
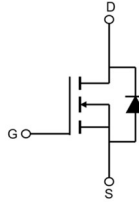


Description

Features <ul style="list-style-type: none"> ● $V_{DS}=600V$, $I_D=20A$ $R_{DS(ON)} < 0.19\Omega$ @ $V_{GS} = 10V$ ● Multi-Epi process SJ-MOSFET ● Smart design in high voltage technology ● Ultra lower on-resistance ● Ultra low gate charge ● Low reverse recovery charge ● Fast switching 	Application <ul style="list-style-type: none"> ● Power factor correction (PFC) ● Switched mode power supplies (SMPS) ● Uninterruptible power supply (UPS) <p>100% UIS 100% ΔV_{ds}</p>
 TO-220F	 Schematic Diagram

Package Marking and Ordering Information

Device Marking	Device	OUTLINE	Device Package	TUBE (PCS)	Inner Box (PCS)	Per Carton (PCS)
VSM20N60-TF	VSM20N60	TUBE	TO-220F	50	1,000	8,000

Absolute Maximum Ratings (T_C=25°C unless otherwise specified)

Symbol	Parameter	Max.	Units
V_{DSS}	Drain-Source Voltage	600	V
V_{GSS}	Gate-Source Voltage	±30	V
I_D	Continuous Drain Current	$T_C = 25^\circ C$	A
		$T_C = 100^\circ C$	
I_{DM}	Pulsed Drain Current ^{note1}	80	A
E_{AS}	Single Pulsed Avalanche Energy ^{note2}	238	mJ
P_D	Power Dissipation $T_C = 25^\circ C$	34	W
$R_{\theta JC}$	Thermal Resistance, Junction to Case	3.67	°C/ W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	80	°C/ W
T_J, T_{STG}	Operating and Storage Temperature Range	-55 to +150	°C

Electrical Characteristics ($T_C=25^{\circ}\text{C}$ 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	600	-	-	V
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} =600V, V _{GS} = 0V, T _C = 25℃	-	0.05	1	μA
		V _{DS} =600V, V _{GS} = 0V, T _C = 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	-	4.0	V
R _{DS(on)}	Static Drain-Source on-Resistance <small>note3</small>	V _{GS} =10V, I _D =10A	-	0.15	0.19	Ω
Dynamic Characteristics						
C _{iss}	Input Capacitance	V _{DS} =50V, V _{GS} = 0V, f = 1.0MHz	-	1950	-	pF
C _{oss}	Output Capacitance		-	150	-	pF
C _{rss}	Reverse Transfer Capacitance		-	5	-	pF
Q _g	Total Gate Charge	V _{DS} =480V, I _D =20A, V _{GS} =10V	-	45	70	nC
Q _{gs}	Gate-Source Charge		-	9	-	nC
Q _{gd}	Gate-Drain(“Miller”) Charge		-	18	-	nC
Switching Characteristics						
t _{d(on)}	Turn-on Delay Time	V _{DS} =380V, I _D =10A, V _{GS} =10V, R _G =4Ω	-	11	-	ns
t _r	Turn-on Rise Time		-	6	-	ns
t _{d(off)}	Turn-off Delay Time		-	61	100	ns
t _f	Turn-off Fall Time		-	4.5	12	ns
Drain-Source Diode Characteristics and Maximum Ratings						
I _s	Maximum Continuous Drain to Source Diode Forward Current		-	-	20	A
I _{SM}	Maximum Pulsed Drain to Source Diode Forward Current		-	-	80	A
V _{SD}	Drain to Source Diode Forward Voltage	V _{GS} =0V, I _s =20A	-	0.9	1.2	V
trr	Reverse Recovery Time	V _{GS} =0V, I _s =20A, di/dt=100A/μs	-	310	-	ns
Qrr	Reverse Recovery Charge		-	5	-	μC

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

2. $I_{AS}=6.9A, V_{DD}=50V, R_G=25\Omega, H=10mH$, Starting $T_J=25^{\circ}\text{C}$

3. Pulse Test: Pulse Width $\leq 300\mu s$, Duty Cycle $\leq 2\%$

Typical Performance Characteristics

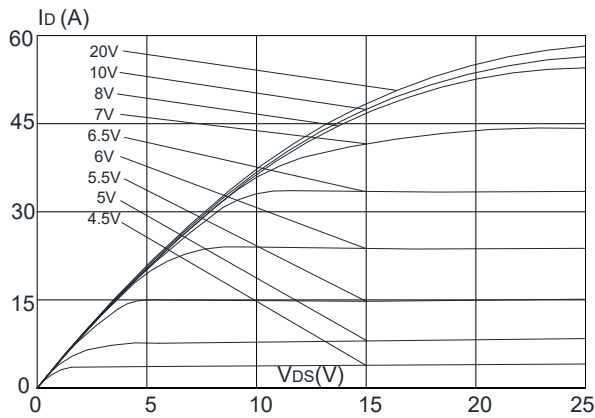
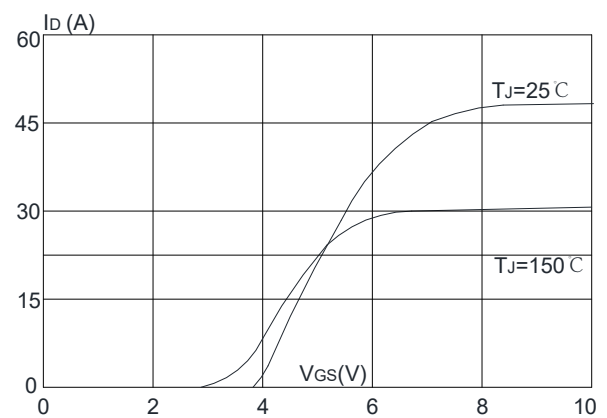
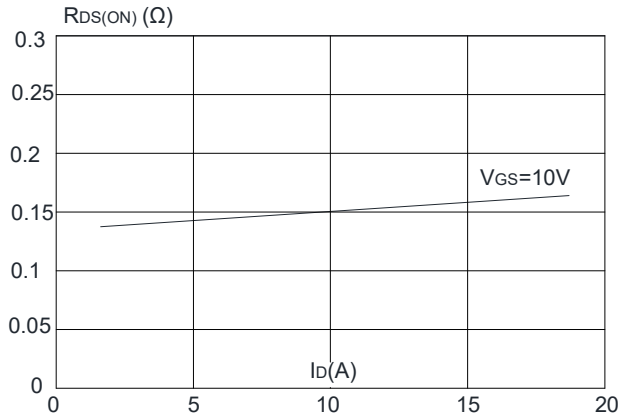
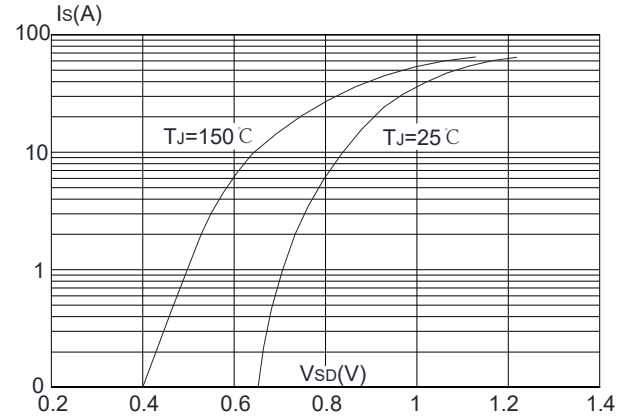
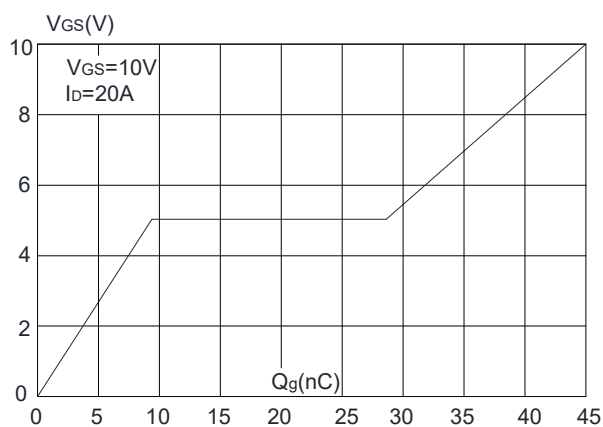
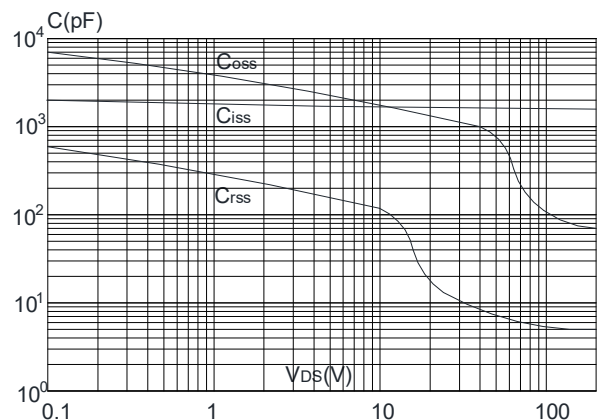
Figure1: Output Characteristics

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

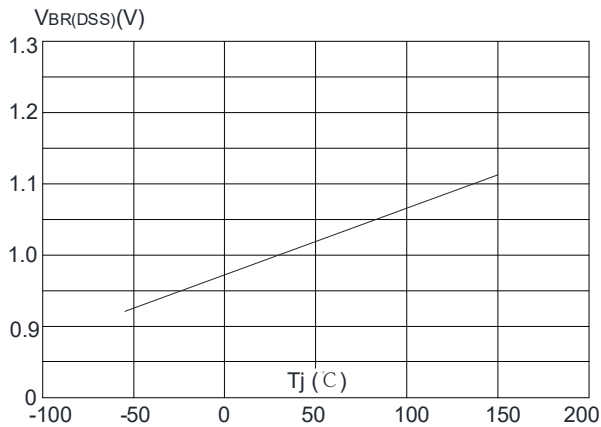


Figure 8: Normalized on Resistance vs. Junction Temperature

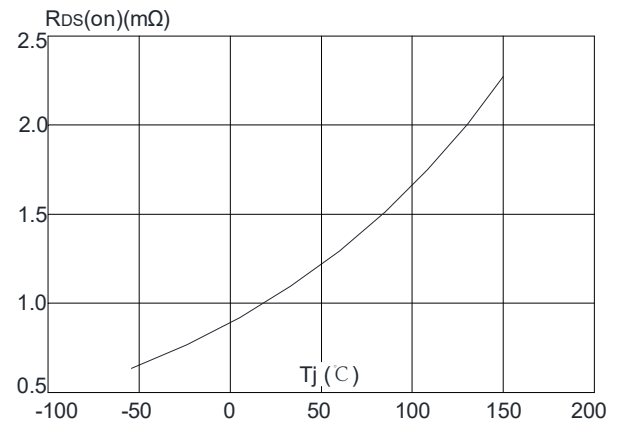


Figure 9: Maximum Safe Operating Area

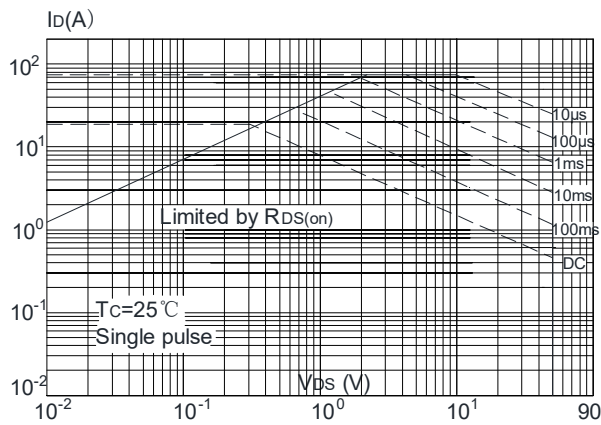


Figure 10: Maximum Continuous Drain Current vs. Case Temperature

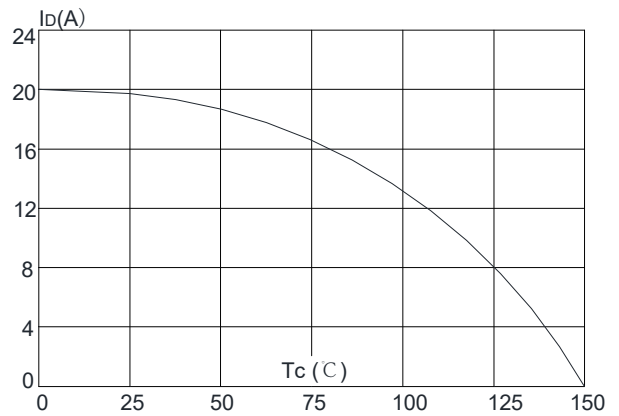
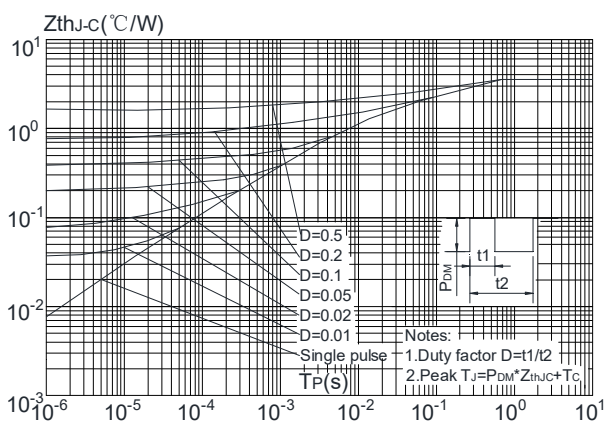


Figure.11: Maximum Effective Transient Thermal Impedance, Junction-to-Case



Test Circuit

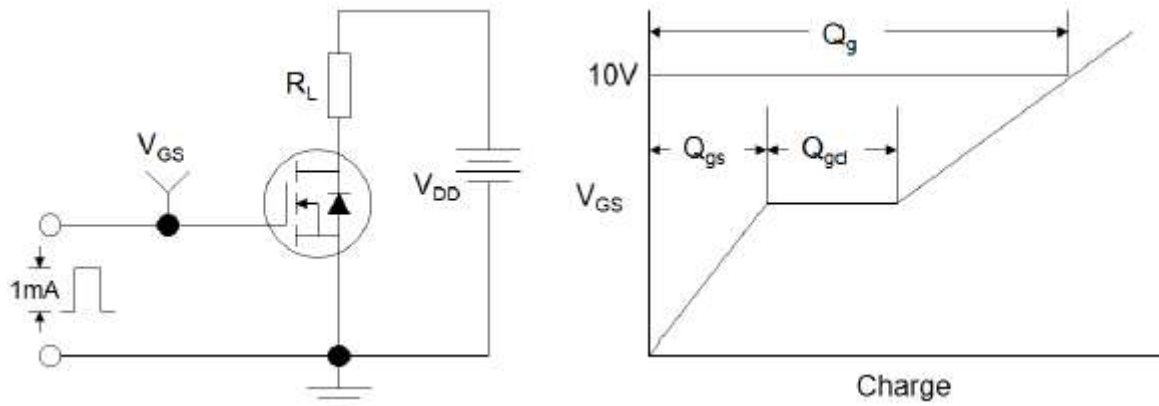


Figure1:Gate Charge Test Circuit & Waveform

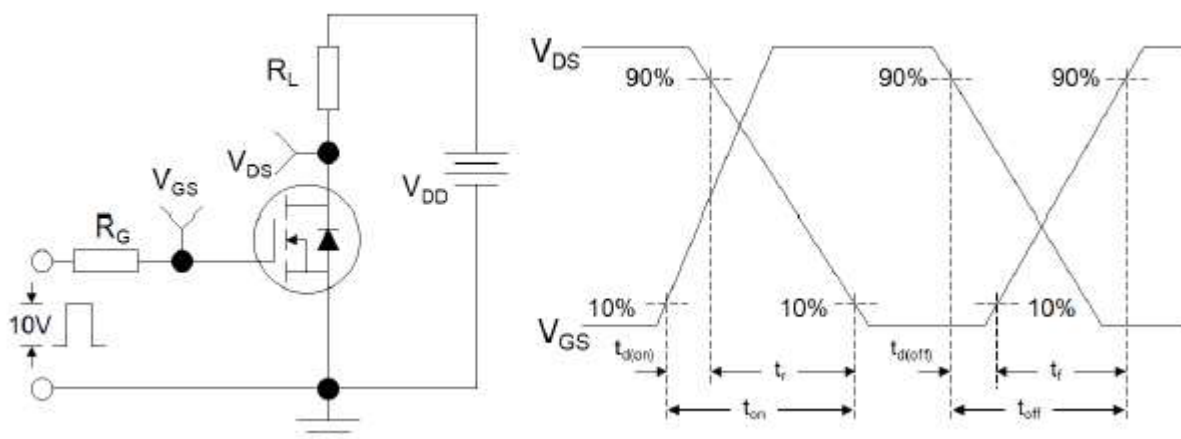


Figure 2: Resistive Switching Test Circuit & Waveforms

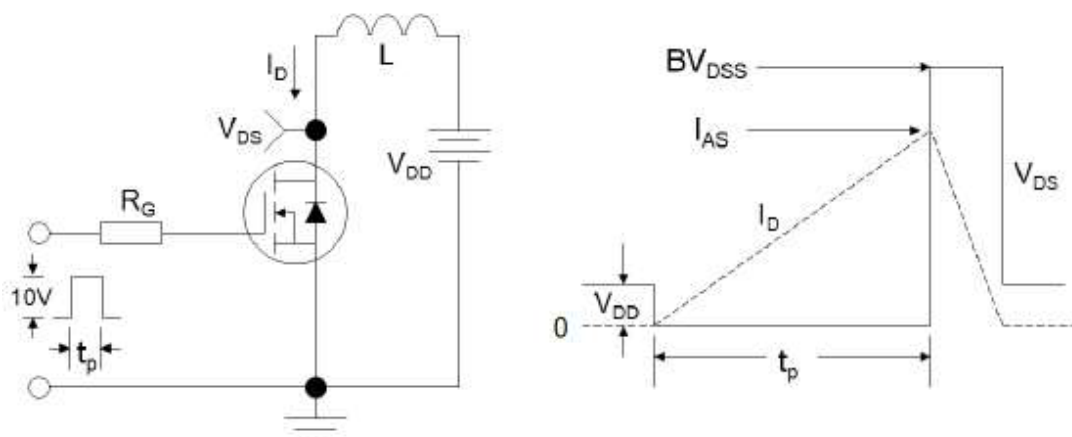


Figure 3:Unclamped Inductive Switching Test Circuit & Waveforms