Thyristor/Diode and Thyristor/Thyristor (Super MAGN-A-PAK Power Modules), 500 A

Super MAGN-A-PAK

FEATURES

- High current capability
- High surge capability
- Industrial standard package
- 3000 V_{RMS} isolating voltage with non-toxic substrate
- UL approved file E78996
- Designed and qualified for industrial level
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

RoHS COMPLIANT

TYPICAL APPLICATIONS

- Motor starters
- DC motor controls - AC motor controls
- Uninterruptible power supplies

PRIMARY CHARACTERISTICS	
$I_{T(AV)}$, $I_{F(AV)}$	500 A
Type	Modules - thyristor, standard
Package	Super MAGN-A-PAK

MAJOR RATINGS AND CHARACTERISTICS			
SYMBOL	CHARACTERISTICS	VALUES	UNITS
$I_{T(AV)}$, $I_{F(AV)}$	T_C = 82 °C	500	A
$I_{T(RMS)}$	T_C = 82 °C	785	A
I_{TSM}	50 Hz	17.8	kA
	60 Hz	18.7	
I^2t	50 Hz	1591	kA^2s
	60 Hz	1452	
$I^2\sqrt{t}$		15 910	$kA^2\sqrt{s}$
V_{RRM}	Range	800 to 1600	V
T_{Stg}	Range	-40 to +150	°C
T_J	Range	-40 to +130	

ELECTRICAL SPECIFICATIONS

VOLTAGE RATINGS				
TYPE NUMBER	VOLTAGE CODE	V_{RRM}/V_{DRM}, MAXIMUM REPETITIVE PEAK REVERSE VOLTAGE V	V_{RSM}, MAXIMUM NON-REPETITIVE PEAK REVERSE VOLTAGE V	I_{RRM}/I_{DRM} MAXIMUM AT $T_J = T_J$ MAXIMUM mA
VS-VSK.500	08	800	900	100
	12	1200	1300	
	14	1400	1500	
	16	1600	1700	

ON-STATE CONDUCTION						
PARAMETER	**SYMBOL**	**TEST CONDITIONS**			**VALUES**	**UNITS**
Maximum average on-state current at case temperature	$I_{T(AV)}$, $I_{F(AV)}$	180° conduction, half sine wave			500	A
					82	°C
Maximum RMS on-state current	$I_{T(RMS)}$	180° conduction, half sine wave at T_C = 82 °C			785	A
Maximum peak, one-cycle, non-repetitive on-state surge current	I_{TSM}, I_{FSM}	t = 10 ms	No voltage reapplied	Sinusoidal half wave, initial T_J = T_J maximum	17.8	kA
		t = 8.3 ms			18.7	
		t = 10 ms	100 % V_{RRM} reapplied		15.0	
		t = 8.3 ms			15.7	
Maximum I^2t for fusing	I^2t	t = 10 ms	No voltage reapplied		1591	kA^2s
		t = 8.3 ms			1452	
		t = 10 ms	100 % V_{RRM} reapplied		1125	
		t = 8.3 ms			1027	
Maximum $I^2\sqrt{t}$ for fusing	$I^2\sqrt{t}$	t = 0.1 ms to 10 ms, no voltage reapplied			15 910	$kA^2\sqrt{s}$
Low level value or threshold voltage	$V_{T(TO)1}$	(16.7 % x π x $I_{T(AV)}$ < I < π x $I_{T(AV)}$), T_J = T_J maximum			0.85	V
High level value of threshold voltage	$V_{T(TO)2}$	(I > π x $I_{T(AV)}$), T_J = T_J maximum			0.93	
Low level value on-state slope resistance	r_{t1}	(16.7 % x π x $I_{T(AV)}$ < I < π x $I_{T(AV)}$), T_J = T_J maximum			0.36	mΩ
High level value on-state slope resistance	r_{t2}	(I > π x $I_{T(AV)}$), T_J = T_J maximum			0.32	
Maximum on-state voltage drop	V_{TM}	I_{pk} = 1500 A, T_J = 25 °C, t_p = 10 ms sine pulse			1.50	V
Maximum forward voltage drop	V_{FM}	I_{pk} = 1500 A, T_J = 25 °C, t_p = 10 ms sine pulse			1.50	V
Maximum holding current	I_H	T_J = 25 °C, anode supply 12 V resistive load			500	mA
Maximum latching current	I_L				1000	

SWITCHING				
PARAMETER	**SYMBOL**	**TEST CONDITIONS**	**VALUES**	**UNITS**
Maximum rate of rise of turned-on current	dI/dt	T_J = T_J maximum, I_{TM} = 400 A, V_{DRM} applied	1000	A/µs
Typical delay time	t_d	Gate current 1 A, dI_g/dt = 1 A/µs V_d = 0.67 % V_{DRM}, T_J = 25 °C	2.0	µs
Typical turn-off time	t_q	I_{TM} = 750 A; T_J = T_J maximum, dI/dt = - 60 A/µs, V_R = 50 V, dV/dt = 20 V/µs, gate 0 V 100 Ω	200	

BLOCKING				
PARAMETER	**SYMBOL**	**TEST CONDITIONS**	**VALUES**	**UNITS**
Maximum critical rate of rise of off-state voltage	dV/dt	T_J = 130 °C, linear to V_D = 80 % V_{DRM}	1000	V/µs
RMS insulation voltage	V_{INS}	t = 1 s	3000	V
Maximum peak reverse and off-state leakage current	I_{RRM}, I_{DRM}	T_J = T_J maximum, rated V_{DRM}/V_{RRM} applied	100	mA

TRIGGERING				
PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Maximum peak gate power	P_{GM}	$T_J = T_J$ maximum, $t_p \leq 5$ ms	10	W
Maximum peak average gate power	$P_{G(AV)}$	$T_J = T_J$ maximum, f = 50 Hz, d% = 50	2.0	
Maximum peak positive gate current	$+I_{GM}$	$T_J = T_J$ maximum, $t_p \leq 5$ ms	3.0	A
Maximum peak positive gate voltage	$+V_{GM}$		20	V
Maximum peak negative gate voltage	$-V_{GM}$		5.0	
Maximum DC gate current required to trigger	I_{GT}	T_J = 25 °C, V_{ak} 12 V	200	mA
DC gate voltage required to trigger	V_{GT}		3.0	V
DC gate current not to trigger	I_{GD}	$T_J = T_J$ maximum	10	mA
DC gate voltage not to trigger	V_{GD}		0.25	V

THERMAL AND MECHANICAL SPECIFICATIONS				
PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Maximum junction operating temperature range	T_J		-40 to +130	°C
Maximum storage temperature range	T_{Stg}		-40 to +150	
Maximum thermal resistance, junction to case per junction	R_{thJC}	DC operation	0.065	K/W
Maximum thermal resistance, case to heatsink per module	R_{thC-hs}	Mounting surface smooth, flat and greased	0.02	
Mounting torque ± 10 % — Super MAGN-A-PAK to heatsink		A mounting compound is recommended and the torque should be rechecked after a period of 3 hours to allow for the spread of the compound	6 to 8	Nm
Mounting torque ± 10 % — busbar to super MAGN-A-PAK			12 to 15	
Approximate weight			1500	g
Case style		See dimensions - link at the end of datasheet	Super MAGN-A-PAK	

ΔR_{thJC} CONDUCTION				
CONDUCTION ANGLE	SINUSOIDAL CONDUCTION	RECTANGULAR CONDUCTION	TEST CONDITIONS	UNITS
180°	0.009	0.006	$T_J = T_J$ maximum	K/W
120°	0.011	0.011		
90°	0.014	0.015		
60°	0.021	0.022		
30°	0.037	0.038		

Note

- Table shows the increment of thermal resistance R_{thJC} when devices operate at different conduction angles than DC

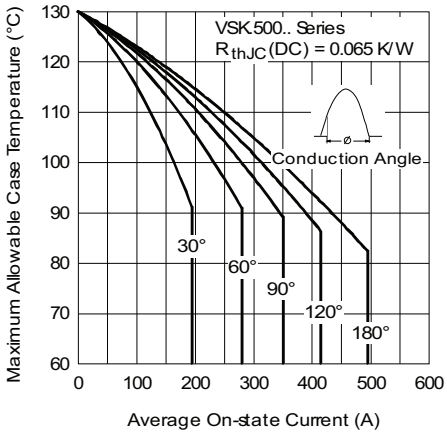


Fig. 1 - Current Ratings Characteristics

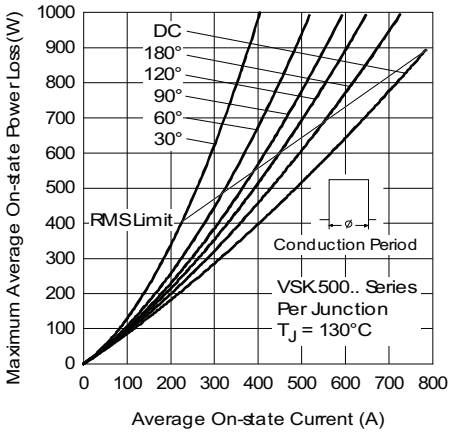


Fig. 4 - On-State Power Loss Characteristics

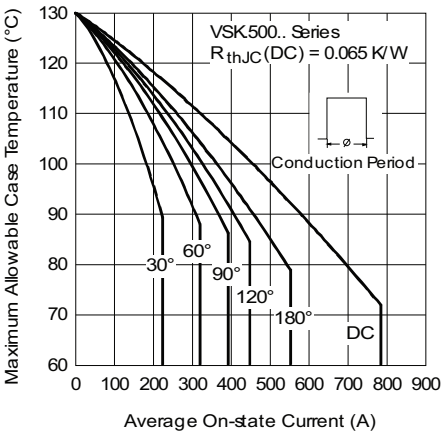


Fig. 2 - Current Ratings Characteristics

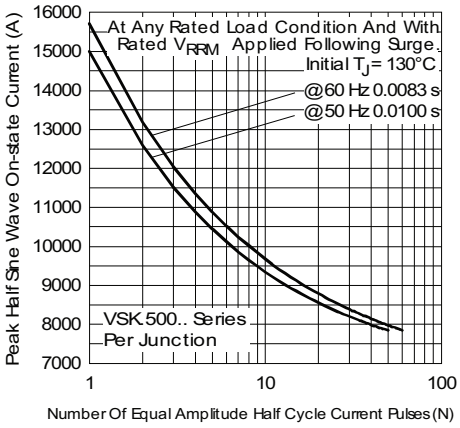


Fig. 5 - Maximum Non-Repetitive Surge Current

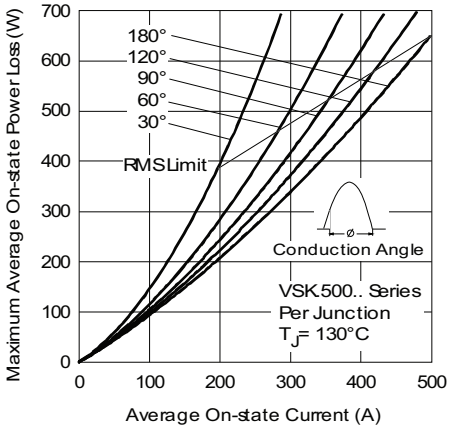


Fig. 3 - On-State Power Loss Characteristics

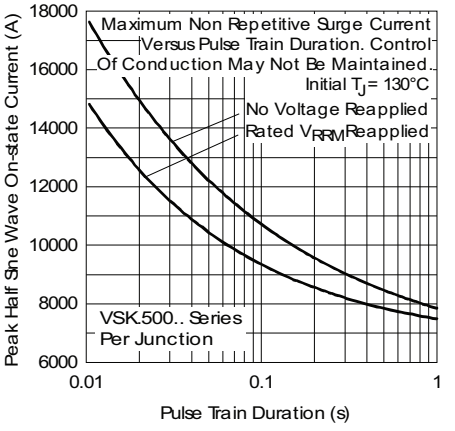


Fig. 6 - Maximum Non-Repetitive Surge Current

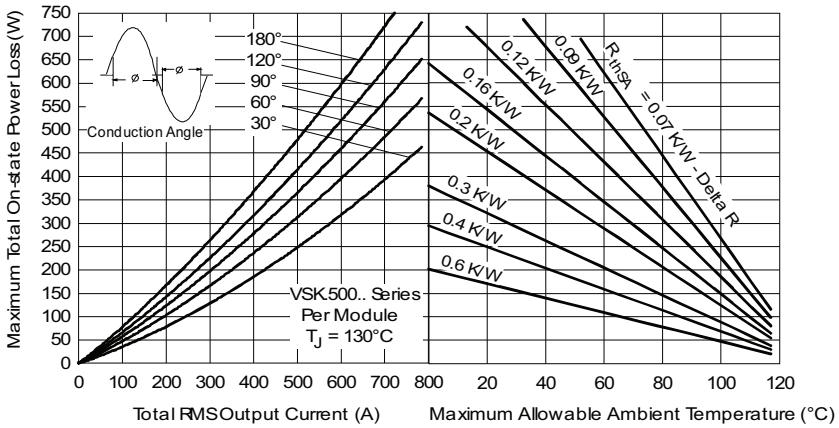


Fig. 7 - On-State Power Loss Characteristics

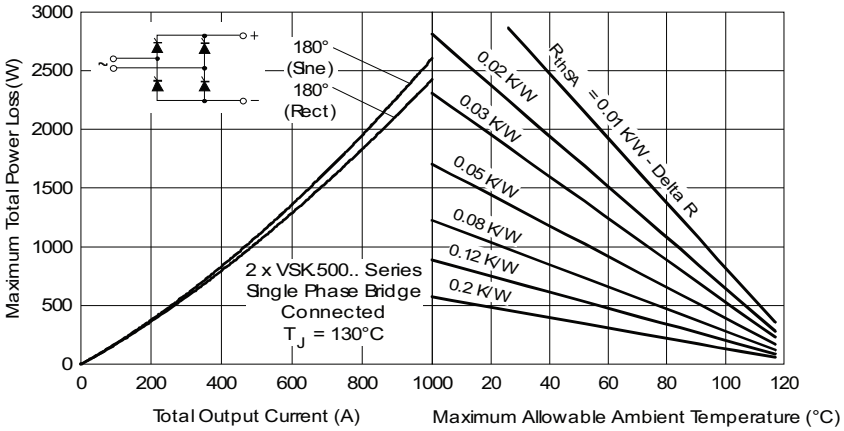


Fig. 8 - On-State Power Loss Characteristics

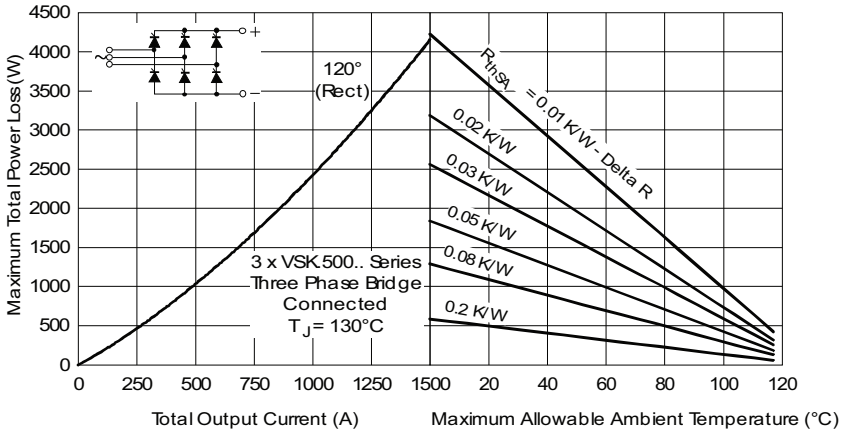


Fig. 9 - On-State Power Loss Characteristics

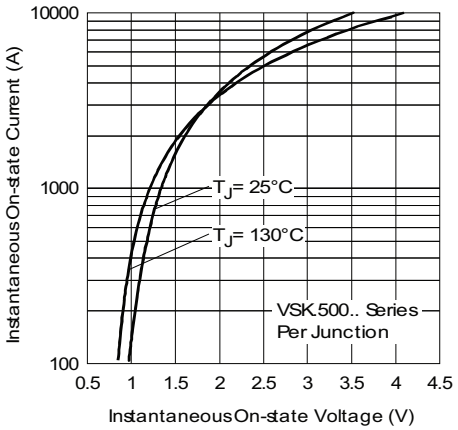


Fig. 10 - On-State Voltage Drop Characteristics

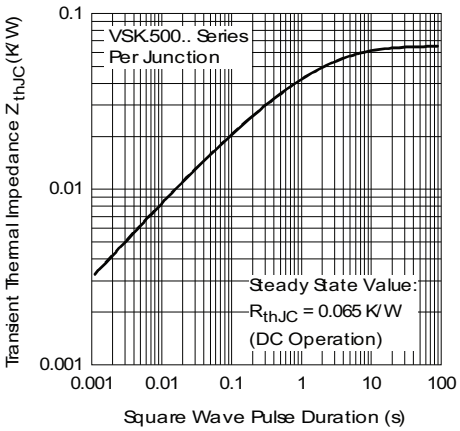


Fig. 11 - Thermal Impedance Z_{thJC} Characteristics

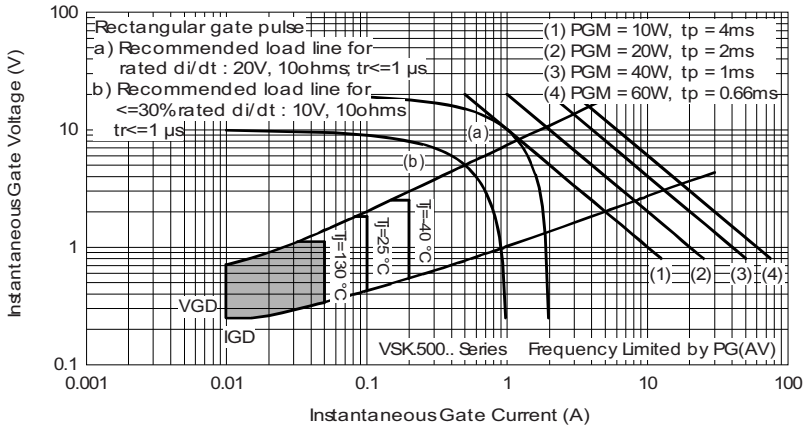


Fig. 12 - Gate Characteristics

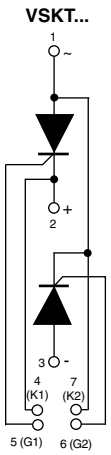
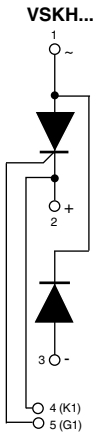
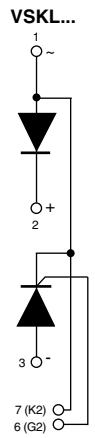
ORDERING INFORMATION TABLE

Device code	VS-VS	KT	500	-	16	PbF
	1	2	3		4	5

1	-	Vishay Semiconductors product
2	-	Circuit configuration (see end of datasheet)
3	-	Current rating
4	-	Voltage code x 100 = V_{RRM} (see voltage ratings table)
5	-	Lead (Pb)-free

Note

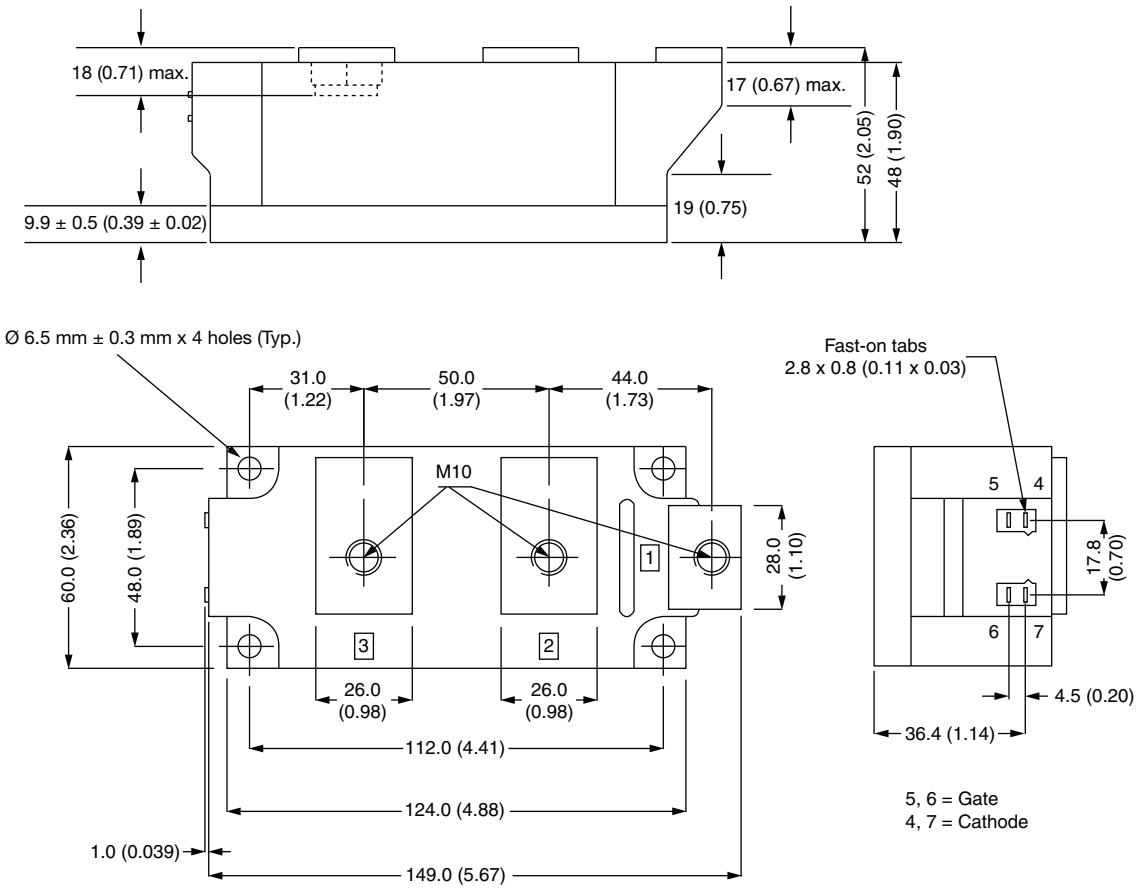
- To order the optional hardware go to www.vishay.com/doc?95172

CIRCUIT CONFIGURATION		
CIRCUIT DESCRIPTION	**CIRCUIT CONFIGURATION CODE**	**CIRCUIT DRAWING**
Two SCRs doubler circuit	KT	
SCR/diode doubler circuit, positive control	KH	
SCR/diode doubler circuit, negative control	KL	

LINKS TO RELATED DOCUMENTS	
Dimensions	www.vishay.com/doc?95283

Super MAGN-A-PAK Thyristor/Diode

DIMENSIONS in millimeters (inches)



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