

Description

The VSM40N04 uses **Super Trench** technology that is uniquely optimized to provide the most efficient high frequency switching performance. Both conduction and switching power losses are minimized due to an extremely low combination of $R_{DS(ON)}$ and Q_g . This device is ideal for high-frequency switching and synchronous rectification

Application

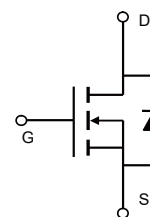
- DC/DC Converter
- Ideal for high-frequency switching and synchronous rectification

General Features

- $V_{DS}=40V, I_D=40A$
 $R_{DS(ON)}=9.5m\Omega$ (typical) @ $V_{GS}=10V$
- Excellent gate charge x $R_{DS(on)}$ product(FOM)
- Very low on-resistance $R_{DS(on)}$
- 150°C operating temperature
- Pb-free lead plating;RoHscompliant
- Halogen-freeaccordingtoIEC61249-2-21
- 100% UIS tested
- 100% ΔV_{ds} tested



DFN5x6



Schematic

Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
VSM40N04	VSM40N04-D56	DFN5x6	Ø330mm	12mm	5000units

Absolute Maximum Ratings ($T_c=25^\circ\text{C}$ 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	40	A
Drain Current-Continuous($T_c=100^\circ\text{C}$)	$I_D(100^\circ\text{C})$	25	A
Pulsed Drain Current	I_{DM}	160	A
Maximum Power Dissipation	P_D	28	W
Derating factor		0.23	W/°C
Single pulse avalanche energy (Note 1)	E_{AS}	70	mJ
Operating Junction and Storage Temperature Range	T_J, T_{STG}	-55 To 150	°C

Thermal Characteristic

Thermal Resistance,Junction-to-Case	$R_{\theta JC}$	4.5	°C/W
Thermal Resistance,Junction-to-Ambient(†Note 4)	$R_{\theta JA}$	50	°C/W

Electrical Characteristics (T_c=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	-	-	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						
Gate Threshold Voltage	V _{GS(th)}	V _{DS} =V _{GS} , I _D =250μA	2.0	3.0	4.0	V
Drain-Source On-State Resistance	R _{DS(ON)}	V _{GS} =10V, I _D =20A	-	9.5	10.5	mΩ
Forward Transconductance	g _{FS}	V _{DS} =5V, I _D =20A	-	30	-	S
Dynamic Characteristics						
Input Capacitance	C _{iss}	V _{DS} =20V, V _{GS} =0V, F=1.0MHz	-	725	-	pF
Output Capacitance	C _{oss}		-	375	-	pF
Reverse Transfer Capacitance	C _{rss}		-	28	-	pF
Switching Characteristics (Note 2)						
Turn-on Delay Time	t _{d(on)}	V _{DD} =20V, I _D =20A V _{GS} =10V, R _G =1.6Ω	-	6	-	nS
Turn-on Rise Time	t _r		-	2.8	-	nS
Turn-Off Delay Time	t _{d(off)}		-	23	-	nS
Turn-Off Fall Time	t _f		-	3	-	nS
Total Gate Charge	Q _g	V _{DS} =20V, I _D =20A, V _{GS} =10V	-	14.6	-	nC
Gate-Source Charge	Q _{gs}		-	4.7	-	nC
Gate-Drain Charge	Q _{gd}		-	4.1	-	nC
Drain-Source Diode Characteristics						
Diode Forward Voltage	V _{SD}	V _{GS} =0V, I _S =20A	-	-	1.2	V
Diode Forward Current	I _S		-	-	40	A
Reverse Recovery Time	t _{rr}	T _J = 25°C, I _F = I _S	-	11	-	nS
Reverse Recovery Charge	Q _{rr}	di/dt = 100A/μs	-	19	-	nC

Notes:

1. EAS condition : T_J=25°C, V_{DD}=20V, V_G=10V, L=0.5mH, R_G=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)}=150°C. The SOA curve provides a single pulse rating.
4. The value of R_{θJA} is measured with the device mounted on 1in2 FR-4 board with 2oz. Copper, in a still air environment with T_A=25° 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.

Typical Electrical and Thermal Characteristics

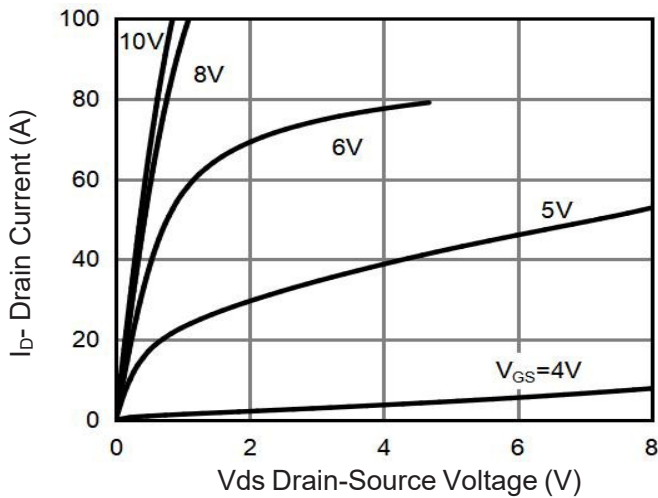


Figure 1 Output Characteristics

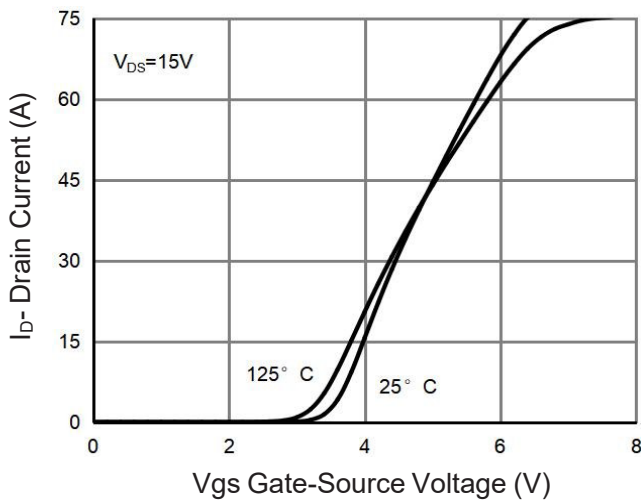


Figure 2 Transfer Characteristics

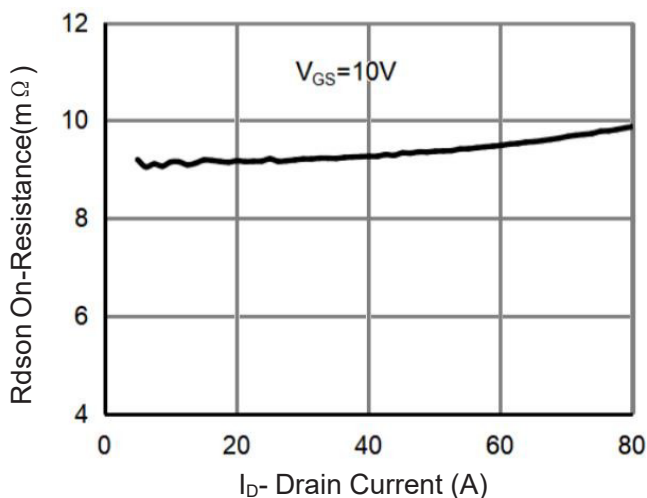


Figure 3 Rdson- Drain Current

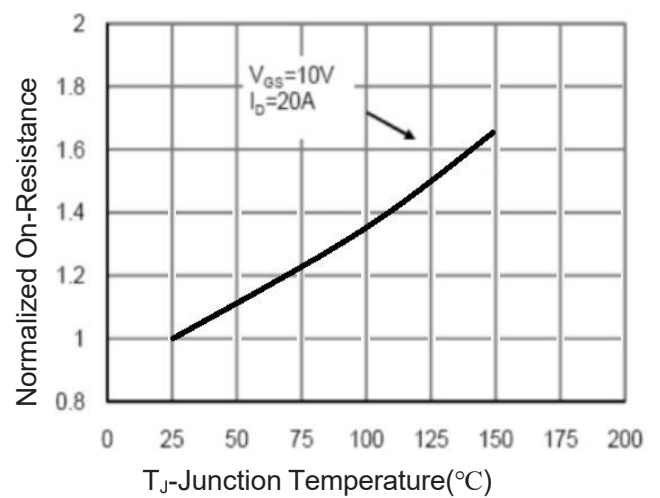


Figure 4 Rdson-Junction Temperature

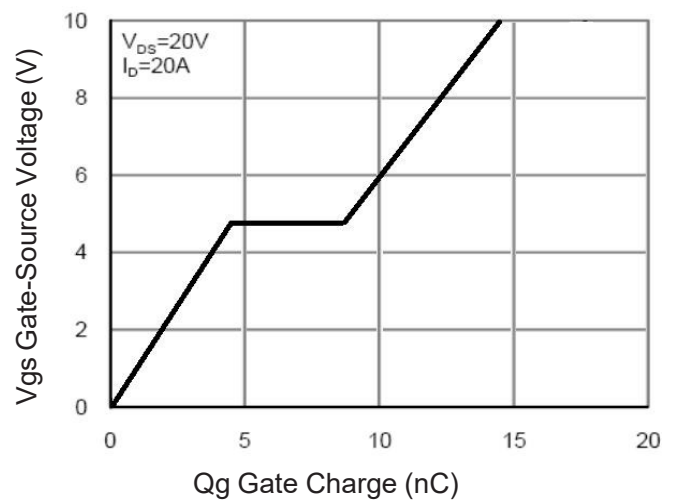


Figure 5 Gate Charge

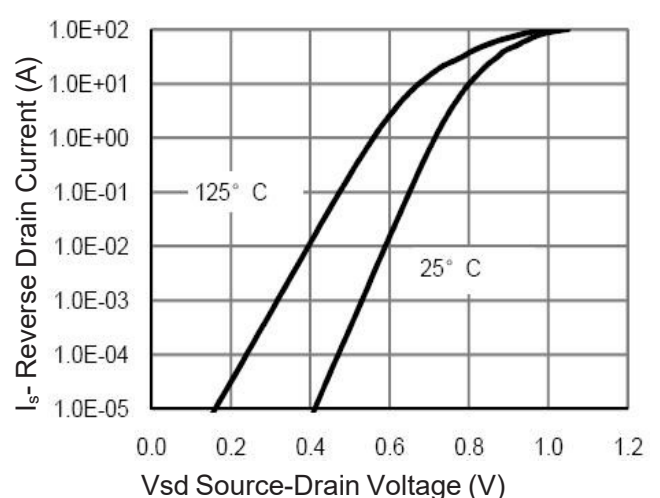
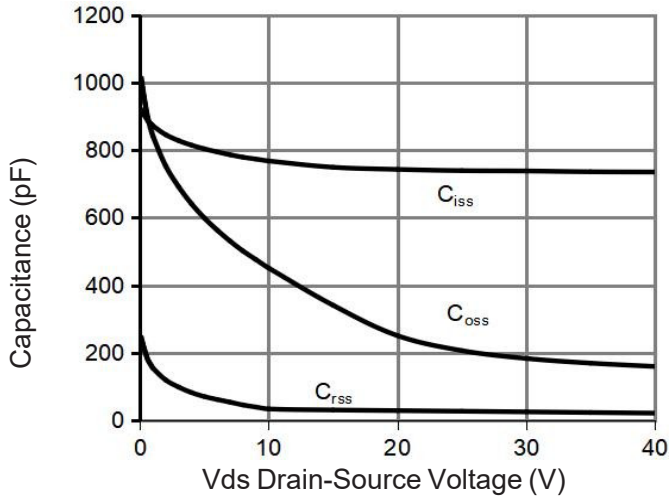
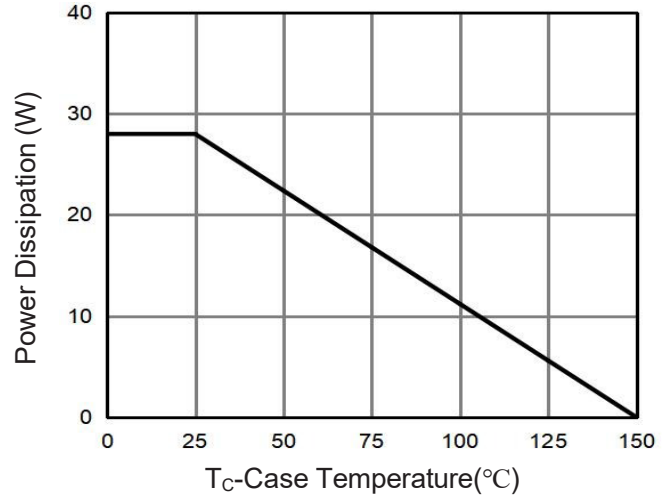
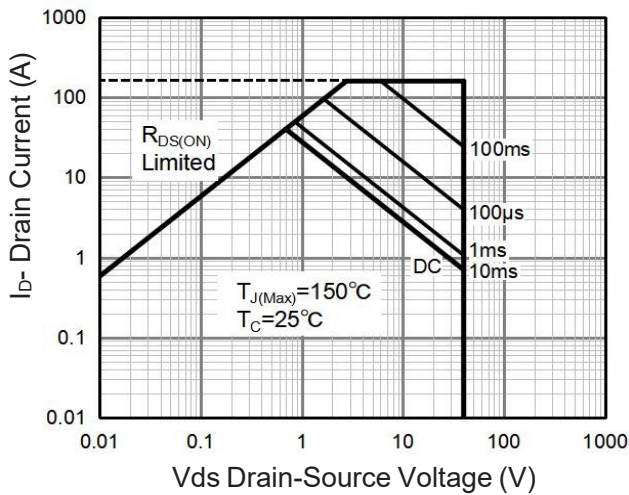
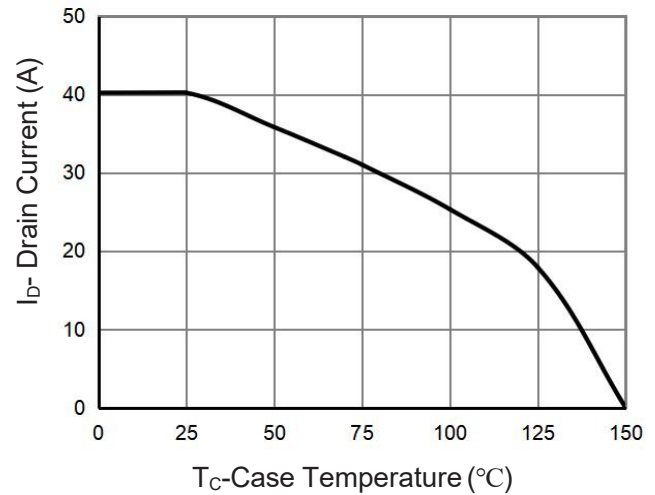
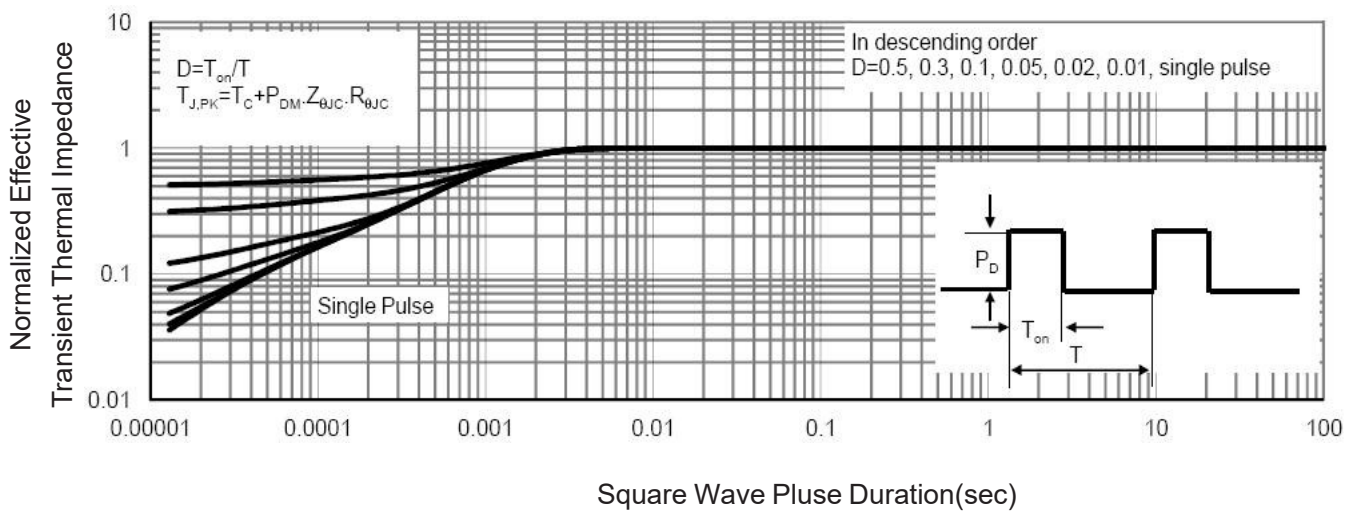


Figure 6 Source- Drain Diode Forward


Figure 7 Capacitance vs Vds

Figure 9 Power De-rating

Figure 8 Safe Operation Area(Note3)

Figure 10 Current De-rating

Figure 11 Normalized Maximum Transient Thermal Impedance