

SCR/Diode (MAGN-A-PAK Power Modules), 320 A



MAGN-A-PAK

FEATURES

- High voltage
- Electrically isolated base plate
- 3500 V_{RMS} isolating voltage
- Industrial standard package
- Simplified mechanical designs, rapid assembly
- High surge capability
- Large creepage distances
- Designed and qualified for industrial level
- Material categorization: for definitions of compliance please see www.vishay.com/doc?999912


RoHS
COMPLIANT

DESCRIPTION

This VSK series of MAGN-A-PAK modules uses high voltage power thyristor/thyristor and thyristor / diode in seven basic configurations. The semiconductors are electrically isolated from the metal base, allowing common heatsinks and compact assemblies to be built. They can be interconnected to form single phase or three phase bridges or as AC-switches when modules are connected in anti-parallel mode. These modules are intended for general purpose applications such as battery chargers, welders, motor drives, UPS, etc.

PRIMARY CHARACTERISTICS

$I_{T(AV)}$ or $I_{F(AV)}$	320 A
Type	Modules - thyristor, standard
Package	MAGN-A-PAK

MAJOR RATINGS AND CHARACTERISTICS

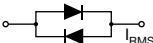
SYMBOL	CHARACTERISTICS	VALUES	UNITS
$I_{T(AV)}/I_{F(AV)}$	70 °C	320	A
$I_{T(RMS)}$		502	
I_{TSM}/I_{FSM}	50 Hz	9000	
	60 Hz	9420	kA ² s
I^2t	50 Hz	405	
	60 Hz	370	kA ² √s
$I^2\sqrt{t}$		4050	
V_{DRM}/V_{RRM}		1600	V
T_J	Range	-40 to +130	°C

ELECTRICAL SPECIFICATIONS

VOLTAGE RATINGS

TYPE NUMBER	VOLTAGE CODE	V_{RRM}/V_{DRM} , MAXIMUM REPETITIVE PEAK REVERSE AND OFF-STATE BLOCKING VOLTAGE V	V_{RSM} , MAXIMUM NON-REPETITIVE PEAK REVERSE VOLTAGE V	I_{RRM}/I_{DRM} AT 130 °C MAXIMUM mA
VS-VSKH320-	16	1600	1700	50



ON-STATE CONDUCTION						
PARAMETER	SYMBOL	TEST CONDITIONS			VALUES	UNITS
Maximum average on-state current at case temperature (thyristor)	$I_{T(AV)}$	180° conduction, half sine wave			320	A
Maximum average forward current (diode)	$I_{F(AV)}$				70	°C
Maximum RMS on-state current	$I_{O(RMS)}$	As AC switch 			704	
Maximum peak, one-cycle on-state non-repetitive, surge current	I_{TSM}	t = 10 ms	No voltage reapplied	Sinusoidal half wave, initial $T_J = T_J$ maximum	9000	A
		t = 8.3 ms			9420	
		t = 10 ms	100 % V_{RRM} reapplied		7570	
		t = 8.3 ms			7920	
Maximum I^2t for fusing	I^2t	t = 10 ms	No voltage reapplied		405	kA ² s
		t = 8.3 ms			370	
		t = 10 ms	100 % V_{RRM} reapplied		287	
		t = 8.3 ms			262	
Maximum $I^2\sqrt{t}$ for fusing	$I^2\sqrt{t}$	t = 0.1 ms to 10 ms, no voltage reapplied			4050	kA ² √s
Low level value or threshold voltage	$V_{T(TO)1}$	(16.7 % $\times \pi \times I_{T(AV)} < I < \pi \times I_{T(AV)}$, $T_J = T_J$ maximum			0.80	V
High level value of threshold voltage	$V_{T(TO)2}$	(1 $> \pi \times I_{T(AV)} < I < \pi \times I_{T(AV)}$, $T_J = T_J$ maximum			1.03	
Low level value on-state slope resistance	r_{t1}	(16.7 % $\times \pi \times I_{T(AV)} < I < \pi \times I_{T(AV)}$, $T_J = T_J$ maximum			0.75	mΩ
High level value on-state slope resistance	r_{t2}	(1 $> \pi \times I_{T(AV)} < I < \pi \times I_{T(AV)}$, $T_J = T_J$ maximum			0.53	
Maximum on-state voltage drop	V_{TM}, V_{FM}	$I_{TM} = \pi \times I_{T(AV)}$, $I_{FM} = \pi \times I_{F(AV)}$, $T_J = T_J$ maximum, 180° conduction			1.50	V
Maximum holding current	I_H	Anode supply = 12 V, initial $I_T = 30$ A, $T_J = 25$ °C			500	mA
Maximum latching current	I_L	Anode supply = 12 V, resistive load = 1 Ω, gate pulse: 10 V, 100 μs, $T_J = 25$ °C			1000	

SWITCHING				
PARAMETER	SYMBOL	TEST CONDITIONS	VS-VSKH320	UNITS
Typical delay time	t_d	$T_J = 25$ °C, gate current = 1 A $dI_g/dt = 1$ A/μs $V_d = 0.67$ % V_{DRM}	1.0	μs
Typical rise time	t_r		2.0	
Typical turn-off time	t_q	$I_{TM} = 300$ A; $dI/dt = 15$ A/μs; $T_J = T_J$ maximum; $V_R = 50$ V; $dV/dt = 20$ V/μs; gate 0 V, 100 Ω	200 to 350	

BLOCKING				
PARAMETER	SYMBOL	TEST CONDITIONS	VS-VSKH320	UNITS
Maximum peak reverse and off-state leakage current	I_{RRM}, I_{DRM}	$T_J = T_J$ maximum	50	mA
RMS insulation voltage	V_{INS}	50 Hz, circuit to base, all terminals shorted, 25 °C, 1 s	3000	V
Critical rate of rise of off-state voltage	dV/dt	$T_J = T_J$ maximum, exponential to 67 % rated V_{DRM}	1000	V/μs



TRIGGERING					
PARAMETER	SYMBOL	TEST CONDITIONS		VS-VSKH320	UNITS
Maximum peak gate power	P _{GM}	t _p ≤ 5 ms, T _J = T _J maximum		10.0	W
Maximum average gate power	P _{G(AV)}	f = 50 Hz, T _J = T _J maximum		2.0	
Maximum peak gate current	+ I _{GM}	t _p ≤ 5 ms, T _J = T _J maximum		3.0	A
Maximum peak negative gate voltage	- V _{GT}	t _p ≤ 5 ms, T _J = T _J maximum		5.0	V
Maximum required DC gate voltage to trigger	V _{GT}	T _J = - 40 °C	Anode supply = 12 V, resistive load; R _a = 1 Ω	4.0	
		T _J = 25 °C		3.0	
		T _J = T _J maximum		2.0	
Maximum required DC gate current to trigger	I _{GT}	T _J = - 40 °C	Anode supply = 12 V, resistive load; R _a = 1 Ω	350	mA
		T _J = 25 °C		200	
		T _J = T _J maximum		100	
Maximum gate voltage that will not trigger	V _{GD}	T _J = T _J maximum, rated V _{DRM} applied		0.25	V
Maximum gate current that will not trigger	I _{GD}	T _J = T _J maximum, rated V _{DRM} applied		10.0	mA
Maximum rate of rise of turned-on current	di/dt	T _J = T _J maximum, I _{TM} = 400 A, rated V _{DRM} applied		500	A/μs

THERMAL AND MECHANICAL SPECIFICATIONS					
PARAMETER	SYMBOL	TEST CONDITIONS		VS-VSKH320	UNITS
Junction operating and storage temperature range	T_J, T_{Stg}			-40 to +130	$^\circ\text{C}$
Maximum thermal resistance, junction to case per junction	R_{thJC}	DC operation		0.125	K/W
Typical thermal resistance, case to heatsink per module	R_{thCS}	Mounting surface flat, smooth, and greased		0.02	
Mounting torque $\pm 10\%$	MAGN-A-PAK to heatsink busbar to MAGN-A-PAK	A mounting compound is recommended and the torque should be rechecked after a period of about 3 hours to allow for the spread of the compound.		4 to 6	Nm
Approximate weight				500 17.8	g oz.
Case style				MAGN-A-PAK	

ΔR CONDUCTION PER JUNCTION											
DEVICES	SINUSOIDAL CONDUCTION AT T_J MAXIMUM					RECTANGULAR CONDUCTION AT T_J MAXIMUM					UNITS
	180°	120°	90°	60°	30°	180°	120°	90°	60°	30°	
VS-VSKH320-	0.009	0.010	0.014	0.020	0.032	0.007	0.011	0.015	0.020	0.033	K/W

Note

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

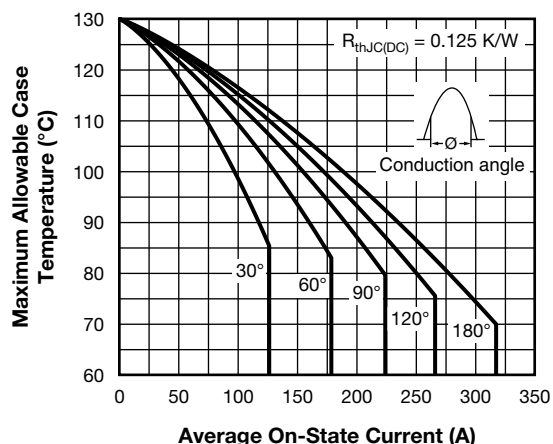


Fig. 1 - Current Ratings Characteristics

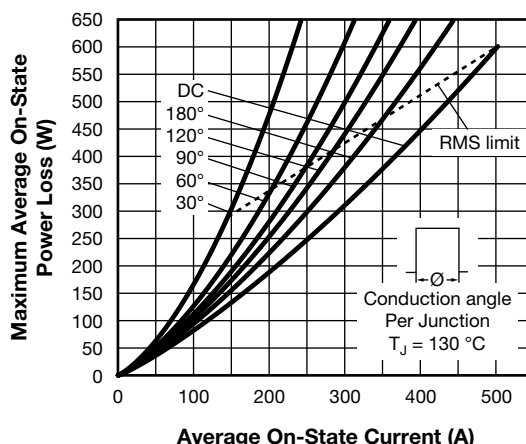


Fig. 4 - On-State Power Loss Characteristics

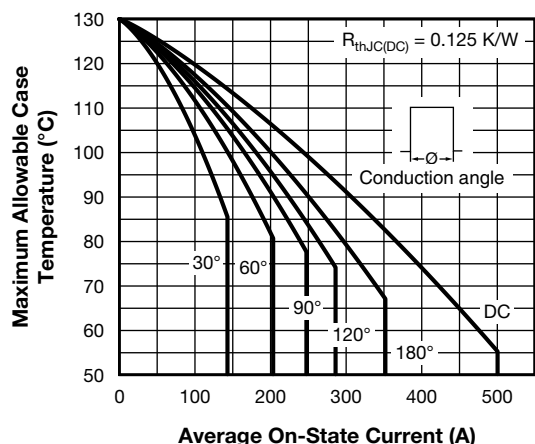


Fig. 2 - Current Ratings Characteristics

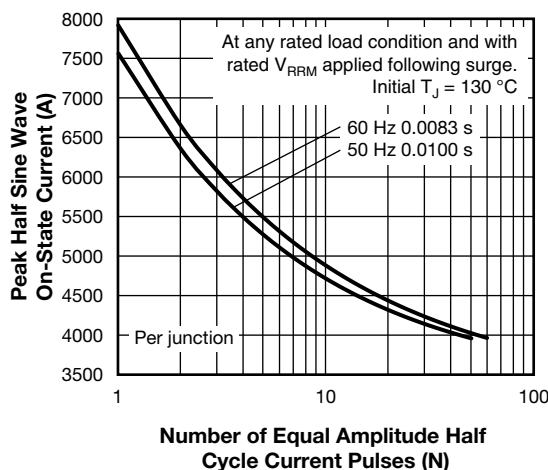


Fig. 5 - Maximum Non-Repetitive Surge Current

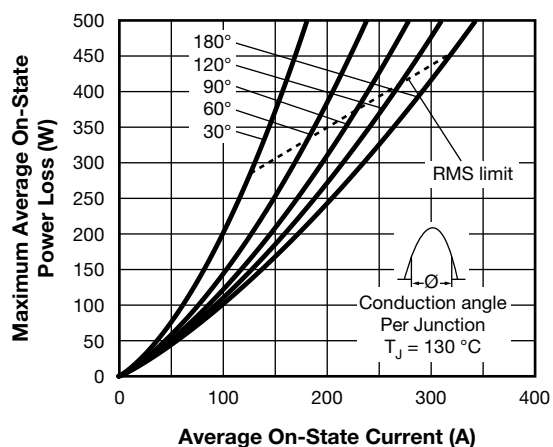


Fig. 3 - On-State Power Loss Characteristics

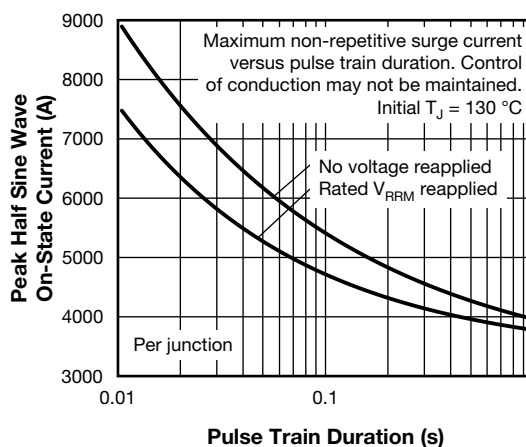


Fig. 6 - Maximum Non-Repetitive Surge Current

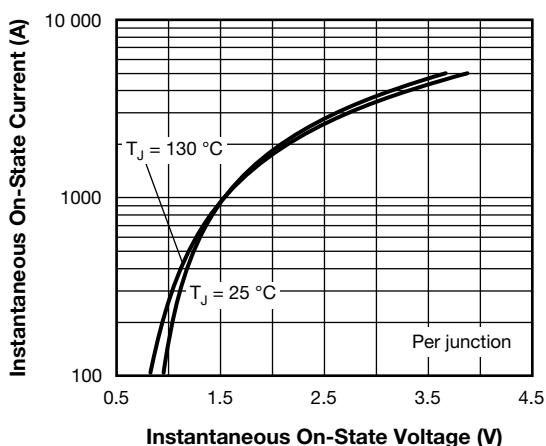
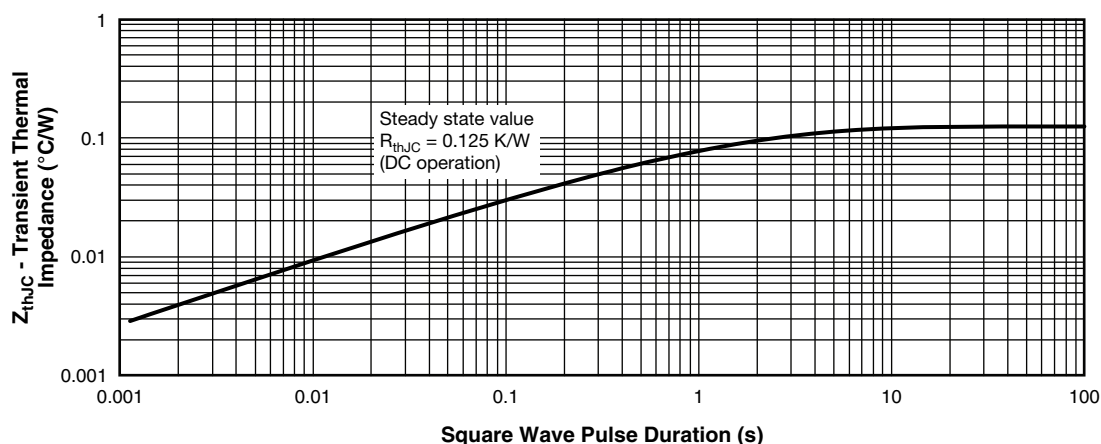


Fig. 7 - On-State Voltage Drop Characteristics


Fig. 8 - Thermal Impedance Z_{thJC} Characteristics

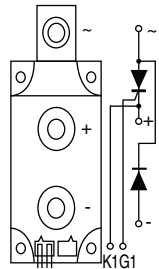
ORDERING INFORMATION TABLE

Device code	VS-VS	KH	320	-	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	-	<ul style="list-style-type: none"> None = Standard production PbF = Lead (Pb)-free 				

Note

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

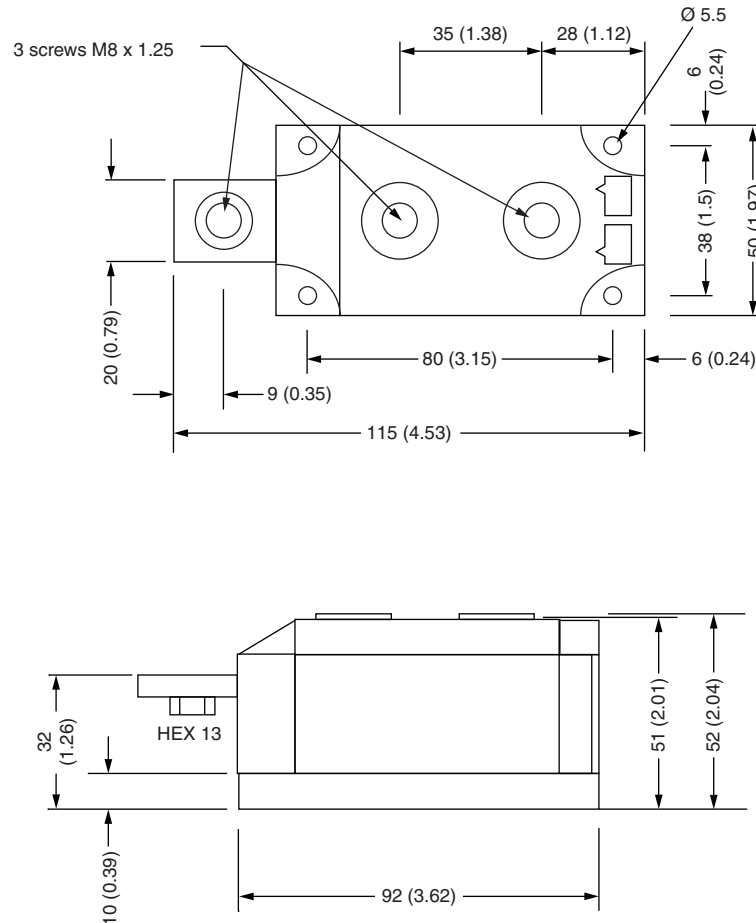


CIRCUIT CONFIGURATION		
CIRCUIT DESCRIPTION	CIRCUIT CONFIGURATION CODE	CIRCUIT DRAWING
SCR/diode doubler circuit, positive control	KH	

LINKS TO RELATED DOCUMENTS	
Dimensions	www.vishay.com/doc?95086
Application Note	www.vishay.com/doc?95557

MAGN-A-PAK

DIMENSIONS in millimeters (inches)



Notes

- Dimensions are nominal
- Full engineering drawings are available on request
- UL identification number for gate and cathode wire: UL 1385
- UL identification number for package: UL 94 V-0



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