

## Thyristor/Thyristor, 75/95 A (ADD-A-PAK Generation 5 Power Modules)



ADD-A-PAK

### PRODUCT SUMMARY

$I_{T(AV)}$	75/95 A
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### MECHANICAL DESCRIPTION


The Generation 5 of ADD-A-PAK module 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 allow an easier mounting on the majority of heatsink with increased tolerance of surface roughness and improved thermal spread.

The Generation 5 of ADD-A-PAK module 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 Al metal die and double stick bonding
- 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
- Full 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 charger.

### MAJOR RATINGS AND CHARACTERISTICS

SYMBOL	CHARACTERISTICS	VSKU/V71	VSKU/V91	UNITS
$I_{T(AV)}$	85 °C	75	95	A
$I_{T(RMS)}$		115	150	
$I_{TSM}$	50 Hz	1665	1785	
	60 Hz	1740	1870	
$I^2t$	50 Hz	13.86	15.91	kA <sup>2</sup> s
	60 Hz	12.56	14.52	
$I^2\sqrt{t}$		138.6	159.1	kA <sup>2</sup> √s
$V_{RRM}$	Range	400 to 1600		V
$T_J, T_{Stg}$		- 40 to 125		°C

# VSK(U, V)71..PbF, VSK(U, V)91..PbF Series



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## 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
VSKU/V71, 91	04	400	500	400	15
	08	800	900	800	
	12	1200	1300	1200	
	16	1600	1700	1600	

ON-STATE CONDUCTION							
PARAMETER	SYMBOL	TEST CONDITIONS			VSKU/V71	VSKU/V91	UNITS
Maximum average on-state current	I <sub>T(AV)</sub>	180° conduction, half sine wave, T <sub>C</sub> = 85 °C			75	95	A
Maximum RMS on-state current	I <sub>T(RMS)</sub>	DC			115	150	
		T <sub>C</sub>			80	75	°C
Maximum peak, one-cycle non-repetitive on-state current	I <sub>TSM</sub>	t = 10 ms	No voltage reappplied	Sinusoidal half wave, initial T <sub>J</sub> = T <sub>J</sub> maximum	1665	1785	A
		t = 8.3 ms			1740	1870	
		t = 10 ms	100 % V <sub>RRM</sub> reappplied		1400	1500	
		t = 8.3 ms			1470	1570	
		t = 10 ms	T <sub>J</sub> = 25 °C, no voltage reappplied		1850	2000	
		t = 8.3 ms			1940	2100	
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	13.86	15.91	kA <sup>2</sup> s
		t = 8.3 ms			12.56	14.52	
		t = 10 ms	100 % V <sub>RRM</sub> reappplied		9.80	11.25	
		t = 8.3 ms			8.96	10.27	
		t = 10 ms	T <sub>J</sub> = 25 °C, no voltage reappplied		17.11	20.00	
		t = 8.3 ms			15.60	18.30	
Maximum I <sup>2</sup> √t for fusing	I <sup>2</sup> √t (1)	t = 0.1 to 10 ms, no voltage reappplied			138.6	159.1	kA <sup>2</sup> √s
Maximum value of threshold voltage	V <sub>T(TO)</sub> (2)	Low level (3)	T <sub>J</sub> = T <sub>J</sub> maximum		0.82	0.80	V
		High level (4)			0.85	0.85	
Maximum value of on-state slope resistance	r <sub>t</sub> (2)	Low level (3)			3.00	2.40	mΩ
		High level (4)			2.90	2.25	
Maximum on-state voltage drop	V <sub>TM</sub>	I <sub>TM</sub> = π × I <sub>T(AV)</sub>	T <sub>J</sub> = 25 °C		1.59	1.58	V
		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>



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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	$I_{GT}$	$T_J = -40\text{ }^\circ\text{C}$		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	$I_{GD}$			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
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)	$T_J = 125\text{ }^\circ\text{C}$ , linear to $0.67 V_{DRM}$ , gate open circuit		500	V/ $\mu\text{s}$

**Note**

(1) Available with  $dV/dt = 1000\text{ V}/\mu\text{s}$ , to complete code add S90 i.e. VSKU91/16S90P

THERMAL AND MECHANICAL SPECIFICATIONS					
PARAMETER	SYMBOL	TEST CONDITIONS		VALUES	UNITS
Operating junction and storage temperature range	$T_J$ , $T_{Stg}$			- 40 to 125	$^\circ\text{C}$
Maximum internal thermal resistance, junction to case per module	$R_{thJC}$	DC operation		0.165	K/W
Typical thermal resistance, case to heatsink	$R_{thCS}$	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.		5	Nm
	busbar			3	
Approximate weight				110	g
				4	oz.
Case style			JEDEC	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°	
VSKU/V71	0.06	0.07	0.09	0.12	0.18	0.04	0.08	0.10	0.13	0.18	$^\circ\text{C}/\text{W}$
VSKU/V91	0.04	0.05	0.06	0.08	0.12	0.03	0.05	0.06	0.08	0.12	

**Note**

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

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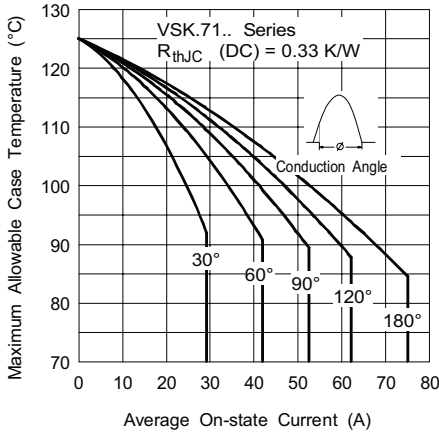


Fig. 1 - Current Ratings Characteristics

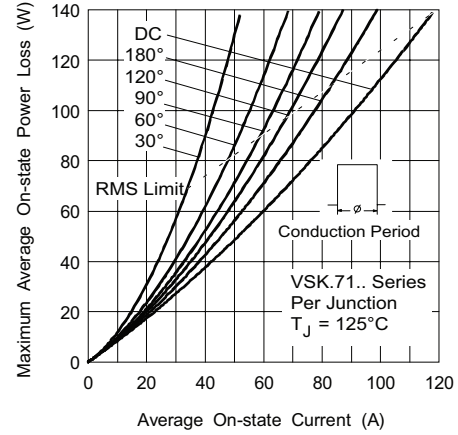


Fig. 4 - On-State Power Loss Characteristics

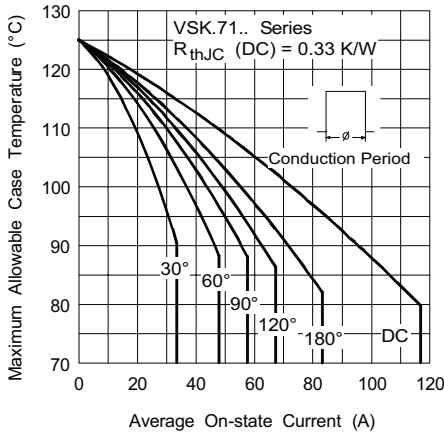


Fig. 2 - Current Ratings Characteristics

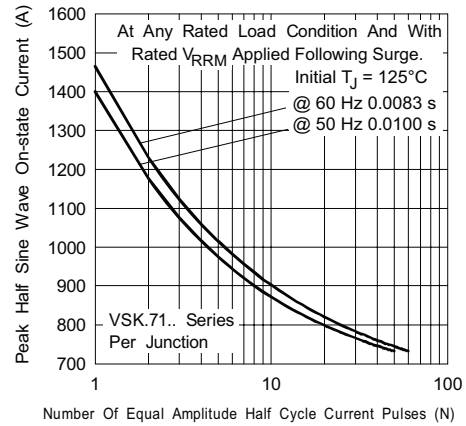


Fig. 5 - Maximum Non-Repetitive Surge Current

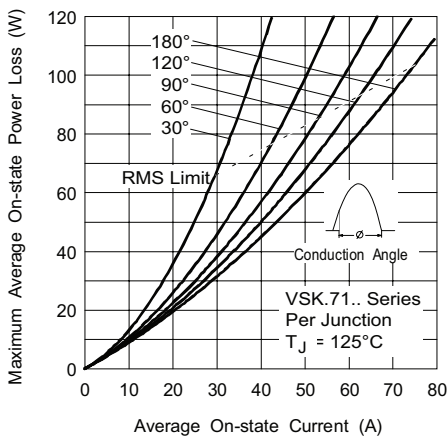


Fig. 3 - On-State Power Loss Characteristics

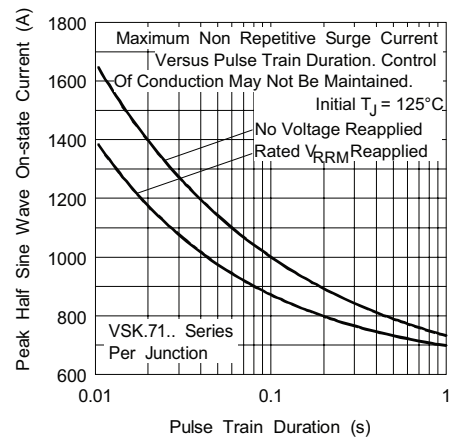


Fig. 6 - Maximum Non-Repetitive Surge Current



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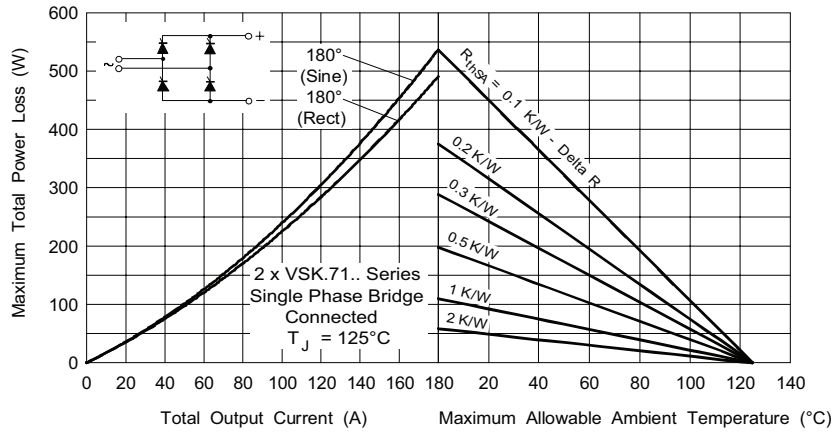


Fig. 7 - On-State Power Loss Characteristics (Single Phase Bridge VSKU and VSKV)

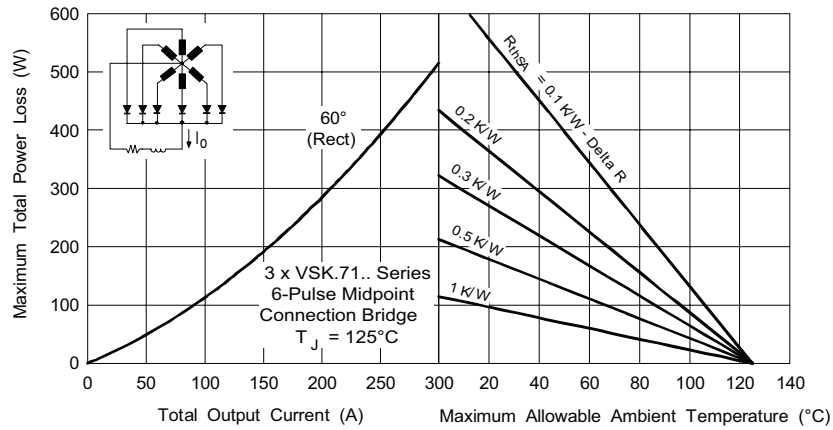


Fig. 8 - On-State Power Loss Characteristics

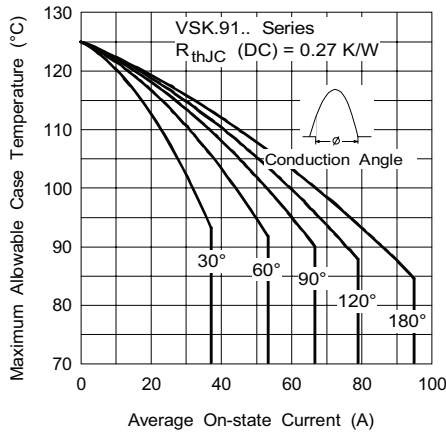


Fig. 9 - Current Ratings Characteristics

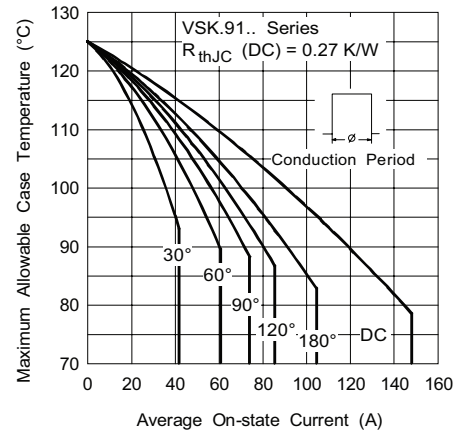


Fig. 10 - Current Ratings Characteristics

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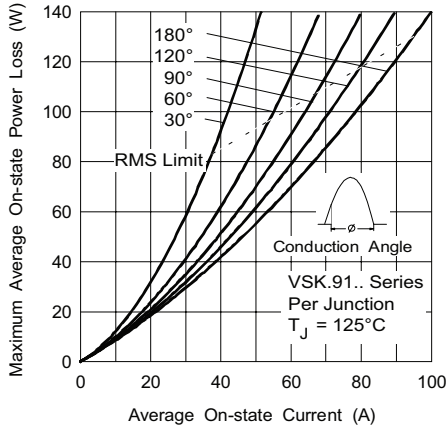


Fig. 11 - On-State Power Loss Characteristics

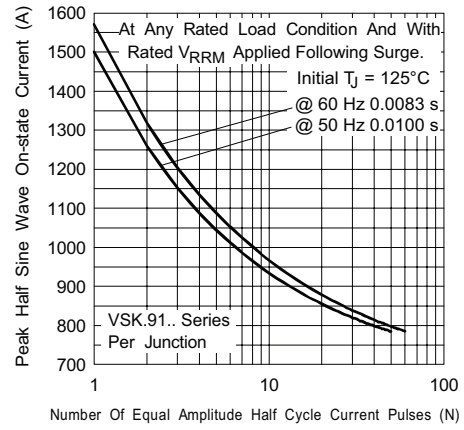


Fig. 13 - Maximum Non-Repetitive Surge Current

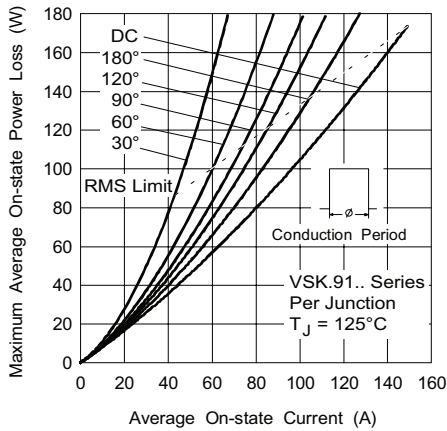


Fig. 12 - On-State Power Loss Characteristics

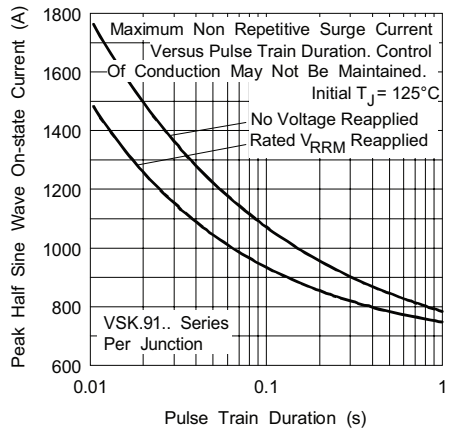


Fig. 14 - Maximum Non-Repetitive Surge Current

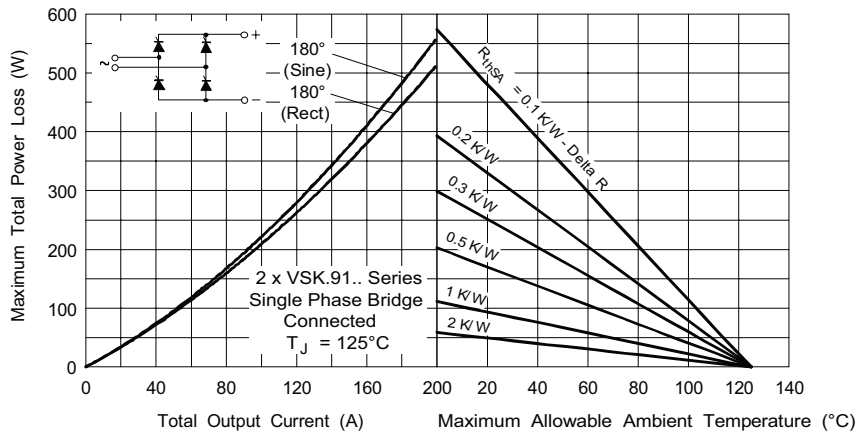


Fig. 15 - On-State Power Loss Characteristics (Single Phase Bridge VSKU and VSKV)



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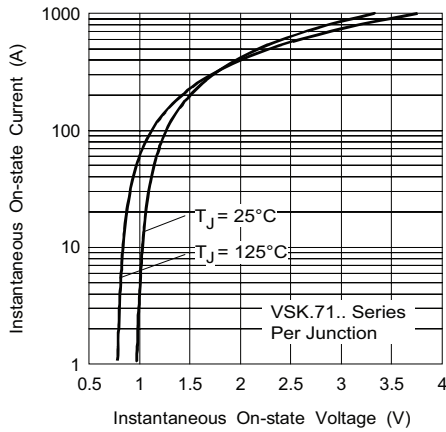
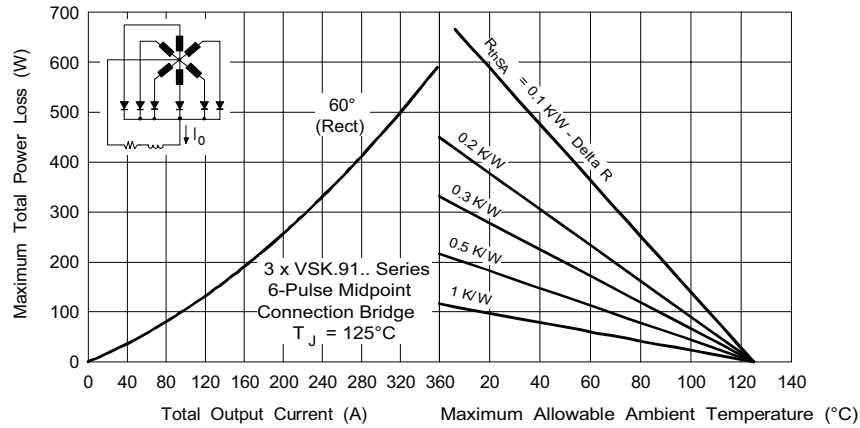


Fig. 17 - On-State Voltage Drop Characteristics

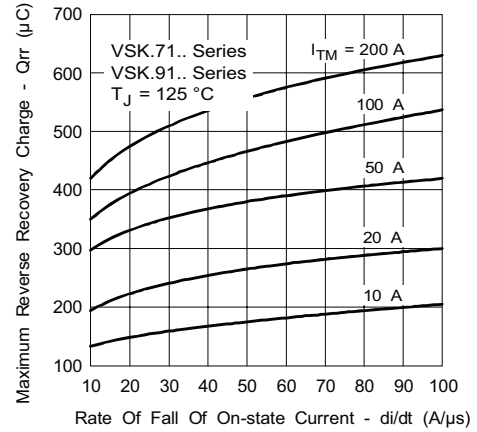


Fig. 19 - Recovery Charge Characteristics

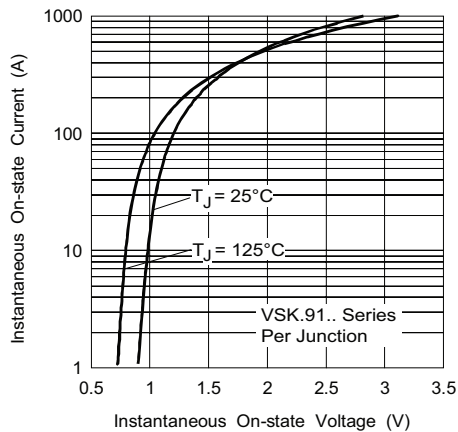


Fig. 18 - On-State Voltage Drop Characteristics

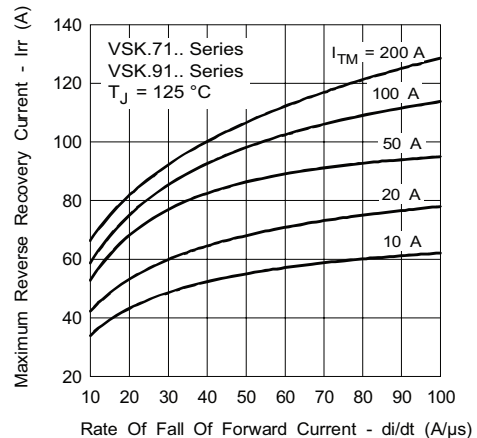


Fig. 20 - Recovery Current Characteristics

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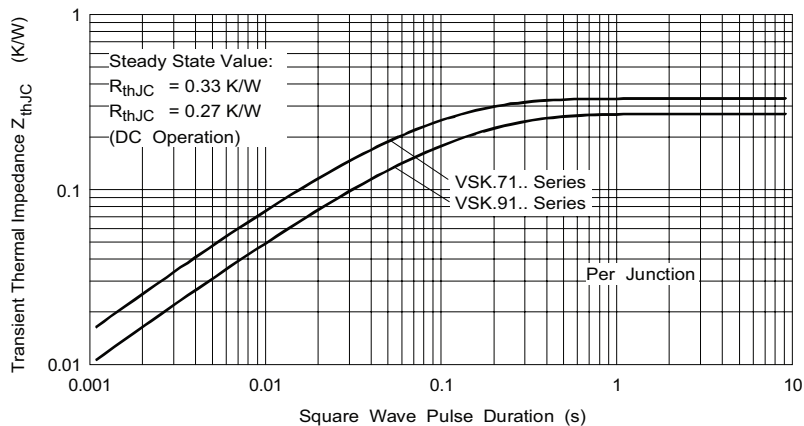


Fig. 21 - Thermal Impedance  $Z_{thJC}$  Characteristics

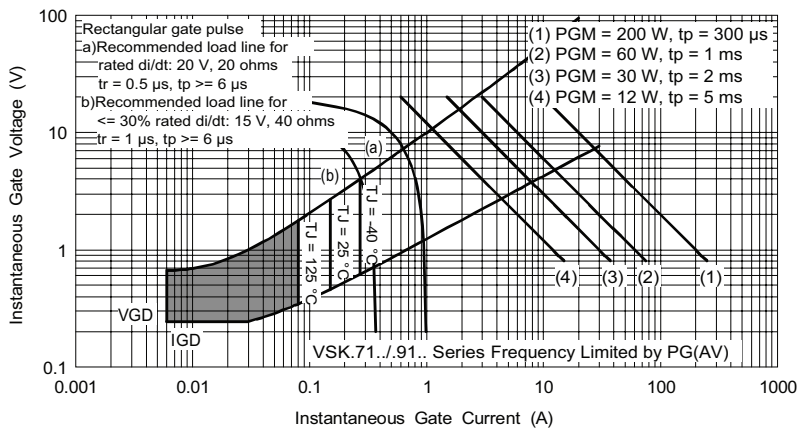


Fig. 22 - Gate Characteristics



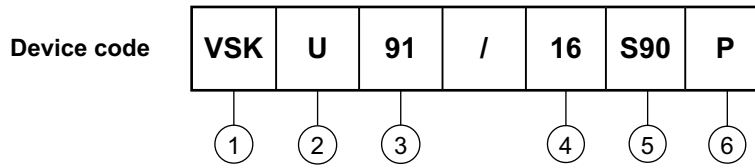


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## ORDERING INFORMATION TABLE



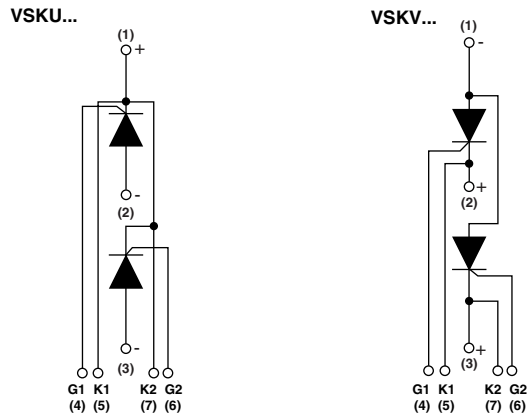
- 1** - Module type
- 2** - Circuit configuration:
  - U = Two SCR common cathode
  - V = Two SCR common anode
- 3** - Current code
- 4** - Voltage code (see Voltage Ratings table)
- 5** - dV/dt code:
  - S90 = dV/dt 1000 V/μs
  - No letter = dV/dt 500 V/μs
- 6** - P = Lead (Pb)-free

Note: Contact factory for availability

### 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?95087">http://www.vishay.com/doc?95087</a>
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