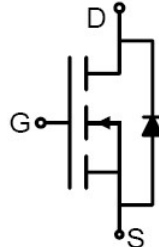## Description

Features

- 20V, 60A

  $R_{DS(ON)} < 6.5m\Omega$ @ $V_{GS} = 4.5V$

  $R_{DS(ON)} < 10m\Omega$ @ $V_{GS} = 2.5V$

- Advanced Trench Technology
- Excellent $R_{DS(ON)}$ and Low Gate Charge
- Lead free product is acquired

Application

- Load Switch
- PWM Application
- Power management

  100% UIS
  100% ΔVds

TO-252

Schematic Diagram

Package Marking and Ordering Information

Device Marking	Device	OUTLINE	Device Package	Reel Size	Reel (PCS)	Per Carton (PCS)
VSM60N02-T2	VSM60N02	TAPING	TO-252	13inch	2500	25000

Absolute Maximum Ratings (T$_C$=25℃ unless otherwise specified)

Symbol	Parameter		Max.	Units
V_{DSS}	Drain-Source Voltage		20	V
V_{GSS}	Gate-Source Voltage		±12	V
I_D	Continuous Drain Current	$T_C = 25℃$	60	A
		$T_C = 100℃$	39	A
I_{DM}	Pulsed Drain Current [note1]		240	A
E_{AS}	Single Pulsed Avalanche Energy [note2]		47.6	mJ
P_D	Power Dissipation	$T_C = 25℃$	37	W
$R_{\theta JC}$	Thermal Resistance, Junction to Case		4	℃/W
T_J, T_{STG}	Operating and Storage Temperature Range		-55 to +175	℃

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	$V_{GS}=0V$, $I_D=250μA$	20	-	-	V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS}=20V$, $V_{GS}=0V$,	-	-	1.0	μA
I_{GSS}	Gate to Body Leakage Current	$V_{DS}=0V$, $V_{GS}=±12V$	-	-	±100	nA
On Characteristics						
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}$, $I_D=250μA$	0.4	0.7	1.0	V
$R_{DS(on)}$	Static Drain-Source on-Resistance note3	$V_{GS}=4.5V$, $I_D=25A$	-	4.8	6.5	mΩ
		$V_{GS}=2.5V$, $I_D=15A$	-	6.8	10	
Dynamic Characteristics						
C_{iss}	Input Capacitance	$V_{DS}=10V$, $V_{GS}=0V$, f=1.0MHz	-	1832	-	pF
C_{oss}	Output Capacitance		-	289	-	pF
C_{rss}	Reverse Transfer Capacitance		-	271	-	pF
Q_g	Total Gate Charge	$V_{DS}=10V$, $I_D=25A$, $V_{GS}=4.5V$	-	23	-	nC
Q_{gs}	Gate-Source Charge		-	4.5	-	nC
Q_{gd}	Gate-Drain("Miller") Charge		-	7.3	-	nC
Switching Characteristics						
$t_{d(on)}$	Turn-on Delay Time	$V_{DS}=10V$, $I_D=25A$, $R_{GEN}=3Ω$, $V_{GS}=4.5V$	-	15	-	ns
t_r	Turn-on Rise Time		-	37	-	ns
$t_{d(off)}$	Turn-off Delay Time		-	52	-	ns
t_f	Turn-off Fall Time		-	21	-	ns
Drain-Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain to Source Diode Forward Current		-	-	60	A
I_{SM}	Maximum Pulsed Drain to Source Diode Forward Current		-	-	240	A
V_{SD}	Drain to Source Diode Forward Voltage	$V_{GS}=0V$, $I_S=30A$	-	-	1.2	V
trr	Body Diode Reverse Recovery Time	IF=25A,dI/dt=100A/μs	-	25	-	ns
Qrr	Body Diode Reverse Recovery Charge		-	21	-	nC

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

2. EAS condition: $T_J=25℃$, $V_{DD}=10V$, $V_G=4.5V$, L=0.5mH, $R_G=25Ω$, $I_{AS}=13.8A$

3. Pulse Test: Pulse Width≤300μs, Duty Cycle≤0.5%
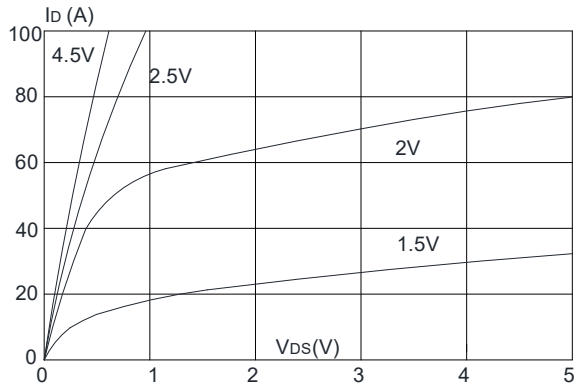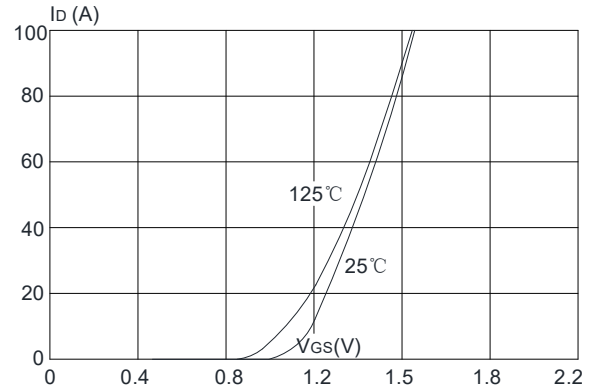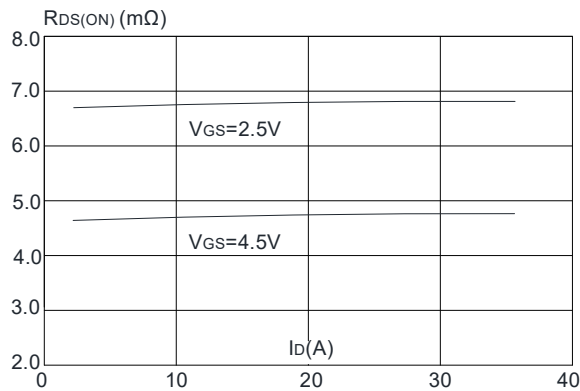
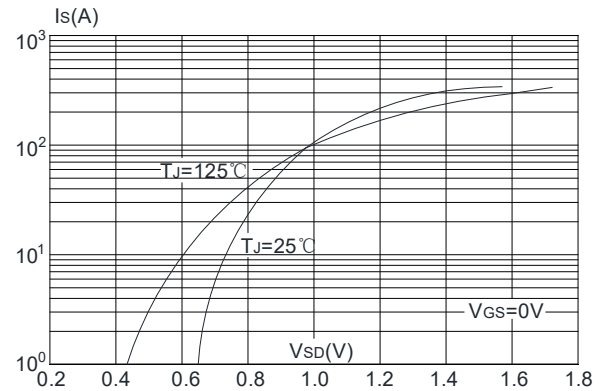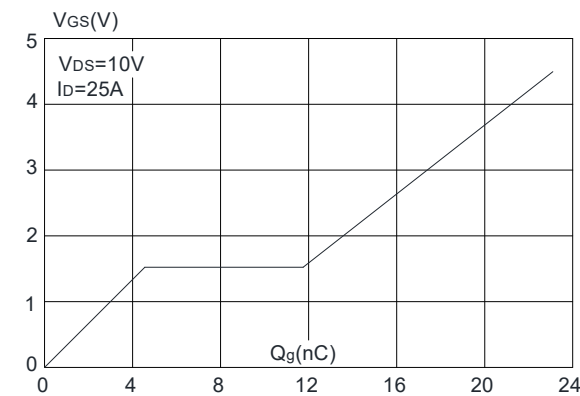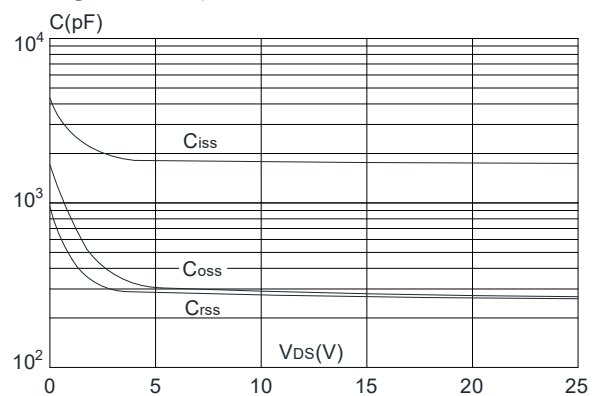# Typical Performance Characteristics

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

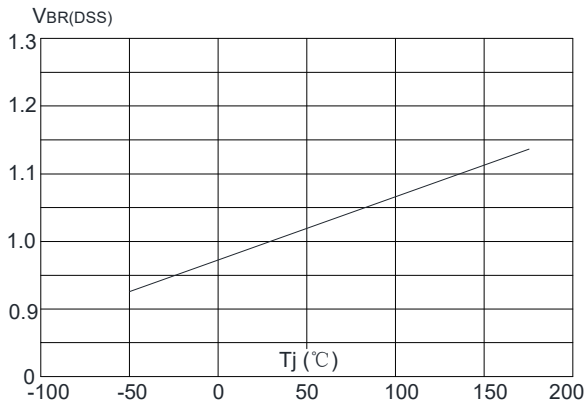**Figure 7:** Normalized Breakdown Voltage vs. Junction Temperature
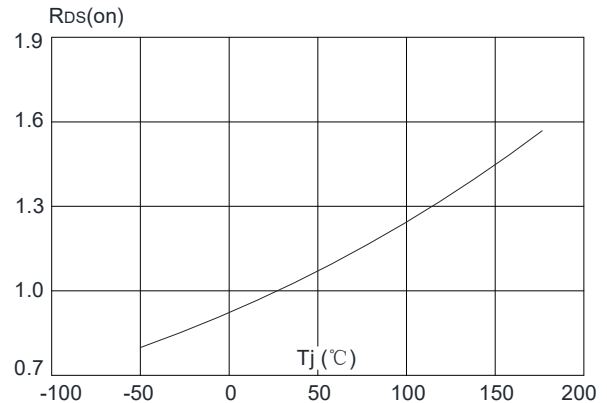
VBR(DSS)

Figure 8: Normalized on Resistance vs. Junction Temperature

RDS(on)

Figure 9: Maximum Safe Operating Area

ID(A)

1μs

10μs

Limited by RDS(on)

100μs
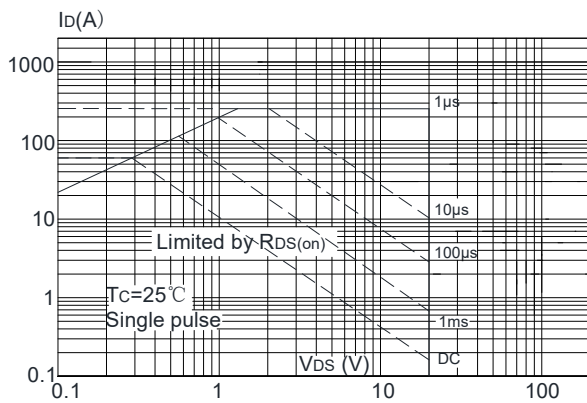
TC=25℃
Single pulse

1ms

VDS (V)

DC

Figure 10: Maximum Continuous Drain Current vs. Case Temperature

ID(A)

Tc (℃)
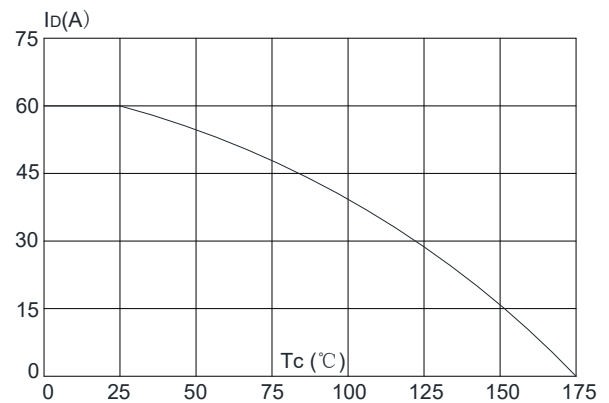
Figure.11: Maximum Effective Transient Thermal Impedance, Junction-to-Case

ZthJ-C(℃/W)

D=0.5
D=0.2
D=0.1
D=0.05
D=0.02
D=0.01
Single pulse

TP(s)

t1

t2

PDM

Notes:
1.Duty factor D=t1/t2
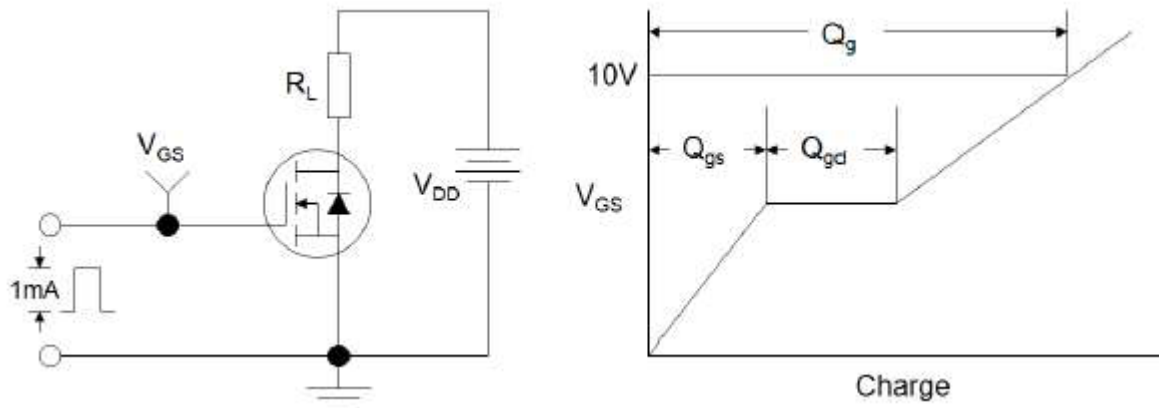2.Peak TJ=PDM*ZthJC+TC
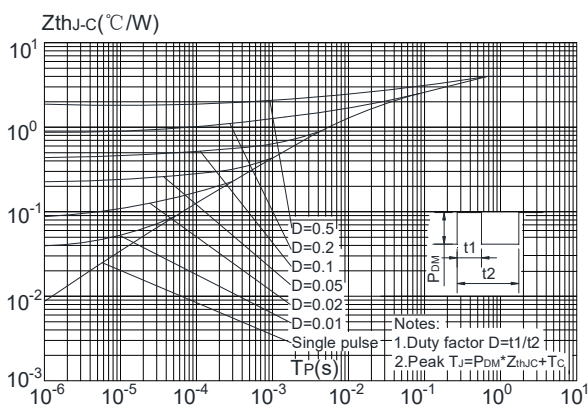
Test Circuit

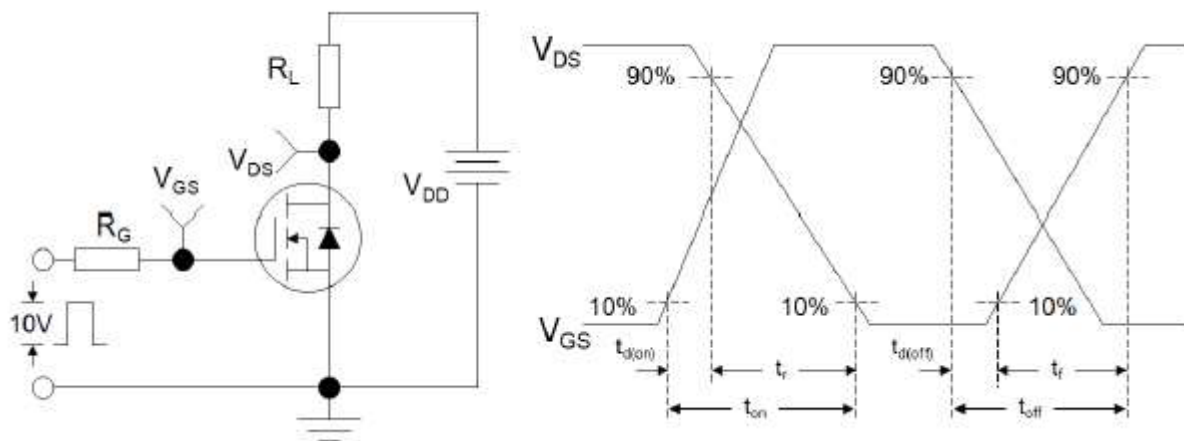**Figure1:Gate Charge Test Circuit & Waveform**

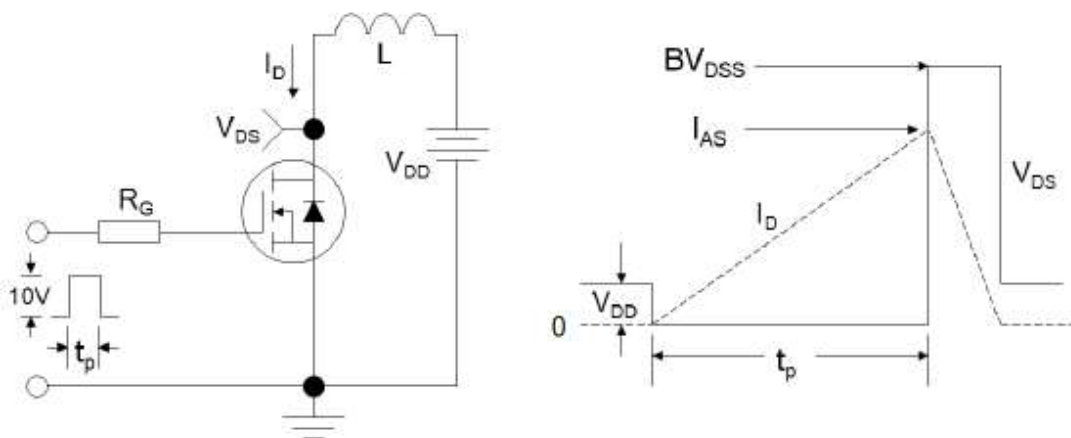**Figure 2: Resistive Switching Test Circuit & Waveforms**

Figure 3:Unclamped Inductive Switching Test Circuit & Waveforms