

## Thyristor/Diode and Thyristor/Thyristor (ADD-A-PAK™ Generation 5 Power Modules), 27 A


**ADD-A-PAK™**

### PRODUCT SUMMARY

$I_{T(AV)}$ or $I_{F(AV)}$	27 A
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### MECHANICAL DESCRIPTION

The Generation 5 of ADD-A-PAK™ modules combine the excellent thermal performance obtained by the usage of Direct Bonded Copper substrate with superior mechanical ruggedness, thanks to the insertion of a solid copper baseplate at the bottom side of the device. The Cu baseplate allows an easier mounting on the majority of heatsink with increased tolerance of surface roughness and improved thermal spread. The Generation 5 of AAP modules is manufactured without hard mold, eliminating in this way any possible direct stress on the leads.

The electrical terminals are secured against axial pull-out: they are fixed to the module housing via a click-stop feature already tested and proved as reliable on other Vishay HPP modules.

### FEATURES

- High voltage
- Industrial standard package
- Thick copper baseplate
- UL E78996 approved
- 3500  $V_{RMS}$  isolating voltage
- Totally lead (Pb)-free
- Designed and qualified for industrial level


**RoHS  
COMPLIANT**

### BENEFITS

- Up to 1600 V
- Fully compatible TO-240AA
- High surge capability
- Easy mounting on heatsink
- $Al_2O_3$  DBC insulator
- Heatsink grounded

### ELECTRICAL DESCRIPTION

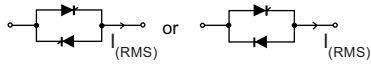
These modules are intended for general purpose high voltage applications such as high voltage regulated power supplies, lighting circuits, temperature and motor speed control circuits, UPS and battery chargers.

### MAJOR RATINGS AND CHARACTERISTICS

SYMBOL	CHARACTERISTICS	VALUES	UNITS
$I_{T(AV)}$ or $I_{F(AV)}$	85 °C	27	A
$I_{O(RMS)}$	As AC switch	60	
$I_{TSM}$ , $I_{FSM}$	50 Hz	400	
	60 Hz	420	
$I^2t$	50 Hz	800	A <sup>2</sup> s
	60 Hz	730	
$I^2\sqrt{t}$		8000	A <sup>2</sup> √s
$V_{RRM}$	Range	400 to 1600	V
$T_{Stg}$		- 40 to 125	°C
$T_J$			

## ELECTRICAL SPECIFICATIONS

VOLTAGE RATINGS					
TYPE NUMBER	VOLTAGE CODE	V <sub>RRM</sub> , MAXIMUM REPETITIVE REVERSE VOLTAGE V	V <sub>RSM</sub> , MAXIMUM NON-REPETITIVE PEAK REVERSE VOLTAGE V	V <sub>DRM</sub> , MAXIMUM REPETITIVE PEAK OFF-STATE VOLTAGE, GATE OPEN CIRCUIT V	I <sub>RRM</sub> , I <sub>DRM</sub> AT 125 °C mA
VSK.26	04	400	500	400	15
	06	600	700	600	
	08	800	900	800	
	10	1000	1100	1000	
	12	1200	1300	1200	
	14	1400	1500	1400	
	16	1600	1700	1600	

ON-STATE CONDUCTION					
PARAMETER	SYMBOL	TEST CONDITIONS		VALUES	UNITS
Maximum average on-state current (thyristors)	I <sub>T(AV)</sub>	180° conduction, half sine wave, T <sub>C</sub> = 85 °C		27	
Maximum average forward current (diodes)	I <sub>F(AV)</sub>				
Maximum continuous RMS on-state current as AC switch	I <sub>O(RMS)</sub>			60	A
Maximum peak, one-cycle non-repetitive on-state or forward current	I <sub>TSM</sub> or I <sub>FSM</sub>	t = 10 ms	No voltage reapplied	Sinusoidal half wave, initial T <sub>J</sub> = T <sub>J</sub> maximum	400
		t = 8.3 ms	No voltage reapplied		420
		t = 10 ms	100 % V <sub>RRM</sub> reapplied	Initial T <sub>J</sub> = T <sub>J</sub> maximum	335
		t = 8.3 ms	100 % V <sub>RRM</sub> reapplied		350
		t = 10 ms	T <sub>J</sub> = 25 °C, no voltage reapplied		470
		t = 8.3 ms	T <sub>J</sub> = 25 °C, no voltage reapplied		490
Maximum I <sup>2</sup> t for fusing	I <sup>2</sup> t	t = 10 ms	No voltage reapplied	Initial T <sub>J</sub> = T <sub>J</sub> maximum	800
		t = 8.3 ms	No voltage reapplied		730
		t = 10 ms	100 % V <sub>RRM</sub> reapplied	Initial T <sub>J</sub> = T <sub>J</sub> maximum	560
		t = 8.3 ms	100 % V <sub>RRM</sub> reapplied		510
		t = 10 ms	T <sub>J</sub> = 25 °C, no voltage reapplied		1100
		t = 8.3 ms	T <sub>J</sub> = 25 °C, no voltage reapplied		1000
Maximum I <sup>2</sup> √t for fusing	I <sup>2</sup> √t <sup>(1)</sup>	t = 0.1 to 10 ms, no voltage reapplied		8000	A <sup>2</sup> √s
Maximum value or threshold voltage	V <sub>T(TO)</sub> <sup>(2)</sup>	Low level <sup>(3)</sup>	T <sub>J</sub> = T <sub>J</sub> maximum	0.92	V
		High level <sup>(4)</sup>		0.95	
Maximum value of on-state slope resistance	r <sub>t</sub> <sup>(2)</sup>	Low level <sup>(3)</sup>	T <sub>J</sub> = T <sub>J</sub> maximum	12.11	mΩ
		High level <sup>(4)</sup>		11.82	
Maximum peak on-state or forward voltage	V <sub>TM</sub>	I <sub>TM</sub> = π × I <sub>T(AV)</sub>	T <sub>J</sub> = 25 °C	1.95	V
	V <sub>FM</sub>	I <sub>FM</sub> = π × I <sub>F(AV)</sub>			
Maximum non-repetitive rate of rise of turned on current	di/dt	T <sub>J</sub> = 25 °C, from 0.67 V <sub>DRM</sub> , I <sub>TM</sub> = π × I <sub>T(AV)</sub> , I <sub>g</sub> = 500 mA, t <sub>r</sub> < 0.5 μs, t <sub>p</sub> > 6 μs		150	A/μs
Maximum holding current	I <sub>H</sub>	T <sub>J</sub> = 25 °C, anode supply = 6 V, resistive load, gate open circuit		200	mA
Maximum latching current	I <sub>L</sub>	T <sub>J</sub> = 25 °C, anode supply = 6 V, resistive load		400	

### Notes

(1) I<sup>2</sup>t for time t<sub>x</sub> = I<sup>2</sup>√t × √t<sub>x</sub>

(2) Average power = V<sub>T(TO)</sub> × I<sub>T(AV)</sub> + r<sub>t</sub> × (I<sub>T(RMS)</sub>)<sup>2</sup>

(3) 16.7 % × π × I<sub>AV</sub> < I < π × I<sub>AV</sub>

(4) I > π × I<sub>AV</sub>



TRIGGERING					
PARAMETER	SYMBOL	TEST CONDITIONS		VALUES	UNITS
Maximum peak gate power	$P_{GM}$			10	W
Maximum average gate power	$P_{G(AV)}$			2.5	
Maximum peak gate current	$I_{GM}$			2.5	A
Maximum peak negative gate voltage	$-V_{GM}$			10	V
Maximum gate voltage required to trigger	$V_{GT}$	$T_J = -40\text{ °C}$	Anode supply = 6 V resistive load	4.0	
		$T_J = 25\text{ °C}$		2.5	
		$T_J = 125\text{ °C}$		1.7	
Maximum gate current required to trigger	$I_{GT}$	$T_J = -40\text{ °C}$	Anode supply = 6 V resistive load	270	mA
		$T_J = 25\text{ °C}$		150	
		$T_J = 125\text{ °C}$		80	
Maximum gate voltage that will not trigger	$V_{GD}$	$T_J = 125\text{ °C}$ , rated $V_{DRM}$ applied		0.25	V
Maximum gate current that will not trigger	$I_{GD}$	$T_J = 125\text{ °C}$ , rated $V_{DRM}$ applied		6	mA

BLOCKING					
PARAMETER	SYMBOL	TEST CONDITIONS		VALUES	UNITS
Maximum peak reverse and off-state leakage current at $V_{RRM}$ , $V_{DRM}$	$I_{RRM}$ , $I_{DRM}$	$T_J = 125\text{ °C}$ , gate open circuit		15	mA
RMS insulation voltage	$V_{INS}$	50 Hz, circuit to base, all terminals shorted		2500 (1 min) 3500 (1 s)	V
Maximum critical rate of rise of off-state voltage	$dV/dt^{(1)}$	$T_J = 125\text{ °C}$ , linear to $0.67 V_{DRM}$		500	V/μs

**Note**

(1) Available with  $dV/dt = 1000\text{ V/ms}$ , to complete code add S90 i.e. VSKT26/16AS90

THERMAL AND MECHANICAL SPECIFICATIONS					
PARAMETER	SYMBOL	TEST CONDITIONS		VALUES	UNITS
Junction operating and storage temperature range	$T_J, T_{Stg}$			- 40 to 125	°C
Maximum internal thermal resistance, junction to case per module	$R_{thJC}$	DC operation		0.31	K/W
Typical thermal resistance, case to heatsink	$R_{thCS}$	Mounting surface flat, smooth and greased		0.1	
Mounting torque ± 10 %	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.		5	Nm
	busbar			3	
Approximate weight				110	g
				4	oz.
Case style		JEDEC		TO-240AA	

ΔR CONDUCTION PER JUNCTION											
DEVICES	SINE HALF WAVE CONDUCTION					RECTANGULAR WAVE CONDUCTION					UNITS
	180°	120°	90°	60°	30°	180°	120°	90°	60°	30°	
VSK.26	0.23	0.27	0.34	0.48	0.73	0.17	0.28	0.36	0.49	0.73	°C/W

**Note**

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

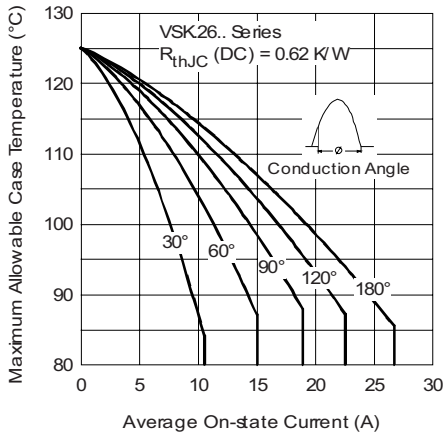


Fig. 1 - Current Ratings Characteristics

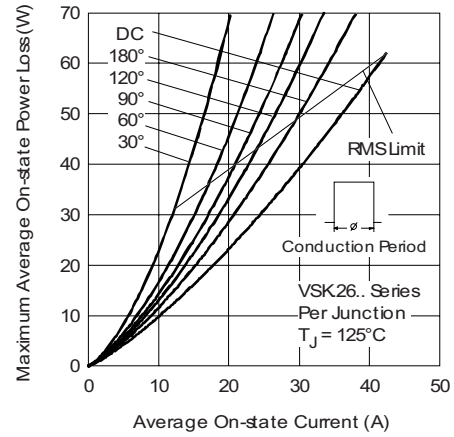


Fig. 4 - On-State Power Loss Characteristics

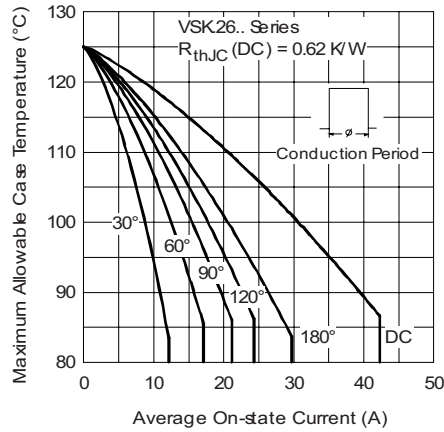


Fig. 2 - Current Ratings Characteristics

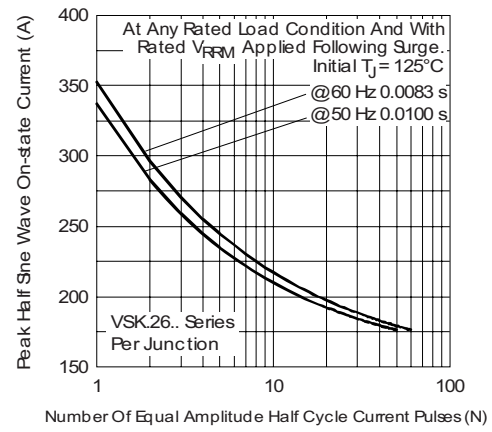


Fig. 5 - Maximum Non-Repetitive Surge Current

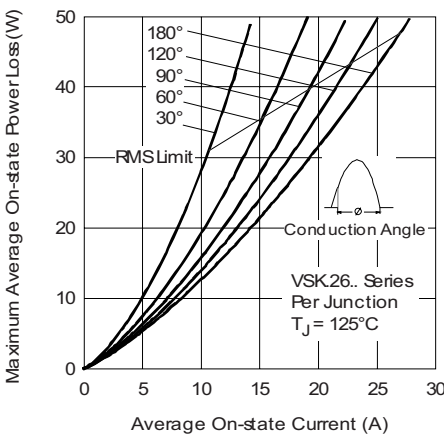


Fig. 3 - On-State Power Loss Characteristics

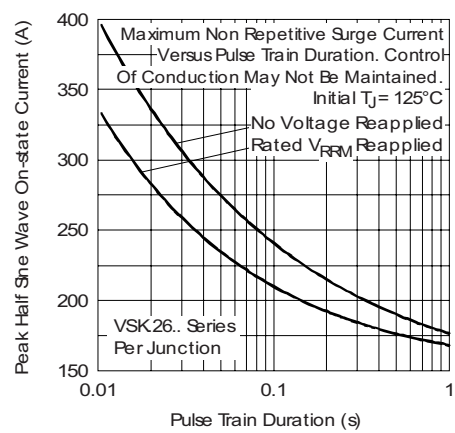


Fig. 6 - Maximum Non-Repetitive Surge Current

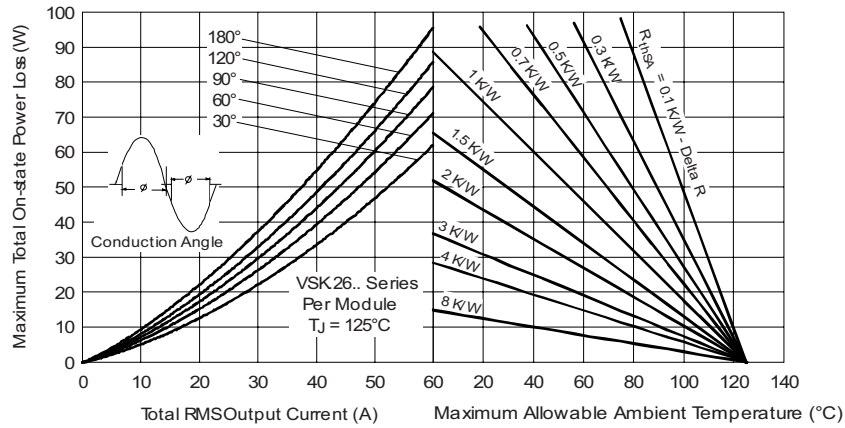


Fig. 7 - On-State Power Loss Characteristics

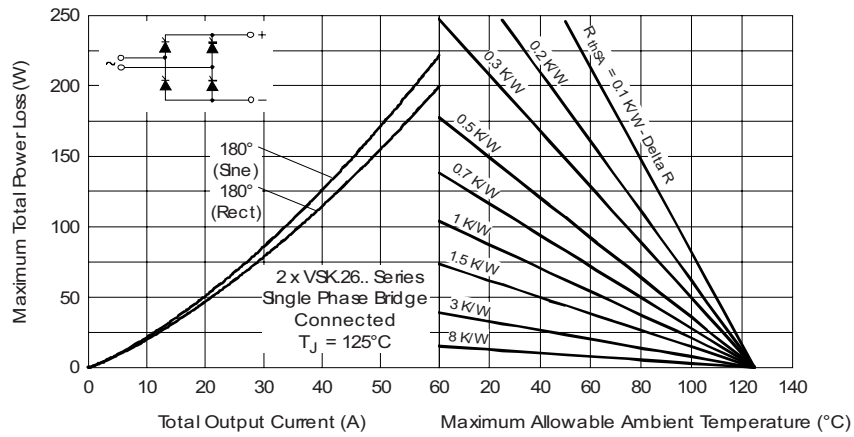


Fig. 8 - On-State Power Loss Characteristics

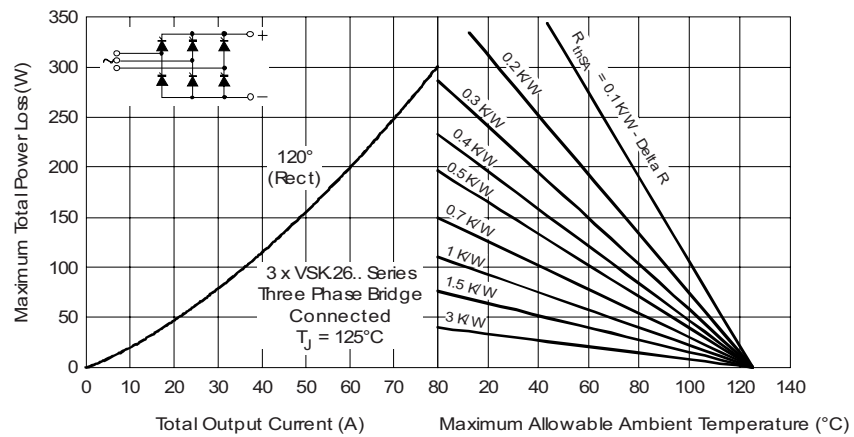


Fig. 9 - On-State Power Loss Characteristics

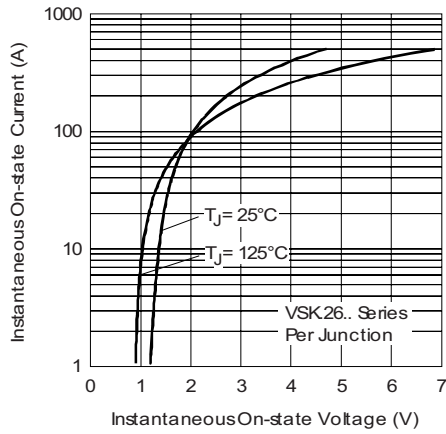


Fig. 10 - On-State Voltage Drop Characteristics

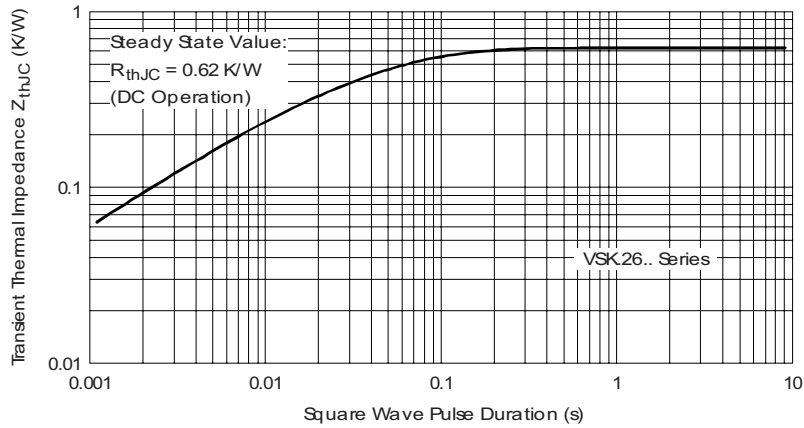


Fig. 11 - Thermal Impedance  $Z_{thJC}$  Characteristics

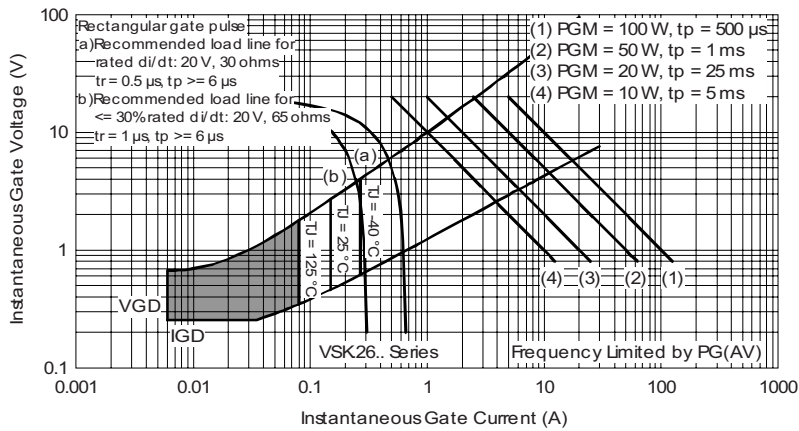


Fig. 12 - Gate Characteristics



**ORDERING INFORMATION TABLE**

Device code	VSK	T	26	/	16	S90	P
	①	②	③		④	⑤	⑥

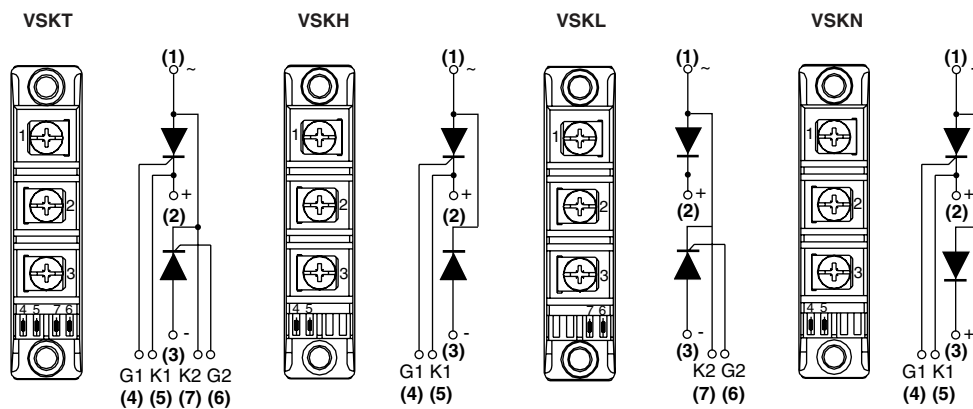
- 1** - Module type
- 2** - Circuit configuration (see end of datasheet)
- 3** - Current code <sup>(1)</sup>
- 4** - Voltage code (see Voltage Ratings table)
- 5** - dV/dt code: S90 = dV/dt 1000 V/μs  
No letter = dV/dt 500 V/μs
- 6** - P = Lead (Pb)-free

<sup>(1)</sup> Available with no auxiliary cathode  
(for details see dimensions - link at the end of datasheet)  
To specify change: 26 to 27  
e.g.: VSKT27/16P etc.

**Note**

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

**CIRCUIT CONFIGURATION**



**LINKS TO RELATED DOCUMENTS**

Dimensions	<a href="http://www.vishay.com/doc?95085">http://www.vishay.com/doc?95085</a>
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