

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.

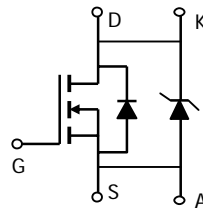
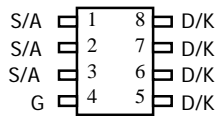
Features

V_{DS} (V) = 30V
 I_D = 12 A (V_{GS} = 10V)
 $R_{DS(ON)}$ < 11.5m Ω (V_{GS} = 10V)
 $R_{DS(ON)}$ < 13m Ω (V_{GS} = 4.5V)

SCHOTTKY

V_{DS} (V) = 30V, I_F = 3A, V_F < 0.5V@1A

SOIC-8



Absolute Maximum Ratings $T_A=25^\circ\text{C}$ unless otherwise noted

Parameter	Symbol	MOSFET	Schottky	Units
Drain-Source Voltage	V_{DS}	30		V
Gate-Source Voltage	V_{GS}	± 12		V
Continuous Drain Current ^A	I_D	$T_A=25^\circ\text{C}$	12	A
		$T_A=70^\circ\text{C}$	10.4	
Pulsed Drain Current ^B	I_{DM}	40		
Schottky reverse voltage	V_{KA}		30	V
Continuous Forward Current ^A	I_F	$T_A=25^\circ\text{C}$	4.4	A
		$T_A=70^\circ\text{C}$	3.2	
Pulsed Diode Forward Current ^B	I_{FM}		30	
Power Dissipation	P_D	$T_A=25^\circ\text{C}$	3.1	W
		$T_A=70^\circ\text{C}$	2	
Junction and Storage Temperature Range	T_J, T_{STG}	-55 to 150	-55 to 150	$^\circ\text{C}$

Thermal Characteristics					
Parameter		Symbol	Typ	Max	Units
Maximum Junction-to-Ambient ^A	t ≤ 10s	R _{θJA}	28	40	°C/W
Maximum Junction-to-Ambient ^A	Steady-State		54	75	°C/W
Maximum Junction-to-Lead ^C	Steady-State	R _{θJL}	21	30	°C/W

Thermal Characteristics: Schottky					
Parameter		Symbol	Typ	Max	Units
Maximum Junction-to-Ambient ^A	t ≤ 10s	R _{θJA}	36	40	°C/W
Maximum Junction-to-Ambient ^A	Steady-State		67	75	°C/W
Maximum Junction-to-Lead ^C	Steady-State	R _{θJL}	25	30	°C/W

A: 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. The current rating is based on the t ≤ 10s thermal resistance rating.

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

C: The R_{θJA} is the sum of the thermal impedance from junction to lead R_{θJL} and lead to ambient.

D: The static characteristics in Figures 1 to 6 are obtained using 80 μs pulses, duty cycle 0.5% max.

E: These tests are performed with the device mounted on 1 in² 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_J=25°C unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
STATIC PARAMETERS						
BV _{DSS}	Drain-Source Breakdown Voltage	I _D =250μA, V _{GS} =0V	30			V
I _{DSS}	Zero Gate Voltage Drain Current. (Set by Schottky leakage)	V _R =30V		0.007		mA
		V _R =30V, T _J =125°C		3.2		
		V _R =30V, T _J =150°C		12		
I _{GSS}	Gate-Body leakage current	V _{DS} =0V, V _{GS} = ±12V			100	nA
V _{GS(th)}	Gate Threshold Voltage	V _{DS} =V _{GS} I _D =250μA	0.5		2.0	V
I _{D(ON)}	On state drain current	V _{GS} =4.5V, V _{DS} =5V	40			A
R _{DS(ON)}	Static Drain-Source On-Resistance	V _{GS} =10V, I _D =13A		8.0		mΩ
		T _J =125°C		11.0		
		V _{GS} =4.5V, I _D =12.2A		9.0		mΩ
g _{FS}	Forward Transconductance	V _{DS} =5V, I _D =13A	30	37		S
V _{SD}	Diode + Schottky Forward Voltage	I _S =1A, V _{GS} =0V		0.45	0.5	V
I _S	Maximum Body-Diode + Schottky Continuous Current				5	A
DYNAMIC PARAMETERS						
C _{iss}	Input Capacitance	V _{GS} =0V, V _{DS} =15V, f=1MHz		3656		pF
C _{oss}	Output Capacitance (FET+Schottky)			322		pF
C _{rss}	Reverse Transfer Capacitance			168		pF
R _g	Gate resistance	V _{GS} =0V, V _{DS} =0V, f=1MHz		0.86	1.1	Ω
SWITCHING PARAMETERS						
Q _{g(4.5V)}	Total Gate Charge	V _{GS} =10V, V _{DS} =15V, I _D =13A		30.5	36	nC
Q _{gs}	Gate Source Charge			4.6		nC
Q _{gd}	Gate Drain Charge			8.6		nC
t _{D(on)}	Turn-On DelayTime	V _{GS} =10V, V _{DS} =15V, R _L =1.1Ω, R _{GEN} =0Ω		6.2	9	ns
t _r	Turn-On Rise Time			4.8	7	ns
t _{D(off)}	Turn-Off DelayTime			55	75	ns
t _f	Turn-Off Fall Time			7.3	11	ns
t _{rr}	Body Diode+Schottky Reverse Recovery Time	I _F =13A, dI/dt=100A/μs		20.3	25	ns
Q _{rr}	Body Diode+Schottky Reverse Recovery Charge	I _F =13A, dI/dt=100A/μs		8.4	12.5	nC

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Rev5: August 2005.

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

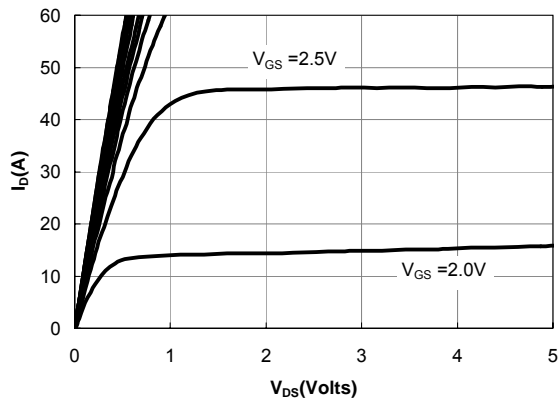


Figure 1: On-Regions Characteristics

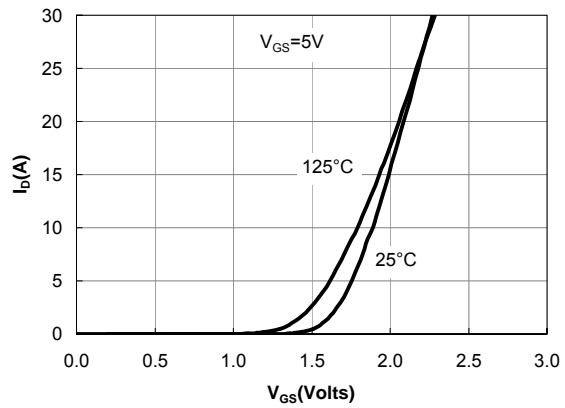


Figure 2: Transfer Characteristics

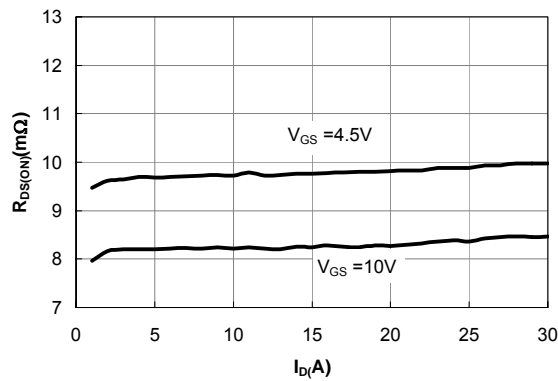


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

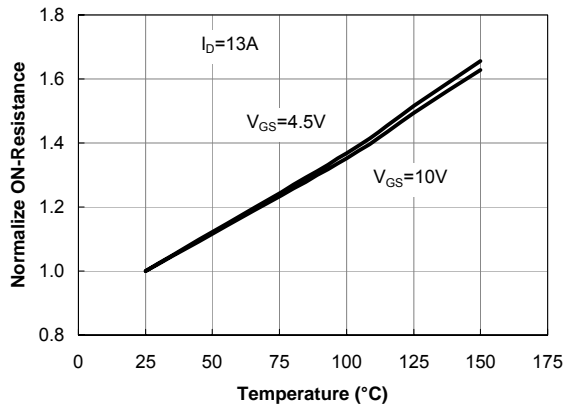


Figure 4: On-Resistance vs. Junction Temperature

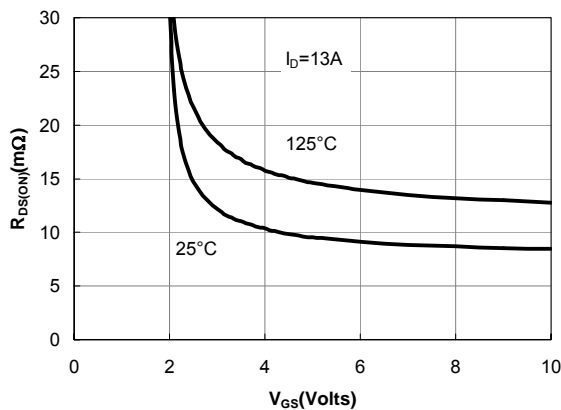


Figure 5: On-Resistance vs. Gate-Source Voltage

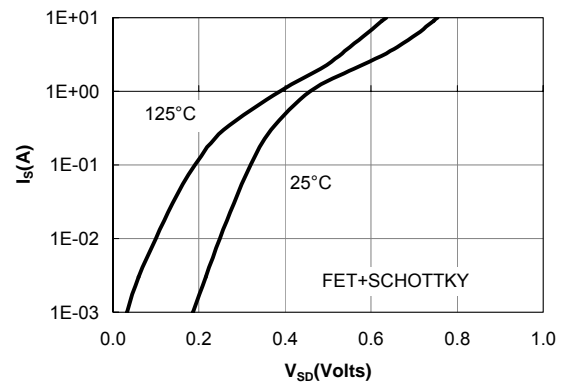


Figure 6: Body-Diode Characteristics (Note F)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

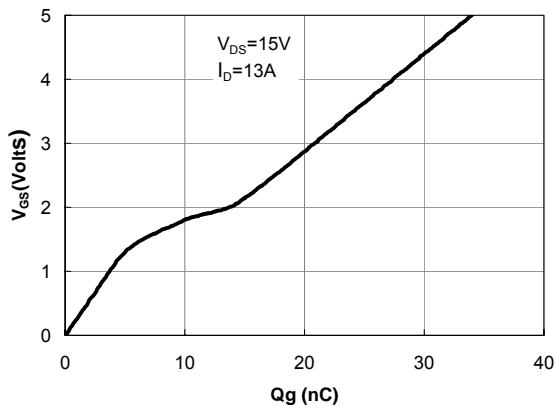


Figure 7: Gate-Charge Characteristics

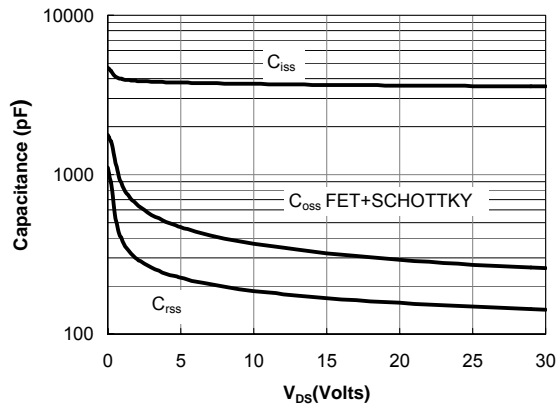


Figure 8: Capacitance Characteristics

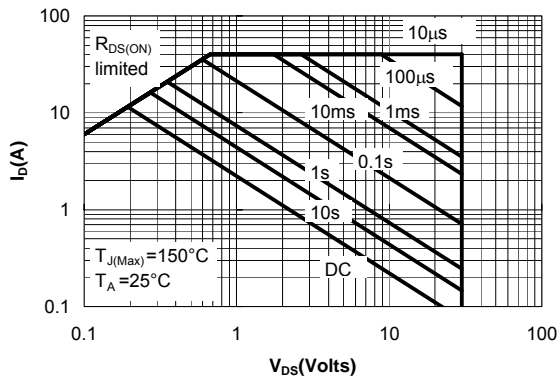


Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

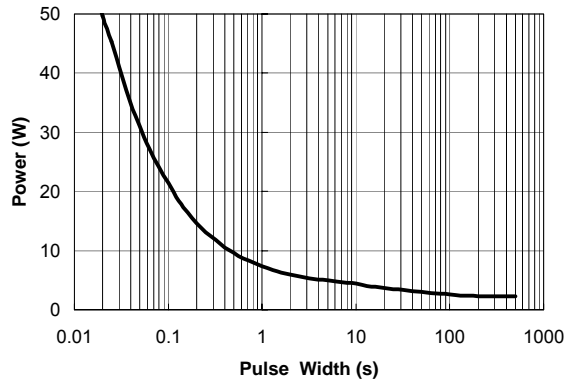


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

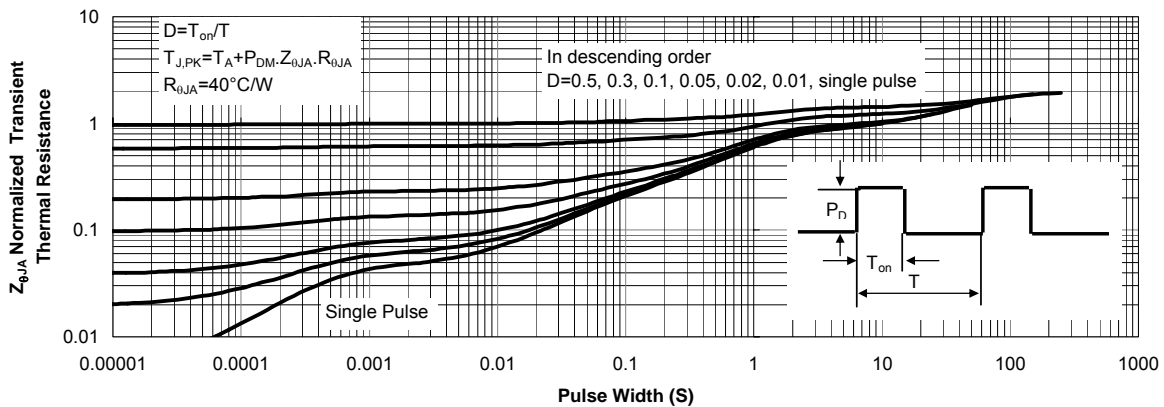
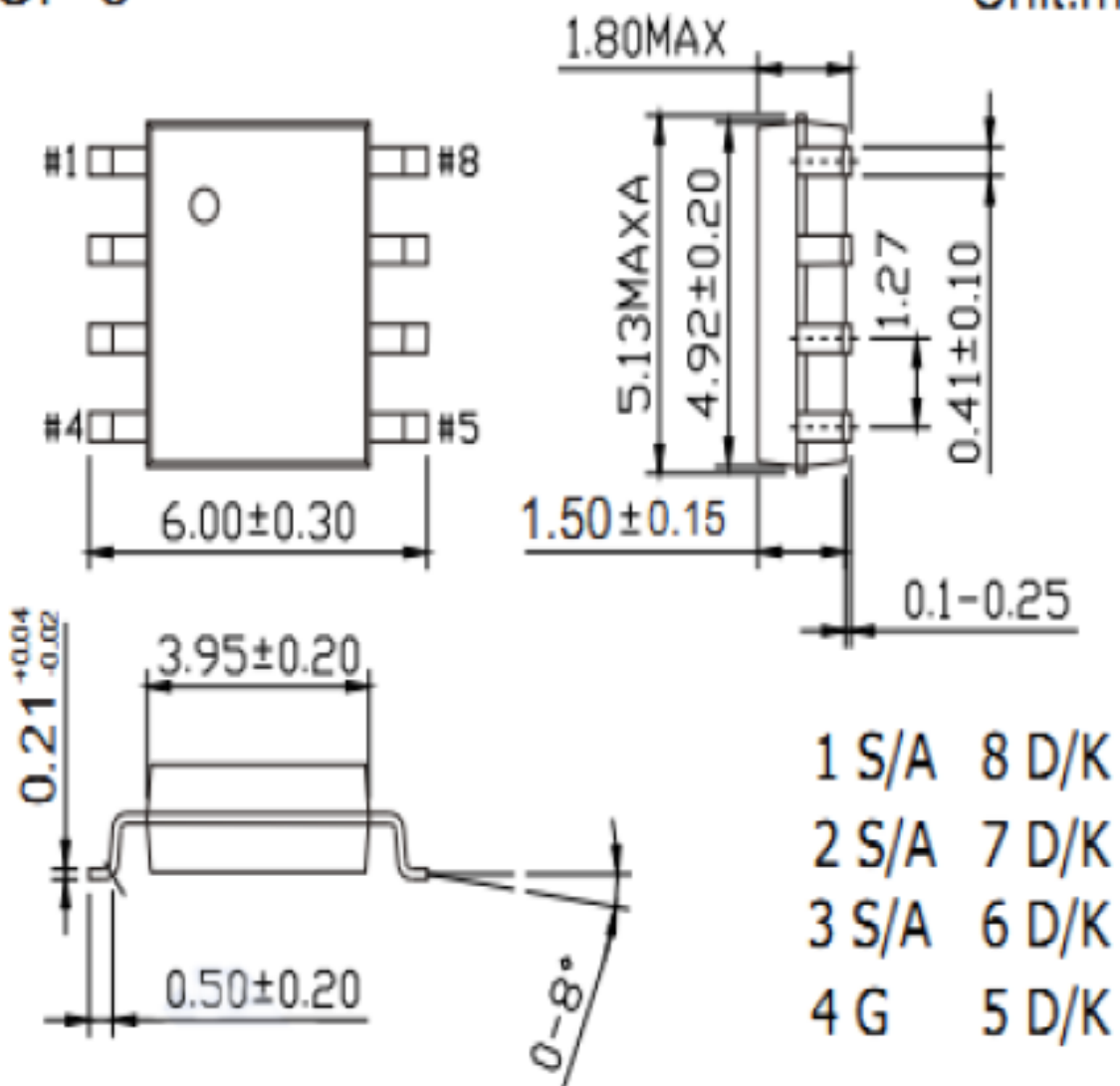


Figure 11: Normalized Maximum Transient Thermal Impedance

SOIC (NARROW): 8-LEAD

SOP-8

Unit:mm



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