

## Standard Recovery Diodes, 250 A to 320 A (MAGN-A-PAK Power Modules)



MAGN-A-PAK

### FEATURES

- High voltage
- Electrically isolated base plate
- 3000 V<sub>RMS</sub> isolating voltage
- Industrial standard package
- Simplified mechanical designs, rapid assembly
- High surge capability
- Large creepage distances
- UL approved file E78996 
- Compliant to RoHS directive 2002/95/EC
- Designed and qualified for industrial level



**RoHS**  
COMPLIANT

### PRODUCT SUMMARY

I <sub>F(AV)</sub>	250 A to 320 A
Type	Modules - Diode, High Voltage

### DESCRIPTION

This new VSK series of MAGN-A-PAKs uses high voltage power diodes in two 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 and the single diode module can be used in conjunction with the thyristor modules as a freewheel diode. These modules are intended for general purpose applications such as battery chargers, welders and plating equipment and where high voltage and high current are required (motor drives, etc.).

### MAJOR RATINGS AND CHARACTERISTICS

SYMBOL	CHARACTERISTICS	VSK.250..	VSK.270..	VSK.320..	UNITS
I <sub>F(AV)</sub>		250	270	320	A
	T <sub>C</sub>	100	100	100	°C
I <sub>F(RMS)</sub>		393	424	502	A
I <sub>FSM</sub>	50 Hz	7015	8920	10 110	
	60 Hz	7345	9430	10 580	
I <sup>2</sup> t	50 Hz	246	398	511	kA <sup>2</sup> s
	60 Hz	225	363	466	
I <sup>2</sup> √t		2460	3980	5110	kA <sup>2</sup> √s
V <sub>RRM</sub>		400 to 3000			V
T <sub>J</sub>		- 40 to 150			°C

# VSK.250, VSK.270, VSK.320 Series



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## ELECTRICAL SPECIFICATIONS

VOLTAGE RATINGS				
TYPE NUMBER	VOLTAGE CODE	V <sub>RRM</sub> , MAXIMUM REPETITIVE PEAK REVERSE VOLTAGE V	V <sub>RSM</sub> , MAXIMUM NON-REPETITIVE PEAK REVERSE VOLTAGE V	I <sub>RRM</sub> MAXIMUM AT 150 °C mA
VSK.250 VSK.270 VSK.320	04	400	500	50
	08	800	900	
	12	1200	1300	
	16	1600	1700	
	20	2000	2100	
VSK.270	30	3000	3100	

FORWARD CONDUCTION								
PARAMETER	SYMBOL	TEST CONDITIONS		VSK.250	VSK.270	VSK.320	UNITS	
Maximum average forward current at case temperature	I <sub>F(AV)</sub>	180° conduction, half sine wave		250	270	320	A	
				100	100	100	°C	
Maximum RMS forward current	I <sub>F(RMS)</sub>	As AC switch		393	424	502		
Maximum peak, one-cycle forward, non-repetitive surge current	I <sub>FSM</sub>	t = 10 ms	No voltage reappplied	Sinusoidal half wave, initial T <sub>J</sub> = T <sub>J maximum</sub>	7015	8920	10 110	A
		t = 8.3 ms			7345	9340	10 580	
		t = 10 ms	100 % V <sub>RRM</sub> reappplied		5900	7500	8500	
		t = 8.3 ms			6180	7850	8900	
Maximum I <sup>2</sup> t for fusing	I <sup>2</sup> t	t = 10 ms	No voltage reappplied		246	398	511	kA <sup>2</sup> s
		t = 8.3 ms			225	363	466	
		t = 10 ms	100 % V <sub>RRM</sub> reappplied		174	281	361	
		t = 8.3 ms			159	257	330	
Maximum I <sup>2</sup> √t for fusing	I <sup>2</sup> √t	t = 0.1 ms to 10 ms, no voltage reappplied		2460	3980	5110	kA <sup>2</sup> √s	
Low level value of threshold voltage	V <sub>F(TO)1</sub>	(16.7 % × π × I <sub>F(AV)</sub> < I < π × I <sub>F(AV)</sub> ), T <sub>J</sub> = T <sub>J maximum</sub>		0.79	0.74	0.69	V	
High level value of threshold voltage	V <sub>F(TO)2</sub>	(I > π × I <sub>F(AV)</sub> ), T <sub>J</sub> = T <sub>J maximum</sub>		0.92	0.87	0.86		
Low level forward slope resistance	r <sub>f1</sub>	(16.7 % × π × I <sub>F(AV)</sub> < I < π × I <sub>F(AV)</sub> ), T <sub>J</sub> = T <sub>J maximum</sub>		0.63	0.94	0.59	mΩ	
High level forward slope resistance	r <sub>f2</sub>	(I > π × I <sub>F(AV)</sub> ), T <sub>J</sub> = T <sub>J maximum</sub>		0.49	0.81	0.44		
Maximum forward voltage drop	V <sub>FM</sub>	I <sub>FM</sub> = π × I <sub>F(AV)</sub> , T <sub>J</sub> = T <sub>J maximum</sub> , 180° conduction Average power = V <sub>F(TO)</sub> × I <sub>F(AV)</sub> + r <sub>f</sub> × (I <sub>F(RMS)</sub> ) <sup>2</sup>		1.29	1.48	1.28	V	

BLOCKING					
PARAMETER	SYMBOL	TEST CONDITIONS		VALUES	UNITS
Maximum peak reverse leakage current	I <sub>RRM</sub>	T <sub>J</sub> = 150 °C		50	mA
RMS insulation voltage	V <sub>INS</sub>	50 Hz, circuit to base, all terminals shorted, t = 1 s		3000	V



# VSK.250, VSK.270, VSK.320 Series

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THERMAL AND MECHANICAL SPECIFICATIONS						
PARAMETER	SYMBOL	TEST CONDITIONS	VALUES			UNITS
			VSK.250	VSK.270	VSK.320	
Maximum junction operating and storage temperature range	$T_J, T_{Stg}$		- 40 to 150			°C
Maximum thermal resistance, junction to case per junction	$R_{thJC}$	DC operation	0.16	0.125		K/W
Maximum resistance, case to heatsink per module	$R_{thCS}$	Mounting surface flat, smooth and greased	0.035			
Mounting torque ± 10 %	MAP to heatsink	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
	busbar to MAP		8 to 10			
Approximate weight			800			g
			30			oz.
Case style			MAGN-A-PAK			

ΔR CONDUCTION PER JUNCTION											
DEVICE	SINUSOIDAL CONDUCTION AT $T_J$ MAXIMUM					RECTANGULAR CONDUCTION AT $T_J$ MAXIMUM					UNITS
	180°	120°	90°	60°	30°	180°	120°	90°	60°	30°	
	VSK.250	0.009	0.010	0.014	0.020	0.032	0.007	0.011	0.015	0.021	
VSK.270	0.008	0.012	0.014	0.020	0.032	0.007	0.011	0.015	0.020	0.033	
VSK.320	0.008	0.010	0.013	0.020	0.032	0.007	0.011	0.015	0.020	0.033	

**Note**

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

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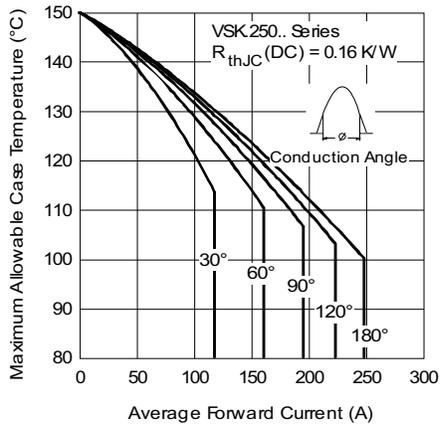


Fig. 1 - Current Ratings Characteristics

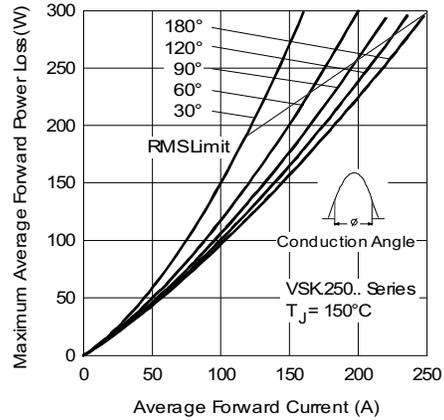


Fig. 3 - Forward Power Loss Characteristics

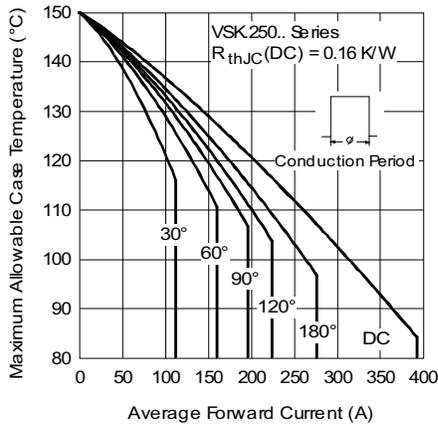


Fig. 2 - Current Ratings Characteristics

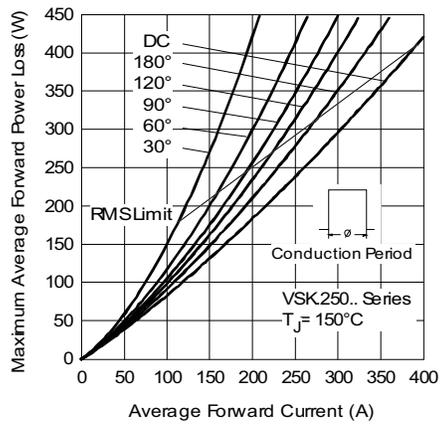


Fig. 4 - Forward Power Loss Characteristics

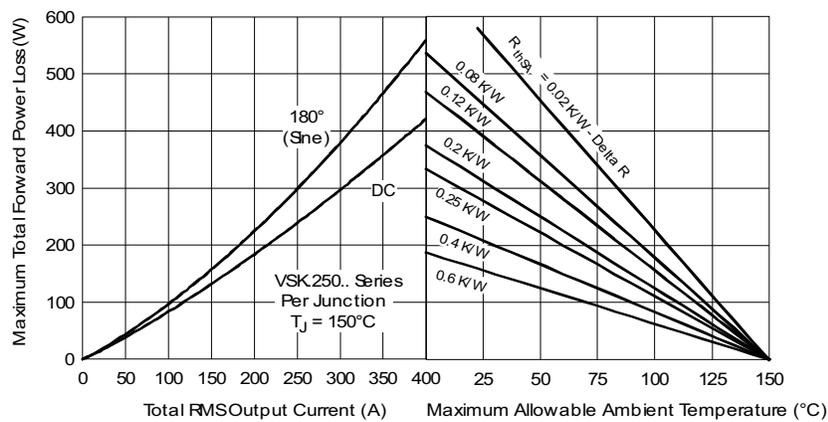


Fig. 5 - Forward Power Loss Characteristics



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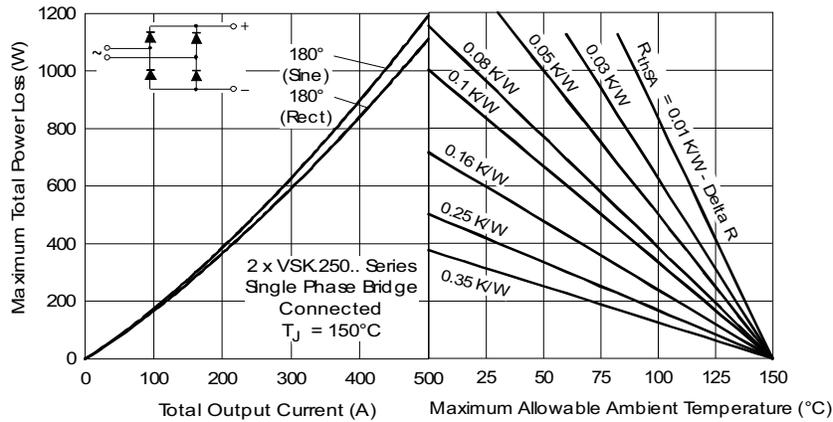


Fig. 6 - Forward Power Loss Characteristics

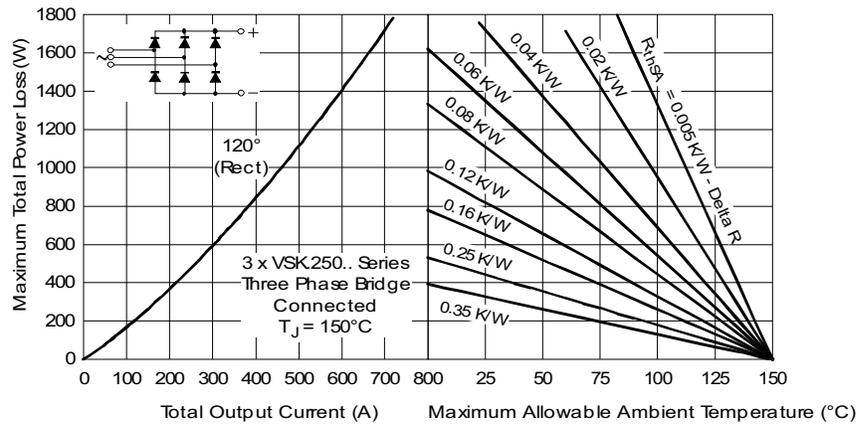


Fig. 7 - Forward Power Loss Characteristics

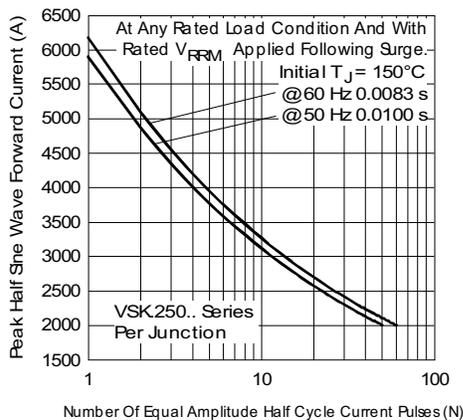


Fig. 8 - Maximum Non-Repetitive Surge Current

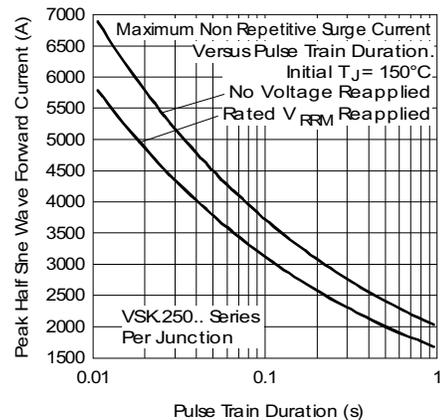


Fig. 9 - Maximum Non-Repetitive Surge Current

# VSK.250, VSK.270, VSK.320 Series



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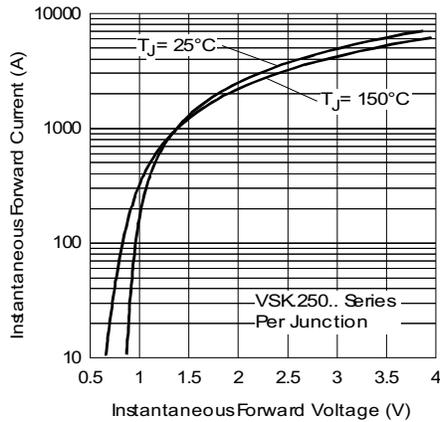


Fig. 10 - Forward Voltage Drop Characteristics

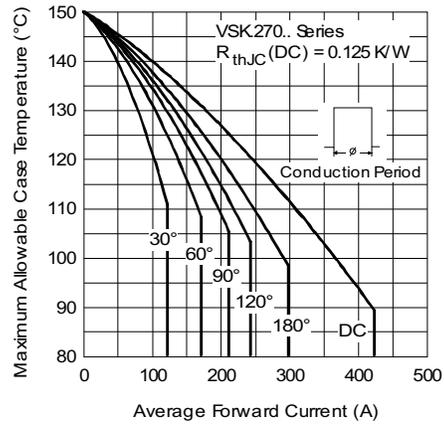


Fig. 13 - Current Ratings Characteristics

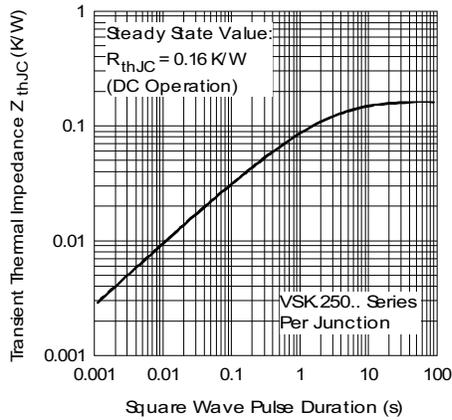


Fig. 11 - Thermal Impedance  $Z_{thJC}$  Characteristics

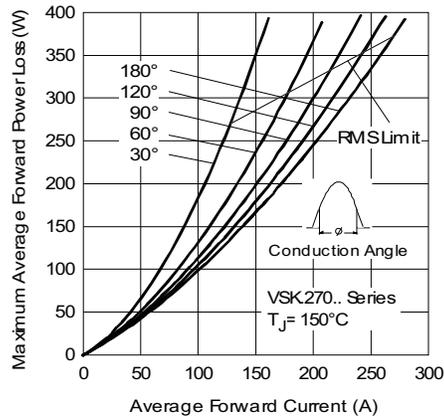


Fig. 14 - Forward Power Loss Characteristics

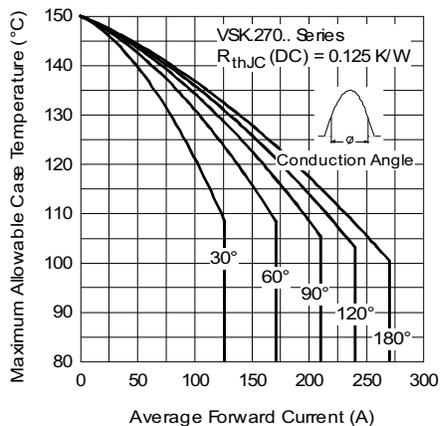


Fig. 12 - Current Ratings Characteristics

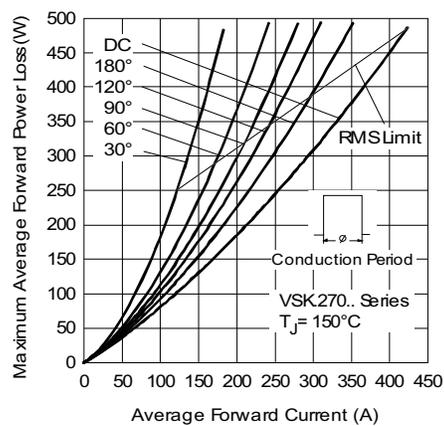


Fig. 15 - Forward Power Loss Characteristics



# VSK.250, VSK.270, VSK.320 Series

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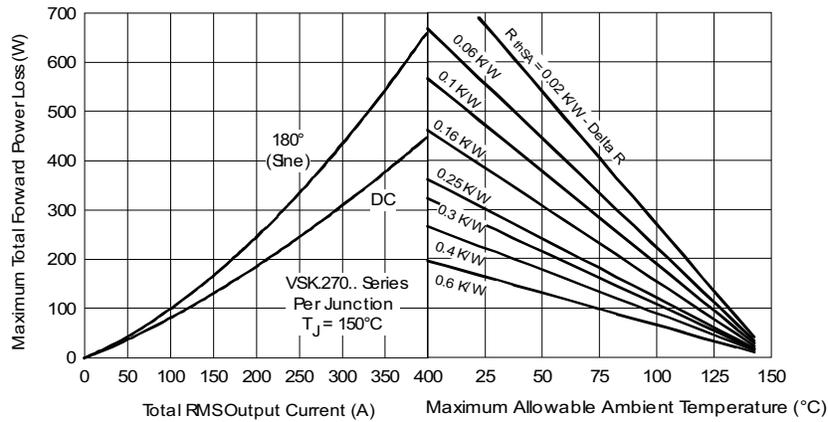


Fig. 16 - Forward Power Loss Characteristics

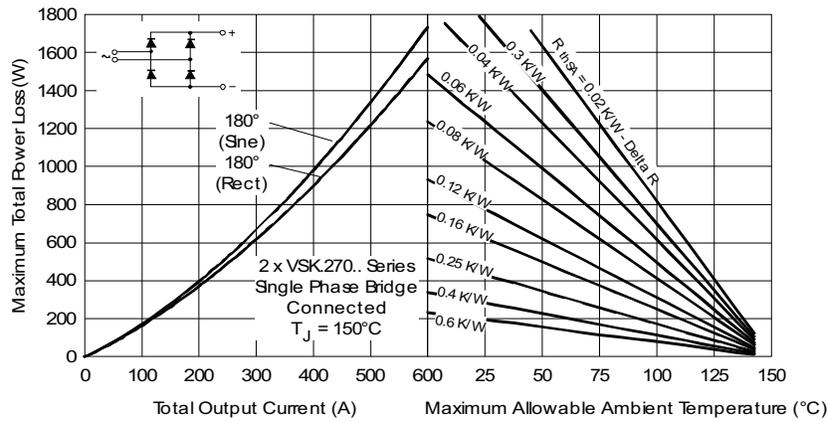


Fig. 17 - Forward Power Loss Characteristics

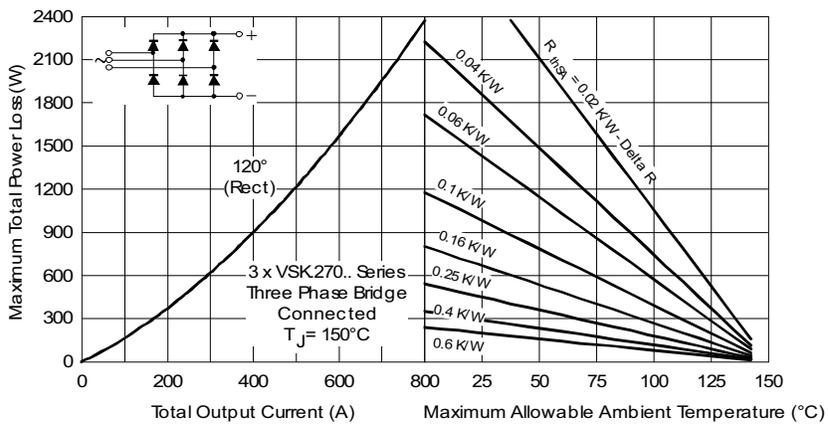


Fig. 18 - Forward Power Loss Characteristics

# VSK.250, VSK.270, VSK.320 Series



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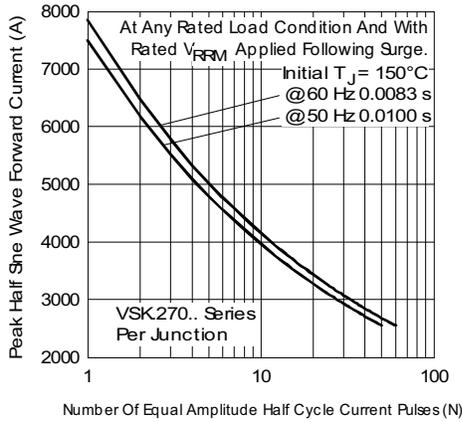


Fig. 19 - Maximum Non-Repetitive Surge Current

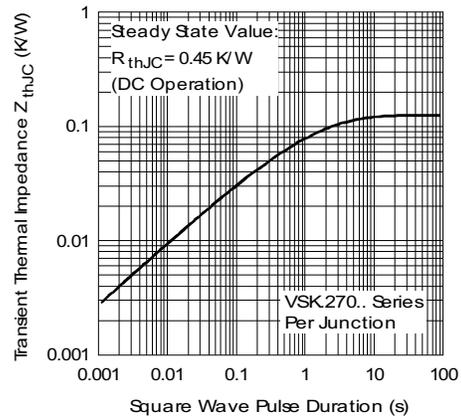


Fig. 22 - Thermal Impedance  $Z_{thJC}$  Characteristics

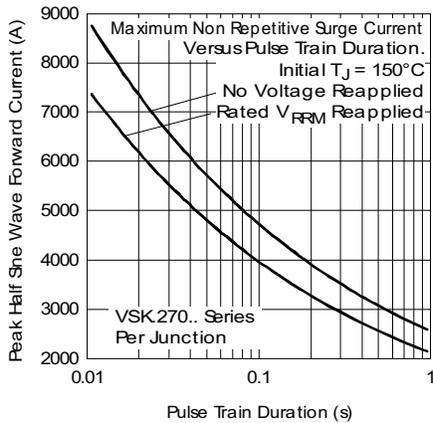


Fig. 20 - Maximum Non-Repetitive Surge Current

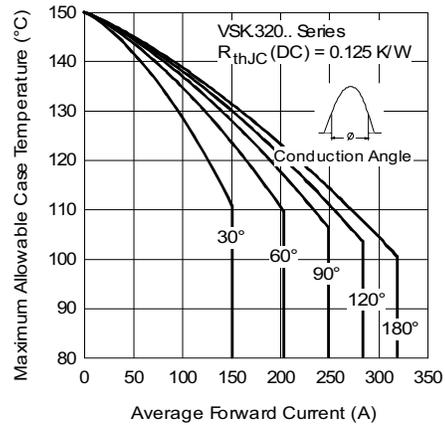


Fig. 23 - Current Ratings Characteristics

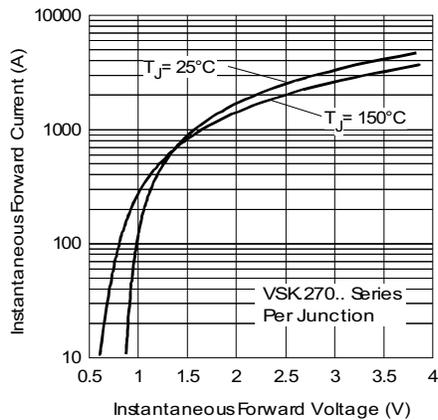


Fig. 21 - Forward Voltage Drop Characteristics

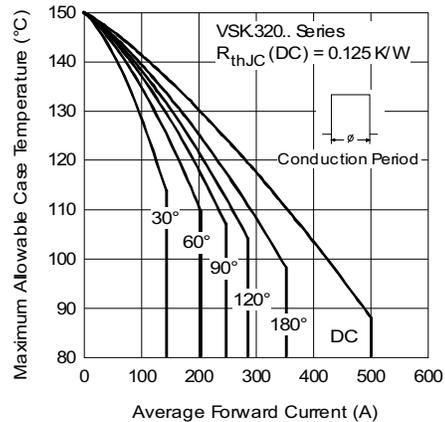


Fig. 24 - Current Ratings Characteristics



# VSK.250, VSK.270, VSK.320 Series

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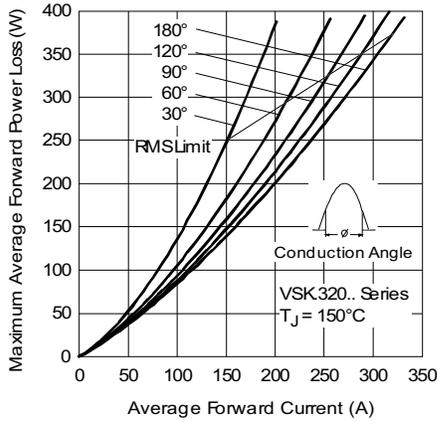


Fig. 25 - Forward Power Loss Characteristics

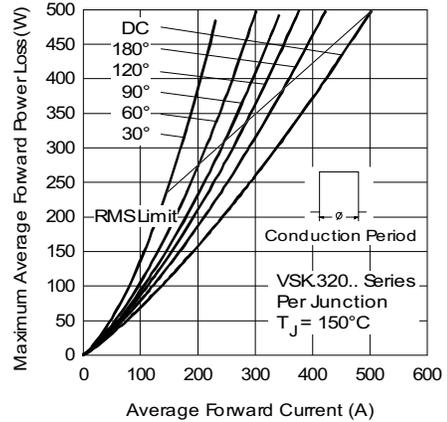


Fig. 26 - Forward Power Loss Characteristics

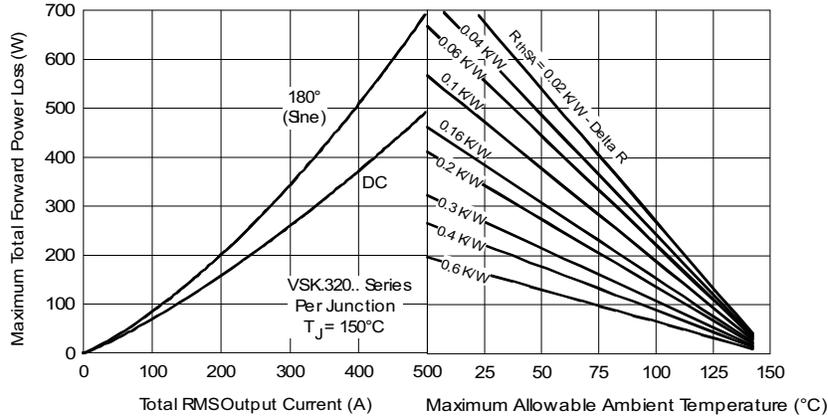


Fig. 27 - Forward Power Loss Characteristics

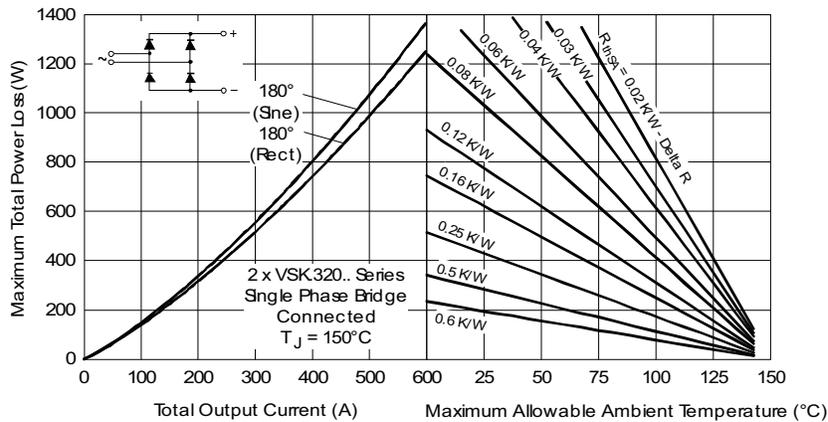


Fig. 28 - Forward Power Loss Characteristics

# VSK.250, VSK.270, VSK.320 Series



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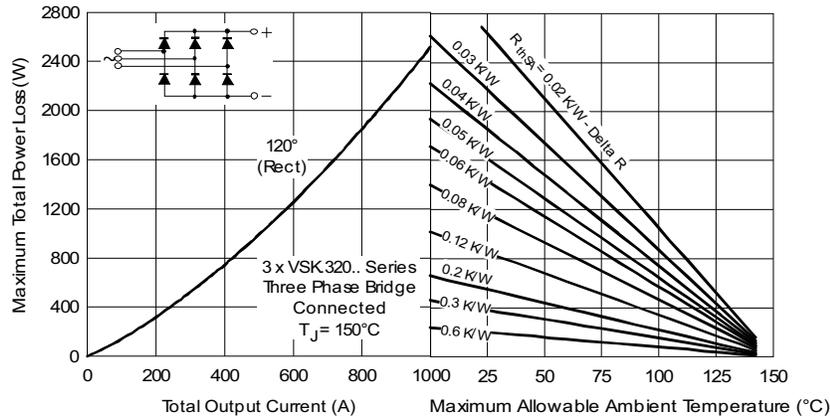


Fig. 29 - Forward Power Loss Characteristics

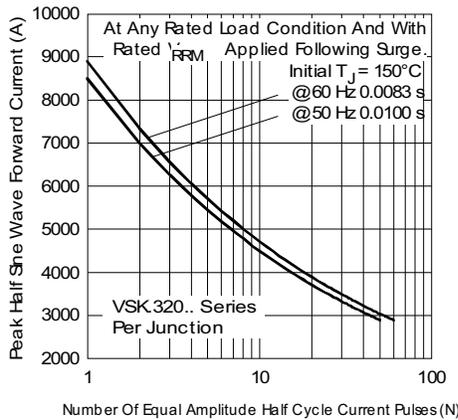


Fig. 30 - Maximum Non-Repetitive Surge Current

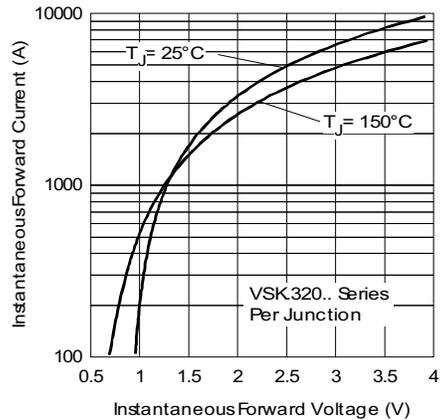


Fig. 32 - Forward Voltage Drop Characteristics

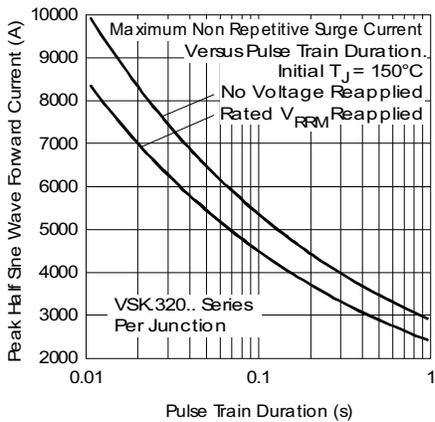


Fig. 31 - Maximum Non-Repetitive Surge Current

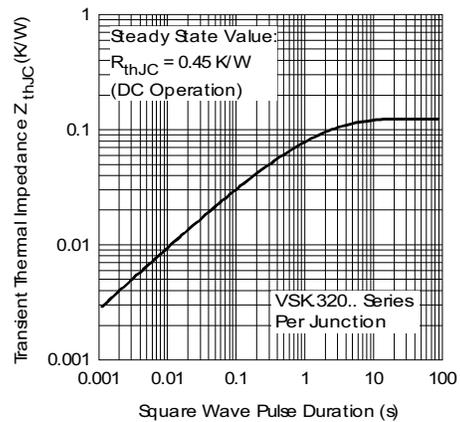


Fig. 33 - Thermal Impedance  $Z_{thJC}$  Characteristics



# VSK.250, VSK.270, VSK.320 Series

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## ORDERING INFORMATION TABLE

Device code	<b>VSK</b>	<b>D</b>	<b>320</b>	<b>-</b>	<b>24</b>
	①	②	③		④

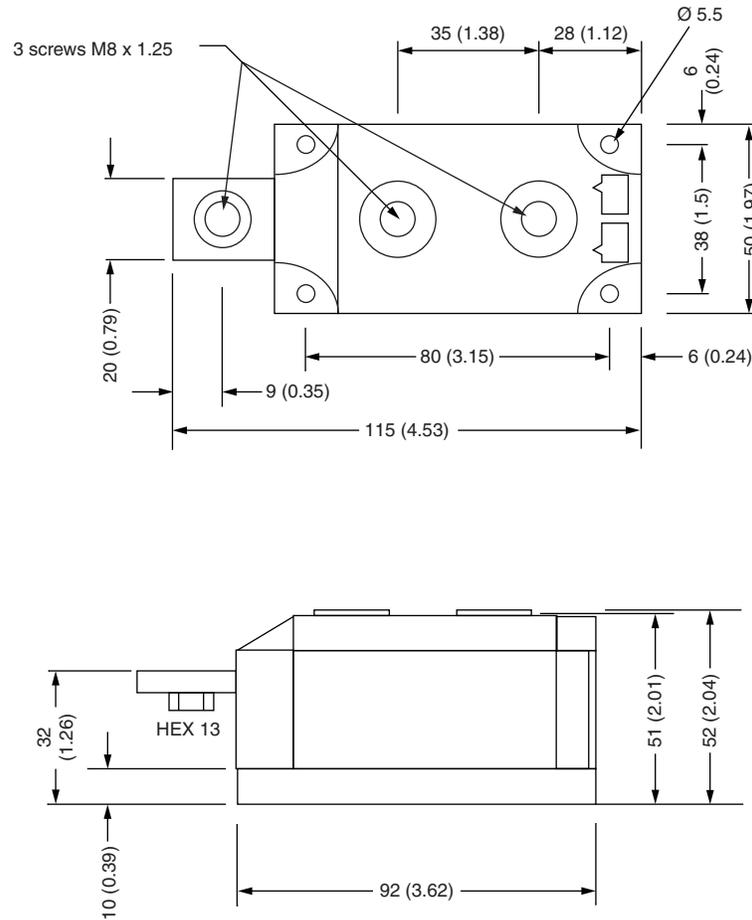
- 1** - Module type
- 2** - Circuit configuration (see Circuit Configuration table)
- 3** - Current rating:  $I_{F(AV)}$  rounded
- 4** - Voltage code  $\times 100 = V_{RRM}$  (see Voltage Ratings table)

CIRCUIT CONFIGURATION		
CIRCUIT DESCRIPTION	CIRCUIT CONFIGURATION CODE	CIRCUIT DRAWING
Two diodes doubler circuit	D	<p><b>VSKD...</b></p>
Two diodes common cathodes	C	<p><b>VSKC...</b></p>
Two diodes common anodes	J	<p><b>VSKJ...</b></p>
Single diode	E	<p><b>VSKE...</b></p>

LINKS TO RELATED DOCUMENTS	
Dimensions	<a href="http://www.vishay.com/doc?95086">www.vishay.com/doc?95086</a>

## 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



## Disclaimer

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**Vishay Intertechnology, Inc. hereby certifies that all its products that are identified as RoHS-Compliant fulfill the definitions and restrictions defined under Directive 2011/65/EU of The European Parliament and of the Council of June 8, 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (EEE) - recast, unless otherwise specified as non-compliant.**

**Please note that some Vishay documentation may still make reference to RoHS Directive 2002/95/EC. We confirm that all the products identified as being compliant to Directive 2002/95/EC conform to Directive 2011/65/EU.**