

## 9406GM-VB Datasheet

## N-Channel 30-V (D-S) MOSFET

PRODUCT SUMMARY						
V <sub>DS</sub> (V)	R <sub>DS(on)</sub> (Ω)	I <sub>D</sub> (A) <sup>a</sup>	Q <sub>g</sub> (Typ.)			
30	0.008 at V <sub>GS</sub> = 10 V	13	6.1 nC			
- 50	0.011 at V <sub>GS</sub> = 4.5 V	11	0.1110			

SO-8

Top View

8 D

D

6 D

5 D

S

S

S

G

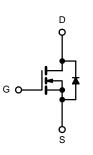
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#### FEATURES

- Halogen-free
- Trench Power MOSFET
- Optimized for High-Side Synchronous Rectifier Operation
- 100 % R<sub>g</sub> Tested
- 100 % UIS Tested

#### **APPLICATIONS**

Notebook CPU Core
High-Side Switch



N-Channel MOSFET

<b>ABSOLUTE MAXIMUM RATING</b>	<b>S</b> T <sub>A</sub> = 25 °C, unles	s otherwise not	ed		
Parameter		Symbol	Limit	Unit	
Drain-Source Voltage	V <sub>DS</sub>	30	V		
Gate-Source Voltage		V <sub>GS</sub>			± 20
	T <sub>C</sub> = 25 °C		13		
Continuous Drain Current (T <sub>J</sub> = 150 °C)	T <sub>C</sub> = 70 °C		10		
$Continuous Drain Current (1) = 150^{\circ} C)$	T <sub>A</sub> = 25 °C	I <sub>D</sub>	9 <sup>b, c</sup>		
	T <sub>A</sub> = 70 °C		7 <sup>b, c</sup>	•	
Pulsed Drain Current		I <sub>DM</sub>	45	— A	
Continuous Source-Drain Diode Current	T <sub>C</sub> = 25 °C		3.7		
	T <sub>A</sub> = 25 °C	I <sub>S</sub>	2.0 <sup>b, c</sup>		
Single Pulse Avalanche Current	L = 0.1 mH	I <sub>AS</sub>	20		
Avalanche Energy		E <sub>AS</sub>	21	mJ	
	T <sub>C</sub> = 25 °C		4.1		
Movimum Dower Dissinction	T <sub>C</sub> = 70 °C	Pn	2.5	w	
Maximum Power Dissipation	T <sub>A</sub> = 25 °C		2.2 <sup>b, c</sup>	vv	
	T <sub>A</sub> = 70 °C		1.3 <sup>b, c</sup>		
Operating Junction and Storage Temperature Ra	T <sub>J</sub> , T <sub>stg</sub>	- 55 to 150	°C		

THERMAL RESISTANCE RATINGS						
Parameter		Symbol	Typical	Maximum	Unit	
Maximum Junction-to-Ambient <sup>b, d</sup>	t ≤ 10 s	R <sub>thJA</sub>	39	55	°C/W	
Maximum Junction-to-Foot (Drain)	Steady State	R <sub>thJF</sub>	25	29	0/11	

Notes:

a. Base on T<sub>C</sub> = 25 °C.

b. Surface Mounted on 1" x 1" FR4 board.

c. t = 10 s. d. Maximum under Steady State conditions is 85 °C/W.





Parameter	Symbol	Test Conditions	Min.	Тур.	Max.	Unit
Static					I	
Drain-Source Breakdown Voltage	V <sub>DS</sub>	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA	30			V
V <sub>DS</sub> Temperature Coefficient	$\Delta V_{DS}/T_{J}$	L 050 A		26		mV/°C
V <sub>GS(th)</sub> Temperature Coefficient	$\Delta V_{GS(th)}/T_J$	I <sub>D</sub> = 250 μA		- 6		
Gate-Source Threshold Voltage	V <sub>GS(th)</sub>	$V_{DS} = V_{GS}, I_{D} = 250 \ \mu A$	1.0		3.0	V
Gate-Source Leakage	I <sub>GSS</sub>	$V_{DS} = 0 V, V_{GS} = \pm 20 V$			± 100	nA
		V <sub>DS</sub> = 30 V, V <sub>GS</sub> = 0 V			1	μA
Zero Gate Voltage Drain Current	IDSS	V <sub>DS</sub> = 30 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 55 °C			10	
On-State Drain Current <sup>a</sup>	I <sub>D(on)</sub>	$V_{DS} \ge 5 \text{ V}, V_{GS} = 10 \text{ V}$	20			А
_		$V_{GS} = 10 \text{ V}, \text{ I}_{D} = 10 \text{ A}$		0.008		<u> </u>
Drain-Source On-State Resistance <sup>a</sup>	R <sub>DS(on)</sub>	V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 9 A		0.011		Ω
Forward Transconductance <sup>a</sup>	9 <sub>fs</sub>	V <sub>DS</sub> = 15 V, I <sub>D</sub> = 10 A		50		S
Dynamic <sup>b</sup>	<u> </u>					•
Input Capacitance	C <sub>iss</sub>			800		pF
Output Capacitance	C <sub>oss</sub>	V <sub>DS</sub> = 15 V, V <sub>GS</sub> = 0 V, f = 1 MHz		165		
Reverse Transfer Capacitance	C <sub>rss</sub>	20 00		73		
Total Gate Charge		V <sub>DS</sub> = 15 V, V <sub>GS</sub> = 10 V, I <sub>D</sub> = 10 A		15	23	nC
	Q <sub>g</sub>			6.8	10.2	
Gate-Source Charge	Q <sub>gs</sub>	$V_{DS} = 15 \text{ V}, \text{ V}_{GS} = 5 \text{ V}, \text{ I}_{D} = 10 \text{ A}$		2.5		
Gate-Drain Charge	Q <sub>gd</sub>			2.3		
Gate Resistance	Rg	f = 1 MHz	0.36	1.8	3.6	Ω
Turn-On Delay Time	t <sub>d(on)</sub>			16	23	-
Rise Time	t <sub>r</sub>	$V_{DD}$ = 15 V, $R_L$ = 1.4 $\Omega$		12	16	
Turn-Off Delay Time	t <sub>d(off)</sub>	$I_D \cong$ 9 A, $V_{GEN}$ = 4.5 V, $R_g$ = 1 $\Omega$		16	22	
Fall Time	t <sub>f</sub>			10	18	
Turn-On Delay Time	t <sub>d(on)</sub>			8	16	ns
Rise Time	t <sub>r</sub>	$V_{DD}$ = 15 V, $R_L$ = 1.4 $\Omega$		10	20	-
Turn-Off Delay Time	t <sub>d(off)</sub>	$I_D \cong$ 9 A, $V_{GEN}$ = 10 V, $R_g$ = 1 $\Omega$		16	22	
Fall Time	t <sub>f</sub>			8	15	
Drain-Source Body Diode Characterist	ics				<u> </u>	<u> </u>
Continuous Source-Drain Diode Current	۱ <sub>S</sub>	T <sub>C</sub> = 25 °C			10	
Pulse Diode Forward Current <sup>a</sup>	I <sub>SM</sub>				50	A
Body Diode Voltage	V <sub>SD</sub>	I <sub>S</sub> = 9 A		0.8	1.2	V
Body Diode Reverse Recovery Time	t <sub>rr</sub>			15	30	ns
Body Diode Reverse Recovery Charge	Q <sub>rr</sub>			6	12	nC
Reverse Recovery Fall Time	t <sub>a</sub>	I <sub>F</sub> = 9 A, dl/dt = 100 A/μs, T <sub>J</sub> = 25 °C		8		
Reverse Recovery Rise Time	t <sub>b</sub>			7		ns

Notes:

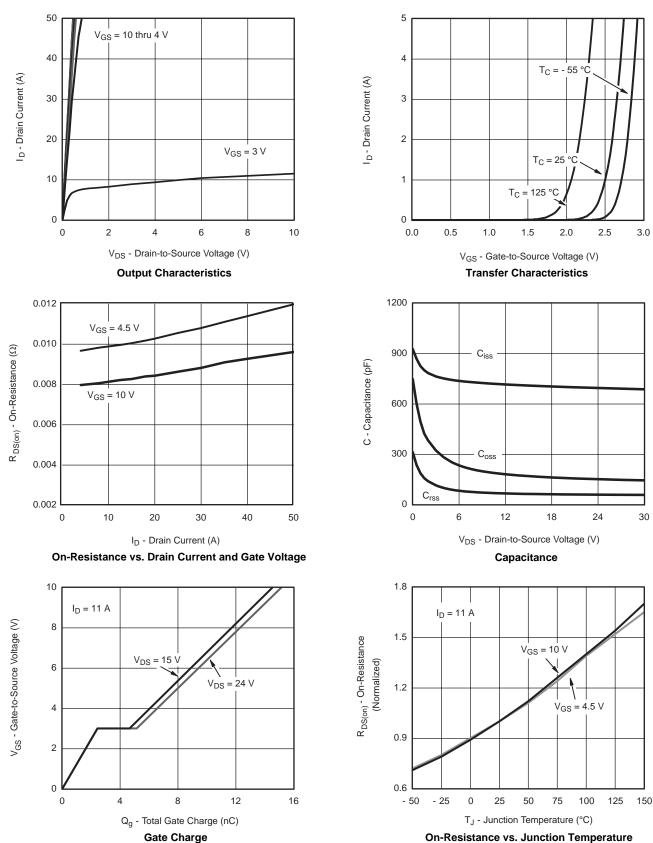
a. Pulse test; pulse width  $\leq$  300 µs, duty cycle  $\leq$  2 %.

b. Guaranteed by design, not subject to production testing.

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.

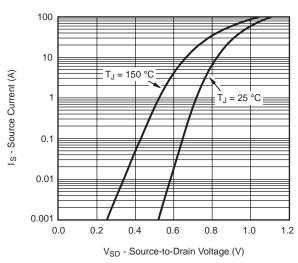




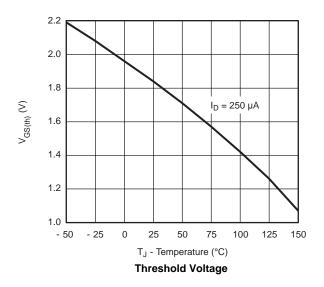


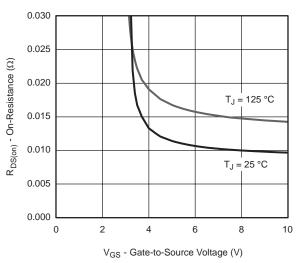












On-Resistance vs. Gate-to-Source Voltage

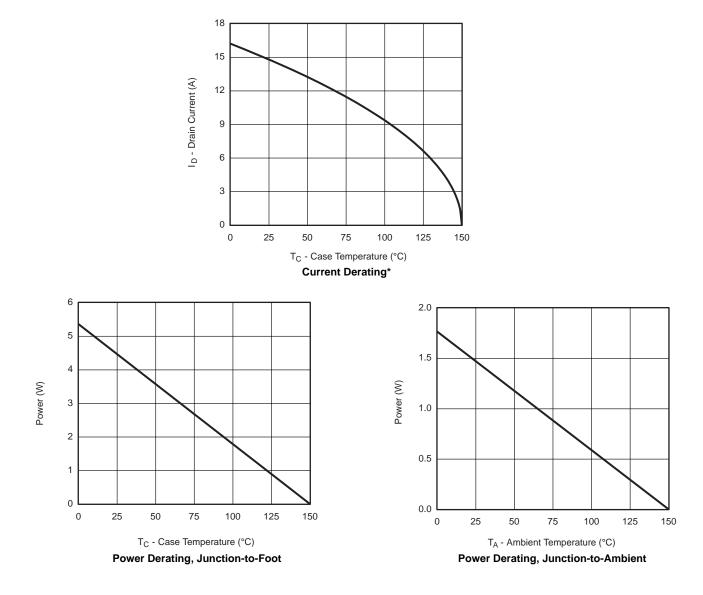






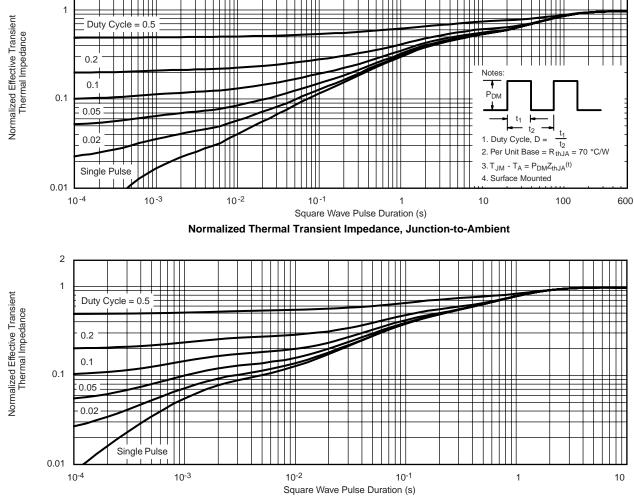


#### TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



\* The power dissipation  $P_D$  is based on  $T_{J(max)} = 150$  °C, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package limit.

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

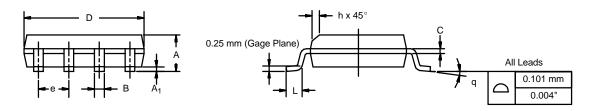
Normalized Thermal Transient Impedance, Junction-to-Foot

<u>VBsemi</u> www.VBsemi.com



### SOIC (NARROW): 8-LEAD

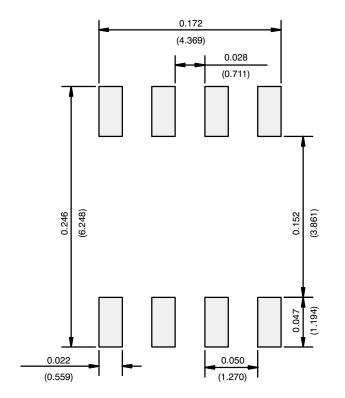




MILLIMETERS			INCHES			
DIM	Min	Мах	Min	Max		
A	1.35	1.75	0.053	0.069		
A <sub>1</sub>	0.10	0.20	0.004	0.008		
В	0.35	0.51	0.014	0.020		
С	0.19	0.25	0.0075	0.010		
D	4.80	5.00	0.189	0.196		
E	3.80	4.00	0.150	0.157		
е	1.27	BSC	0.050	0.050 BSC		
н	5.80	6.20	0.228	0.244		
h	0.25	0.50	0.010	0.020		
L	0.50	0.93	0.020	0.037		
q	0°	8°	0°	8°		
S	0.44	0.64	0.018	0.026		
ECN: C-06527-Rev. I, 11-Sep-06 DWG: 5498						



**RECOMMENDED MINIMUM PADS FOR SO-8** 



Recommended Minimum Pads Dimensions in Inches/(mm)



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