



## AAP Gen 7 (TO-240AA) Power Modules Thyristor/Diode and Thyristor/Thyristor, 95 A




ADD-A-PAK

PRIMARY CHARACTERISTICS	
$I_{T(AV)}$ or $I_{F(AV)}$	95 A
Type	Modules - thyristor, standard
Package	AAP Gen 7 (TO-240AA)

### MECHANICAL DESCRIPTION

The AAP Gen 7 (TO-240AA), new generation of AAP module, combines the excellent thermal performances obtained by the usage of exposed direct bonded copper substrate, with advanced compact simple package solution and simplified internal structure with minimized number of interfaces.

### FEATURES

- High voltage
- Industrial standard package
- Low thermal resistance
- UL approved file E78996 
- Designed and qualified for industrial level
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



RoHS  
COMPLIANT

### BENEFITS

- Excellent thermal performances obtained by the usage of exposed direct bonded copper substrate
- Up to 1600 V
- High surge capability
- Easy mounting on heatsink

### ELECTRICAL DESCRIPTION

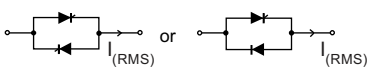
These modules are intended for general purpose high voltage applications such as high voltage regulated power supplies, lighting circuits, temperature and motor speed control circuits, UPS and battery charger.

MAJOR RATINGS AND CHARACTERISTICS			
SYMBOL	CHARACTERISTICS	VALUES	UNITS
$I_{T(AV)}$ or $I_{F(AV)}$	85 °C	95	A
$I_{O(RMS)}$	As AC switch	210	
$I_{TSM}$ , $I_{FSM}$	50 Hz	2000	
	60 Hz	2094	
$I^2t$	50 Hz	20	kA <sup>2</sup> s
	60 Hz	18.26	
$I^2\sqrt{t}$		200	kA <sup>2</sup> √s
$V_{RRM}$	Range	400 to 1600	V
$T_{Stg}$		-40 to +125	°C
$T_J$		-40 to +125	°C



**ELECTRICAL SPECIFICATIONS**

VOLTAGE RATINGS					
TYPE NUMBER	VOLTAGE CODE	V <sub>RRM</sub> , MAXIMUM REPETITIVE PEAK 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
VS-VSK.91	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		95	A
Maximum average forward current (diodes)	I <sub>F(AV)</sub>				
Maximum continuous RMS on-state current, as AC switch	I <sub>O(RMS)</sub>			210	
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 reappplied	Sinusoidal half wave, initial T <sub>J</sub> = T <sub>J</sub> maximum	2000
		t = 8.3 ms	No voltage reappplied		2094
		t = 10 ms	100 % V <sub>RRM</sub> reappplied		1682
		t = 8.3 ms	100 % V <sub>RRM</sub> reappplied		1760
Maximum I <sup>2</sup> t for fusing	I <sup>2</sup> t	t = 10 ms	No voltage reappplied	Initial T <sub>J</sub> = T <sub>J</sub> maximum	20
		t = 8.3 ms	No voltage reappplied		18.26
		t = 10 ms	100 % V <sub>RRM</sub> reappplied		14.14
		t = 8.3 ms	100 % V <sub>RRM</sub> reappplied		12.91
Maximum I <sup>2</sup> √t for fusing	I <sup>2</sup> √t (1)	t = 0.1 ms to 10 ms, no voltage reappplied T <sub>J</sub> = T <sub>J</sub> maximum		200	kA <sup>2</sup> √s
Maximum value or threshold voltage	V <sub>T(TO)</sub> (2)	Low level (3)	T <sub>J</sub> = T <sub>J</sub> maximum	0.97	V
		High level (4)		1.1	
Maximum value of on-state slope resistance	r <sub>t</sub> (2)	Low level (3)	T <sub>J</sub> = T <sub>J</sub> maximum	2.76	mΩ
		High level (4)		2.38	
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	1.73	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		250	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	$P_{GM}$			12	W
Maximum average gate power	$P_{G(AV)}$			3.0	
Maximum peak gate current	$I_{GM}$			3.0	A
Maximum peak negative gate voltage	$-V_{GM}$			10	V
Maximum gate voltage required to trigger	$V_{GT}$	$T_J = -40\text{ }^\circ\text{C}$	Anode supply = 6 V resistive load	4.0	
		$T_J = 25\text{ }^\circ\text{C}$		2.5	
		$T_J = 125\text{ }^\circ\text{C}$		1.7	
Maximum gate current required to trigger	$I_{GT}$	$T_J = -40\text{ }^\circ\text{C}$	Anode supply = 6 V resistive load	270	mA
		$T_J = 25\text{ }^\circ\text{C}$		150	
		$T_J = 125\text{ }^\circ\text{C}$		80	
Maximum gate voltage that will not trigger	$V_{GD}$	$T_J = 125\text{ }^\circ\text{C}$ , rated $V_{DRM}$ applied		0.25	V
Maximum gate current that will not trigger	$I_{GD}$	$T_J = 125\text{ }^\circ\text{C}$ , rated $V_{DRM}$ applied		6	mA

BLOCKING					
PARAMETER	SYMBOL	TEST CONDITIONS		VALUES	UNITS
Maximum peak reverse and off-state leakage current at $V_{RRM}$ , $V_{DRM}$	$I_{RRM}$ , $I_{DRM}$	$T_J = 125\text{ }^\circ\text{C}$ , gate open circuit		15	mA
Maximum RMS insulation voltage	$V_{INS}$	50 Hz		3000 (1 min) 3600 (1 s)	V
Maximum critical rate of rise of off-state voltage	$dV/dt$	$T_J = 125\text{ }^\circ\text{C}$ , linear to $0.67 V_{DRM}$		1000	V/ $\mu$ s

THERMAL AND MECHANICAL SPECIFICATIONS						
PARAMETER	SYMBOL	TEST CONDITIONS		VALUES	UNITS	
Junction operating and storage temperature range	$T_J$ , $T_{Stg}$			-40 to +125	$^\circ\text{C}$	
Maximum internal thermal resistance, junction to case per leg	$R_{thJC}$	DC operation		0.22	$^\circ\text{C/W}$	
Typical thermal resistance, case to heatsink per module	$R_{thCS}$	Mounting surface flat, smooth and greased		0.1		
Mounting torque $\pm 10\%$	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.		4	Nm	
	busbar			3		
Approximate weight					75	g
Case style			JEDEC <sup>®</sup>		AAP Gen 7 (TO-240AA)	

$\Delta R$ CONDUCTION PER JUNCTION											
DEVICES	SINE HALF WAVE CONDUCTION					RECTANGULAR WAVE CONDUCTION					UNITS
	180 $^\circ$	120 $^\circ$	90 $^\circ$	60 $^\circ$	30 $^\circ$	180 $^\circ$	120 $^\circ$	90 $^\circ$	60 $^\circ$	30 $^\circ$	
VSK.91..	0.04	0.048	0.063	0.085	0.125	0.033	0.052	0.067	0.088	0.127	$^\circ\text{C/W}$

**Note**

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

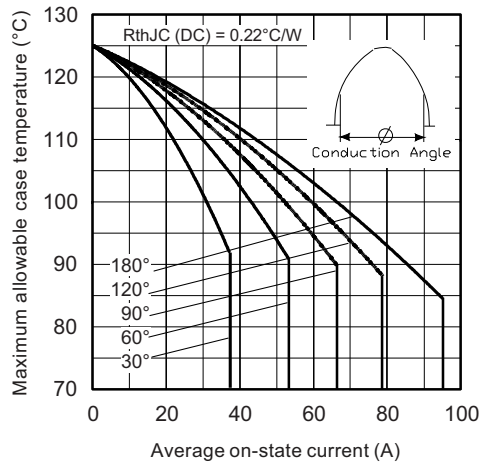


Fig. 1 - Current Ratings Characteristics

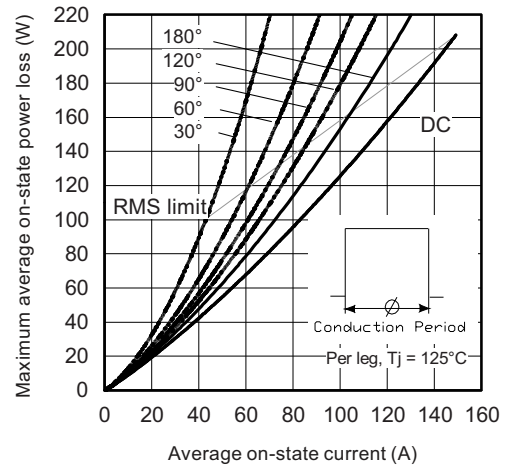


Fig. 4 - On-State Power Loss Characteristics

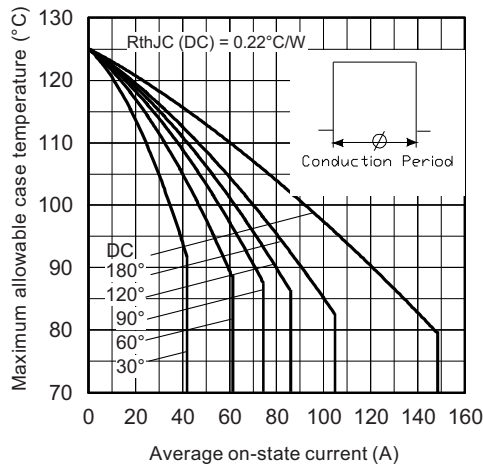


Fig. 2 - Current Ratings Characteristics

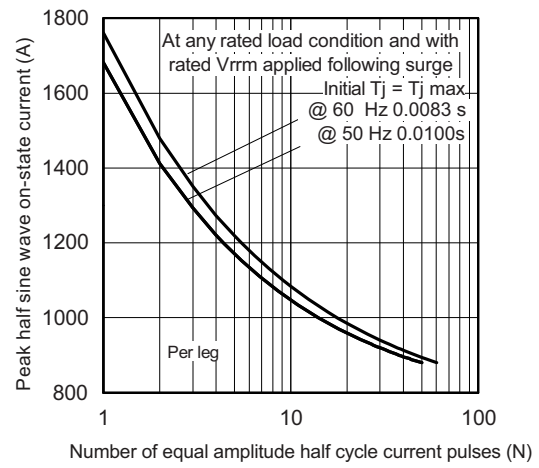


Fig. 5 - Maximum Non-Repetitive Surge Current

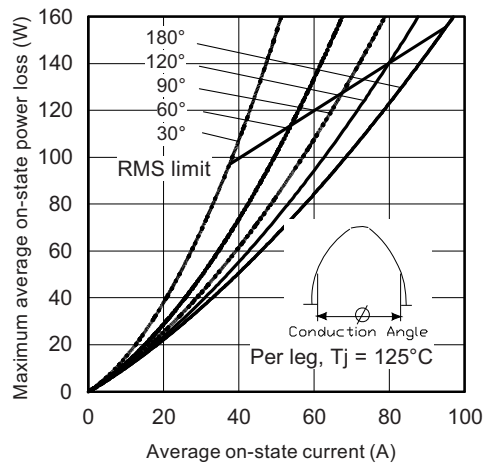


Fig. 3 - On-State Power Loss Characteristics

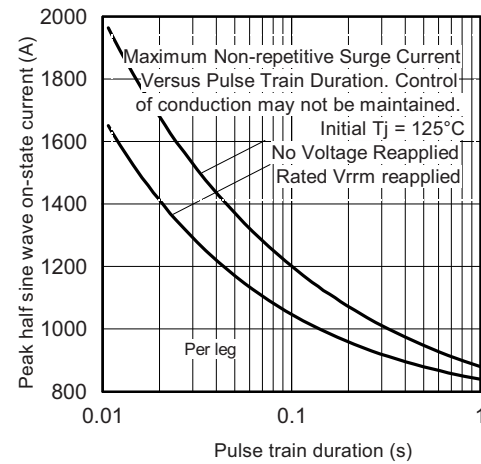


Fig. 6 - Maximum Non-Repetitive Surge Current



Fig. 7 - On-State Power Loss Characteristics

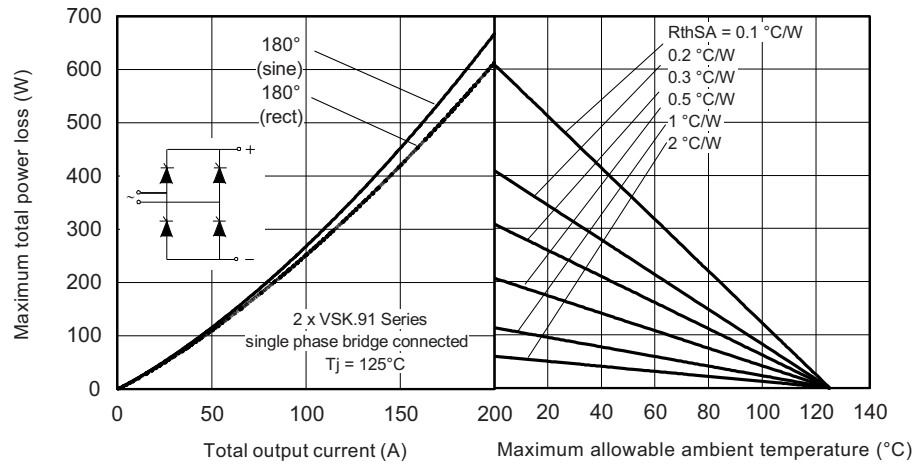


Fig. 8 - On-State Power Loss Characteristics

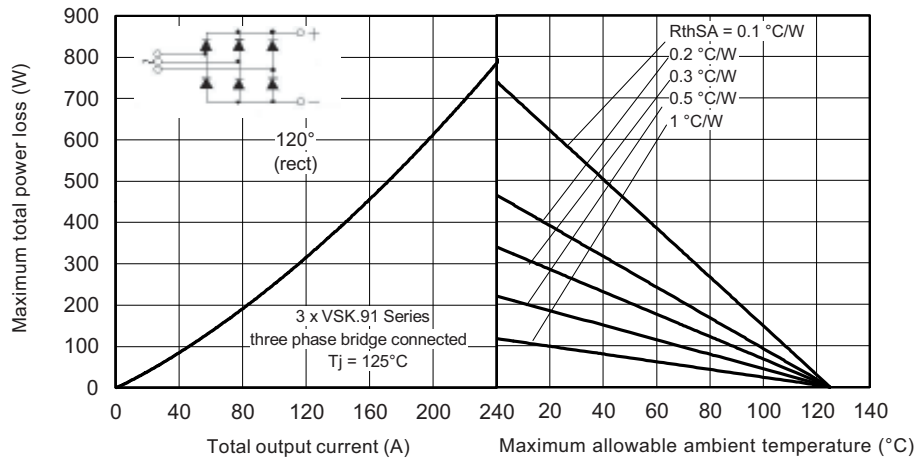


Fig. 9 - On-State Power Loss Characteristics

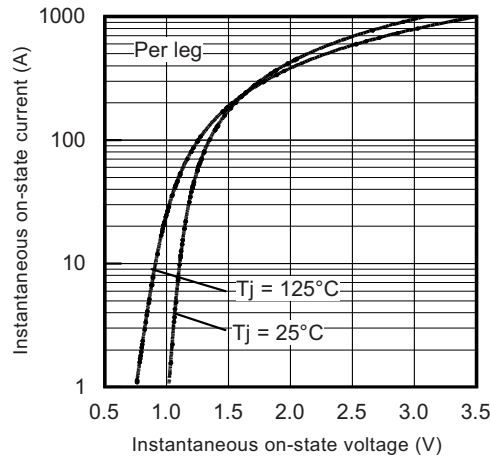


Fig. 10 - On-State Voltage Drop Characteristics

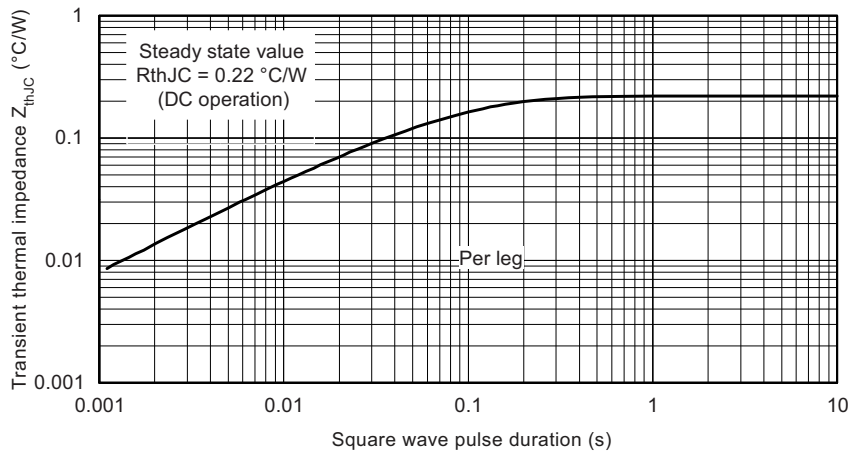


Fig. 11 - Thermal Impedance  $Z_{thJC}$  Characteristics

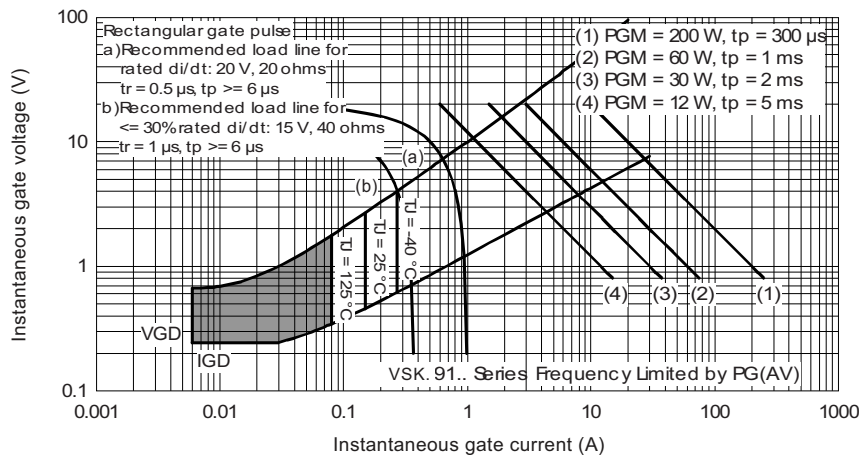


Fig. 12 - Gate Characteristics



**ORDERING INFORMATION TABLE**

Device code	<b>VS-VS</b>	<b>K</b>	<b>T</b>	<b>91</b>	<b>/</b>	<b>16</b>
	①	②	③	④		⑤

- 1** - Vishay Semiconductors product
- 2** - Module type
- 3** - Circuit configuration (see Circuit Configuration table)
- 4** - Current code (95 A)
- 5** - Voltage code (see Voltage Ratings table)

**Note**

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

<b>CIRCUIT CONFIGURATION</b>		
<b>CIRCUIT DESCRIPTION</b>	<b>CIRCUIT CONFIGURATION CODE</b>	<b>CIRCUIT DRAWING</b>
Two SCRs doubler circuit	T	
SCR/diode doubler circuit, positive control	H	
SCR/diode doubler circuit, negative control	L	
SCR/diode common anodes	N	

<b>LINKS TO RELATED DOCUMENTS</b>	
Dimensions	<a href="http://www.vishay.com/doc?95368">www.vishay.com/doc?95368</a>

## ADD-A-PAK Generation VII - Thyristor

**DIMENSIONS** in millimeters (inches)







## Disclaimer

ALL PRODUCT, PRODUCT SPECIFICATIONS AND DATA ARE SUBJECT TO CHANGE WITHOUT NOTICE TO IMPROVE RELIABILITY, FUNCTION OR DESIGN OR OTHERWISE.

Vishay Intertechnology, Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, "Vishay"), disclaim any and all liability for any errors, inaccuracies or incompleteness contained in any datasheet or in any other disclosure relating to any product.

Vishay makes no warranty, representation or guarantee regarding the suitability of the products for any particular purpose or the continuing production of any product. To the maximum extent permitted by applicable law, Vishay disclaims (i) any and all liability arising out of the application or use of any product, (ii) any and all liability, including without limitation special, consequential or incidental damages, and (iii) any and all implied warranties, including warranties of fitness for particular purpose, non-infringement and merchantability.

Statements regarding the suitability of products for certain types of applications are based on Vishay's knowledge of typical requirements that are often placed on Vishay products in generic applications. Such statements are not binding statements about the suitability of products for a particular application. It is the customer's responsibility to validate that a particular product with the properties described in the product specification is suitable for use in a particular application. Parameters provided in datasheets and / or specifications may vary in different applications and performance may vary over time. All operating parameters, including typical parameters, must be validated for each customer application by the customer's technical experts. Product specifications do not expand or otherwise modify Vishay's terms and conditions of purchase, including but not limited to the warranty expressed therein.

Hyperlinks included in this datasheet may direct users to third-party websites. These links are provided as a convenience and for informational purposes only. Inclusion of these hyperlinks does not constitute an endorsement or an approval by Vishay of any of the products, services or opinions of the corporation, organization or individual associated with the third-party website. Vishay disclaims any and all liability and bears no responsibility for the accuracy, legality or content of the third-party website or for that of subsequent links.

Except as expressly indicated in writing, Vishay products are not designed for use in medical, life-saving, or life-sustaining applications or for any other application in which the failure of the Vishay product could result in personal injury or death. Customers using or selling Vishay products not expressly indicated for use in such applications do so at their own risk. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Vishay. Product names and markings noted herein may be trademarks of their respective owners.