



# 5N70Z

**Power MOSFET**

## 5A, 700V LOGIC N-CHANNEL MOSFET

■ DESCRIPTION

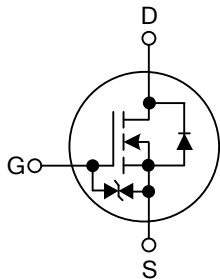
The UTC **5N70Z** is an N-Channel enhancement MOSFET, it uses UTC's advanced technology to provide customers with a minimum on-state resistance, high switching speed and low gate charge. It can also withstand high energy pulse in the avalanche and commutation modes.

The UTC **5N70Z** is suitable for high efficiency switching DC/DC converter, motor control and switch mode power supply.

■ FEATURES

- \*  $R_{DS(ON)} < 2.5\Omega @ V_{GS}=10V$
- \* Low gate charge ( Typ=4.8nC)
- \* Low  $C_{RSS}$  (Typ=6.0pF)
- \* High switching speed
- \* ESD Capability

■ SYMBOL

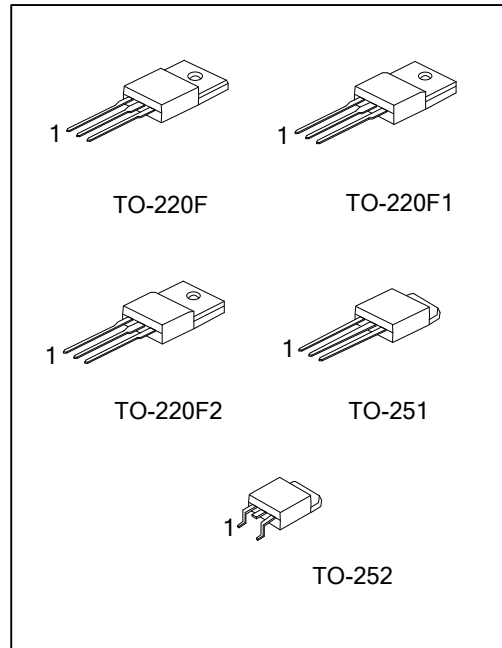


■ ORDERING INFORMATION

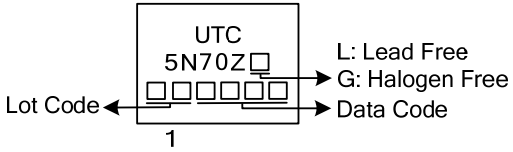
Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
5N70ZL-TF3-T	5N70ZG-TF3-T	TO-220F	G	D	S	Tube
5N70ZL-TF1-T	5N70ZG-TF1-T	TO-220F1	G	D	S	Tube
5N70ZL-TF2-T	5N70ZG-TF2-T	TO-220F2	G	D	S	Tube
5N70ZL-TM3-T	5N70ZG-TM3-T	TO-251	G	D	S	Tube
5N70ZL-TN3-R	5N70ZG-TN3-R	TO-252	G	D	S	Tape Reel

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

<p>5N70ZL-TF3-T</p> <p>(1)Packing Type</p> <p>(2)Package Type</p> <p>(3)Lead Free</p>	<p>(1) T: Tube, R: Tape Reel</p> <p>(2) TF3: TO-220F, TF1: TO-220F1, TF2: TO-220F2</p> <p>TM3: TO-251, TN3: TO-252</p> <p>(3) L: Lead Free, G: Halogen Free</p>
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■ MARKING INFORMATION

PACKAGE	MARKING
TO-220F TO-220F1 TO-220F2 TO-251 TO-252	 <p style="text-align: center;">UTC 5N70Z</p> <p style="text-align: center;">Lot Code ← [ ] [ ] [ ] [ ] [ ] → Data Code</p> <p style="text-align: center;">1</p> <p style="text-align: right;">L: Lead Free G: Halogen Free</p>

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

PARAMETER		SYMBOL	RATINGS	UNIT
Drain-Source Voltage		$V_{DSS}$	700	V
Gate-Source Voltage		$V_{GSS}$	$\pm 20$	V
Avalanche Current (Note 2)		$I_{AR}$	5	A
Drain Current	Continuous	$I_D$	5	A
	Pulsed (Note 2)	$I_{DM}$	20	A
Avalanche Energy	Single Pulsed (Note 3)	$E_{AS}$	100	mJ
	Repetitive (Note 2)	$E_{AR}$	10	mJ
Peak Diode Recovery $dv/dt$ (Note 4)		$dv/dt$	4.5	V/ns
Power Dissipation	TO-220F/TO-220F1	$P_D$	36	W
	TO-220F2			
	TO-251/TO-252		28	W
Junction Temperature		$T_J$	+150	$^\circ\text{C}$
Operation 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.  $L=6.2\text{mH}$ ,  $I_{AS}=5\text{A}$ ,  $V_{DD}=50\text{V}$ ,  $R_G=25\Omega$ , Starting  $T_J=25^\circ\text{C}$ .

4.  $I_{SD}\leq 4.5\text{A}$ ,  $di/dt\leq 300\text{A}/\mu\text{s}$ ,  $V_{DD}\leq BV_{DSS}$ , Starting  $T_J=25^\circ\text{C}$

■ THERMAL CHARACTERISTICS

PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Ambient	TO-220F/TO-220F1	$\theta_{JA}$	62.5	$^\circ\text{C}/\text{W}$
	TO-220F2			
	TO-251/TO-252		110	$^\circ\text{C}/\text{W}$
Junction to Case	TO-220F/TO-220F1	$\theta_{JC}$	3.47	$^\circ\text{C}/\text{W}$
	TO-220F2			
	TO-251/TO-252		4.53	$^\circ\text{C}/\text{W}$

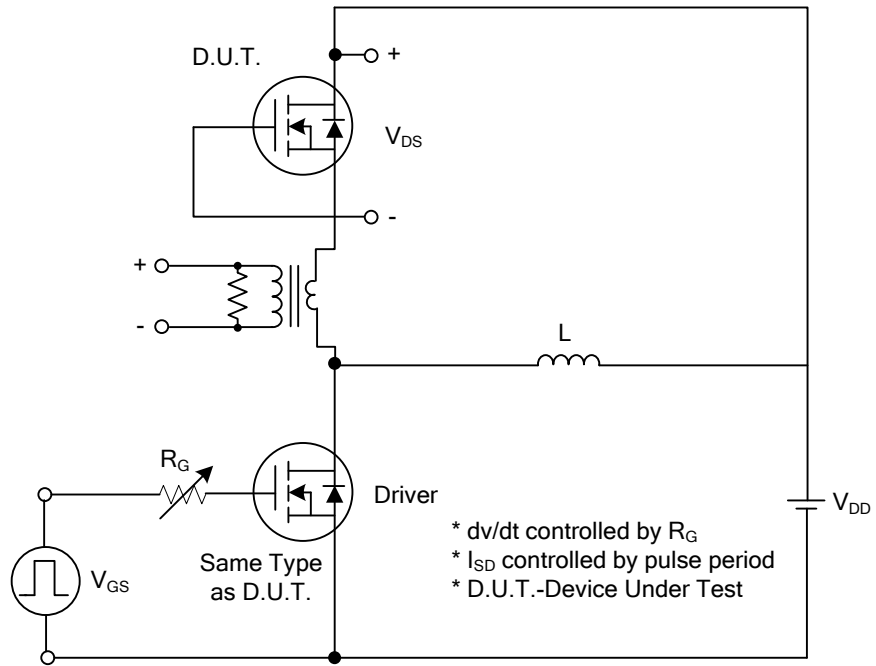
■ ELECTRICAL CHARACTERISTICS ( $T_C=25^\circ\text{C}$ , unless otherwise noted)

PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
<b>OFF CHARACTERISTICS</b>							
Drain-Source Breakdown Voltage		$BV_{DSS}$	$I_D=250\mu\text{A}$ , $V_{GS}=0\text{V}$	700			V
Breakdown Voltage Temperature Coefficient		$\Delta BV_{DSS}/\Delta T_J$	Reference to $25^\circ\text{C}$ , $I_D=250\mu\text{A}$		0.18		$^\circ\text{V}/^\circ\text{C}$
Drain-Source Leakage Current		$I_{DSS}$	$V_{DS}=700\text{V}$ , $V_{GS}=0\text{V}$			1	$\mu\text{A}$
			$V_{DS}=560\text{V}$ , $V_{GS}=0\text{V}$ , $T_C=125^\circ\text{C}$			10	$\mu\text{A}$
Gate-Source Leakage Current	Forward	$I_{GSS}$	$V_{GS}=+20\text{V}$ , $V_{DS}=0\text{V}$			+10	$\mu\text{A}$
	Reverse		$V_{GS}=-20\text{V}$ , $V_{DS}=0\text{V}$			-10	$\mu\text{A}$
<b>ON CHARACTERISTICS</b>							
Gate Threshold Voltage		$V_{GS(TH)}$	$V_{DS}=V_{GS}$ , $I_D=250\mu\text{A}$	2		4	V
Static Drain-Source On-State Resistance		$R_{DS(ON)}$	$V_{GS}=10\text{V}$ , $I_D=2.5\text{A}$		2.15	2.5	$\Omega$
<b>DYNAMIC PARAMETERS</b>							
Input Capacitance		$C_{ISS}$	$V_{GS}=0\text{V}$ , $V_{DS}=25\text{V}$ , $f=1.0\text{MHz}$		420	625	pF
Output Capacitance		$C_{OSS}$			55	65	pF
Reverse Transfer Capacitance		$C_{RSS}$			9	12	pF
<b>SWITCHING PARAMETERS</b>							
Turn-ON Delay Time		$t_{D(ON)}$	$V_{DD}=30\text{V}$ , $I_D=0.5\text{A}$ , $R_G=25\Omega$ (Note 1, 2)		40	60	ns
Rise Time		$t_R$			42	60	ns
Turn-OFF Delay Time		$t_{D(OFF)}$			135	155	ns
Fall-Time		$t_F$			48	60	ns
Total Gate Charge		$Q_G$	$V_{GS}=5\text{V}$ , $V_{DS}=160\text{V}$ , $I_D=4.5\text{A}$ (Note 1, 2)		70	90	nC
Gate to Source Charge		$Q_{GS}$			20		nC
Gate to Drain Charge		$Q_{GD}$			15		nC
<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		$V_{SD}$	$I_S=5\text{A}$ , $V_{GS}=0\text{V}$			1.4	V
Body Diode Reverse Recovery Time		$t_{rr}$	$I_S=4.5\text{A}$ , $V_{GS}=0\text{V}$ , $di_F/dt=100\text{A}/\mu\text{s}$		95		ns
Body Diode Reverse Recovery Charge		$Q_{RR}$	(Note 1)		0.3		$\mu\text{C}$

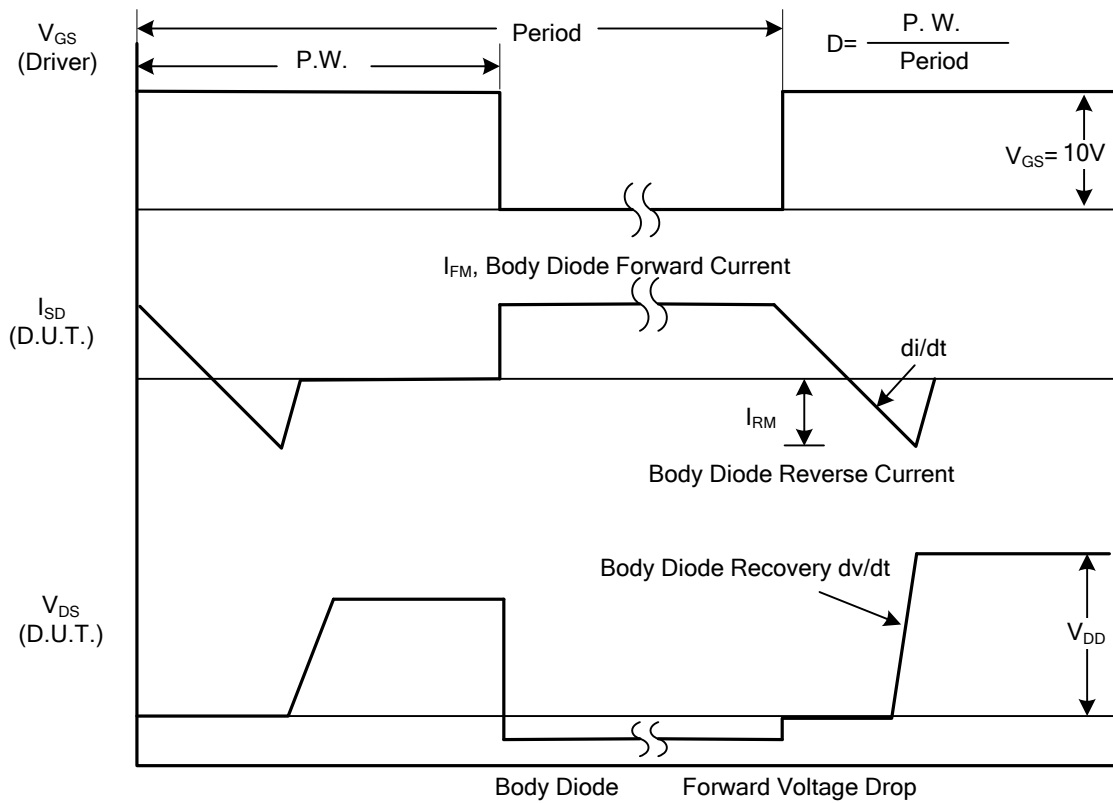
Notes: 1. Pulse Test: Pulse width  $\leq 300\mu\text{s}$ , Duty cycle  $\leq 2\%$

2. Essentially independent of operating temperature

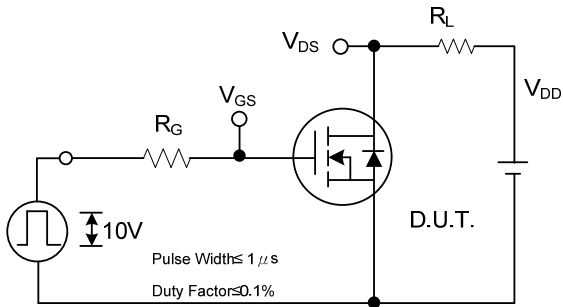
■ TEST CIRCUITS AND WAVEFORMS



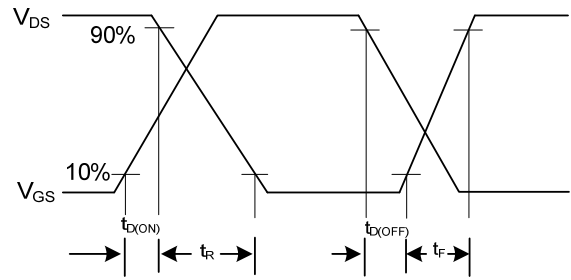
Peak Diode Recovery dv/dt Test Circuit



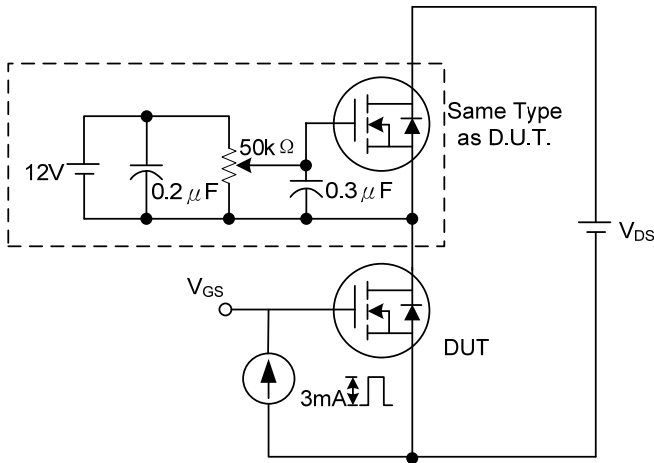
TEST CIRCUITS AND WAVEFORMS(Cont.)



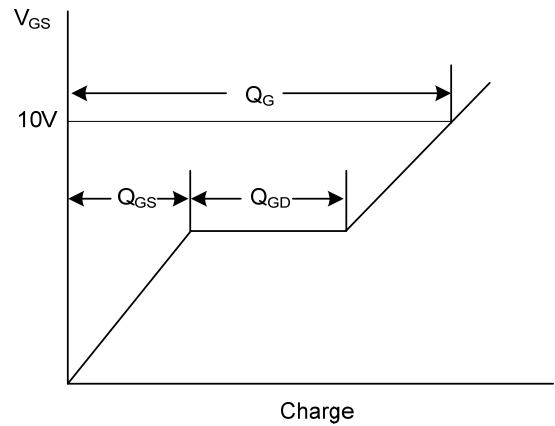
Switching Test Circuit



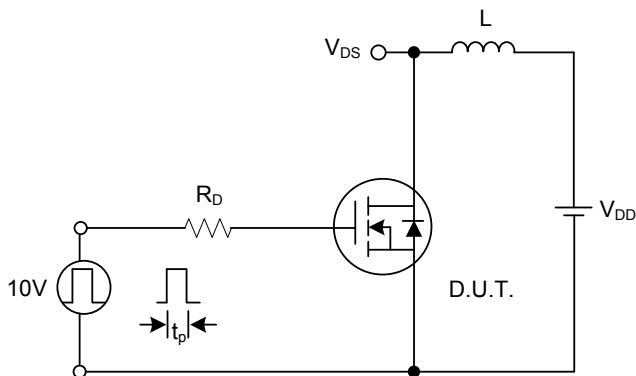
Switching Waveforms



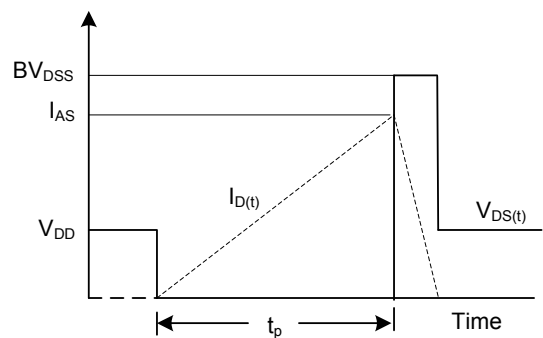
Gate Charge Test Circuit



Gate Charge Waveform

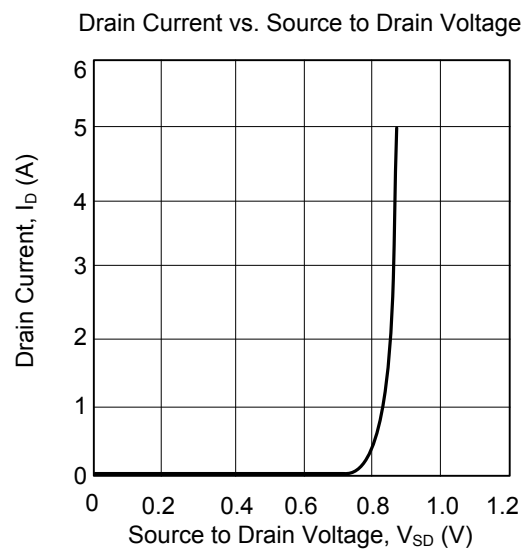
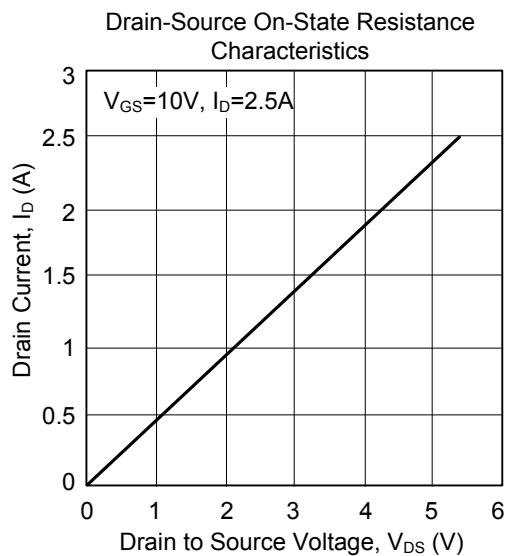
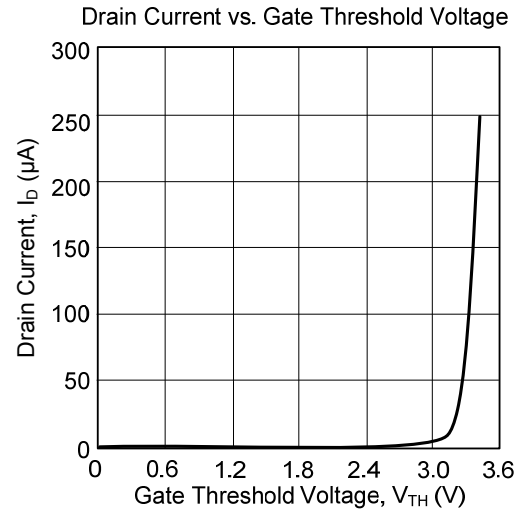
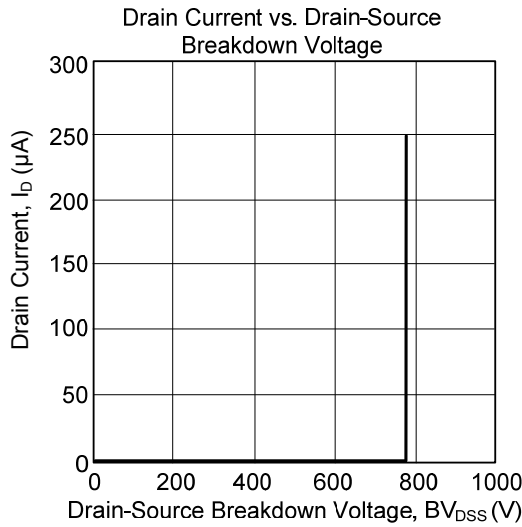


Unclamped Inductive Switching Test Circuit



Unclamped Inductive Switching Waveforms

### TYPICAL CHARACTERISTICS



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