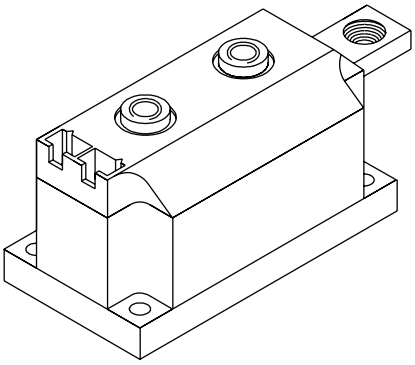
SCR/SCR and SCR/Diode (MAGN-A-PAK™ Power Modules), 170/250 A



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
- Lead (Pb)-free
- Designed and qualified for industrial level

Pb-free

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	
$I_{T(AV)}$	170/250 A

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^2s
	60 Hz	119	330	
$I^2\sqrt{t}$		1310	3610	$kA^2\sqrt{s}$
V_{DRM}/V_{RRM}		Up to 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
VSK.170- VSK.250-	04	400	500	50
	08	800	900	
	10	1000	1100	
	12	1200	1300	
	14	1400	1500	
	16	1600	1700	

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 reapplied	Sinusoidal half wave, initial T_J = T_J maximum	5100	8500	
		t = 8.3 ms			5350	8900	
		t = 10 ms	100 % V_{RRM} reapplied		4300	7150	
		t = 8.3 ms			4500	7500	
Maximum I^2t for fusing	I^2t	t = 10 ms	No voltage reapplied		131	361	kA^2s
		t = 8.3 ms			119	330	
		t = 10 ms	100 % V_{RRM} reapplied		92.5	255	
		t = 8.3 ms			84.4	233	
Maximum $I^2\sqrt{t}$ for fusing	$I^2\sqrt{t}$	t = 0.1 to 10 ms, no voltage reapplied			1310	3610	$kA^2\sqrt{s}$
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			0.89	0.97	V
High level value of threshold voltage	$V_{T(TO)2}$	(I > π x $I_{T(AV)}$ < I < π x $I_{T(AV)}$), T_J = T_J maximum			1.12	1.00	
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			1.34	0.60	mΩ
High level value on-state slope resistance	r_{t2}	(I > π x $I_{T(AV)}$ < I < π x $I_{T(AV)}$), T_J = T_J maximum			0.96	0.57	
Maximum on-state voltage drop	V_{TM}	I_{TM} = π x $I_{T(AV)}$, T_J = T_J maximum, 180° conduction, average power = $V_{T(TO)}$ x $I_{T(AV)}$ + r_f x $(I_{T(RMS)})^2$			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 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	50 - 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		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**		**VSK.170**	**VSK.250**	**UNITS**
Maximum peak gate power	P_{GM}	$t_p \leq 5$ 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}	$t_p \leq 5$ ms, $T_J = T_J$ maximum		3.0		A
Maximum peak negative gate voltage	- V_{GT}	$t_p \leq 5$ 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; Ra = 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; Ra = 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 willnot 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**	**VSK.170**	**VSK.250**	**UNITS**
Junction operating temperature range	T_J		- 40 to 130		°C
Storage temperature range	T_{Stg}		- 40 to 150		
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 ± 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
Mounting torque ± 10 % — busbar to MAP					
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

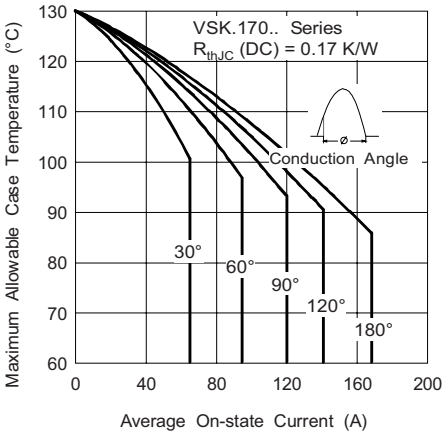


Fig. 1 - Current Ratings Characteristics

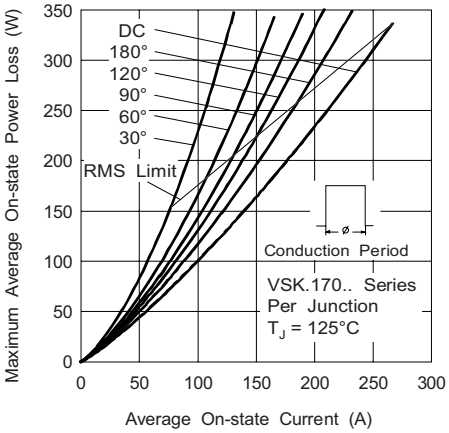


Fig. 4 - On-State Power Loss Characteristics

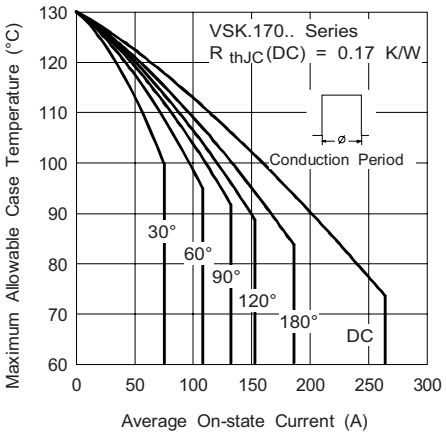


Fig. 2 - Current Ratings Characteristics

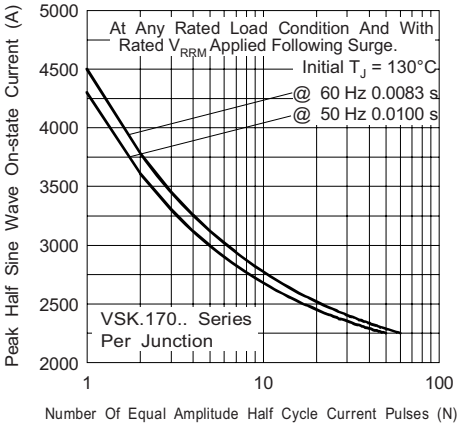


Fig. 5 - Maximum Non-Repetitive Surge Current

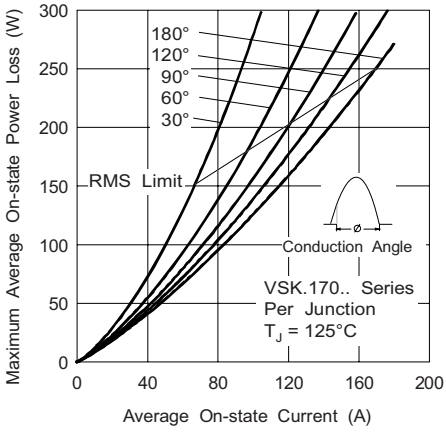


Fig. 3 - On-State Power Loss Characteristics

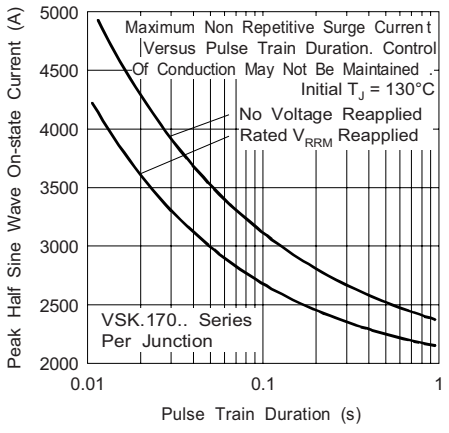


Fig. 6 - Maximum Non-Repetitive Surge Current

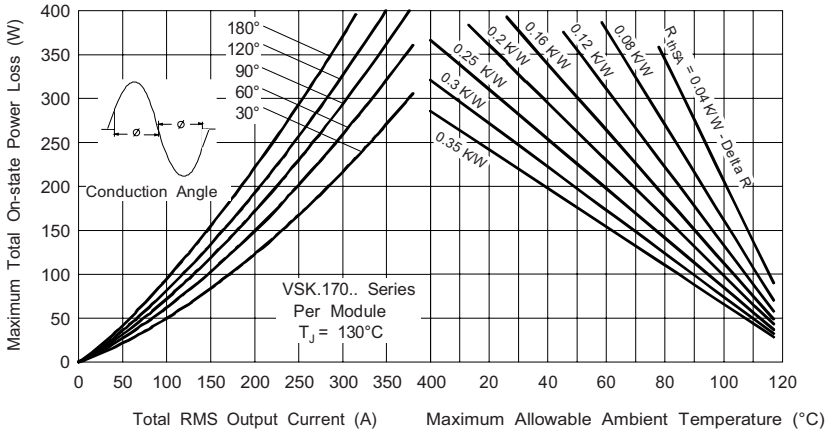


Fig. 7 - On-State Power Loss Characteristics

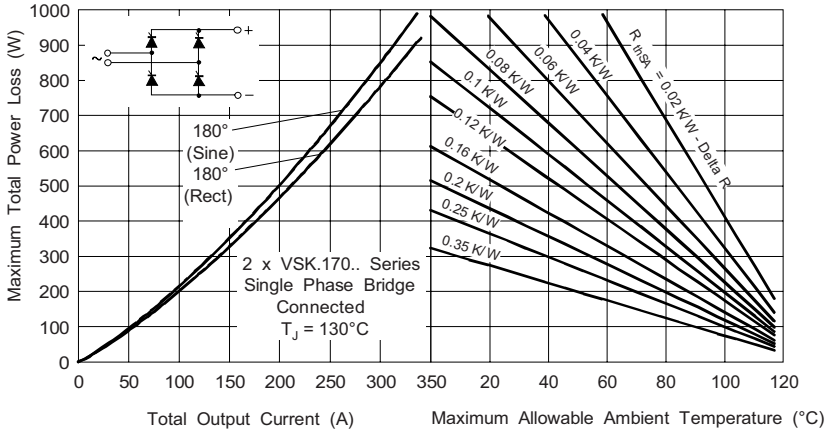


Fig. 8 - On-State Power Loss Characteristics

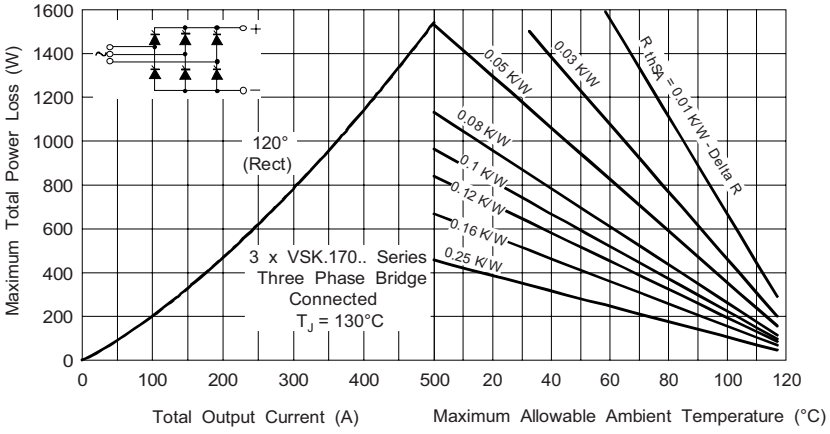


Fig. 9 - On-State Power Loss Characteristics

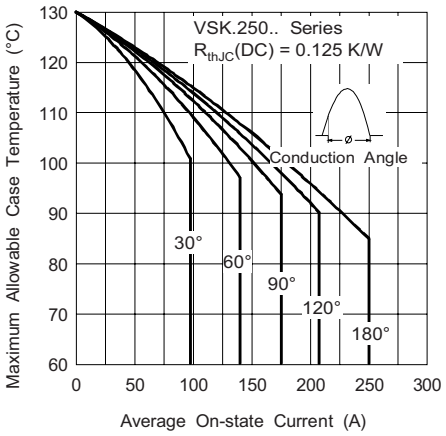


Fig. 10 - Current Ratings Characteristics

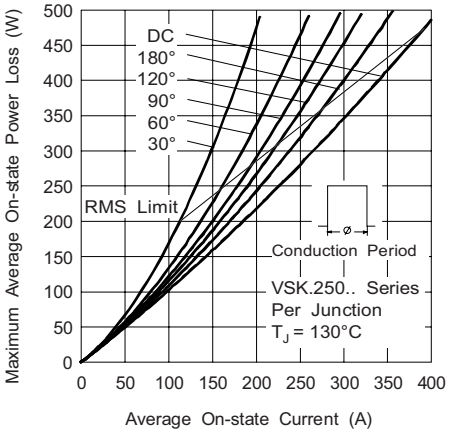


Fig. 13 - On-State Power Loss Characteristics

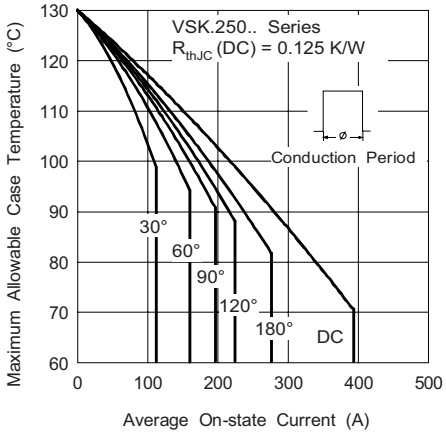


Fig. 11 - Current Ratings Characteristics

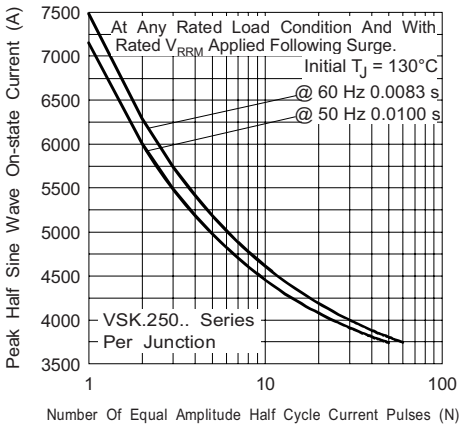


Fig. 14 - Maximum Non-Repetitive Surge Current

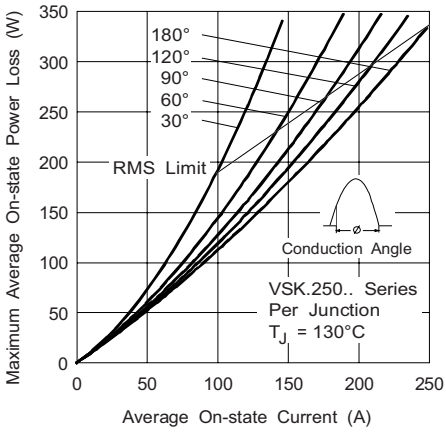


Fig. 12 - On-State Power Loss Characteristics

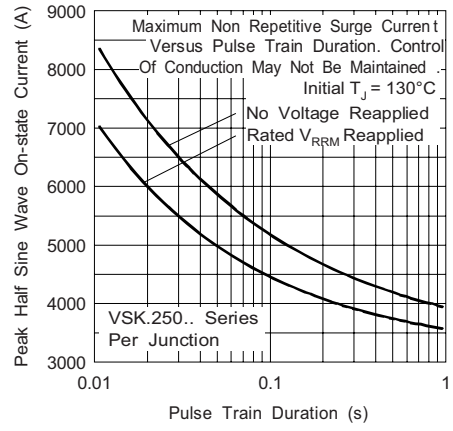


Fig. 15 - Maximum Non-Repetitive Surge Current

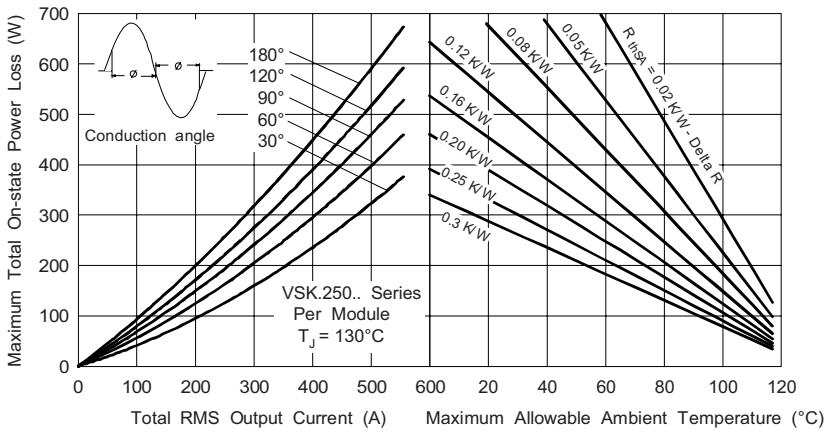


Fig. 16 - On-State Power Loss Characteristics

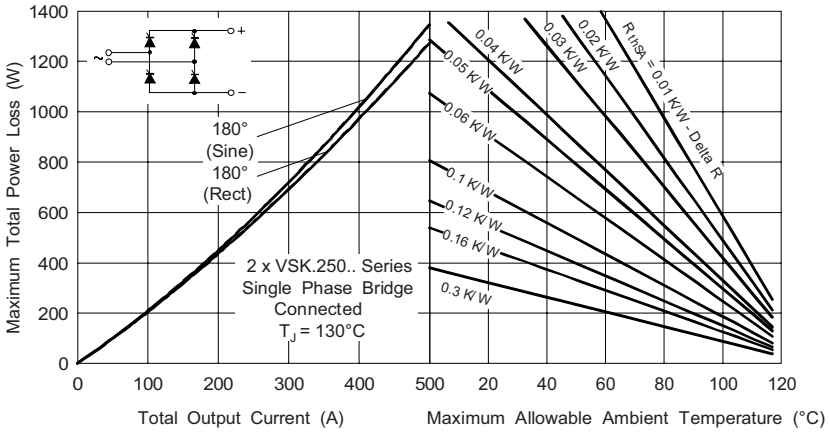


Fig. 17 - On-State Power Loss Characteristics

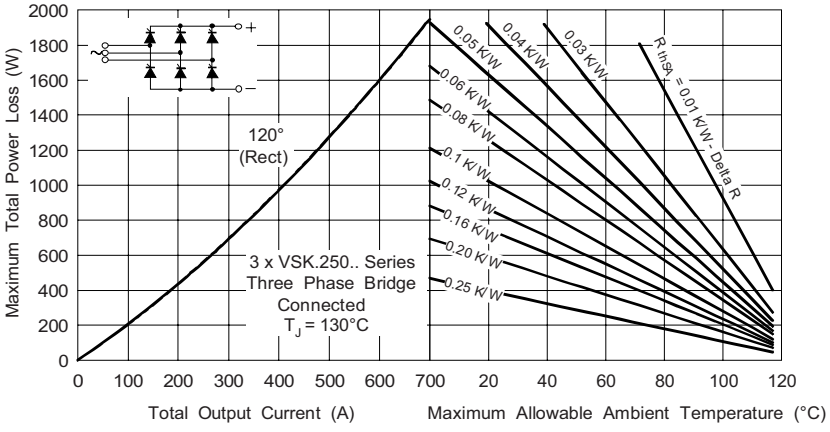


Fig. 18 - On-State Power Loss Characteristics

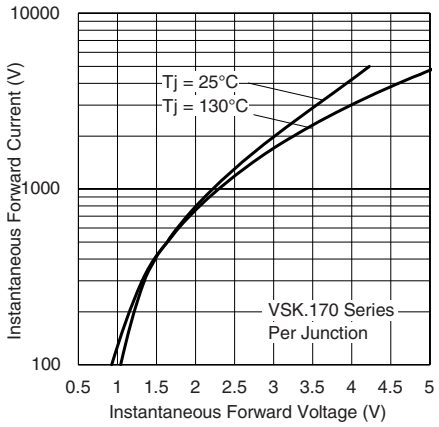


Fig. 19 - On-State Voltage Drop Characteristics

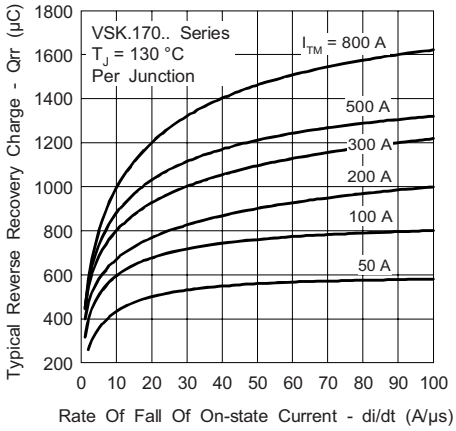


Fig. 21 - Reverse Recovery Charge Characteristics

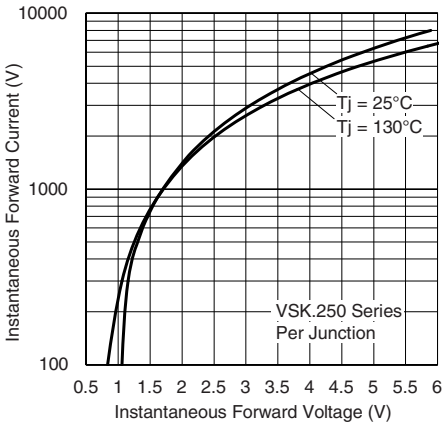


Fig. 20 - On-State Voltage Drop Characteristics

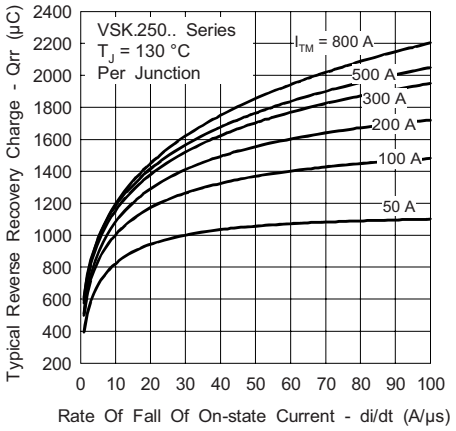


Fig. 22 - Reverse Recovery Charge Characteristics

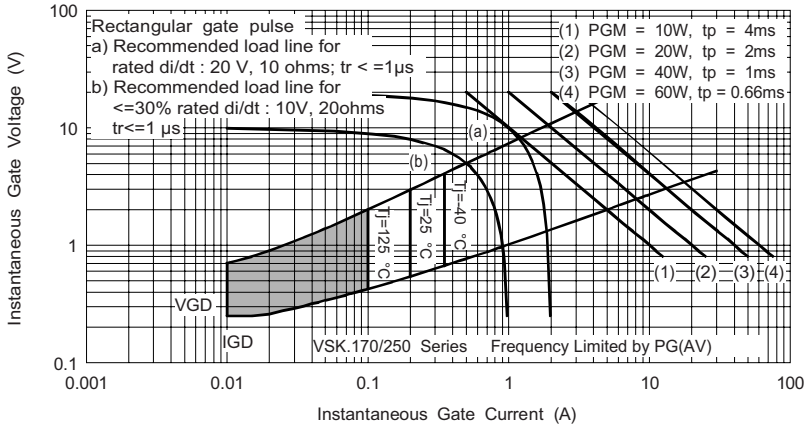


Fig. 23 - Gate Characteristics

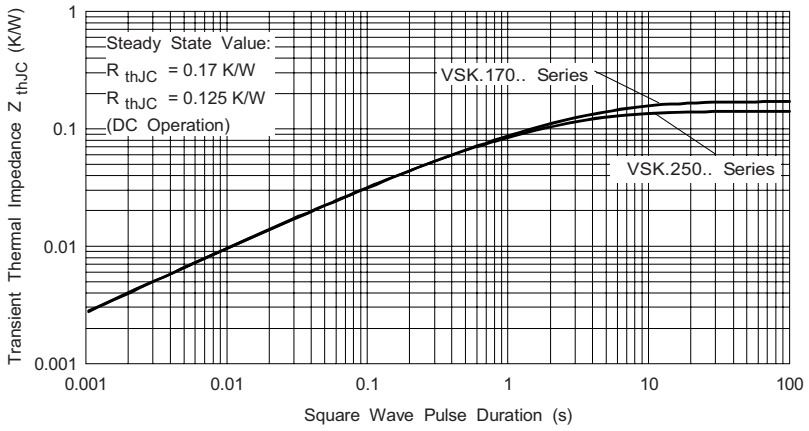


Fig. 24 - Thermal Impedance Z_{thJC} Characteristics

ORDERING INFORMATION TABLE

Device code

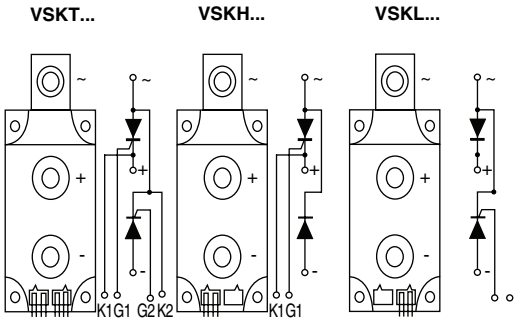
VSK	T	250	-	16	PbF
1	2	3		4	5

- 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 - Lead (Pb)-free

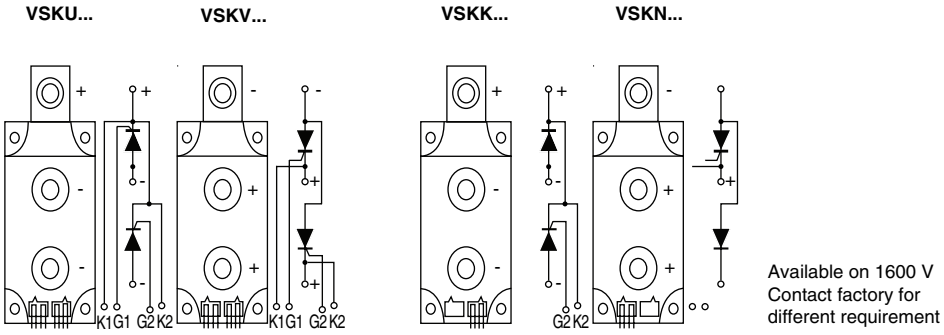
Note

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

CIRCUIT CONFIGURATION



Available from 400 V to 1600 V



Available on 1600 V
Contact factory for
different requirement

LINKS TO RELATED DOCUMENTS	
Dimensions	http://www.vishay.com/doc?95086

Disclaimer

All product specifications and data are subject to change without notice.

Vishay Intertechnology, Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, “Vishay”), disclaim any and all liability for any errors, inaccuracies or incompleteness contained herein or in any other disclosure relating to any product.

Vishay disclaims any and all liability arising out of the use or application of any product described herein or of any information provided herein to the maximum extent permitted by law. The product specifications do not expand or otherwise modify Vishay’s terms and conditions of purchase, including but not limited to the warranty expressed therein, which apply to these products.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Vishay.

The products shown herein are not designed for use in medical, life-saving, or life-sustaining applications unless otherwise expressly indicated. Customers using or selling Vishay products not expressly indicated for use in such applications do so entirely at their own risk and agree to fully indemnify Vishay for any damages arising or resulting from such use or sale. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

Product names and markings noted herein may be trademarks of their respective owners.