
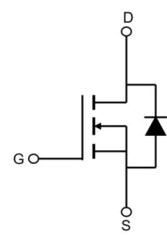


Description

Features <ul style="list-style-type: none"> ● 600V, 4A $R_{DS(ON)} < 2.3\Omega @ V_{GS} = 10V$ ● Fast Switching ● Improved dv/dt Capability 	Application <ul style="list-style-type: none"> ● Load Switch ● PWM Application ● Power management <p style="text-align: center;">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)
VSM4N60-TF	VSM4N60	TAPING	TO-220F	50	1,000	5,000

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°C	4
		T _C = 100°C	2.6
I _{DM}	Pulsed Drain Current ^{note1}	16	A
E _{AS}	Single Pulsed Avalanche Energy ^{note2}	80	mJ
P _D	Power Dissipation	T _C = 25°C	36
R _{θJC}	Thermal Resistance, Junction to Case	3.4	°C/W
R _{θJA}	Thermal Resistance, Junction to Ambient	62.5	°C/W
T _J , T _{STG}	Operating and Storage Temperature Range	-55 to +150	°C

Electrical Characteristics ($T_J=25^\circ\text{C}$ unless otherwise specified)

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Units
Off Characteristic						
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	$V_{GS}=0V, I_D=250\mu A$	600	-	-	V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS}=600V, V_{GS}=0V, T_J=25^\circ\text{C}$	-	-	1	μA
I_{GSS}	Gate to Body Leakage Current	$V_{DS}=0V, V_{GS}=\pm 30V$	-	-	± 100	nA
On Characteristics						
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}, I_D=250\mu A$	2	3	4	V
$R_{DS(on)}$ note3	Static Drain-Source on-Resistance	$V_{GS}=10V, I_D=2A$	-	1.9	2.3	Ω
Dynamic Characteristics						
C_{iss}	Input Capacitance	$V_{DS}=25V, V_{GS}=0V, f=1.0\text{MHz}$	-	593	-	pF
C_{oss}	Output Capacitance		-	66	-	pF
C_{riss}	Reverse Transfer Capacitance		-	10	-	pF
Q_g	Total Gate Charge	$V_{DD}=480V, I_D=4A, V_{GS}=10V$	-	15	-	nC
Q_{gs}	Gate-Source Charge		-	2.5	-	nC
Q_{gd}	Gate-Drain("Miller") Charge		-	7.5	-	nC
Switching Characteristics						
$t_{d(on)}$	Turn-on Delay Time	$V_{DD}=300V, I_D=4A, R_G=25\Omega$	-	12	-	ns
t_r	Turn-on Rise Time		-	22	-	ns
$t_{d(off)}$	Turn-off Delay Time		-	50	-	ns
t_f	Turn-off Fall Time		-	48	-	ns
Drain-Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain to Source Diode Forward Current		-	-	4	A
I_{SM}	Maximum Pulsed Drain to Source Diode Forward Current		-	-	16	A
V_{SD}	Drain to Source Diode Forward Voltage	$V_{GS}=0V, I_{SD}=4A$	-	-	1.4	V
t_{rr}	Reverse Recovery Time	$V_{GS}=0V, I_S=4A, di/dt=100A/\mu s$	-	250	-	ns
Q_{rr}	Reverse Recovery Charge		-	3.5	-	μC

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

 2. EAS condition: $T_J=25^\circ\text{C}, V_{DD}=50V, V_G=10V, L=10\text{mH}, I_{AS}=4A$

 3. Pulse Test: Pulse Width $\leq 300\mu s$, Duty Cycle $\leq 1\%$

Typical Performance Characteristics

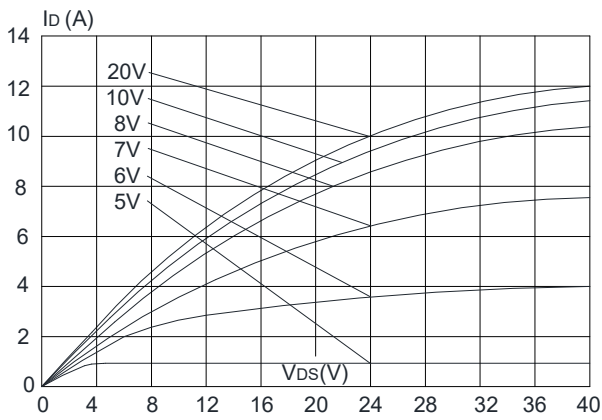
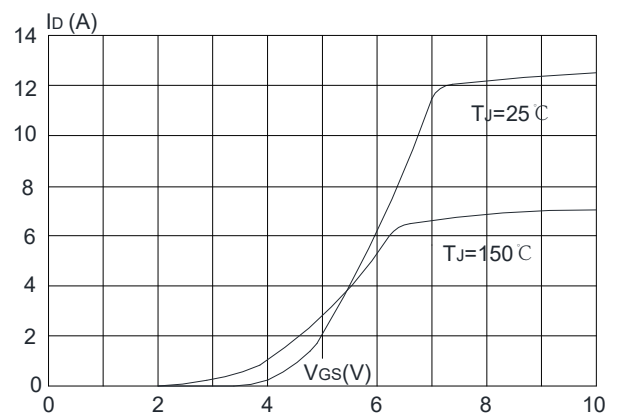
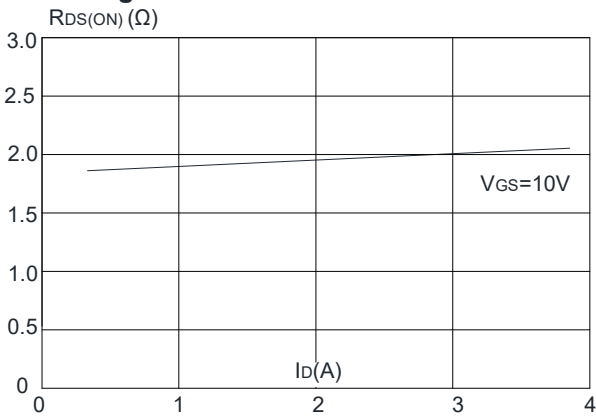
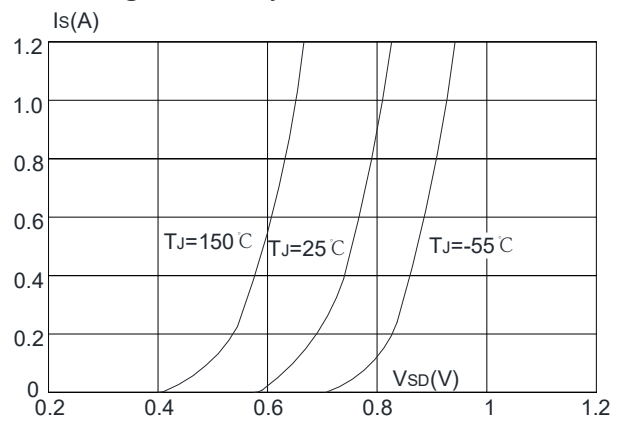
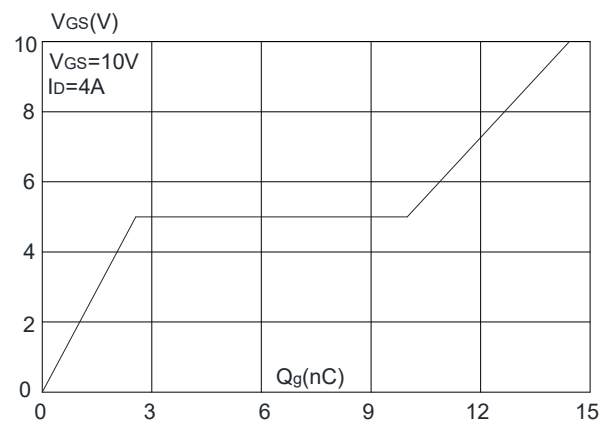
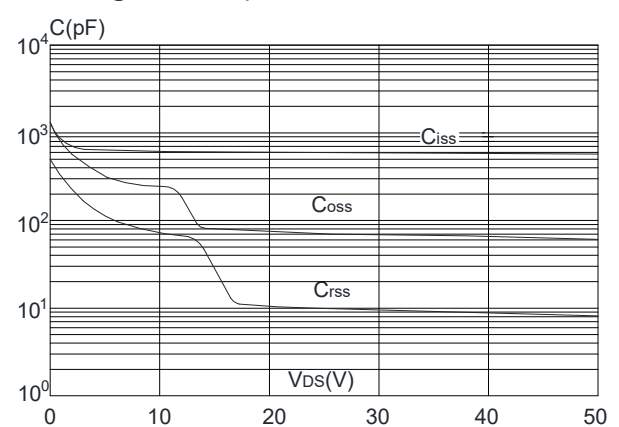
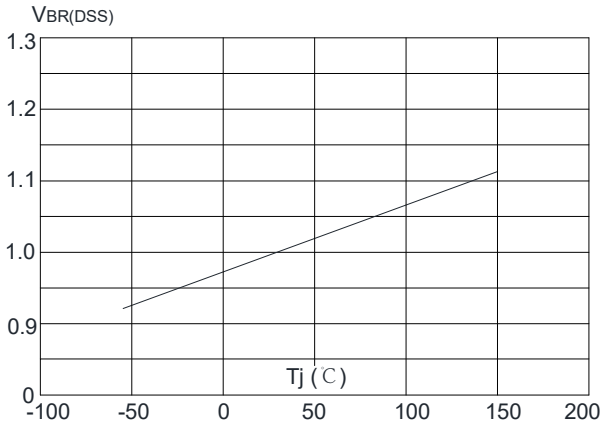
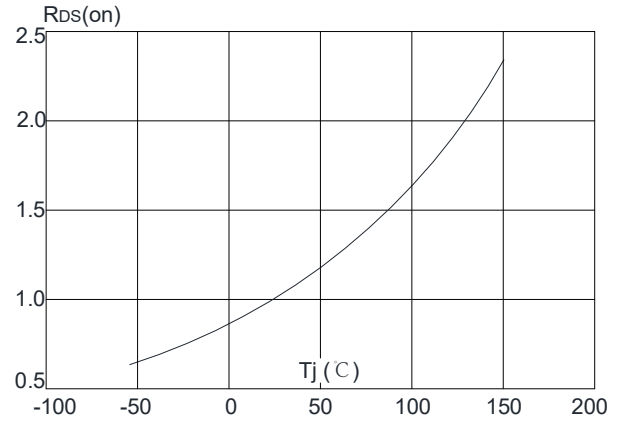
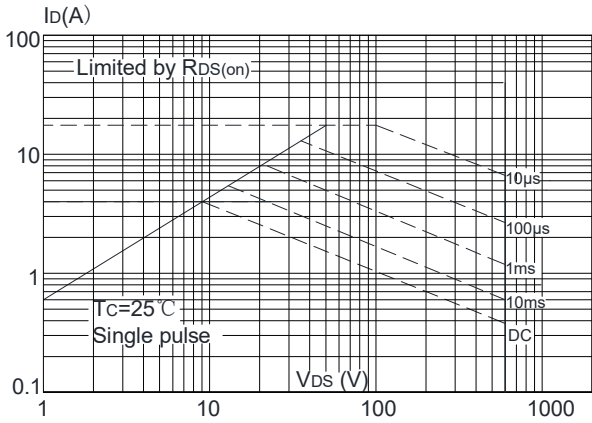
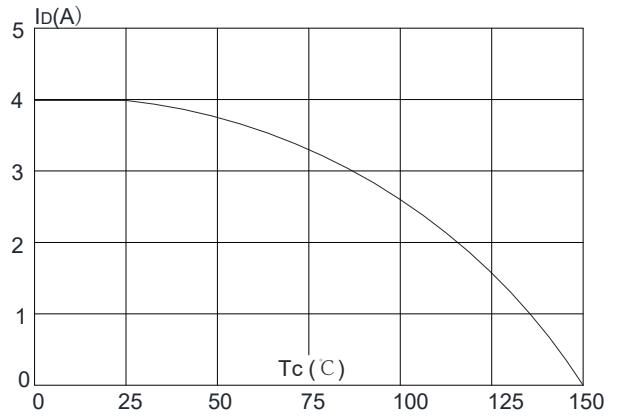
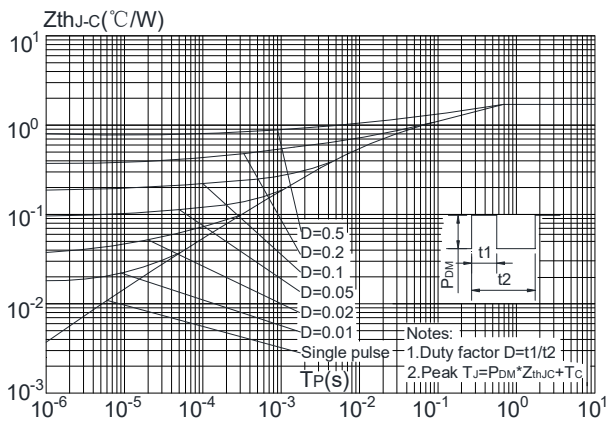
Figure 1: Output Characteristics

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

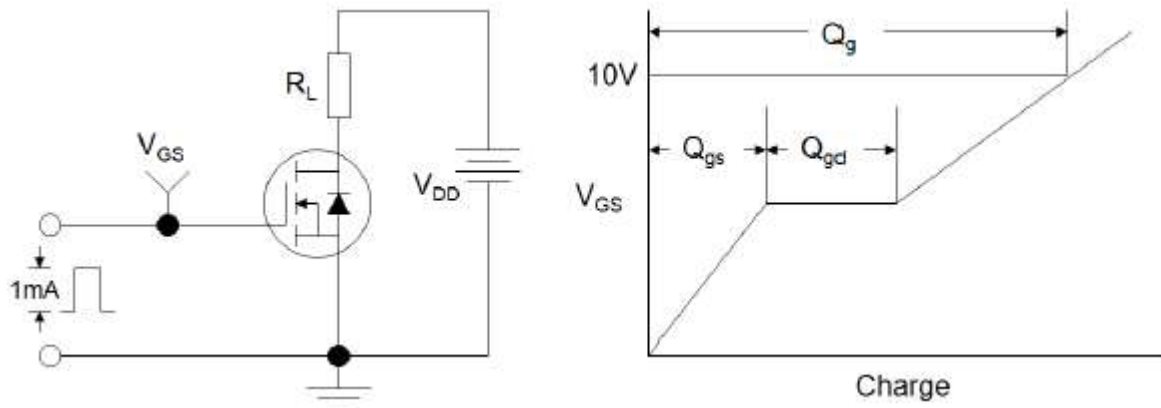


Figure 1: Gate Charge Test Circuit & Waveform

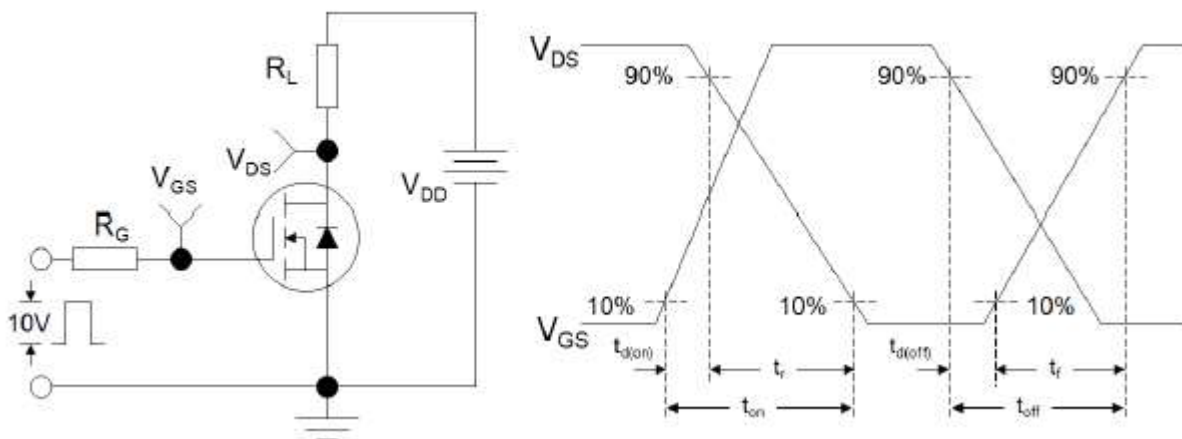


Figure 2: Resistive Switching Test Circuit & Waveforms

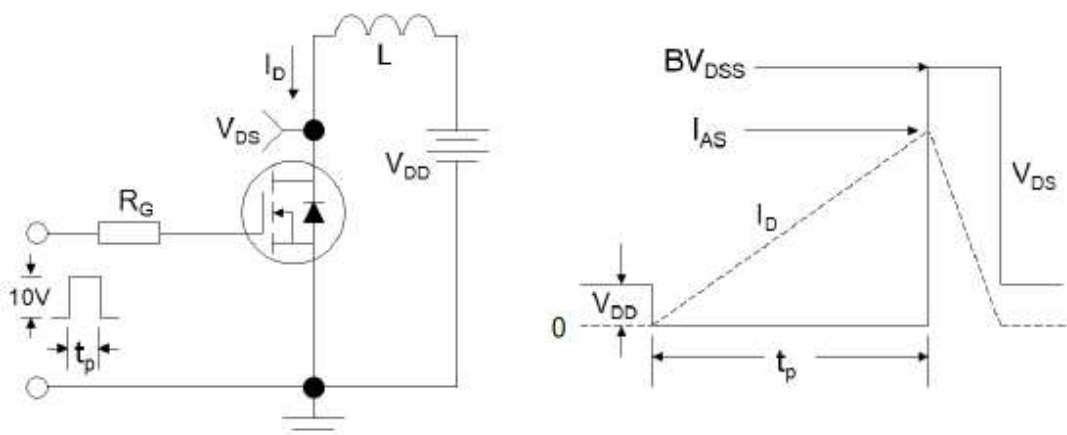


Figure 3: Unclamped Inductive Switching Test Circuit & Waveforms