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

APPLICATIONS

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

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

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	°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			°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 °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^2s
		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	$kA^2\sqrt{s}$
Low level value of threshold voltage	$V_{F(TO)1}$	(16.7 % x π x $I_{F(AV)}$ < I < π x $I_{F(AV)}$), T_J maximum			0.73	0.69	0.7	V
High level value of threshold voltage	$V_{F(TO)2}$	(I > π x $I_{F(AV)}$), T_J maximum			0.88	0.78	0.83	
Low level value on-state slope resistance	r_{t1}	(16.7 % x π x $I_{F(AV)}$ < I < π x $I_{F(AV)}$), T_J maximum			1.5	1.3	1.2	mΩ
High level value on-state	r_{t2}	(I > π x $I_{F(AV)}$), T_J maximum			1.26	1.2	1.07	
Maximum forward voltage drop	V_{FM}	I_{FM} = π x $I_{F(AV)}$, T_J = 25 °C, 180° conduction Average power = $V_{F(TO)}$ x $I_{F(AV)}$ + r_f x $(I_{F(RMS)})^2$			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 °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		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
Mounting torque ± 10 % — busbar to IAP						
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

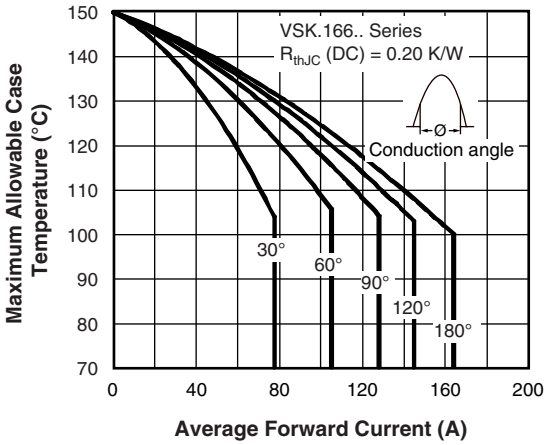


Fig. 1 - Current Ratings Characteristics

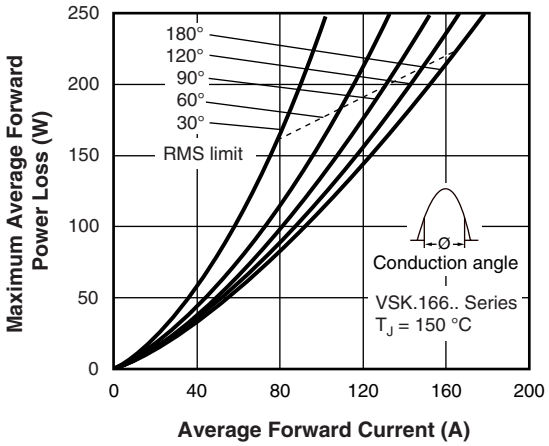


Fig. 3 - On-State Power Loss Characteristics

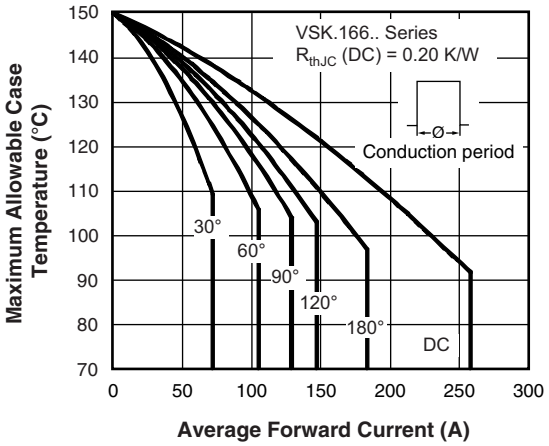


Fig. 2 - Current Ratings Characteristics

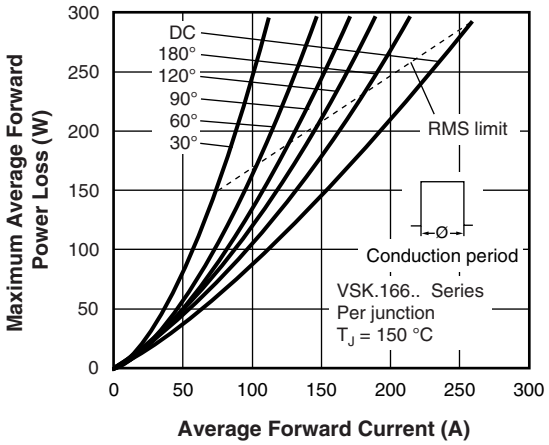


Fig. 4 - On-State Power Loss Characteristics

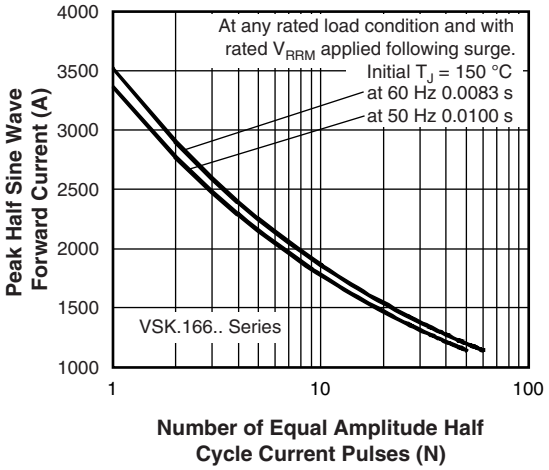


Fig. 5 - Maximum Non-Repetitive Surge Current

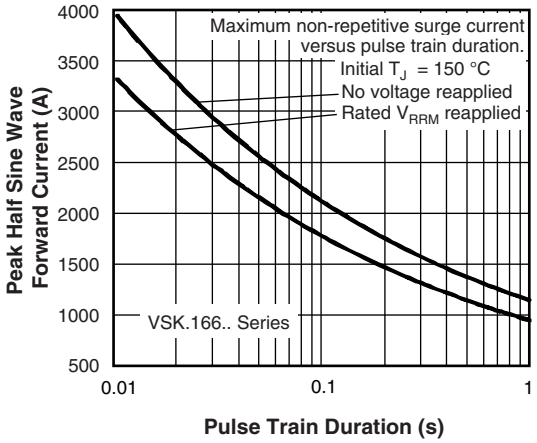
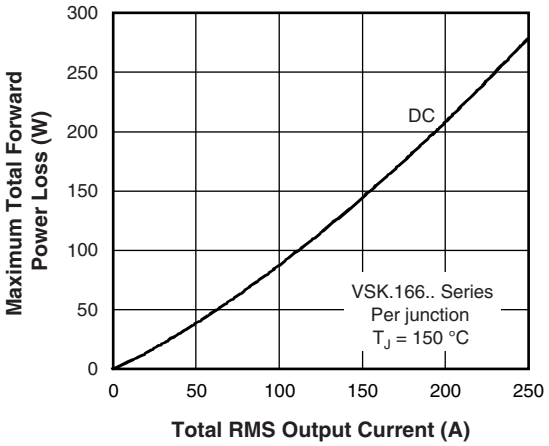


Fig. 6 - Maximum Non-Repetitive Surge Current



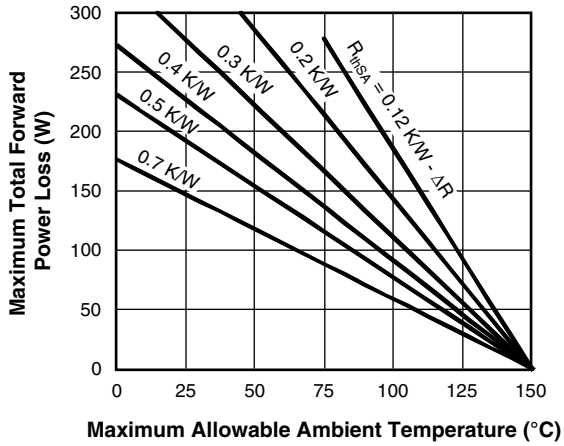
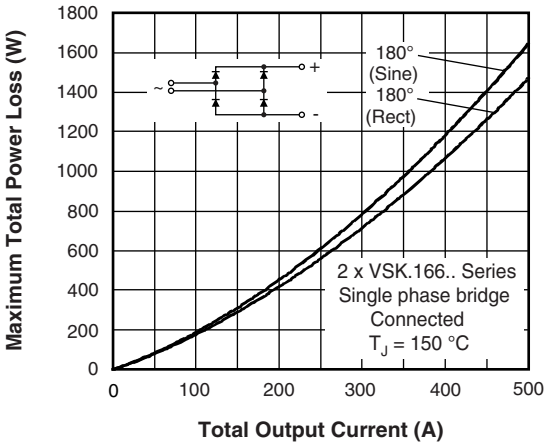


Fig. 7 - On-State Power Loss Characteristics



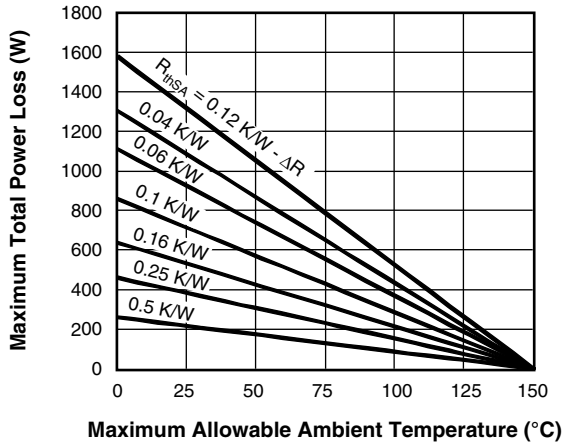


Fig. 8 - On-State Power Loss Characteristics

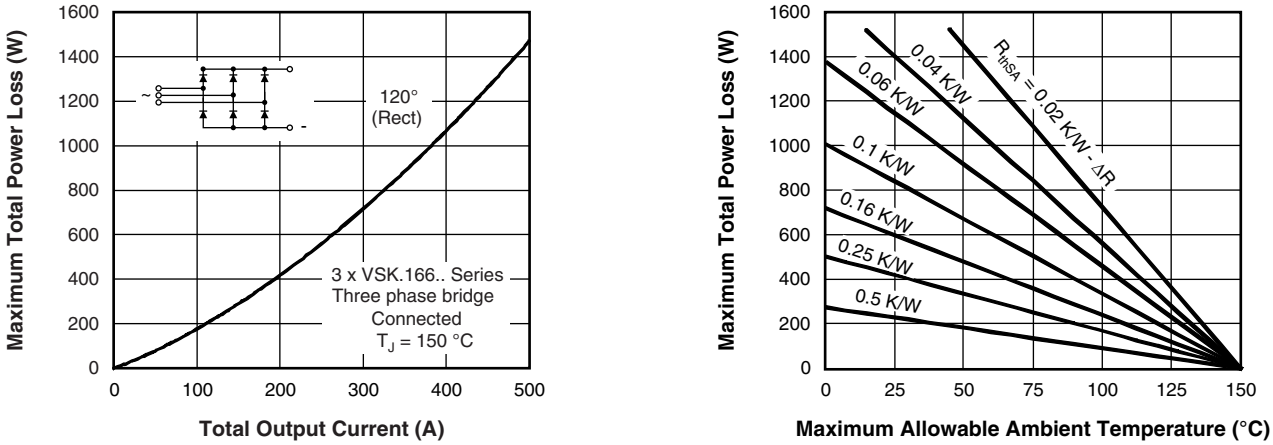


Fig. 9 - On-State Power Loss Characteristics

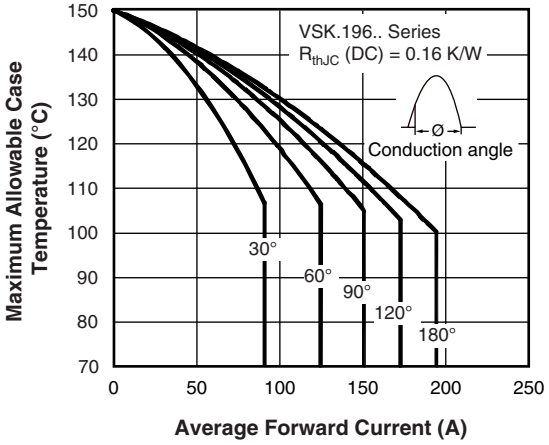


Fig. 10 - Current Ratings Characteristics

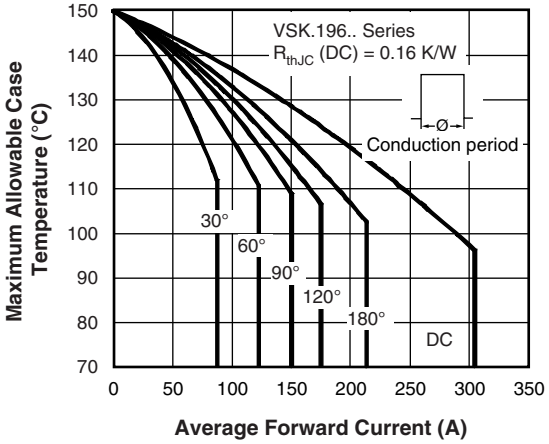


Fig. 11 - Current Ratings Characteristics

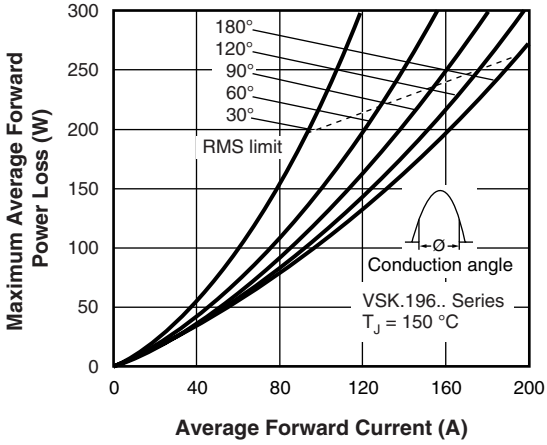


Fig. 12 - On-State Power Loss Characteristics

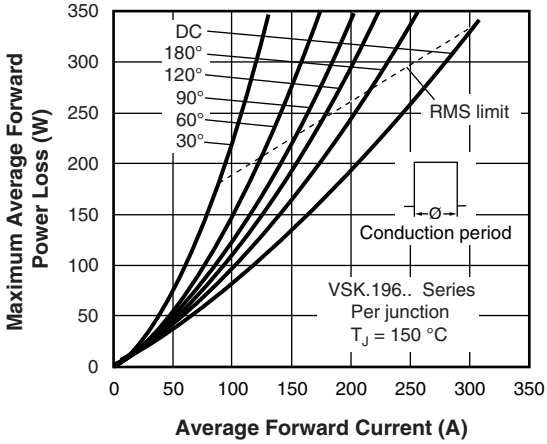


Fig. 13 - On-State Power Loss Characteristics

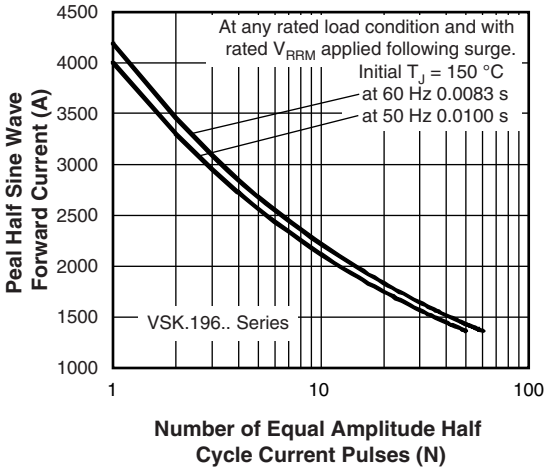


Fig. 14 - Maximum Non-Repetitive Surge Current

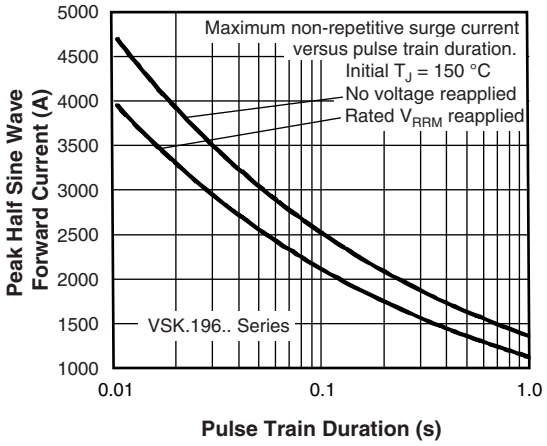
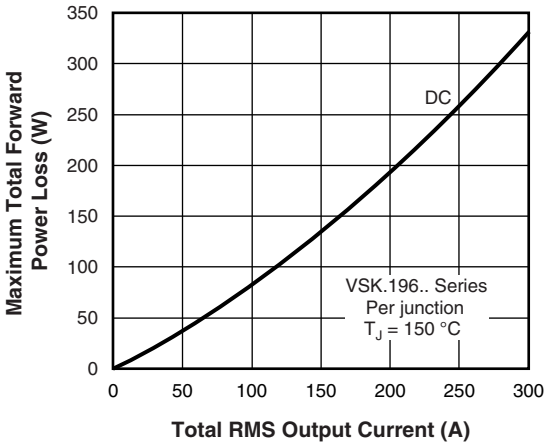


Fig. 15 - Maximum Non-Repetitive Surge Current



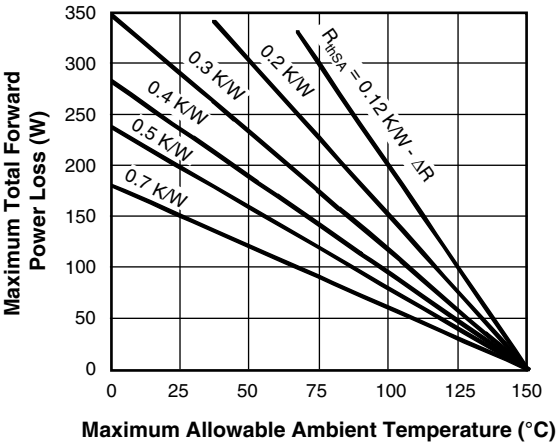
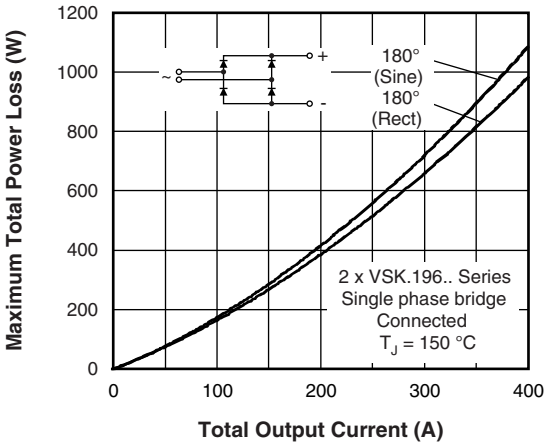


Fig. 16 - On-State Power Loss Characteristics



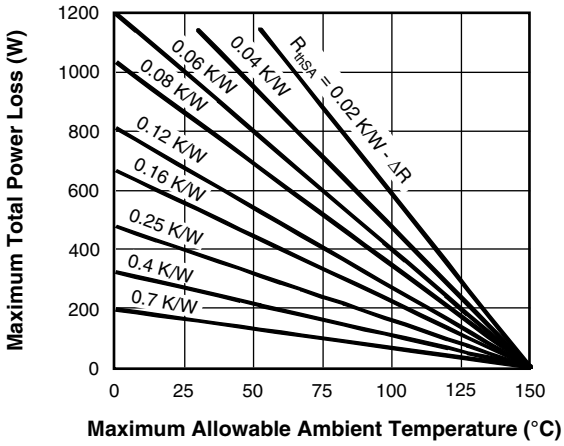
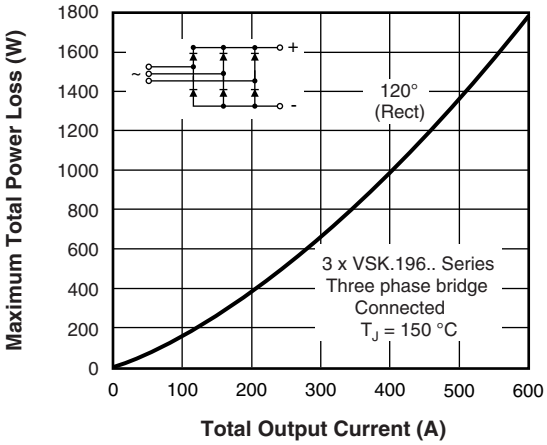


Fig. 17 - On-State Power Loss Characteristics



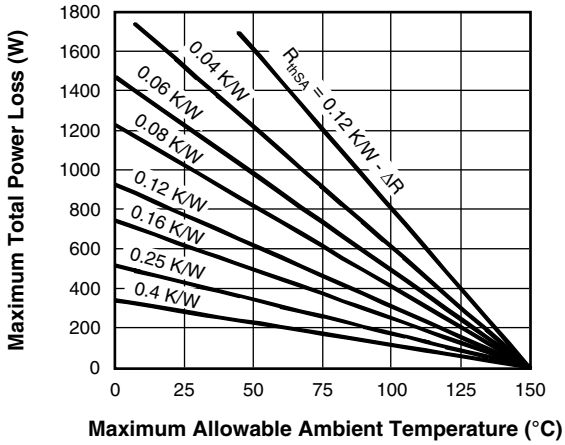


Fig. 18 - On-State Power Loss Characteristics

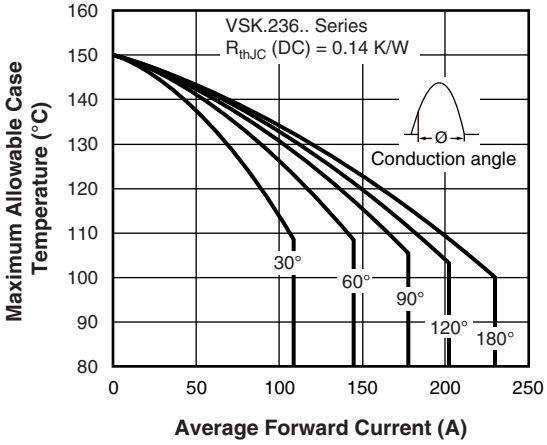


Fig. 19 - Current Ratings Characteristics

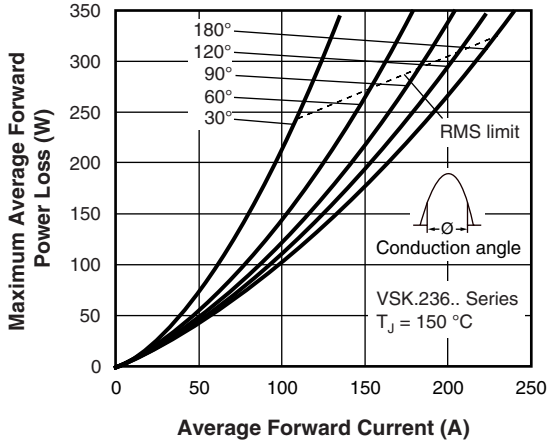


Fig. 21 - On-State Power Loss Characteristics

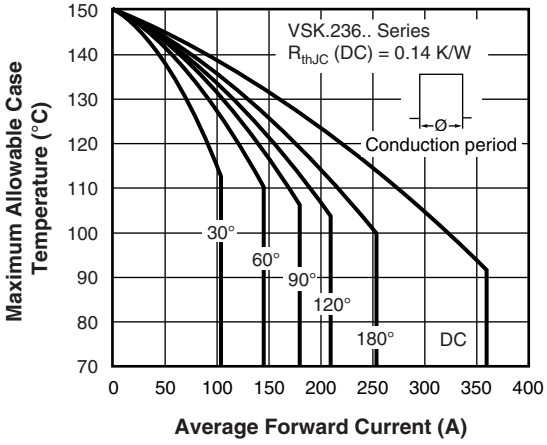


Fig. 20 - Current Ratings Characteristics

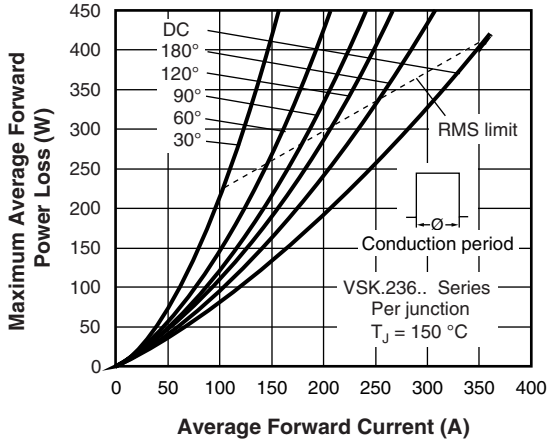


Fig. 22 - On-State Power Loss Characteristics

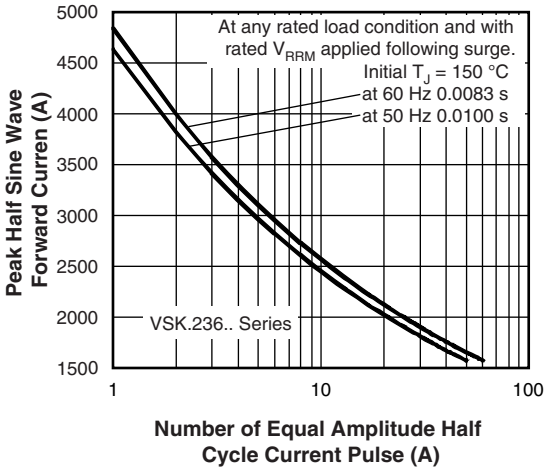


Fig. 23 - Maximum Non-Repetitive Surge Current

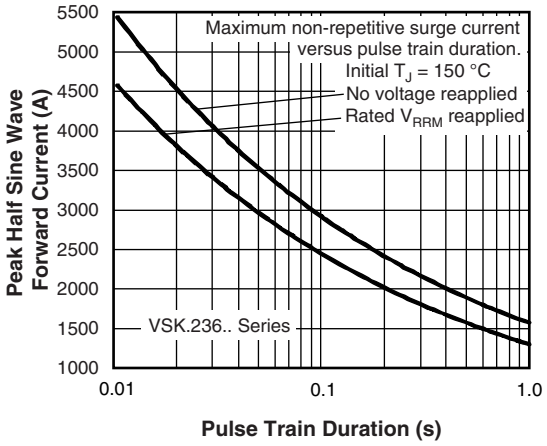
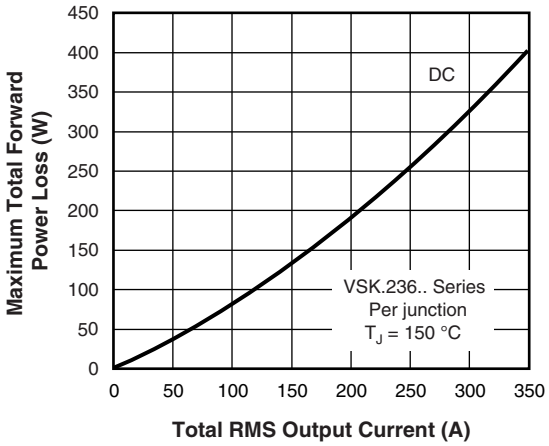


Fig. 24 - Maximum Non-Repetitive Surge Current



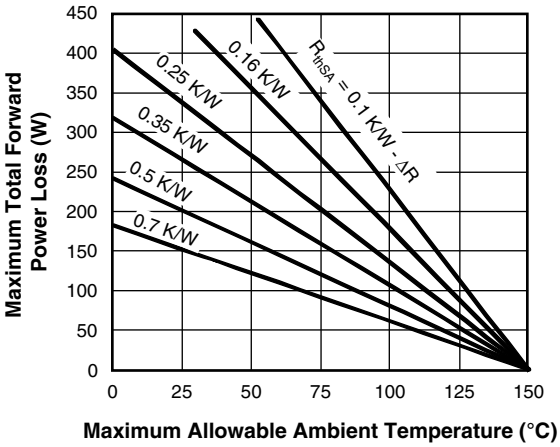
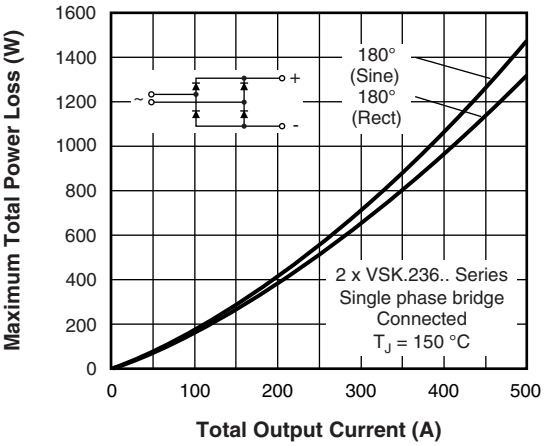


Fig. 25 - On-State Power Loss Characteristics



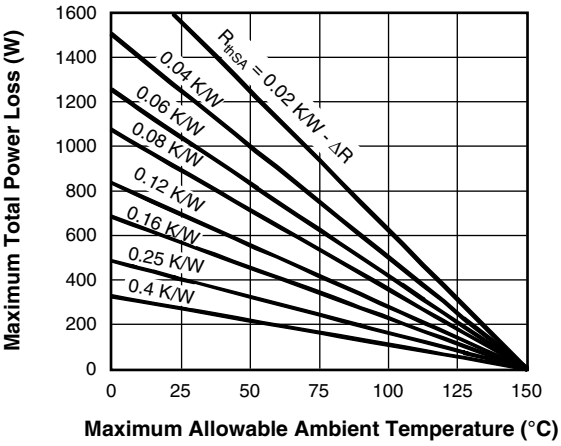
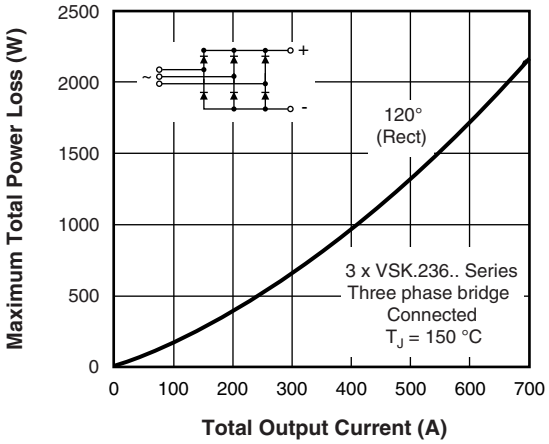


Fig. 26 - On-State Power Loss Characteristics



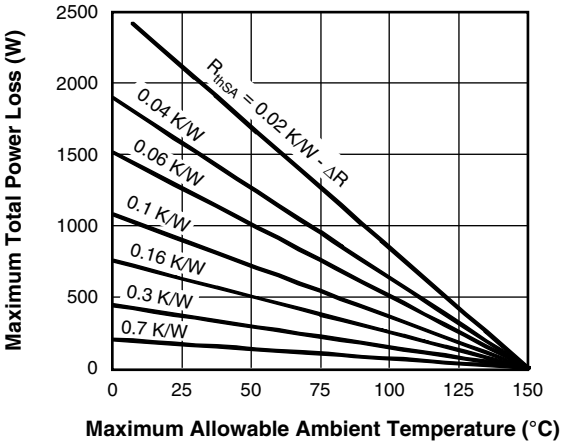


Fig. 27 - On-State Power Loss Characteristics

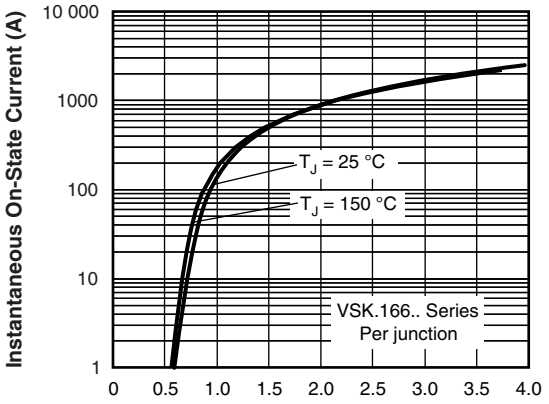


Fig. 28 - On-State Voltage Drop Characteristics

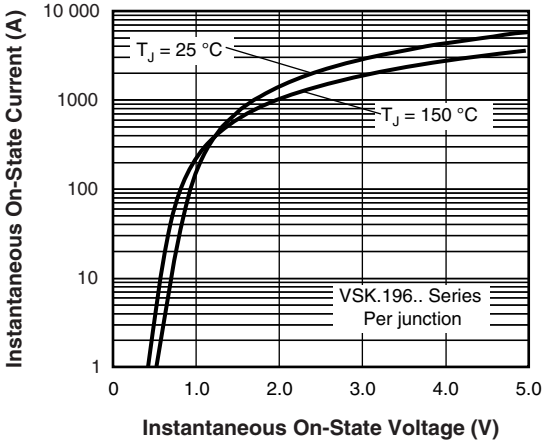


Fig. 29 - On-State Voltage Drop Characteristics

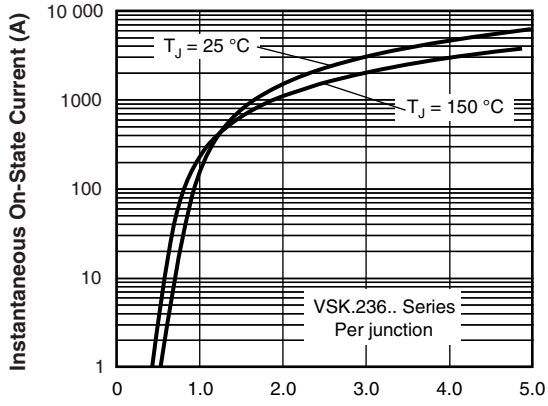


Fig. 30 - On-State Voltage Drop Characteristics

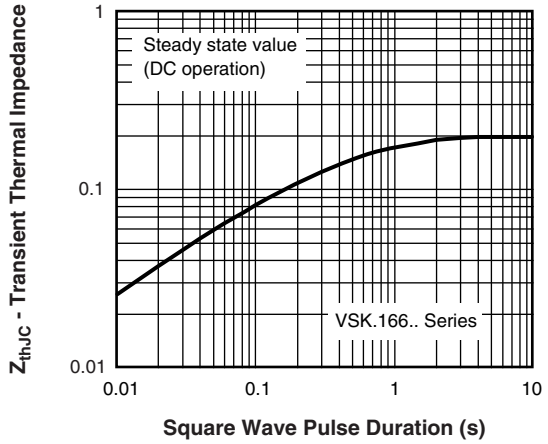


Fig. 31 - Thermal Impedance Z_{thJC} Characteristics

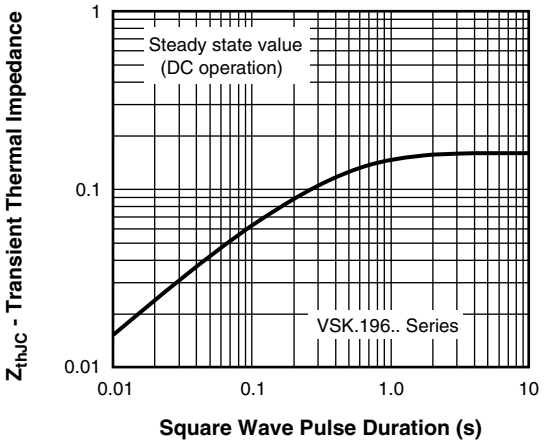


Fig. 32 - Thermal Impedance Z_{thJC} Characteristics

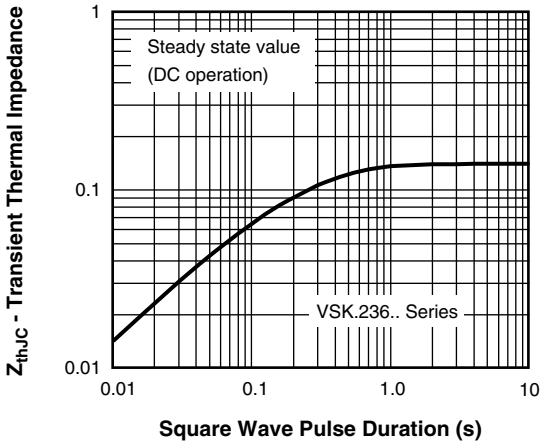


Fig. 33 - Thermal Impedance Z_{thJC} Characteristics

ORDERING INFORMATION TABLE

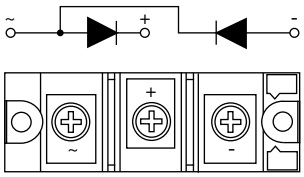
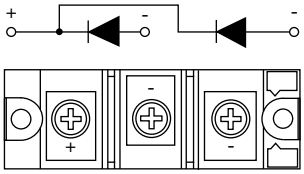
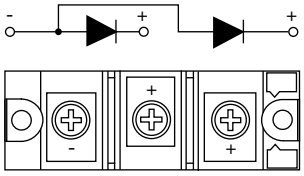
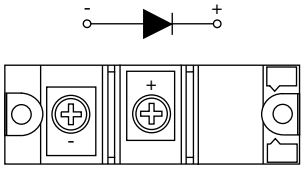
Device code

VS-VS	KD	236	16	PbF
1	2	3	4	5

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 cathode	C	**VSKC...** 
Two diodes common anode	J	**VSKJ...** 
Single diode	E	**VSKE...** 

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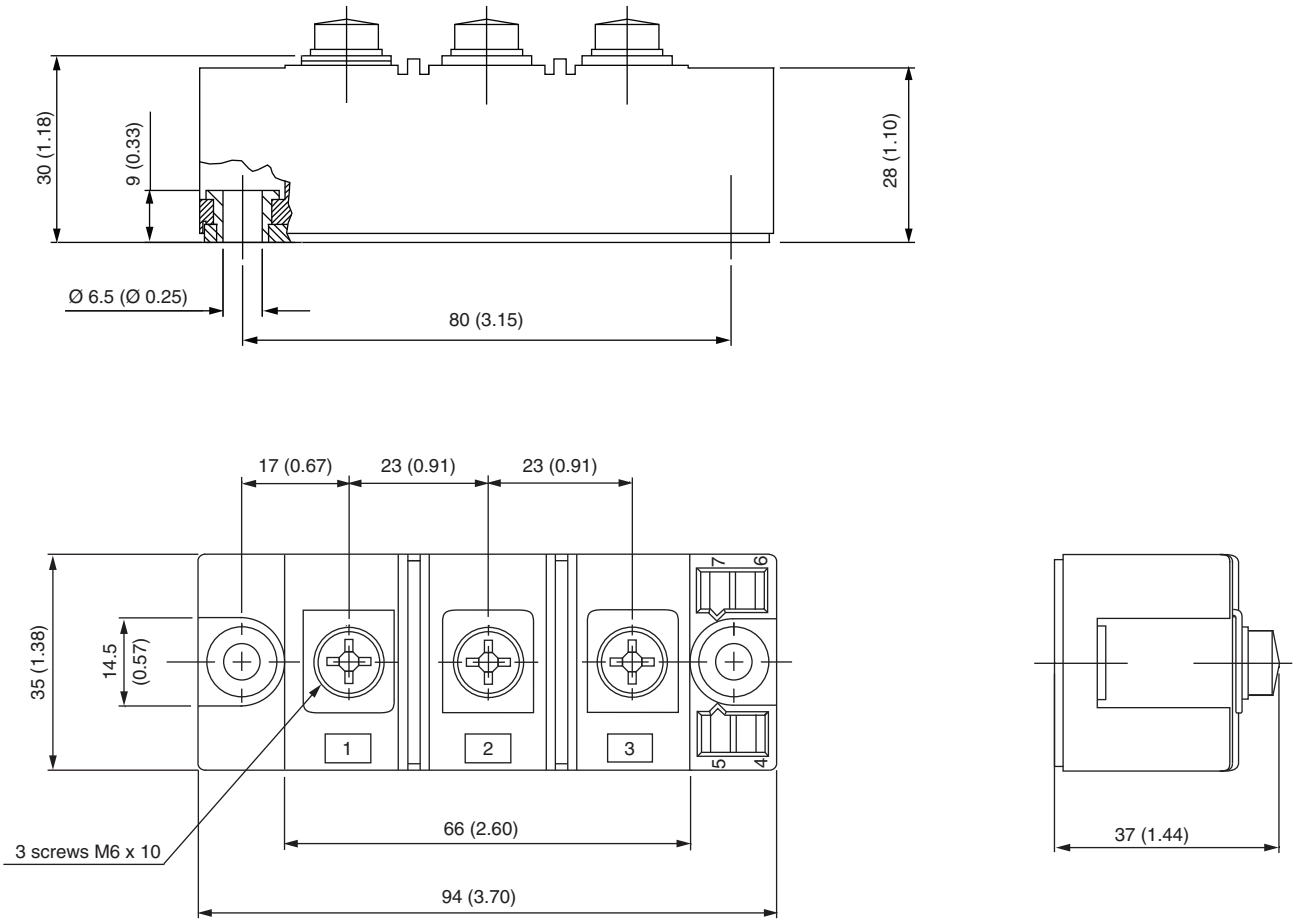
Dimensions	www.vishay.com/doc?95254

INT-A-PAK DBC

DIMENSIONS in millimeters (inches)



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