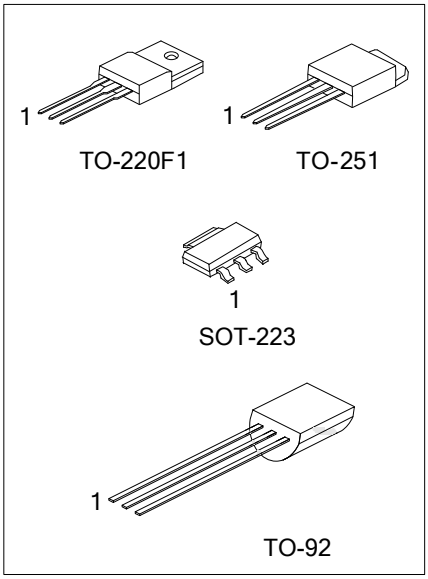
1.0A, 700V N-CHANNEL SUPER-JUNCTION MOSFET



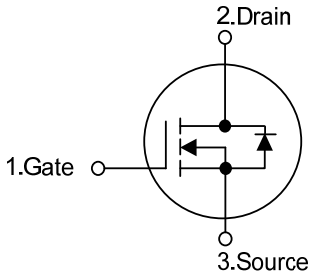
■ DESCRIPTION

The **UTC 1NM70-S** 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

* $R_{DS(ON)}$ < 4.3Ω @ V_{GS} = 10V, I_D =0.5A
* Fast switching capability
* Avalanche energy specified
* Improved dv/dt capability, high ruggedness

■ SYMBOL



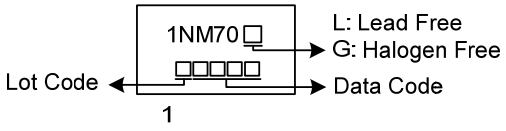
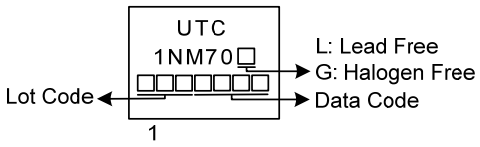
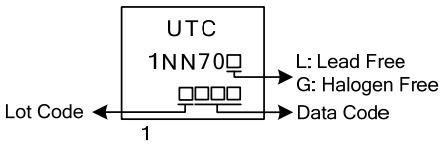
■ ORDERING INFORMATION

Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
1NM70L-AA3-R	1NM70G-AA3-R	SOT-223	G	D	S	Tape Reel
1NM70L-TF1-R	1NM70G-TF1-R	TO-220F1	G	D	S	Tape Reel
1NM70L-TM3-R	1NM70G-TM3-R	TO-251	G	D	S	Tape Reel
1NM70L-T92-B	1NM70G-T92-B	TO-92	G	D	S	Tape Box
1NM70L-T92-K	1NM70G-T92-K	TO-92	G	D	S	Bulk

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

1NM70G-AA3-R (1)Packing Type (2)Package Type (3)Green Package	(1) B: Tape Box, K: Bulk, R: Tape Reel (2) AA3: SOT-223, TF1: TO-220F1, TM3: TO-251, T92: TO-92 (3) G: Halogen Free and Lead Free, L: Lead Free

■ MARKING

Package	Marking
SOT-223	
TO-220F1 / TO-251	
TO-92	

■ 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
Drain Current	Continuous	I_D	1.0	A
	Pulsed (Note 2)	I_{DM}	4	A
Avalanche Current (Note 2)		I_{AR}	0.77	A
Avalanche Energy	Single Pulsed (Note 3)	E_{AS}	41	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	4.5	V/ns
Power Dissipation	SOT-223	P_D	8	W
	TO-220F1		21	W
	TO-251		28	W
	TO-92		1.6	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 maximum junction temperature.
3. L=138mH, I_{AS}=0.77A, V_{DD}=50V, R_G=25 Ω, Starting T_J = 25°C
4. I_{SD}≤1.0A, di/dt≤200A/μs, V_{DD} ≤ BV_{DSS}, Starting T_J = 25°C

■ THERMAL CHARACTERISTICS

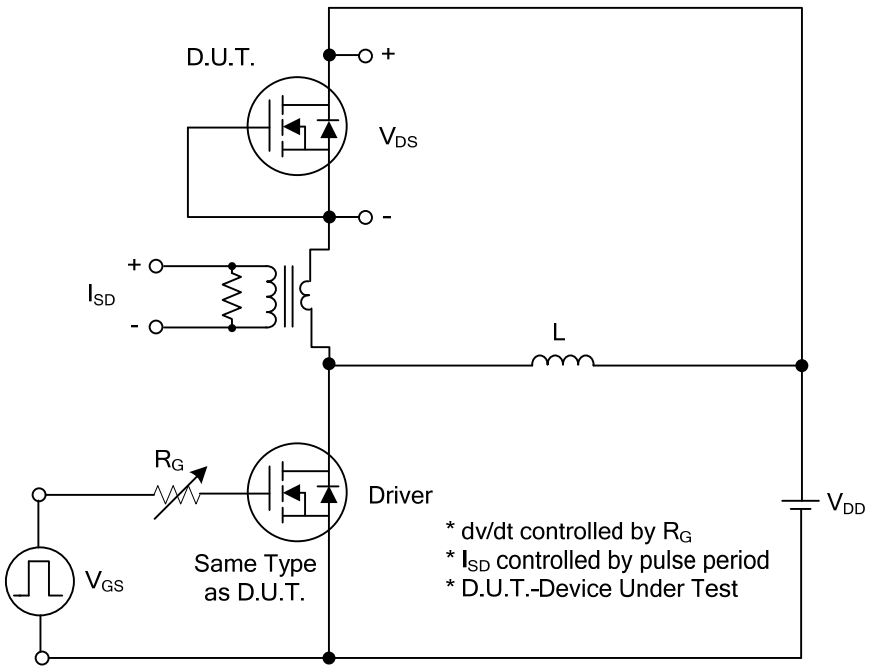
PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Ambient	SOT-223	θ_{JA}	150	°C/W
	TO-220F1		62.5	°C/W
	TO-251		110	°C/W
	TO-92		180	°C/W
Junction to Case	SOT-223	θ_{JC}	15.6	°C/W
	TO-220F1		5.95	°C/W
	TO-251		4.46	°C/W
	TO-92		78	°C/W

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

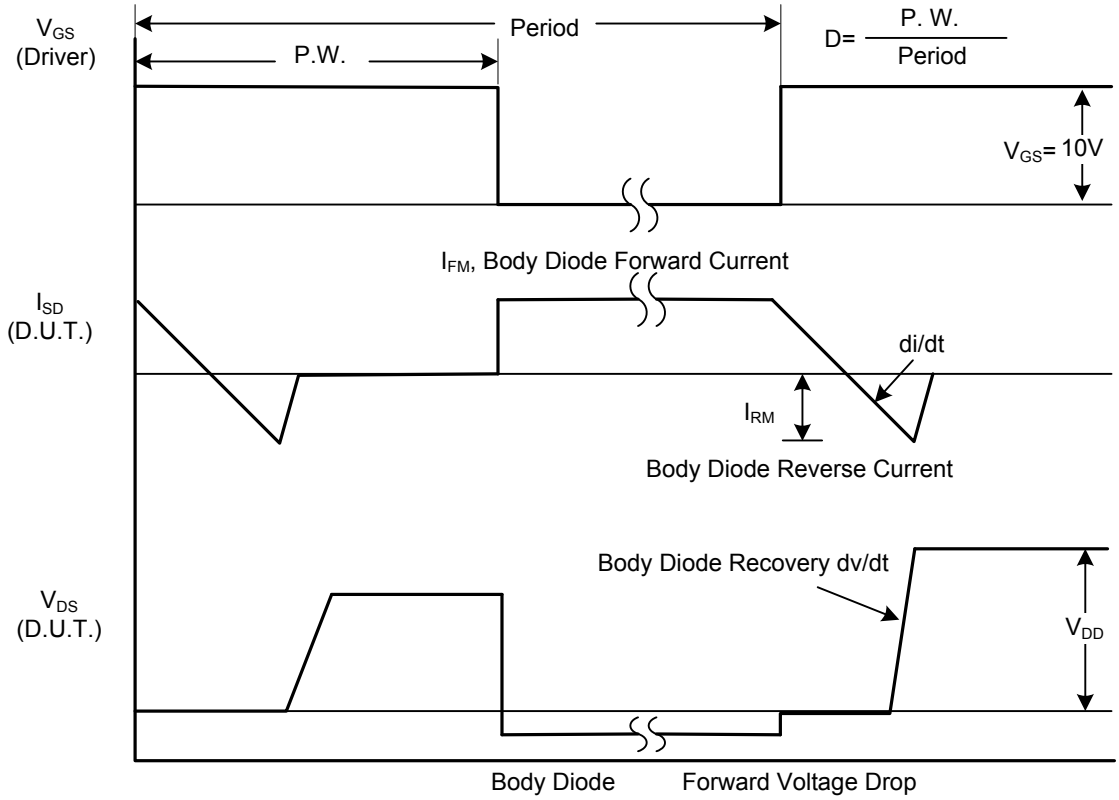
PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS							
Drain-Source Breakdown Voltage		BV_{DSS}	V_{GS} = 0V, I_D = 250μA	700			V
Drain-Source Leakage Current		I_{DSS}	V_{DS} = 700V, V_{GS} = 0V			10	μA
Gate-Source Leakage Current	Forward	I_{GSS}	V_{GS} = 30V, V_{DS} = 0V			100	nA
	Reverse		V_{GS} = -30V, V_{DS} = 0V			-100	nA
ON CHARACTERISTICS							
Gate Threshold Voltage		$V_{GS(TH)}$	V_{DS} = V_{GS}, I_D = 250μA	2.5		4.5	V
Static Drain-Source On-State Resistance		$R_{DS(ON)}$	V_{GS} = 10V, I_D =0.5A			4.3	Ω
DYNAMIC CHARACTERISTICS							
Input Capacitance		C_{ISS}	V_{DS} =25V, V_{GS} =0V, f =1MHz		116		pF
Output Capacitance		C_{OSS}			62		pF
Reverse Transfer Capacitance		C_{RSS}			8		pF
SWITCHING CHARACTERISTICS							
Total Gate Charge (Note 1)		Q_G	V_{DS}=50V, V_{GS}=10V, I_D=0.5A I_G=100μA (Note 1, 2)		14.6		nC
Gate-Source Charge		Q_{GS}			1.5		nC
Gate-Drain Charge		Q_{GD}			4.5		nC
Turn-On Delay Time (Note 1)		$t_{D(ON)}$	V_{DD}=30V, V_{GS}=10V, I_D =0.5A, R_G =25Ω (Note 1, 2)		37		ns
Turn-On Rise Time		t_R			38		ns
Turn-Off Delay Time		$t_{D(OFF)}$			63		ns
Turn-Off Fall Time		t_F			19		ns
DRAIN-SOURCE DIODE CHARACTERISTICS							
Continuous Drain-Source Current		I_S				1.0	A
Maximum Body-Diode Pulsed Current		I_{SM}				4.0	A
Drain-Source Diode Forward Voltage (Note 1)		V_{SD}	I_S=1.0A, V_{GS}=0V			1.4	V
Body Diode Reverse Recovery Time (Note 1)		t_{rr}	I_S=1.0A, V_{GS}=0V, dI_F/dt=100A/μs		162		nS
Body Diode Reverse Recovery Charge		Q_{rr}			0.7		μC

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

■ TEST CIRCUITS AND WAVEFORMS

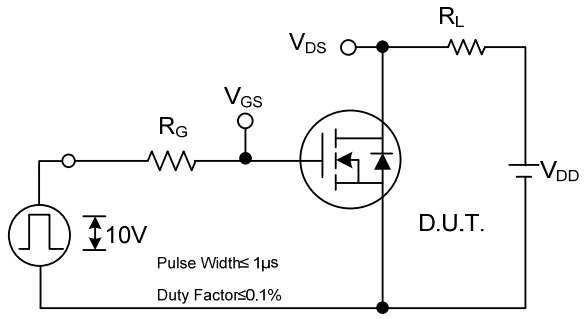


Peak Diode Recovery dv/dt Test Circuit

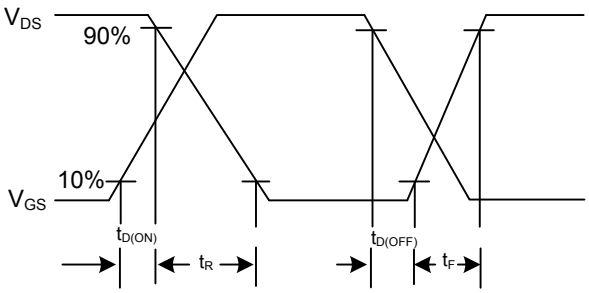


Peak Diode Recovery dv/dt Waveforms

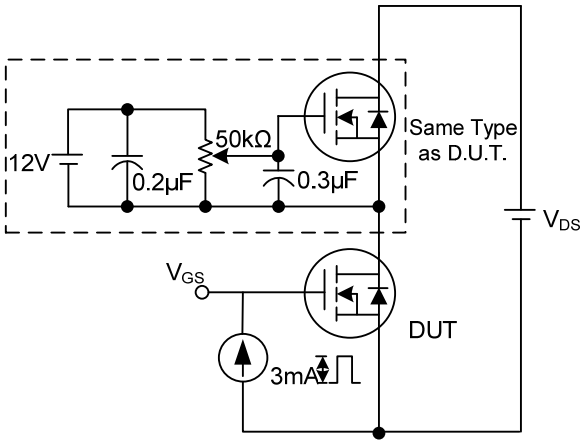
■ TEST CIRCUITS AND WAVEFORMS (Cont.)



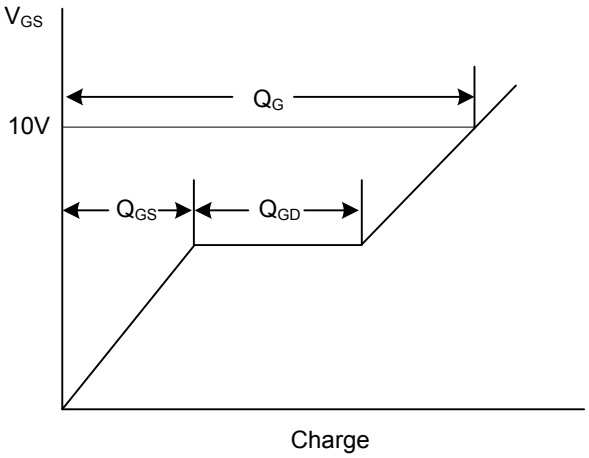
Switching Test Circuit



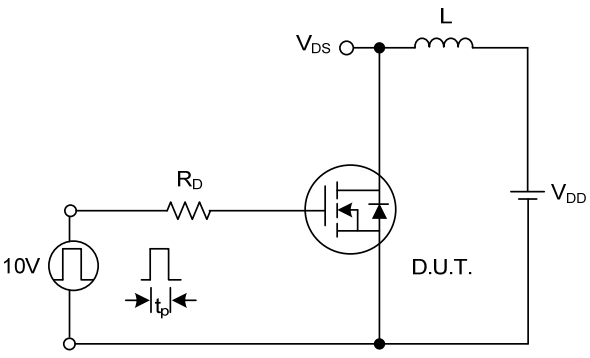
Switching Waveforms



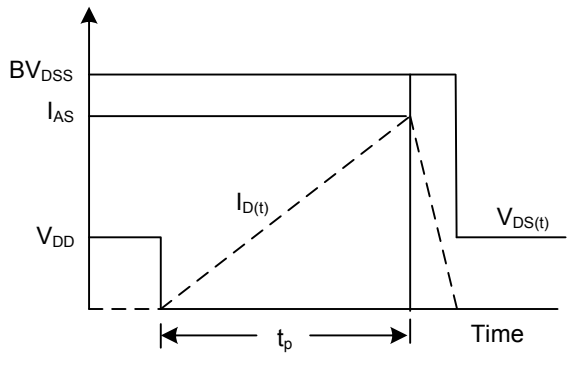
Gate Charge Test Circuit



Gate Charge Waveform



Unclamped Inductive Switching Test Circuit



Unclamped Inductive Switching Waveforms