

## ADD-A-PAK Generation VII Power Modules Standard Diodes, 60 A



ADD-A-PAK

**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.

PRODUCT SUMMARY	
$I_{F(AV)}$	60 A
Type	Modules - Diode, High Voltage
Package	ADD-A-PAK
Circuit	Two diodes doubler circuit, Two diodes common cathode, Two diodes common anode, Single diode

**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.

MAJOR RATINGS AND CHARACTERISTICS			
SYMBOL	CHARACTERISTICS	VALUES	UNITS
$I_{F(AV)}$	114 °C	60	A
$I_{F(RMS)}$		94	
$I_{FSM}$	50 Hz	1300	
	60 Hz	1360	
$I^2t$	50 Hz	8.44	kA <sup>2</sup> s
	60 Hz	7.68	
$I^2\sqrt{t}$		84.5	kA <sup>2</sup> √s
$V_{RRM}$	Range	400 to 1600	V
$T_J$		-40 to 150	°C
$T_{Stg}$			



**ELECTRICAL SPECIFICATIONS**

<b>VOLTAGE RATINGS</b>				
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	I <sub>RRM</sub> MAXIMUM AT T <sub>J</sub> = 150 °C mA
VS-VSK.56	04	400	500	10
	06	600	700	
	08	800	900	
	10	1000	1100	
	12	1200	1300	
	14	1400	1500	
	16	1600	1700	

<b>FORWARD CONDUCTION</b>					
PARAMETER	SYMBOL	TEST CONDITIONS		VALUES	UNITS
Maximum average forward current at case temperature	I <sub>F(AV)</sub>	180° conduction, half sine wave		60	A
				114	°C
Maximum RMS forward current	I <sub>F(RMS)</sub>	DC at 90 °C case temperature		94	A
Maximum peak, one-cycle forward, non-repetitive surge current	I <sub>FSM</sub>	t = 10 ms	No voltage reapplied	1300	
		t = 8.3 ms	No voltage reapplied	1360	
		t = 10 ms	100 % V <sub>RRM</sub> reapplied	1090	
		t = 8.3 ms	100 % V <sub>RRM</sub> reapplied	1140	
Maximum I <sup>2</sup> t for fusing	I <sup>2</sup> t	t = 10 ms	No voltage reapplied	8.44	kA <sup>2</sup> s
		t = 8.3 ms	No voltage reapplied	7.68	
		t = 10 ms	100 % V <sub>RRM</sub> reapplied	5.97	
		t = 8.3 ms	100 % V <sub>RRM</sub> reapplied	5.43	
Maximum I <sup>2</sup> √t for fusing	I <sup>2</sup> √t	t = 0.1 ms to 10 ms, no voltage reapplied		84.5	kA <sup>2</sup> √s
Low level value of threshold voltage	V <sub>F(TO)1</sub>	(16.7 % × π × I <sub>F(AV)</sub> < I < π × I <sub>F(AV)</sub> ), T <sub>J</sub> = T <sub>J</sub> maximum		0.74	V
High level value of threshold voltage	V <sub>F(TO)2</sub>	(I > π × I <sub>F(AV)</sub> ), T <sub>J</sub> = T <sub>J</sub> maximum		0.86	
Low level value of forward slope resistance	r <sub>f1</sub>	(16.7 % × π × I <sub>F(AV)</sub> < I < π × I <sub>F(AV)</sub> ), T <sub>J</sub> = T <sub>J</sub> maximum		3.94	mΩ
High level value of forward slope resistance	r <sub>f2</sub>	(I > π × I <sub>F(AV)</sub> ), T <sub>J</sub> = T <sub>J</sub> maximum		3.43	
Maximum forward voltage drop	V <sub>FM</sub>	I <sub>FM</sub> = π × I <sub>F(AV)</sub> , T <sub>J</sub> = 25 °C, t <sub>p</sub> = 400 μs square wave		1.6	V

<b>BLOCKING</b>					
PARAMETER	SYMBOL	TEST CONDITIONS		VALUES	UNITS
Maximum peak reverse leakage current	I <sub>RRM</sub>	T <sub>J</sub> = 150 °C		10	mA
Maximum RMS insulation voltage	V <sub>INS</sub>	50 Hz		3000 (1 min)	V
				3600 (1 s)	



THERMAL AND MECHANICAL SPECIFICATIONS				
PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Junction and storage temperature range	$T_J, T_{Stg}$		-40 to 150	°C
Maximum internal thermal resistance, junction to case per leg	$R_{thJC}$	DC operation	0.33	°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 busbar		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
			3	
Approximate weight			75	g
			2.7	oz.
Case style		JEDEC®	ADD-A-PAK Gen. VII (TO-240AA)	

$\Delta R$ CONDUCTION PER JUNCTION											
DEVICES	SINE HALF WAVE CONDUCTION					RECTANGULAR WAVE CONDUCTION					UNITS
	180°	120°	90°	60°	30°	180°	120°	90°	60°	30°	
VSK.56	0.115	0.136	0.173	0.236	0.346	0.09	0.145	0.185	0.243	0.349	°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

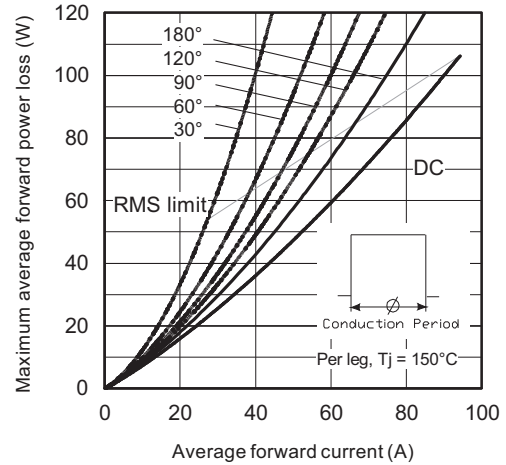


Fig. 4 - Forward Power Loss Characteristics



Fig. 2 - Current Ratings Characteristics



Fig. 5 - Maximum Non-Repetitive Surge Current



Fig. 3 - Forward Power Loss Characteristics



Fig. 6 - Maximum Non-Repetitive Surge Current



Fig. 7 - Forward Power Loss Characteristics

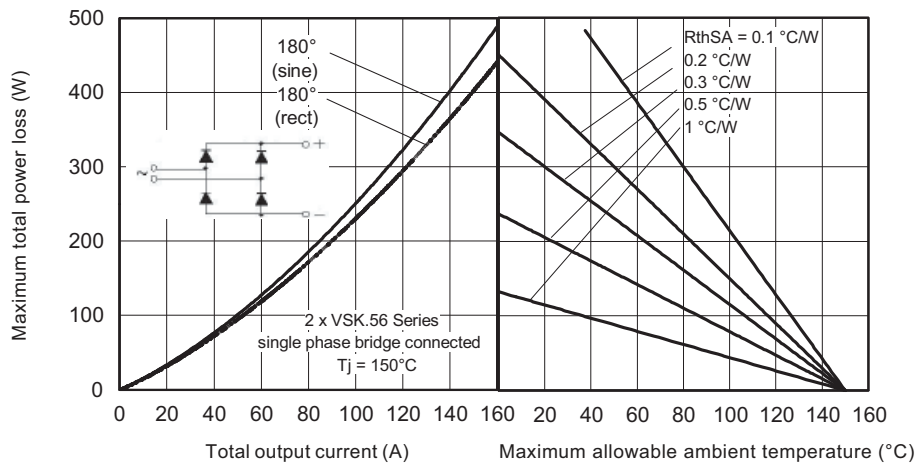


Fig. 8 - Forward Power Loss Characteristics

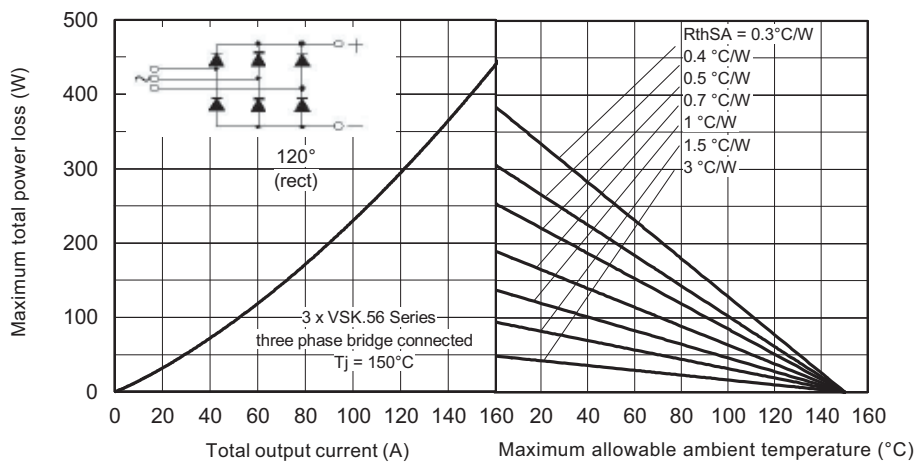


Fig. 9 - Forward Power Loss Characteristics



Fig. 10 - Forward Voltage Characteristics



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

**ORDERING INFORMATION TABLE**

Device code	<b>VS-VS</b>	<b>K</b>	<b>D</b>	<b>56</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 (60 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)



CIRCUIT CONFIGURATION		
CIRCUIT DESCRIPTION	CIRCUIT CONFIGURATION CODE	CIRCUIT DRAWING
Two diodes doubler circuit	D	<p><b>VSKD...</b></p> <p>(1) <math>\bar{\circ}</math> — <math>\blacktriangleright</math> — <math>\circ</math> (2) — <math>\blacktriangleright</math> — <math>\bar{\circ}</math> (3)</p>
Two diodes common cathodes	C	<p><b>VSKC...</b></p> <p>(1) <math>\circ</math> — <math>\blacktriangleright</math> — <math>\bar{\circ}</math> (2) — <math>\blacktriangleright</math> — <math>\bar{\circ}</math> (3)</p>
Two diodes common anodes	J	<p><b>VSKJ...</b></p> <p>(1) <math>\bar{\circ}</math> — <math>\blacktriangleright</math> — <math>\circ</math> (2) — <math>\blacktriangleright</math> — <math>\circ</math> (3)</p>
Single diode	E	<p><b>VSKE...</b></p> <p>(2) <math>\circ</math> — <math>\blacktriangleright</math> — <math>\bar{\circ}</math> (3)</p>

LINKS TO RELATED DOCUMENTS	
Dimensions	<a href="http://www.vishay.com/doc?95369">www.vishay.com/doc?95369</a>

## ADD-A-PAK Generation VII - Diode

**DIMENSIONS** in millimeters (inches)







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