N-Channel Enhancement Mode Field Effect Transistor with Schottky Diode

General Description

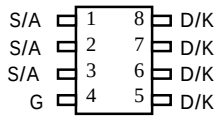
The VBA1310S uses advanced trench technology to provide excellent $R_{DS(ON)}$, shoot-through immunity and body diode characteristics.This device is suitable for use as a synchronous switch in PWM applications. The co-packaged Schottky Diode boosts efficiency further.

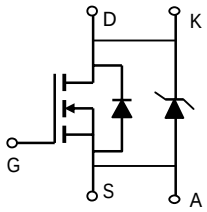
Features

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

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

SOIC-8





Absolute Maximum Ratings T_A=25°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]	T_A=25°C	I_D	12		A
	T_A=70°C		10.4		
Pulsed Drain Current[B]		I_{DM}	40		
Schottky reverse voltage		V_{KA}		30	V
Continuous Forward Current[A]	T_A=25°C	I_F		4.4	A
	T_A=70°C			3.2	
Pulsed Diode Forward Current[B]		I_{FM}		30	
Power Dissipation	T_A=25°C	P_D	3.1	3.1	W
	T_A=70°C		2	2	
Junction and Storage Temperature Range		T_J, T_{STG}	-55 to 150	-55 to 150	°C

Thermal Characteristics					
Parameter		**Symbol**	**Typ**	**Max**	**Units**
Maximum Junction-to-Ambient[A]	t ≤ 10s	$R_{\theta JA}$	28	40	°C/W
Maximum Junction-to-Ambient[A]	Steady-State		54	75	°C/W
Maximum Junction-to-Lead[C]	Steady-State	$R_{\theta JL}$	21	30	°C/W

Thermal Characteristics: Schottky					
Parameter		**Symbol**	**Typ**	**Max**	**Units**
Maximum Junction-to-Ambient[A]	t ≤ 10s	$R_{\theta JA}$	36	40	°C/W
Maximum Junction-to-Ambient[A]	Steady-State		67	75	°C/W
Maximum Junction-to-Lead[C]	Steady-State	$R_{\theta JL}$	25	30	°C/W

A: The value of $R_{\theta JA}$ 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 ≤ 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 μs 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_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, ID=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

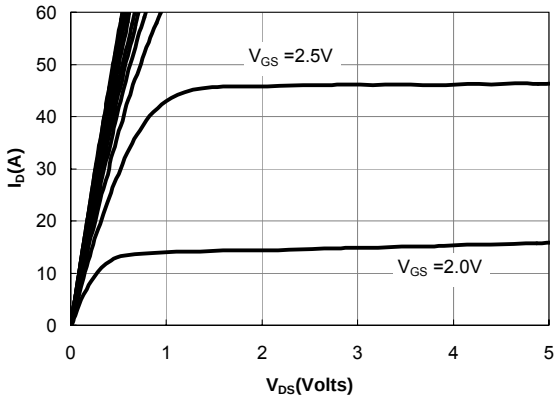


Figure 1: On-Regions CharacteristiCS

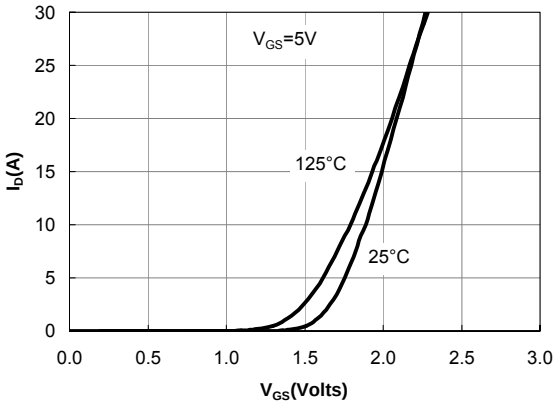


Figure 2: Transfer Characteristics

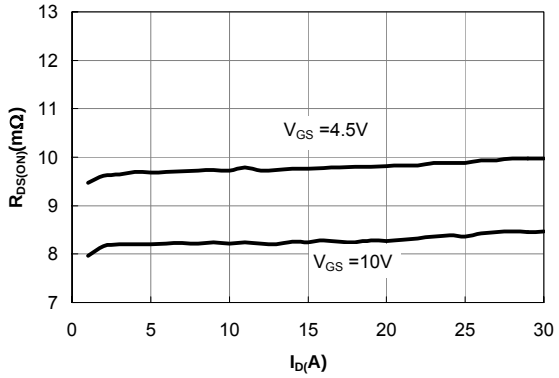


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

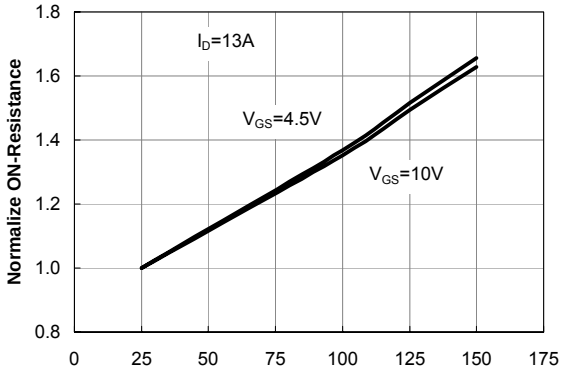


Figure 4: On-Resistance vs. Junction Temperature

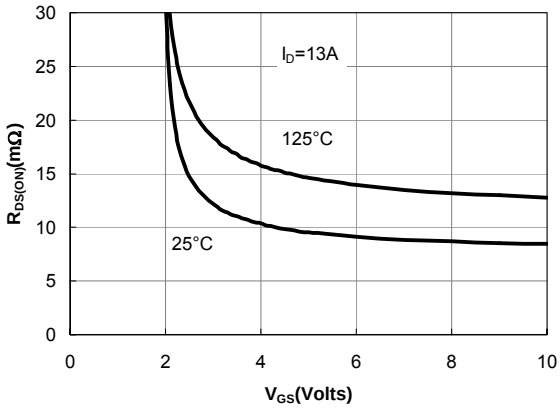


Figure 5: On-Resistance vs. Gate-Source Voltage

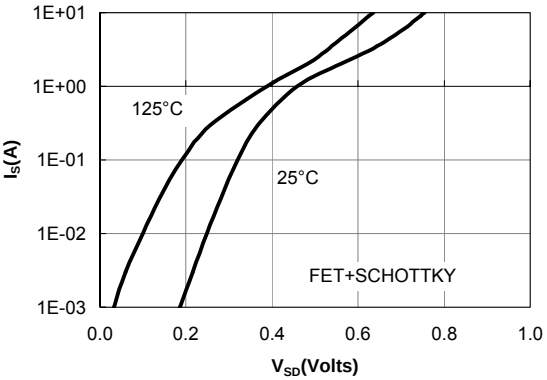


Figure 6: Body-Diode Characteristics (Note F)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

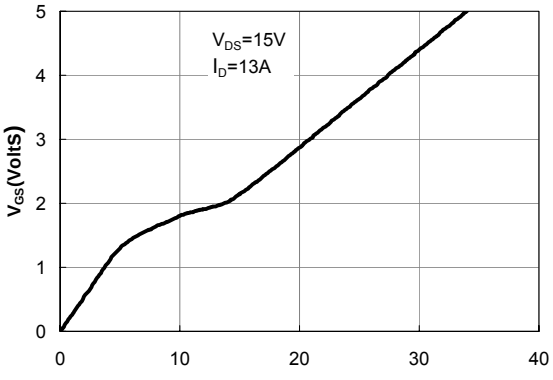


Figure 7: Gate-Charge Characteristics

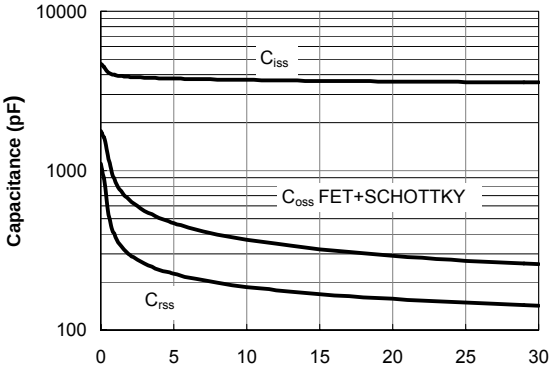


Figure 8: Capacitance Characteristics

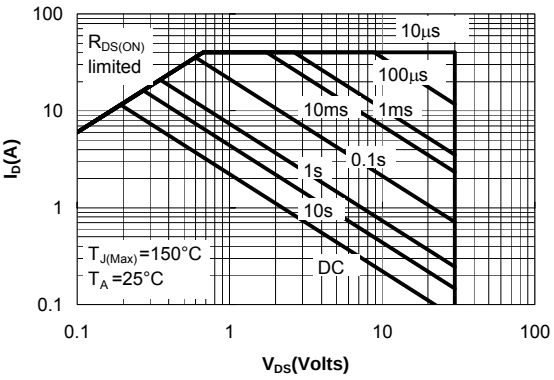


Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

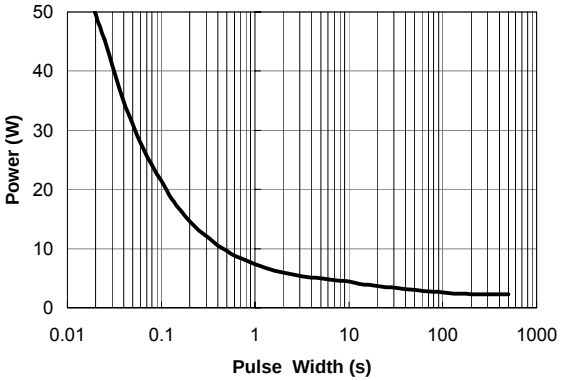


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

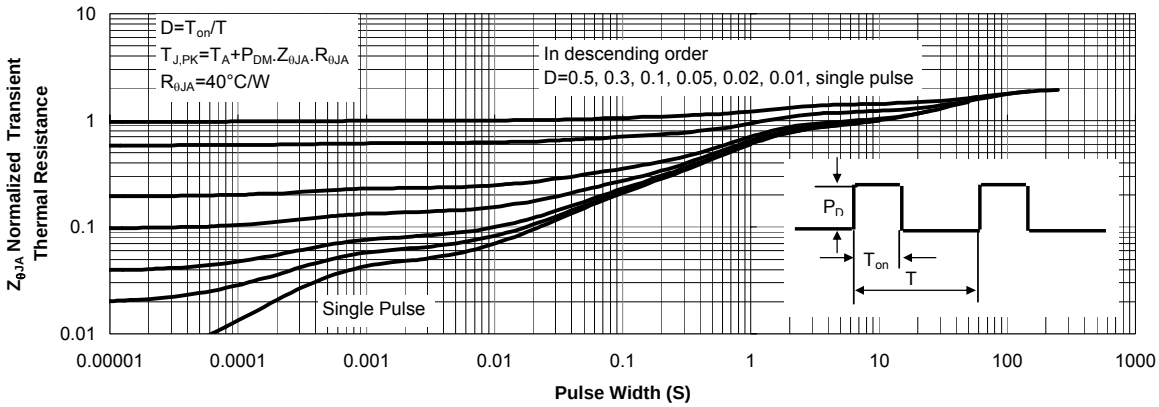
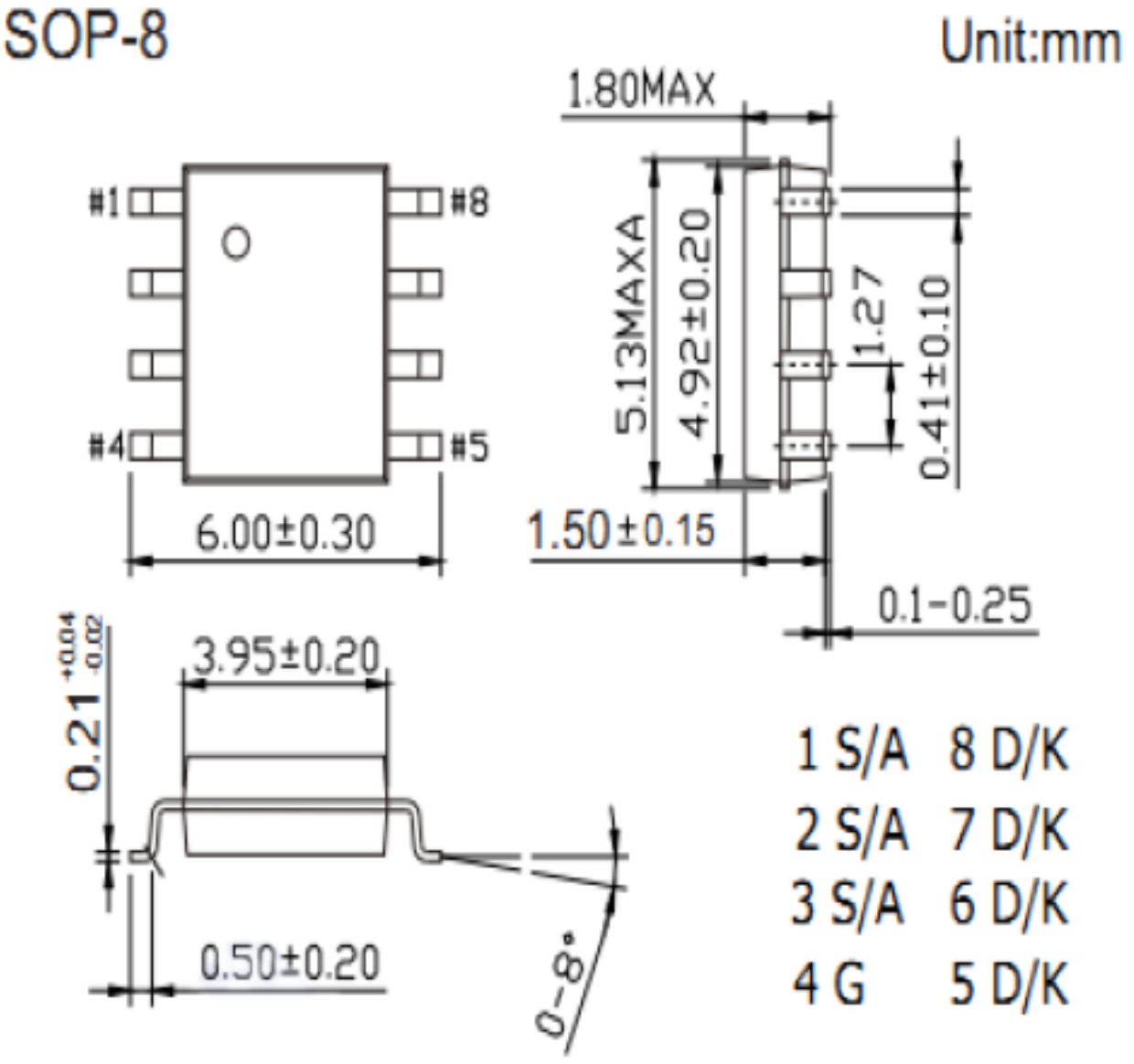


Figure 11: Normalized Maximum Transient Thermal Impedence

SOIC (NARROW): 8-LEAD



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