



# 11N40

*Power MOSFET*

## 400 V N-CHANNEL MOSFET

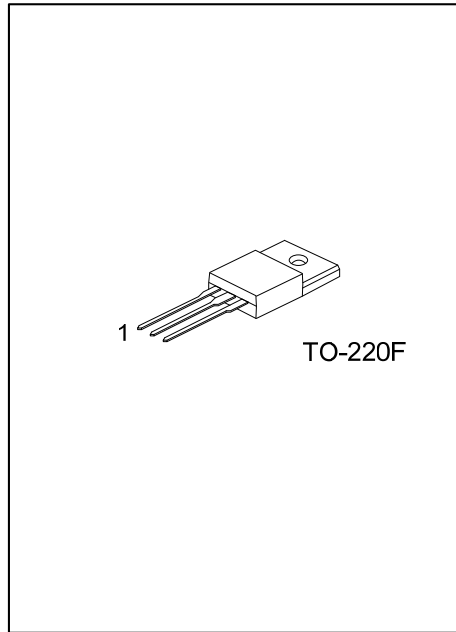
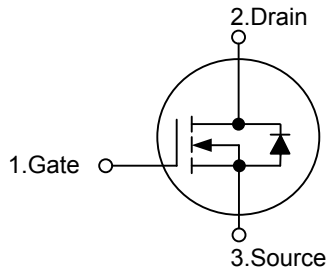
■ DESCRIPTION

The **11N40** uses UTC's advanced proprietary, planar stripe, DMOS technology to provide excellent  $R_{DS(ON)}$ , low gate charge and operation with low gate voltages. This device is suitable for use as a load switch or in PWM applications.

■ FEATURES

- \*  $R_{DS(ON)} = 0.48\Omega @ V_{GS} = 10 V$
- \* Ultra low gate charge ( typical 27 nC )
- \* Low reverse transfer capacitance (  $C_{RSS} = \text{typical } 20 \text{ pF}$  )
- \* Fast switching capability
- \* Avalanche energy specified
- \* Improved dv/dt capability, high ruggedness

■ SYMBOL



Lead-free: 11N40L  
Halogen-free: 11N40G

■ ORDERING INFORMATION

Ordering Number			Package	Pin Assignment			Packing
Normal	Lead Free Plating	Halogen Free		1	2	3	
11N40-TF3-T	11N40L-TF3-T	11N40G-TF3-T	TO-220F	G	D	S	Tube

<p>11N40L-TF3-T</p>	<p>(1) T: Tube (2) TF3: TO-220F (3) G: Halogen Free, L: Lead Free, Blank: Pb/Sn</p>
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■ ABSOLUTE MAXIMUM RATING ( $T_C = 25^\circ\text{C}$ , 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 ( $T_C = 25^\circ\text{C}$ )		$I_D$	11.4	A
Pulsed Drain Current (Note 1)		$I_{DM}$	46	A
Avalanche Current (Note 1)		$I_{AR}$	11.4	A
Avalanche Energy	Single Pulsed (Note 2)	$E_{AS}$	520	mJ
	Repetitive (Note 1)	$E_{AR}$	14.7	
Peak Diode Recovery dv/dt (Note 3)		dv/dt	4.5	V/ns
Power Dissipation Derate above $25^\circ\text{C}$		$P_D$	147 1.18	W W/ $^\circ\text{C}$
Junction Temperature		$T_J$	150	$^\circ\text{C}$
Storage Temperature		$T_{STG}$	-55 ~ +150	$^\circ\text{C}$

Note: 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.

■ THERMAL DATA

PARAMETER	SYMBOL	MIN	TYP	MAX	UNIT
Junction-to- Ambient	$\theta_{JA}$			62.5	$^\circ\text{C}/\text{W}$
Junction-to-Case	$\theta_{JC}$			0.85	$^\circ\text{C}/\text{W}$

■ 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	$BV_{DSS}$	$V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$	400			V
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = 400\text{ V}, V_{GS} = 0\text{ V}$			1	$\mu\text{A}$
		$V_{DS} = 320\text{ V}, T_C = 125^\circ\text{C}$			10	
Gate-Body Leakage Current	$I_{GSS}$	$V_{DS} = 0\text{ V}, V_{GS} = \pm 30\text{ V}$			$\pm 100$	nA
Breakdown Voltage Temperature Coefficient	$\Delta BV_{DSS}/\Delta T_J$	$I_D = 250\ \mu\text{A}$ , Referenced to $25^\circ\text{C}$		0.42		mV/ $^\circ\text{C}$
<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-Resistance	$R_{DS(ON)}$	$V_{GS} = 10\text{ V}, I_D = 5.7\text{ A}$		0.38	0.48	$\Omega$
<b>DYNAMIC PARAMETERS</b>						
Input Capacitance	$C_{ISS}$	$V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$		1100	1400	pF
Output Capacitance	$C_{OSS}$		180	240		
Reverse Transfer Capacitance	$C_{RSS}$		20	30		
<b>SWITCHING PARAMETERS</b>						
Turn-ON Delay Time	$t_{D(ON)}$	$V_{DD} = 200\text{ V}, I_D = 11.4\text{ A},$ $R_{GEN} = 25\ \Omega$ (Note 4,5)		30	70	ns
Turn-ON Rise Time	$t_R$		100	210		
Turn-OFF Delay Time	$t_{D(OFF)}$		60	130		
Turn-OFF Fall-Time	$t_F$		60	130		
Total Gate Charge	$Q_G$	$V_{DS} = 320\text{ V}, V_{GS} = 10\text{ V},$ $I_D = 11.4\text{ A}$ (Note 4,5)		27	35	nC
Gate Source Charge	$Q_{GS}$		7.3			
Gate Drain Charge	$Q_{GD}$		12.3			

■ ELECTRICAL CHARACTERISTICS(Cont.)

SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS						
Drain-Source Diode Forward Voltage	$V_{SD}$	$I_S=11.4\text{ A}, V_{GS}=0\text{V}$			1.5	V
Maximum Continuous Drain-Source Diode Forward Current	$I_S$				11.4	A
Maximum Pulsed Drain-Source Diode Forward Current	$I_{SM}$				46	
Reverse Recovery Time	$t_{RR}$	$V_{GS} = 0\text{ V}, di_F/dt = 100\text{ A/s},$		240		ns
Reverse Recovery Charge	$Q_{RR}$	$I_S = 11.4\text{ A (Note 4)}$		1.8		$\mu\text{C}$

- Note
1. Repetitive Rating: Pulse width limited by maximum junction temperature.
  2.  $L=7\text{mH}, I_{AS}=11.4\text{A}, V_{DD}=50\text{V}, R_G=25\Omega,$  Satarting  $T_J=25^\circ\text{C}.$
  3.  $I_{SD} \leq 11.4\text{A}, di/dt \leq 200\text{A}/\mu\text{s}, V_{DD} \leq BV_{DSS},$  Satarting  $T_J=25^\circ\text{C}.$
  4. Pulse Test: Pulse Width  $\leq 300\text{ s},$  Duty Cycle  $\leq 2\%.$
  5. Independent of operating temperature.

■ TEST CIRCUIT

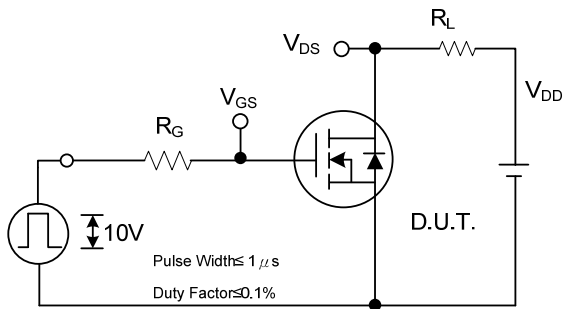


Fig. 2A Switching Test Circuit

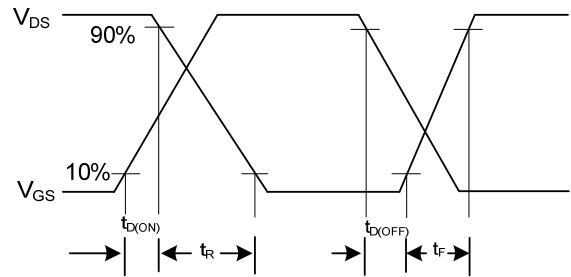


Fig. 2B Switching Waveforms

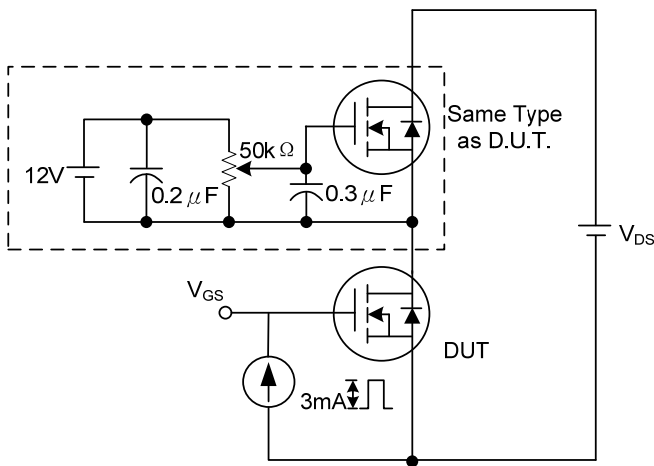


Fig. 3A Gate Charge Test Circuit

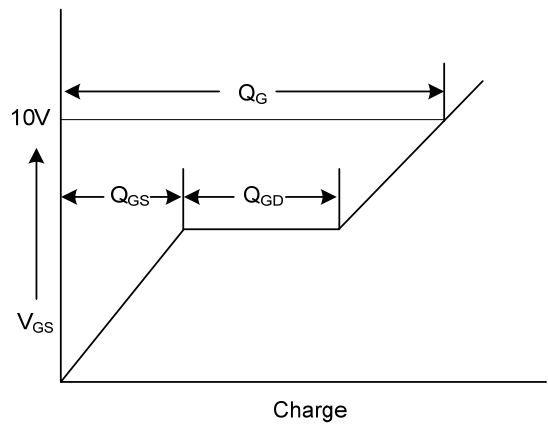


Fig. 3B Gate Charge Waveform

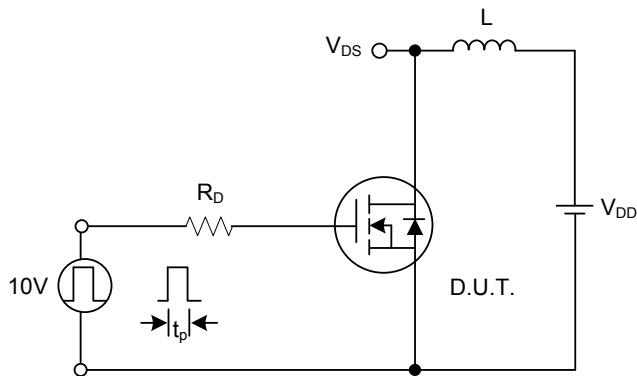


Fig. 4A Unclamped Inductive Switching Test Circuit

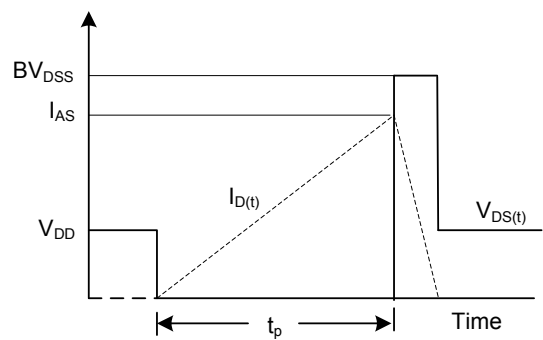


Fig. 4B Unclamped Inductive Switching Waveforms

■ TEST CIRCUIT(Cont.)

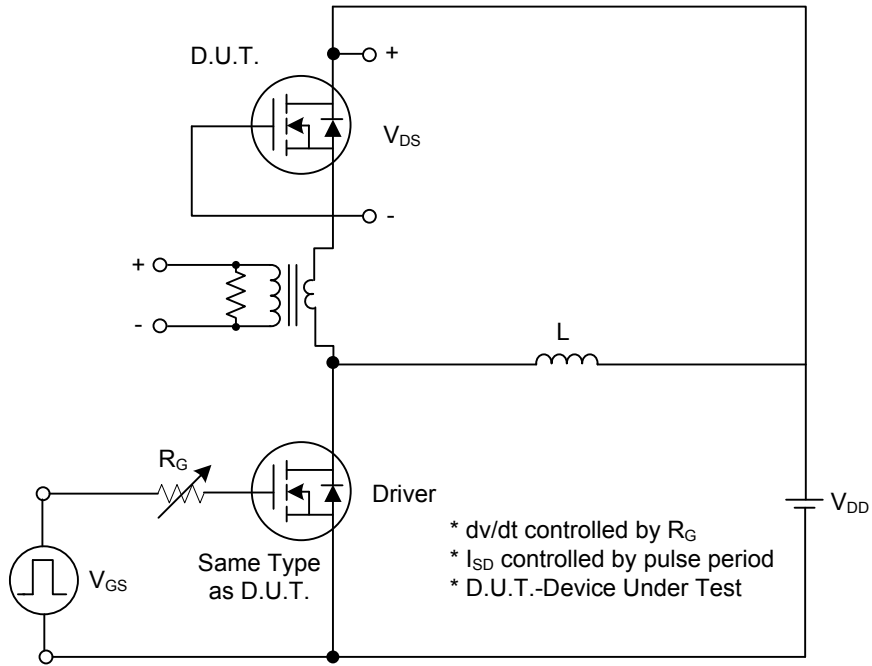
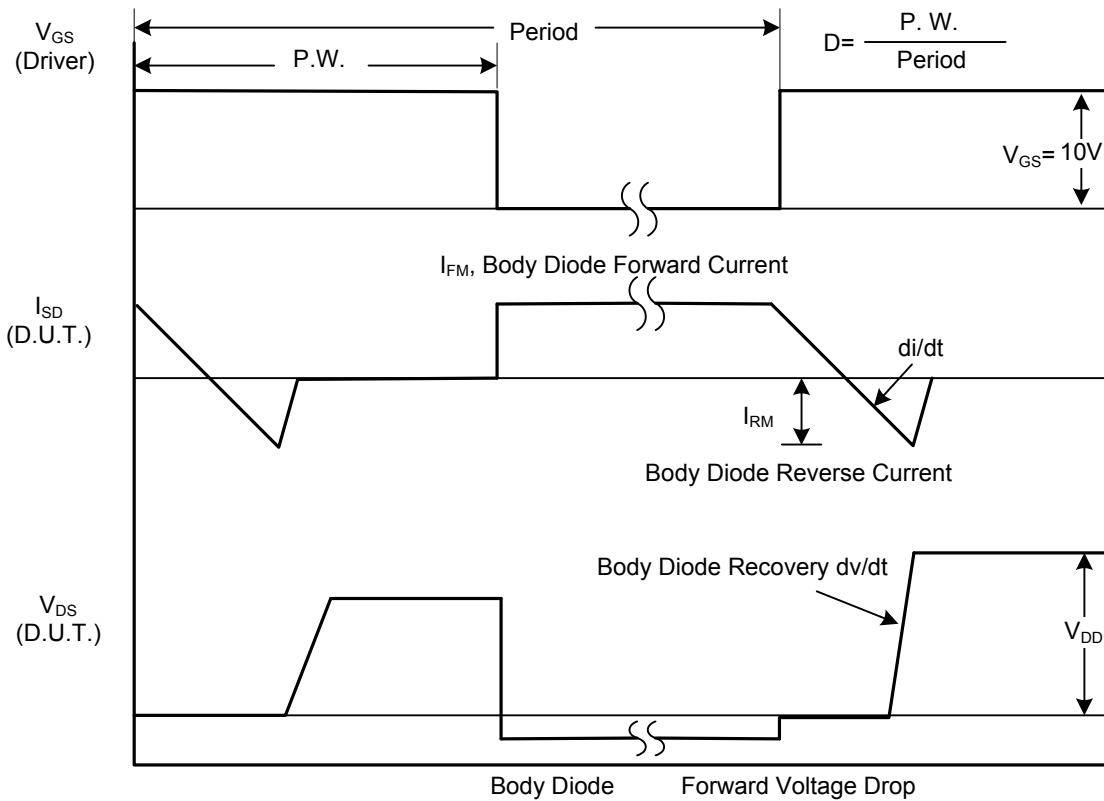


Fig. 1A Peak Diode Recovery  $dv/dt$  Test Circuit



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