



9NM65-V

Power MOSFET

9A, 650V N-CHANNEL SUPER-JUNCTION MOSFET

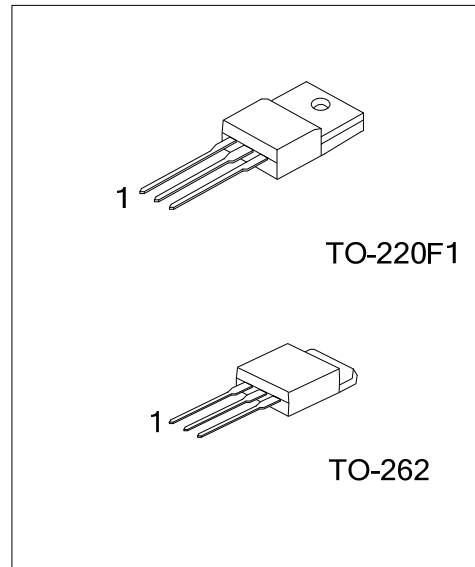
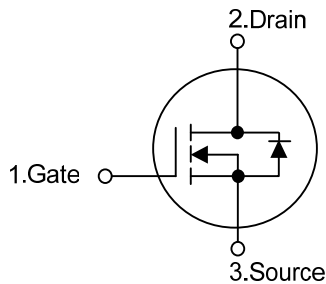
■ DESCRIPTION

The **UTC 9NM65-V** 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

- * $R_{DS(ON)} < 0.62 \Omega @ V_{GS} = 10V, I_D = 4.5A$
- * Fast Switching Capability
- * Avalanche Energy Tested
- * Improved dv/dt Capability, High Ruggedness

■ SYMBOL



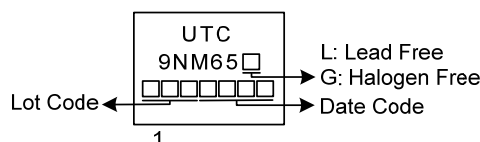
■ ORDERING INFORMATION

Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen-Free		1	2	3	
9NM65L-TF1-T	9NM65G-TF1-T	TO-220F1	G	D	S	Tube
9NM65L-T2Q-T	9NM65G-T2Q-T	TO-262	G	D	S	Tube

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

<p>9NM65G-TF1-T</p>	<p>(1) T: Tube (2) TF1: TO-220F1, T2Q: TO-262 (3) G: Halogen Free and Lead Free, L: Lead Free</p>
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■ MARKING



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

PARAMETER		SYMBOL	RATINGS	UNIT
Drain-Source Voltage		V_{DSS}	650	V
Gate-Source Voltage		V_{GSS}	± 30	V
Drain Current	Continuous	I_D	9	A
	Pulsed (Note 2)	I_{DM}	18	A
Avalanche Energy	Single Pulsed (Note 3)	E_{AS}	346	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	6	V/ns
Power Dissipation	TO-220F1	P_D	46	W
	TO-262		154	W
Junction Temperature		T_J	+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. $L=60\text{mH}$, $I_{AS}=3.4\text{A}$, $V_{DD}=50\text{V}$, $R_G=25\ \Omega$, Starting $T_J = 25^\circ\text{C}$

4. $I_{SD}\leq 9.0\text{A}$, $di/dt\leq 200\text{A}/\mu\text{s}$, $V_{DD}\leq BV_{DSS}$, Starting $T_J = 25^\circ\text{C}$

■ THERMAL DATA

PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Ambient		θ_{JA}	62.5	$^\circ\text{C}/\text{W}$
Junction to Case	TO-220F1	θ_{JC}	2.72	$^\circ\text{C}/\text{W}$
	TO-262		0.81	$^\circ\text{C}/\text{W}$

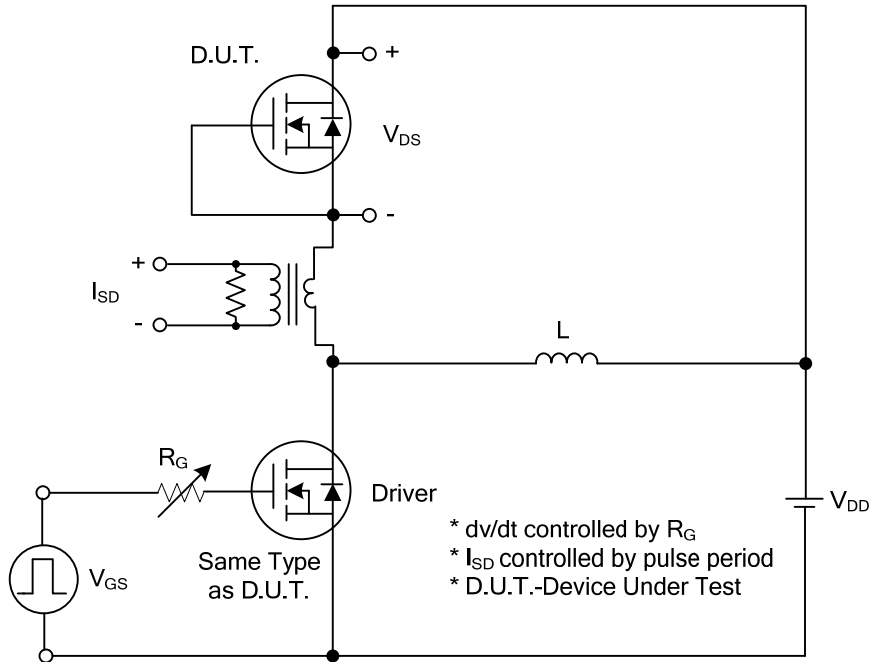
■ ELECTRICAL CHARACTERISTICS (T_J=25°C, unless otherwise specified)

PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT	
OFF CHARACTERISTICS								
Drain-Source Breakdown Voltage		BV _{DSS}	V _{GS} = 0V, I _D = 250μA	650			V	
Drain-Source Leakage Current		I _{DSS}	V _{DS} = 650V, 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	1.0		3.0	V	
Static Drain-Source On-State Resistance		R _{DS(ON)}	V _{GS} = 10V, I _D = 4.5A			0.62	Ω	
DYNAMIC CHARACTERISTICS								
Input Capacitance		C _{ISS}	V _{GS} =0V, V _{DS} =25V, f=1MHz		810		pF	
Output Capacitance		C _{OSS}				365		pF
Reverse Transfer Capacitance		C _{RSS}				25		pF
SWITCHING CHARACTERISTICS								
Total Gate Charge (Note 1)		Q _G	V _{DS} =150V, V _{GS} =10V, I _D =5A I _G =3mA (Note 1, 2)		24		nC	
Gate-source Charge		Q _{GS}				4.8		nC
Gate-Drain Charge		Q _{GD}				6.6		nC
Turn-ON Delay Time (Note 1)		t _{D(ON)}	V _{DD} =80V, V _{GS} =10V, I _D =8A, R _G =25Ω (Note 1, 2)		6		ns	
Rise Time		t _R				22		ns
Turn-OFF Delay Time		t _{D(OFF)}				110		ns
Fall-Time		t _F				50		ns
SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS								
Maximum Body-Diode Continuous Current		I _S				9	A	
Maximum Body-Diode Pulsed Current		I _{SM}				18	A	
Drain-Source Diode Forward Voltage (Note 1)		V _{SD}	I _S =9A, V _{GS} =0V			1.4	V	
Body Diode Reverse Recovery Time (Note 1)		t _{rr}	I _S =9A, V _{GS} =0V, di/dt=100A/μs			250	ns	
Body Diode Reverse Recovery Charge		Q _{rr}				2.2		μC

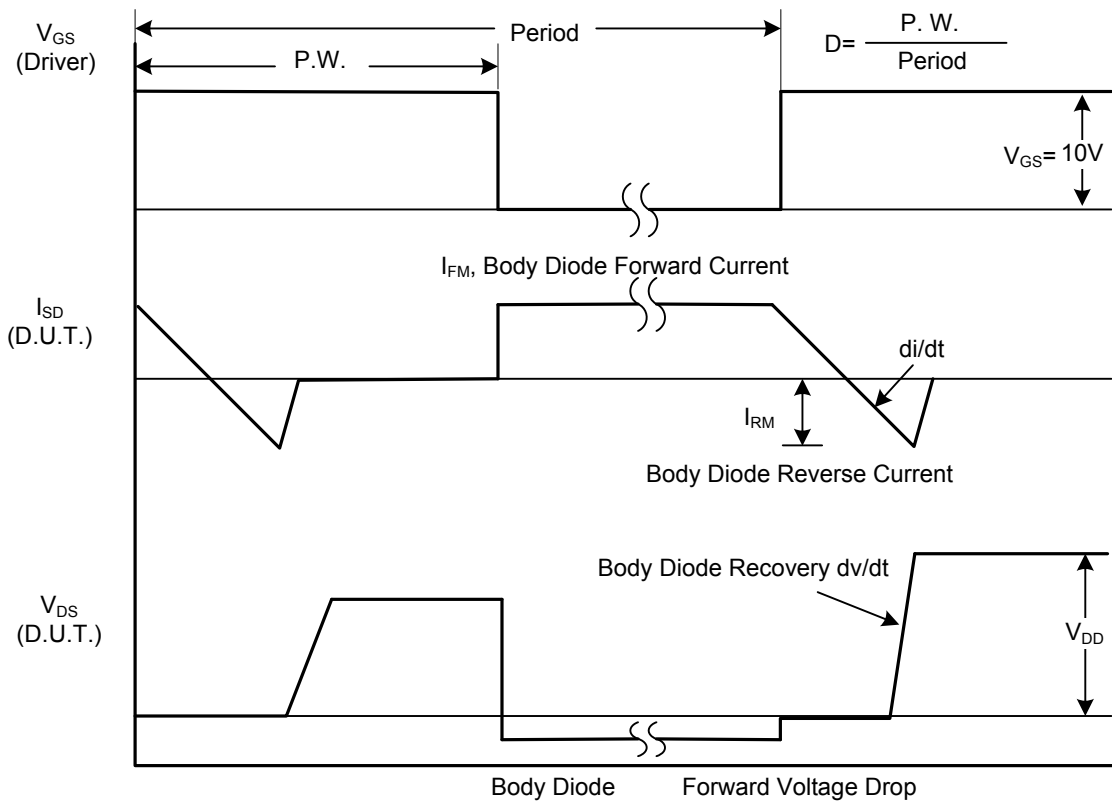
Notes: 1. Pulse Test: Pulse width ≤ 300μs, Duty cycle ≤ 2%.

2. Essentially independent of operating temperature.

■ TEST CIRCUITS AND WAVEFORMS

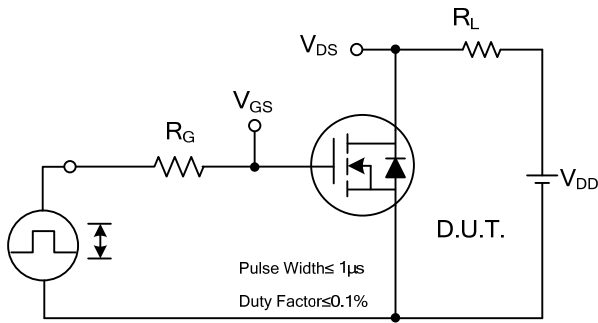


Peak Diode Recovery dv/dt Test Circuit

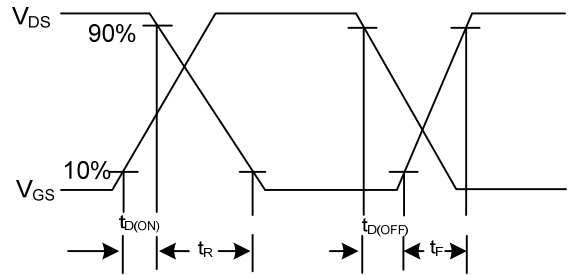


Peak Diode Recovery dv/dt Waveforms

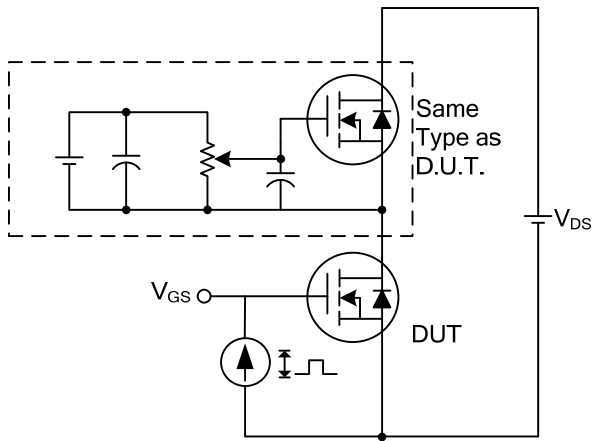
TEST CIRCUITS AND WAVEFORMS



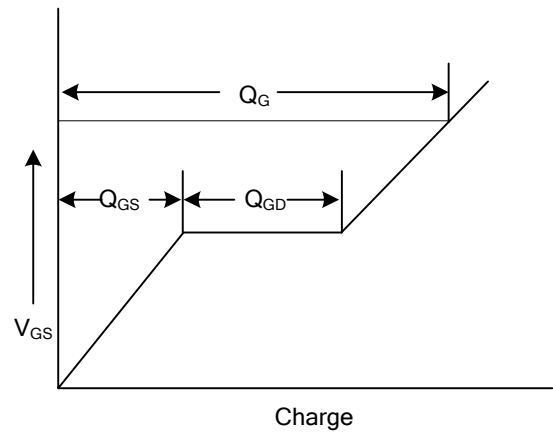
Switching Test Circuit



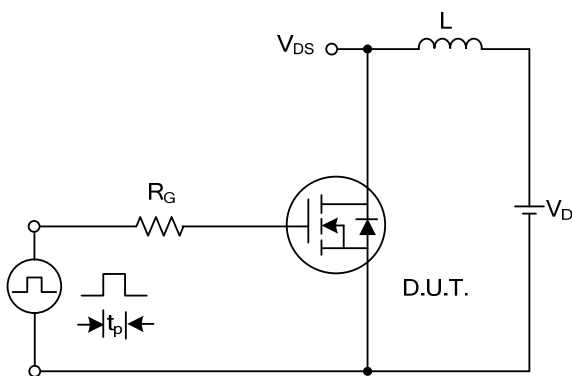
Switching Waveforms



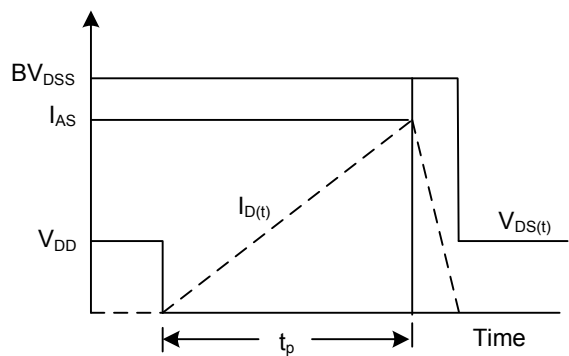
Gate Charge Test Circuit



Gate Charge Waveform

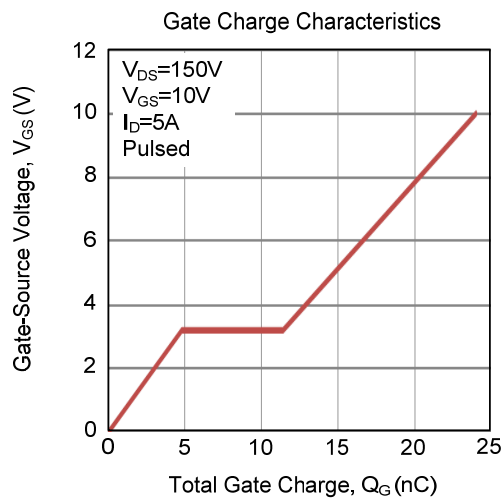


Unclamped Inductive Switching Test Circuit



Unclamped Inductive Switching Waveforms

■ TYPICAL CHARACTERISTICS



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