

## Thyristor/Diode and Thyristor/Thyristor (ADD-A-PAK Generation 5 Power Modules), 105 A



ADD-A-PAK

### PRODUCT SUMMARY

$I_{T(AV)}$ or $I_{F(AV)}$	105 A
----------------------------	-------

### 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<sub>RMS</sub> 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<sub>2</sub>O<sub>3</sub> DBC insulator
- Heatsink grounded

### ELECTRICAL DESCRIPTION

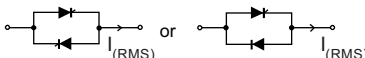
These modules are intended for general purpose high voltage applications such as high voltage regulated power supplies, lighting circuits, temperature and motor speed control circuits, UPS and battery charger.

### MAJOR RATINGS AND CHARACTERISTICS

SYMBOL	CHARACTERISTICS	VALUES	UNITS
$I_{T(AV)}$ or $I_{F(AV)}$	85 °C	105	A
$I_{O(RMS)}$	As AC switch	235	
$I_{TSM}$ , $I_{FSM}$	50 Hz 60 Hz	1785 1870	
$I^2t$	50 Hz	15.91	kA <sup>2</sup> s
	60 Hz	14.52	
$I^2\sqrt{t}$		159.1	kA <sup>2</sup> √s
$V_{RRM}$	Range	400 to 1600	V
$T_{Stg}$		- 40 to 150	°C
$T_J$		- 40 to 130	

## 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 130 °C mA
VSK.105	04	400	500	400	20
	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			105	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>				235	
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	1785	
		t = 8.3 ms			1870	
		t = 10 ms	100 % V <sub>RRM</sub> reapplied		1500	
		t = 8.3 ms			1570	
		t = 10 ms	T <sub>J</sub> = 25 °C, no voltage reapplied	2000		
		t = 8.3 ms		2100		
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	15.91	kA <sup>2</sup> s
		t = 8.3 ms			14.52	
		t = 10 ms	100 % V <sub>RRM</sub> reapplied		11.25	
		t = 8.3 ms			10.27	
		t = 10 ms	T <sub>J</sub> = 25 °C, no voltage reapplied	20.00		
		t = 8.3 ms		18.30		
Maximum I <sup>2</sup> √t for fusing	I <sup>2</sup> √t (1)	t = 0.1 to 10 ms, no voltage reapplied T <sub>J</sub> = T <sub>J</sub> maximum			159.1	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		0.80	V
		High level (4)			0.85	
Maximum value of on-state slope resistance	r <sub>t</sub> (2)	Low level (3)	T <sub>J</sub> = T <sub>J</sub> maximum		2.37	mΩ
		High level (4)			2.25	
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		1.64	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 <sub>GM</sub>			12	W
Maximum average gate power	P <sub>G(AV)</sub>			3	
Maximum peak gate current	I <sub>GM</sub>			3	A
Maximum peak negative gate voltage	- V <sub>GM</sub>			10	V
Maximum gate voltage required to trigger	V <sub>GT</sub>	T <sub>J</sub> = - 40 °C	Anode supply = 6 V resistive load	4.0	
		T <sub>J</sub> = 25 °C		2.5	
		T <sub>J</sub> = 125 °C		1.7	
Maximum gate current required to trigger	I <sub>GT</sub>	T <sub>J</sub> = - 40 °C	Anode supply = 6 V resistive load	270	mA
		T <sub>J</sub> = 25 °C		150	
		T <sub>J</sub> = 125 °C		80	
Maximum gate voltage that will not trigger	V <sub>GD</sub>	T <sub>J</sub> = 125 °C, rated V <sub>DRM</sub> applied		0.25	V
Maximum gate current that will not trigger	I <sub>GD</sub>	T <sub>J</sub> = 125 °C, rated V <sub>DRM</sub> applied		6	mA

BLOCKING				
PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Maximum peak reverse and off-state leakage current at $V_{RRM}$ , $V_{DRM}$	$I_{RRM}$ , $I_{DRM}$	$T_J = 130\text{ }^{\circ}\text{C}$ , gate open circuit	20	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	$dV/dt$ <sup>(1)</sup>	$T_J = 130\text{ }^{\circ}\text{C}$ , linear to 0.67 $V_{DRM}$ , gate open circuit	500	V/ $\mu$ s

**Note**

<sup>(1)</sup> Available with  $dV/dt = 1000\text{ V}/\mu\text{s}$ , to complete code add S90 i.e. VSKT105/16S90P

THERMAL AND MECHANICAL SPECIFICATIONS				
PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Junction operating temperature range	T <sub>J</sub>		- 40 to 130	°C
Storage temperature range	T <sub>Stg</sub>		- 40 to 150	
Maximum internal thermal resistance, junction to case per module	R <sub>thJC</sub>	DC operation	0.135	K/W
Typical thermal resistance, case to heatsink	R <sub>thCS</sub>	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.105	0.04	0.05	0.05	0.08	0.12	0.03	0.05	0.06	0.08	0.12	°C/W

**Note**

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

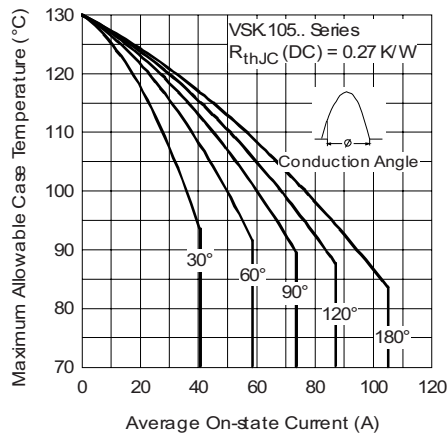


Fig. 1 - Current Ratings Characteristics

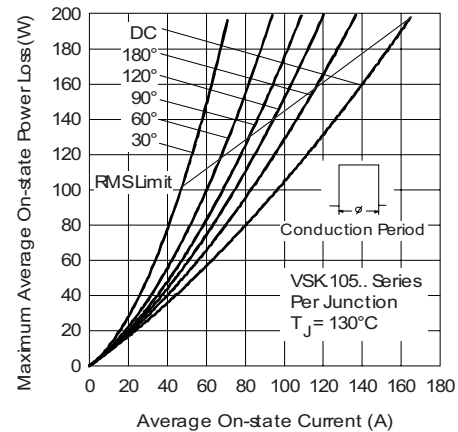


Fig. 4 - On-State Power Loss Characteristics

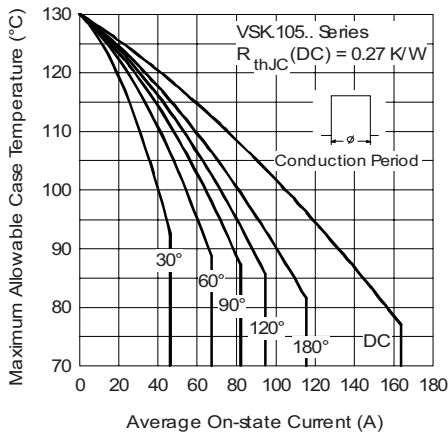


Fig. 2 - Current Ratings Characteristics

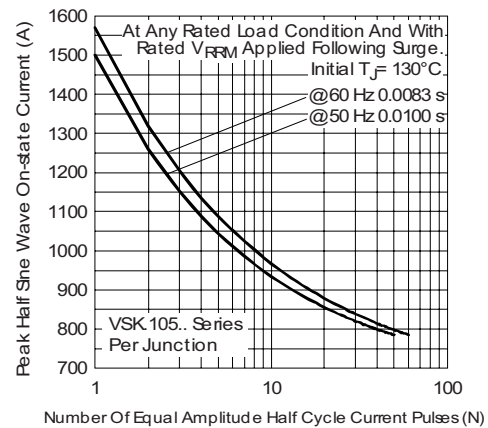


Fig. 5 - Maximum Non-Repetitive Surge Current

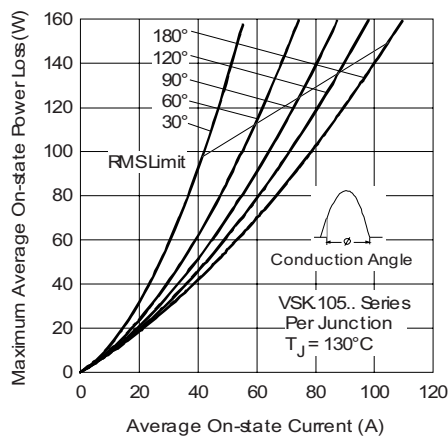


Fig. 3 - On-State Power Loss Characteristics

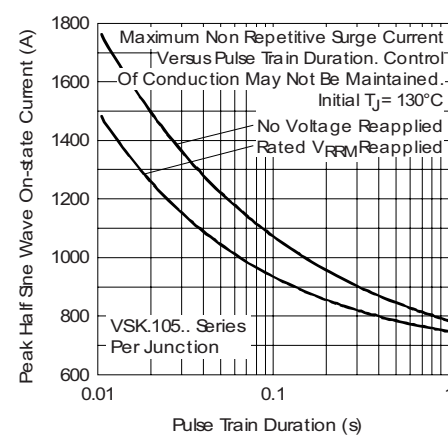


Fig. 6 - Maximum Non-Repetitive Surge Current

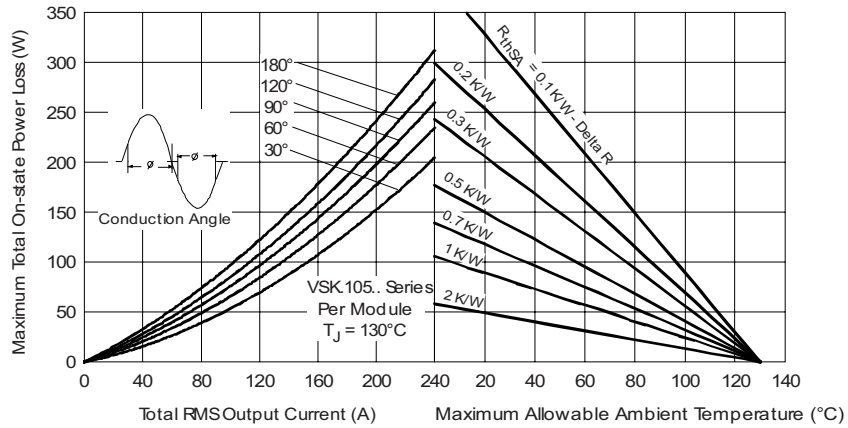


Fig. 7 - On-State Power Loss Characteristics

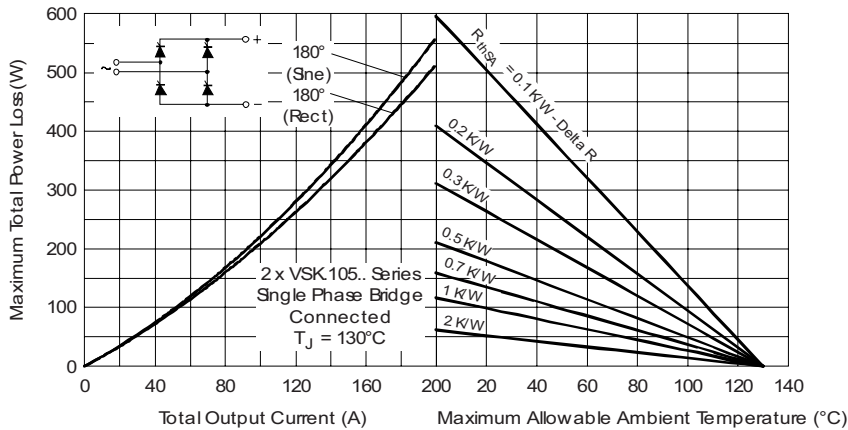


Fig. 8 - On-State Power Loss Characteristics

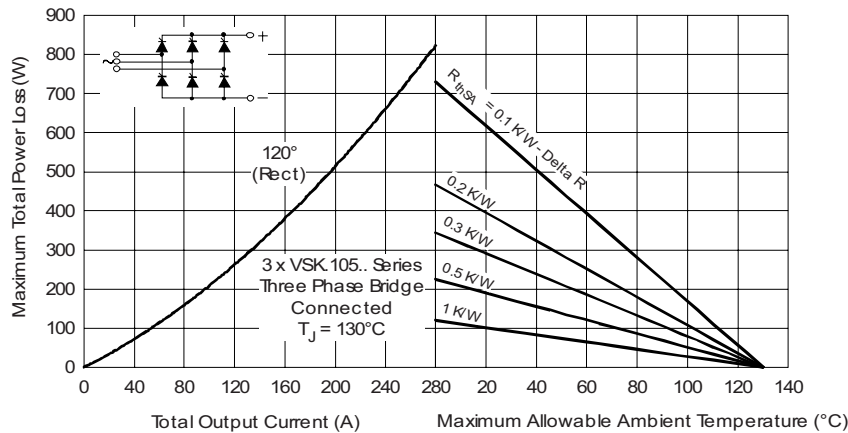


Fig. 9 - On-State Power Loss Characteristics

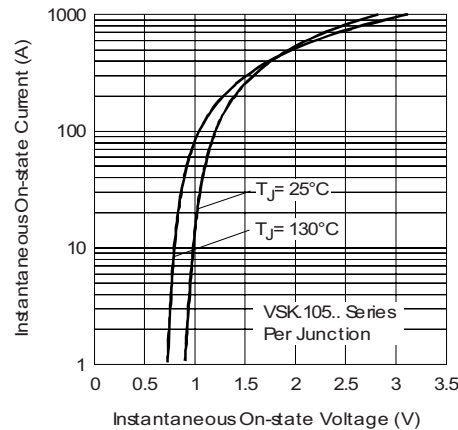


Fig. 10 - On-State Voltage Drop Characteristics

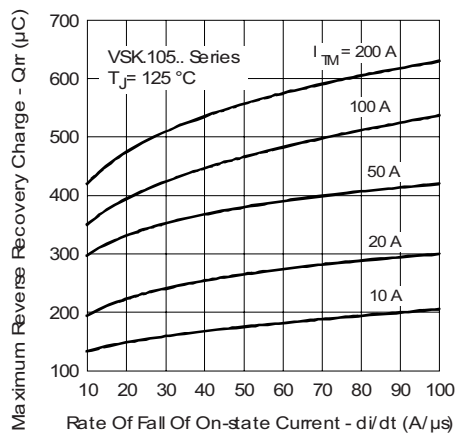


Fig. 11 - Recovery Charge Characteristics

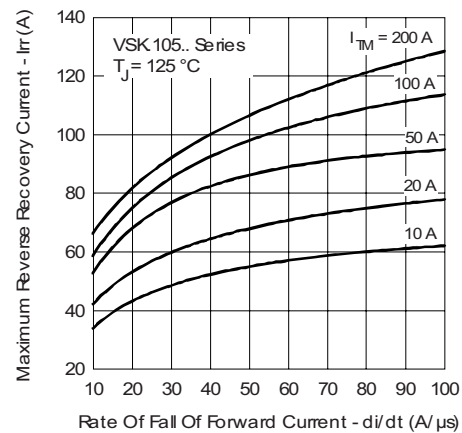


Fig. 12 - Recovery Current Characteristics

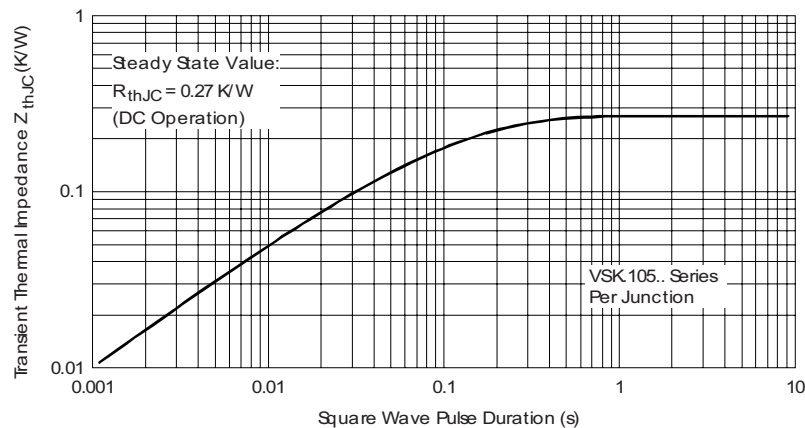


Fig. 13 - Thermal Impedance  $Z_{thJC}$  Characteristics

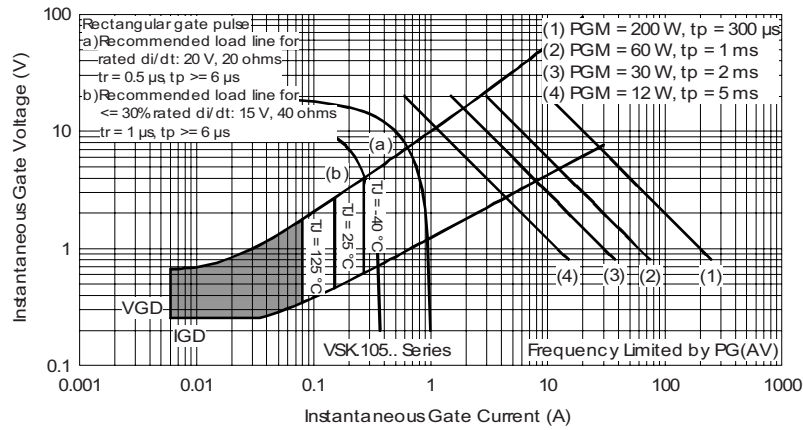


Fig. 14 - Gate Characteristics

## ORDERING INFORMATION TABLE

Device code	VSK	T	105	/	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/ $\mu s$   
No letter =  $dV/dt$  500 V/ $\mu s$
- 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: 105 to 106  
e.g.: VSKT106/16P etc.

### Note

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

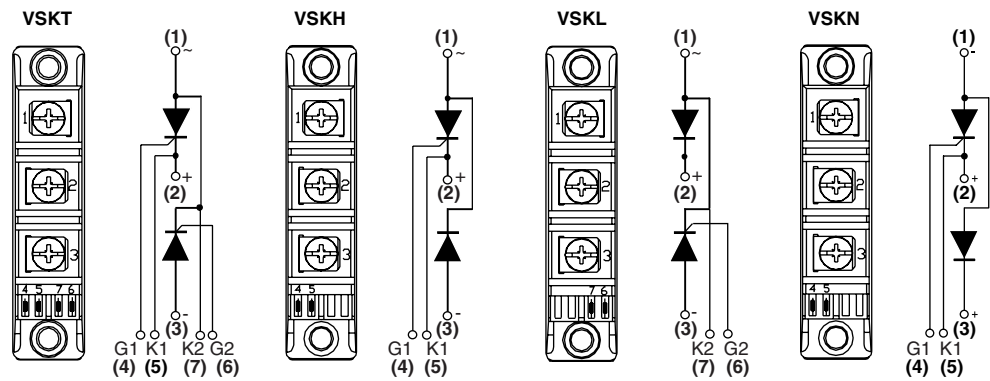
# VSK.105..PbF Series



Vishay High Power Products

Thyristor/Diode and Thyristor/Thyristor  
(ADD-A-PAK Generation 5 Power Modules), 105 A

## CIRCUIT CONFIGURATION



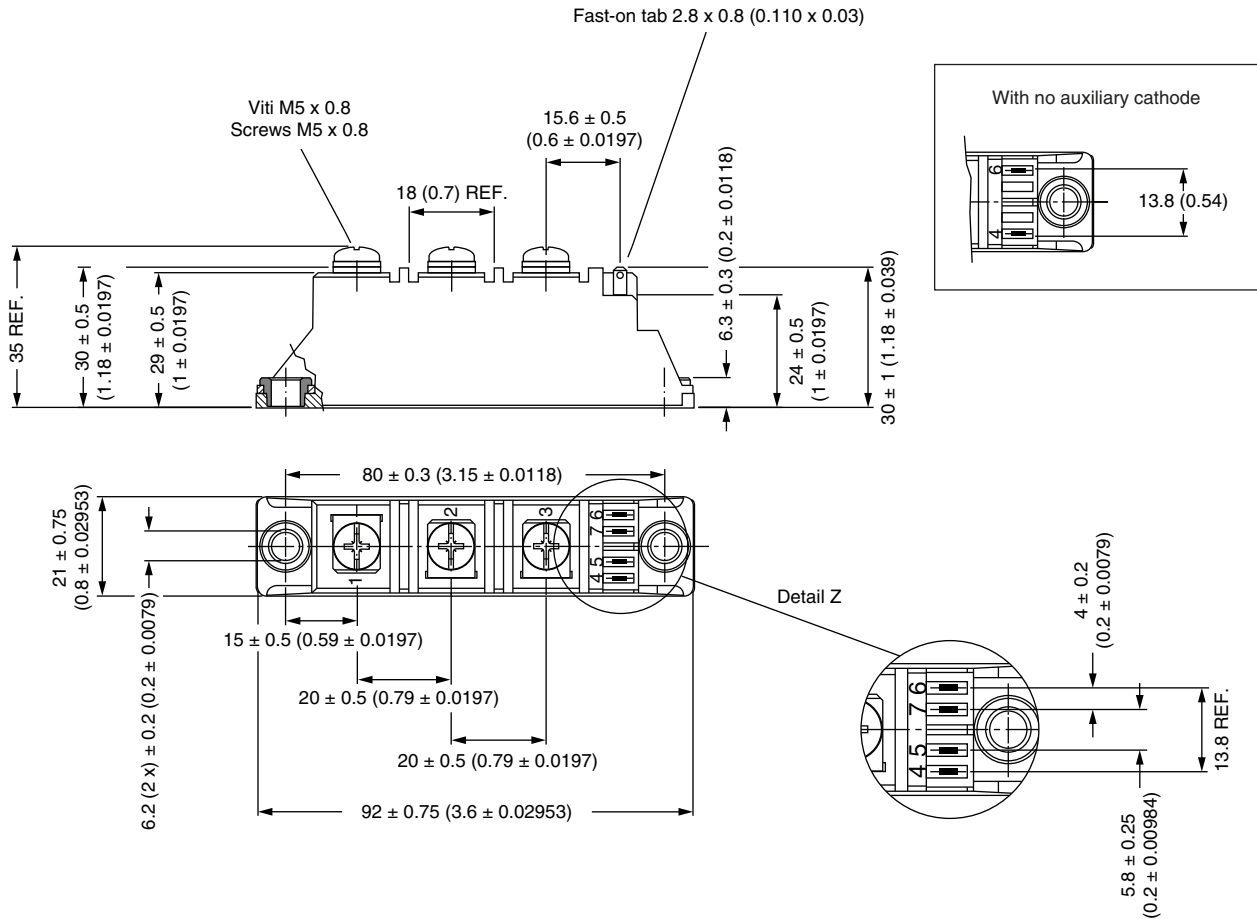
### LINKS TO RELATED DOCUMENTS

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



## ADD-A-PAK SCR

**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.

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 and agree to fully indemnify and hold Vishay and its distributors harmless from and against any and all claims, liabilities, expenses and damages arising or resulting in connection with such use or sale, including attorneys fees, even if such claim alleges that Vishay or its distributor was negligent regarding the design or manufacture of the part. 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.