




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



INT-A-PAK

PRIMARY CHARACTERISTICS	
$I_{F(AV)}$	165 A to 230 A
Type	Modules - diode, high voltage
Package	INT-A-PAK
Circuit configuration	Single diode, two diodes common anode, two diodes common cathode, two diodes doubler circuit

### 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](http://www.vishay.com/doc?99912)



RoHS COMPLIANT

### APPLICATIONS

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

MAJOR RATINGS AND CHARACTERISTICS					
SYMBOL	CHARACTERISTICS	VSK.166..	VSK.196..	VSK.236..	UNITS
$I_{F(AV)}$		165	195	230	A
	$T_C$	100	100	100	$^{\circ}C$
$I_{F(RMS)}$		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	$kA^2\sqrt{s}$
$V_{RRM}$		400 to 1600			V
$T_J$	Range	-40 to +150			$^{\circ}C$

### 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 $^{\circ}C$ 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			VALUES			UNITS
					VSK.166	VSK.196	VSK.236	
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 $I^2t$ for fusing	$I^2t$	t = 10 ms	No voltage reapplied		80	113	151	kA <sup>2</sup> s
		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 $I^2\sqrt{t}$ for fusing	$I^2\sqrt{t}$	t = 0.1 ms to 10 ms, no voltage reapplied			798	1130	1516	kA <sup>2</sup> √s
Low level value of threshold voltage	$V_{F(TO)1}$	(16.7 % $\times \pi \times I_{F(AV)} < I < \pi \times I_{F(AV)}$ ), $T_J$ maximum			0.73	0.69	0.7	V
High level value of threshold voltage	$V_{F(TO)2}$	(I > $\pi \times I_{F(AV)}$ ), $T_J$ maximum			0.88	0.78	0.83	
Low level value on-state slope resistance	$r_{t1}$	(16.7 % $\times \pi \times I_{F(AV)} < I < \pi \times I_{F(AV)}$ ), $T_J$ maximum			1.5	1.3	1.2	mΩ
High level value on-state	$r_{t2}$	(I > $\pi \times I_{F(AV)}$ ), $T_J$ maximum			1.26	1.2	1.07	
Maximum forward voltage drop	$V_{FM}$	$I_{FM} = \pi \times I_{F(AV)}$ , $T_J = 25^\circ\text{C}$ , 180° conduction Average power = $V_{F(TO)} \times I_{F(AV)} + r_f \times (I_{F(RMS)})^2$			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	$I_{RRM}$	$T_J = 150^\circ\text{C}$	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
Case style					7.1			oz.
					INT-A-PAK			



<b>ΔR CONDUCTION PER JUNCTION</b>											
DEVICES	SINUSOIDAL CONDUCTION AT T <sub>J</sub> MAXIMUM					RECTANGULAR CONDUCTION AT T <sub>J</sub> 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<sub>thJC</sub> when devices operate at different conduction angles than DC

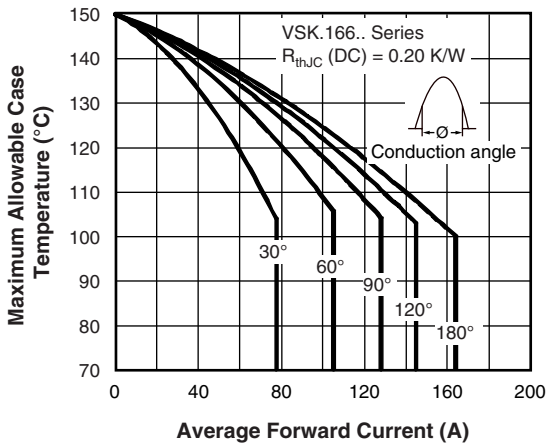


Fig. 1 - Current Ratings Characteristics

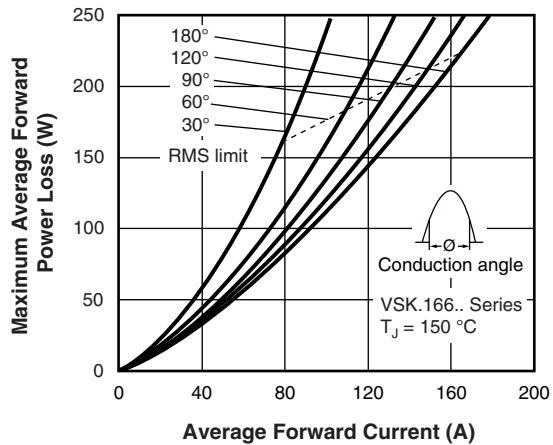


Fig. 3 - On-State Power Loss Characteristics

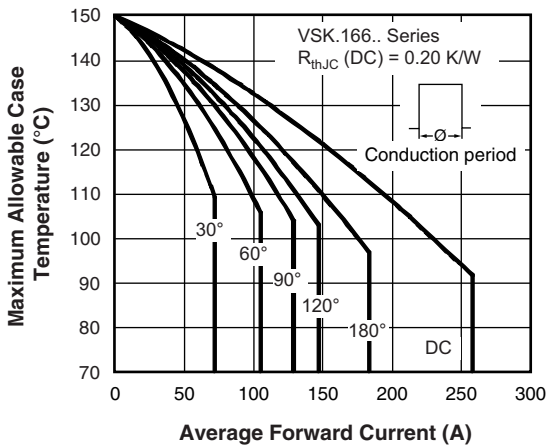


Fig. 2 - Current Ratings Characteristics

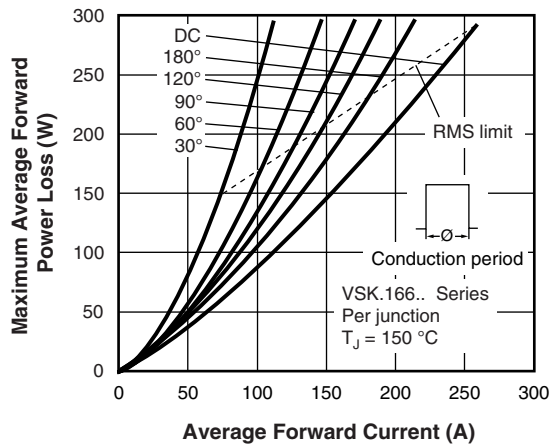


Fig. 4 - On-State Power Loss Characteristics



Fig. 5 - Maximum Non-Repetitive Surge Current

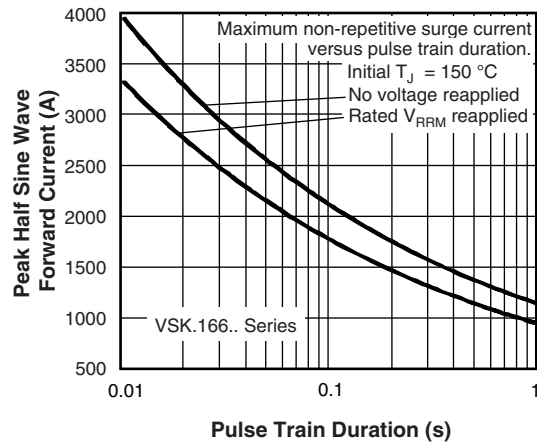


Fig. 6 - Maximum Non-Repetitive Surge Current

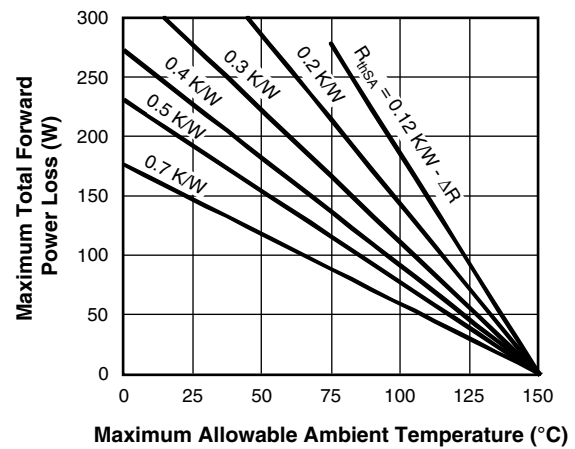
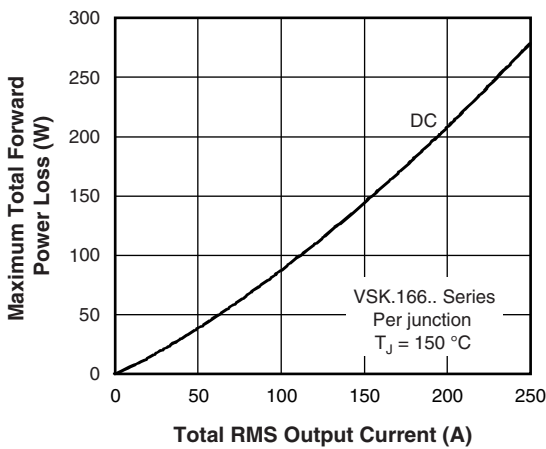


Fig. 7 - On-State Power Loss Characteristics

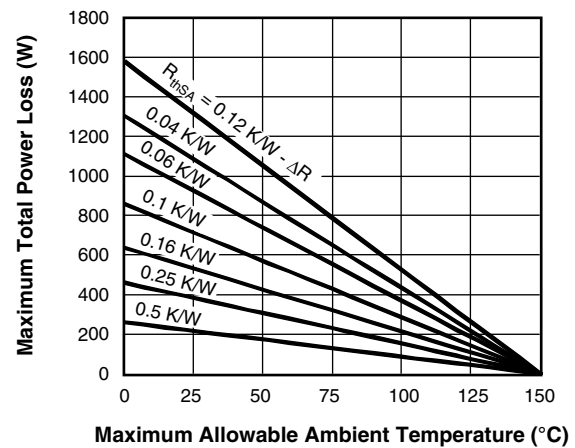
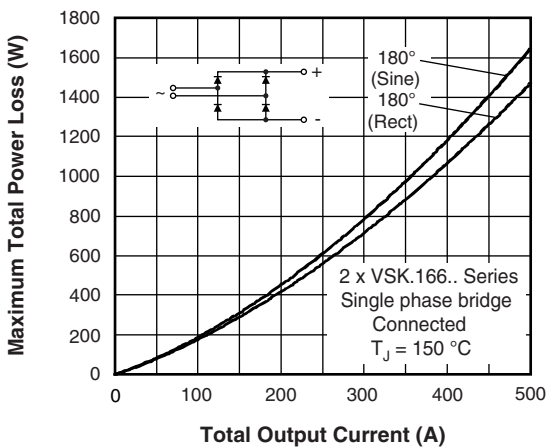


Fig. 8 - On-State Power Loss Characteristics

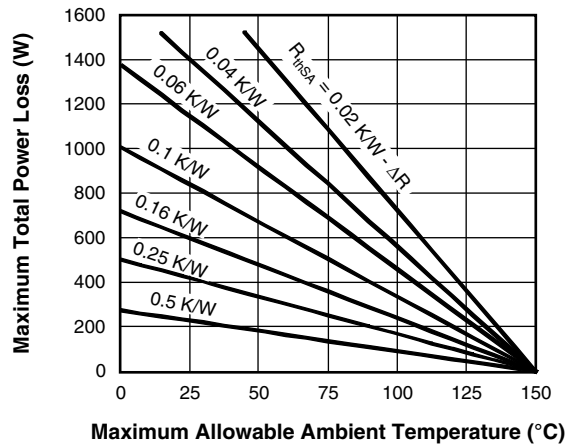


Fig. 9 - On-State Power Loss Characteristics

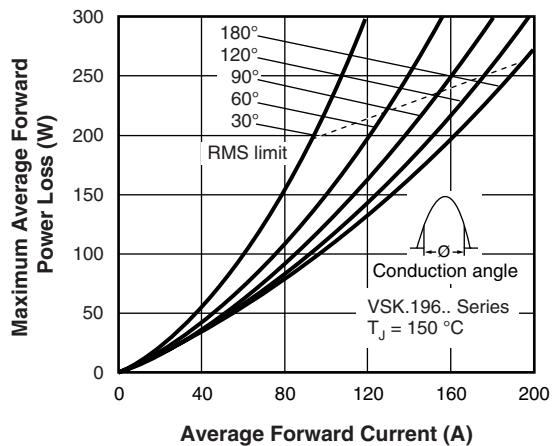
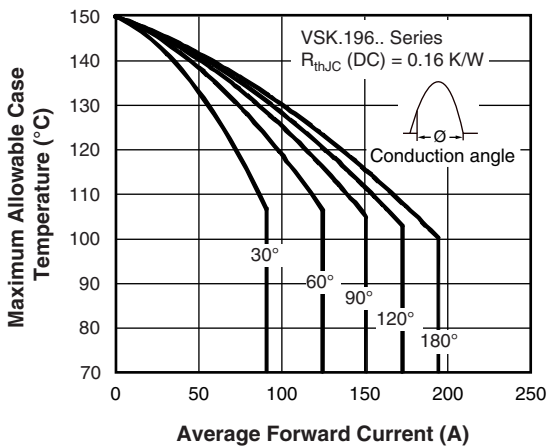


Fig. 10 - Current Ratings Characteristics

Fig. 12 - On-State Power Loss Characteristics

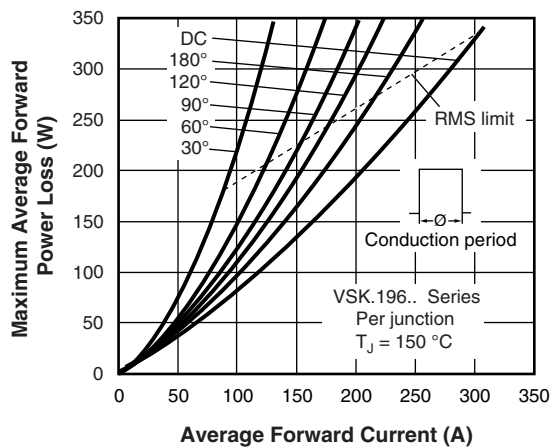
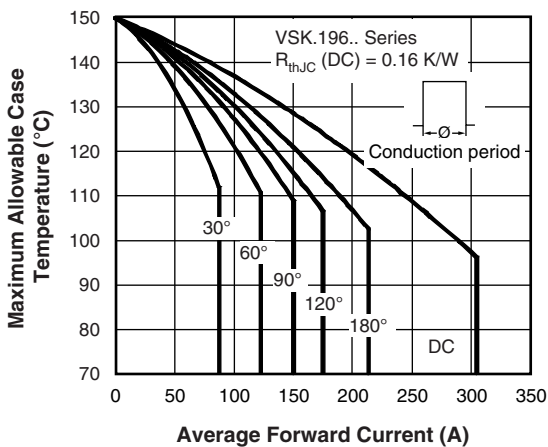


Fig. 11 - Current Ratings Characteristics

Fig. 13 - On-State Power Loss Characteristics



Fig. 14 - Maximum Non-Repetitive Surge Current

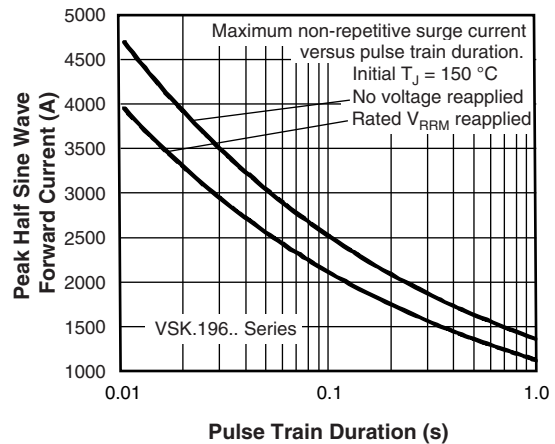


Fig. 15 - Maximum Non-Repetitive Surge Current

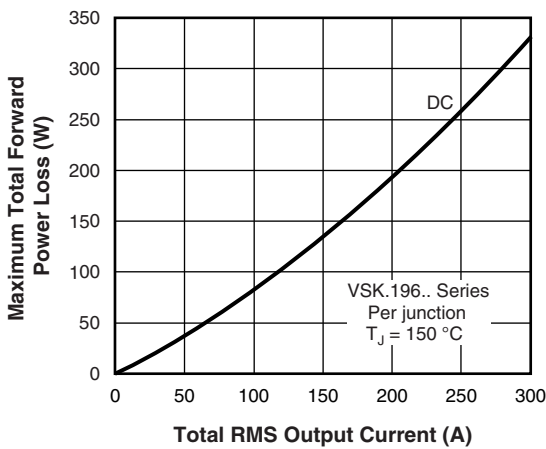


Fig. 16 - On-State Power Loss Characteristics

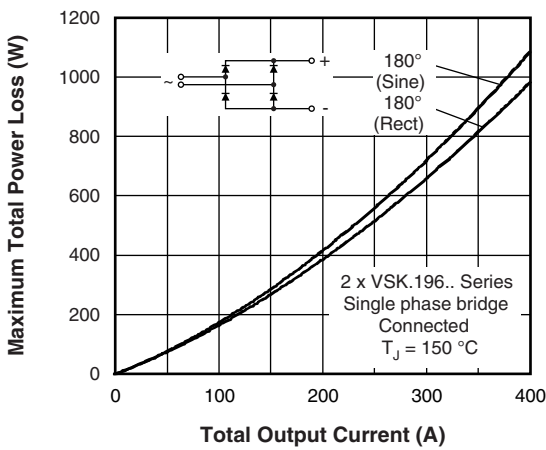
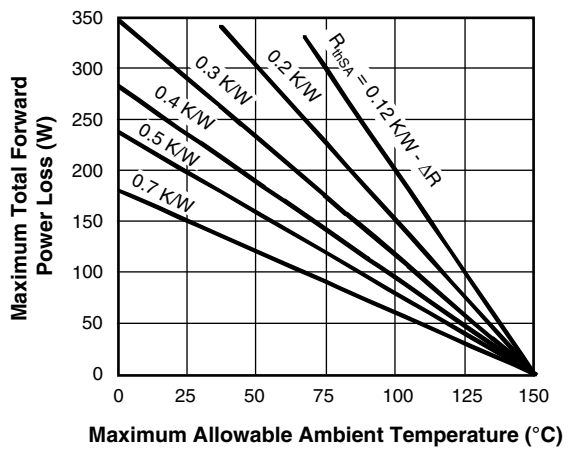
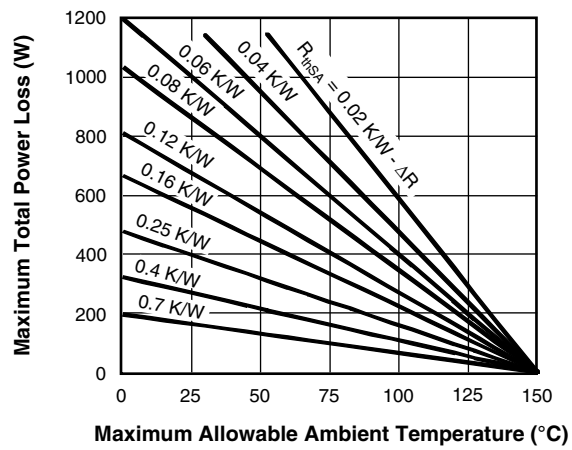


Fig. 17 - On-State Power Loss Characteristics



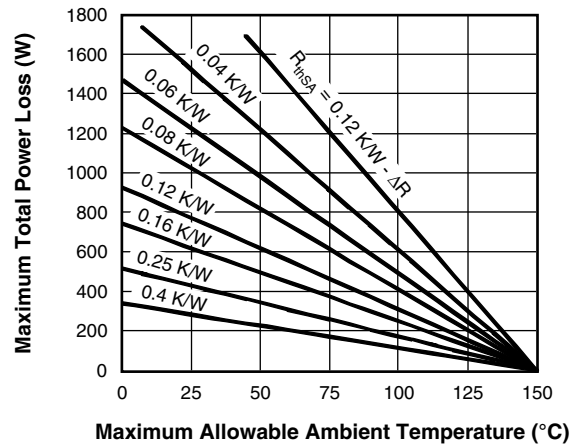
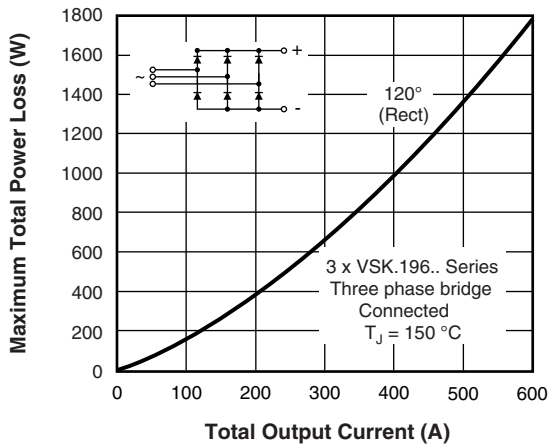


Fig. 18 - On-State Power Loss Characteristics

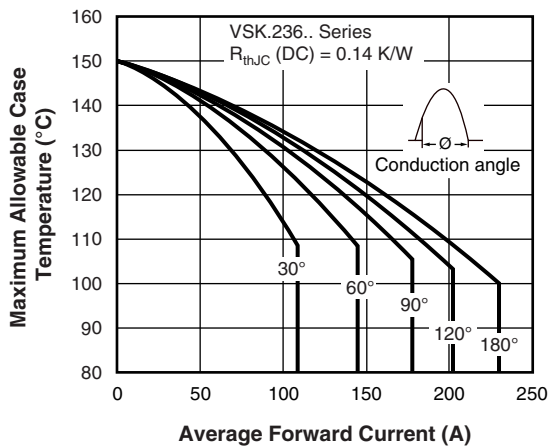


Fig. 19 - Current Ratings Characteristics

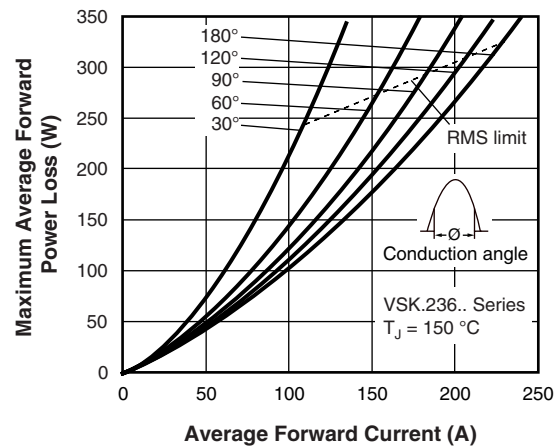


Fig. 21 - On-State Power Loss Characteristics

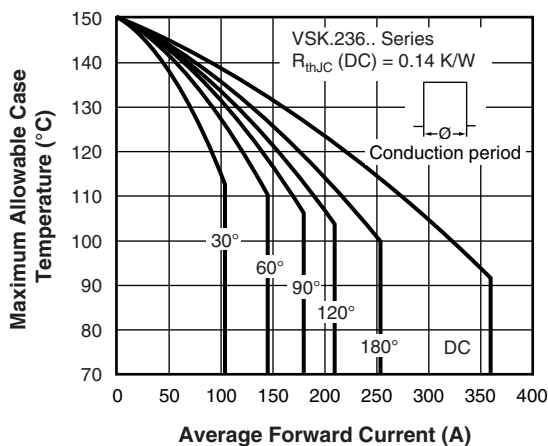


Fig. 20 - Current Ratings Characteristics

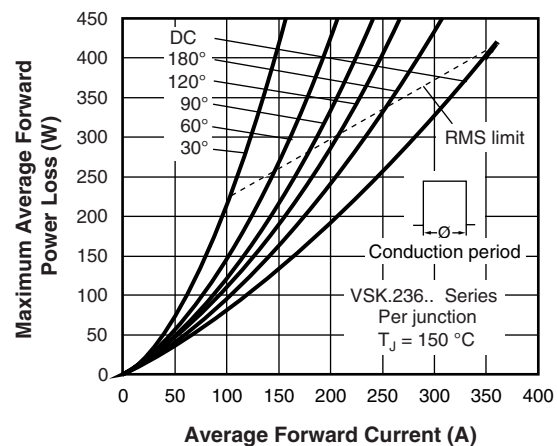


Fig. 22 - On-State Power Loss Characteristics

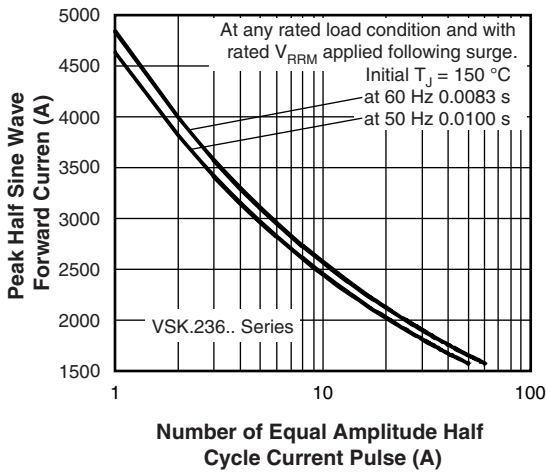


Fig. 23 - Maximum Non-Repetitive Surge Current

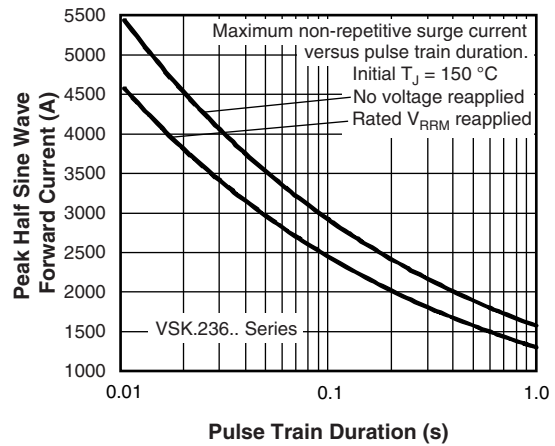


Fig. 24 - Maximum Non-Repetitive Surge Current

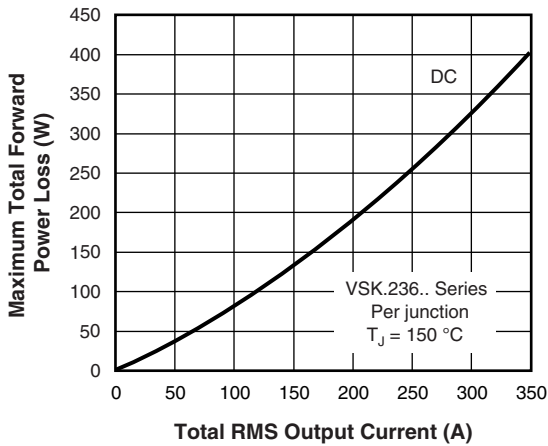


Fig. 25 - On-State Power Loss Characteristics

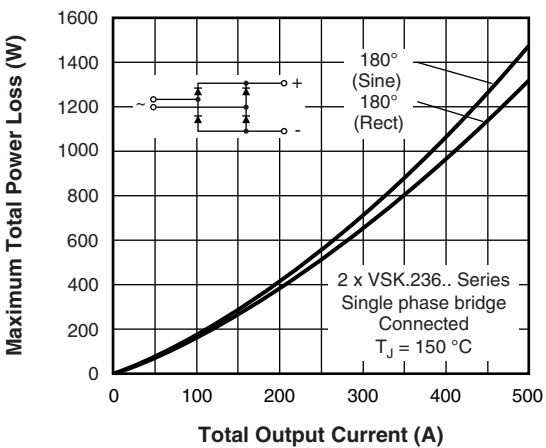
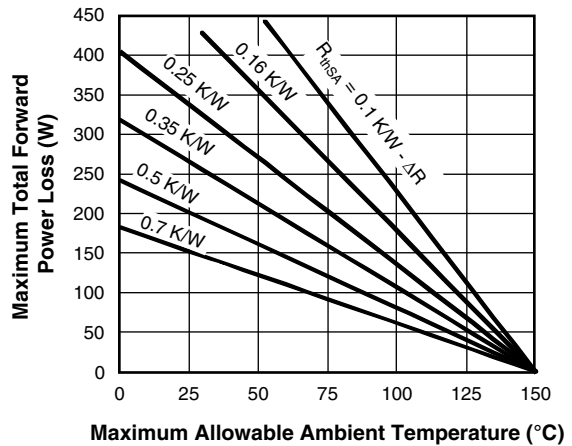
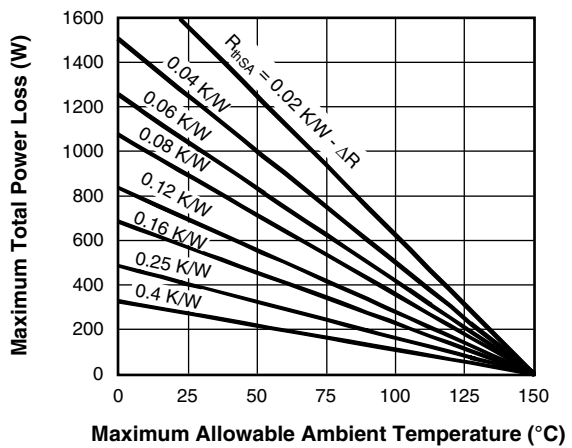


Fig. 26 - On-State Power Loss Characteristics





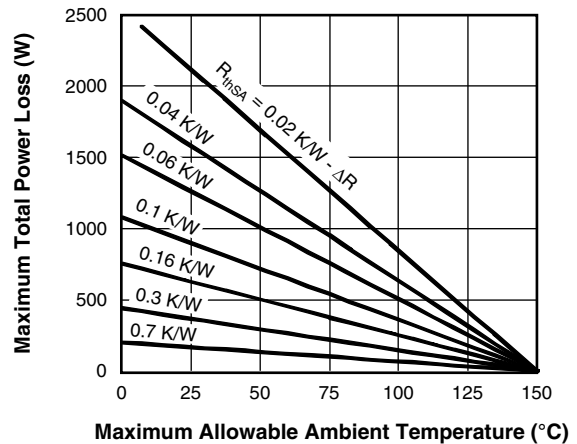
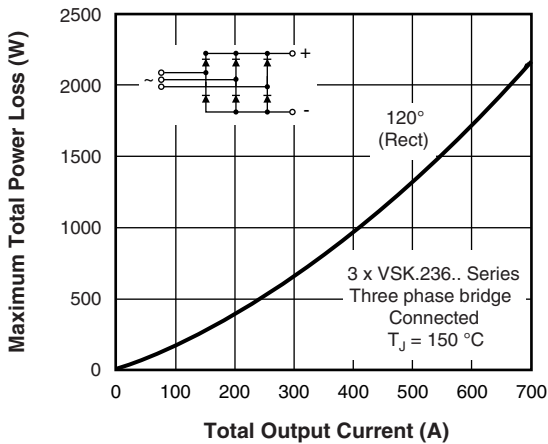


Fig. 27 - On-State Power Loss Characteristics

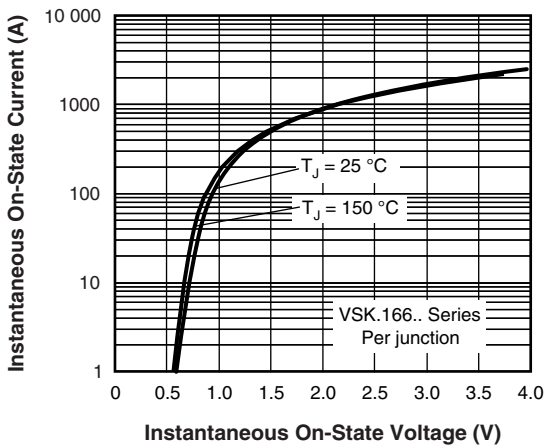


Fig. 28 - On-State Voltage Drop Characteristics

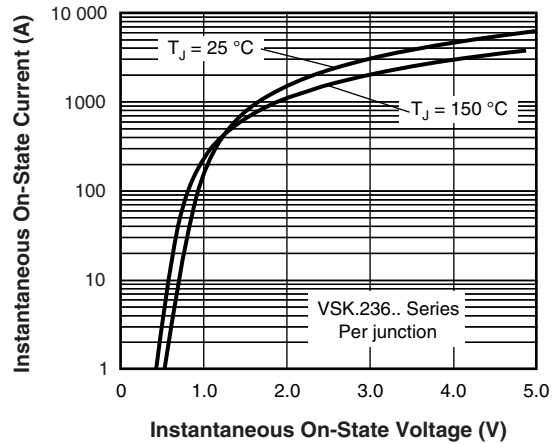


Fig. 30 - On-State Voltage Drop Characteristics

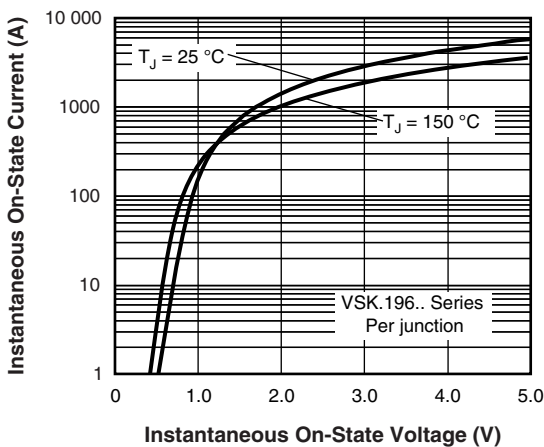


Fig. 29 - On-State Voltage Drop Characteristics

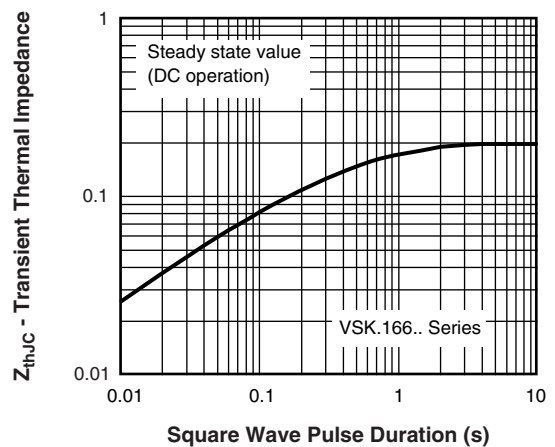


Fig. 31 - Thermal Impedance  $Z_{\theta JC}$  Characteristics

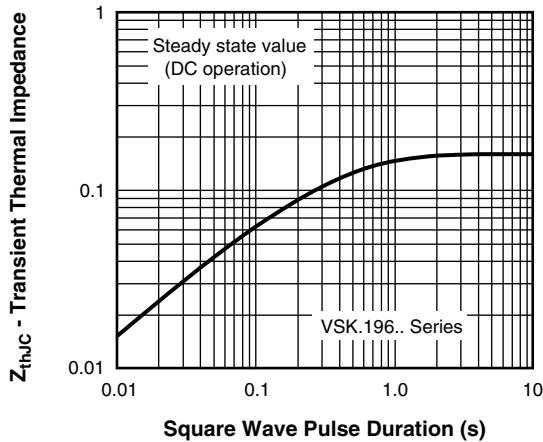


Fig. 32 - Thermal Impedance  $Z_{thJC}$  Characteristics

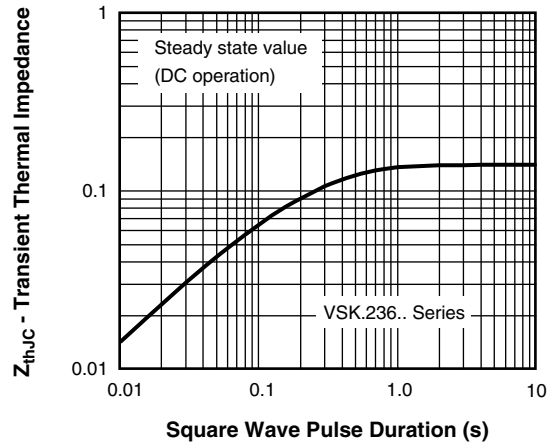


Fig. 33 - Thermal Impedance  $Z_{thJC}$  Characteristics

**ORDERING INFORMATION TABLE**

Device code	<b>VS-VS</b>	<b>KD</b>	<b>236</b>	<b>16</b>	<b>PbF</b>
	①	②	③	④	⑤
	<b>1</b>	-	Vishay Semiconductors product		
	<b>2</b>	-	Circuit configuration		
	<b>3</b>	-	Current rating: $I_{F(AV)}$		
	<b>4</b>	-	Voltage code x 100 = $V_{RRM}$		
	<b>5</b>	-	PbF = Lead (Pb)-free		

**Note**

- To order the optional hardware go to [www.vishay.com/doc?95172](http://www.vishay.com/doc?95172)



CIRCUIT CONFIGURATION		
CIRCUIT DESCRIPTION	CIRCUIT CONFIGURATION CODE	CIRCUIT DRAWING
Two diodes doubler circuit	D	<p><b>VSKD...</b></p>
Two diodes common cathode	C	<p><b>VSKC...</b></p>
Two diodes common anode	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?95254">www.vishay.com/doc?95254</a>

## INT-A-PAK DBC

**DIMENSIONS** in millimeters (inches)





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