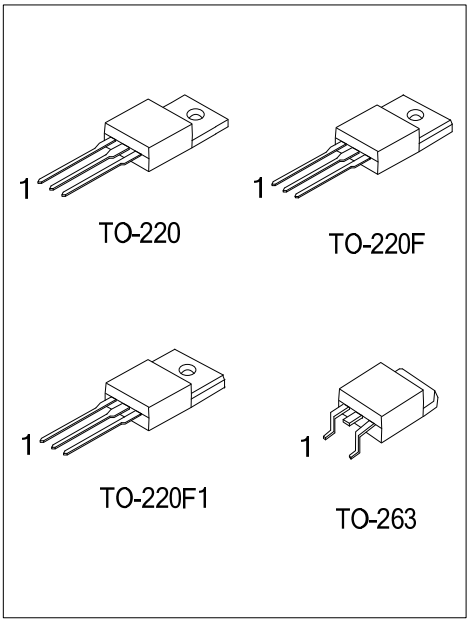
7N70

Power MOSFET

7A, 700V N-CHANNEL POWER MOSFET



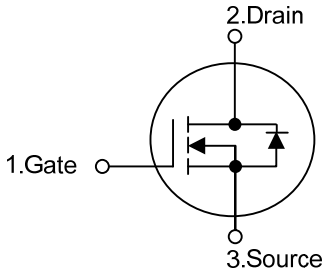
■ DESCRIPTION

The **UTC 7N70** 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 have a high rugged avalanche characteristics. This power MOSFET is usually used at high speed switching applications in power supplies, PWM motor controls, high efficient DC to DC converters and bridge circuits.

■ FEATURES

* $R_{DS(ON)}$ = 1.6Ω @V_{GS} = 10 V
* Ultra low gate charge (typical 30 nC)
* Low reverse transfer capacitance (C_{RSS} = typical 18 pF)
* Fast switching capability
* Avalanche energy specified
* Improved dv/dt capability, high ruggedness

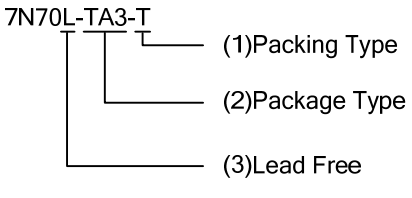
■ SYMBOL



■ ORDERING INFORMATION

Order Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
7N70L-TF3-T	7N70G-TF3-T	TO-220F	G	D	S	Tube
7N70L-TF1-T	7N70G-TF1-T	TO-220F1	G	D	S	Tube
7N70L-TA3-T	7N70G-TA3-T	TO-220	G	D	S	Tube
7N70L-TQ2-T	7N70G-TQ2-T	TO-263	G	D	S	Tube
7N70L-TQ2-T	7N70G-TQ2-T	TO-263	G	D	S	Tape Reel

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



(1) T: Tube, R: Tape Reel
(2) TA3: TO-220 ,TF3: TO-220F, TF1: TO-220F1, TQ2: TO-263
(3) L: Lead Free, G: Halogen Free

■ ABSOLUTE MAXIMUM RATINGS (T_C = 25°C, unless otherwise specified)

PARAMETER		SYMBOL	RATINGS	UNIT
Drain-Source Voltage		V_{DSS}	700	V
Gate-Source Voltage		V_{GSS}	±30	V
Continuous Drain Current	T_C = 25°C	I_D	7.0	A
	T_C = 100°C		4.7	A
Drain Current Pulsed (Note 2)		I_{DM}	28	A
Avalanche Energy, Single Pulsed (Note 3)		E_{AS}	530	mJ
Avalanche Energy, Repetitive, Limited by T_{JMAX}		E_{AR}	14.2	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	4.5	V/ns
Power Dissipation (T_C = 25°C)	TO-220F/TO-220F1	P_D	48	W
	TO-220/TO-263		142	W
Junction Temperature		T_J	+150	°C
Storage Temperature		T_{STG}	-55 ~ +150	°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 T_J
3. L=19.5mH, I_{AS}=7.0A, V_{DD}=50V, R_G=0 Ω, Starting T_J=25°C
4. I_{SD} ≤ 7.0A, di/dt ≤100A/μs, V_{DD} ≤ BV_{DSS}, Starting T_J=25°C

■ THERMAL DATA

PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Ambient	TO-220F/TO-220F1 TO-220/TO-263	θ_{JA}	62.5	°C/W
Junction to Case	TO-220F/TO-220F1	θ_{JC}	2.6	°C/W
	TO-220/TO-263		0.88	°C/W

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

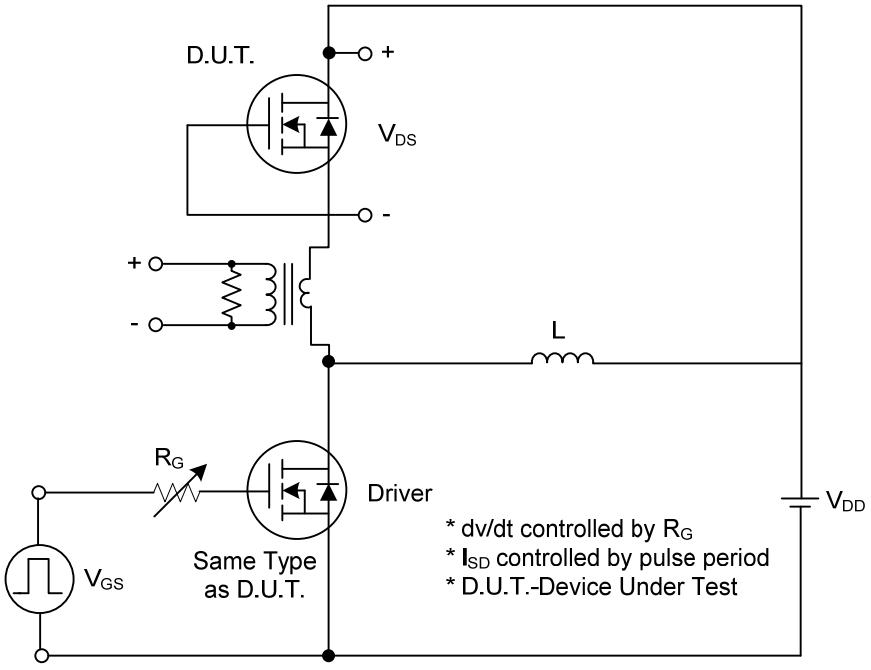
PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS							
Drain-Source Breakdown Voltage		BV_{DSS}	V_{GS} = 0V, I_D = 250μA	700			V
Drain-Source Leakage Current		I_{DSS}	V_{DS} = 700V, V_{GS} = 0V			1	μA
			V_{DS} = 560V, T_C = 125°C			1	μA
Gate-Source Leakage Current	Forward	I_{GSS}	V_{GS} = 30V, V_{DS} = 0V			100	nA
	Reverse		V_{GS} = -30V, V_{DS} = 0V			-100	nA
Breakdown Voltage Temperature Coefficient		$\triangle BV_{DSS}/\triangle T_J$	I_D = 250mA Referenced to 25°C		0.67		V/°C
ON CHARACTERISTICS							
Gate Threshold Voltage		$V_{GS(TH)}$	V_{DS} = V_{GS}, I_D = 250μA	2.0		4.0	V
Drain-Source ON-State Resistance		$R_{DS(ON)}$	V_{GS} = 10V, I_D = 3.5A		1.4	1.6	Ω
Forward Transconductance (Note 1)		g_{FS}	V_{DS} = 40V, I_D = 3.5A		8.0		S
DYNAMIC CHARACTERISTICS							
Input Capacitance		C_{ISS}	V_{DS} = 25V, V_{GS} = 0V, f = 1MHz		1200	1600	pF
Output Capacitance		C_{OSS}			150	190	pF
Reverse Transfer Capacitance		C_{RSS}			18	25	pF

■ ELECTRICAL CHARACTERISTICS(Cont.)

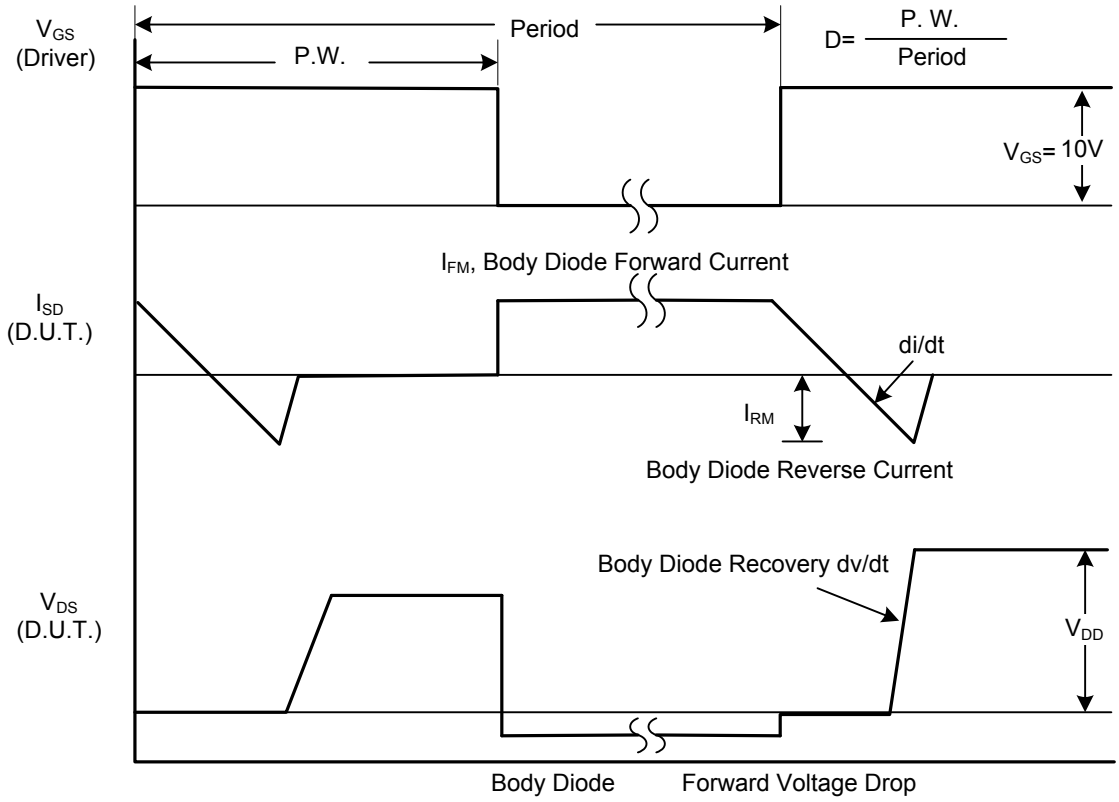
PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
SWITCHING CHARACTERISTICS						
Turn-on Delay Time	$t_{D(ON)}$	V_{DD} = 350V, I_D = 7.0A (Note 1, 2)		35	80	ns
Turn-on Rise Time	t_R			79	165	ns
Turn-off Delay Time	$t_{D(OFF)}$			80	160	ns
Turn-off Fall Time	t_F			52	120	ns
Total Gate Charge	Q_G	V_{DS}= 560V, I_D= 7.0A, V_{GS}= 10V (Note 1, 2)		30		nC
Gate-Source Charge	Q_{GS}			6.5		nC
Gate-Drain Charge	Q_{DD}			13		nC
SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS						
Drain-Source Diode Forward Voltage	V_{SD}	V_{GS} = 0V, I_S =7.0A			1.4	V
Maximum Continuous Drain-Source Diode Forward Current	I_S				7.0	A
Maximum Pulsed Drain-Source Diode Forward Current	I_{SM}				28	A
Reverse Recovery Time	t_{rr}	V_{GS} = 0V, I_S = 7.0A, dI_F/dt = 100 A/μs (Note 1)		320		ns
Reverse Recovery Charge	Q_{RR}			2.4		μC

Notes: 1. Pulse Test: Pulse width ≤ 300μs, Duty cycle ≤ 2%
2. Essentially independent of operating temperature

■ TEST CIRCUITS AND WAVEFORMS

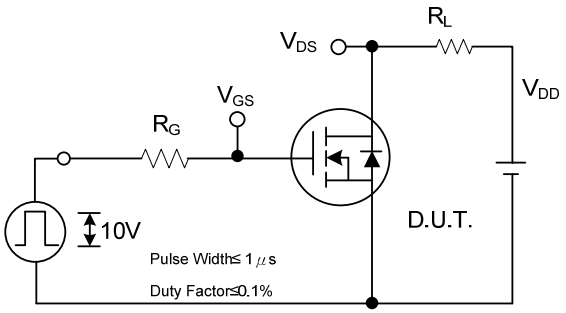


Peak Diode Recovery dv/dt Test Circuit

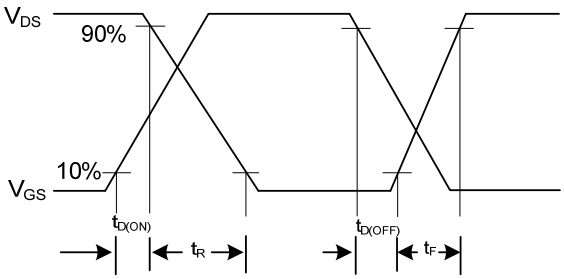


Peak Diode Recovery dv/dt Waveforms

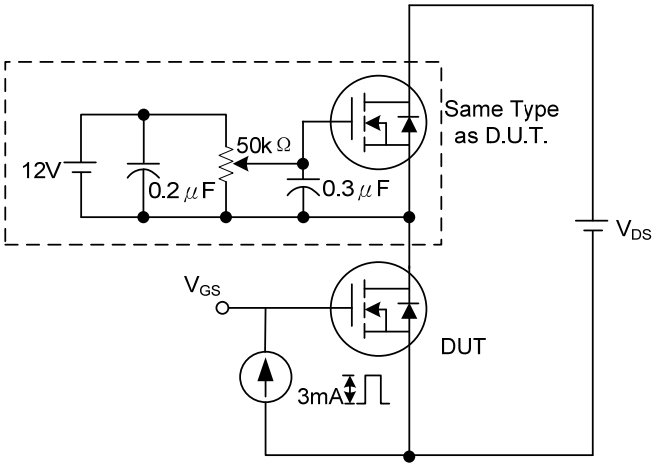
■ TEST CIRCUITS AND WAVEFORMS (Cont.)



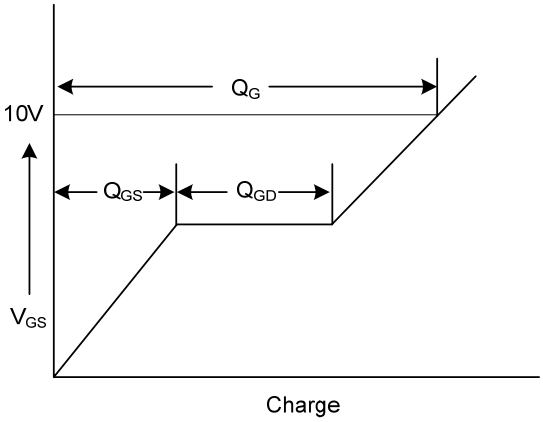
Switching Test Circuit



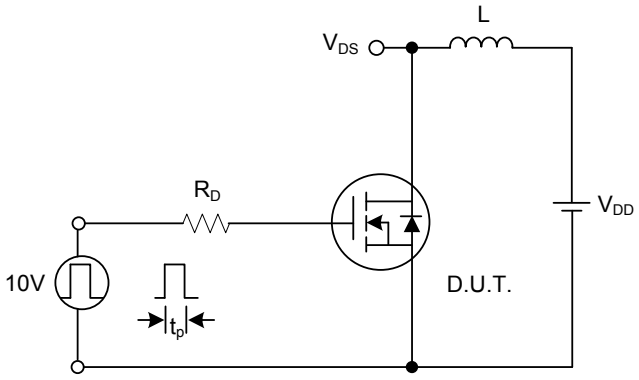
Switching Waveforms



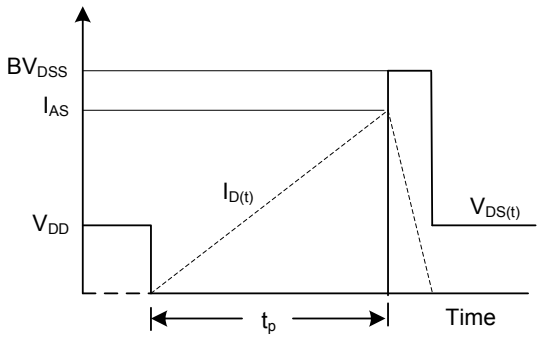
Gate Charge Test Circuit



Gate Charge Waveform



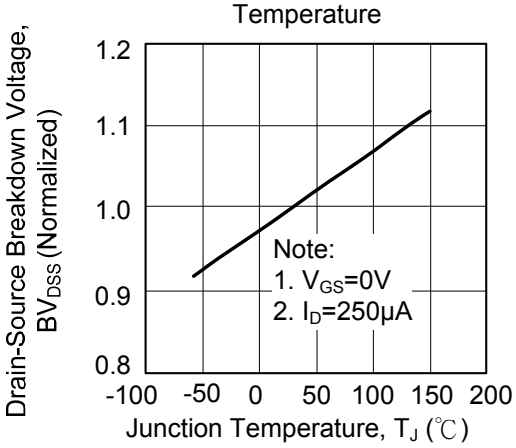
Unclamped Inductive Switching Test Circuit



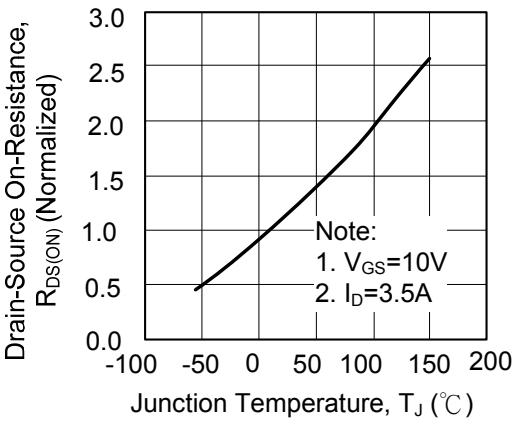
Unclamped Inductive Switching Waveforms

■ TYPICAL CHARACTERISTICS

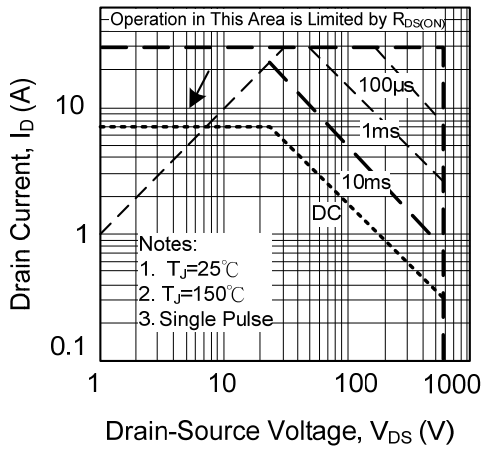
Breakdown Voltage Variation vs. Temperature



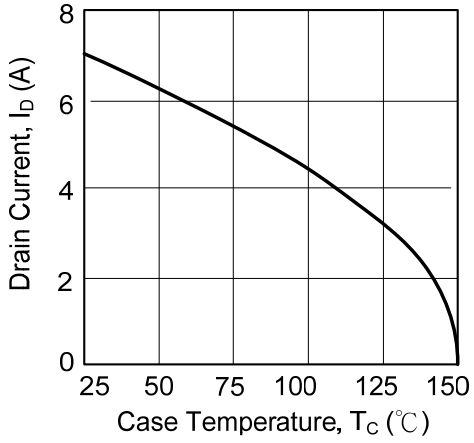
On-Resistance Junction Temperature



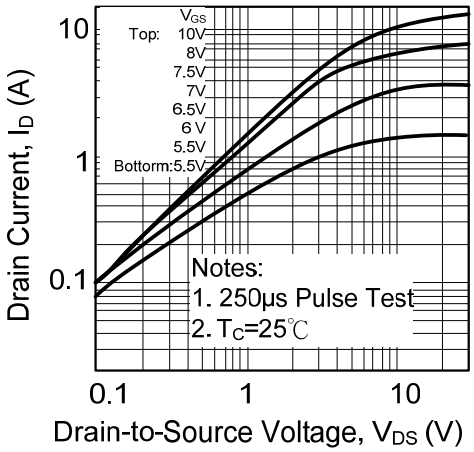
Maximum Safe Operating Area



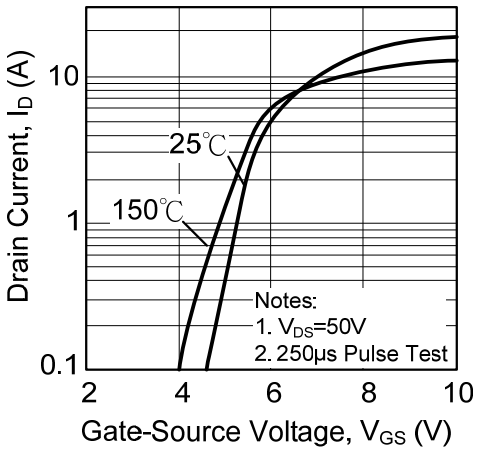
Maximum Drain Current vs. Case Temperature



On-State Characteristics

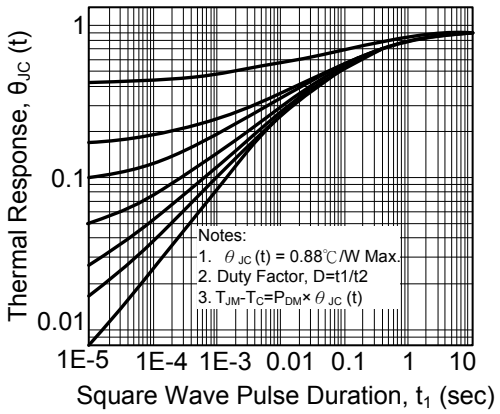


Transfer Characteristics

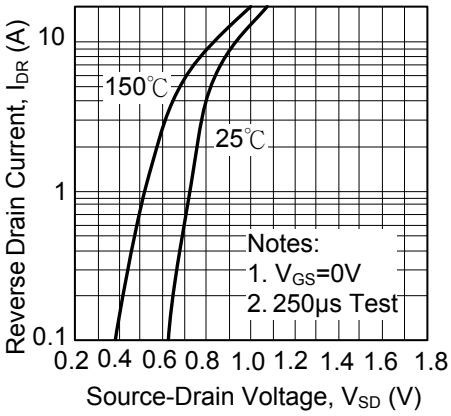


■ TYPICAL CHARACTERISTICS(Cont.)

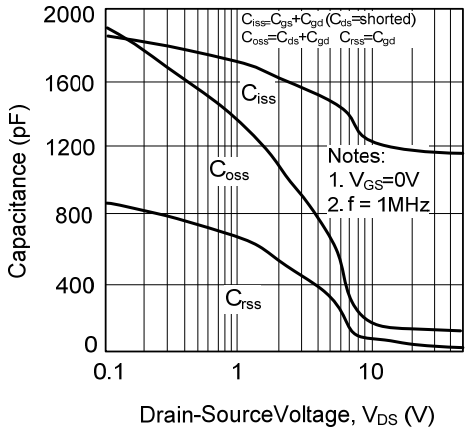
Transient Thermal Response Curve



On State Current vs.
Allowable Case Temperature



Capacitance Characteristics
(Non-Repetitive)



Gate Charge Characteristics