




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

$I_{F(AV)}$	165 A to 230 A
Type	Modules - Diode, High Voltage

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
VSK.166 VSK.196 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	4000	4750	5500	
		t = 8.3 ms	100 % V_{RRM} reapplied	4200	4980	5765	
		t = 10 ms		Sine half wave, initial $T_J = T_J$ maximum	3350	4000	
		t = 8.3 ms	3500		4200	4850	
Maximum I^2t for fusing	I^2t	t = 10 ms	No voltage reapplied	80	113	151	kA ² s
		t = 8.3 ms	100 % V_{RRM} reapplied	73	103	138	
		t = 10 ms		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 ² √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
		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

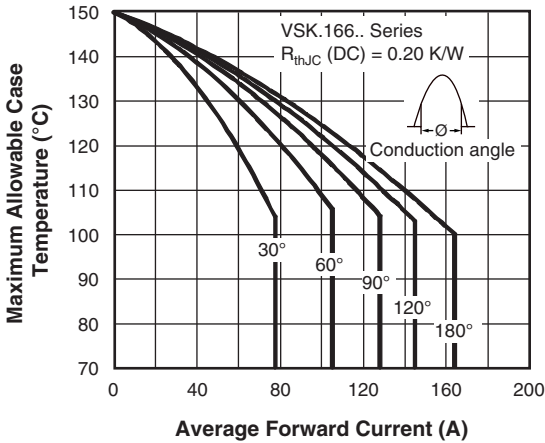


Fig. 1 - Current Ratings Characteristics

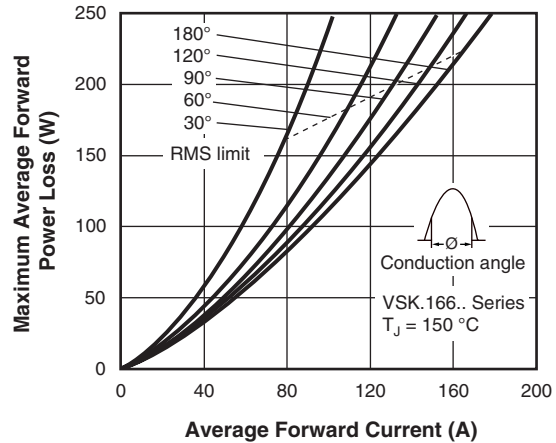


Fig. 3 - On-State Power Loss Characteristics

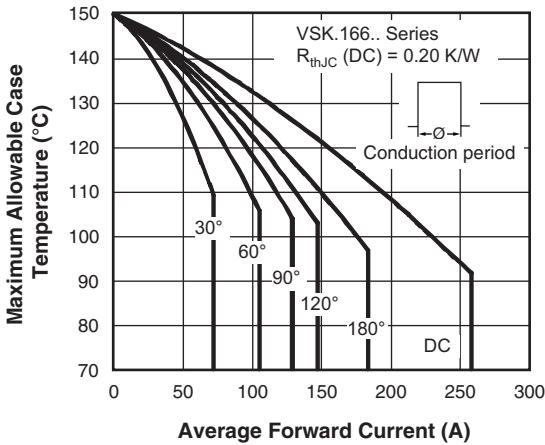


Fig. 2 - Current Ratings Characteristics

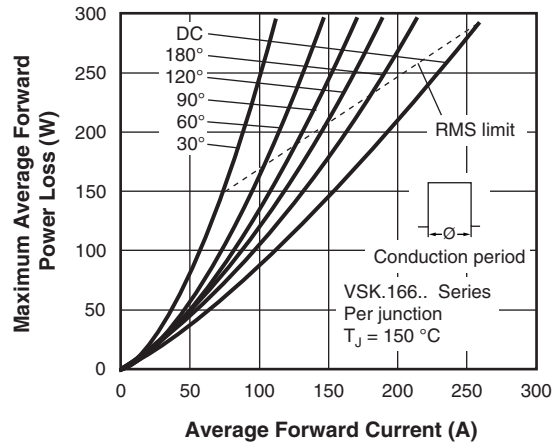


Fig. 4 - On-State Power Loss Characteristics

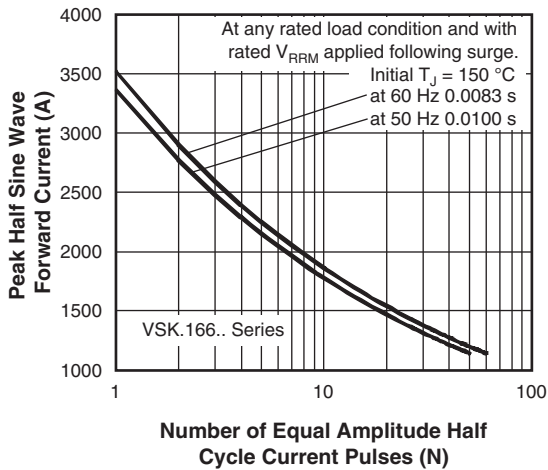


Fig. 5 - Maximum Non-Repetitive Surge Current

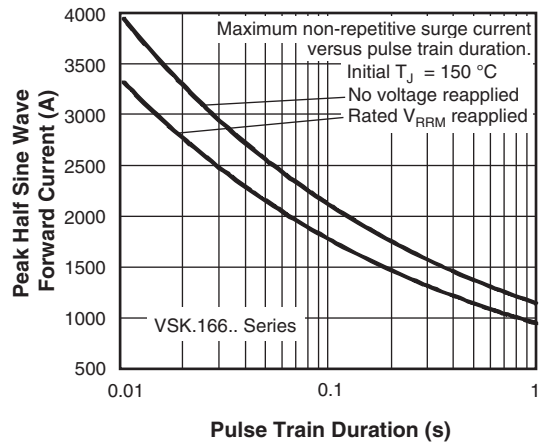


Fig. 6 - Maximum Non-Repetitive Surge Current

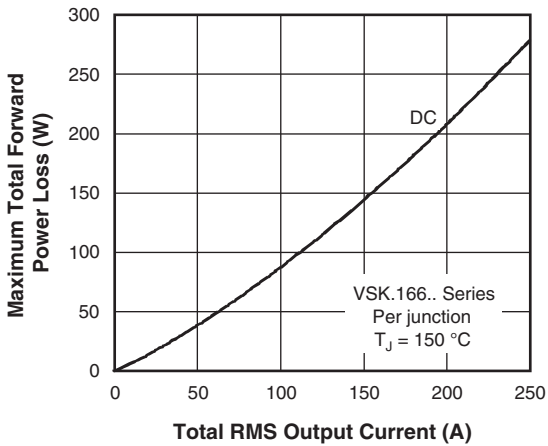


Fig. 7 - On-State Power Loss Characteristics

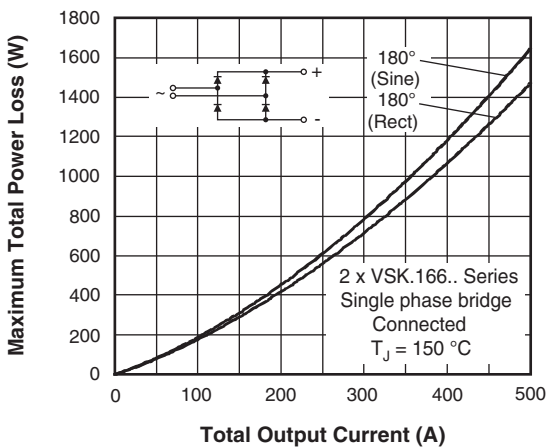
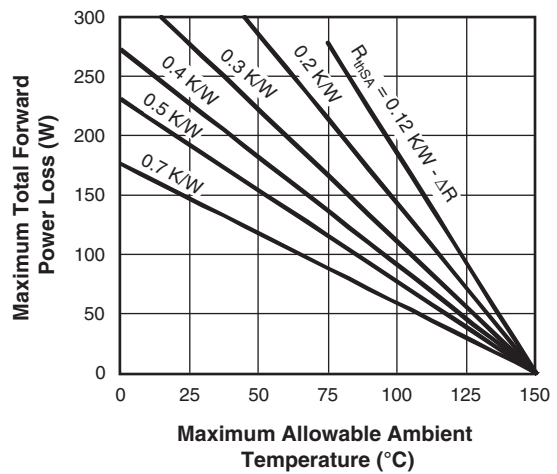
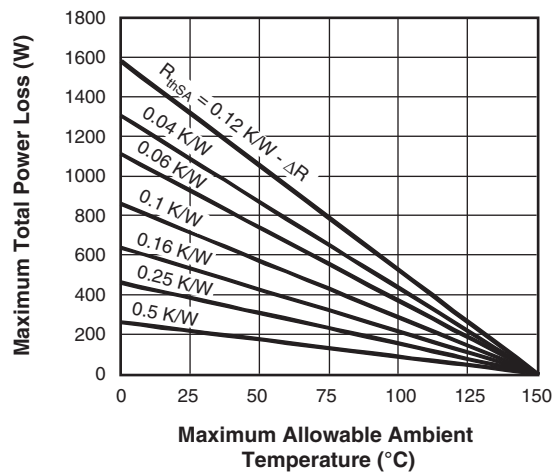


Fig. 8 - On-State Power Loss Characteristics



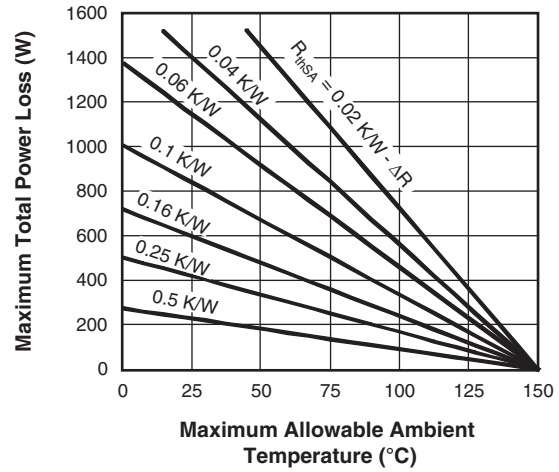
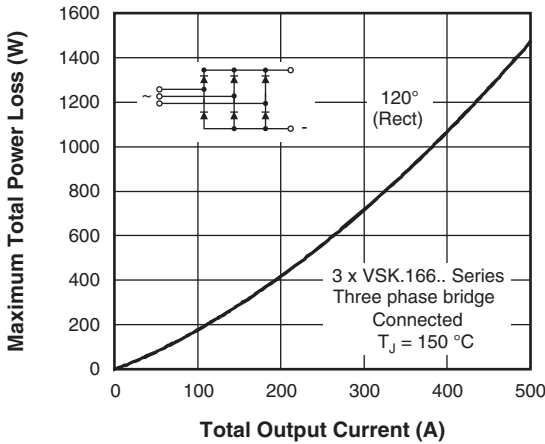


Fig. 9 - On-State Power Loss Characteristics

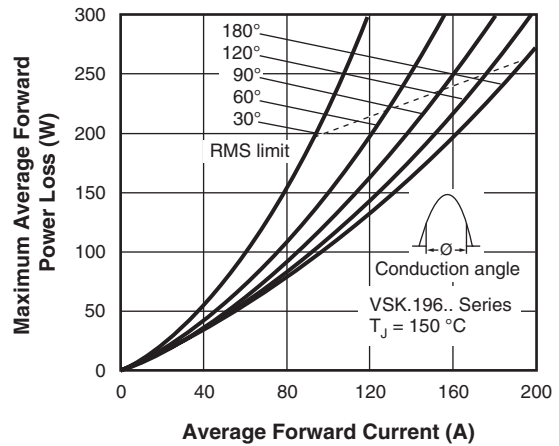
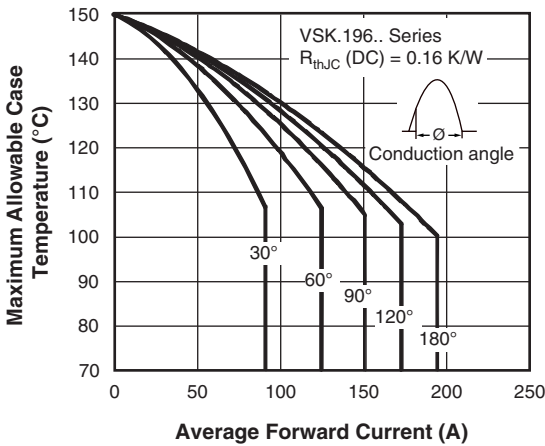


Fig. 10 - Current Ratings Characteristics

Fig. 12 - On-State Power Loss Characteristics

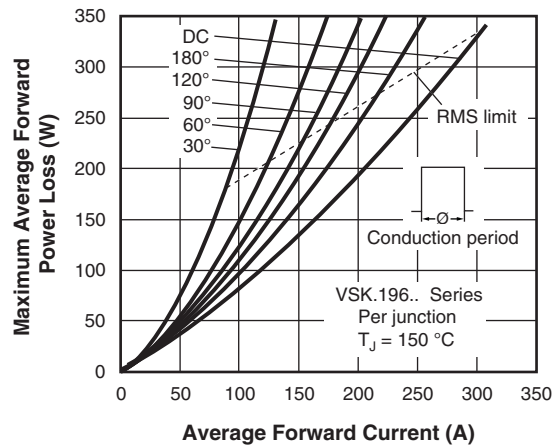
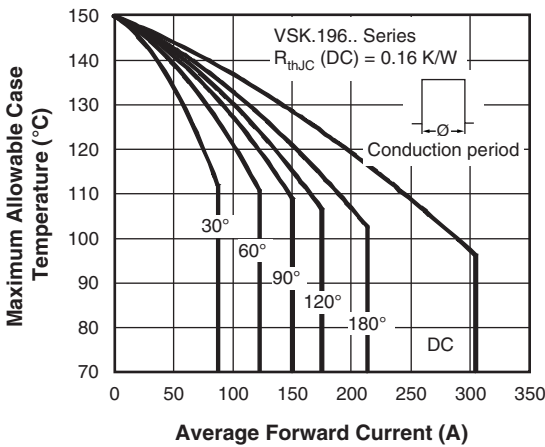


Fig. 11 - Current Ratings Characteristics

Fig. 13 - On-State Power Loss Characteristics

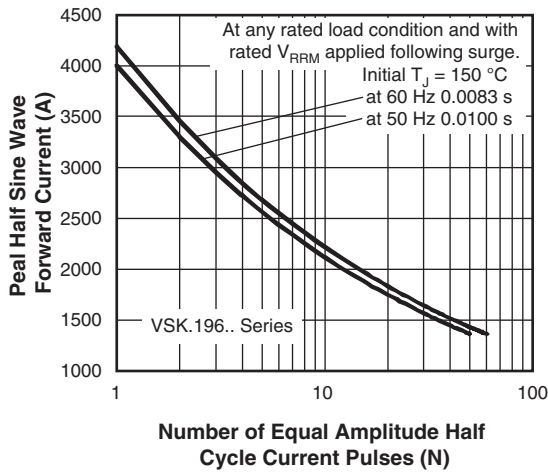


Fig. 14 - Maximum Non-Repetitive Surge Current

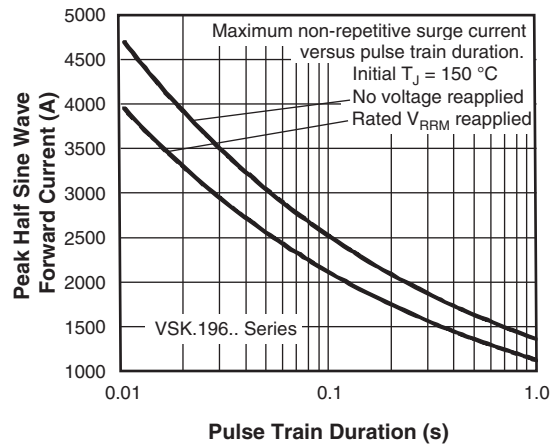


Fig. 15 - Maximum Non-Repetitive Surge Current

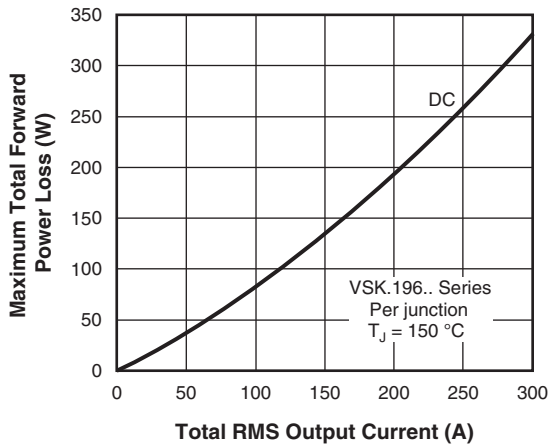


Fig. 16 - On-State Power Loss Characteristics

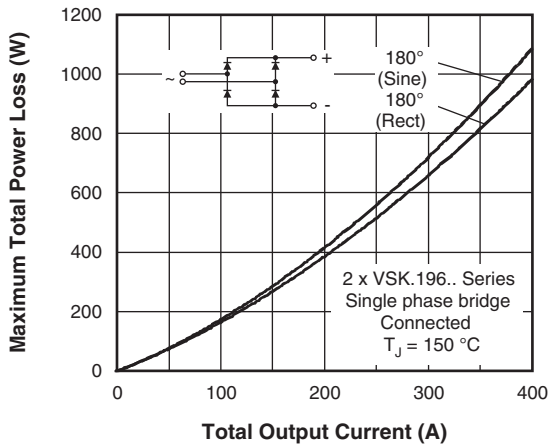
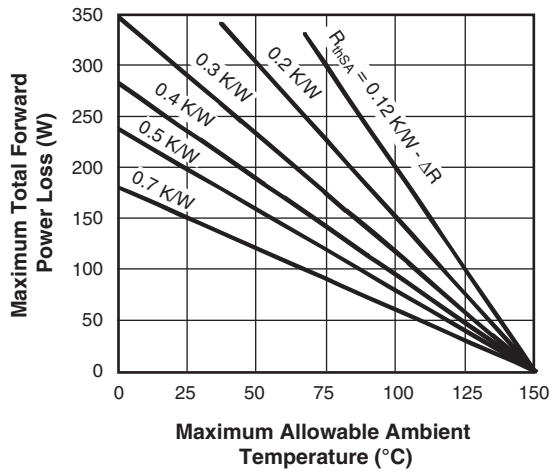
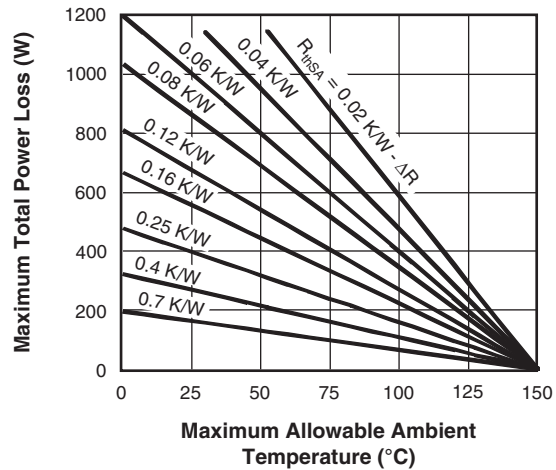


Fig. 17 - On-State Power Loss Characteristics



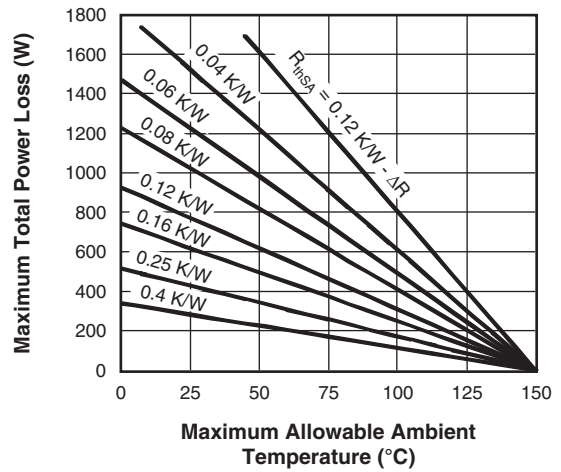
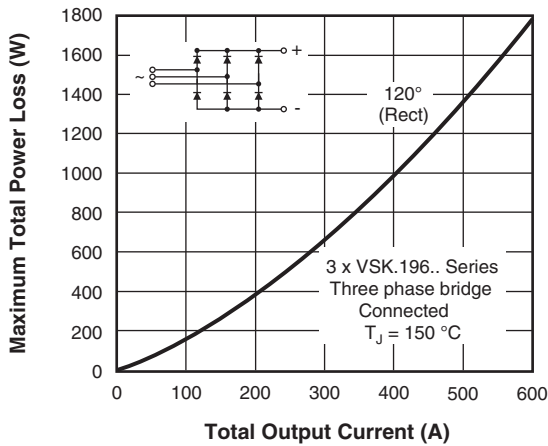


Fig. 18 - On-State Power Loss Characteristics

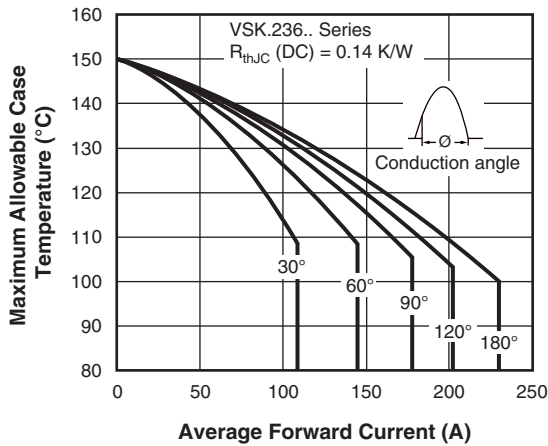


Fig. 19 - Current Ratings Characteristics

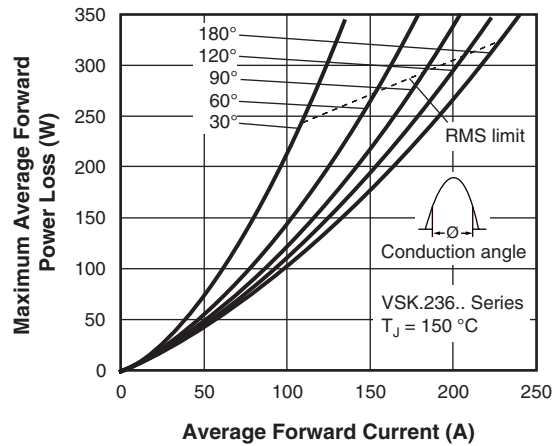


Fig. 21 - On-State Power Loss Characteristics

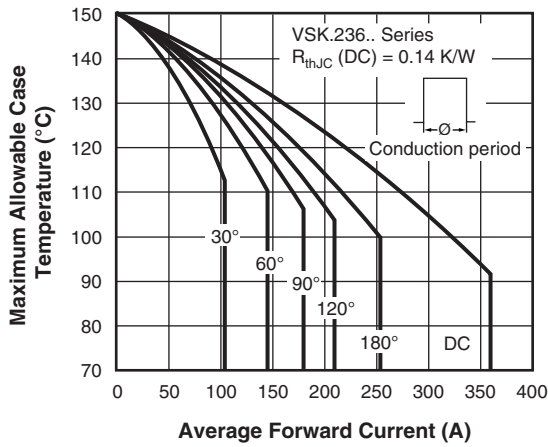


Fig. 20 - Current Ratings Characteristics

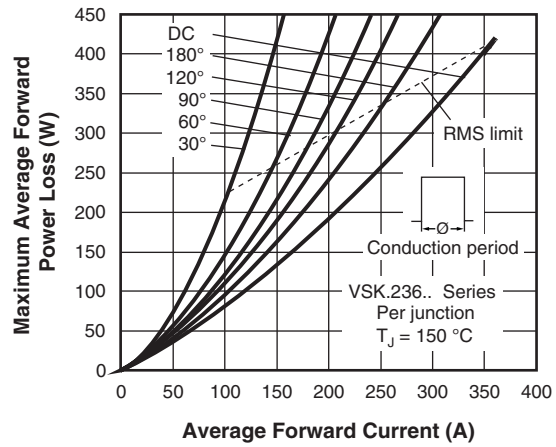


Fig. 22 - On-State Power Loss Characteristics

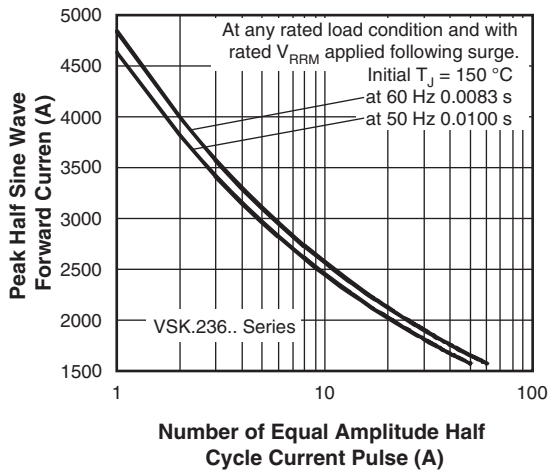


Fig. 23 - Maximum Non-Repetitive Surge Current

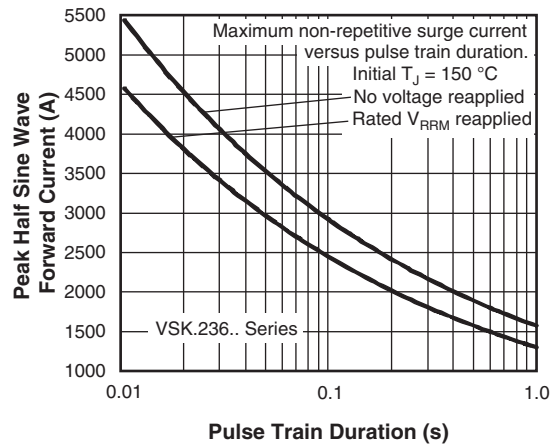


Fig. 24 - Maximum Non-Repetitive Surge Current

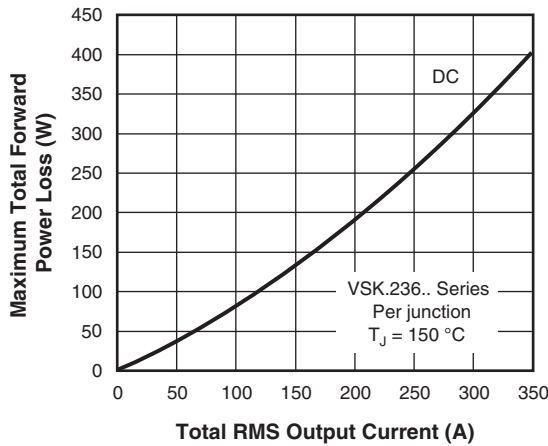


Fig. 25 - On-State Power Loss Characteristics

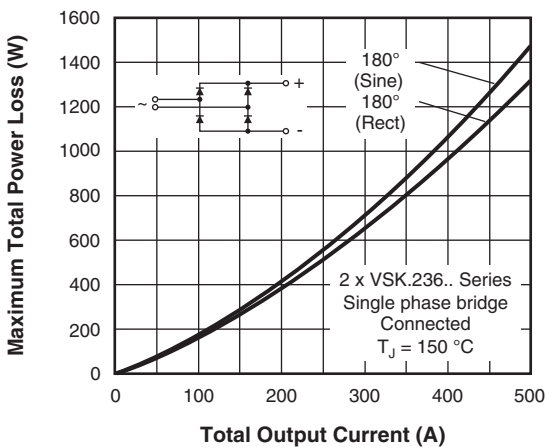
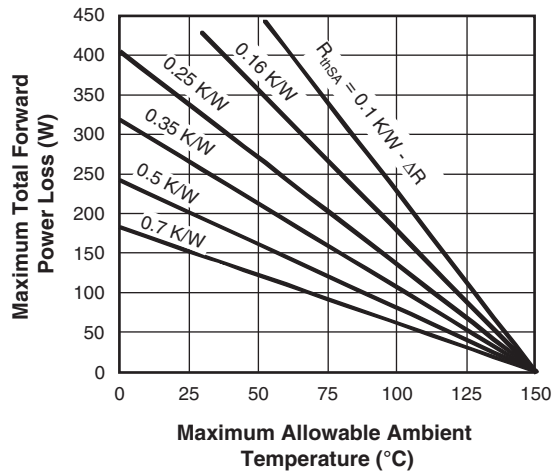
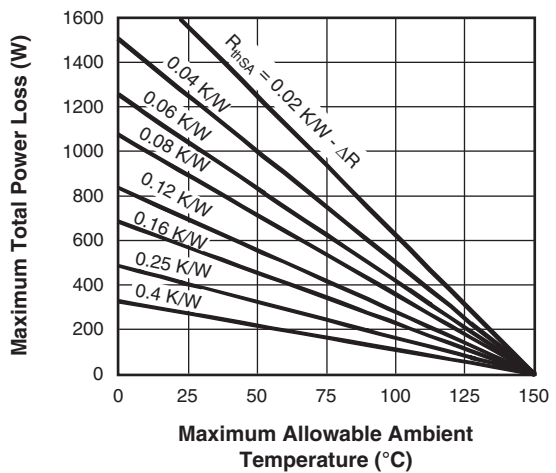


Fig. 26 - On-State Power Loss Characteristics



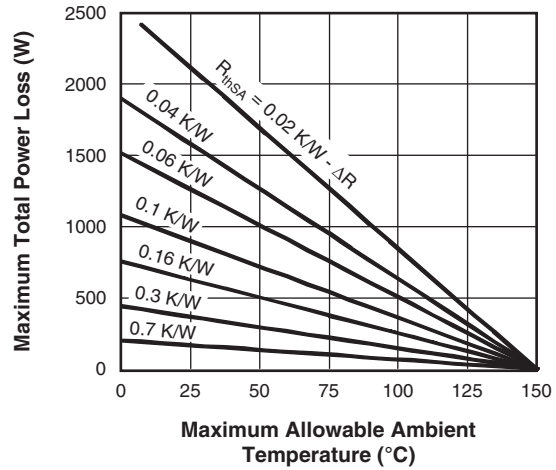
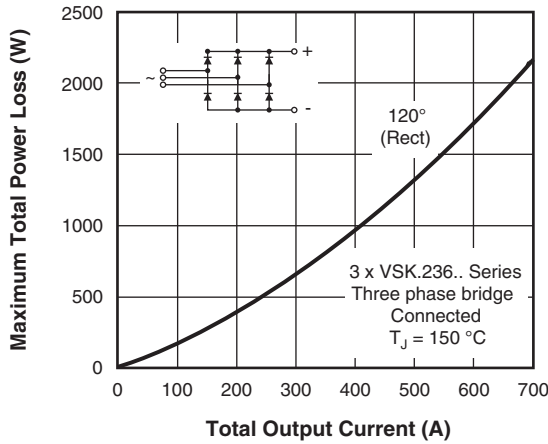


Fig. 27 - On-State Power Loss Characteristics

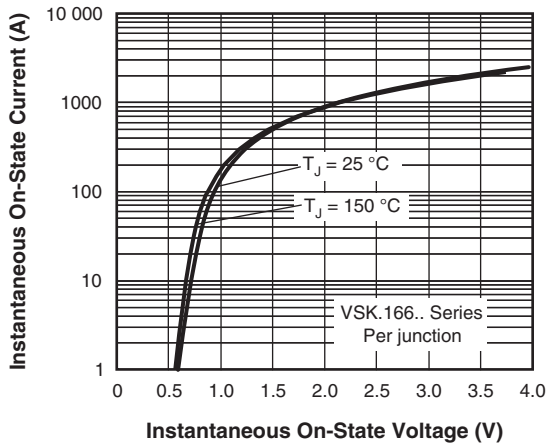


Fig. 28 - On-State Voltage Drop Characteristics

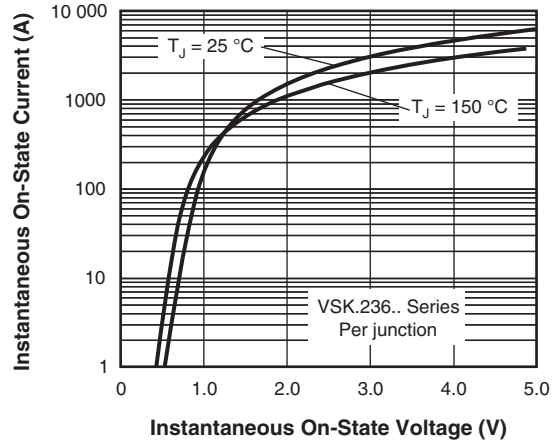


Fig. 30 - On-State Voltage Drop Characteristics

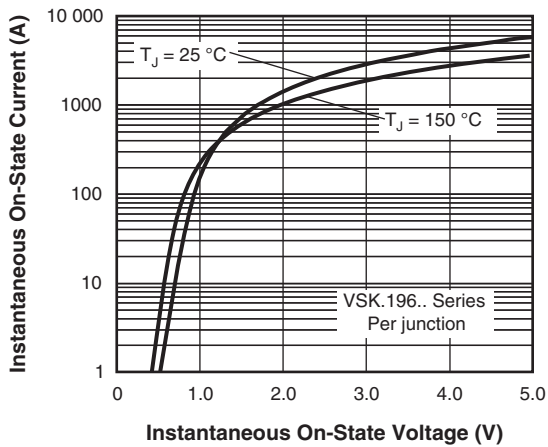


Fig. 29 - On-State Voltage Drop Characteristics

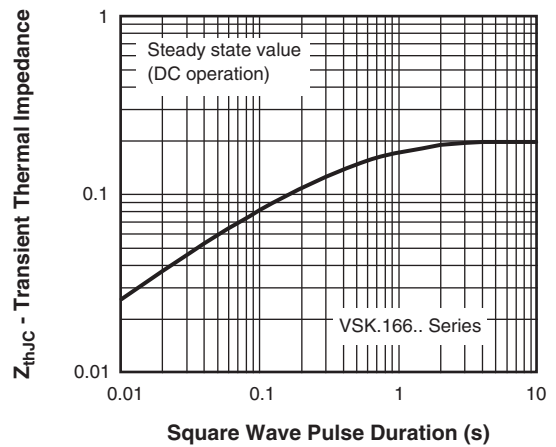


Fig. 31 - Thermal Impedance Z_{thJC} Characteristics

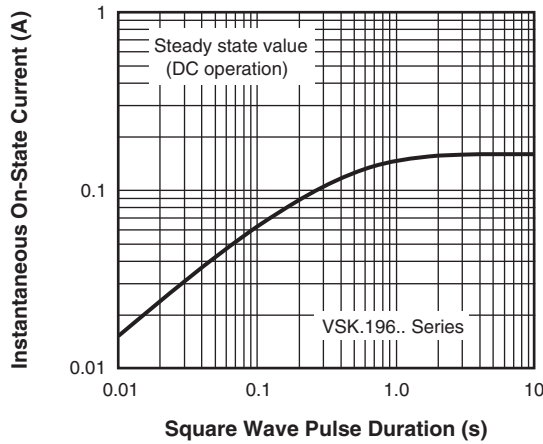


Fig. 32 - Thermal Impedance Z_{thJC} Characteristics

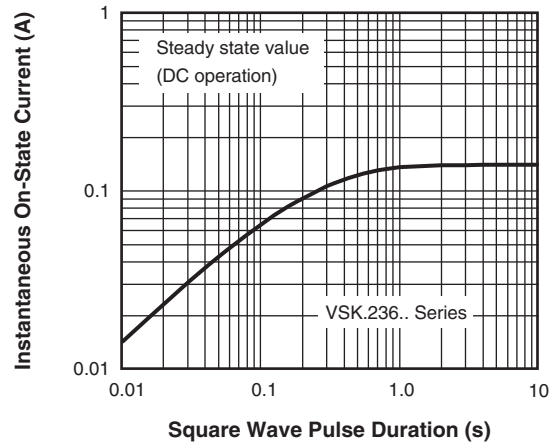


Fig. 33 - Thermal Impedance Z_{thJC} Characteristics

ORDERING INFORMATION TABLE

Device code	VS-	VSK	D	236	/	16	PbF
	①	②	③	④		⑤	⑥
	1	-	Vishay Semiconductors product				
	2	-	Module type				
	3	-	Circuit configuration (see Circuit Configuration table)				
	4	-	Current rating: $I_{F(AV)}$				
	5	-	Voltage code $\times 100 = V_{RRM}$				
	6	-	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	<p>VSKD...</p>
Two diodes common cathodes	C	<p>VSKC...</p>
Two diodes common anodes	J	<p>VSKJ...</p>
Single diode	E	<p>VSKE...</p>

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

INT-A-PAK DBC

DIMENSIONS in millimeters (inches)





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