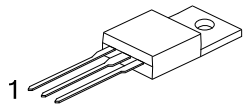
9.0A, 600V N-CHANNEL SUPER-JUNCTION MOSFET



TO-220WF

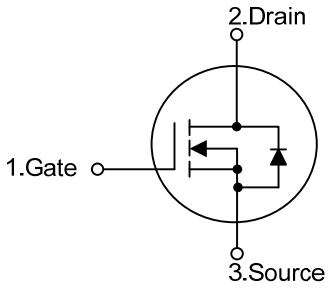
■ DESCRIPTION

The **UTC 9NM60-Q** 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

* $R_{DS(ON)} \leq 0.7\ \Omega$ @ V_{GS}=10V,I_D=4.5A
* By using Super Junction Structure
* Fast Switching
* With 100% Avalanche Tested

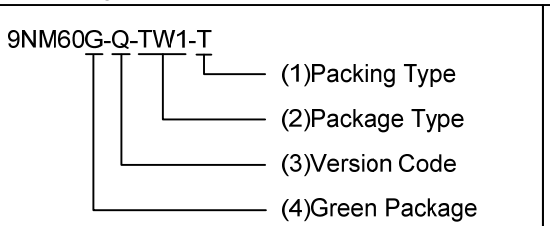
■ SYMBOL



■ ORDERING INFORMATION

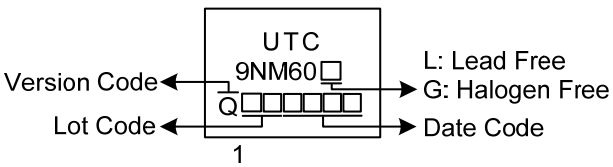
Order Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
9NM60L-Q-TW1-T	9NM60G-Q-TW1-T	TO-220WF	G	D	S	Tube

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



(1) T: Tube
(2) TW1: TO-220WF
(3) Version Q
(4) G: Halogen Free and Lead Free, L: Lead Free

■ MARKING



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

PARAMETER		SYMBOL	RATINGS	UNIT
Drain-Source Voltage		V_{DSS}	600	V
Gate-Source Voltage		V_{GSS}	±30	V
Drain Current	Continuous	I_D	9.0	A
	Pulsed (Note 2)	I_{DM}	36	A
Avalanche Energy	Single Pulsed (Note 3)	E_{AS}	183	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	6	V/ns
Power Dissipation		P_D	50	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 = 60mH, I_{AS} = 2.47A, V_{DD} = 50V, R_G = 25Ω, Starting T_J = 25°C
4. I_{SD} ≤ 9.0A, di/dt ≤ 200A/μs, V_{DD} ≤ BV_{DSS}, Starting T_J = 25°C

■ THERMAL DATA

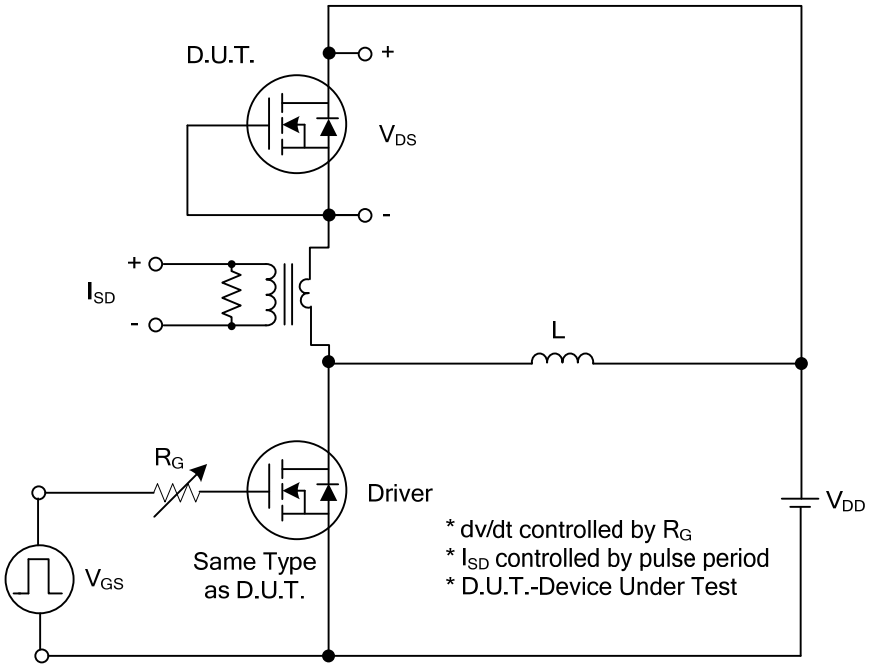
PARAMETER	SYMBOL	RATINGS	UNIT
Junction to Ambient	θ_{JA}	62.5	°C/W
Junction to Case	θ_{JC}	2.5	°C/W

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

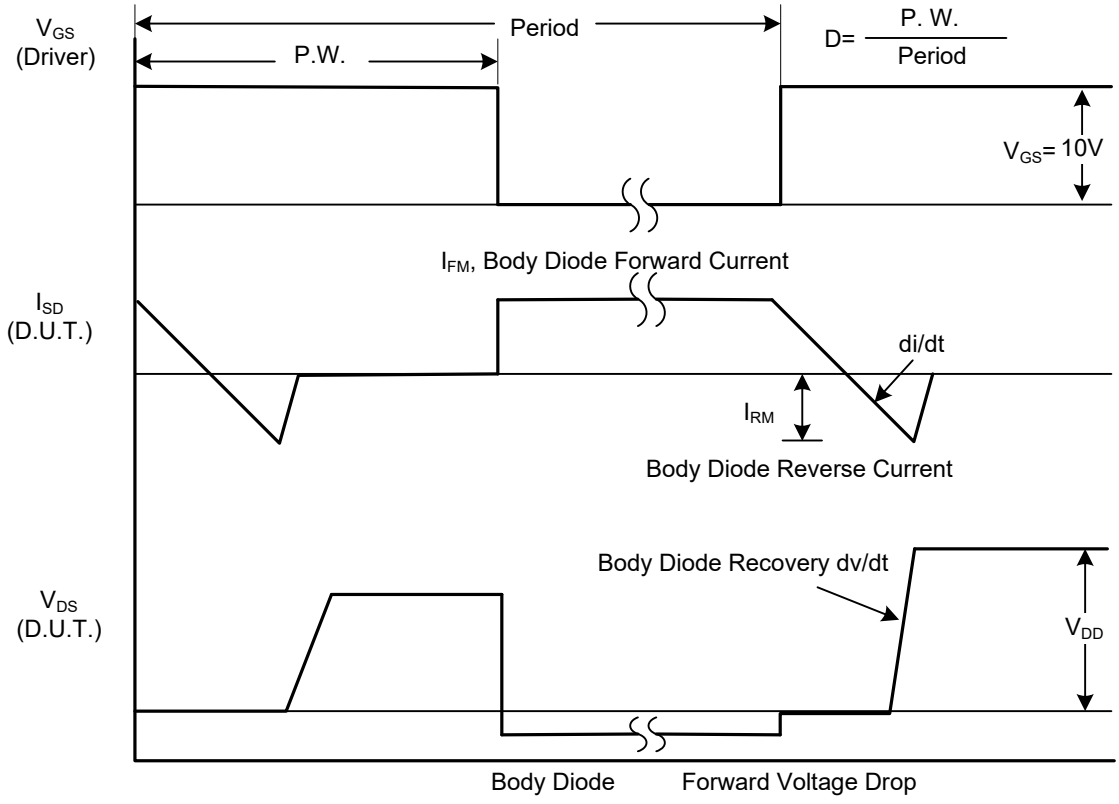
PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS							
Drain-Source Breakdown Voltage		BV_{DSS}	I_D=250μA, V_{GS}=0V	600			V
Drain-Source Leakage Current		I_{DSS}	V_{DS}=600V, V_{GS}=0V			10	μA
Gate- Source Leakage Current	Forward	I_{GSS}	V_{GS}=30V, V_{DS}=0V			100	nA
	Reverse		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=4.5A			0.7	Ω
DYNAMIC PARAMETERS							
Input Capacitance		C_{ISS}	V_{DS}=25V, V_{GS}=0V, f=1.0MHz		465		pF
Output Capacitance		C_{OSS}			300		pF
Reverse Transfer Capacitance		C_{RSS}			25		pF
SWITCHING PARAMETERS							
Total Gate Charge (Note 1)		Q_G	V_{DS}=50V, V_{GS}=10V, I_D=1.3A , I_G=100μA (Note 1, 2)		63		nC
Gate to Source Charge		Q_{GS}			5		nC
Gate to Drain Charge		Q_{GD}			15		nC
Turn-ON Delay Time (Note 1)		$t_{D(ON)}$	V_{DD}=30V, I_D=0.5A, R_G=25Ω V_{GS}=10V (Note 1, 2)		54		ns
Rise Time		t_R			116		ns
Turn-OFF Delay Time		$t_{D(OFF)}$			176		ns
Fall-Time		t_F			86		ns
SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS							
Maximum Body-Diode Continuous Current		I_S				9	A
Maximum Body-Diode Pulsed Current		I_{SM}				36	A
Drain-Source Diode Forward Voltage (Note 1)		V_{SD}	I_S=9.0A,V_{GS}=0V			1.4	V
Reverse Recovery Time (Note 1)		t_{rr}	I_S=9.0A,V_{GS}=0V, dI_F/dt=100A/μs		314		ns
Reverse Recovery Charge		Q_{rr}			0.385		μC

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

■ TEST CIRCUITS AND WAVEFORMS

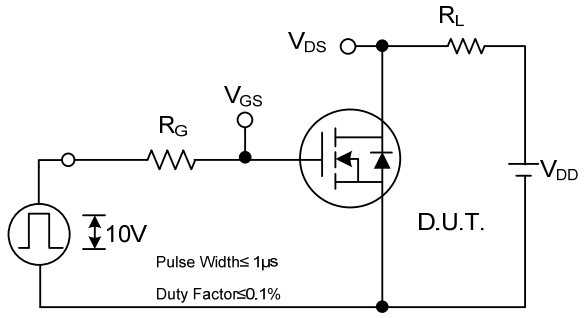


Peak Diode Recovery dv/dt Test Circuit

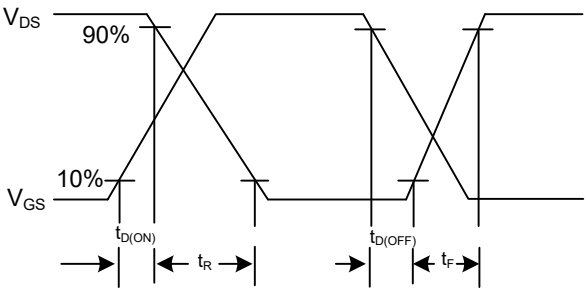


Peak Diode Recovery dv/dt Waveforms

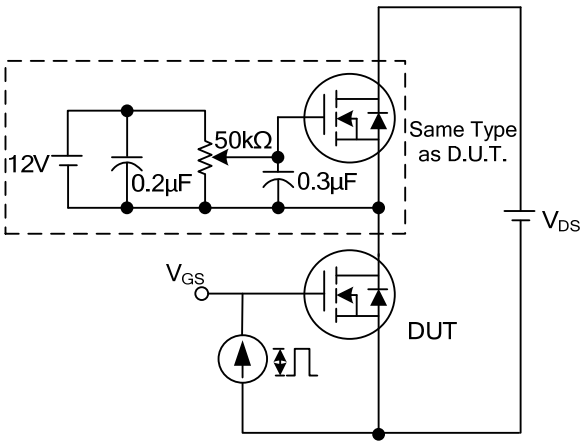
■ TEST CIRCUITS AND WAVEFORMS



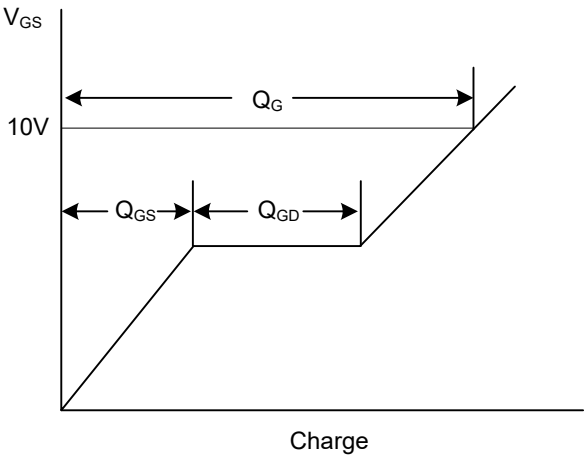
Switching Test Circuit



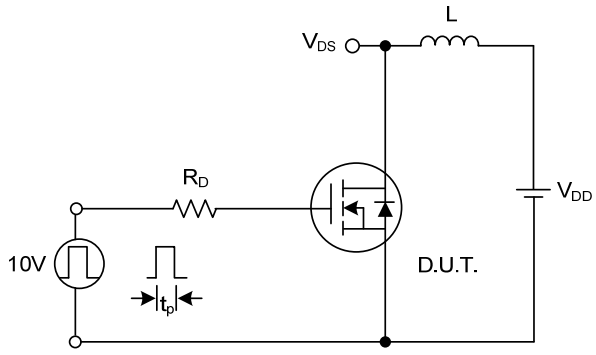
Switching Waveforms



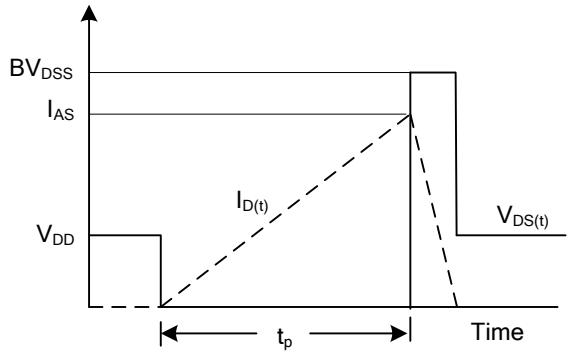
Gate Charge Test Circuit



Gate Charge Waveform



Unclamped Inductive Switching Test Circuit



Unclamped Inductive Switching Waveforms