

SCR/SCR and SCR/Diode (MAGN-A-PAK Power Modules), 170 A/250 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
- 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

DESCRIPTION

This new 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.

PRODUCT SUMMARY

$I_{T(AV)}$	170 A/250 A
Type	Modules - Thyristor, Standard

MAJOR RATINGS AND CHARACTERISTICS

SYMBOL	CHARACTERISTICS	VSK.170..	VSK.250..	UNITS
$I_{T(AV)}$	85 °C	170	250	A
$I_{T(RMS)}$		377	555	
I_{TSM}	50 Hz	5100	8500	
	60 Hz	5350	8900	
I^2t	50 Hz	131	361	kA ² s
	60 Hz	119	330	
$I^2\sqrt{t}$		1310	3610	kA ² √s
V_{DRM}/V_{RRM}		Up to 1600	Up to 2000	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
VSK.170-	04	400	500	50
	08	800	900	
	10	1000	1100	
	12	1200	1300	
	14	1400	1500	
	16	1600	1700	
VSK.250-	04	400	500	50
	08	800	900	
	10	1000	1100	
	12	1200	1300	
	14	1400	1500	
	16	1600	1700	
	18	1800	1900	60
	20	2000	2100	

ON-STATE CONDUCTION								
PARAMETER	SYMBOL	TEST CONDITIONS			VSK.170	VSK.250	UNITS	
Maximum average on-state current at case temperature	I _{T(AV)}	180° conduction, half sine wave			170	250	A	
					85	85	°C	
Maximum RMS on-state current	I _{T(RMS)}	As AC switch			377	555	A	
Maximum peak, one-cycle on-state non-repetitive, surge current	I _{TSM}	t = 10 ms	No voltage reappplied	Sinusoidal half wave, initial T _J = T _J maximum	5100	8500		
		t = 8.3 ms			5350	8900		
		t = 10 ms	100 % V _{RRM} reappplied		4300	7150		
		t = 8.3 ms			4500	7500		
Maximum I ² t for fusing	I ² t	t = 10 ms	No voltage reappplied		131	361	kA ² s	
		t = 8.3 ms			119	330		
		t = 10 ms	100 % V _{RRM} reappplied		92.5	255		
		t = 8.3 ms			84.4	233		
Maximum I ² √t for fusing	I ² √t	t = 0.1 ms to 10 ms, no voltage reappplied			1310	3610	kA ² √s	
Low level value or threshold voltage	V _{T(TO)1}	(16.7 % × π × I _{T(AV)} < I < π × I _{T(AV)}), T _J = T _J maximum			0.89	0.97	V	
High level value of threshold voltage	V _{T(TO)2}	(I > π × I _{T(AV)} < I < π × I _{T(AV)}), T _J = T _J maximum			1.12	1.00		
Low level value on-state slope resistance	r _{t1}	(16.7 % × π × I _{T(AV)} < I < π × I _{T(AV)}), T _J = T _J maximum			1.34	0.60	mΩ	
High level value on-state slope resistance	r _{t2}	(I > π × I _{T(AV)} < I < π × I _{T(AV)}), T _J = T _J maximum			0.96	0.57		
Maximum on-state voltage drop	V _{TM}	I _{TM} = π × I _{T(AV)} , T _J = T _J maximum, 180° conduction, average power = V _{T(TO)} × I _{T(AV)} + r _f × (I _{T(RMS)}) ²			1.60	1.44	V	
Maximum holding current	I _H	Anode supply = 12 V, initial I _T = 30 A, T _J = 25 °C			500	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	1000		

**SWITCHING**

PARAMETER	SYMBOL	TEST CONDITIONS	VSK.170	VSK.250	UNITS
Typical delay time	t _d	T _J = 25 °C, gate current = 1 A dl _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; dl/dt = 15 A/μs; T _J = T _J maximum; V _R = 50 V; dV/dt = 20 V/μs; gate 0 V, 100 Ω	50 to 150		

BLOCKING

PARAMETER	SYMBOL	TEST CONDITIONS	VSK.170	VSK.250	UNITS
Maximum peak reverse and off-state leakage current	I_{RRM} , I_{DRM}	$T_J = T_J$ maximum	50	60	mA
RMS insulation voltage	V_{INS}	50 Hz, circuit to base, all terminals shorted, 25 $^\circ\text{C}$, 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	VSK.170	VSK.250	UNITS
Maximum peak gate power	P_{GM}	$t_p \leq 5\text{ ms}$, $T_J = T_J$ maximum	10.0		W
Maximum average gate power	$P_{\text{G(AV)}}$	$f = 50\text{ Hz}$, $T_J = T_J$ maximum	2.0		
Maximum peak gate current	+ I_{GM}	$t_p \leq 5\text{ ms}$, $T_J = T_J$ maximum	3.0		A
Maximum peak negative gate voltage	- V_{GT}	$t_p \leq 5\text{ ms}$, $T_J = T_J$ maximum	5.0		V
Maximum required DC gate voltage to trigger	V_{GT}	$T_J = -40\text{ }^\circ\text{C}$	4.0		
		$T_J = 25\text{ }^\circ\text{C}$	3.0		
		$T_J = T_J$ maximum	2.0		
Maximum required DC gate current to trigger	I_{GT}	$T_J = -40\text{ }^\circ\text{C}$	350		mA
		$T_J = 25\text{ }^\circ\text{C}$	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, $I_{\text{TM}} = 400\text{ A}$, rated V_{DRM} applied	500		A/ μs

THERMAL AND MECHANICAL SPECIFICATIONS

PARAMETER	SYMBOL	TEST CONDITIONS	VSK.170	VSK.250	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	0.17	0.125	K/W
Typical thermal resistance, case to heatsink per module	R_{thCS}	Mounting surface flat, smooth and greased	0.02	0.02	
Mounting torque $\pm 10\%$ — MAP to heatsink busbar to MAP		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		g
			17.8		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°	
VSK.170-	0.009	0.010	0.010	0.020	0.032	0.007	0.011	0.015	0.020	0.033	K/W
VSK.250-	0.009	0.010	0.014	0.020	0.032	0.007	0.011	0.015	0.020	0.033	

Note

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

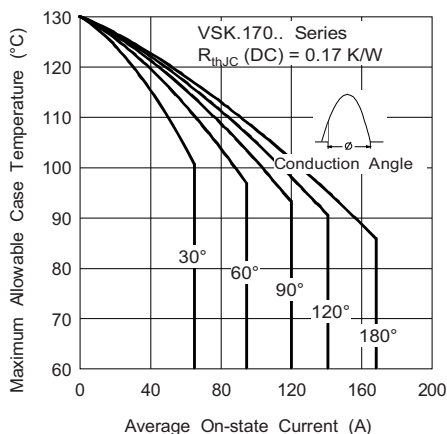


Fig. 1 - Current Ratings Characteristics

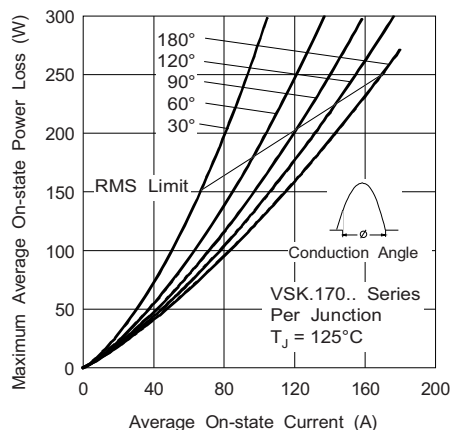


Fig. 3 - On-State Power Loss Characteristics

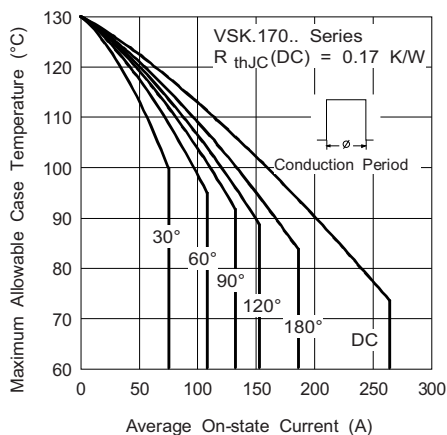


Fig. 2 - Current Ratings Characteristics

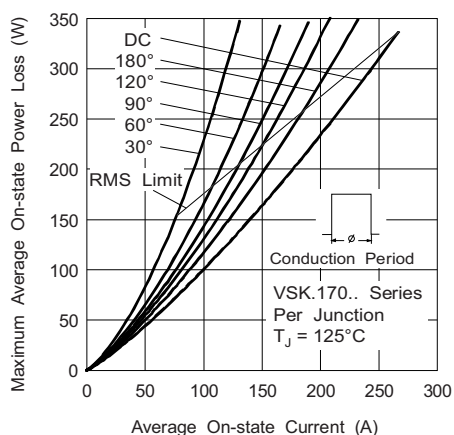


Fig. 4 - On-State Power Loss Characteristics

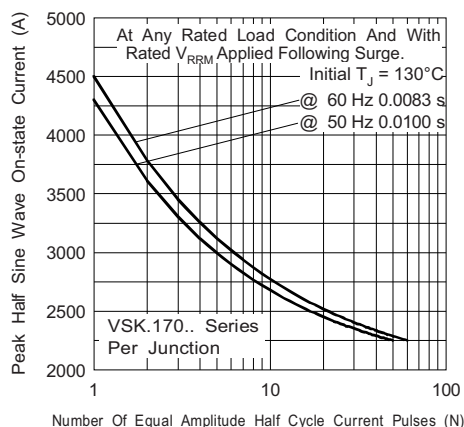


Fig. 5 - Maximum Non-Repetitive Surge Current

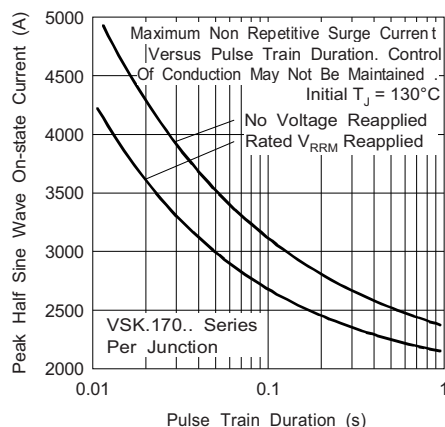


Fig. 6 - Maximum Non-Repetitive Surge Current

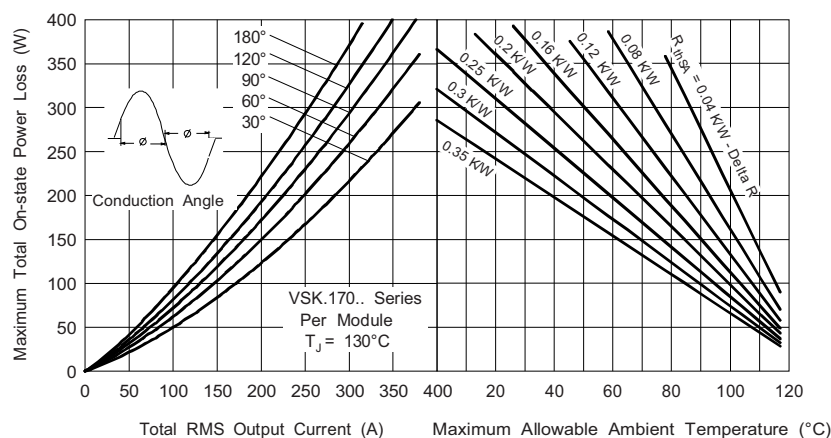


Fig. 7 - On-State Power Loss Characteristics

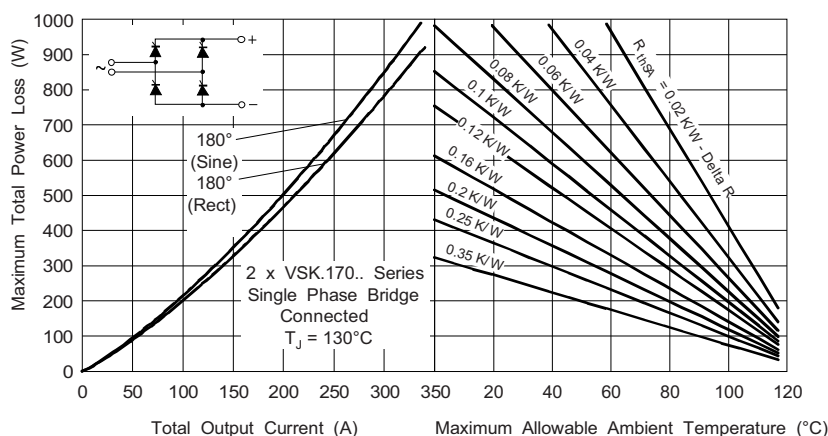


Fig. 8 - On-State Power Loss Characteristics

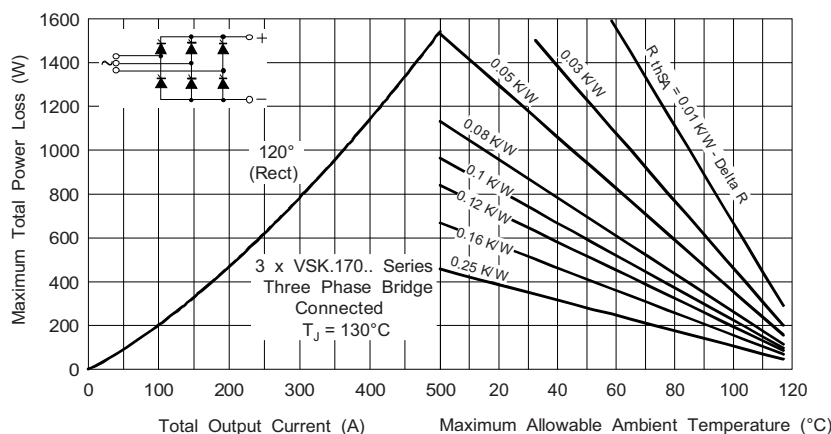


Fig. 9 - On-State Power Loss Characteristics

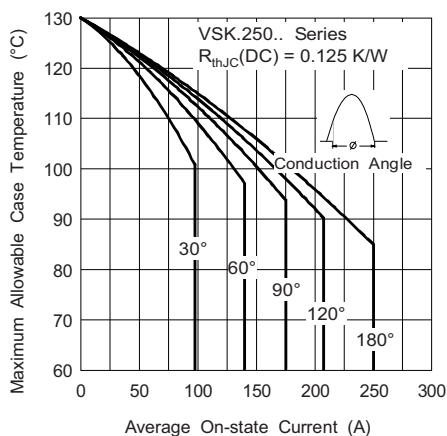


Fig. 10 - Current Ratings Characteristics

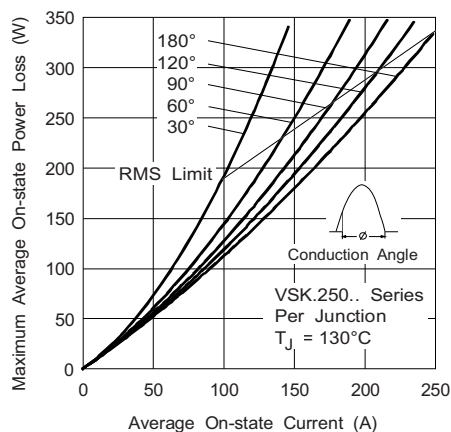


Fig. 12 - On-State Power Loss Characteristics

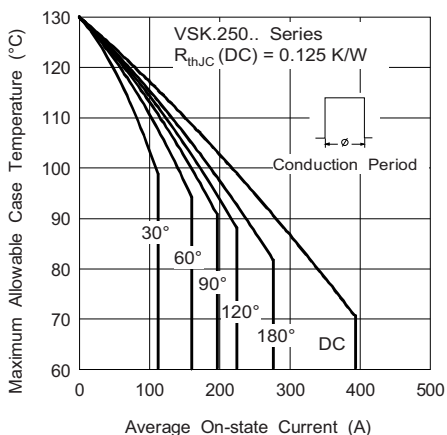


Fig. 11 - Current Ratings Characteristics

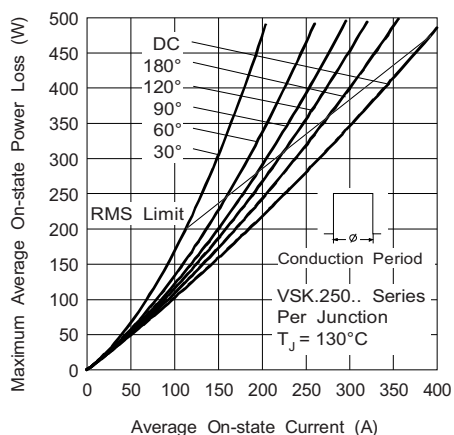


Fig. 13 - On-State Power Loss Characteristics

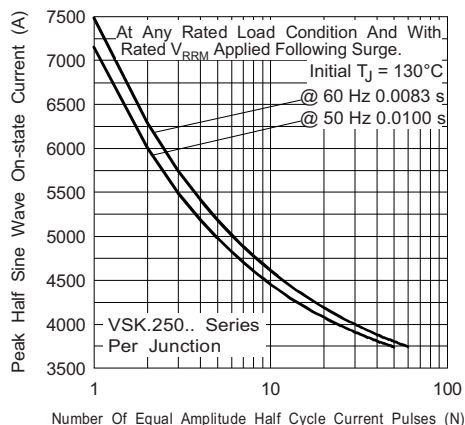


Fig. 14 - Maximum Non-Repetitive Surge Current

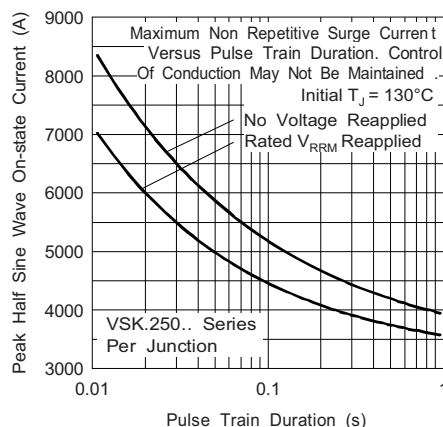


Fig. 15 - Maximum Non-Repetitive Surge Current

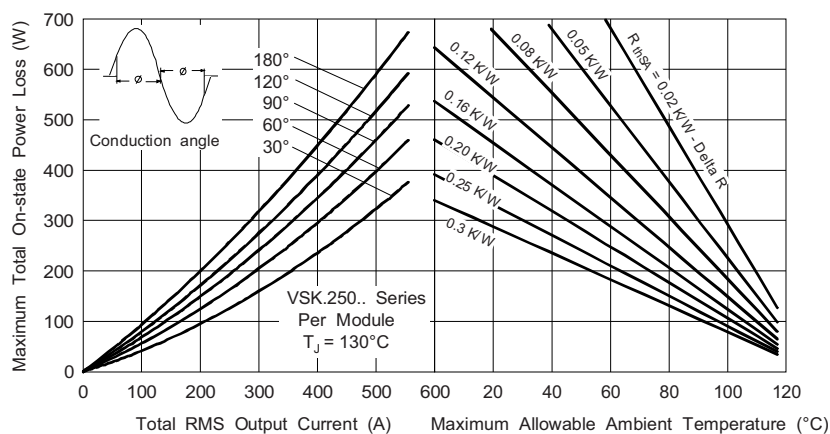


Fig. 16 - On-State Power Loss Characteristics

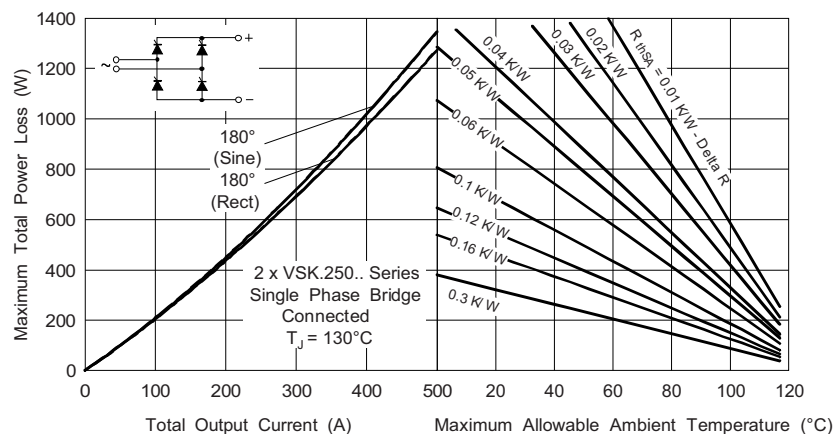


Fig. 17 - On-State Power Loss Characteristics

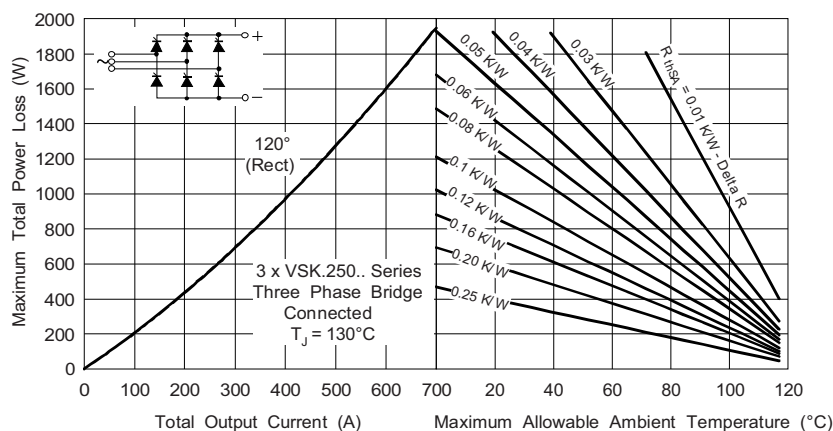


Fig. 18 - On-State Power Loss Characteristics

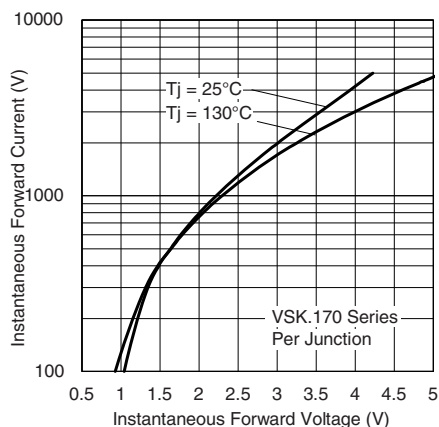


Fig. 19 - On-State Voltage Drop Characteristics

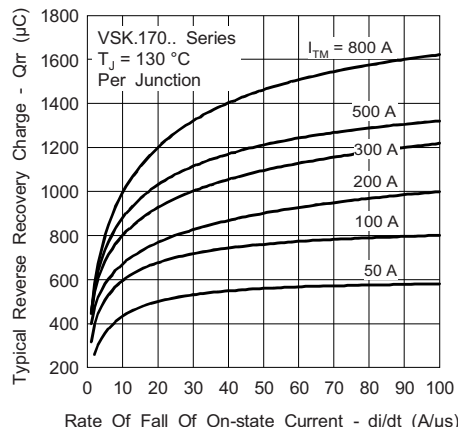


Fig. 21 - Reverse Recovery Charge Characteristics

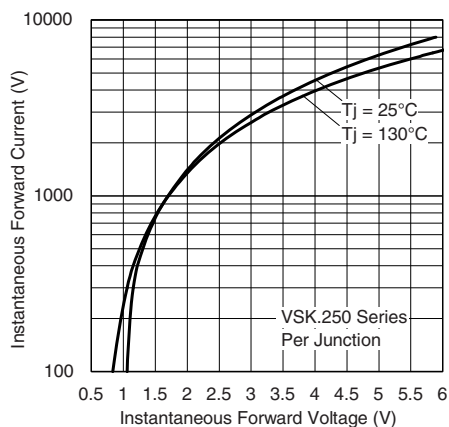


Fig. 20 - On-State Voltage Drop Characteristics

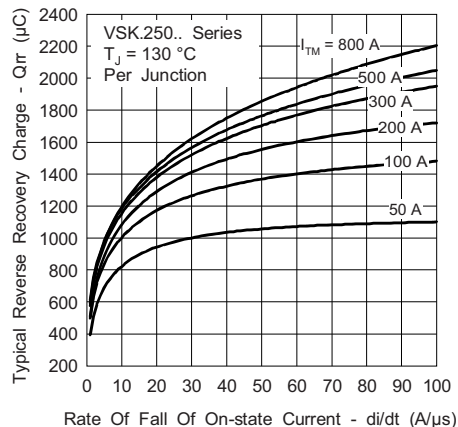


Fig. 22 - Reverse Recovery Charge Characteristics

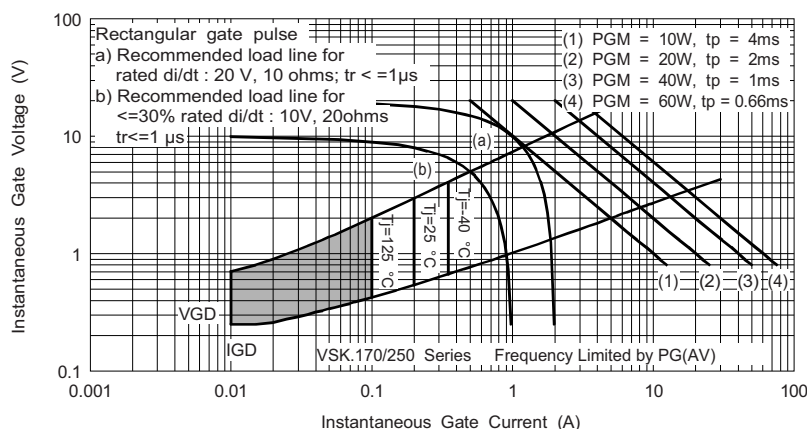
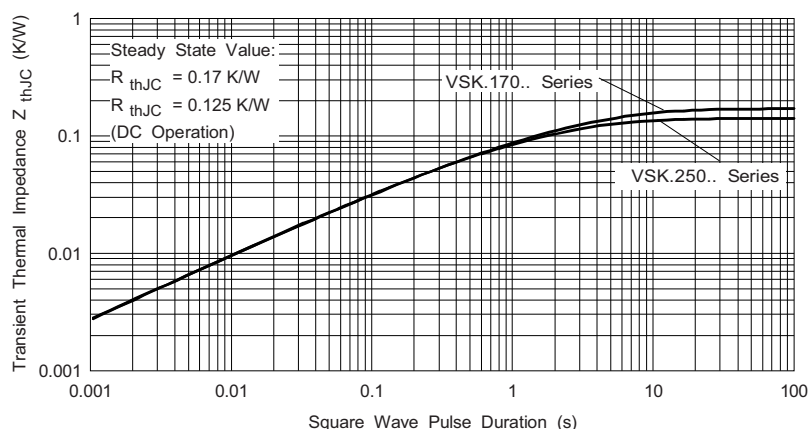


Fig. 23 - Gate Characteristics


Fig. 24 - Thermal Impedance Z_{thJC} Characteristics

ORDERING INFORMATION TABLE

Device code	VSK	T	250	-	20	PbF
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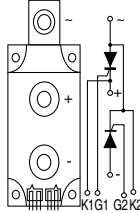
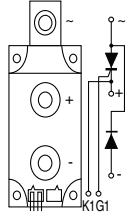
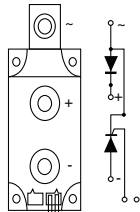
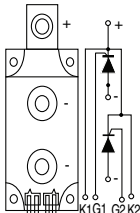
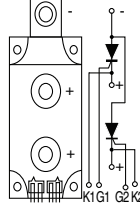
① ② ③ ④ ⑤

- ① - Module type
- ② - Circuit configuration (see dimensions - link at the end of datasheet)
- ③ - Current rating
- ④ - Voltage code x 100 = V_{RRM} (see Voltage Ratings table)
- ⑤ -
 - None = Standard production
 - PbF = Lead (Pb)-free

Note

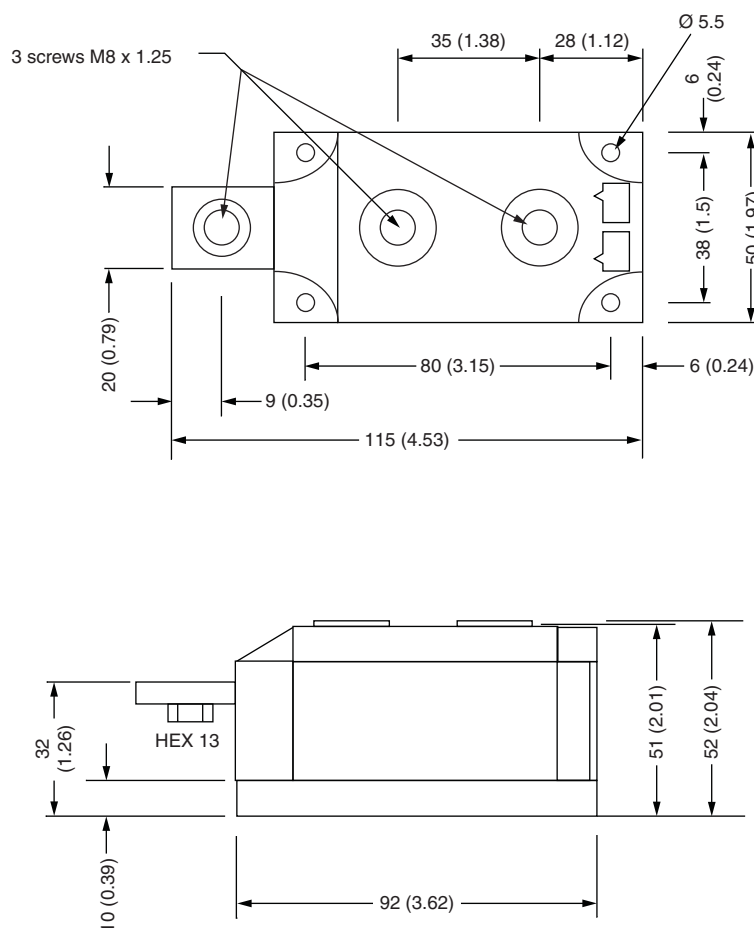
- To order the optional hardware go to www.vishay.com/doc?95172



CIRCUIT CONFIGURATION		
CIRCUIT DESCRIPTION	CIRCUIT CONFIGURATION CODE	CIRCUIT DRAWING
Two SCRs coupler circuit	T	VSKT...  Available from 400 V to 1600 V for VSK.170PbF Series, available from 400 V to 2000 V for VSK.250PbF Series
SCR/diode doubler circuit, positive control	H	VSKH...  Available from 400 V to 1600 V for VSK.170PbF Series, available from 400 V to 2000 V for VSK.250PbF Series
SCR/diode doubler circuit, negative control	L	VSKL...  Available from 400 V to 1600 V for VSK.170PbF Series, available from 400 V to 2000 V for VSK.250PbF Series
Two SCRs common cathodes	U	VSKU...  Available up to 1200 V, contact factory for different requirement
Two SCRs common anodes	V	VSKV...  Available up to 1200 V, contact factory for different requirement
LINKS TO RELATED DOCUMENTS		
Dimensions	www.vishay.com/doc?95086	

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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