



## 4NM70A

Power MOSFET

### 4A, 700V N-CHANNEL SUPER-JUNCTION MOSFET

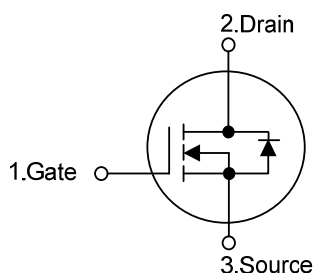
#### DESCRIPTION

The **UTC 4NM70A** is a Super Junction MOSFET Structure and is designed to have better characteristics, such as fast switching time, low gate charge, low on-state resistance and a high rugged avalanche characteristics. This power MOSFET is usually used at DC-DC, AC-DC converters for power applications.

#### FEATURES

- \*  $R_{DS(ON)} < 1.8\Omega$  @  $V_{GS} = 10V$ ,  $I_D = 2.0A$
- \* Fast Switching Capability
- \* Avalanche Energy Specified
- \* Improved  $dv/dt$  Capability, High Ruggedness

#### SYMBOL

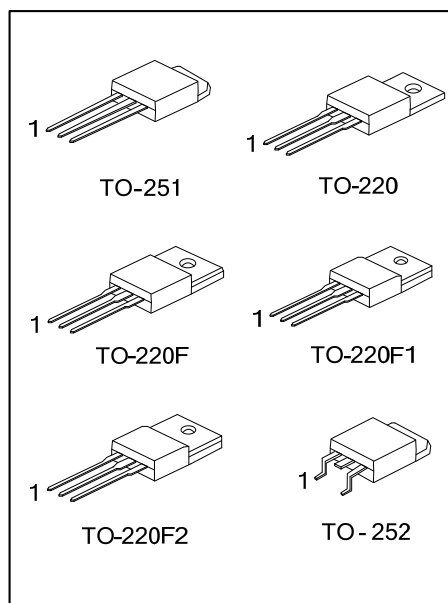


#### ORDERING INFORMATION

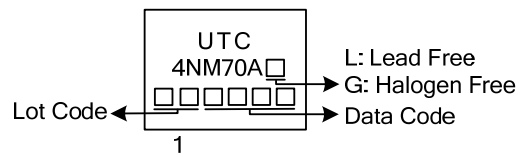
Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
4NM70AL-TA3-T	4NM70AG-TA3-T	TO-220	G	D	S	Tube
4NM70AL-TF3-T	4NM70AG-TF3-T	TO-220F	G	D	S	Tube
4NM70AL-TF1-T	4NM70AG-TF1-T	TO-220F1	G	D	S	Tube
4NM70AL-TF2-T	4NM70AG-TF2-T	TO-220F2	G	D	S	Tube
4NM70AL-TM3-T	4NM70AG-TM3-T	TO-251	G	D	S	Tube
4NM70AL-TN3-R	4NM70AG-TN3-R	TO-252	G	D	S	Tape Reel

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

<p>4NM70AL-TA3-T</p> <p>(1) Packing Type</p> <p>(2) Package Type</p> <p>(3) Green Package</p>		<p>(1) T: Tube, R: Tape Reel</p> <p>(2) TA3: TO-220, TF3: TO-220F, TF1: TO-220F1, TF2: TO-220F2, TM3: TO-251, TN3: TO-252</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		$V_{DS}$	700	V
Gate-Source Voltage		$V_{GS}$	$\pm 30$	V
Drain Current	Continuous	$I_D$	4	A
	Pulsed (Note 2)	$I_{DM}$	16	A
Avalanche Current (Note 2)		$I_{AR}$	1.14	A
Avalanche Energy	Single Pulsed (Note 3)	$E_{AS}$	90	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	4.7	V/ns
Power Dissipation	TO-220	$P_D$	106	W
	TO-220F/TO-220F1		36	W
	TO-220F2			
	TO-251/TO-252		49	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.  $L = 138\text{mH}$ ,  $I_{AS} = 1.14\text{A}$ ,  $V_{DD} = 50\text{V}$ ,  $R_G = 25\ \Omega$ , Starting  $T_J = 25^\circ\text{C}$

4.  $I_{SD} \leq 4.0\text{A}$ ,  $di/dt \leq 200\text{A}/\mu\text{s}$ ,  $V_{DD} \leq BV_{DSS}$ , Starting  $T_J = 25^\circ\text{C}$

■ THERMAL DATA

PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Ambient	TO-220/TO-220F	$\theta_{JA}$	62.5	$^\circ\text{C}/\text{W}$
	TO-220F1/TO-220F2		110	$^\circ\text{C}/\text{W}$
	TO-251/TO-252			
Junction to Case	TO-220	$\theta_{JC}$	1.18	$^\circ\text{C}/\text{W}$
	TO-220F/TO-220F1		3.47	$^\circ\text{C}/\text{W}$
	TO-220F2			
	TO-251/TO-252		2.55	$^\circ\text{C}/\text{W}$

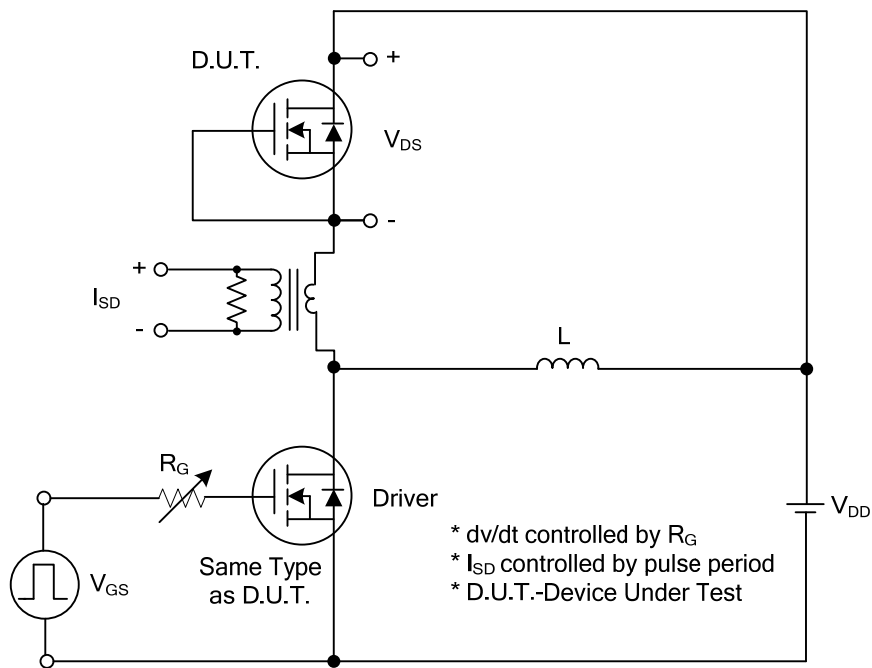
■ ELECTRICAL CHARACTERISTICS ( $T_J = 25^\circ\text{C}$ , unless otherwise specified)

PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS							
Drain-Source Breakdown Voltage		$BV_{DSS}$	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$	700			V
Drain-Source Leakage Current		$I_{DSS}$	$V_{DS} = 700\text{ V}, V_{GS} = 0\text{ V}$			10	$\mu\text{A}$
Gate-Source Leakage Current	Forward	$I_{GSS}$	$V_{GS} = 30\text{ V}, V_{DS} = 0\text{ V}$			100	nA
	Reverse		$V_{GS} = -30\text{ V}, V_{DS} = 0\text{ V}$			-100	
ON CHARACTERISTICS							
Gate Threshold Voltage		$V_{GS(TH)}$	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	2.5		4.5	V
Static Drain-Source On-State Resistance		$R_{DS(ON)}$	$V_{GS} = 10\text{ V}, I_D = 2.0\text{ A}$			1.8	$\Omega$
DYNAMIC CHARACTERISTICS							
Input Capacitance		$C_{ISS}$	$V_{GS}=0\text{V}, V_{DS}=25\text{V}, f=1\text{MHz}$		275		pF
Output Capacitance		$C_{OSS}$			130		pF
Reverse Transfer Capacitance		$C_{RSS}$			17		pF
SWITCHING CHARACTERISTICS							
Total Gate Charge (Note 1)		$Q_G$	$V_{DS}=50\text{V}, V_{GS}=10\text{V}, I_D=1.3\text{A}, I_D=100\mu\text{A}$ (Note 1, 2)		35		nC
Gate to Source Charge		$Q_{GS}$			4		nC
Gate to Drain Charge		$Q_{GD}$			7.5		nC
Turn-ON Delay Time (Note 1)		$t_{D(ON)}$	$V_{DS}=30\text{V}, V_{GS}=10\text{V}, I_D=0.5\text{A}, R_G=25\Omega$ (Note 1, 2)		40		ns
Rise Time		$t_R$			54		ns
Turn-OFF Delay Time		$t_{D(OFF)}$			110		ns
Fall-Time		$t_F$			23		ns
SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS							
Maximum Body-Diode Continuous Current		$I_S$				4	A
Maximum Body-Diode Pulsed Current		$I_{SM}$				16	A
Drain-Source Diode Forward Voltage (Note 1)		$V_{SD}$	$V_{GS} = 0\text{ V}, I_S = 4.0\text{ A}$			1.4	V
Body Diode Reverse Recovery Time (Note 1)		$t_{rr}$	$V_{GS} = 0\text{ V}, I_S = 4.0\text{ A},$		290		ns
Body Diode Reverse Recovery Charge		$Q_{rr}$	$dl_F/dt = 100\text{ A}/\mu\text{s}$		2		$\mu\text{C}$

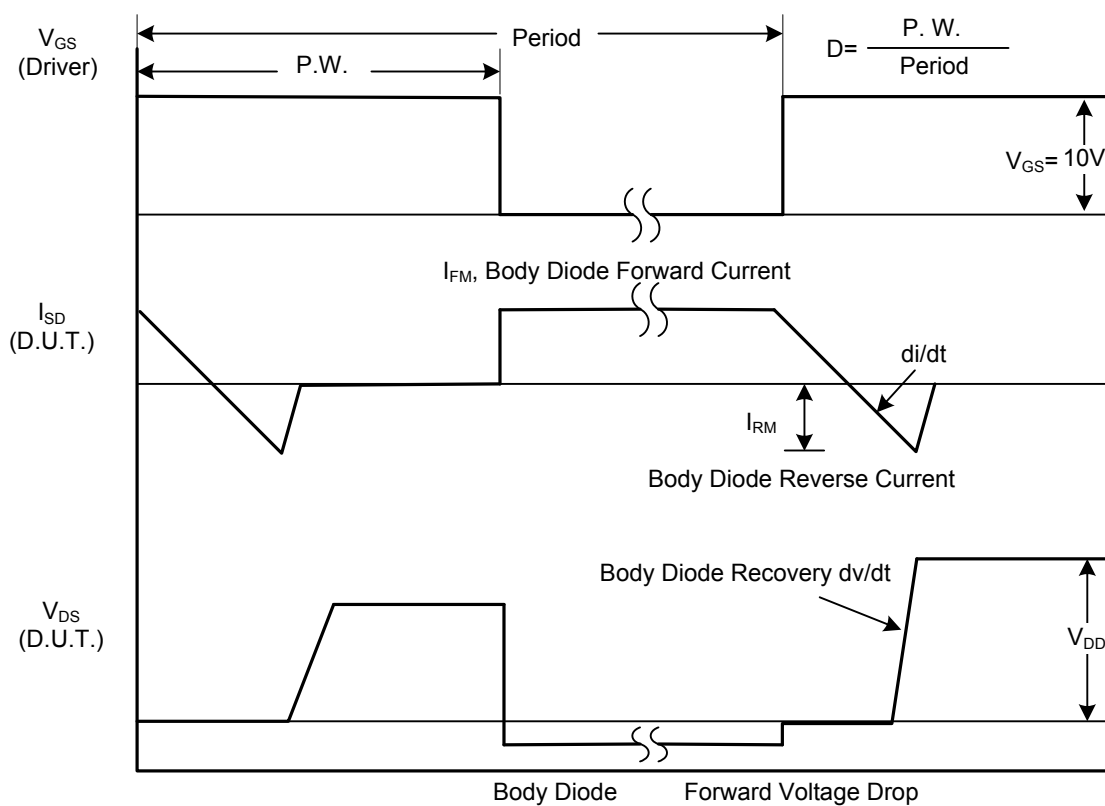
Notes: 1. Pulse Test: Pulse width  $\leq 300\text{ }\mu\text{s}$ , Duty cycle  $\leq 2\%$ .

2. Essentially independent of operating temperature.

### ■ TEST CIRCUITS AND WAVEFORMS

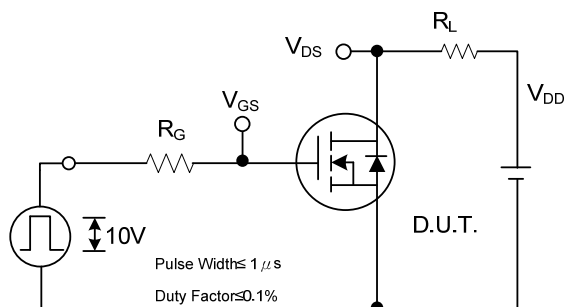


**Peak Diode Recovery dv/dt Test Circuit**

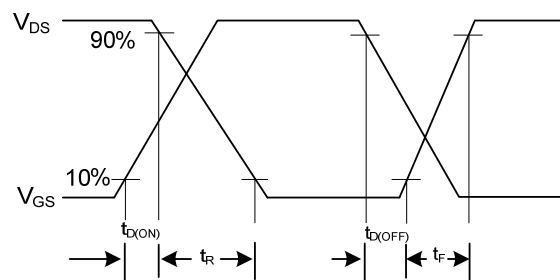


**Peak Diode Recovery dv/dt Waveforms**

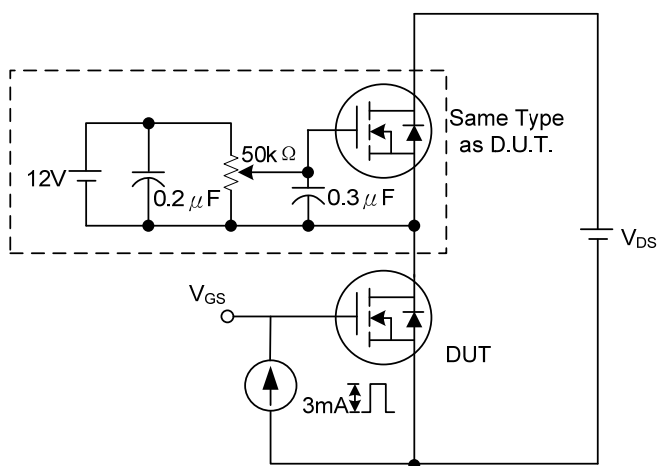
### ■ TEST CIRCUITS AND WAVEFORMS (Cont.)



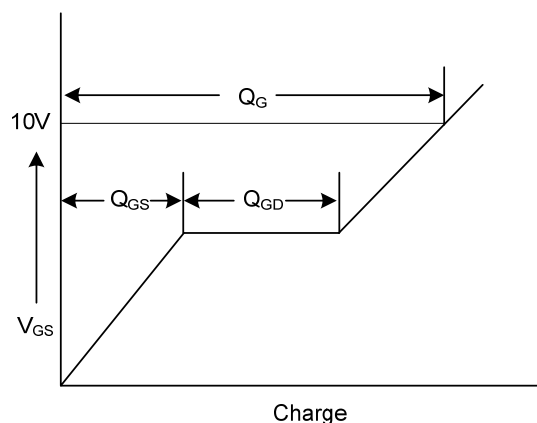
**Switching Test Circuit**



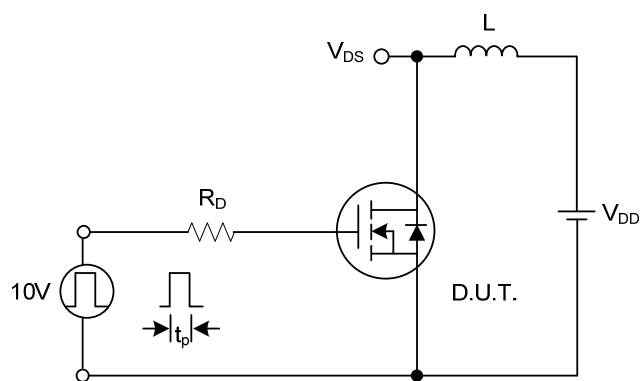
**Switching Waveforms**



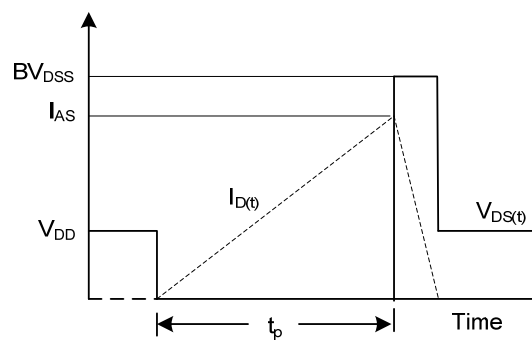
**Gate Charge Test Circuit**



**Gate Charge Waveform**



**Unclamped Inductive Switching Test Circuit**



**Unclamped Inductive Switching Waveforms**

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