

Description

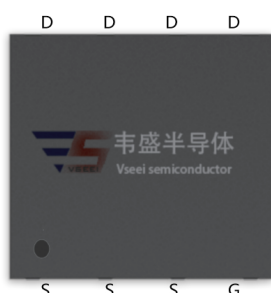
The VSM53N04 uses advanced trench technology and design to provide excellent $R_{DS(ON)}$ with low gate charge. It can be used in a wide variety of applications.

Application

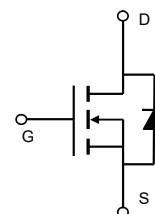
- Load switching
- Hard switched and high frequency circuits
- Uninterruptible power supply

General Features

- $V_{DS}=40V, I_D=53A$
- $R_{DS(ON)} < 6.4m\Omega @ V_{GS}=10V$
- $R_{DS(ON)} < 11m\Omega @ V_{GS}=4.5V$
- High density cell design for ultra low $R_{DS(on)}$
- Fully characterized avalanche voltage and current
- Good stability and uniformity with high E_{AS}
- Excellent package for good heat dissipation
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DFN3x3



Schematic

Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
VSM53N04	VSM53N04-D33	DFN3x3	-	-	-

Absolute Maximum Ratings ($T_c=25^{\circ}C$ 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	53	A
Drain Current-Continuous($T_c=100^{\circ}C$)	$I_D(100^{\circ}C)$	33	A
Pulsed Drain Current	I_{DM}	212	A
Maximum Power Dissipation	P_D	30	W
Derating factor		0.24	W/ $^{\circ}C$
Single pulse avalanche energy (Note 5)	E_{AS}	196	mJ
Operating Junction and Storage Temperature Range	T_J, T_{STG}	-55 To 150	$^{\circ}C$

Thermal Characteristic

Thermal Resistance, Junction-to-Case	$R_{\theta JC}$	4.2	$^{\circ}C/W$
Thermal Resistance, Junction-to-Ambient (Note 2)	$R_{\theta JA}$	60	$^{\circ}C/W$

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

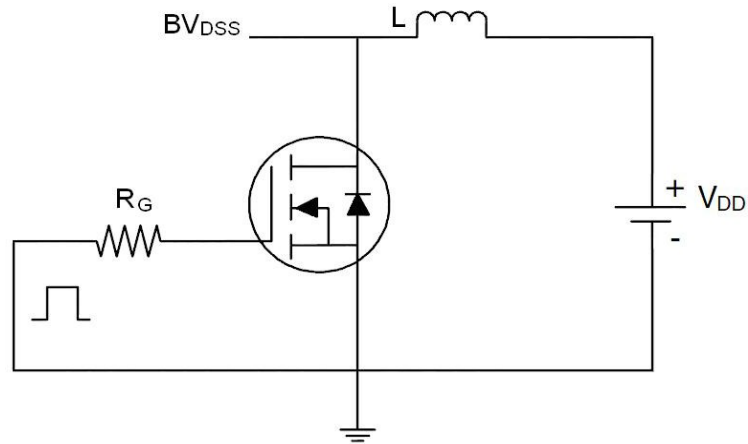
Parameter	Symbol	Condition	Min	Typ	Max	Unit
Off Characteristics						
Drain-Source Breakdown Voltage	BV_{DSS}	$V_{GS}=0V, I_D=250\mu A$	40	-	-	V
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS}=40V, V_{GS}=0V$	-	-	1	μA
Gate-Body Leakage Current	I_{GSS}	$V_{GS}=\pm 20V, V_{DS}=0V$	-	-	± 100	nA
On Characteristics (Note 3)						
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=250\mu A$	1.2	1.6	2.0	V
Drain-Source On-State Resistance	$R_{DS(ON)}$	$V_{GS}=10V, I_D=20A$	-	5.5	6.4	m Ω
		$V_{GS}=4.5V, I_D=20A$	-	8.3	11	
Forward Transconductance	g_{FS}	$V_{DS}=10V, I_D=20A$	-	35	-	S
Dynamic Characteristics (Note4)						
Input Capacitance	C_{iss}	$V_{DS}=20V, V_{GS}=0V,$ $F=1.0MHz$	-	1630	-	pF
Output Capacitance	C_{oss}		-	186	-	pF
Reverse Transfer Capacitance	C_{rss}		-	180	-	pF
Switching Characteristics (Note 4)						
Turn-on Delay Time	$t_{d(on)}$	$V_{DD}=20V, I_D=2A, R_L=1\Omega$ $V_{GS}=10V, R_G=3\Omega$	-	6	-	nS
Turn-on Rise Time	t_r		-	16	-	nS
Turn-Off Delay Time	$t_{d(off)}$		-	25	-	nS
Turn-Off Fall Time	t_f		-	14	-	nS
Total Gate Charge	Q_g	$V_{DS}=20V, I_D=20A,$ $V_{GS}=10V$	-	43	-	nC
Gate-Source Charge	Q_{gs}		-	4.5	-	nC
Gate-Drain Charge	Q_{gd}		-	12.5	-	nC
Drain-Source Diode Characteristics						
Diode Forward Voltage (Note 3)	V_{SD}	$V_{GS}=0V, I_S=20A$	-	-	1.2	V
Diode Forward Current (Note 2)	I_S		-	-	53	A
Reverse Recovery Time	t_{rr}	$T_J = 25^{\circ}C, I_F = 20A$ $di/dt = 100A/\mu s$ (Note3)	-	29	-	nS
Reverse Recovery Charge	Q_{rr}		-	26	-	nC
Forward Turn-On Time	t_{on}	Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD)				

Notes:

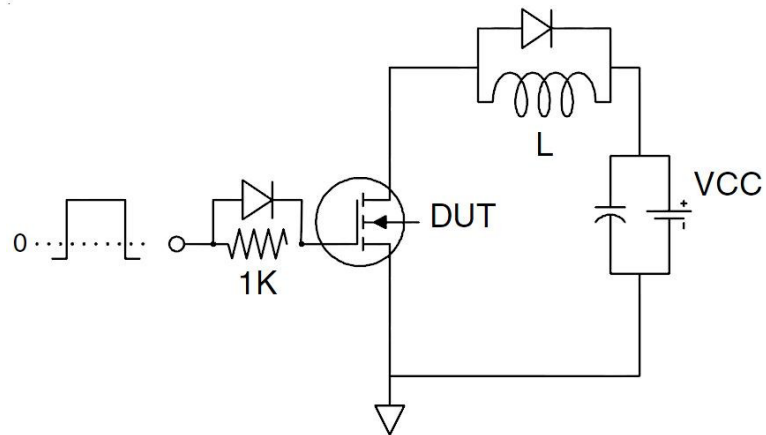
1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. The value of $R_{\theta JA}$ is measured with the device mounted on 1in² FR-4 board with 2oz. Copper, in a still air environment with $T_A = 25^{\circ}\text{C}$. The value in any given application depends on the user's specific board design, and the maximum temperature of 150°C may be used if the PCB allows it. The $R_{\theta JA}$ is the sum of the thermal impedance from junction to case $R_{\theta JC}$ and case to ambient.
3. Pulse Test: Pulse Width $\leq 300\mu s$, Duty Cycle $\leq 2\%$.
4. Guaranteed by design, not subject to production
5. E_{AS} condition : $T_J=25^{\circ}\text{C}, V_{DD}=20V, V_G=10V, L=0.5mH, R_g=25\Omega$.

Test circuit

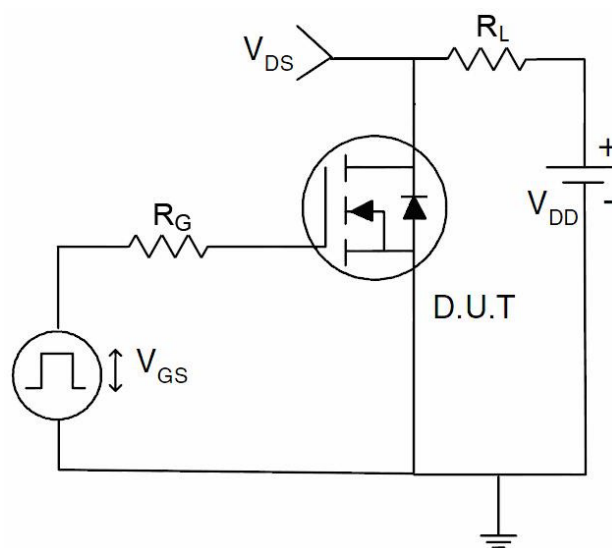
1) E_{AS} Test Circuit



2) Gate Charge Test Circuit



3) Switch Time Test Circuit



Typical Electrical and Thermal Characteristics (Curves)

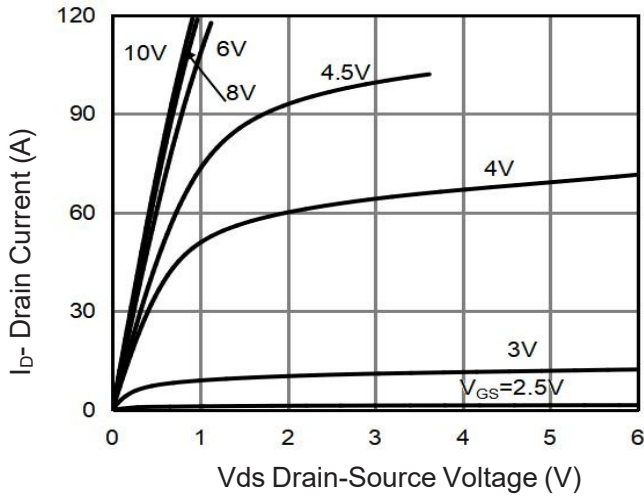


Figure 1 Output Characteristics

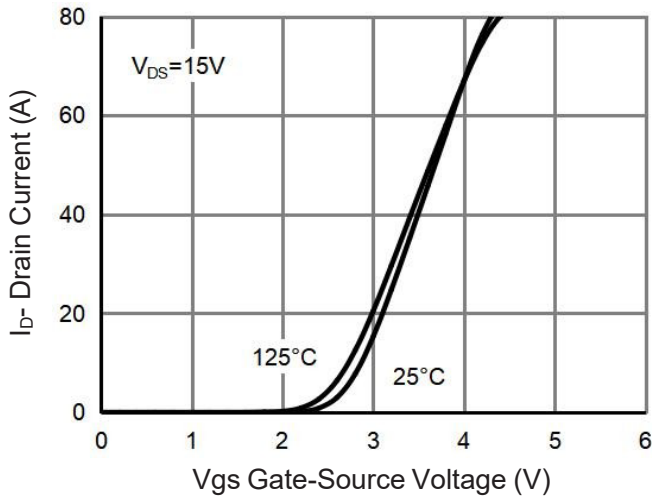


Figure 2 Transfer Characteristics

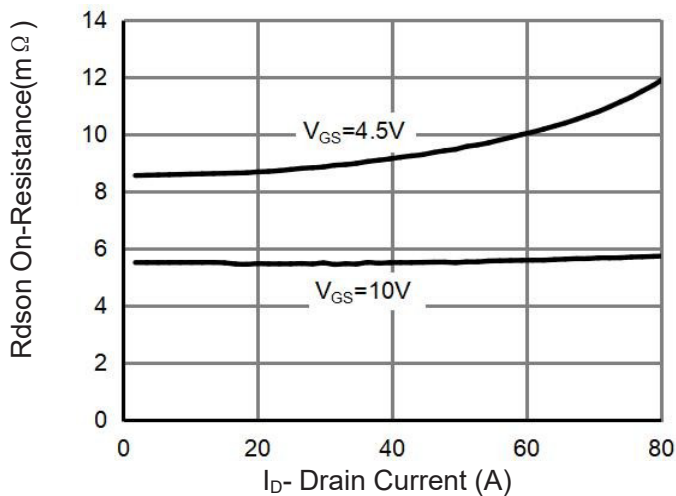


Figure 3 Rdson- Drain Current

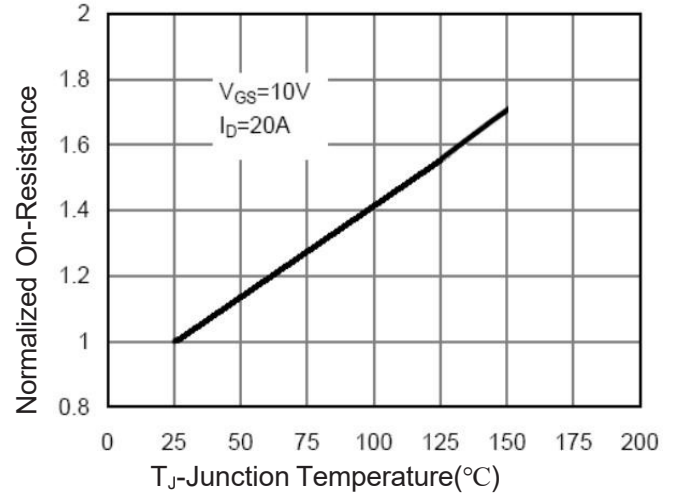


Figure 4 Rdson-Junction Temperature

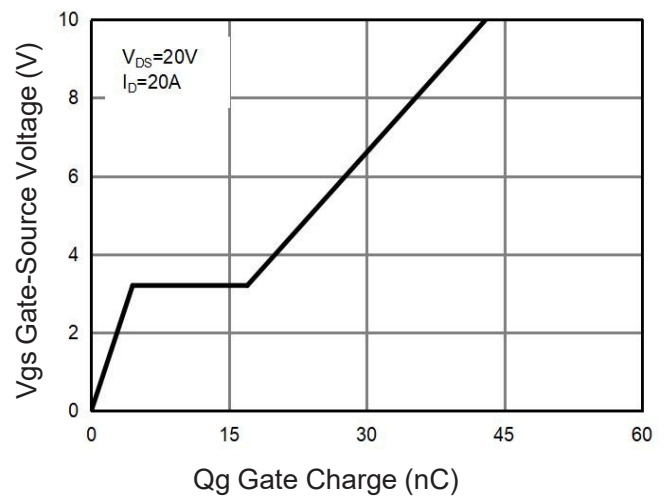


Figure 5 Gate Charge

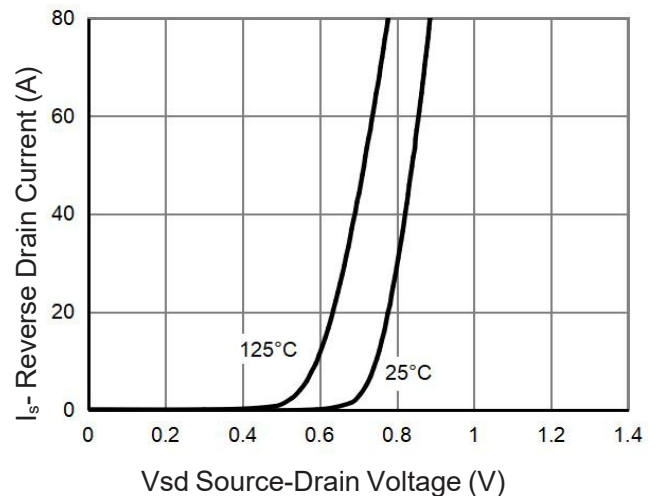
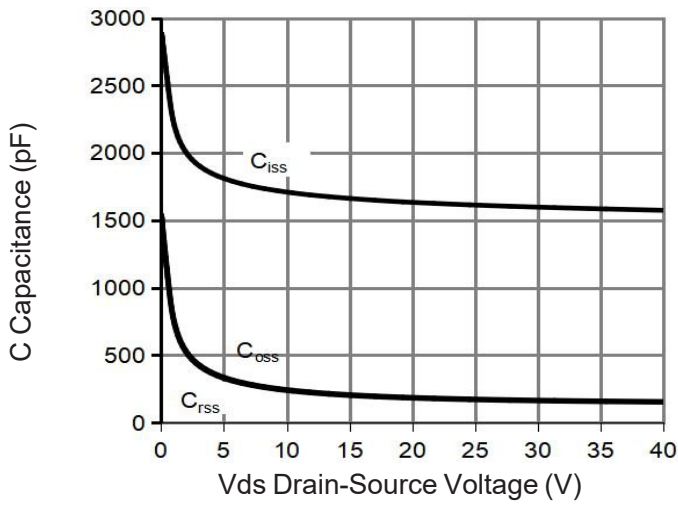
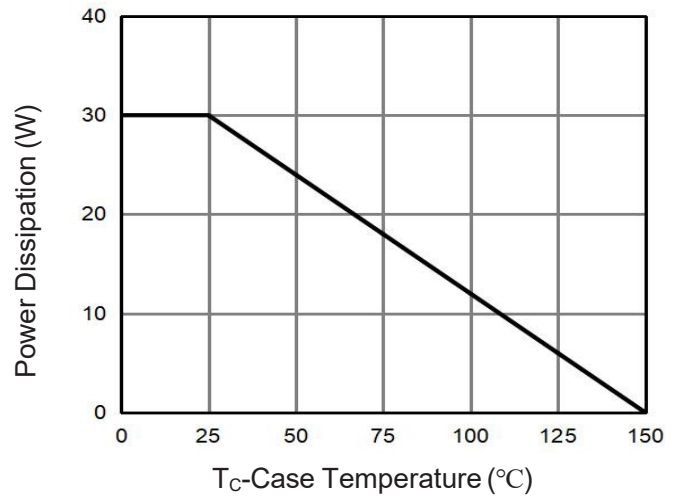
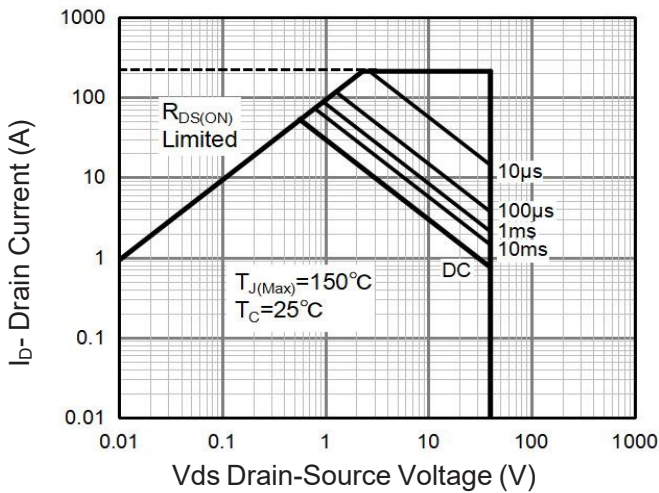
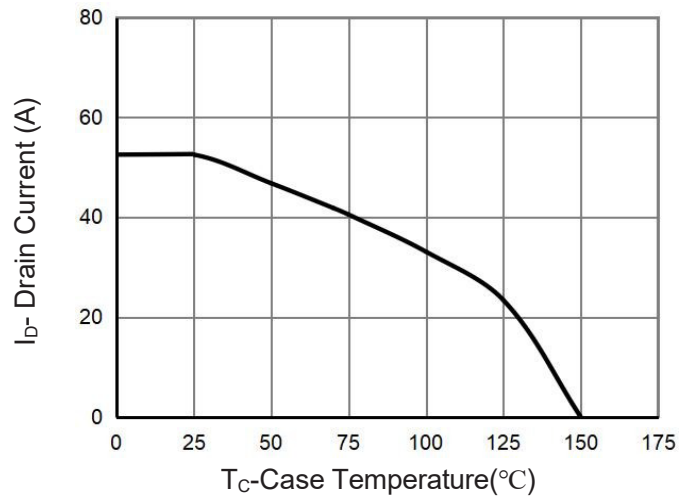
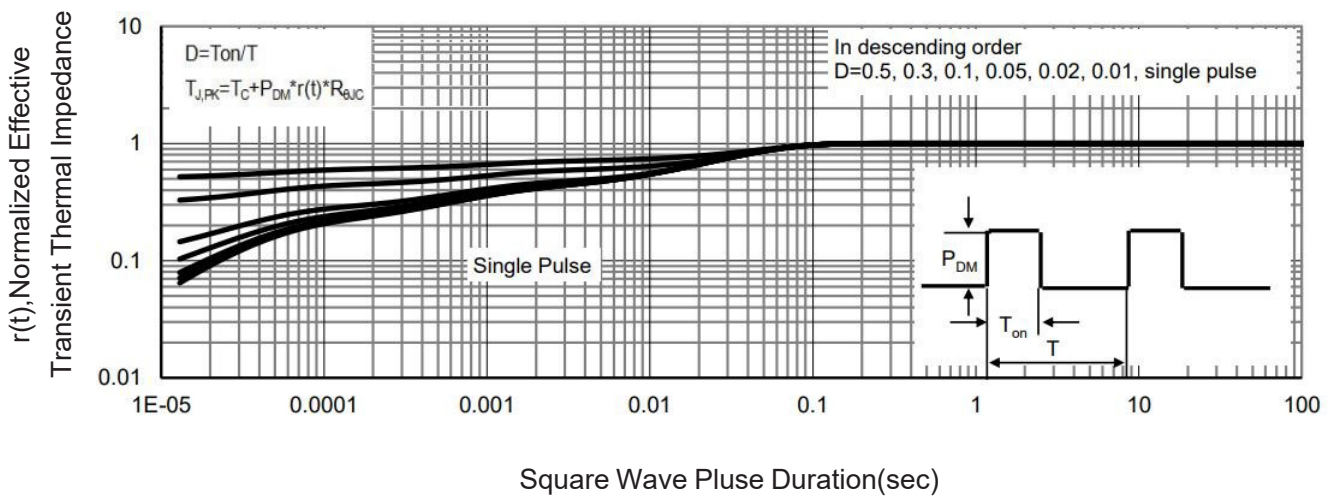


Figure 6 Source- Drain Diode Forward


Figure 7 Capacitance vs Vds

Figure 9 Power De-rating

Figure 8 Safe Operation Area

Figure 10 Current De-rating

Figure 11 Normalized Maximum Transient Thermal Impedance