

## ADD-A-PAK Generation VII Power Modules Thyristor/Diode and Thyristor/Thyristor, 95 A



ADD-A-PAK

### FEATURES

- High voltage
- Industrial standard package
- UL pending
- 3500 V<sub>RMS</sub> isolating voltage
- Low thermal resistance
- Totally lead (Pb)-free
- Designed and qualified for industrial level



**RoHS**  
COMPLIANT

### PRODUCT SUMMARY

$I_{T(AV)}$ or $I_{F(AV)}$	95 A
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### MECHANICAL DESCRIPTION

The ADD-A-PAK Generation VII, new generation of ADD-A-PAK 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.

### 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

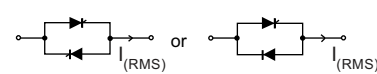
These modules are intended for general purpose high voltage applications such as high voltage regulated power supplies, lighting circuits, temperature and motor speed control circuits, UPS and battery charger.

### 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
$T_J$			

## 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
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 reapplied	Sinusoidal half wave, initial T <sub>J</sub> = T <sub>J</sub> maximum		2000
		t = 8.3 ms				2094
		t = 10 ms	100 % V <sub>RRM</sub> reapplied			1682
		t = 8.3 ms			1760	
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	20	
		t = 8.3 ms			18.26	
		t = 10 ms	100 % V <sub>RRM</sub> reapplied		14.14	
		t = 8.3 ms			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 reapplied 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	$V_{GT}$	$T_J = -40\text{ °C}$	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, 1 s		3500	V
Maximum critical rate of rise of off-state voltage	$dV/dt$	$T_J = 125\text{ °C}$ , 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	°C
Maximum internal thermal resistance, junction to case per leg	$R_{thJC}$	DC operation		0.22	°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
				2.7	oz.
Case style			JEDEC	TO-240AA compatible	

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

**Note**

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

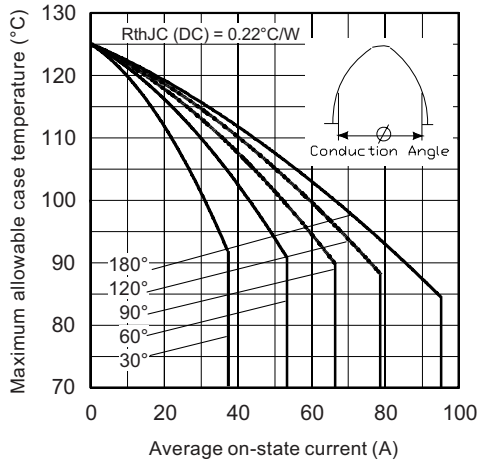


Fig. 1 - Current Ratings Characteristics

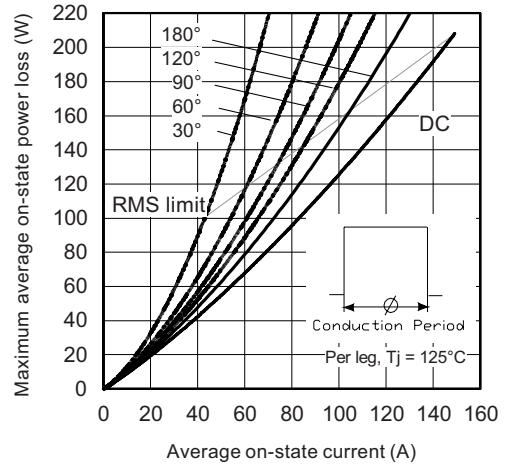


Fig. 4 - On-State Power Loss Characteristics

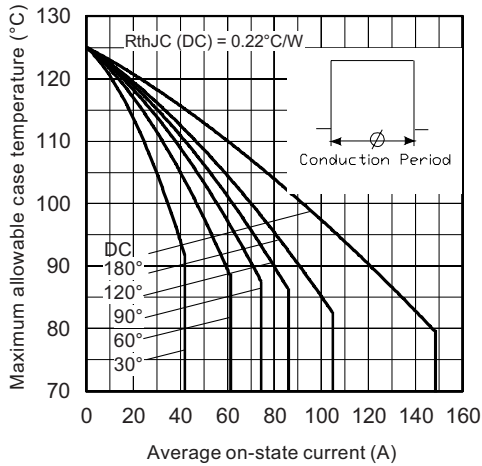


Fig. 2 - Current Ratings Characteristics

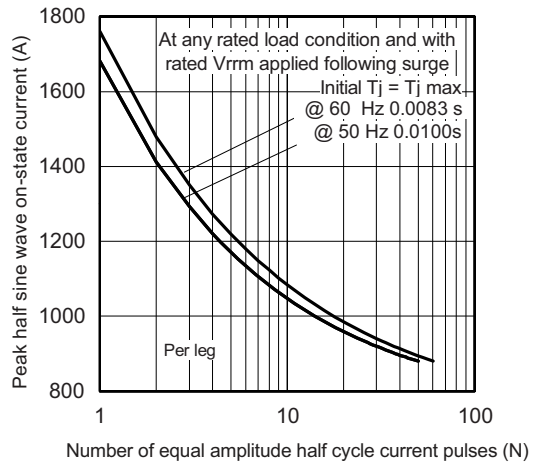


Fig. 5 - Maximum Non-Repetitive Surge Current

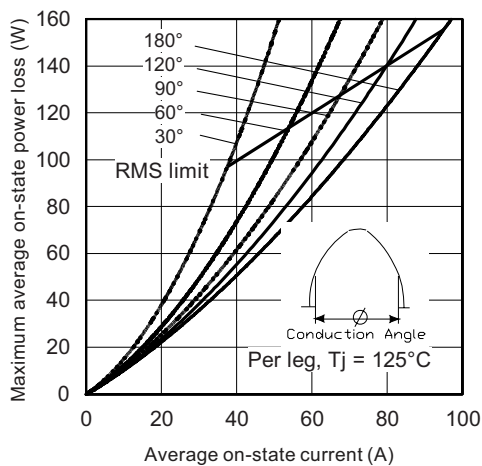


Fig. 3 - On-State Power Loss Characteristics

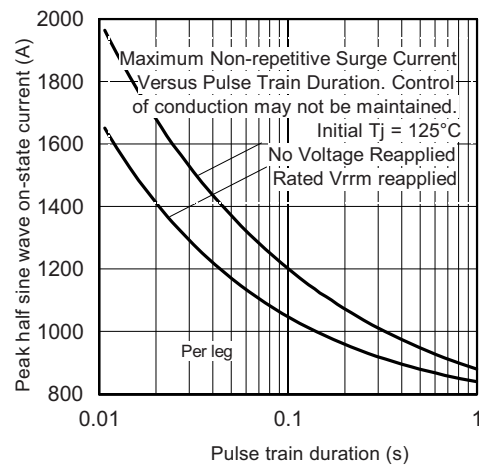


Fig. 6 - Maximum Non-Repetitive Surge Current

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Fig. 7 - On-State Power Loss Characteristics

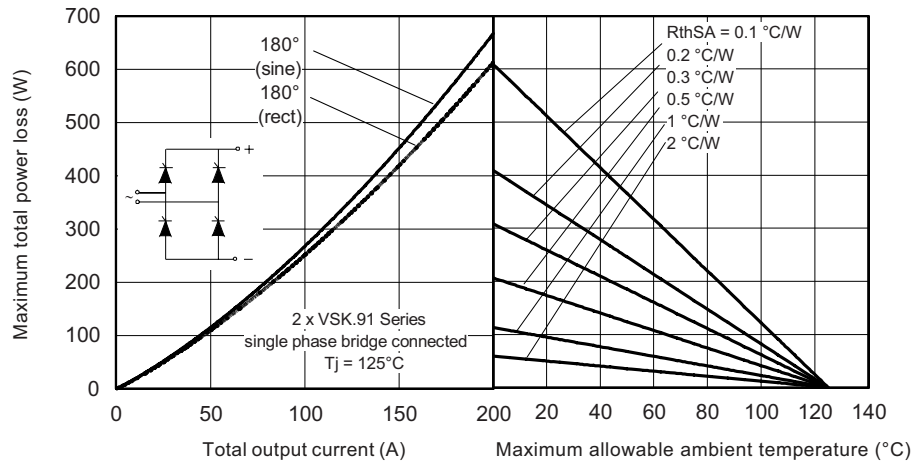


Fig. 8 - On-State Power Loss Characteristics

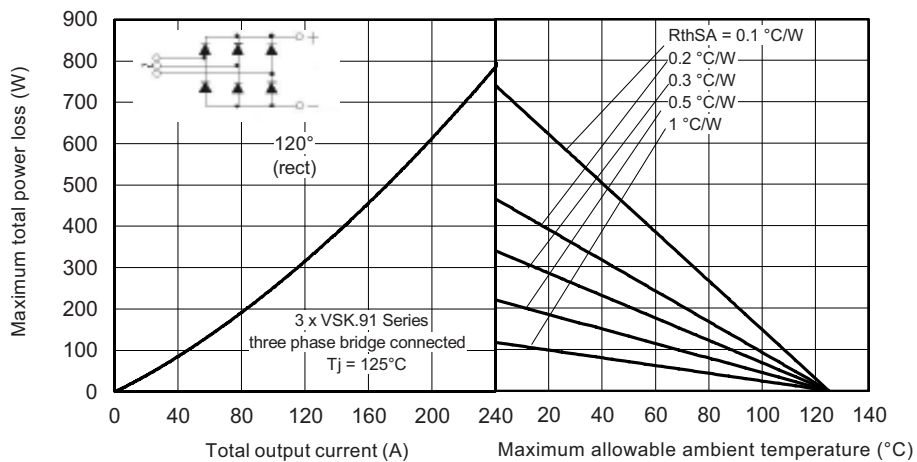


Fig. 9 - On-State Power Loss Characteristics



Fig. 10 - On-State Voltage Drop Characteristics

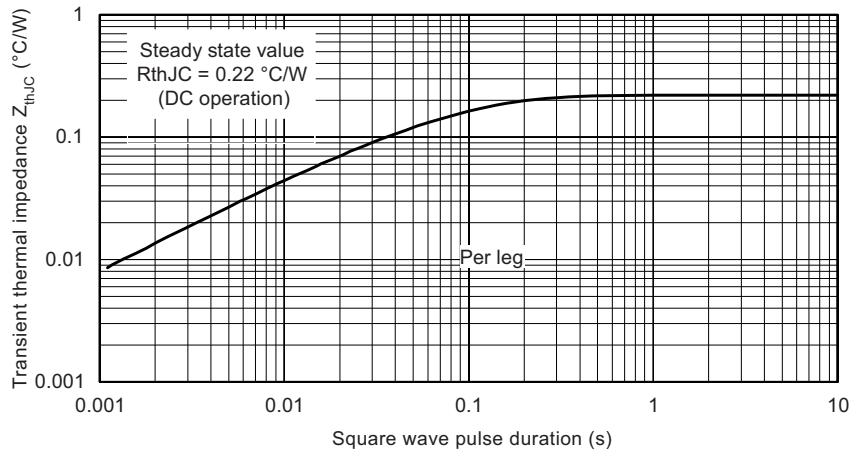


Fig. 11 - Thermal Impedance  $Z_{thJC}$  Characteristics

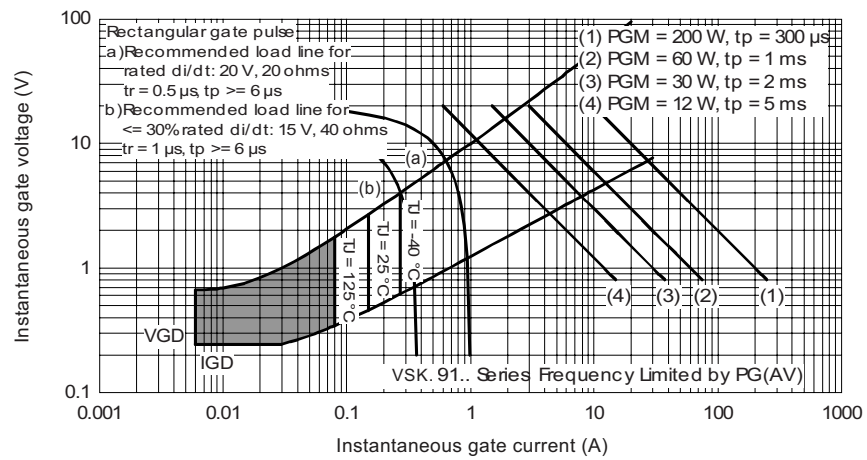
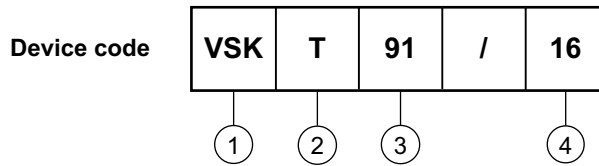


Fig. 12 - Gate Characteristics



### ORDERING INFORMATION TABLE

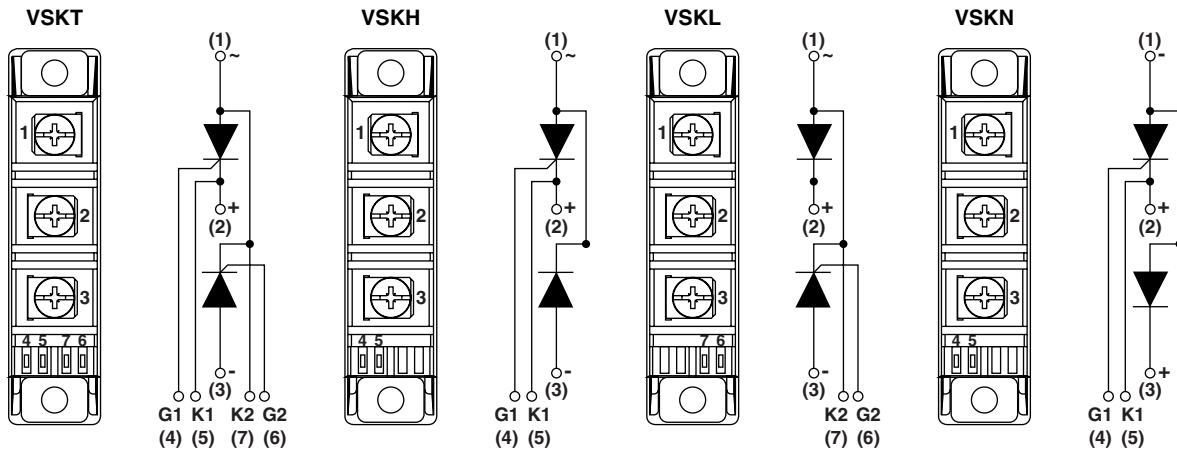


- 1 - Module type
- 2 - Circuit configuration (see end of datasheet)
- 3 - Current code (95 A)
- 4 - Voltage code (see Voltage Ratings table)

#### Note

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

### CIRCUIT CONFIGURATION



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



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