Description

The VSM210N04 uses advanced trench technology and design to provide excellent $R_{DS(ON)}$ with low gate charge. It can be used in a wide variety of applications.

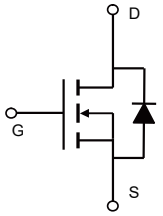
General Features

- V_{DS} =40V ,I_D =210A
  $R_{DS(ON)}$ < 2.3mΩ @ V_{GS}=10V
  $R_{DS(ON)}$ < 3.2mΩ @ V_{GS}=4.5V
- High density cell design for ultra low Rdson
- Fully characterized avalanche voltage and current
- Good stability and uniformity with high E_{AS}
- Excellent package for good heat dissipation

Application

- Power switching application
- Hard switched and high frequency circuits
- Uninterruptible power supply

TO-220



Schematic

Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
VSM210N04	VSM210N04-TC	TO-220	-	-	-

Absolute Maximum Ratings (T_A=25℃unless otherwise noted)

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	V_{DS}	40	V
Gate-Source Voltage	V_{GS}	±20	V
Drain Current-Continuous	I_D	210	A
Drain Current-Continuous(T_C=100℃)	I_D (100℃)	190	A
Pulsed Drain Current	I_{DM}	840	A
Maximum Power Dissipation	P_D	310	W
Derating factor		2.07	W/℃
Single pulse avalanche energy (Note 1)	E_{AS}	2500	mJ
Operating Junction and Storage Temperature Range	T_J,T_{STG}	-55 To 175	℃

Thermal Characteristic

Thermal Resistance,Junction-to-Case	$R_{\theta JC}$	0.48	℃/W

Electrical Characteristics (T_A=25℃unless otherwise noted)

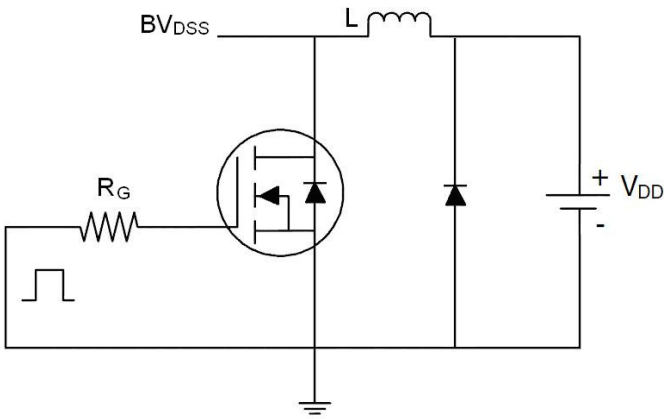
Parameter	Symbol	Condition	Min	Typ	Max	Unit
Off Characteristics						
Drain-Source Breakdown Voltage	BV_{DSS}	V_{GS}=0V I_D=250μA	40	-	-	V
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS}=40V,V_{GS}=0V	-	-	1	μA
Gate-Body Leakage Current	I_{GSS}	V_{GS}=±20V,V_{DS}=0V	-	-	±100	nA
On Characteristics (Note 3)						
Gate Threshold Voltage	$V_{GS(th)}$	V_{DS}=V_{GS},I_D=250μA	1.3	1.8	2.5	V
Drain-Source On-State Resistance	$R_{DS(ON)}$	V_{GS}=10V, I_D=20A	-	1.9	2.3	mΩ
	$R_{DS(ON)}$	V_{GS}=4.5V, I_D=20A	-	2.45	3.2	mΩ
Forward Transconductance	g_{FS}	V_{DS}=5V,I_D=40A	-	50	-	S
Dynamic Characteristics						
Input Capacitance	C_{lss}	V_{DS}=20V,V_{GS}=0V, F=1.0MHz	-	8300	-	pF
Output Capacitance	C_{oss}		-	1145	-	pF
Reverse Transfer Capacitance	C_{rss}		-	998	-	pF
Switching Characteristics (Note 2)						
Turn-on Delay Time	$t_{d(on)}$	V_{DD}=30V,R_L=15Ω, R_G=2.5Ω,V_{GS}=10V	-	15	-	nS
Turn-on Rise Time	t_r		-	40	-	nS
Turn-Off Delay Time	$t_{d(off)}$		-	100	-	nS
Turn-Off Fall Time	t_f		-	32	-	nS
Total Gate Charge	Q_g	I_D=20A,V_{DD}=20V,V_{GS}=10V	-	179.5	-	nC
Gate-Source Charge	Q_{gs}		-	27.6	-	nC
Gate-Drain Charge	Q_{gd}		-	40.9	-	nC
Drain-Source Diode Characteristics						
Diode Forward Voltage	V_{SD}	V_{GS}=0V,I_S=20A	-	0.85	1.2	V
Diode Forward Current	I_S		-	-	210	A
Reverse Recovery Time	t_{rr}	T_J = 25°C, I_F = 20A di/dt = 100A/μs	-	54	-	nS
Reverse Recovery Charge	Qrr		-	86	-	nC
Forward Turn-On Time	t_{on}	Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD)				

Notes:

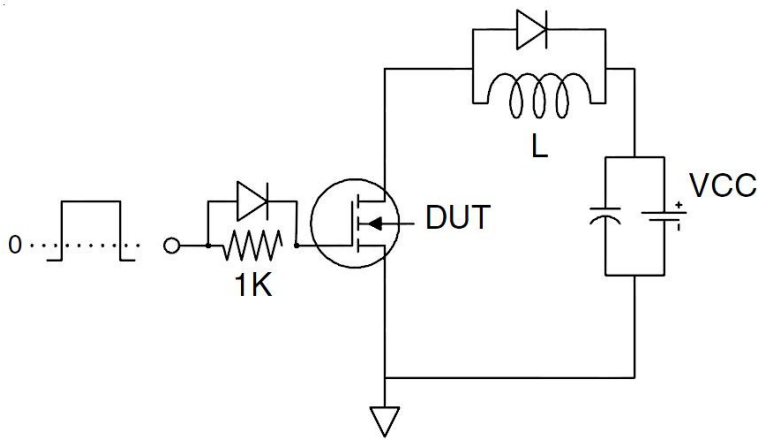
1. EAS condition : Tj=25℃,V_{DD}=20V,V_G=10V,L=0.5mH,Rg=25Ω
2. Guaranteed by design, not subject to production
3. These curves are based on the junction-to-case thermal impedance which is measured with the device mounted to a large heatsink, assuming a maximum junction temperature of $T_{J(MAX)}$=175°C. The SOA curve provides a single pulse rating.

Test circuit

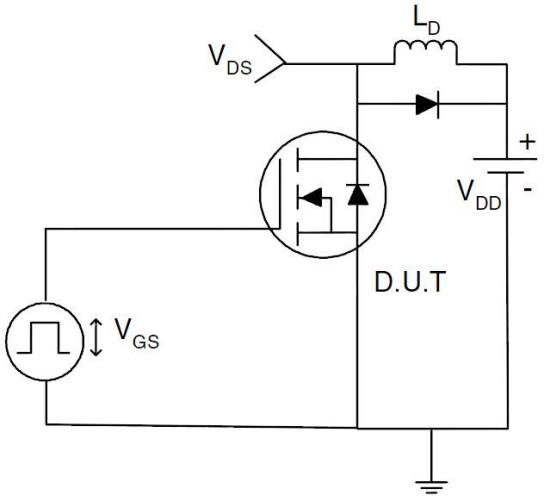
1） **E_{AS} test Circuits**



2） **Gate charge test Circuit:**



3） **Switch Time Test Circuit:**



Typical Electrical and Thermal Characteristics (Curves)

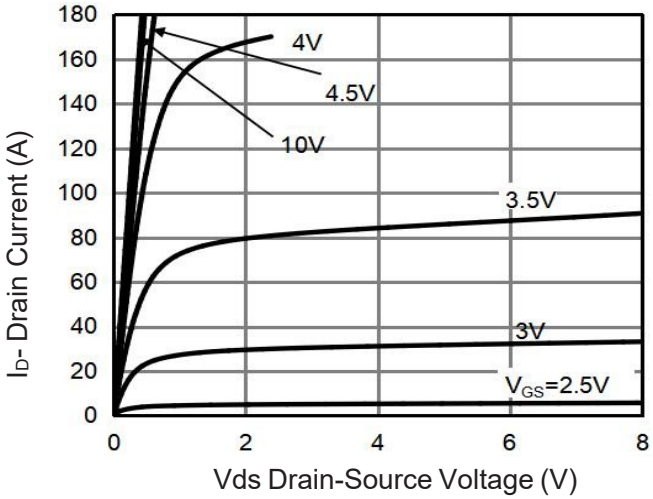


Figure 1 Output Characteristics

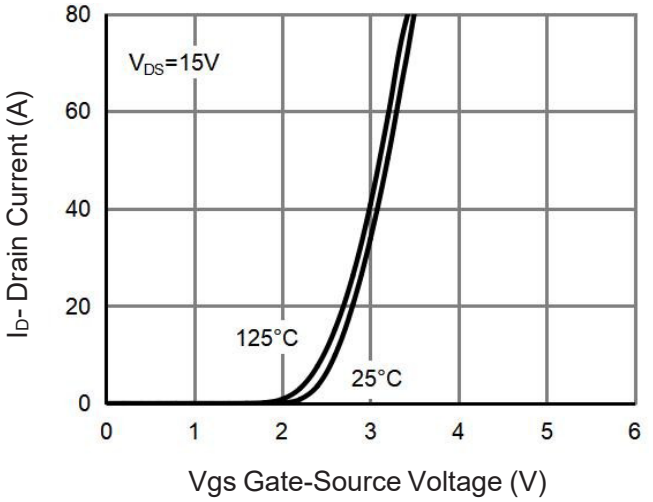


Figure 2 Transfer Characteristics

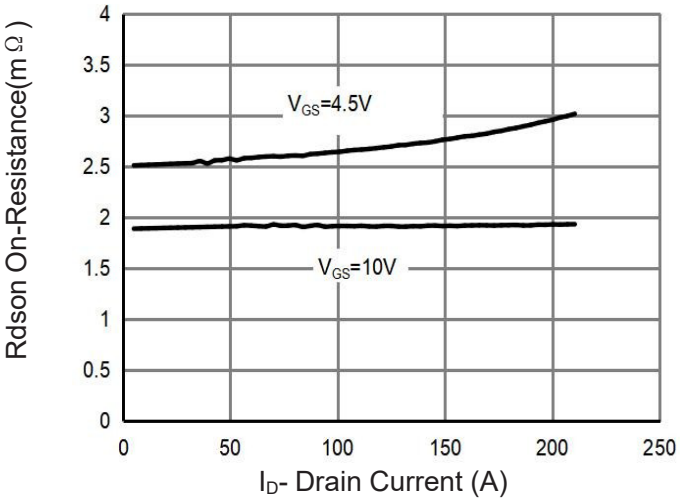


Figure 3 Rdson- Drain Current

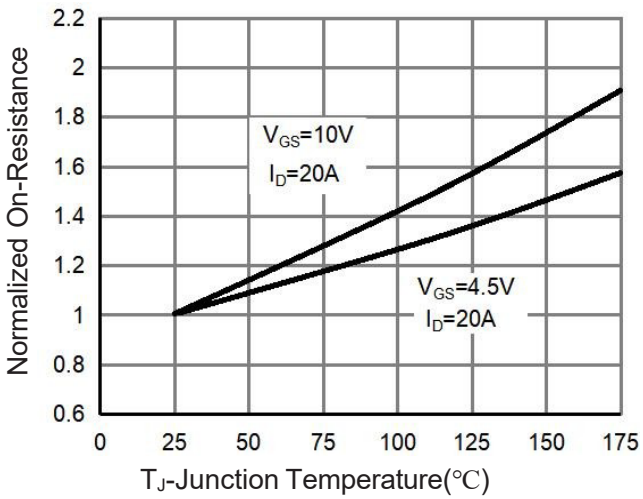


Figure 4 Rdson-JunctionTemperature

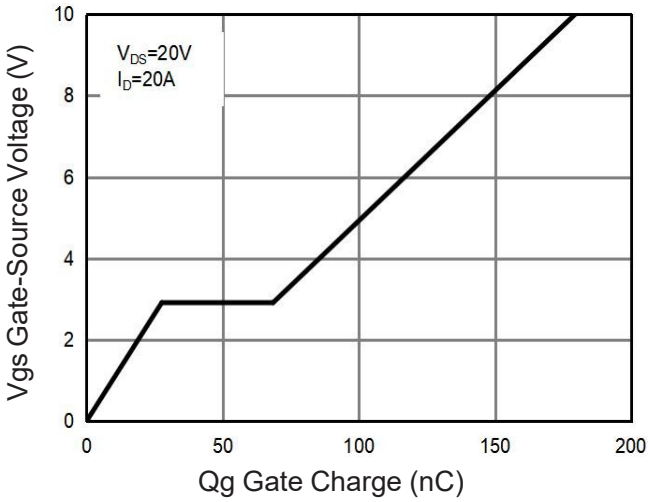


Figure 5 Gate Charge

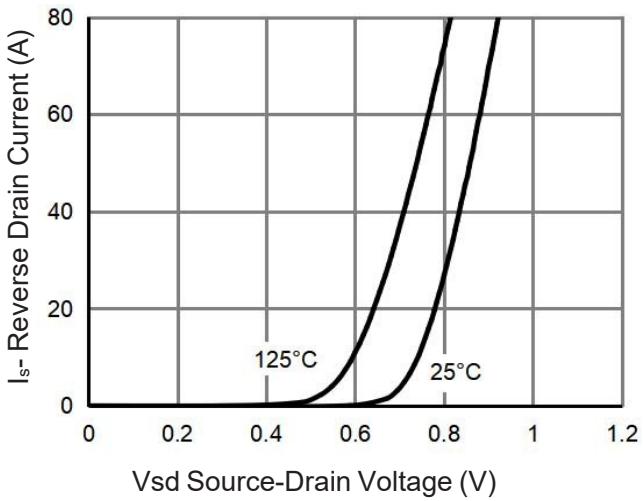


Figure 6 Source- Drain Diode Forward

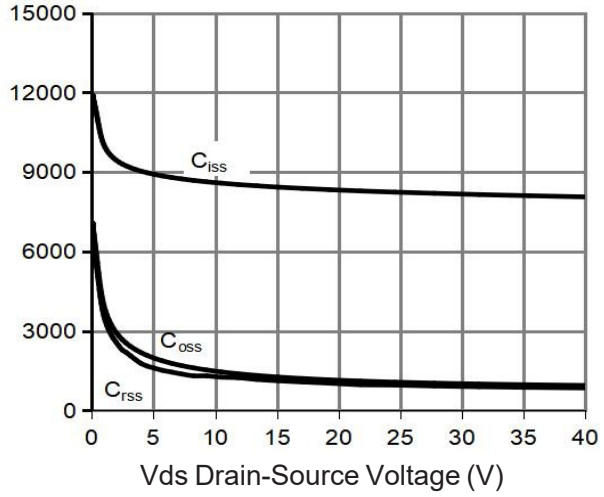


Figure 7 Capacitance vs Vds

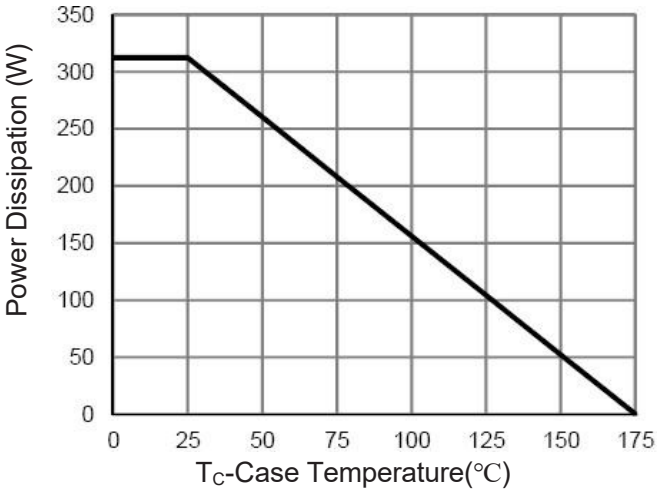


Figure 9 Power De-rating

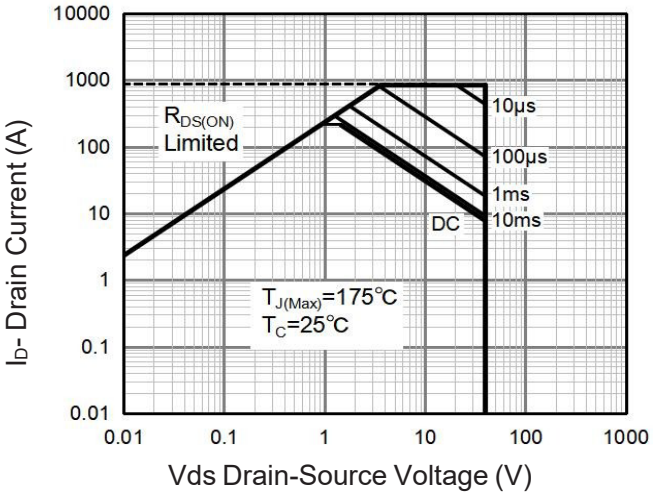


Figure 8 Safe Operation Area (Note3)

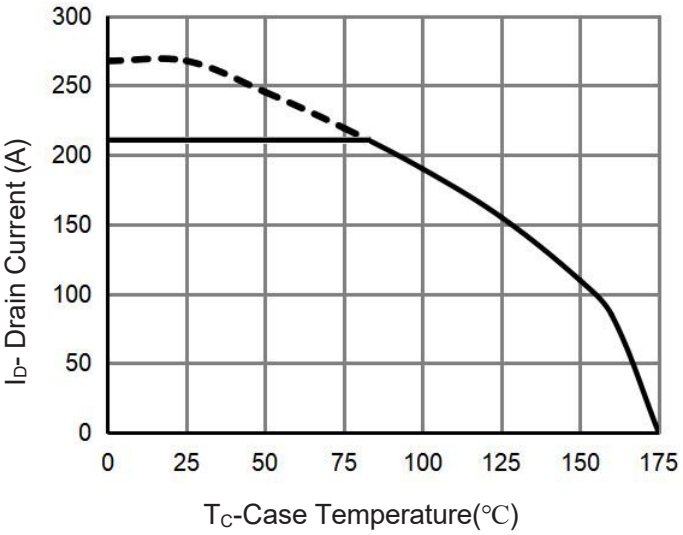


Figure 10 Current De-rating

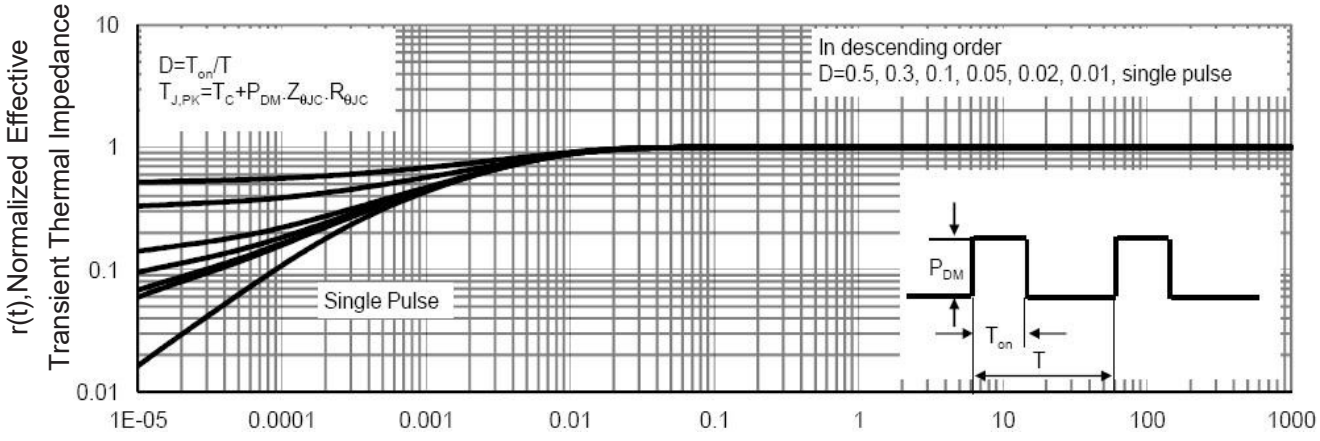


Figure 11 Normalized Maximum Transient Thermal Impedance