

Description

The VSM60N04 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

N-Ch1&N-Ch2

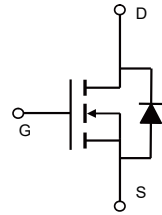
- $V_{DS}=40V, I_D=60A$
 $R_{DS(ON)}=6m\Omega @ V_{GS}=10V(typ.)$
 $R_{DS(ON)}=9.2m\Omega @ V_{GS}=4.5V(typ.)$
- Excellent gate charge x $R_{DS(ON)}$ product(FOM)
- Very low on-resistance $R_{DS(ON)}$
- Half Bridge Power MOSFET

Application

- Compact DC/DC converter applications
- Motor Drive



DFN5x6



Schematic

Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
VSM60N04	VSM60N04-D56	DFN5x6	-	-	-

Absolute Maximum Ratings ($T_c=25^\circ C$ unless otherwise noted)

Parameter	Symbol	Limit		Unit
		N-Ch1	N-Ch2	
Drain-Source Voltage	V_{DS}	40	40	V
Gate-Source Voltage	V_{GS}	± 20	± 20	V
Drain Current-Continuous	I_D	60	60	A
Drain Current-Continuous($T_c=100^\circ C$)	$I_D(100^\circ C)$	38.3	38.3	A
Pulsed Drain Current	I_{DM}	240	240	A
Maximum Power Dissipation	P_D	45	45	W
Single pulse avalanche energy (Note 5)	E_{AS}	174	174	mJ
Operating Junction and Storage Temperature Range	T_J, T_{STG}	-55 To 150	-55 To 150	$^\circ C$

Thermal Characteristic

Thermal Resistance, Junction-to-Case (Note 2)	$R_{\theta JC}$	2.78	$^\circ C/W$
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N-Ch1&N-Ch2 Electrical Characteristics (T_c=25°C unless otherwise noted)

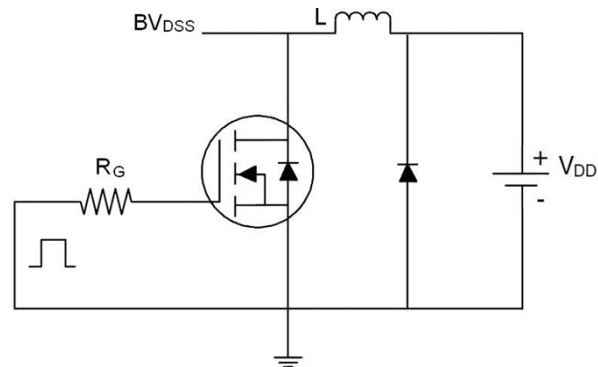
Parameter	Symbol	Condition	Min	Typ	Max	Unit
Off Characteristics						
Drain-Source Breakdown Voltage	BV _{DSS}	V _{GS} =0V I _D =250μA	40	-	-	V
Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} =40V, V _{GS} =0V	-	-	1	μA
Gate-Body Leakage Current	I _{GSS}	V _{GS} =±20V, V _{DS} =0V	-	-	±100	nA
On Characteristics (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	-	6	7.2	mΩ
		V _{GS} =4.5V, I _D =5A	-	9.2	12	mΩ
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, R _L =1Ω V _{GS} =10V, R _{GEN} =3Ω	-	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 =10A, 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 =10A	-	-	1.2	V
Diode Forward Current (Note 2)	I _S		-	-	60	A

Notes:

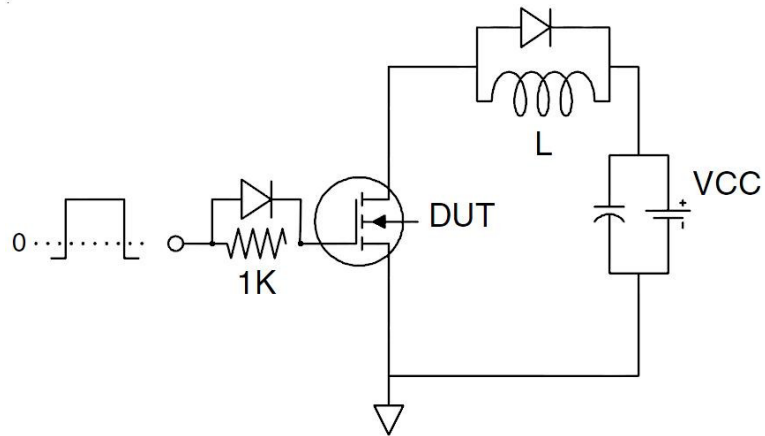
1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board, t ≤ 10 sec.
3. Pulse Test: Pulse Width ≤ 300μs, Duty Cycle ≤ 2%.
4. Guaranteed by design, not subject to production
5. EAS condition: T_j=25°C, V_{DD}=20V, V_G=10V, L=0.5mH, R_g=25Ω

Test circuit

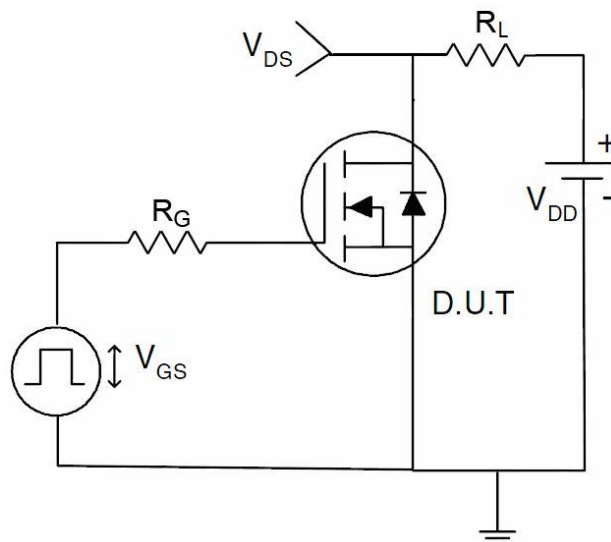
1) E_{AS} test Circuits



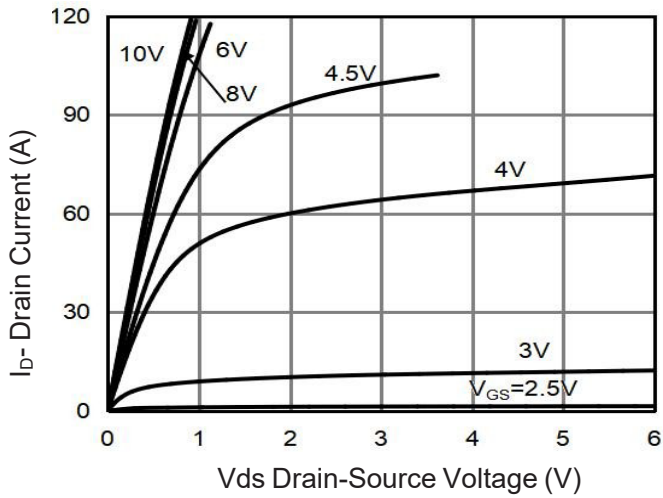
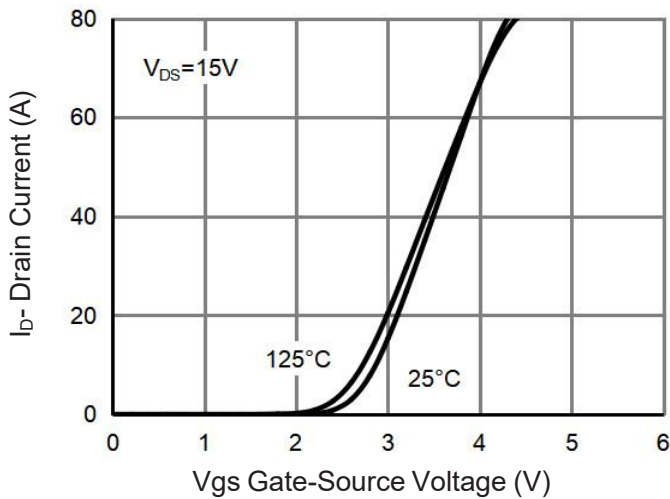
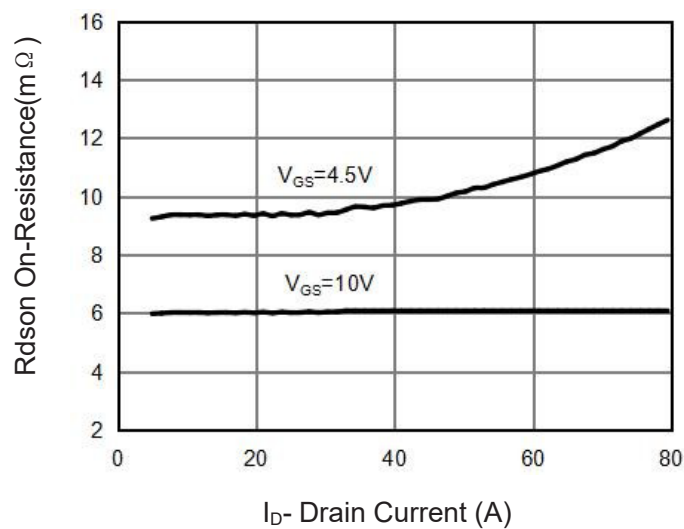
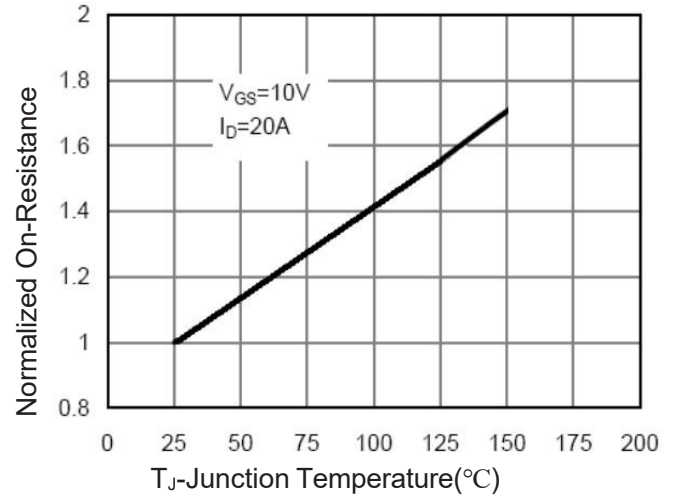
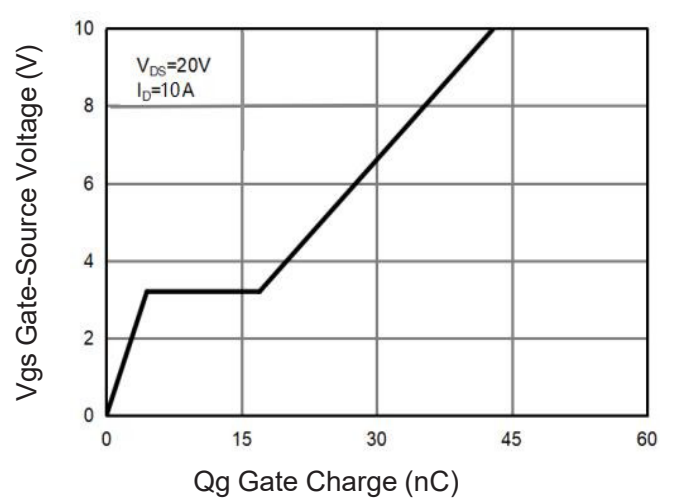
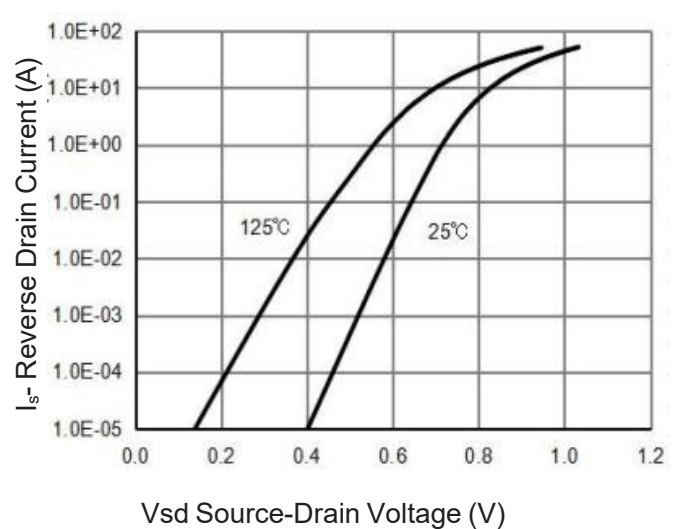
2) Gate charge test Circuit:

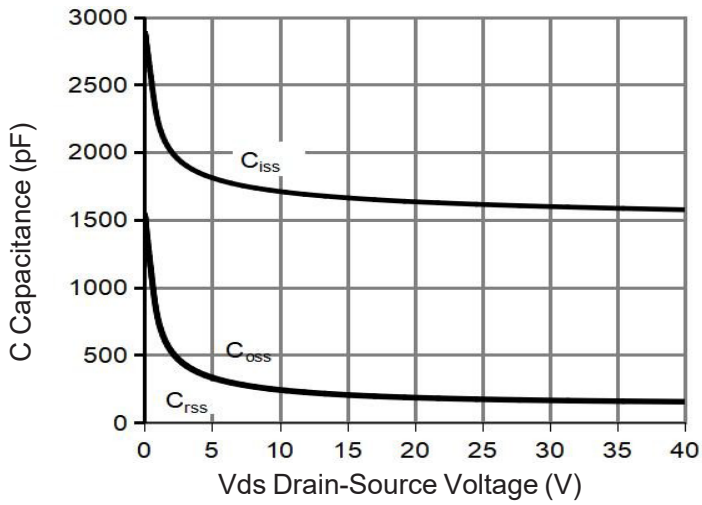
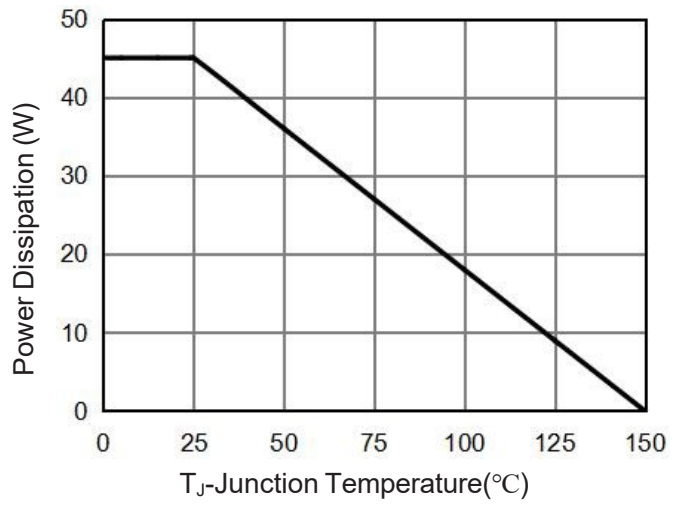
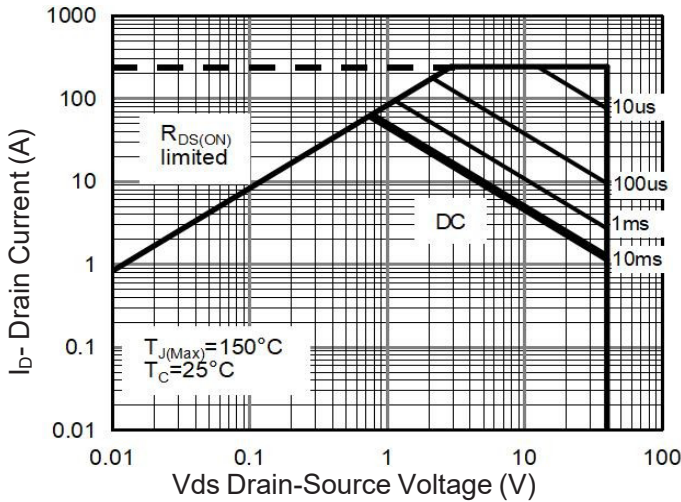
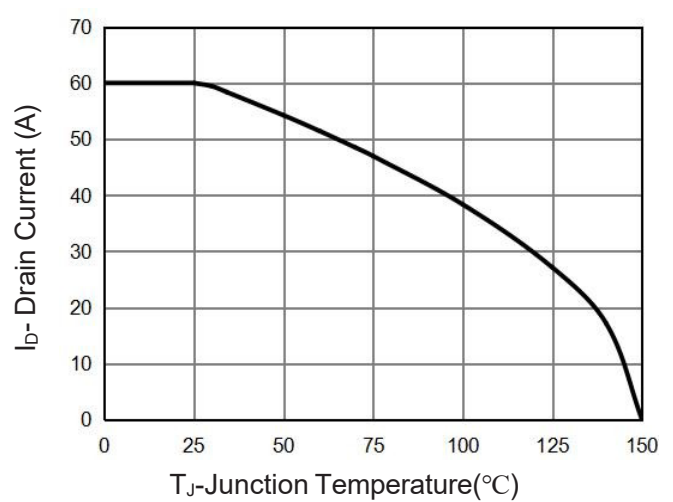
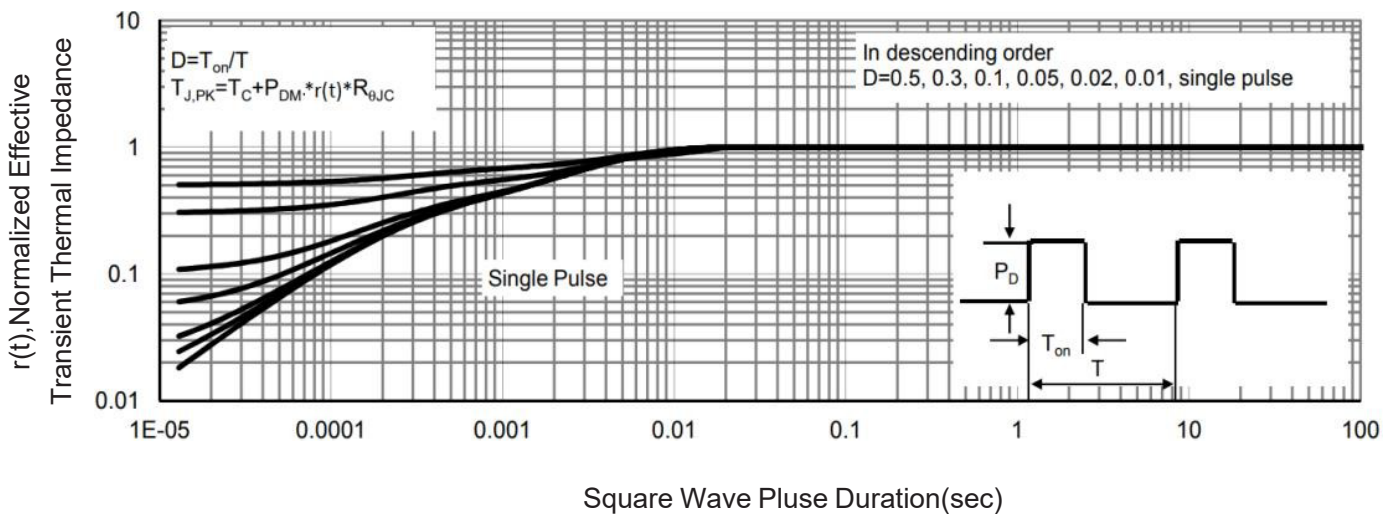


3) Switch Time Test Circuit:



Typical Electrical and Thermal Characteristics (Curves)


Figure 1 Output Characteristics

Figure 2 Transfer Characteristics

Figure 3 Rdson- Drain Current

Figure 4 Rdson-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 I_D Current De-rating

Figure 11 Normalized Maximum Transient Thermal Impedance