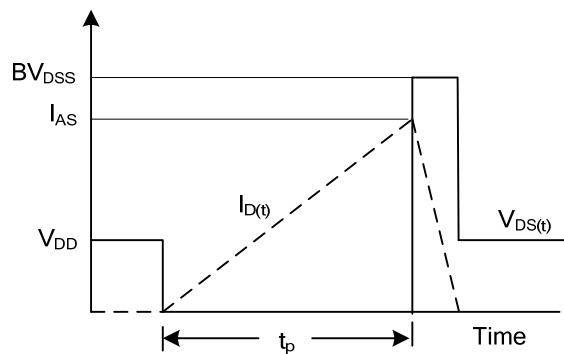
Gate Charge Test Circuit



Gate Charge Waveform



Unclamped Inductive Switching Test Circuit



Unclamped Inductive Switching Waveforms

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