

# N-Channel Enhancement Mode Field Effect Transistor with Schottky Diode

### **General Description**

The VBA1310S uses advanced trench technology to provide excellent  $R_{DS(ON)}$ , shoot-through immunity and body diode characteristics. This device is suitable for use as a synchronous switch in PWM applications. The co-packaged Schottky Diode boosts efficiency further.

#### **Features**

 $V_{DS}(V) = 30V$ 

 $I_D = 12 \text{ A } (V_{GS} = 10 \text{V})$ 

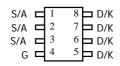
 $R_{DS(ON)}$  < 11.5m $\Omega$  (V<sub>GS</sub> = 10V)

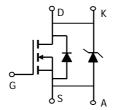
 $R_{DS(ON)} < 13m\Omega (V_{GS} = 4.5V)$ 

#### **SCHOTTKY**

VDS (V) = 30V, IF = 3A, VF<0.5V@1A

#### SOIC-8





#### Absolute Maximum Ratings T<sub>A</sub>=25°C unless otherwise noted Symbol **MOSFET** Units Parameter Schottky $V_{DS}$ Drain-Source Voltage 30 $V_{GS}$ ٧ Gate-Source Voltage ±12 $T_A=25^{\circ}C$ 12 $I_D$ Continuous Drain Current<sup>A</sup> T<sub>A</sub>=70°C 10.4 Α Pulsed Drain Current<sup>B</sup> $I_{DM}$ 40 Schottky reverse voltage $V_{KA}$ V 30 $T_A=25^{\circ}C$ 4.4 $I_{\mathsf{F}}$ Continuous Forward Current<sup>A</sup> T<sub>Δ</sub>=70°C 3.2 Α Pulsed Diode Forward Current<sup>B</sup> $I_{FM}$ 30 T<sub>A</sub>=25°C 3.1 3.1 $P_D$ W T<sub>Δ</sub>=70°C **Power Dissipation** 2 2 $T_J$ , $T_{STG}$ Junction and Storage Temperature Range -55 to 150 -55 to 150 °C



Thermal Characteristics							
Parameter		Symbol Typ		Max	Units		
Maximum Junction-to-Ambient <sup>A</sup>	t ≤ 10s	$R_{\theta JA}$	28	40	°C/W		
Maximum Junction-to-Ambient <sup>A</sup>	Steady-State	⊢ N <sub>θ</sub> JA	54	75	°C/W		
Maximum Junction-to-Lead <sup>C</sup>	Steady-State	$R_{\theta JL}$	21	30	°C/W		

Thermal Characteristics: Schottky							
Parameter		Symbol	Тур	Max	Units		
Maximum Junction-to-Ambient <sup>A</sup>	t ≤ 10s	$R_{\theta JA}$	36	40	°C/W		
Maximum Junction-to-Ambient <sup>A</sup>	Steady-State	N <sub>θ</sub> JA	67	75	°C/W		
Maximum Junction-to-Lead <sup>C</sup>	Steady-State	$R_{\theta JL}$	25	30	°C/W		

A: The value of  $R_{BJA}$  is measured with the device mounted on 1in  $^2$  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. The current rating is based on the t  $\leq$  10s thermal resistance rating. B: Repetitive rating, pulse width limited by junction temperature.

- C. The R  $_{\theta JA}$  is the sum of the thermal impedence from junction to lead R  $_{\theta JL}$  and lead to ambient.
- D. The static characteristics in Figures 1 to 6 are obtained using 80  $\,\mu s$  pulses, duty cycle 0.5% max.
- E. These tests are performed with the device mounted on 1 in  $^2$  FR-4 board with 2oz. Copper, in a still air environment with T  $_A$ =25°C. The SOA curve provides a single pulse rating.
- F. The Schottky appears in parallel with the MOSFET body diode, even though it is a separate chip. Therefore, we provide the net forward drop, capacitance and recovery characteristics of the MOSFET and Schottky. However, the thermal resistance is specified for each chip separately.



#### Electrical Characteristics (T<sub>J</sub>=25°C unless otherwise noted)

Symbol	Parameter	Conditions		Min	Тур	Max	Units
STATIC P	PARAMETERS						
$BV_{DSS}$	Drain-Source Breakdown Voltage	$I_D = 250 \mu A, V_{GS} = 0 V$		30			V
DCC	Zero Gate Voltage Drain Current. (Set by Schottky leakage)	V <sub>R</sub> =30V		0.007			
		V <sub>R</sub> =30V, T <sub>J</sub> =125°C		3.2		mA	
		V <sub>R</sub> =30V, T <sub>J</sub> =150°C		12			
I <sub>GSS</sub>	Gate-Body leakage current	V <sub>DS</sub> =0V, V <sub>GS</sub> = ±12V				100	nA
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS} I_{D}=250\mu A$		0.5		2.0	V
I <sub>D(ON)</sub>	On state drain current	$V_{GS}$ =4.5V, $V_{DS}$ =5V		40			Α
R <sub>DS(ON)</sub>	Static Drain-Source On-Resistance	V <sub>GS</sub> =10V, ID=13A			8.0		0
			T <sub>J</sub> =125°C		11.0		mΩ
		V <sub>GS</sub> =4.5V, I <sub>D</sub> =12.2A		9.0		mΩ	
<b>g</b> FS	Forward Transconductance	V <sub>DS</sub> =5V, I <sub>D</sub> =13A		30	37		S
$V_{SD}$	Diode + Schottky Forward Voltage	I <sub>S</sub> =1A,V <sub>GS</sub> =0V			0.45	0.5	V
Is	Maximum Body-Diode + Schottky Continuous Curr	rrent				5	Α
DYNAMIC	PARAMETERS		•				
C <sub>iss</sub>	Input Capacitance	V <sub>GS</sub> =0V, V <sub>DS</sub> =15V, f=1MHz			3656		pF
C <sub>oss</sub>	Output Capacitance (FET+Schottky)				322		pF
C <sub>rss</sub>	Reverse Transfer Capacitance				168		pF
$R_g$	Gate resistance	V <sub>GS</sub> =0V, V <sub>DS</sub> =0V, f=1MHz			0.86	1.1	Ω
SWITCHII	NG PARAMETERS						
Q <sub>g</sub> (4.5V)	Total Gate Charge	V <sub>GS</sub> =10V, V <sub>DS</sub> =15V, I <sub>D</sub> =13A			30.5	36	nC
$Q_{gs}$	Gate Source Charge				4.6		nC
$Q_{gd}$	Gate Drain Charge				8.6		nC
t <sub>D(on)</sub>	Turn-On DelayTime				6.2	9	ns
t <sub>r</sub>	Turn-On Rise Time	$V_{GS}$ =10V, $V_{DS}$ =15V, $R_L$ =1.1 $\Omega$ , $R_{GEN}$ =0 $\Omega$			4.8	7	ns
t <sub>D(off)</sub>	Turn-Off DelayTime				55	75	ns
t <sub>f</sub>	Turn-Off Fall Time				7.3	11	ns
t <sub>rr</sub>	Body Diode+Schottky Reverse Recovery Time	I <sub>F</sub> =13A, dI/dt=100A/μs			20.3	25	ns
Q <sub>rr</sub>	Body Diode+Schottky Reverse Recovery Charge	I <sub>F</sub> =13A, dI/dt=100A/μs			8.4	12.5	nC

A: The value of R<sub>0JA</sub> is measured with the device mounted on 1in  $^2$  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. The current rating is based on the t  $_1$  ≤ 10s thermal resistance rating.

B: Repetitive rating, pulse width limited by junction temperature.

C. The R  $_{\theta JA}$  is the sum of the thermal impedence from junction to lead R  $_{\theta JL}$  and lead to ambient.

D. The static characteristics in Figures 1 to 6 are obtained using 80  $\,\mu s$  pulses, duty cycle 0.5% max.

E. These tests are performed with the device mounted on 1 in <sup>2</sup> FR-4 board with 2oz. Copper, in a still air environment with T <sub>A</sub>=25°C. The SOA curve provides a single pulse rating.

F. The Schottky appears in parallel with the MOSFET body diode, even though it is a separate chip. Therefore, we provide the net forward drop, capacitance and recovery characteristics of the MOSFET and Schottky. However, the thermal resistance is specified for each chip separately Rev5: August 2005.



#### TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

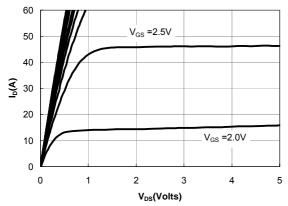


Figure 1: On-Regions CharacteristiCS

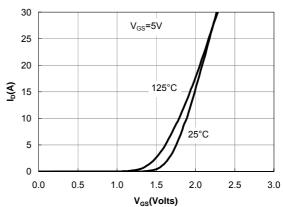


Figure 2: Transfer Characteristics

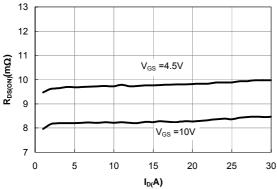


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

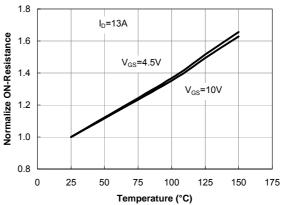


Figure 4: On-Resistance vs. Junction Temperature

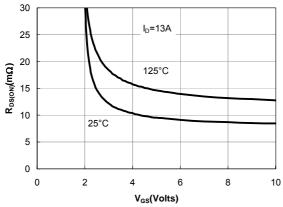


Figure 5: On-Resistance vs. Gate-Source Voltage

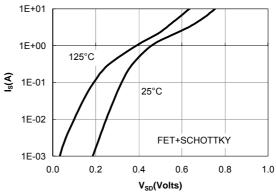


Figure 6: Body-Diode Characteristics (Note F)



#### TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

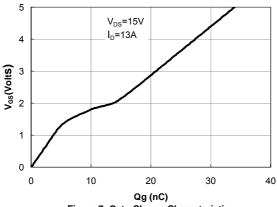


Figure 7: Gate-Charge Characteristics

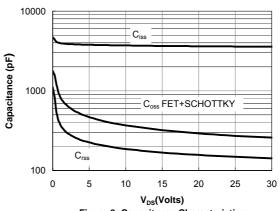


Figure 8: Capacitance Characteristics

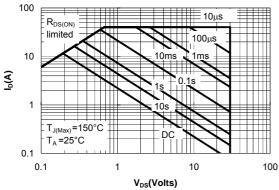


Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

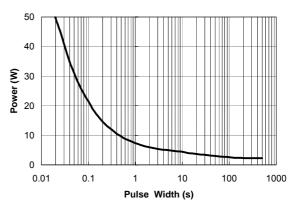


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

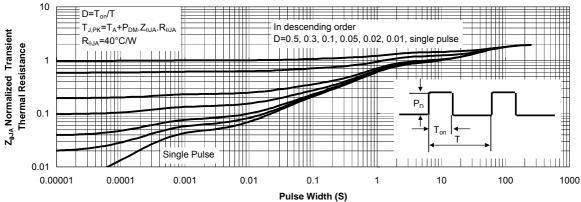
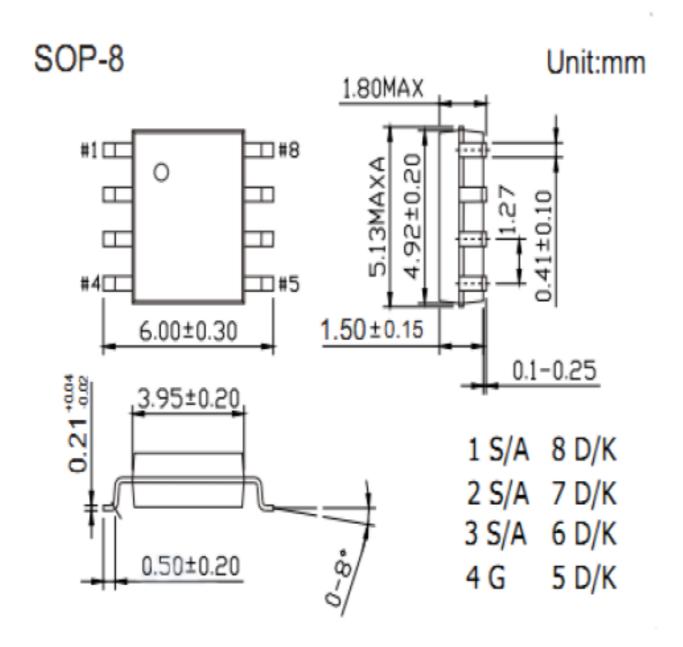


Figure 11: Normalized Maximum Transient Thermal Impedence



**SOIC (NARROW): 8-LEAD** 





## **Disclaimer**

All products due to improve reliability, function or design or for other reasons, product specifications and data are subject to change without notice.

Taiwan VBsemi Electronics Co., Ltd., branches, agents, employees, and all persons acting on its or their representatives (collectively, the "Taiwan VBsemi"), assumes no responsibility for any errors, inaccuracies or incomplete data contained in the table or any other any disclosure of any information related to the product.(www.VBsemi.com)

Taiwan VBsemi makes no guarantee, representation or warranty on the product for any particular purpose of any goods or continuous production. To the maximum extent permitted by applicable law on Taiwan VBsemi relinquished: (1) any application and all liability arising out of or use of any products; (2) any and all liability, including but not limited to special, consequential damages or incidental; (3) any and all implied warranties, including a particular purpose, non-infringement and merchantability guarantee.

Statement on certain types of applications are based on knowledge of the product is often used in a typical application of the general product VBsemi Taiwan demand that the Taiwan VBsemi of. Statement on whether the product is suitable for a particular application is non-binding. It is the customer's responsibility to verify specific product features in the products described in the specification is appropriate for use in a particular application. Parameter data sheets and technical specifications can be provided may vary depending on the application and performance over time. All operating parameters, including typical parameters must be made by customer's technical experts validated for each customer application. Product specifications do not expand or modify Taiwan VBsemi purchasing terms and conditions, including but not limited to warranty herein.

Unless expressly stated in writing, Taiwan VBsemi products are not intended for use in medical, life saving, or life sustaining applications or any other application. Wherein VBsemi product failure could lead to personal injury or death, use or sale of products used in Taiwan VBsemi such applications using client did not express their own risk. Contact your authorized Taiwan VBsemi people who are related to product design applications and other terms and conditions in writing.

The information provided in this document and the company's products without a license, express or implied, by estoppel or otherwise, to any intellectual property rights granted to the VBsemi act or document. Product names and trademarks referred to herein are trademarks of their respective representatives will be all.

## **Material Category Policy**

Taiwan VBsemi Electronics Co., Ltd., hereby certify that all of the products are determined to be oHS compliant and meets the definition of restrictions under Directive of the European Parliament 2011/65 / EU, 2011 Nian. 6. 8 Ri Yue restrict the use of certain hazardous substances in electrical and electronic equipment (EEE) - modification, unless otherwise specified as inconsistent.(www.VBsemi.com)

Please note that some documents may still refer to Taiwan VBsemi RoHS Directive 2002/95 / EC. We confirm that all products identified as consistent with the Directive 2002/95 / EC European Directive 2011/65 /.

Taiwan VBsemi Electronics Co., Ltd. hereby certify that all of its products comply identified as halogen-free halogen-free standards required by the JEDEC JS709A. Please note that some Taiwanese VBsemi documents still refer to the definition of IEC 61249-2-21, and we are sure that all products conform to confirm compliance with IEC 61249-2-21 standard level JS709A.

单击下面可查看定价,库存,交付和生命周期等信息

>>VBsemi(台湾微碧)