



4N70

Power MOSFET

4.4A, 700V N-CHANNEL POWER MOSFET

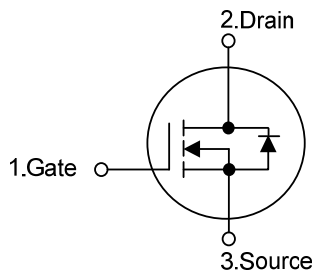
■ DESCRIPTION

The UTC **4N70** is a high voltage power MOSFET and is designed to have better characteristics, such as fast switching time, low gate charge, low on-state resistance and high rugged avalanche. This high speed switching power MOSFET is usually used in power supplies, PWM motor controls, high efficient DC to DC converters and bridge circuits.

■ FEATURES

- * $R_{DS(ON)} < 2.8\Omega @ V_{GS} = 10V$
- * Ultra Low Gate Charge (Typical 15nC)
- * Low Reverse Transfer Capacitance ($C_{RSS} = \text{Typical } 8.0 \text{ pF}$)
- * Fast Switching Capability
- * Avalanche Energy Specified
- * Improved dv/dt Capability, High Ruggedness

■ SYMBOL

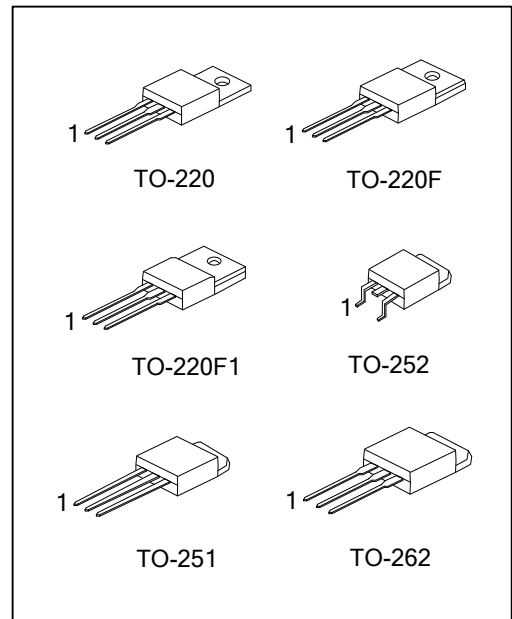


■ ORDERING INFORMATION

Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
4N70L-TA3-T	4N70G-TA3-T	TO-220	G	D	S	Tube
4N70L-TF1-T	4N70G-TF1-T	TO-220F1	G	D	S	Tube
4N70L-TF3-T	4N70G-TF3-T	TO-220F	G	D	S	Tube
4N70L-TM3-T	4N70G-TM3-T	TO-251	G	D	S	Tube
4N70L-TN3-R	4N70G-TN3-R	TO-252	G	D	S	Tape Reel
4N70L-T2Q-T	4N70G-T2Q-T	TO-262	G	D	S	Tube

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

<p>4N70L-TF1-T</p> <p>(1) Packing Type (2) Package Type (3) Lead Free</p>	<p>(1) T: Tube (2) TA3: TO-220, TF1: TO-220F1, TF3: TO-220F, TM3: TO-251, TN3: TO-252, T2Q: TO-262 (3) L: Lead Free, G: Halogen Free,</p>
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■ MARKING INFORMATION

PACKAGE		MARKING
TO-220 TO-220F TO-220F1	TO-251 TO-252 TO-262	<p>The diagram shows a rectangular marking area on a MOSFET package. At the top, it says 'UTC'. Below that is '4N70'. Underneath are five small squares representing a 'Lot Code'. To the right of these squares are two more small squares representing a 'Data Code'. Below the squares is the number '1'. To the right of the marking area, there are two lines of text: 'L: Lead Free' and 'G: Halogen Free'.</p>

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

PARAMETER		SYMBOL	RATINGS	UNIT
Drain-Source Voltage		V_{DSS}	700	V
Gate-Source Voltage		V_{GSS}	± 30	V
Avalanche Current (Note 2)		I_{AR}	4.4	A
Drain Current	Continuous	I_D	4.4	A
	Pulsed (Note 2)	I_{DM}	17.6	A
Avalanche Energy	Single Pulsed (Note 3)	E_{AS}	260	mJ
	Repetitive (Note 2)	E_{AR}	10.6	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	4.5	V/ns
Power Dissipation	TO-220/TO-262	P_D	106	W
	TO-220F/TO-220F1		36	
	TO-251/ TO-252		49	
Junction Temperature		T_J	+150	$^\circ\text{C}$
Operating Temperature		T_{OPR}	-55 ~ +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. $L = 26.9\text{mH}$, $I_{AS} = 4.4\text{A}$, $V_{DD} = 50\text{V}$, $R_G = 25\ \Omega$, Starting $T_J = 25^\circ\text{C}$

4. $I_{SD} \leq 4.4\text{A}$, $di/dt \leq 200\text{A}/\mu\text{s}$, $V_{DD} \leq BV_{DSS}$, Starting $T_J = 25^\circ\text{C}$

■ THERMAL DATA

PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Ambient	TO-220/TO-220F	θ_{JA}	62.5	$^\circ\text{C}/\text{W}$
	TO-220F1/TO-262			
	TO-251/ TO-252			
Junction to Case	TO-220/TO-262	θ_{JC}	1.18	$^\circ\text{C}/\text{W}$
	TO-220F/TO-220F1		3.47	
	TO-251/ TO-252		2.55	

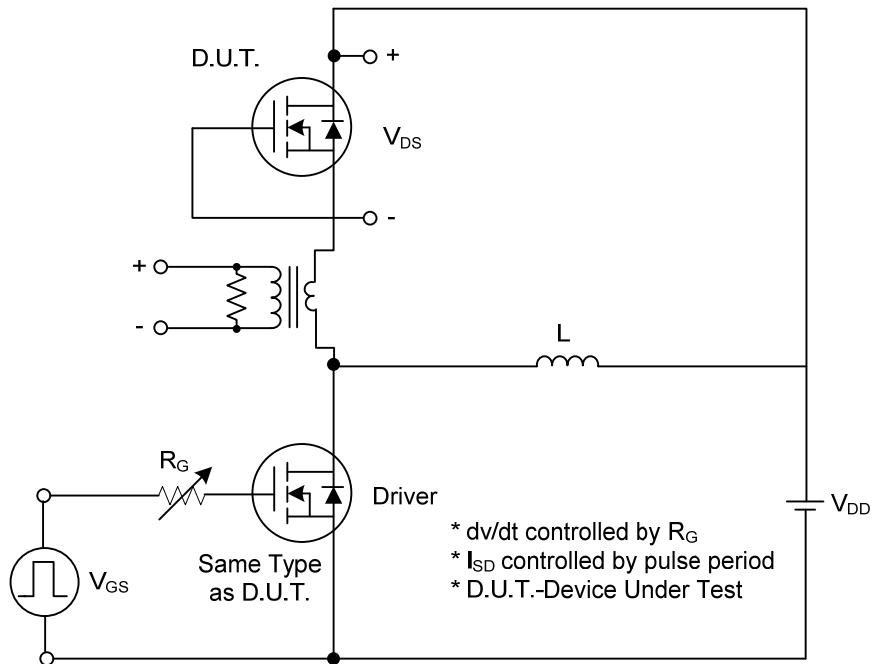
■ ELECTRICAL CHARACTERISTICS (T_A=25°C, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS						
Drain-Source Breakdown Voltage	BV _{DSS}	V _{GS} = 0 V, I _D = 250 μA	700			V
Drain-Source Leakage Current	I _{DSS}	V _{DS} = 700 V, V _{GS} = 0 V			10	μA
Gate-Source Leakage Current	Forward	I _{GSS}			100	nA
	Reverse				-100	
Breakdown Voltage Temperature Coefficient	ΔBV _{DSS} /ΔT _J	I _D = 250μA, Referenced to 25°C		0.6		V/°C
ON CHARACTERISTICS						
Gate Threshold Voltage	V _{GS(TH)}	V _{DS} = V _{GS} , I _D = 250 μA	2.0		4.0	V
Static Drain-Source On-State Resistance	R _{DS(ON)}	V _{GS} = 10 V, I _D = 2.2 A		2.6	2.8	Ω
DYNAMIC CHARACTERISTICS						
Input Capacitance	C _{ISS}	V _{DS} = 25 V, V _{GS} = 0 V, f = 1MHz		520	670	pF
Output Capacitance	C _{OSS}			70	90	pF
Reverse Transfer Capacitance	C _{RSS}			8	11	pF
SWITCHING CHARACTERISTICS						
Turn-On Delay Time	t _{D(ON)}	V _{DD} = 350V, I _D = 4.4A, R _G = 25Ω (Note 1, 2)		13	35	ns
Turn-On Rise Time	t _R			45	100	ns
Turn-Off Delay Time	t _{D(OFF)}			25	60	ns
Turn-Off Fall Time	t _F			35	80	ns
Total Gate Charge	Q _G	V _{DS} = 560V, I _D = 4.4A, V _{GS} = 10 V (Note 1, 2)		15	20	nC
Gate-Source Charge	Q _{GS}			3.4		nC
Gate-Drain Charge	Q _{GD}			7.1		nC
SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS						
Drain-Source Diode Forward Voltage	V _{SD}	V _{GS} = 0 V, I _S = 4.4 A			1.4	V
Maximum Continuous Drain-Source Diode Forward Current	I _S				4.4	A
Maximum Pulsed Drain-Source Diode Forward Current	I _{SM}				17.6	A
Reverse Recovery Time	t _{rr}	V _{GS} = 0 V, I _S = 4.4 A, dI/dt = 100 A/μs (Note 1)		250		ns
Reverse Recovery Charge	Q _{RR}			1.5		μC

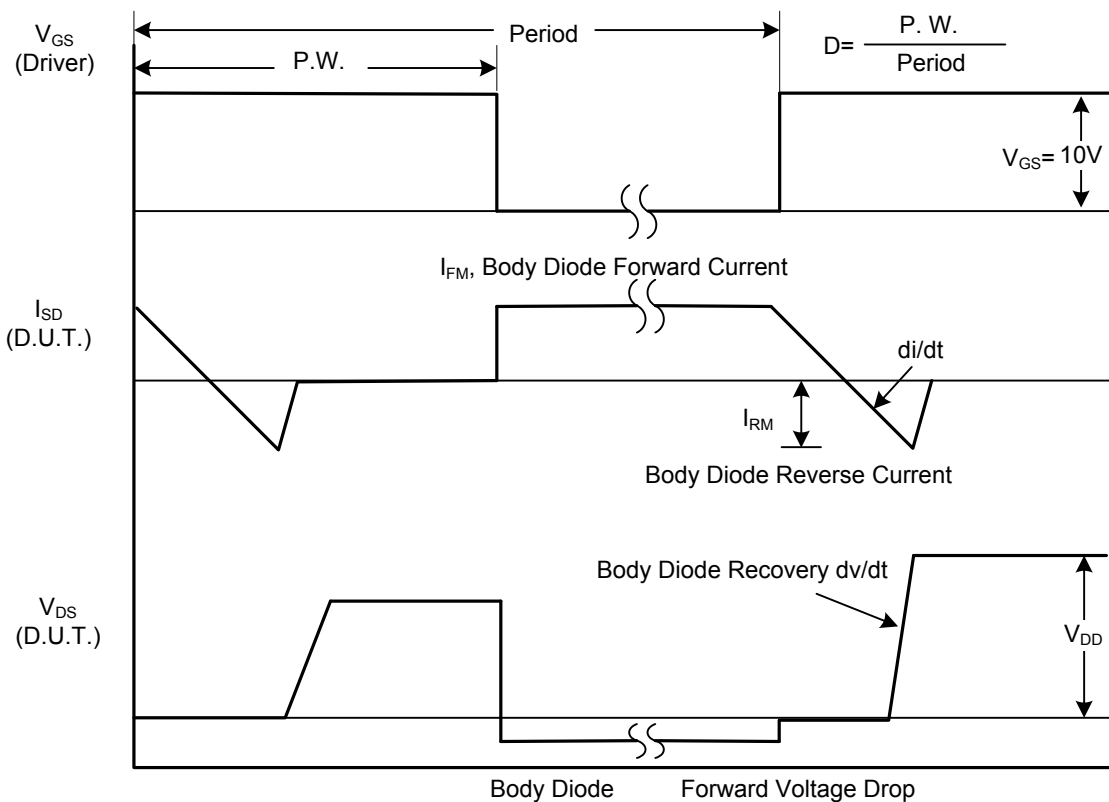
Notes: 1. Pulse Test: Pulse width ≤ 300μs, Duty cycle ≤ 2%

2. Essentially independent of operating temperature

TEST CIRCUITS AND WAVEFORMS

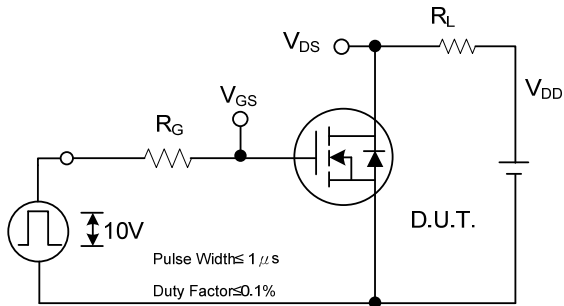


Peak Diode Recovery dv/dt Test Circuit

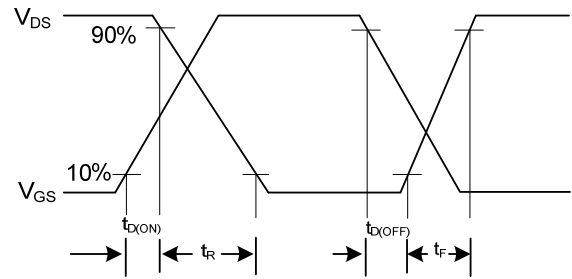


Peak Diode Recovery dv/dt Waveforms

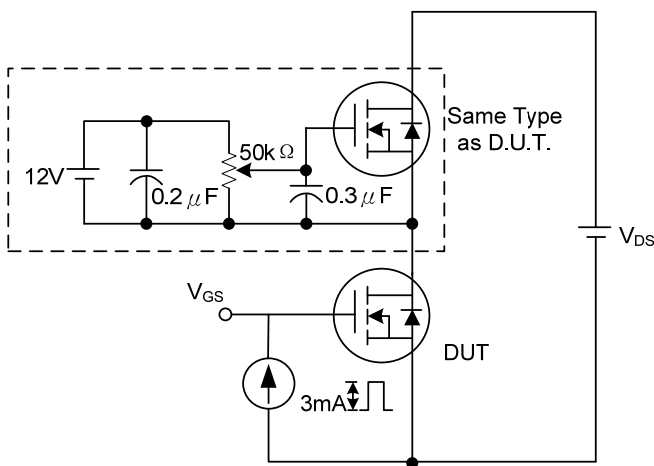
■ TEST CIRCUITS AND WAVEFORMS (Cont.)



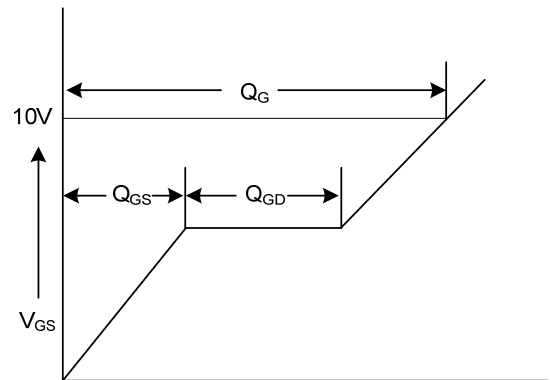
Switching Test Circuit



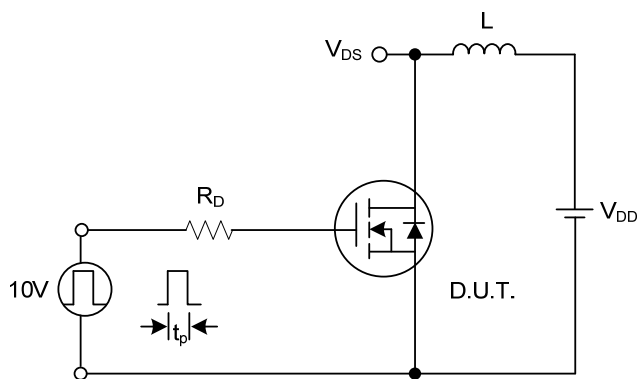
Switching Waveforms



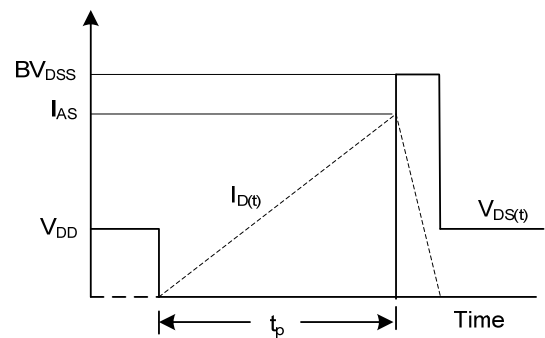
Gate Charge Test Circuit



Gate Charge Waveform

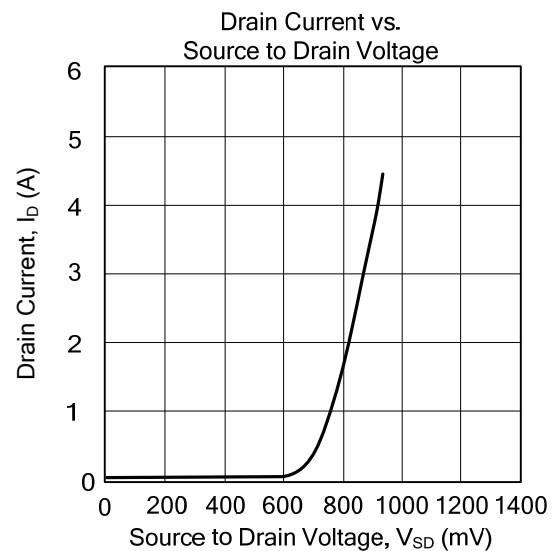
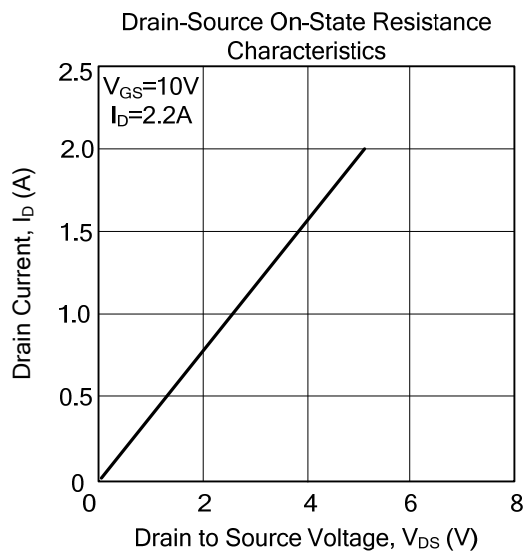
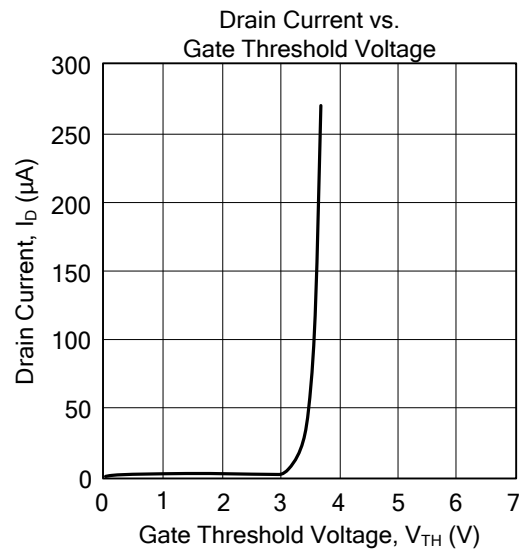
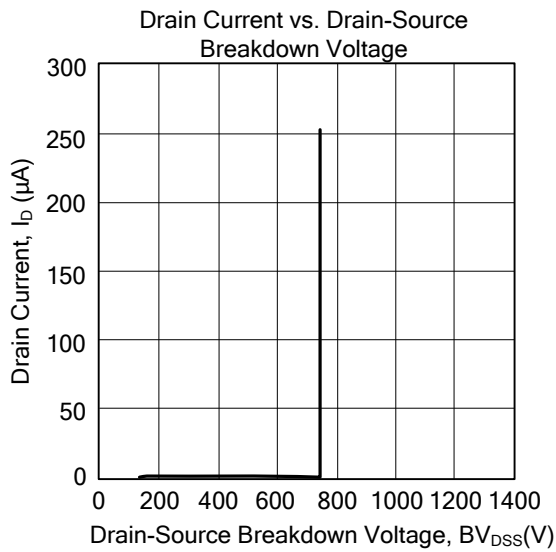


Unclamped Inductive Switching Test Circuit



Unclamped Inductive Switching Waveforms

■ TYPICAL CHARACTERISTICS



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