

## VSI007N04MS-VB Datasheet

### N-Channel 40 V (D-S) MOSFET

#### PRODUCT SUMMARY

$V_{DS}$ (V)	$R_{DS(on)}$ ( $\Omega$ )	$I_D$ (A)	$Q_g$ (Typ.)
40	0.0F3 at $V_{GS} = 10$ V	55 <sup>d</sup>	F9.5
	0.0FI at $V_{GS} = 4.5$ V	15 <sup>d</sup>	

#### FEATURES

- Halogen-free According to IEC 61249-2-21 Definition
- VBmos<sup>®</sup> Trench Cell
- 100 %  $R_g$  and UIS Tested
- Compliant to RoHS Directive 2002/95/EC

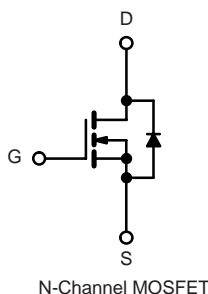
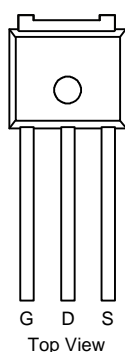


**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**

#### APPLICATIONS

- Power Supply
  - Secondary Synchronous Rectification
- DC/DC Converter

TO-251



#### ABSOLUTE MAXIMUM RATINGS $T_C = 25$ °C, unless otherwise noted

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	$V_{DS}$	40	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	
Continuous Drain Current ( $T_J = 150$ °C)	$I_D$	$T_C = 25$ °C	A
		$T_C = 70$ °C	
Pulsed Drain Current	$I_{DM}$	165	
Avalanche Current	$I_{AS}$	4	
Single Avalanche Energy <sup>a</sup>	$E_{AS}$	8	mJ
Maximum Power Dissipation <sup>a</sup>	$P_D$	$T_C = 25$ °C	W
		$T_A = 25$ °C <sup>c</sup>	
Operating Junction and Storage Temperature Range	$T_J, T_{stg}$	- 55 to 150	°C

#### THERMAL RESISTANCE RATINGS

Parameter	Symbol	Limit	Unit
Junction-to-Ambient (PCB Mount) <sup>c</sup>	$R_{thJA}$	4	°C/W
Junction-to-Case (Drain)	$R_{thJC}$	2.5	

Notes:

a. Duty cycle  $\leq 1$  %.

b. See SOA curve for voltage derating.

c. When mounted on 1" square PCB (FR-4 material).

d. Package limited.

SPECIFICATIONS $T_J = 25\text{ }^{\circ}\text{C}$ , unless otherwise noted						
Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Static						
Drain-Source Breakdown Voltage	$V_{DS}$	$V_{DS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$	40			V
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	1		2.5	
Gate-Body Leakage	$I_{GSS}$	$V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$			$\pm 250$	nA
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = 40\text{ V}, V_{GS} = 0\text{ V}$			1	$\mu\text{A}$
		$V_{DS} = 40\text{ V}, V_{GS} = 0\text{ V}, T_J = 125\text{ }^{\circ}\text{C}$			50	
		$V_{DS} = 40\text{ V}, V_{GS} = 0\text{ V}, T_J = 150\text{ }^{\circ}\text{C}$			250	
On-State Drain Current <sup>a</sup>	$I_{D(on)}$	$V_{DS} \geq 10\text{ V}, V_{GS} = 10\text{ V}$	55			A
Drain-Source On-State Resistance <sup>a</sup>	$R_{DS(on)}$	$V_{GS} = 10\text{ V}, I_D = 22\text{ A}$		0.0F3		$\Omega$
		$V_{GS} = 4.5\text{ V}, I_D = 20\text{ A}$		0.0FI		
Forward Transconductance <sup>a</sup>	$g_{fs}$	$V_{DS} = 15\text{ V}, I_D = 20\text{ A}$		1E0		S
Dynamic <sup>b</sup>						
Input Capacitance	$C_{iss}$	$V_{GS} = 0\text{ V}, V_{DS} = 15\text{ V}, f = 1\text{ MHz}$		1100		pF
Output Capacitance	$C_{oss}$			460		
Reverse Transfer Capacitance	$C_{rss}$			350		
Total Gate Charge <sup>c</sup>	$Q_g$	$V_{DS} = 15\text{ V}, V_{GS} = 10\text{ V}, I_D = 20\text{ A}$		H6		nC
		$V_{DS} = 15\text{ V}, V_{GS} = 4.5\text{ V}, I_D = 20\text{ A}$		25		
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Gate-Source Charge <sup>c</sup>	$Q_{gs}$			Ġ.7		
Gate-Drain Charge <sup>c</sup>	$Q_{gd}$					
Gate Resistance	$R_g$	$f = 1\text{ MHz}$	0.4	2	4	$\Omega$
Turn-On Delay Time <sup>c</sup>	$t_{d(on)}$	$V_{DD} = 15\text{ V}, R_L = 1.5\text{ }\Omega$ $I_D \cong 10\text{ A}, V_{GEN} = 10\text{ V}, R_g = 1\text{ }\Omega$		8	16	ns
Rise Time <sup>c</sup>	$t_r$			9	18	
Turn-Off Delay Time <sup>c</sup>	$t_{d(off)}$			35	53	
Fall Time <sup>c</sup>	$t_f$			9	18	
Drain-Source Body Diode Ratings and Characteristics $T_C = 25\text{ }^{\circ}\text{C}$ <sup>b</sup>						
Continuous Current	$I_S$				55	A
Pulsed Current	$I_{SM}$				165	
Forward Voltage <sup>a</sup>	$V_{SD}$	$I_F = 10\text{ A}, V_{GS} = 0\text{ V}$		0.75	1.5	V
Reverse Recovery Time	$t_{rr}$	$I_F = 10\text{ A}, dI/dt = 100\text{ A}/\mu\text{s}$		34	51	ns
Peak Reverse Recovery Current	$I_{RM(REC)}$			2	3	A
Reverse Recovery Charge	$Q_{rr}$			34	51	nC

Notes:

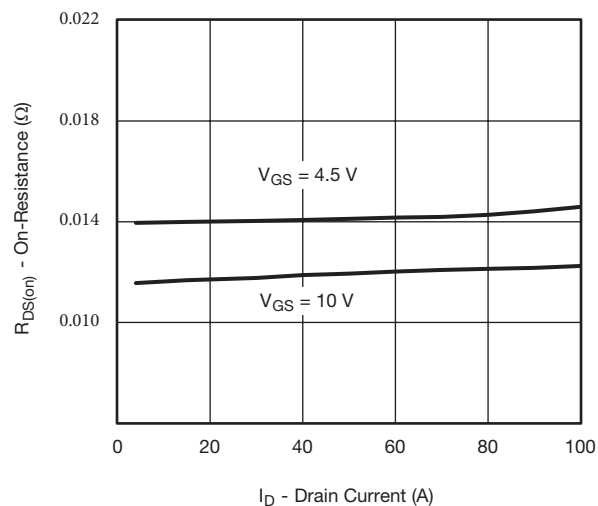
- a. Pulse test; pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$ .  
 b. Guaranteed by design, not subject to production testing.  
 c. Independent of operating temperature.

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

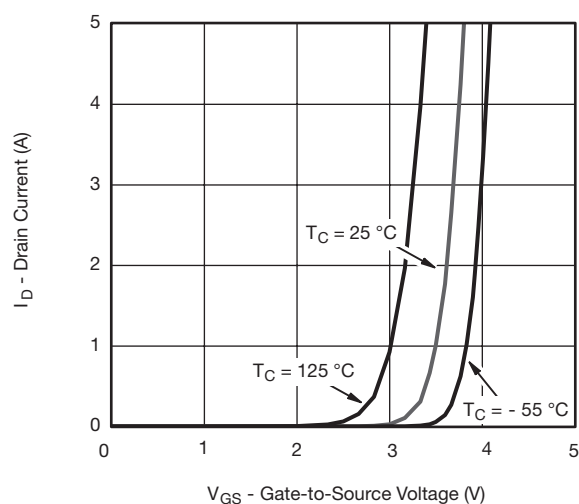
**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted



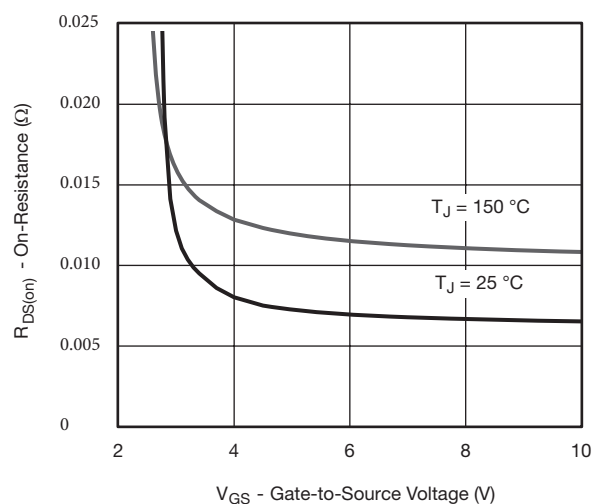
Drain to Source Voltage vs.  $I_D$



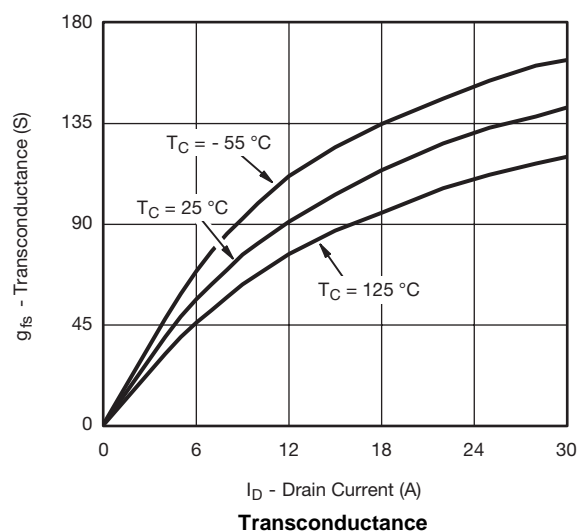
On-Resistance vs. Drain Current



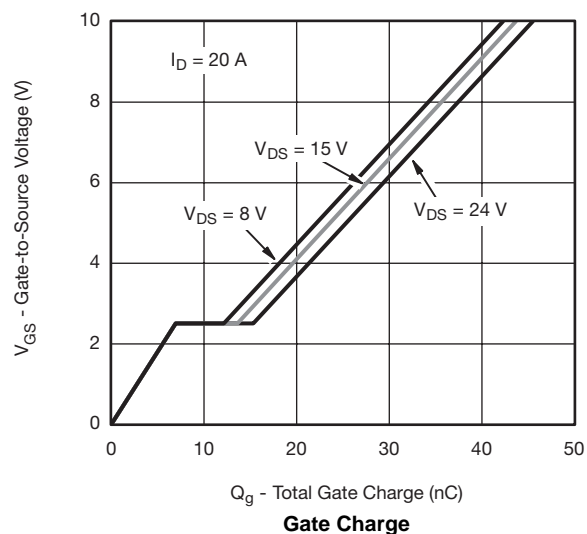
Transfer Characteristics



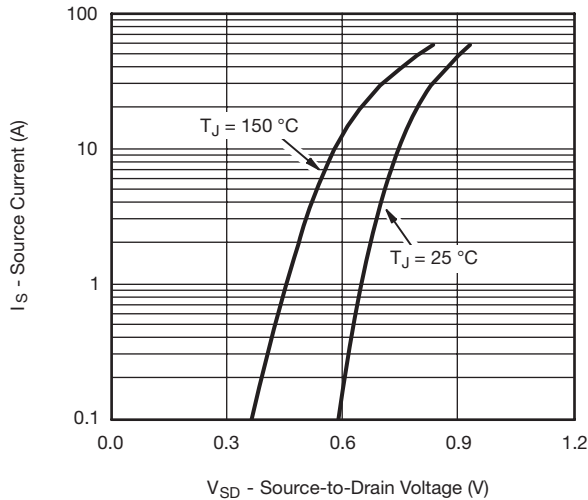
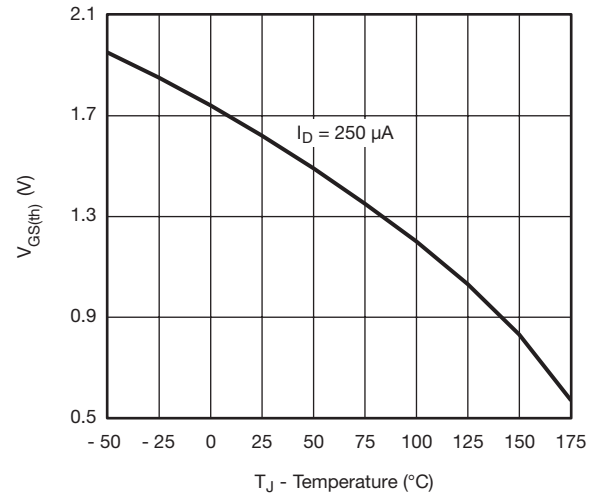
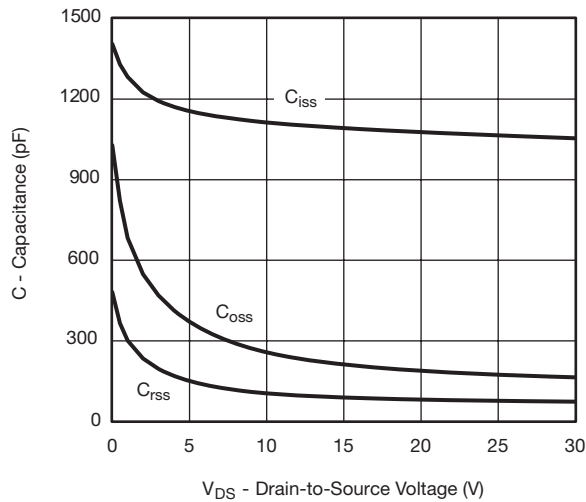
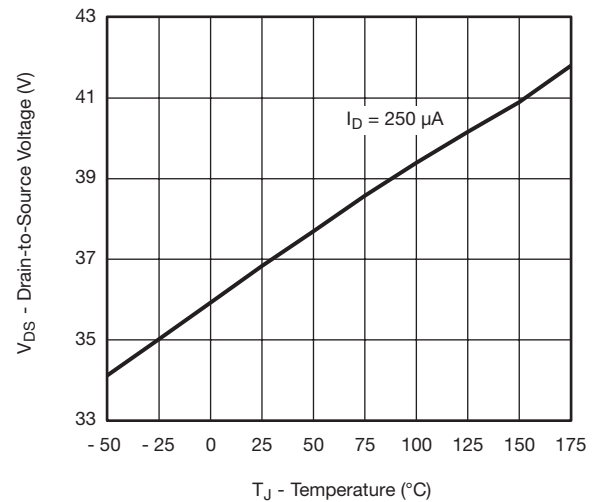
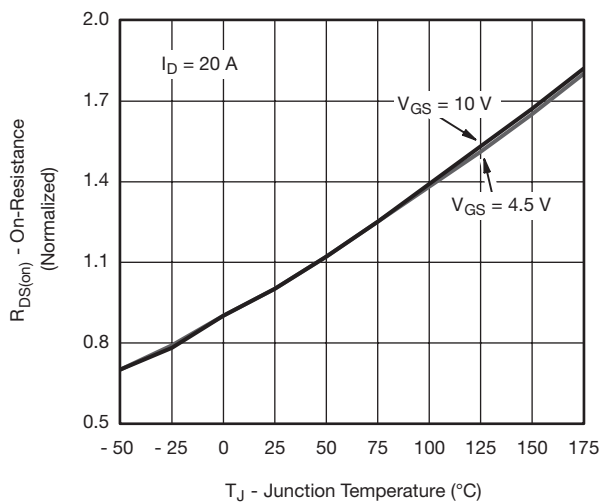
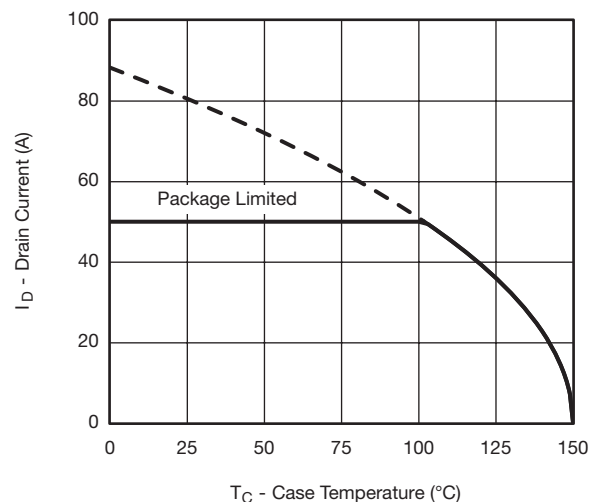
On-Resistance vs. Gate-to-Source Voltage



Transconductance



Gate Charge

**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted

**Source-Drain Diode Forward Voltage**

**Threshold Voltage**

**Capacitance**

**Drain Source Breakdown vs. Junction Temperature**

**On-Resistance vs. Junction Temperature**

**Current Derating**

**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted



**Single Pulse Avalanche Current Capability vs. Time**



\*  $V_{GS} >$  minimum  $V_{GS}$  at which  $R_{DS(on)}$  is specified

**Safe Operating Area**



**Normalized Thermal Transient Impedance, Junction-to-Case**

**TO-251AA**



Note: Dimension L3 is for reference only.

Dim	MILLIMETERS		INCHES	
	Min	Max	Min	Max
<b>A</b>	2.21	2.38	0.087	0.094
<b>A1</b>	0.89	1.14	0.035	0.045
<b>b</b>	0.71	0.89	0.028	0.035
<b>b1</b>	0.76	1.14	0.030	0.045
<b>b2</b>	5.23	5.43	0.206	0.214
<b>c</b>	0.46	0.58	0.018	0.023
<b>c1</b>	0.46	0.58	0.018	0.023
<b>D</b>	5.97	6.22	0.235	0.245
<b>E</b>	6.48	6.73	0.255	0.265
<b>e</b>	2.28 BSC		0.090 BSC	
<b>L</b>	3.89	9.53	0.153	0.375
<b>L1</b>	1.91	2.28	0.075	0.090
<b>L2</b>	0.89	1.27	0.035	0.050
<b>L3</b>	1.15	1.52	0.045	0.060
ECN: S-03946—Rev. E, 09-Jul-01 DWG: 5346				

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