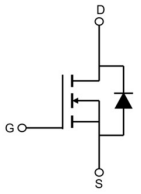
Description

Features	Application
● V_{DS}=650V, I_D=13A $R_{DS(ON)}$ <0.36Ω @ V_{GS} =10V ● Multi-Epi process SJ-MOSFET ● Smart design in high voltage technology ● Ultra lower on-resistance ● Fast switching ● Ultra low gate charge ● Low reverse recovery charge	● Power factor correction (PFC) ● Switched mode power supplies (SMPS) ● Uninterruptible power supply (UPS) 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)
VSM13N65-TF	VSM13N65	TUBE	TO-220F	50	1,000	8,000

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℃	13	A
		T_C = 100℃	8.5	
I_{DM}	Pulsed Drain Current note1		52	A
E_{AS}	Single Pulsed Avalanche Energy note2		146	mJ
P_D	Power Dissipation	T_C = 25℃	32.7	W
$R_{\theta JC}$	Thermal Resistance, Junction to Case		3.82	℃/ W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient		80	℃/ 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
		V_{DS} =650V, V_{GS} = 0V, T_J = 125℃	-	-	100	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	2.0	3.0	4.0	V
$R_{DS(on)}$	Static Drain-Source on-Resistance note3	V_{GS} =10V, I_D =6.5A	-	0.32	0.36	Ω
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} =50V, V_{GS} = 0V, f = 1.0MHz	-	1030	-	pF
C_{oss}	Output Capacitance		-	87	-	pF
C_{rss}	Reverse Transfer Capacitance		-	4.5	-	pF
Q_g	Total Gate Charge	V_{DS}=480V, I_D =13A, V_{GS} =10V	-	23	-	nC
Q_{gs}	Gate-Source Charge		-	5.7	-	nC
Q_{gd}	Gate-Drain(“Miller”) Charge		-	8	-	nC
Switching Characteristics						
$t_{d(on)}$	Turn-on Delay Time	V_{DS} =380V, I_D =6.5A, V_{GS}=10V, R_G=6.8Ω	-	9	-	ns
t_r	Turn-on Rise Time		-	4	-	ns
$t_{d(off)}$	Turn-off Delay Time		-	40	-	ns
t_f	Turn-off Fall Time		-	4.5	-	ns
Drain-Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain to Source Diode Forward Current		-	-	13	A
I_{SM}	Maximum Pulsed Drain to Source Diode Forward Current		-	-	52	A
V_{SD}	Drain to Source Diode Forward Voltage	V_{GS} =0V, I_S =13A	-	-	1.2	V
trr	Reverse Recovery Time	V_{GS} =0V, I_S=6.5A, di/dt=100A/μs	-	245	-	ns
Qrr	Reverse Recovery Charge		-	2.4	-	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} =5.4A

3. Pulse Test: Pulse Width≤300μs, Duty Cycle≤2%

Typical Performance Characteristics

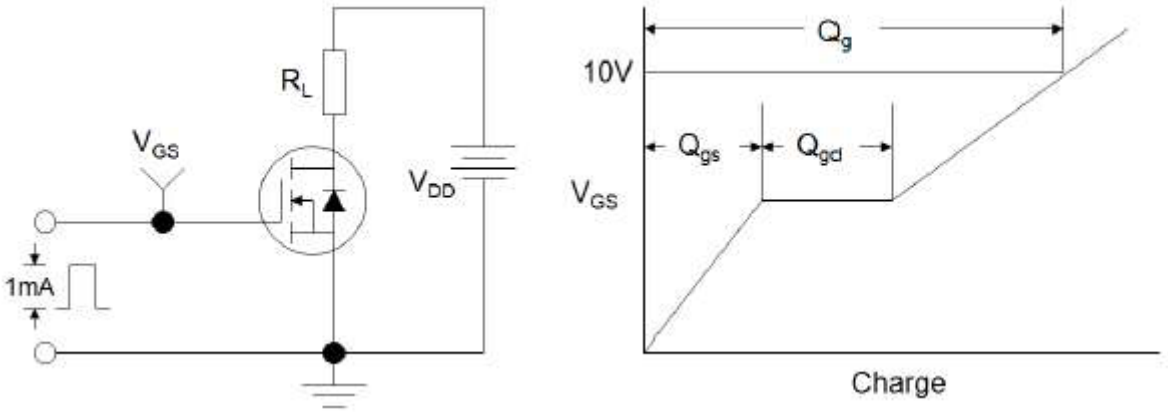


Figure1:Gate Charge Test Circuit & Waveform

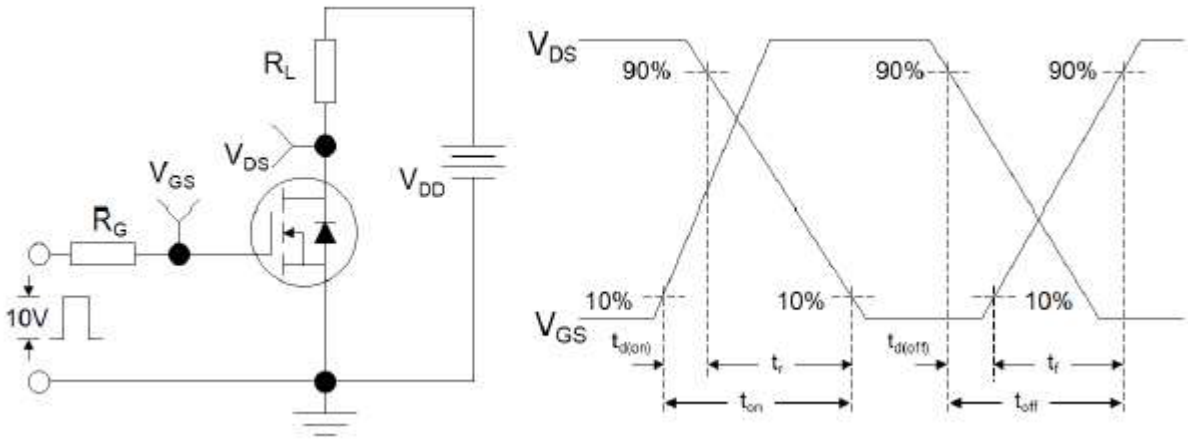


Figure 2: Resistive Switching Test Circuit & Waveforms

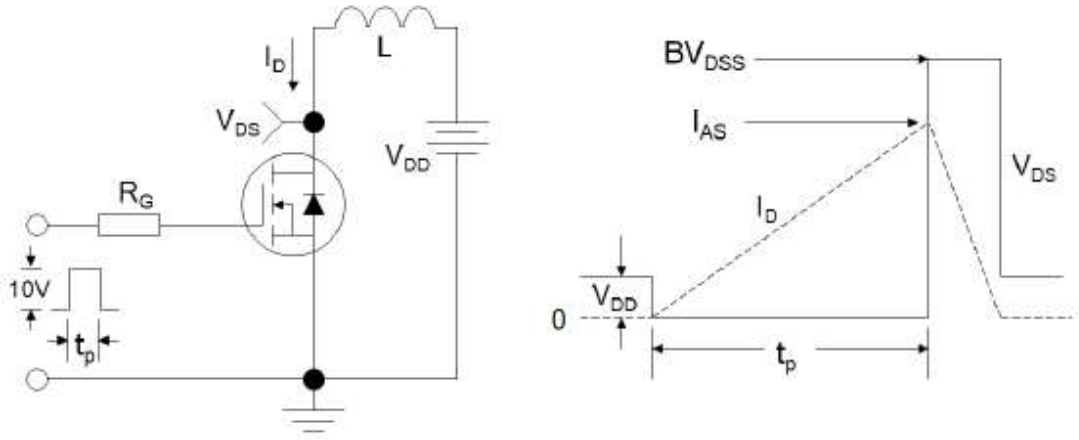


Figure 3:Unclamped Inductive Switching Test Circuit & Waveforms