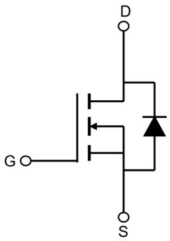
Description

Features	Application
● 650V, 9A $R_{DS(ON)}$ < 1.08Ω @ V_{GS} = 10V ● Fast Switching ● Improved dv/dt Capability	● Load Switch ● PWM Application ● Power management 100% UIS 100% ΔVds

TO-220F



Schematic Diagram

Package Marking and Ordering Information

Device Marking	Device	OUTLINE	Device Package	TUBE (PCS)	Inner Box (PCS)	Per Carton (PCS)
VSM9N65-TF	VSM9N65	TUBE	TO-220F	50	1,000	5,000

Absolute Maximum Ratings (T_C=25℃ unless otherwise specified)

Symbol	Parameter		Max.	Units
V_{DSS}	Drain-Source Voltage		650	V
V_{GSS}	Gate-Source Voltage		±30	V
I_D	Continuous Drain Current	T_C = 25℃	9	A
		T_C = 100℃	5.8	A
I_{DM}	Pulsed Drain Current note1		36	36
E_{AS}	Single Pulsed Avalanche Energy note2		218	mJ
P_D	Power Dissipation	T_C = 25℃	31	W
$R_{\theta JC}$	Thermal Resistance, Junction to Case		4	℃/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient		62.5	℃/W
T_J, T_{STG}	Operating and Storage Temperature Range		-55 to +150	℃

Electrical Characteristics (T_J=25℃ unless otherwise specified)

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Units
Off Characteristic						
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	V_{GS}=0V, I_D=250μA	650	-	-	V
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS}=650V, V_{GS}=0V, T_J=25℃	-	-	1	μA
I_{GSS}	Gate to Body Leakage Current	V_{DS}=0V, V_{GS}= ±30V	-	-	±100	nA
On Characteristics						
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS}=V_{GS}, I_D=250μA	2	3	4	V
$R_{DS(on)}$	Static Drain-Source on-Resistance note3	V_{GS} =10V, I_D =4.5A	-	0.85	1.08	Ω
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS}=25V, V_{GS}=0V, f=1.0MHz	-	1400	-	pF
C_{oss}	Output Capacitance		-	114	-	pF
C_{rss}	Reverse Transfer Capacitance		-	26	-	pF
Q_g	Total Gate Charge	V_{DD}=520V, I_D=9A, V_{GS}=10V	-	32	-	nC
Q_{gs}	Gate-Source Charge		-	5	-	nC
Q_{gd}	Gate-Drain(“Miller”) Charge		-	16	-	nC
Switching Characteristics						
$t_{d(on)}$	Turn-on Delay Time	V_{DD}=325V, I_D=9A, R_G=25Ω	-	23	-	ns
t_r	Turn-on Rise Time		-	15	-	ns
$t_{d(off)}$	Turn-off Delay Time		-	90	-	ns
t_f	Turn-off Fall Time		-	30	-	ns
Drain-Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain to Source Diode Forward Current		-	-	9	A
I_{SM}	Maximum Pulsed Drain to Source Diode Forward Current		-	-	36	A
V_{SD}	Drain to Source Diode Forward Voltage	V_{GS}=0V, I_{SD}=10A	-	-	1.4	V
t_{rr}	Reverse Recovery Time	V_{GS}=0V, I_S=10A, di/dt=100A/μs	-	310	-	ns
Q_{rr}	Reverse Recovery Charge		-	4.1	-	μC

Notes:1. Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature

2. EAS condition: T_J = 25°C, V_{DD} = 50V, V_G = 10V, L= 10mH, I_{AS} = 6.6A

3. Pulse Test: Pulse Width≤300μs, Duty Cycle≤1%

Typical Performance Characteristics

Figure1: Output Characteristics

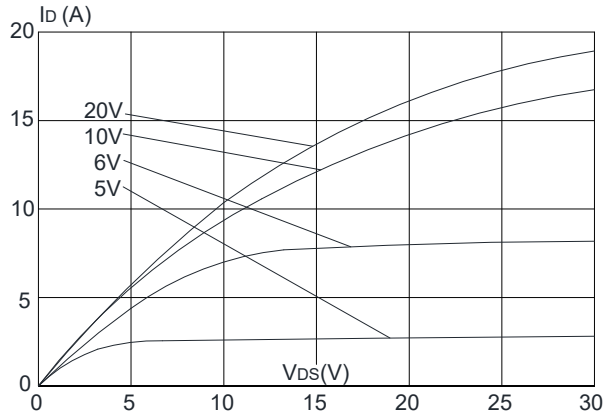


Figure 2: Typical Transfer Characteristics

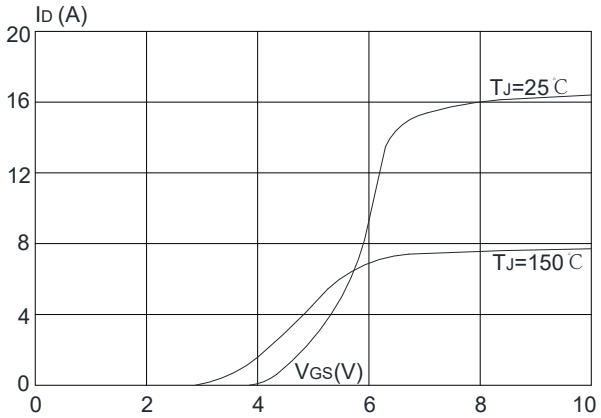


Figure 3: On-resistance vs. Drain Current

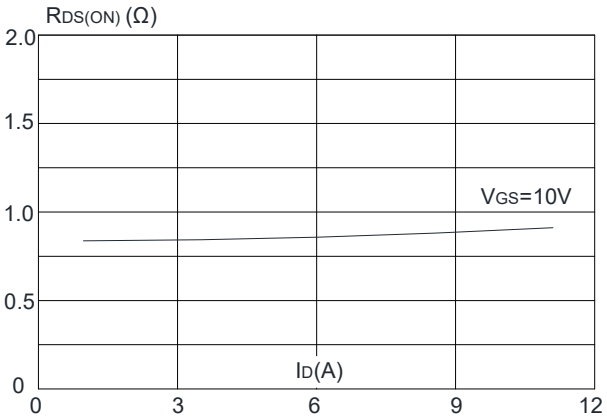


Figure 4: Body Diode Characteristics

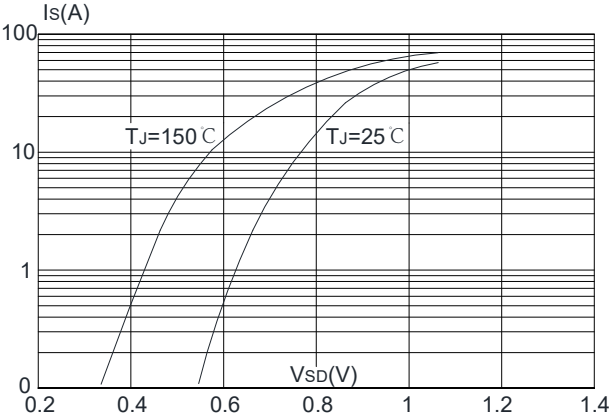


Figure 5: Gate Charge Characteristics

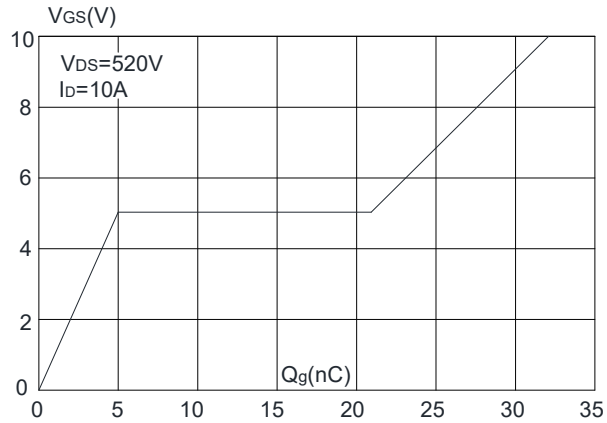


Figure 6: Capacitance Characteristics

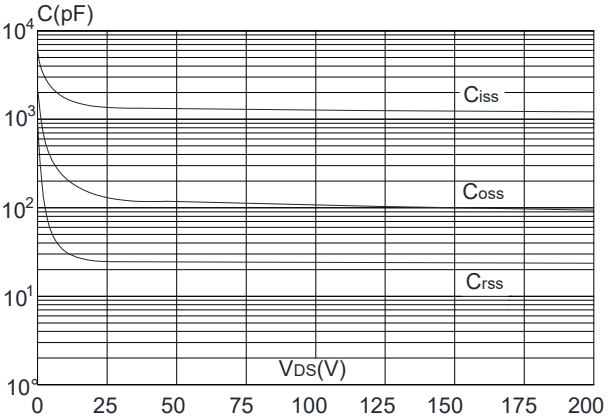


Figure 7: Normalized Breakdown Voltage vs. Junction Temperature

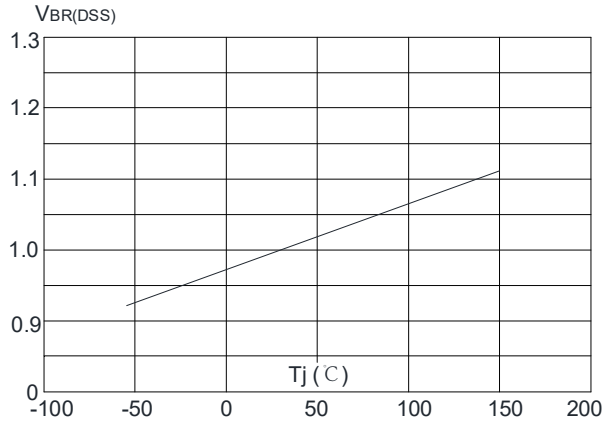


Figure 8: Normalized on Resistance vs. Junction Temperature

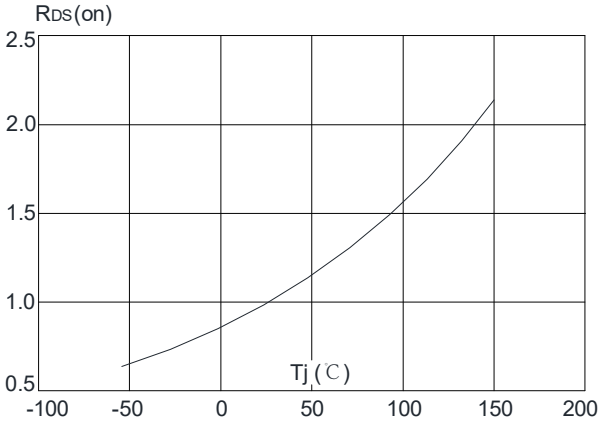


Figure 9: Maximum Safe Operating Area

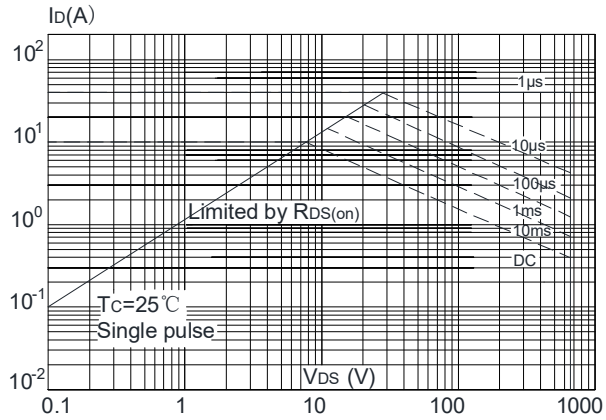


Figure 10: Maximum Continuous Drain Current vs. Case Temperature

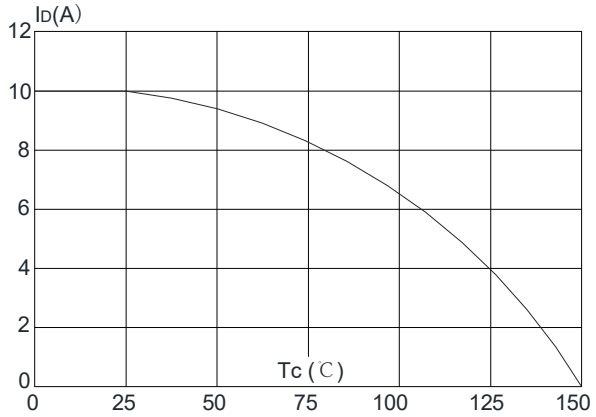
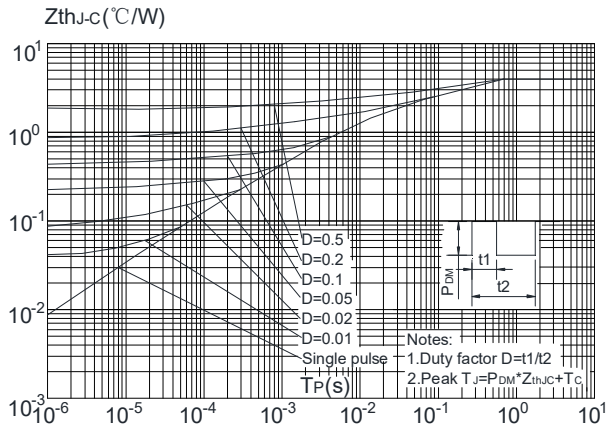


Figure.11: Maximum Effective Transient Thermal Impedance, Junction-to-Case



Test Circuit

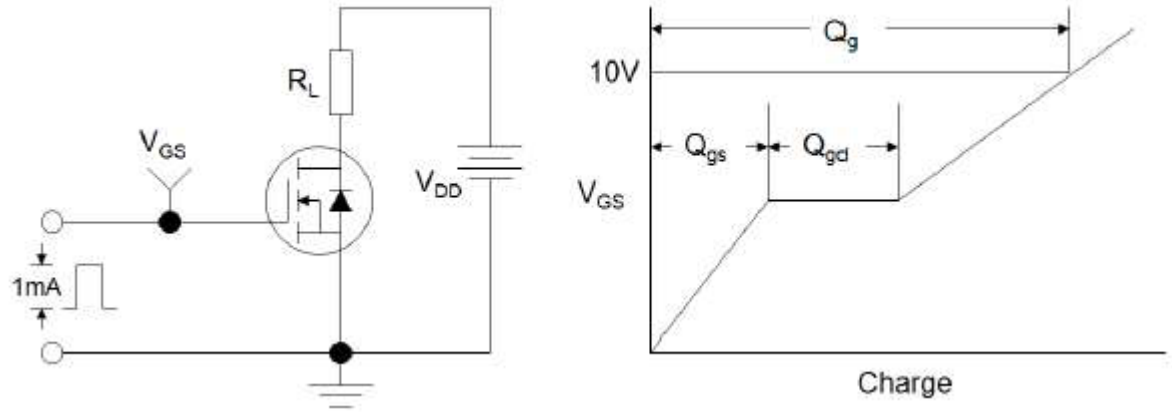


Figure1:Gate Charge Test Circuit & Waveform

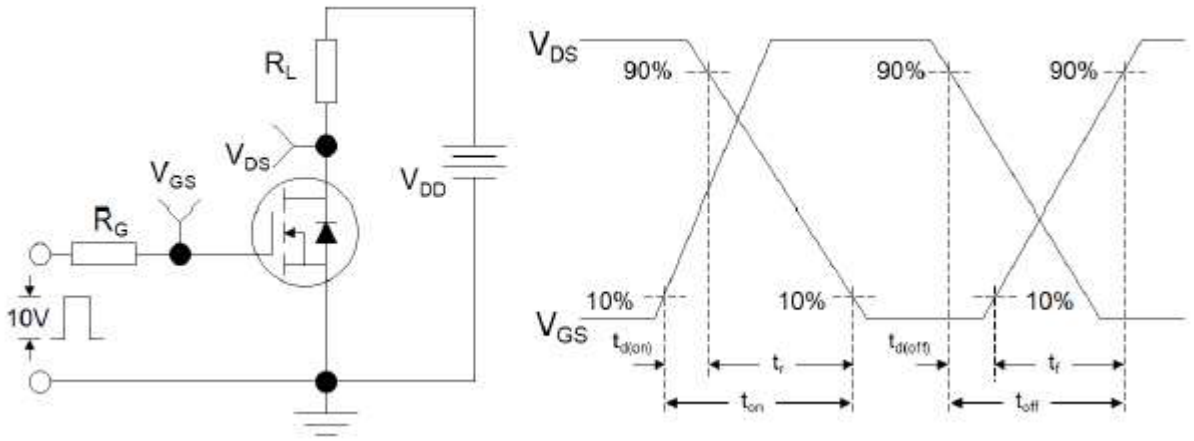


Figure 2: Resistive Switching Test Circuit & Waveforms

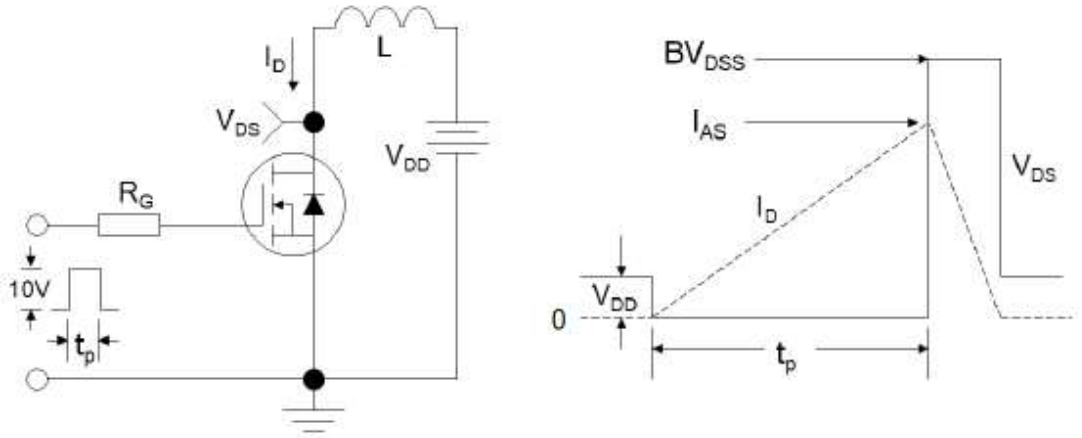


Figure 3:Unclamped Inductive Switching Test Circuit & Waveforms