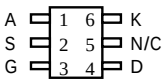
N-Channel Enhancement Mode Field Effect Transistor with Schottky Diode

General Description

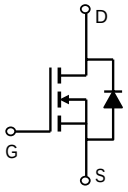
The VB3222A uses advanced trench technology to provide excellent $R_{DS(ON)}$ and low gate charge. A Schottky diode is provided to facilitate the implementation of a bidirectional blocking switch, or for DC-DC conversion applications.

Features

V_{DS} (V) = 20V
I_D = 6.0A (V_{GS} = 4.5V)
$R_{DS(ON)}$ < 26mΩ (V_{GS} = 4.5V)
$R_{DS(ON)}$ < 35mΩ (V_{GS} = 2.5V)
$R_{DS(ON)}$ < 45mΩ (V_{GS} = 1.8V)
SCHOTTKY
V_{DS} (V) = 20V, I_F = 1A, V_F<0.5V@0.5A



TSOP6



Absolute Maximum Ratings T_A=25°C unless otherwise noted

Parameter		Symbol	MOSFET	Schottky	Units
Drain-Source Voltage		V_{DS}	20		V
Gate-Source Voltage		V_{GS}	±8		V
Continuous Drain Current [A]	T_A=25°C	I_D	6.0		A
	T_A=70°C		4.5		
Pulsed Drain Current [B]		I_{DM}	18		
Schottky reverse voltage		V_{KA}		20	V
Continuous Forward Current [A]	T_A=25°C	I_F		2	A
	T_A=70°C			1	
Pulsed Forward Current [B]		I_{FM}		10	
Power Dissipation	T_A=25°C	P_D	1.50	1.0	W
	T_A=70°C		0.9	0.6	
Junction and Storage Temperature Range		T_J, T_{STG}	-55 to 150	-55 to 150	°C

Parameter: Thermal Characteristics MOSFET		Symbol	Typ	Max	Units
Maximum Junction-to-Ambient [A]	t ≤ 10s	$R_{\theta JA}$	80.3	110	°C/W
Maximum Junction-to-Ambient [A]	Steady-State		117	150	
Maximum Junction-to-Lead [C]	Steady-State	$R_{\theta JL}$	43	80	
Thermal Characteristics Schottky					
Maximum Junction-to-Ambient [A]	t ≤ 10s	$R_{\theta JA}$	109.4	135	°C/W
Maximum Junction-to-Ambient [A]	Steady-State		136.5	175	
Maximum Junction-to-Lead [C]	Steady-State	$R_{\theta JL}$	58.5	80	

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	20			V
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS}=16V, V_{GS}=0V			1	μA
		T_J=55°C			5	
I_{GSS}	Gate-Body leakage current	V_{DS}=0V, V_{GS}=±8V			100	nA
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS}=V_{GS} I_D=250μA	0.4		1.5	V
$I_{D(ON)}$	On state drain current	V_{GS}=4.5V, V_{DS}=5V	10			A
$R_{DS(ON)}$	Static Drain-Source On-Resistance	V_{GS}=4.5V, I_D=3.8A		23		mΩ
		T_J=125°C		42		
		V_{GS}=2.5V, I_D=3.3A		27		mΩ
		V_{GS}=1.8V, I_D=2.8A		40		mΩ
g_{FS}	Forward Transconductance	V_{DS}=5V, I_D=3.8A		10.5		S
V_{SD}	Diode Forward Voltage	I_S=1A,V_{GS}=0V		0.8	1	V
I_S	Maximum Body-Diode Continuous Current				1.8	A
DYNAMIC PARAMETERS						
C_{iss}	Input Capacitance	V_{GS}=0V, V_{DS}=10V, f=1MHz		449		pF
C_{oss}	Output Capacitance			74		pF
C_{rss}	Reverse Transfer Capacitance			51.6		pF
R_g	Gate resistance	V_{GS}=0V, V_{DS}=0V, f=1MHz		4.9		Ω
SWITCHING PARAMETERS						
Q_g	Total Gate Charge	V_{GS}=4.5V, V_{DS}=10V, I_D=3.8A		5.9		nC
Q_{gs}	Gate Source Charge			0.36		nC
Q_{gd}	Gate Drain Charge			1.3		nC
$t_{D(on)}$	Turn-On DelayTime	V_{GS}=5V, V_{DS}=10V, R_L=2.6Ω, R_{GEN}=0Ω		4.5		ns
t_r	Turn-On Rise Time			6		ns
$t_{D(off)}$	Turn-Off DelayTime			32.7		ns
t_f	Turn-Off Fall Time			7.1		ns
t_{rr}	Body Diode Reverse Recovery Time	I_F=3.8A, dI/dt=100A/μs		13		ns
Q_{rr}	Body Diode Reverse Recovery Charge	I_F=3.8A, dI/dt=100A/μs		3.3		nC
SCHOTTKY PARAMETERS						
V_F	Forward Voltage Drop	I_F=0.5A		0.39	0.5	V
I_{rm}	Maximum reverse leakage current	V_R=16V			0.02	mA
		V_R=16V, T_J=125°C			20	
C_T	Junction Capacitance	V_R=10V		34		pF
t_{rr}	SchottkyReverse Recovery Time	I_F=1A, dI/dt=100A/μs		5.2	10	ns
Q_{rr}	Schottky Reverse Recovery Charge	I_F=1A, dI/dt=100A/μs		0.8		nC

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 80μs 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.

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

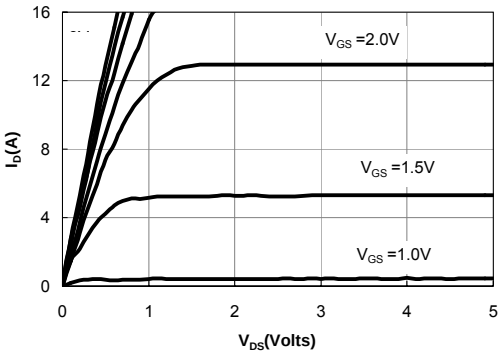


Figure 1: On-Regions CharacteristiCS

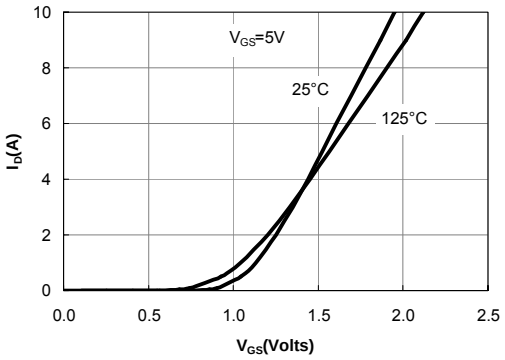


Figure 2: Transfer Characteristics

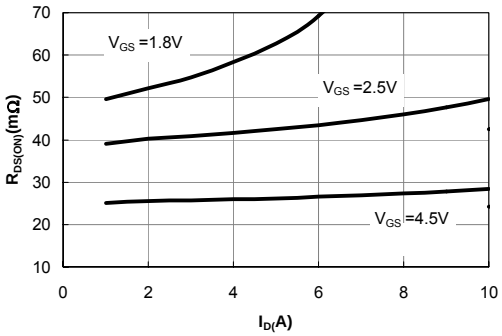


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

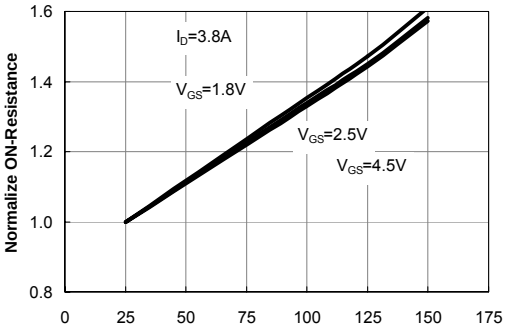


Figure 4: On-Resistance vs. Junction Temperature

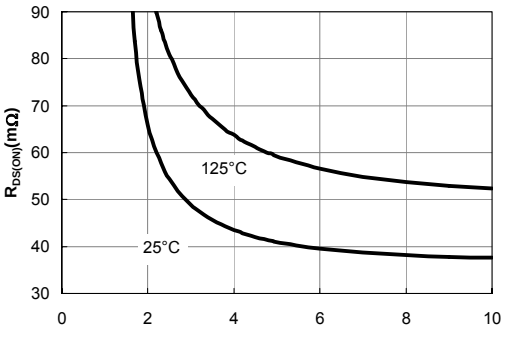


Figure 5: On-Resistance vs. Gate-Source Voltage

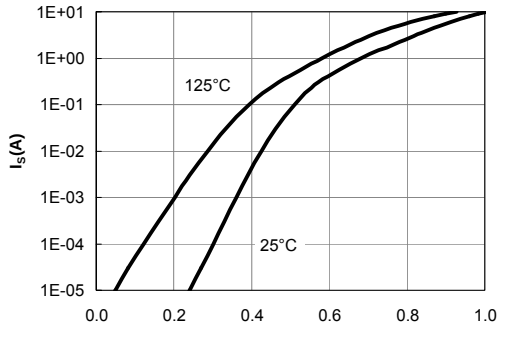


Figure 6: Body-Diode Characteristics

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

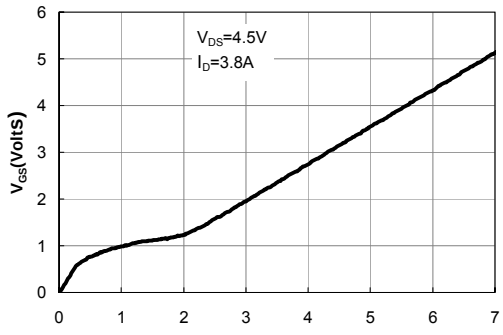


Figure 7: Gate-Charge Characteristics

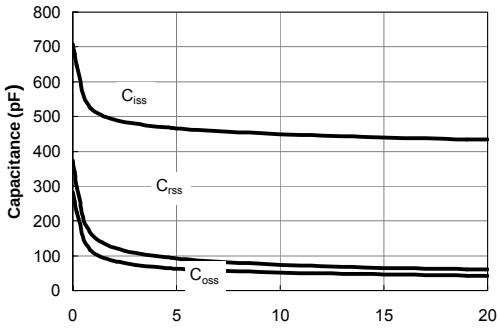


Figure 8: Capacitance Characteristics

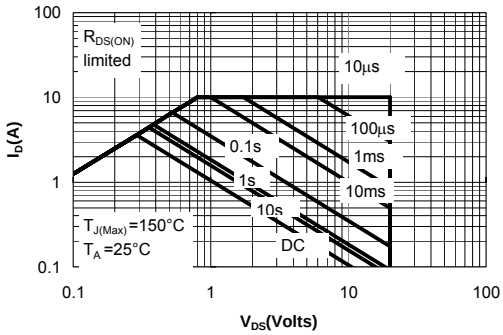


Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

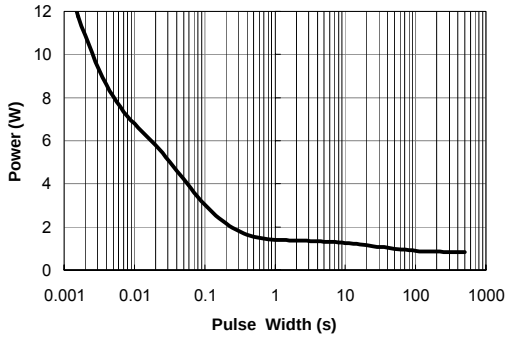


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

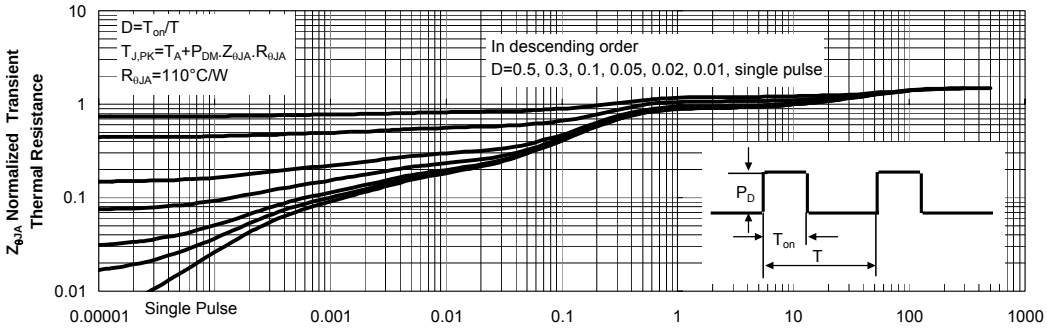


Figure 11: Normalized Maximum Transient Thermal Impedence

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS: SCHOTTKY

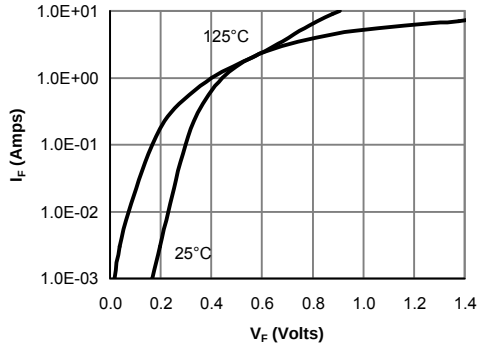


Figure 12: Schottky Forward Characteristics

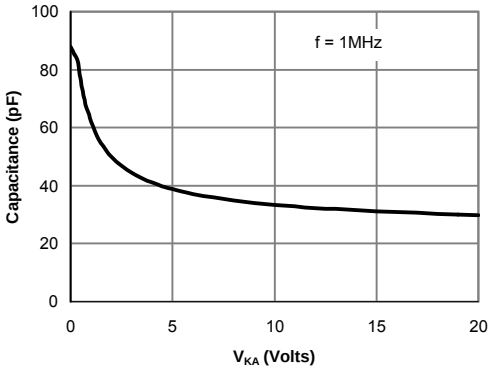


Figure 13: Schottky Capacitance Characteristics

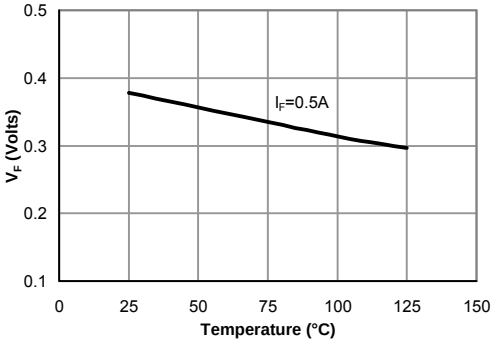


Figure 14: Schottky Forward Drop vs. Junction Temperature

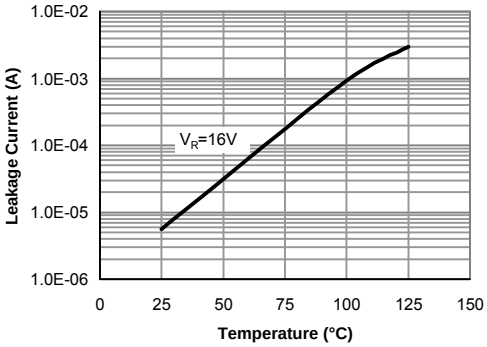


Figure 15: Schottky Leakage current vs. Junction Temperature

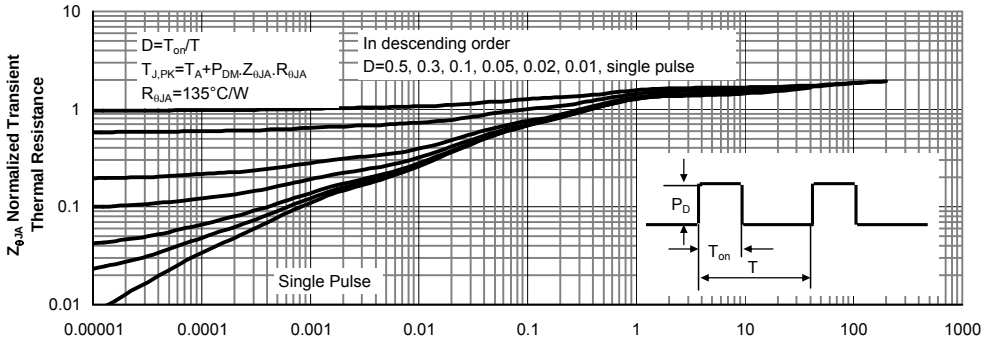
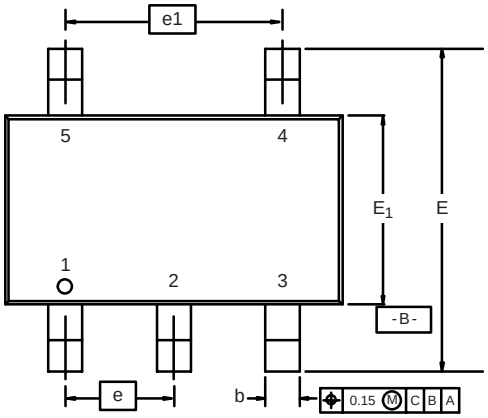
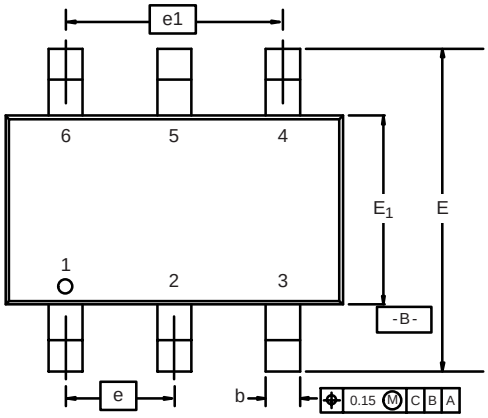


Figure 15: Schottky Normalized Maximum Transient Thermal Impedance

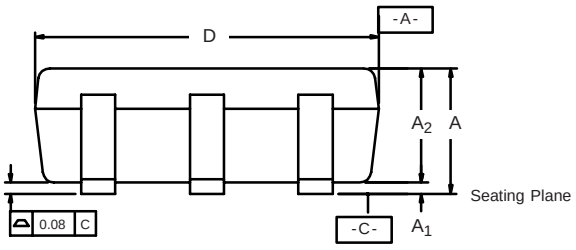
TSOP: 5/6−LEAD
JEDEC Part Number: MO-193C

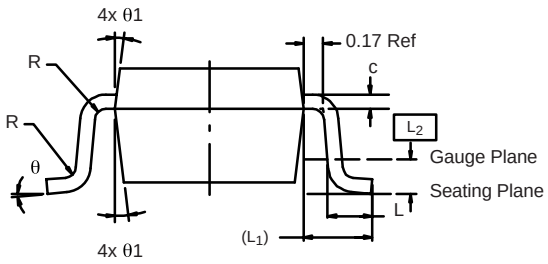


5-LEAD TSOP



6-LEAD TSOP





Dim	MILLIMETERS			INCHES		
	Min	Nom	Max	Min	Nom	Max
A	0.91	-	1.10	0.036	-	0.043
A_1	0.01	-	0.10	0.0004	-	0.004
A_2	0.90	-	1.00	0.035	0.038	0.039
b	0.30	0.32	0.45	0.012	0.013	0.018
c	0.10	0.15	0.20	0.004	0.006	0.008
D	2.95	3.05	3.10	0.116	0.120	0.122
E	2.70	2.85	2.98	0.106	0.112	0.117
E_1	1.55	1.65	1.70	0.061	0.065	0.067
e	0.95 BSC			0.0374 BSC		
e_1	1.80	1.90	2.00	0.071	0.075	0.079
L	0.32	-	0.50	0.012	-	0.020
L_1	0.60 Ref			0.024 Ref		
L_2	0.25 BSC			0.010 BSC		
R	0.10	-	-	0.004	-	-
θ	0°	4°	8°	0°	4°	8°
$θ_1$	7° Nom			7° Nom		
ECN: C-06593-Rev. I, 18-Dec-06 DWG: 5540						

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