

Description

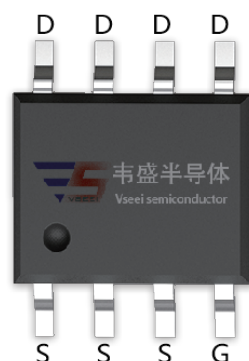
The VSM12N04 uses advanced trench technology and design to provide excellent $R_{DS(ON)}$ with low gate charge. It can be used in a wide variety of applications.

General Features

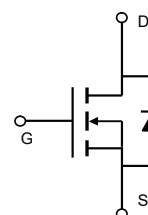
- $V_{DS} = 40V, I_D = 12A$
 $R_{DS(ON)} < 12m\Omega @ V_{GS} = 10V$ (Typ. 8.4 m Ω)
 $R_{DS(ON)} < 18m\Omega @ V_{GS} = 4.5V$ (Typ. 12.3 m Ω)
- High density cell design for ultra low $R_{DS(ON)}$
- Good stability and uniformity with high E_{AS}
- Excellent package for good heat dissipation
- 100% R_g tested
- 100% ΔV_{DS} tested
- 100% UIS tested

Application

- Load switching
- Hard switched and high frequency circuits
- Uninterruptible power supply



SOP-8



Schematic

Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
VSM12N04	VSM12N04-S8	SOP-8	Ø330mm	12mm	4000 units

Absolute Maximum Ratings ($T_A = 25^\circ C$ 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	12	A
Drain Current-Continuous ($T_A = 100^\circ C$)	$I_D (100^\circ C)$	8.5	A
Pulsed Drain Current	I_{DM}	60	A
Single pulse avalanche energy ^(Note 5)	E_{AS}	133	mJ
Maximum Power Dissipation	P_D	3	W
Operating Junction and Storage Temperature Range	T_J, T_{STG}	-55 To 150	$^\circ C$

Thermal Characteristic

Thermal Resistance, Junction-to-Ambient ^(Note 2)	$R_{\theta JA}$	41.7	$^\circ C/W$
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Electrical Characteristics (T_A=25°C unless otherwise noted)

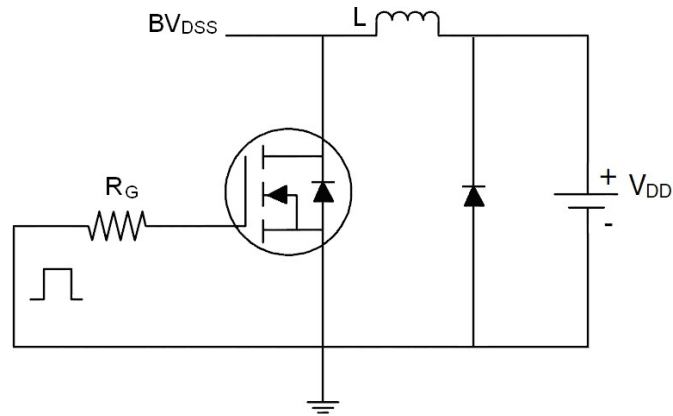
Parameter	Symbol	Condition	Min	Typ	Max	Unit
Off Characteristics						
Drain-Source Breakdown Voltage	BV _{DSS}	V _{GS} =0V I _D =250μA	40	45	-	V
Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} =40V, V _{GS} =0V	-	-	1	μA
Gate-Body Leakage Current	I _{GSS}	V _{GS} =±20V, V _{DS} =0V	-	-	±100	nA
On Characteristics (Note 3)						
Gate Threshold Voltage	V _{GS(th)}	V _{DS} =V _{GS} , I _D =250μA	1.2	1.6	2.5	V
Drain-Source On-State Resistance	R _{DS(ON)}	V _{GS} =10V, I _D =10A	-	8.4	12	mΩ
		V _{GS} =4.5V, I _D =8A	-	12.3	18	mΩ
Forward Transconductance	g _{FS}	V _{DS} =5V, I _D =10A		75	-	S
Dynamic Characteristics (Note4)						
Input Capacitance	C _{iss}	V _{DS} =20V, V _{GS} =0V, F=1.0MHz	-	1780	-	pF
Output Capacitance	C _{oss}		-	209	-	pF
Reverse Transfer Capacitance	C _{rss}		-	160	-	pF
Switching Characteristics (Note 4)						
Turn-on Delay Time	t _{d(on)}	V _{DD} =20V, R _L =2Ω V _{GS} =10V, R _G =3Ω	-	6.4	-	nS
Turn-on Rise Time	t _r		-	17.2	-	nS
Turn-Off Delay Time	t _{d(off)}		-	29.6	-	nS
Turn-Off Fall Time	t _f		-	16.8	-	nS
Total Gate Charge	Q _g	V _{DS} =20V, I _D =10A, V _{GS} =10V	-	38.2		nC
Gate-Source Charge	Q _{gs}		-	5.6		nC
Gate-Drain Charge	Q _{gd}		-	7.4		nC
Drain-Source Diode Characteristics						
Diode Forward Voltage (Note 3)	V _{SD}	V _{GS} =0V, I _S =10A	-		1.2	V
Diode Forward Current (Note 2)	I _S		-	-	12	A
Reverse Recovery Time	t _{rr}	T _J = 25°C, I _F = 10A	-	29	-	nS
Reverse Recovery Charge	Q _{rr}	di/dt = 100A/μs (Note3)	-	26	-	nC

Notes:

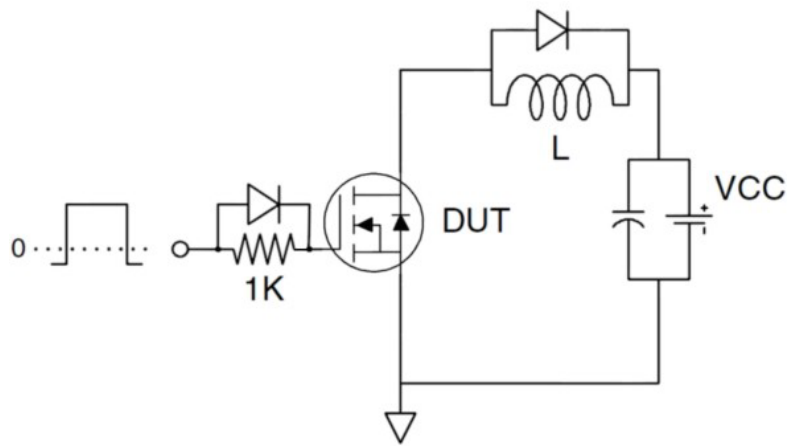
1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board, t ≤ 10 sec.
3. Pulse Test: Pulse Width ≤ 300μs, Duty Cycle ≤ 2%.
4. Guaranteed by design, not subject to production.
5. EAS condition : T_J=25°C, V_{DD}=30V, V_G=10V, L=0.5mH, R_G=25Ω.

Test circuit

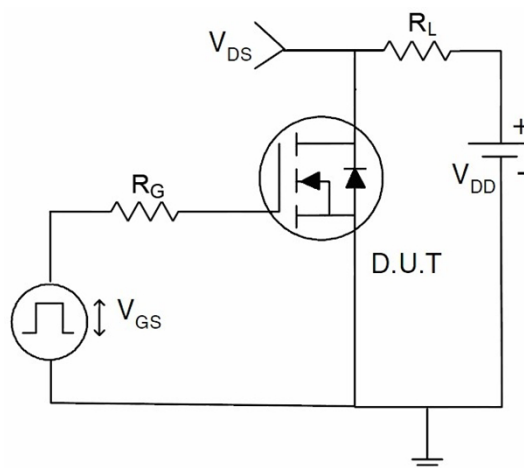
1) E_{AS} Test Circuit



2) Gate Charge Test Circuit



3) Switch Time Test Circuit



Typical Electrical and Thermal Characteristics (Curves)

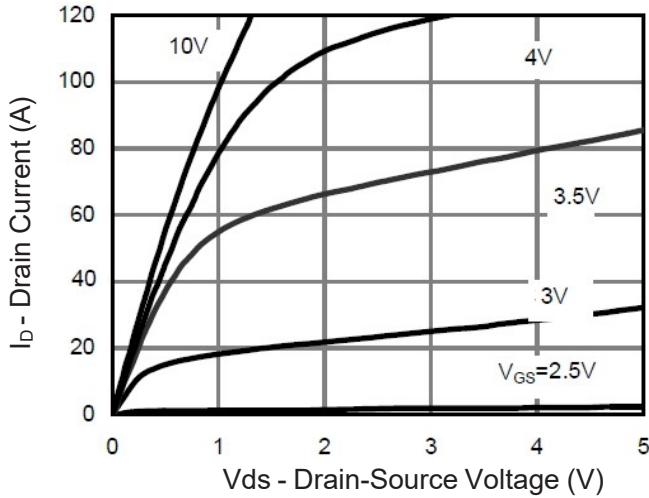


Figure 1 Output Characteristics

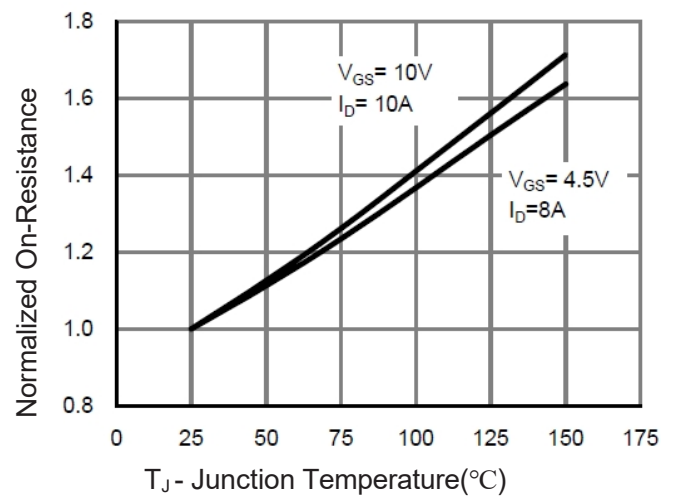


Figure 4 $R_{DS(on)}$ vs Junction Temperature

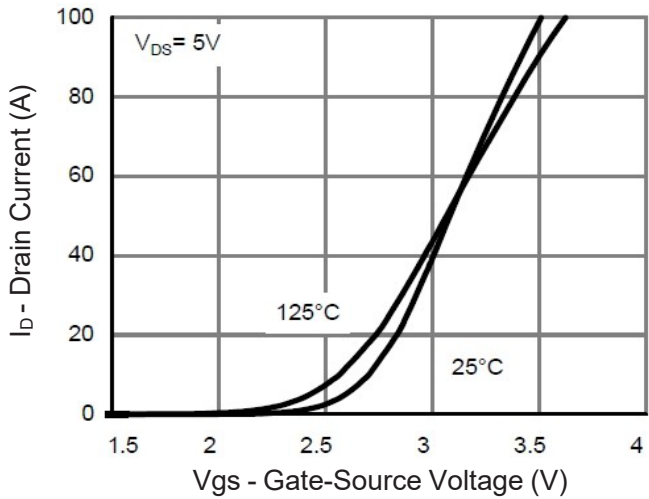


Figure 2 Transfer Characteristics

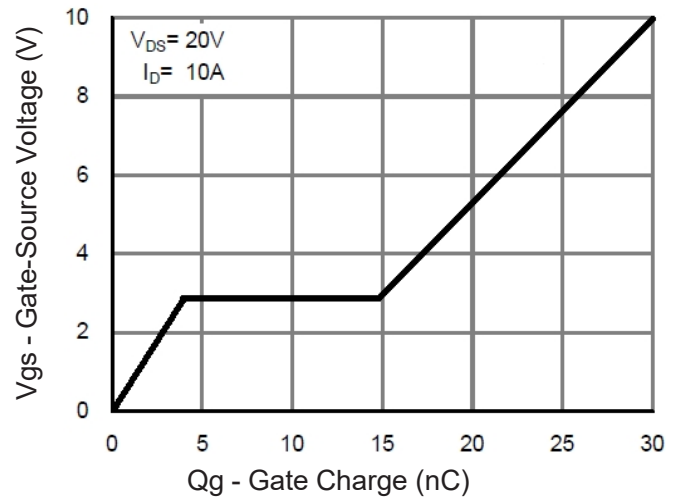


Figure 5 Gate Charge

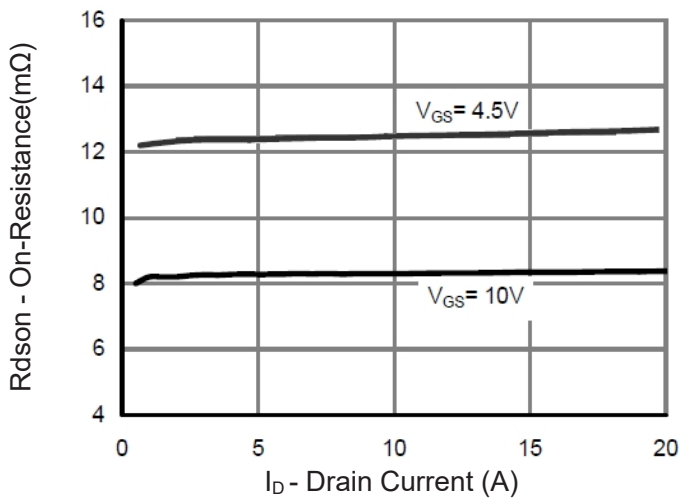


Figure 3 $R_{DS(on)}$ vs Drain Current

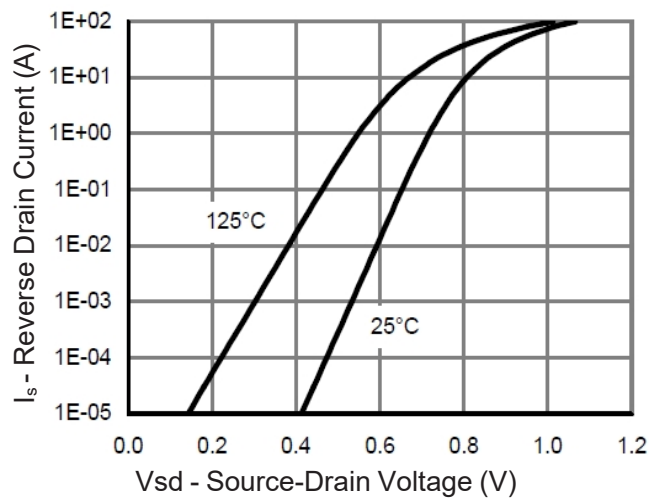
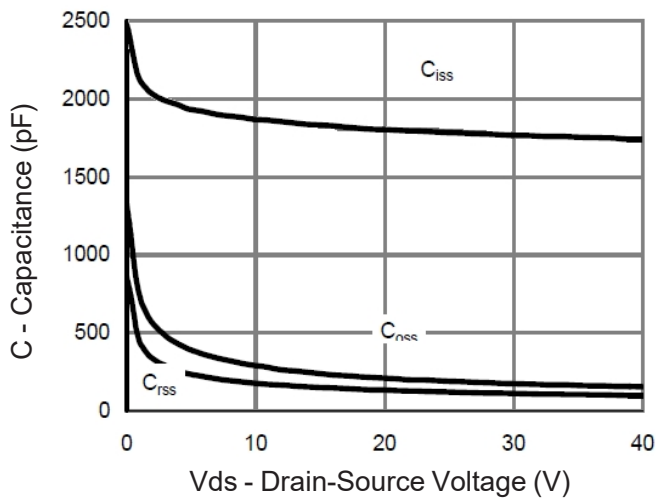
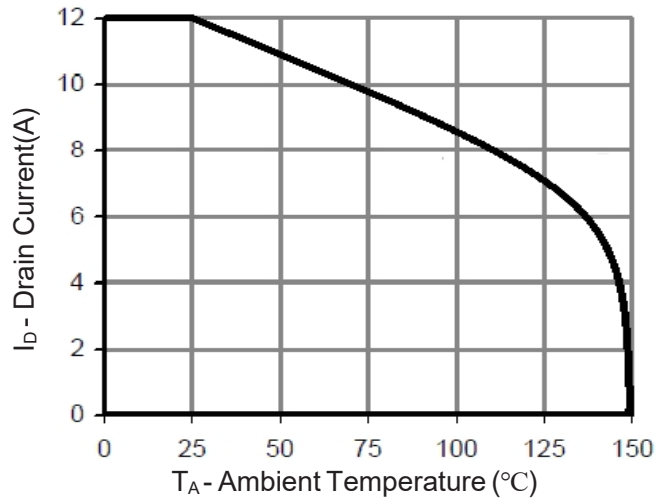
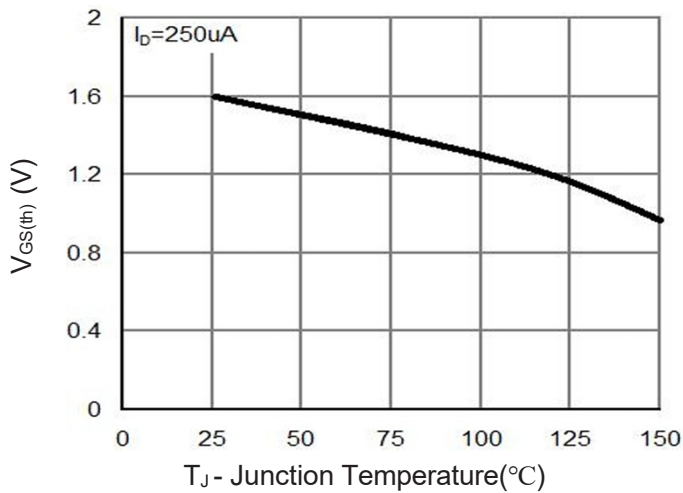
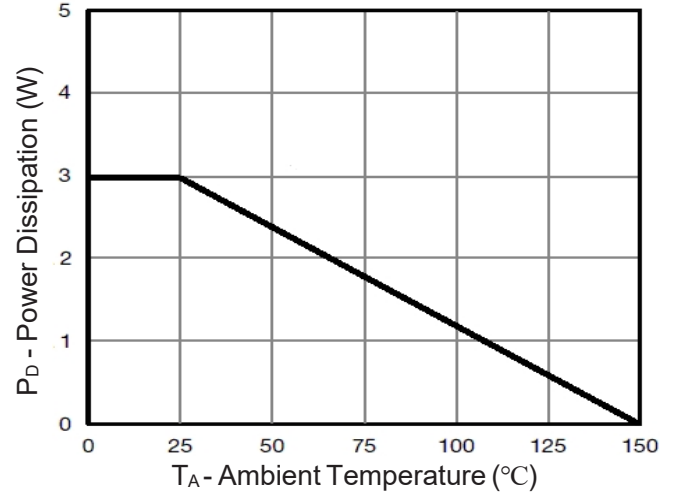
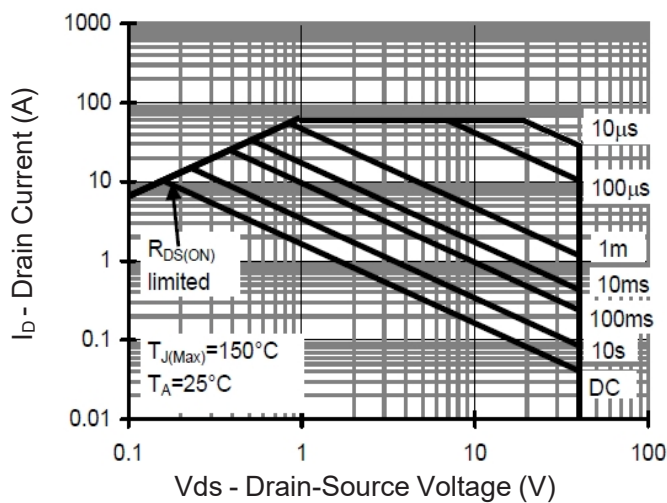
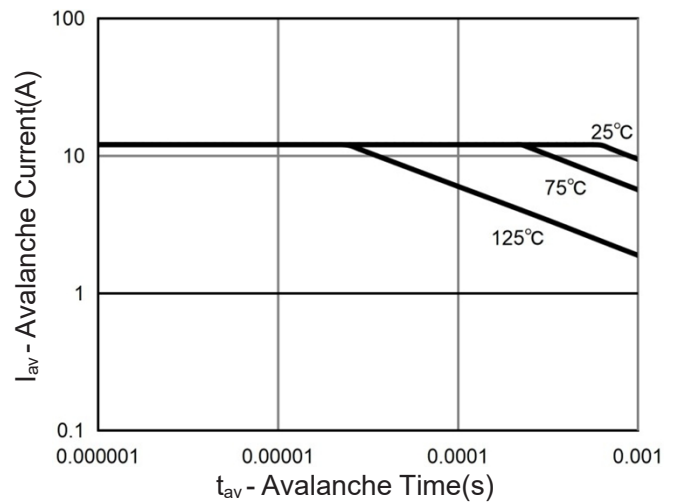


Figure 6 Source-Drain Diode Forward


Figure 7 Capacitance vs Vds

Figure 10 Drain Current De-rating

Figure 8 VGS(th) vs Junction Temperature

Figure 11 Power De-rating

Figure 9 Safe Operation Area

Figure 12 Avalanche Characteristics

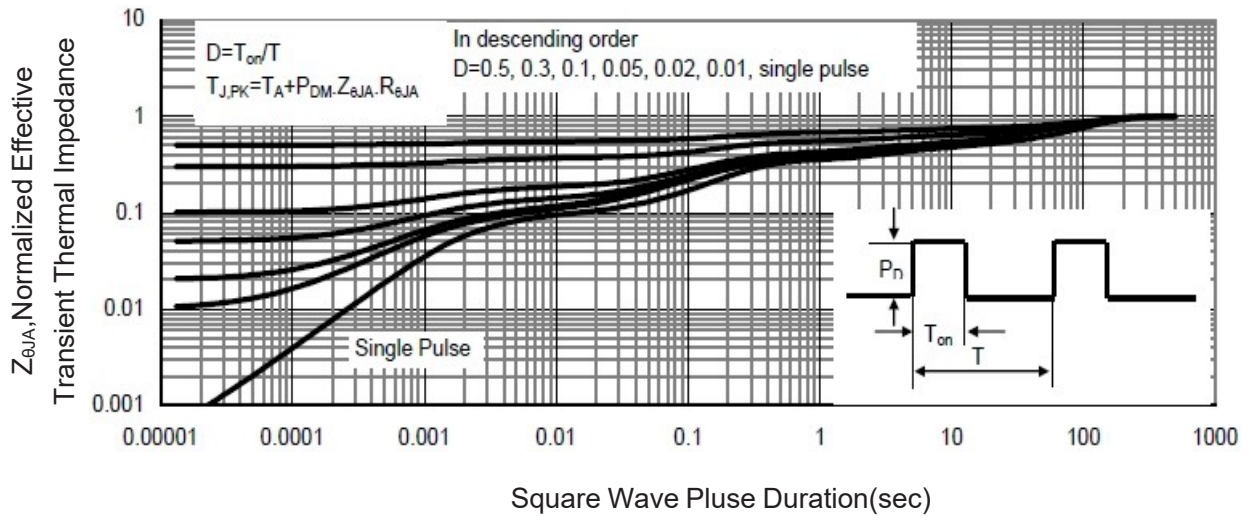


Figure 13 Normalized Maximum Transient Thermal Impedance