



Standard Recovery Diodes, 165 A to 230 A (INT-A-PAK Power Modules)



INT-A-PAK

FEATURES

- High voltage
- Electrically isolated by DBC ceramic (Al_2O_3)
- 3500 V_{RMS} isolating voltage
- Industrial standard package
- High surge capability
- Glass passivated chips
- Modules uses high voltage power diodes in four basic configurations
- Simple mounting
- UL approved file E78996 
- Designed and qualified for multiple level
- Material categorization: For definitions of compliance please see www.vishay.com/doc?99912


RoHS
COMPLIANT

PRODUCT SUMMARY

$I_{\text{F(AV)}}$	165 A to 230 A
Type	Modules - Diode, High Voltage
Package	INT-A-PAK
Circuit	Single diode, Two diodes common cathode, Two diodes common cathode, Two diodes doubler circuit

APPLICATIONS

- DC motor control and drives
- Battery chargers
- Welders
- Power converters

MAJOR RATINGS AND CHARACTERISTICS

SYMBOL	CHARACTERISTICS	VSK.166..	VSK.196..	VSK.236..	UNITS
$I_{\text{F(AV)}}$		165	195	230	A
	T_{C}	100	100	100	$^{\circ}\text{C}$
$I_{\text{F(RMS)}}$		260	305	360	A
I_{FSM}	50 Hz	4000	4750	5500	
	60 Hz	4200	4980	5765	
I^2t	50 Hz	80	113	151	kA^2s
	60 Hz	73	103	138	
$I^2\sqrt{t}$		798	1130	1516	$\text{kA}^2\sqrt{\text{s}}$
V_{RRM}		400 to 1600			V
T_{J}	Range	-40 to 150			$^{\circ}\text{C}$

ELECTRICAL SPECIFICATIONS

VOLTAGE RATINGS

TYPE NUMBER	VOLTAGE CODE	V_{RRM} , MAXIMUM REPETITIVE PEAK REVERSE VOLTAGE V	V_{RSM} , MAXIMUM NON-REPETITIVE PEAK REVERSE VOLTAGE V	I_{RRM} AT 150 $^{\circ}\text{C}$ mA
VS-VSK.166 VS-VSK.196 VS-VSK.236	04	400	500	20
	08	800	900	
	12	1200	1300	
	14	1400	1500	
	16	1600	1700	



FORWARD CONDUCTION								
PARAMETER	SYMBOL	TEST CONDITIONS			VSK.166	VSK.196	VSK.236	UNITS
Maximum average on-state current at case temperature	I _{F(AV)}	180° conduction, half sine wave			165	195	230	A
					100	100	100	°C
Maximum RMS on-state current	I _{F(RMS)}				260	305	360	A
Maximum peak, one-cycle on-state, non-repetitive surge current	I _{FSM}	t = 10 ms	No voltage reapplied	Sine half wave, initial T _J = T _J maximum	4000	4750	5500	
		t = 8.3 ms			4200	4980	5765	
		t = 10 ms	100 % V _{RRM} reapplied		3350	4000	4630	
		t = 8.3 ms			3500	4200	4850	
Maximum I ² t for fusing	I ² t	t = 10 ms	No voltage reapplied		80	113	151	
		t = 8.3 ms			73	103	138	
		t = 10 ms	100 % V _{RRM} reapplied		56	80	107	
		t = 8.3 ms			52	73	98	
Maximum I ² √t for fusing	I ² √t	t = 0.1 ms to 10 ms, no voltage reapplied			798	1130	1516	kA ² √s
Low level value of threshold voltage	V _{F(TO)1}	(16.7 % × π × I _{F(AV)} < I < π × I _{F(AV)}), T _J maximum			0.73	0.69	0.7	V
High level value of threshold voltage	V _{F(TO)2}	(I > π × I _{F(AV)}), T _J maximum			0.88	0.78	0.83	
Low level value on-state slope resistance	r _{t1}	(16.7 % × π × I _{F(AV)} < I < π × I _{F(AV)}), T _J maximum			1.5	1.3	1.2	mΩ
High level value on-state	r _{t2}	(I > π × I _{F(AV)}), T _J maximum			1.26	1.2	1.07	
Maximum forward voltage drop	V _{FM}	I _{FM} = π × I _{F(AV)} , T _J = 25 °C, 180° conduction Average power = V _{F(TO)} × I _{F(AV)} + r _f × (I _{F(RMS)}) ²			1.43	1.38	1.46	V

BLOCKING						
PARAMETER	SYMBOL	TEST CONDITIONS	VSK.166	VSK.196	VSK.236	UNITS
Maximum peak reverse and off-state leakage current	I_{RRM}	$T_J = 150\text{ °C}$	20			mA
RMS insulation voltage	V_{INS}	50 Hz, circuit to base, all terminals shorted, t = 1 s	3500			V

THERMAL AND MECHANICAL SPECIFICATIONS						
PARAMETER	SYMBOL	TEST CONDITIONS	VALUES			UNITS
			VSK.166	VSK.196	VSK.236	
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	0.2	0.16	0.14	K/W
Maximum thermal resistance, case to heatsink per module	R _{thCS}	Mounting surface smooth, flat and greased	0.05			
Mounting torque ± 10 % IAP to heatsink busbar to IAP		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. Lubricated threads.	4 to 6			Nm
Approximate weight			200	g		
			7.1	oz.		
Case style			INT-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.166	0.025	0.03	0.038	0.055	0.089	0.018	0.031	0.041	0.057	0.089	K/W
VSK.196	0.016	0.019	0.024	0.034	0.053	0.012	0.02	0.026	0.035	0.054	
VSK.236	0.009	0.010	0.014	0.018	0.025	0.008	0.012	0.015	0.019	0.025	

Note

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

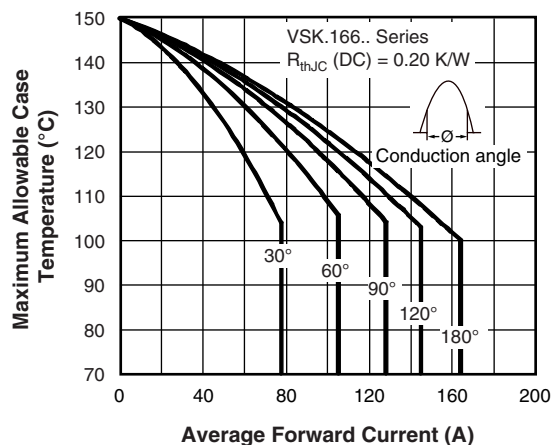


Fig. 1 - Current Ratings Characteristics

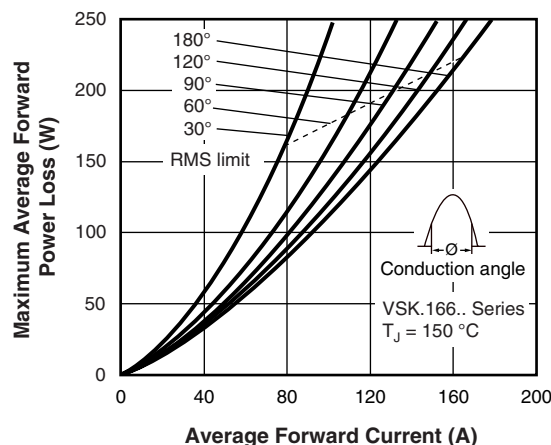


Fig. 3 - On-State Power Loss Characteristics

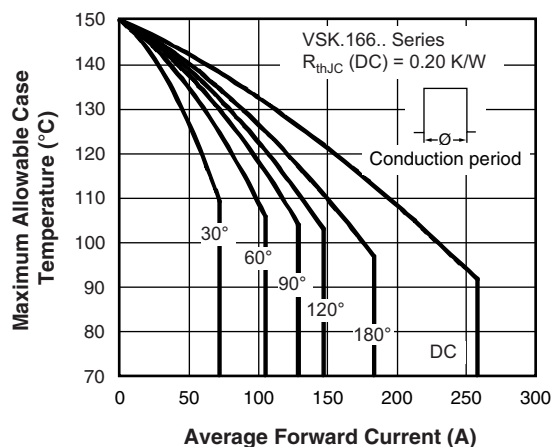


Fig. 2 - Current Ratings Characteristics

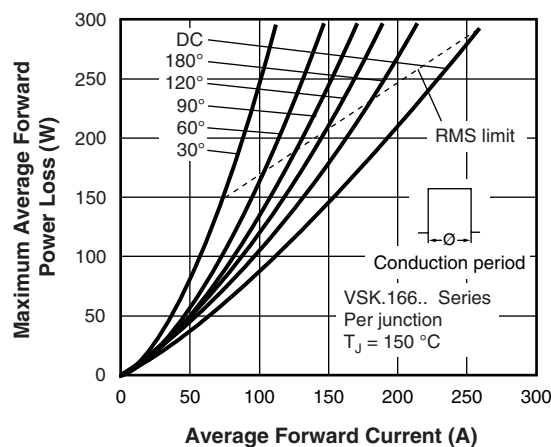


Fig. 4 - On-State Power Loss Characteristics

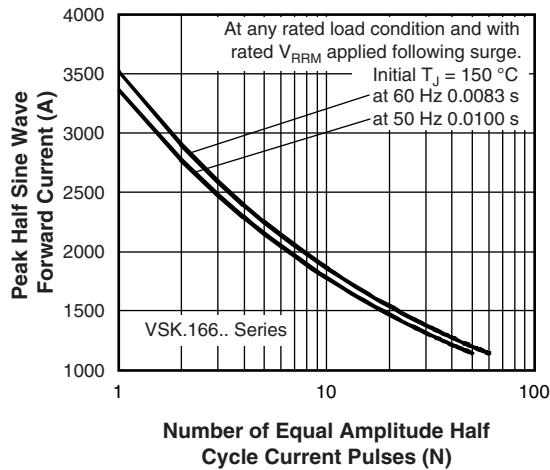


Fig. 5 - Maximum Non-Repetitive Surge Current

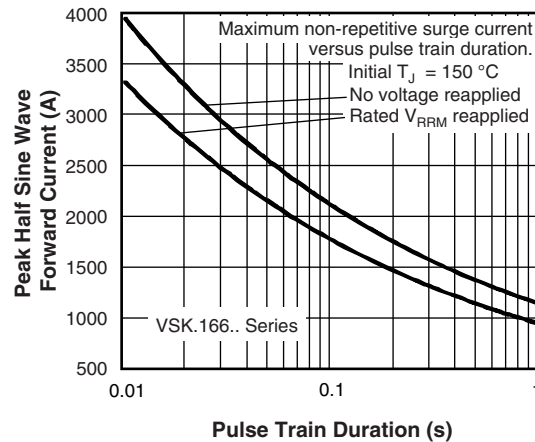


Fig. 6 - Maximum Non-Repetitive Surge Current

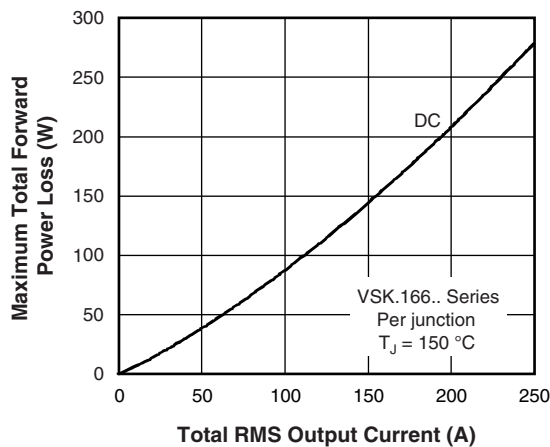


Fig. 7 - On-State Power Loss Characteristics

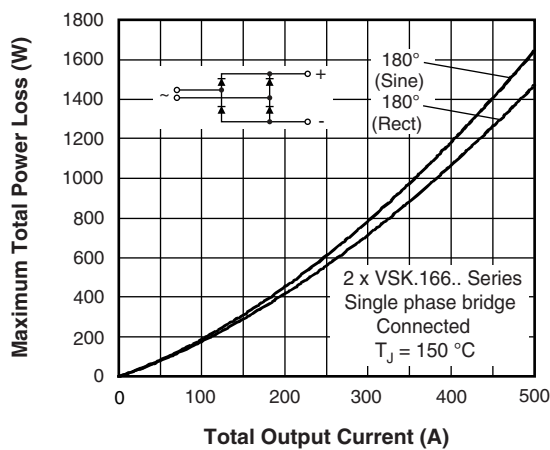
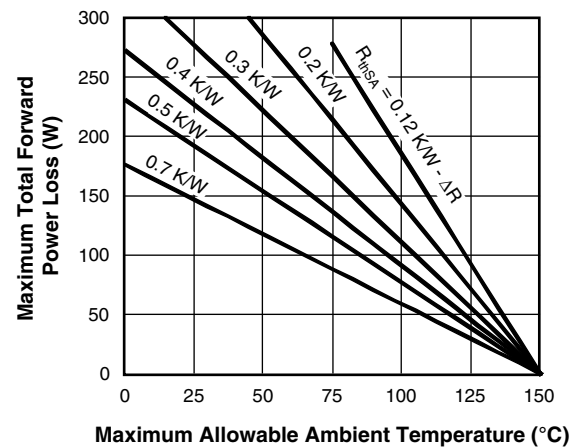
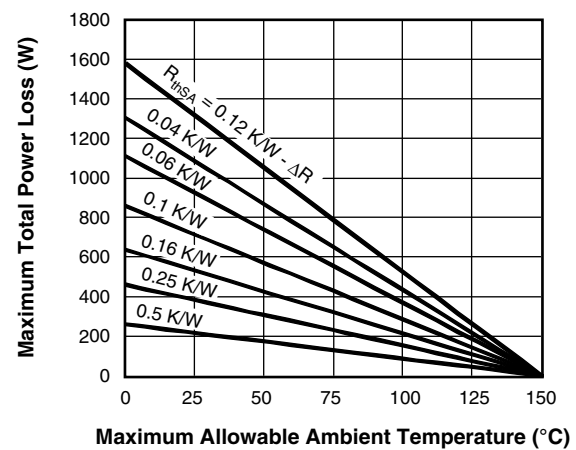


Fig. 8 - On-State Power Loss Characteristics



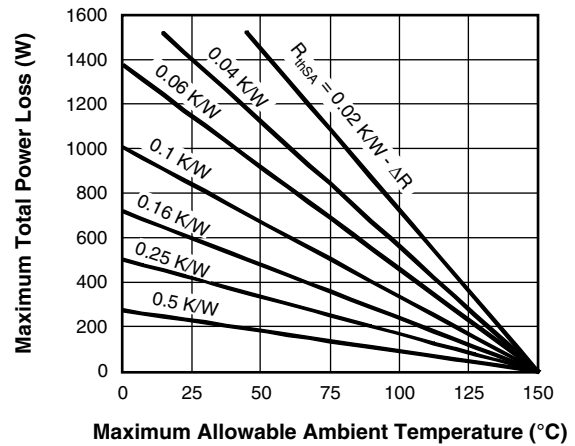
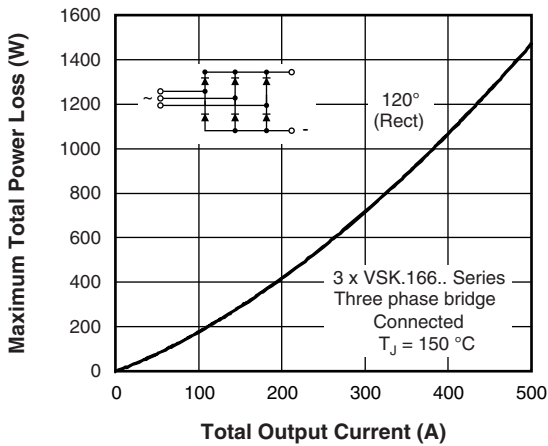


Fig. 9 - On-State Power Loss Characteristics

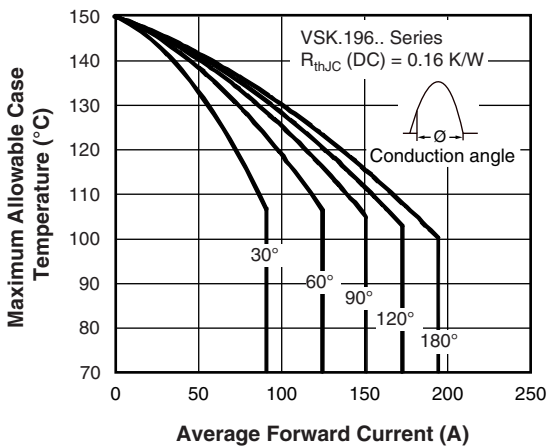


Fig. 10 - Current Ratings Characteristics

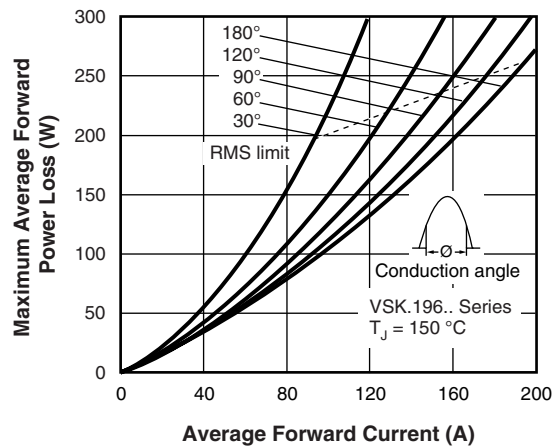


Fig. 12 - On-State Power Loss Characteristics

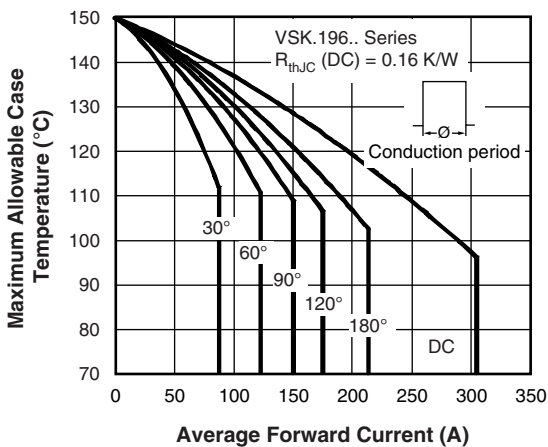


Fig. 11 - Current Ratings Characteristics

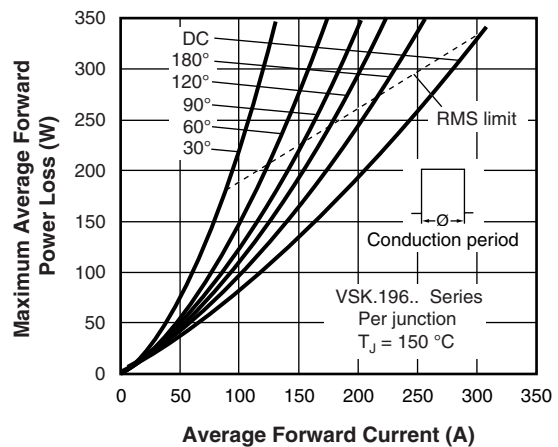


Fig. 13 - On-State Power Loss Characteristics

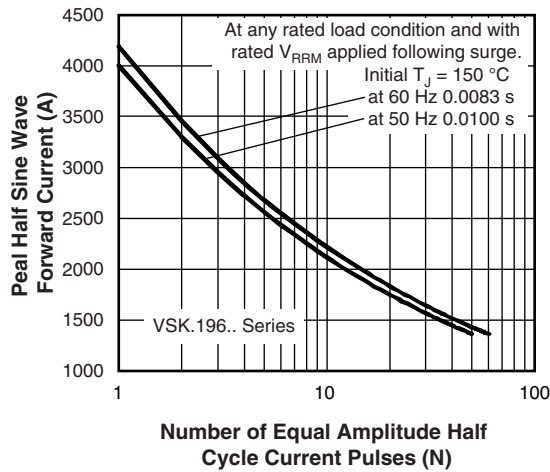


Fig. 14 - Maximum Non-Repetitive Surge Current

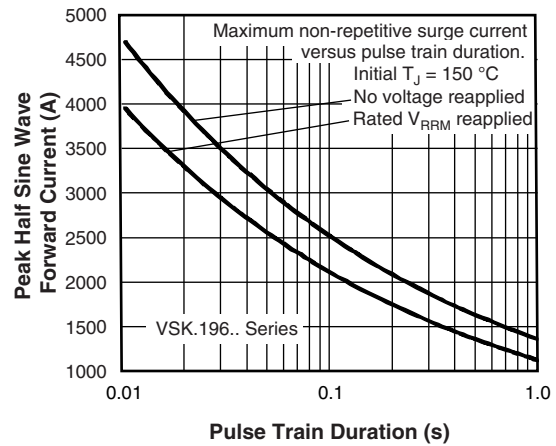


Fig. 15 - Maximum Non-Repetitive Surge Current

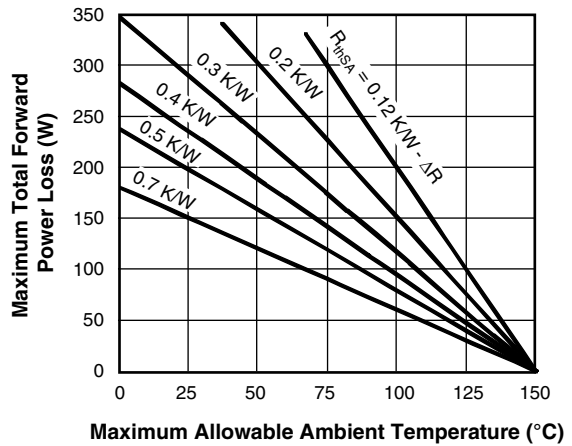
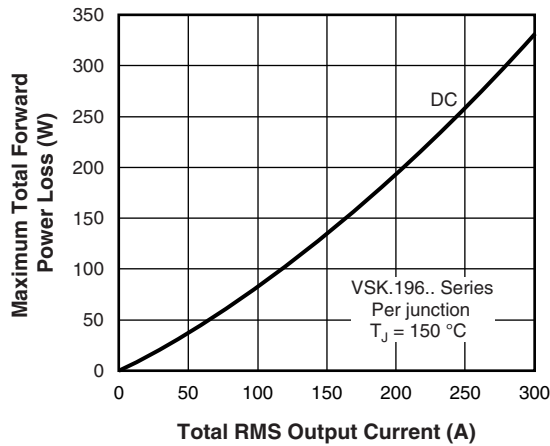


Fig. 16 - On-State Power Loss Characteristics

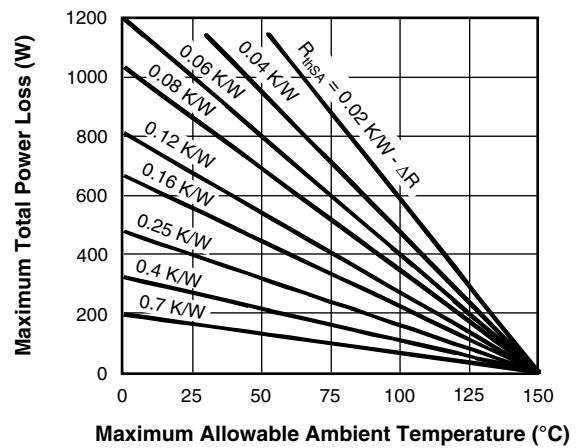
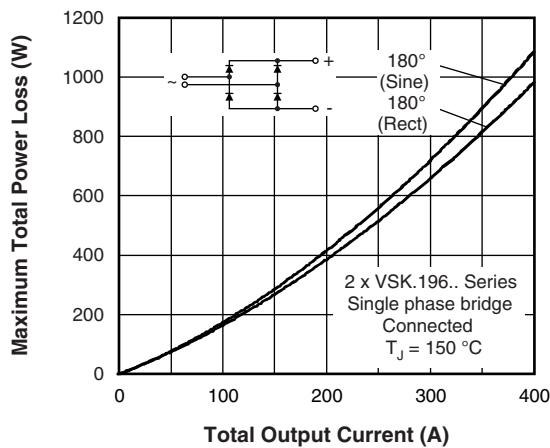


Fig. 17 - On-State Power Loss Characteristics

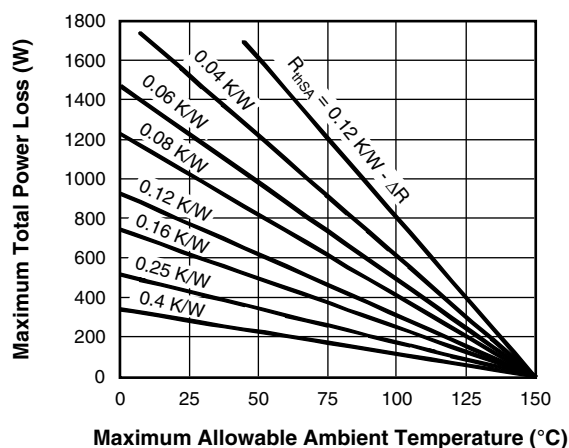
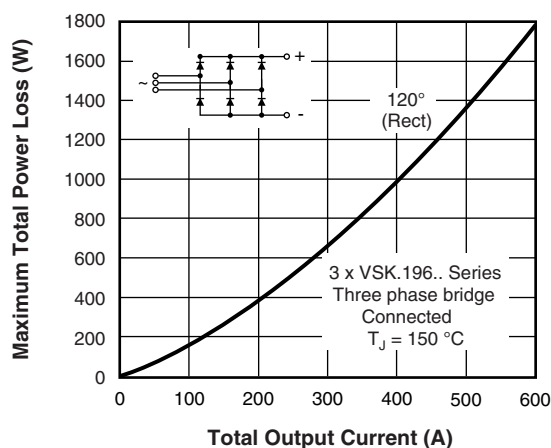


Fig. 18 - On-State Power Loss Characteristics

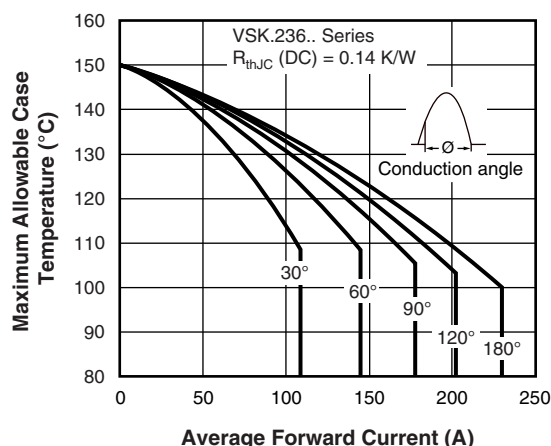


Fig. 19 - Current Ratings Characteristics

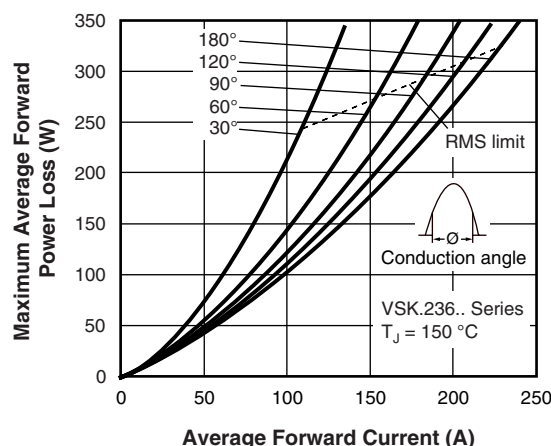


Fig. 21 - On-State Power Loss Characteristics

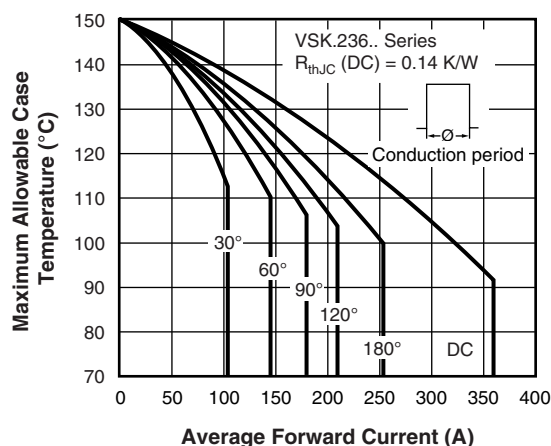


Fig. 20 - Current Ratings Characteristics

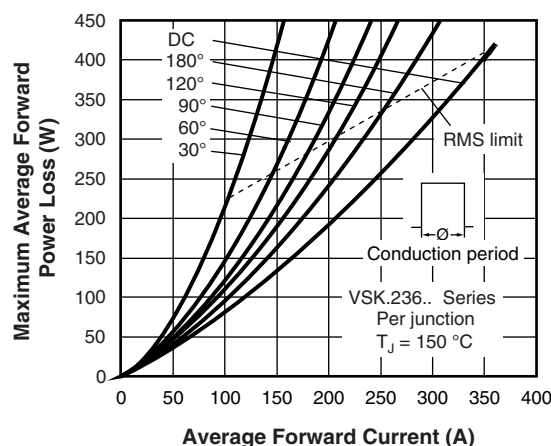


Fig. 22 - On-State Power Loss Characteristics

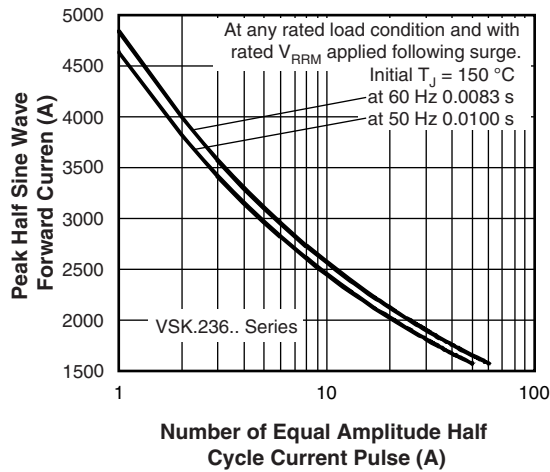


Fig. 23 - Maximum Non-Repetitive Surge Current

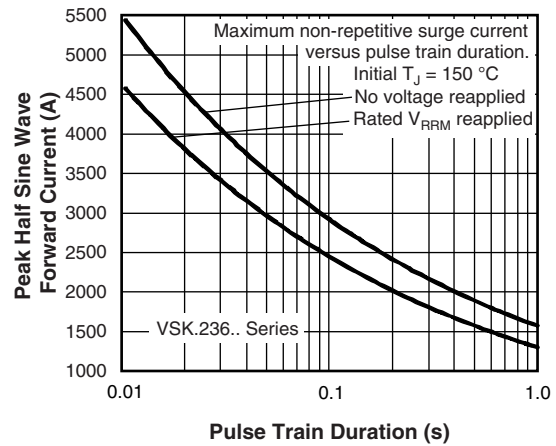


Fig. 24 - Maximum Non-Repetitive Surge Current

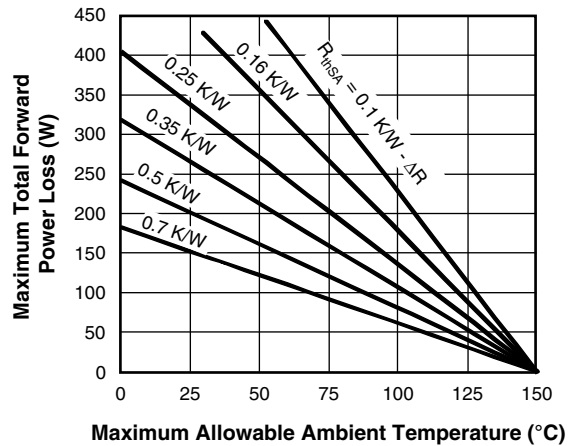
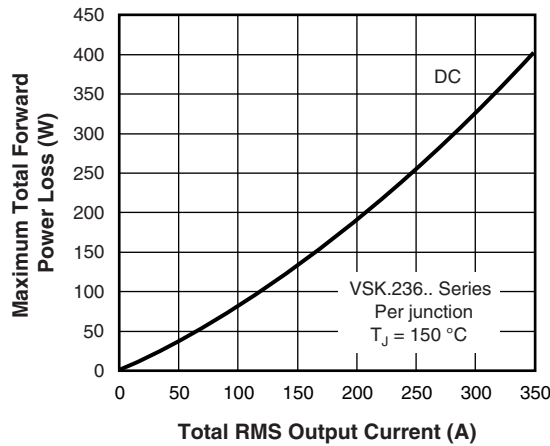


Fig. 25 - On-State Power Loss Characteristics

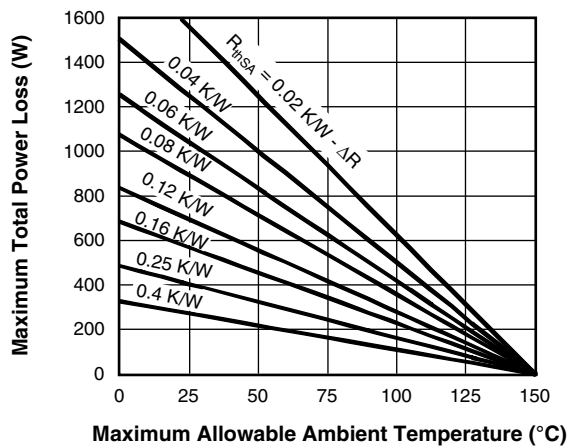
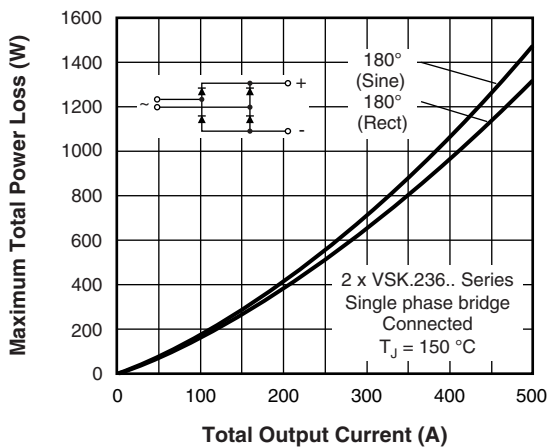


Fig. 26 - On-State Power Loss Characteristics

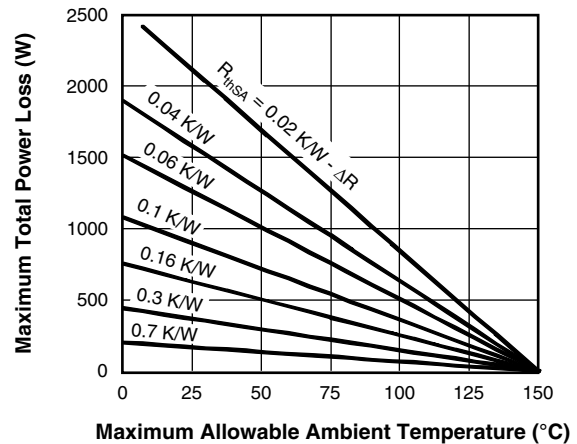
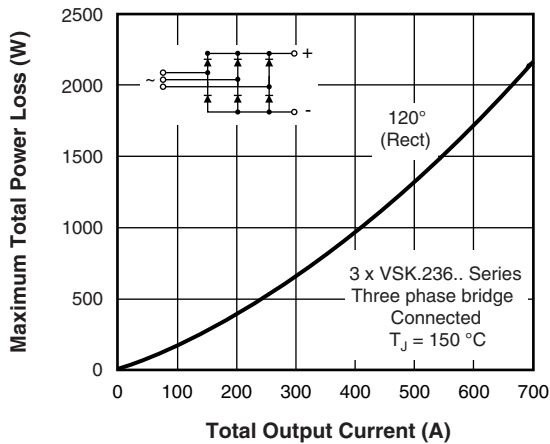


Fig. 27 - On-State Power Loss Characteristics

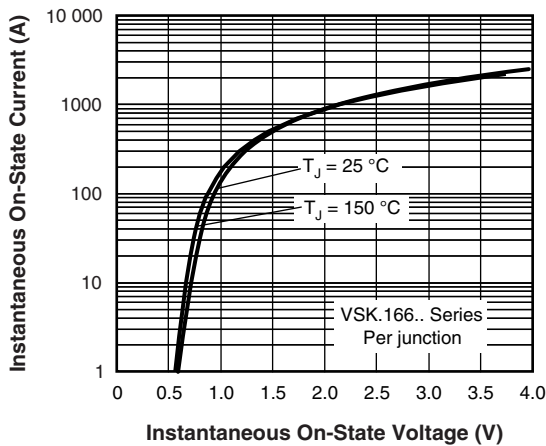


Fig. 28 - On-State Voltage Drop Characteristics

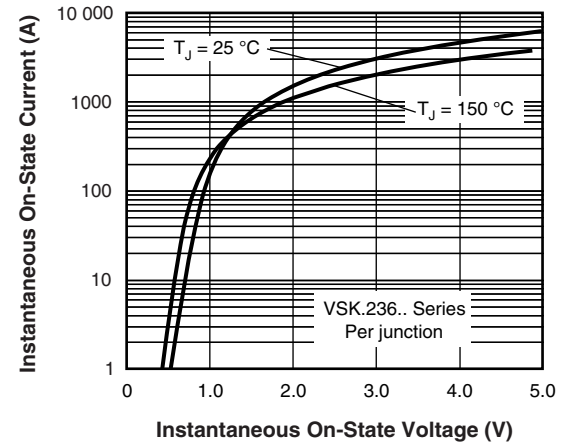


Fig. 30 - On-State Voltage Drop Characteristics

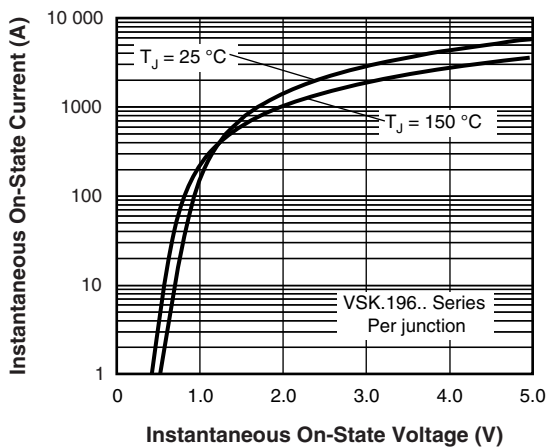


Fig. 29 - On-State Voltage Drop Characteristics

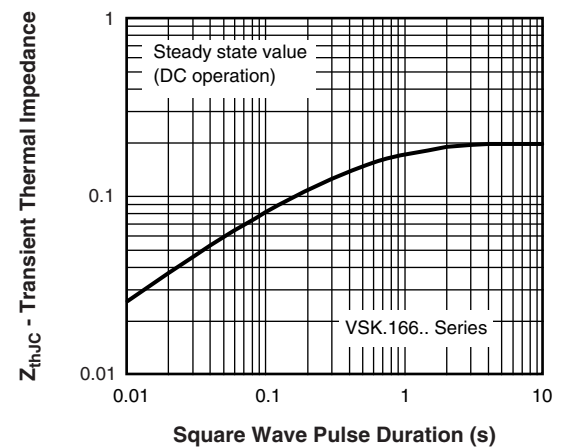


Fig. 31 - Thermal Impedance Z_{thJC} Characteristics

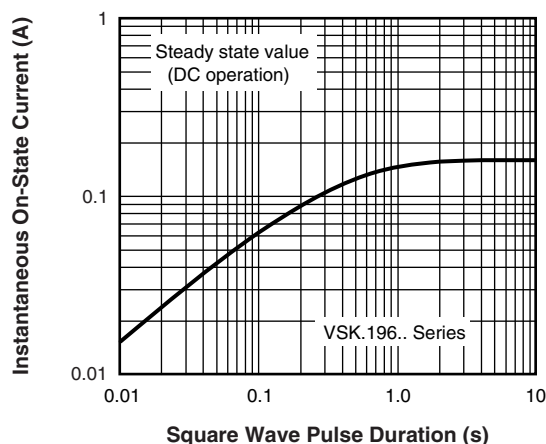


Fig. 32 - Thermal Impedance Z_{thJC} Characteristics

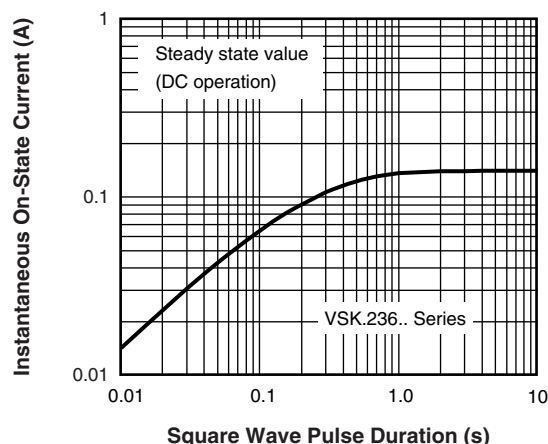


Fig. 33 - Thermal Impedance Z_{thJC} Characteristics

ORDERING INFORMATION TABLE

Device code

VS-VS	KD	236	16	PbF
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1

2

3

4

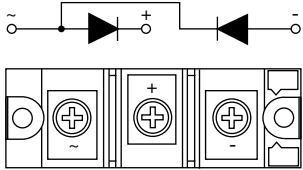
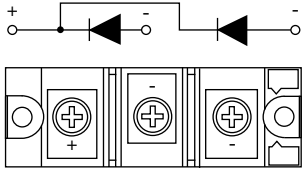
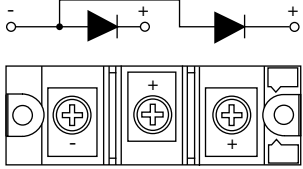
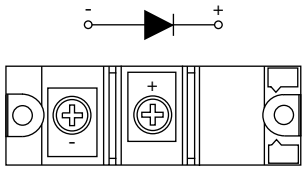
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- | | | |
|---|---|--------------------------------|
| 1 | - | Vishay Semiconductors product |
| 2 | - | Circuit configuration |
| 3 | - | Current rating: $I_{F(AV)}$ |
| 4 | - | Voltage code x 100 = V_{RRM} |
| 5 | - | PbF = Lead (Pb)-free |

Note

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



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

LINKS TO RELATED DOCUMENTS	
Dimensions	www.vishay.com/doc?95254

DIMENSIONS in millimeters (inches)





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