AAP Gen 7 (TO-240AA) Power Modules
Thyristor/Diode and Thyristor/Thyristor, 45 A, 60 A



ADD-A-PAK

PRIMARY CHARACTERISTICS	
$I_{T(AV)}$ or $I_{F(AV)}$	45 A, 60 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

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	VS-VSK.41	VS-VSK.56	UNITS
$I_{T(AV)}$ or $I_{F(AV)}$	85 °C	45	60	A
$I_{O(RMS)}$	As AC switch	100	135	
I_{TSM}, I_{FSM}	50 Hz	850	1200	
	60 Hz	890	1256	
I^2t	50 Hz	3.61	7.20	kA^2s
	60 Hz	3.30	6.57	
$I^2\sqrt{t}$		36.1	72	$kA^2\sqrt{s}$
V_{DRM}/V_{RRM}	Range	400 to 1600	400 to 1600	V
T_{Stg}		-40 to +125		°C
T_J		-40 to +125		°C

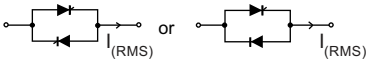
For technical questions within your region: DiodesAmericas@vishay.com, DiodesAsia@vishay.com, DiodesEurope@vishay.com
THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

ELECTRICAL SPECIFICATIONS

VOLTAGE RATINGS

TYPE NUMBER	VOLTAGE CODE	V_{RRM}, MAXIMUM REPETITIVE PEAK REVERSE VOLTAGE V	V_{RSM}, MAXIMUM NON-REPETITIVE PEAK REVERSE VOLTAGE V	V_{DRM}, MAXIMUM REPETITIVE PEAK OFF-STATE VOLTAGE, GATE OPEN CIRCUIT V	I_{RRM}, I_{DRM} AT 125 °C mA
VS-VSK.41 VS-VSK.56	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			VSK.41	VSK.56	UNITS
Maximum average on-state current (thyristors)	$I_{T(AV)}$	180° conduction, half sine wave, T_C = 85 °C			45	60	A
Maximum average forward current (diodes)	$I_{F(AV)}$						
Maximum continuous RMS on-state current, as AC switch	$I_{O(RMS)}$				100	135	
Maximum peak, one-cycle non-repetitive on-state or forward current	I_{TSM} or I_{FSM}	t = 10 ms	No voltage reapplied	Sinusoidal half wave, initial T_J = T_J maximum	850	1200	
		t = 8.3 ms			890	1256	
		t = 10 ms	100 % V_{RRM} reapplied		715	1000	
		t = 8.3 ms			750	1056	
Maximum I^2t for fusing	I^2t	t = 10 ms	No voltage reapplied	Initial T_J = T_J maximum	3.61	7.20	kA^2s
		t = 8.3 ms			3.30	6.57	
		t = 10 ms	100 % V_{RRM} reapplied		2.56	5.10	
		t = 8.3 ms			2.33	4.56	
Maximum $I^2\sqrt{t}$ for fusing	$I^2\sqrt{t}$ (1)	t = 0.1 ms to 10 ms, no voltage reapplied T_J = T_J maximum			36.1	72	$kA^2\sqrt{s}$
Maximum value or threshold voltage	$V_{T(TO)}$ (2)	Low level (3)	T_J = T_J maximum		1.08	0.91	V
		High level (4)			1.12	1.02	
Maximum value of on-state slope resistance	r_t (2)	Low level (3)	T_J = T_J maximum		4.7	4.27	mΩ
		High level (4)			4.5	3.77	
Maximum peak on-state or forward voltage	V_{TM}	$I_{TM} = \pi \times I_{T(AV)}$	T_J = 25 °C		1.81	1.7	V
	V_{FM}	$I_{FM} = \pi \times I_{F(AV)}$					
Maximum non-repetitive rate of rise of turned on current	dI/dt	T_J = 25 °C, from 0.67 V_{DRM}, $I_{TM} = \pi \times I_{T(AV)}$, I_g = 500 mA, t_r < 0.5 µs, t_p > 6 µs			150		A/µs
Maximum holding current	I_H	T_J = 25 °C, anode supply = 6 V, resistive load, gate open circuit			200		mA
Maximum latching current	I_L	T_J = 25 °C, anode supply = 6 V, resistive load			400	400	

Notes

(1) I^2t for time $t_x = I^2\sqrt{t} \times \sqrt{t_x}$

(2) Average power = $V_{T(TO)} \times I_{T(AV)} + r_t \times (I_{T(RMS)})^2$

(3) 16.7 % x π x I_{AV} < I < π x I_{AV}

(4) I > π x I_{AV}

For technical questions within your region: DiodesAmericas@vishay.com, DiodesAsia@vishay.com, DiodesEurope@vishay.com
THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

TRIGGERING

PARAMETER	SYMBOL	TEST CONDITIONS		VS-VSK.41	VS-VSK.56	UNITS
Maximum peak gate power	P_{GM}			10		W
Maximum average gate power	$P_{G(AV)}$			2.5		
Maximum peak gate current	I_{GM}			2.5		A
Maximum peak negative gate voltage	- V_{GM}			10		V
Maximum gate voltage required to trigger	V_{GT}	T_J = -40 °C	Anode supply = 6 V resistive load	4.0		
		T_J = 25 °C		2.5		
		T_J = 125 °C		1.7		
Maximum gate current required to trigger	I_{GT}	T_J = -40 °C	Anode supply = 6 V resistive load	270		mA
		T_J = 25 °C		150		
		T_J = 125 °C		80		
Maximum gate voltage that will not trigger	V_{GD}	T_J = 125 °C, rated V_{DRM} applied		0.25		V
Maximum gate current that will not trigger	I_{GD}	T_J = 125 °C, rated V_{DRM} applied		6		mA

BLOCKING

PARAMETER	SYMBOL	TEST CONDITIONS	VS-VSK.41	VS-VSK.56	UNITS
Maximum peak reverse and off-state leakage current at V_{RRM}, V_{DRM}	I_{RRM}, I_{DRM}	T_J = 125 °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 °C, linear to 0.67 V_{DRM}	1000		V/µs

THERMAL AND MECHANICAL SPECIFICATIONS

PARAMETER		SYMBOL	TEST CONDITIONS	VS-VSK.41	VS-VSK.56	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	0.44	0.35	°C/W
Typical thermal resistance, case to heatsink per module		R_{thCS}	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.	4		Nm
	busbar			3		
Approximate weight				75		g
				2.7		oz.
Case style			JEDEC®	AAP Gen 7 (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.41..	0.110	0.131	0.17	0.23	0.342	0.085	0.138	0.177	0.235	0.345	°C/W
VSK.56..	0.088	0.104	0.134	0.184	0.273	0.07	0.111	0.143	0.189	0.275	

Note

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

For technical questions within your region: DiodesAmericas@vishay.com, DiodesAsia@vishay.com, DiodesEurope@vishay.com
THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

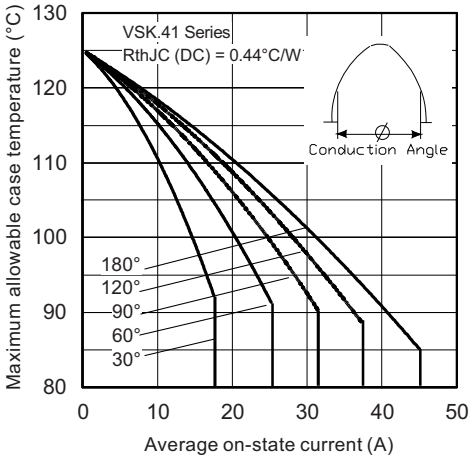


Fig. 1 - Current Ratings Characteristics

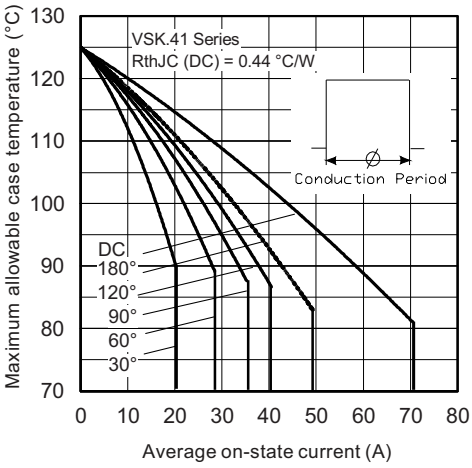


Fig. 2 - Current Ratings Characteristics

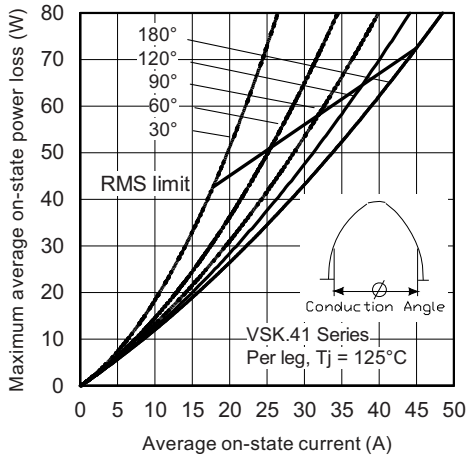


Fig. 3 - On-State Power Loss Characteristics

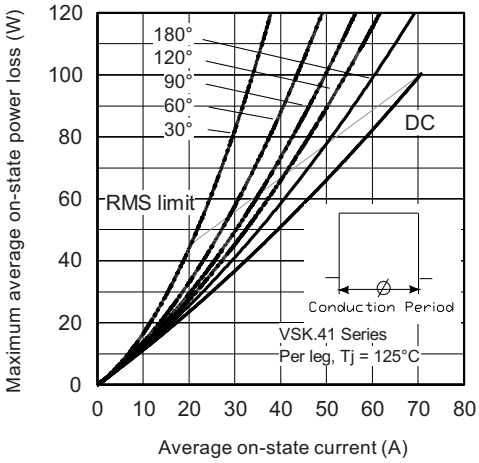


Fig. 4 - On-State Power Loss Characteristics

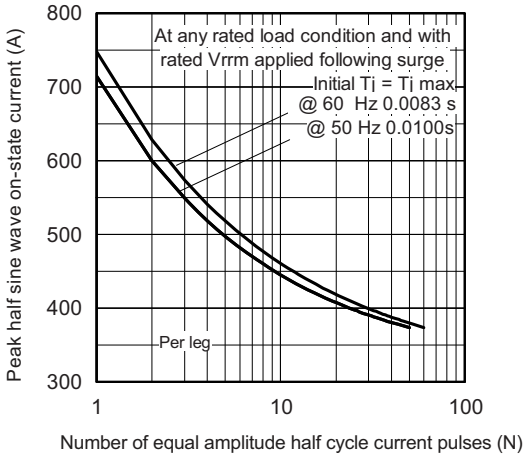


Fig. 5 - Maximum Non-Repetitive Surge Current

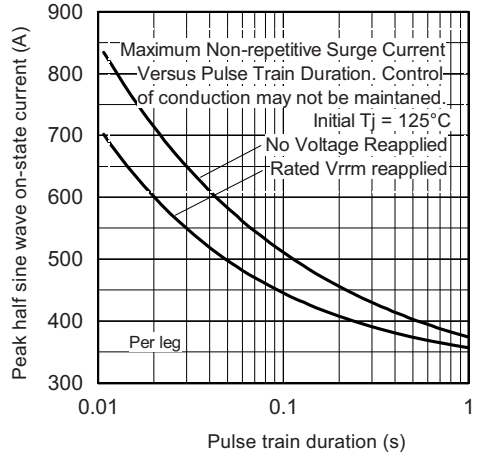


Fig. 6 - Maximum Non-Repetitive Surge Current

For technical questions within your region: DiodesAmericas@vishay.com, DiodesAsia@vishay.com, DiodesEurope@vishay.com
THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

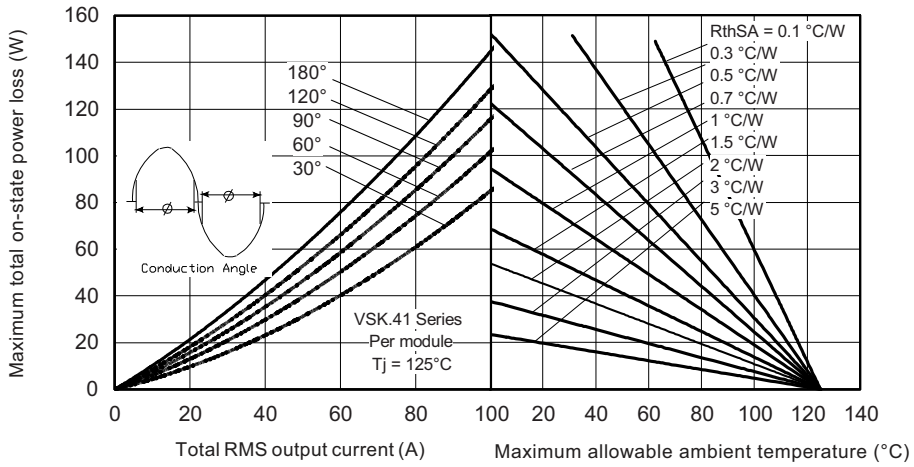


Fig. 7 - On-State Power Loss Characteristics

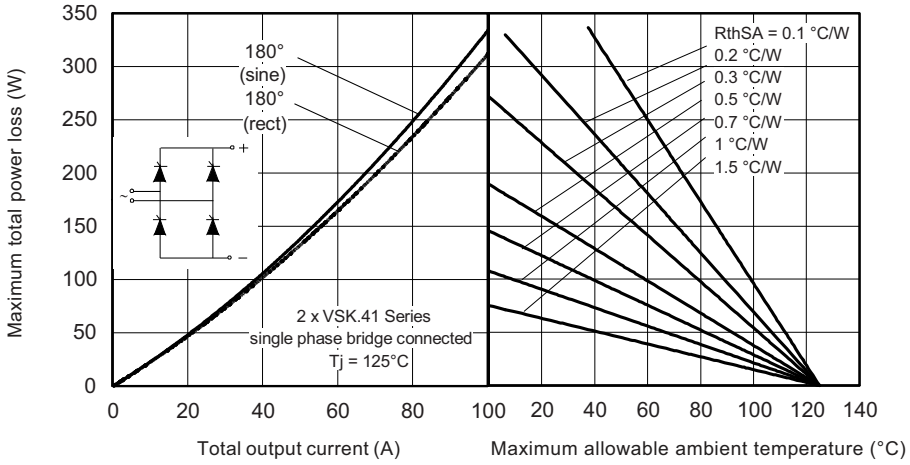


Fig. 8 - On-State Power Loss Characteristics

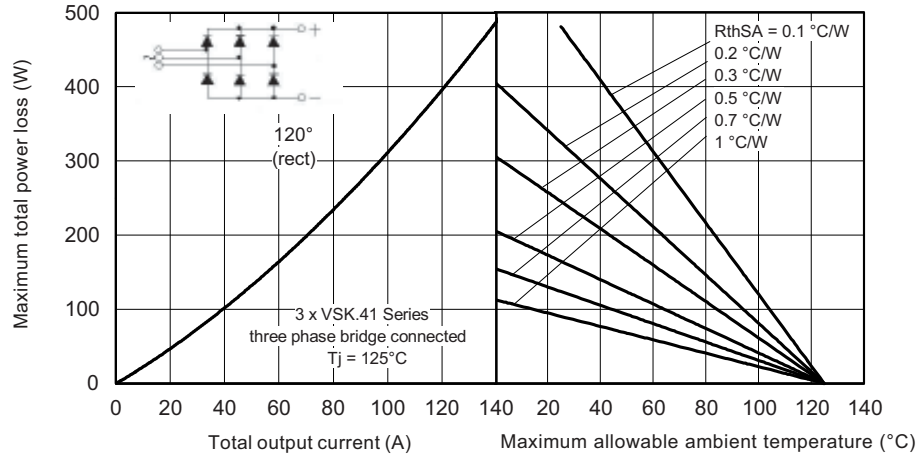


Fig. 9 - On-State Power Loss Characteristics

For technical questions within your region: DiodesAmericas@vishay.com, DiodesAsia@vishay.com, DiodesEurope@vishay.com
THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

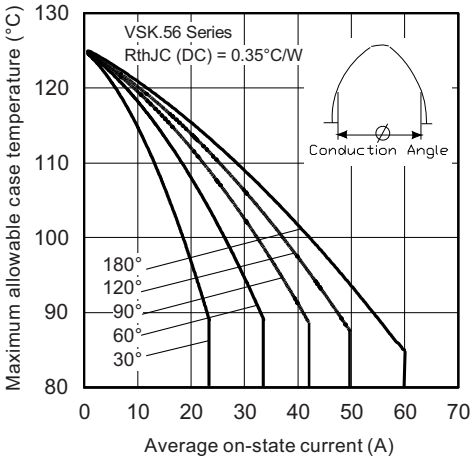


Fig. 10 - Current Ratings Characteristics

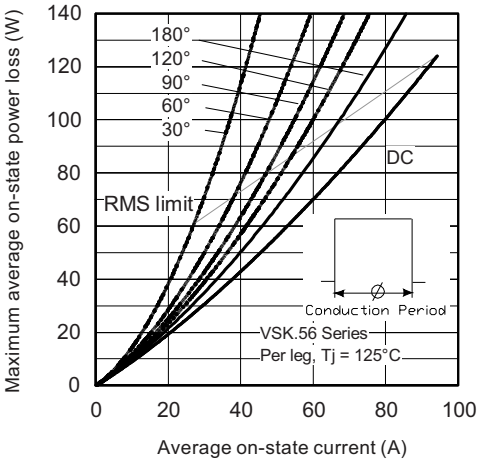


Fig. 13 - On-State Power Loss Characteristics

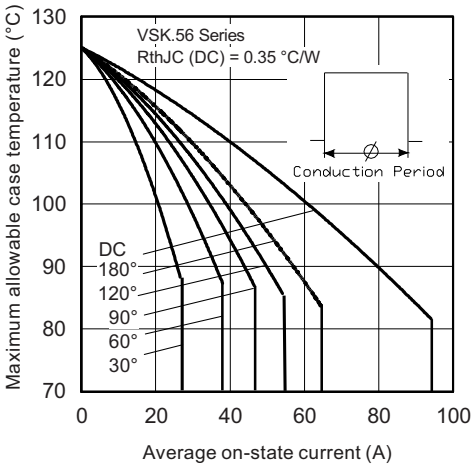


Fig. 11 - Current Ratings Characteristics

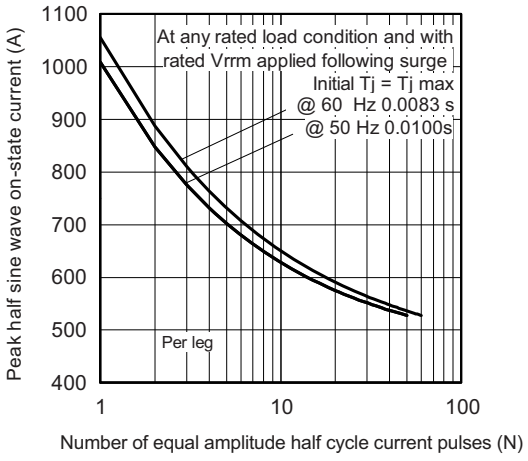


Fig. 14 - Maximum Non-Repetitive Surge Current

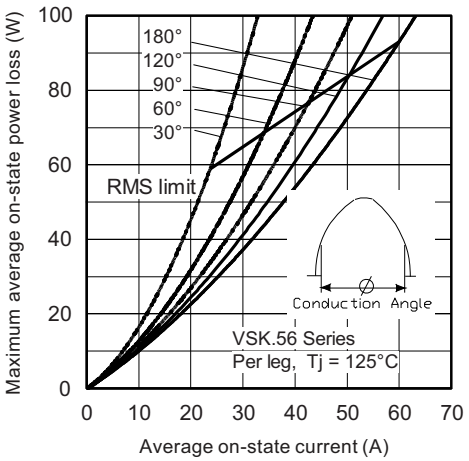


Fig. 12 - On-State Power Loss Characteristics

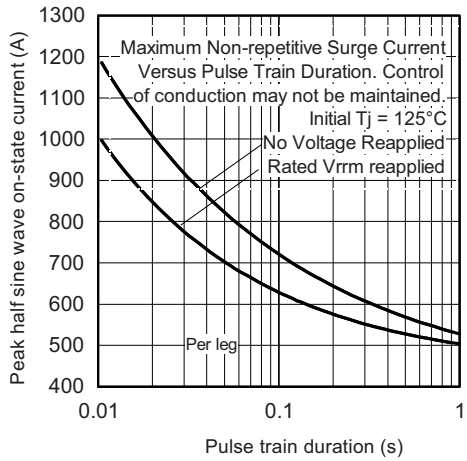


Fig. 15 - Maximum Non-Repetitive Surge Current

For technical questions within your region: DiodesAmericas@vishay.com, DiodesAsia@vishay.com, DiodesEurope@vishay.com
THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

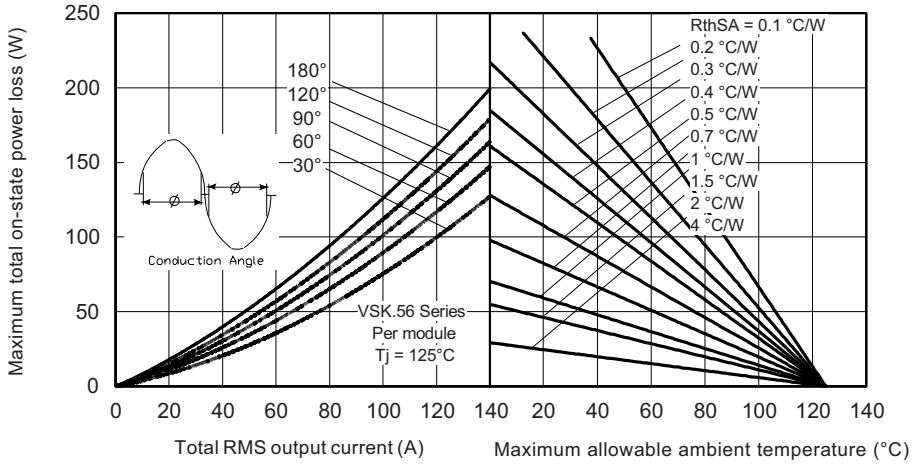


Fig. 16 - On-State Power Loss Characteristics

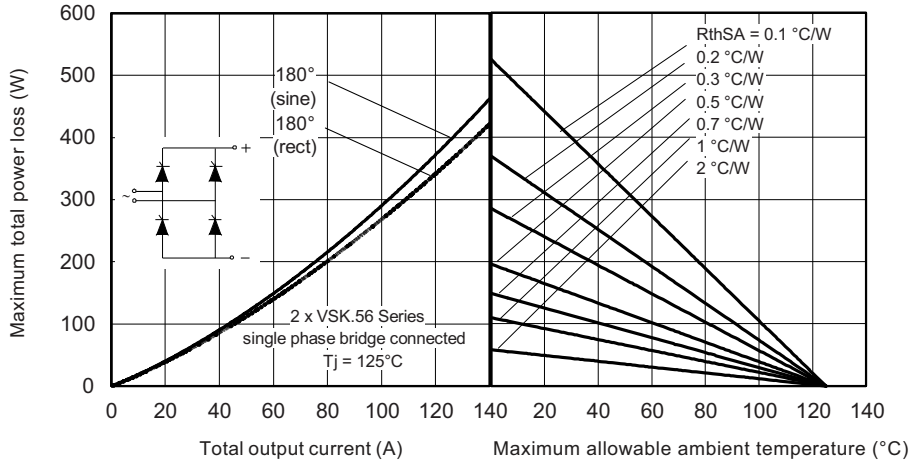


Fig. 17 - On-State Power Loss Characteristics

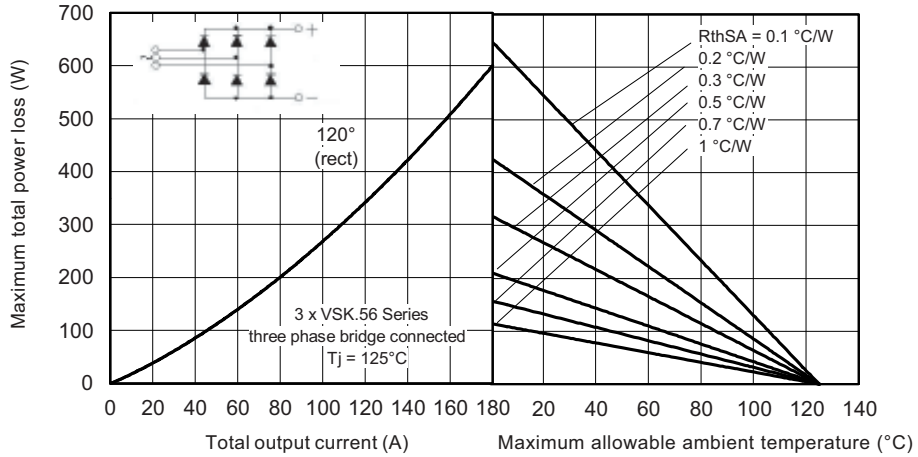


Fig. 18 - On-State Power Loss Characteristics

For technical questions within your region: DiodesAmericas@vishay.com, DiodesAsia@vishay.com, DiodesEurope@vishay.com
THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

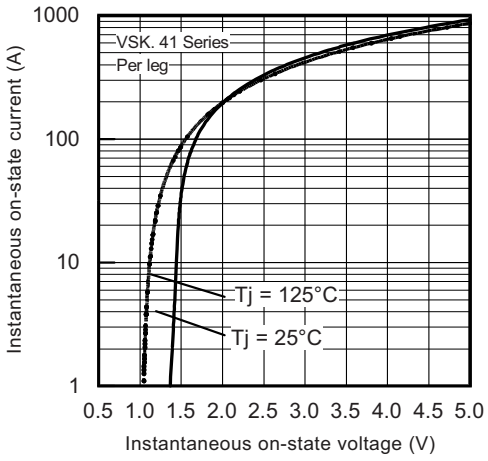


Fig. 19 - On-State Voltage Drop Characteristics

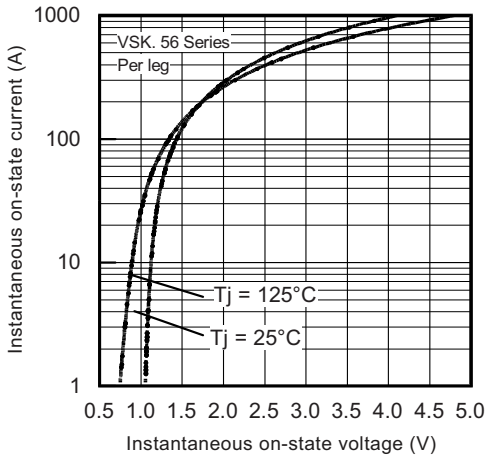


Fig. 20 - On-State Voltage Drop Characteristics

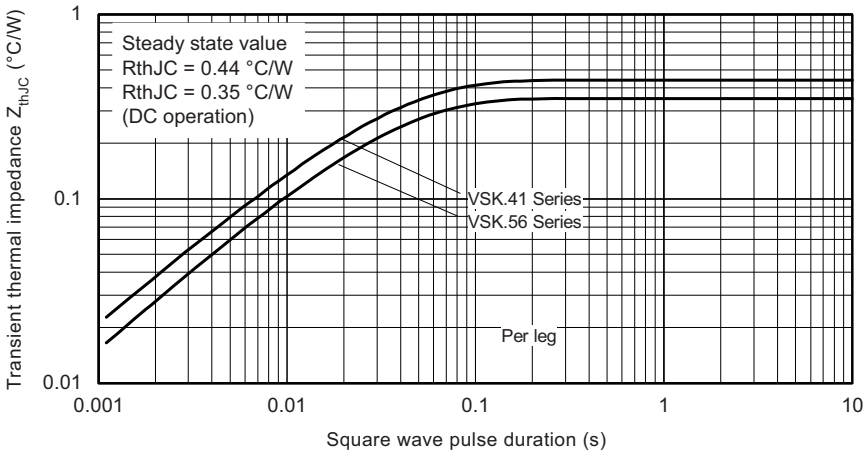


Fig. 21 - Thermal Impedance Z_{thJC} Characteristics

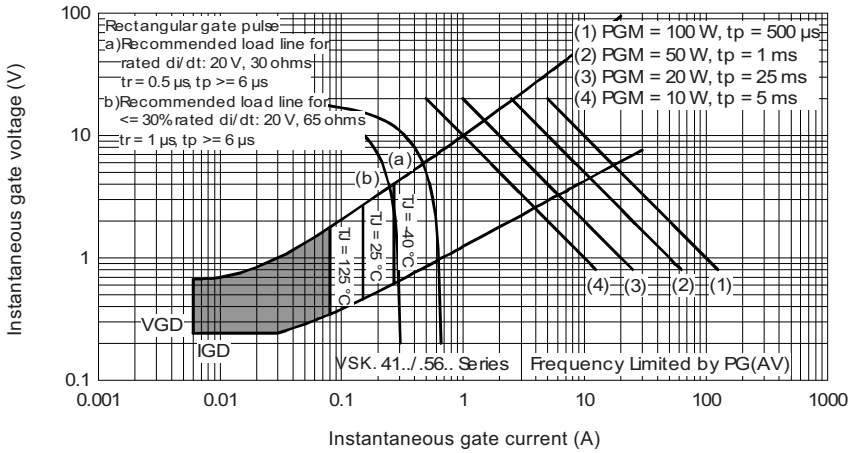


Fig. 22 - Gate Characteristics

For technical questions within your region: DiodesAmericas@vishay.com, DiodesAsia@vishay.com, DiodesEurope@vishay.com
THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

ORDERING INFORMATION TABLE

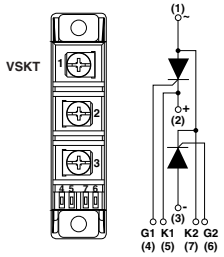
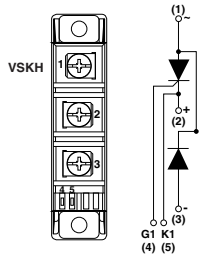
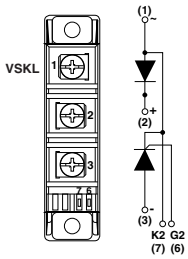
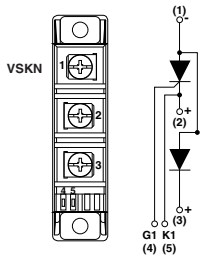
Device code	VS-VS	K	T	56	/	16
	1	2	3	4		5

1 - Vishay Semiconductors product
2 - Module type
3 - Circuit configuration (see Circuit configuration table)
4 - Current code — 41 = 45 A, 56 = 60 A
5 - Voltage code (see Voltage Ratings table)

Note

- To order the optional hardware go to www.vishay.com/doc?95172

CIRCUIT CONFIGURATION

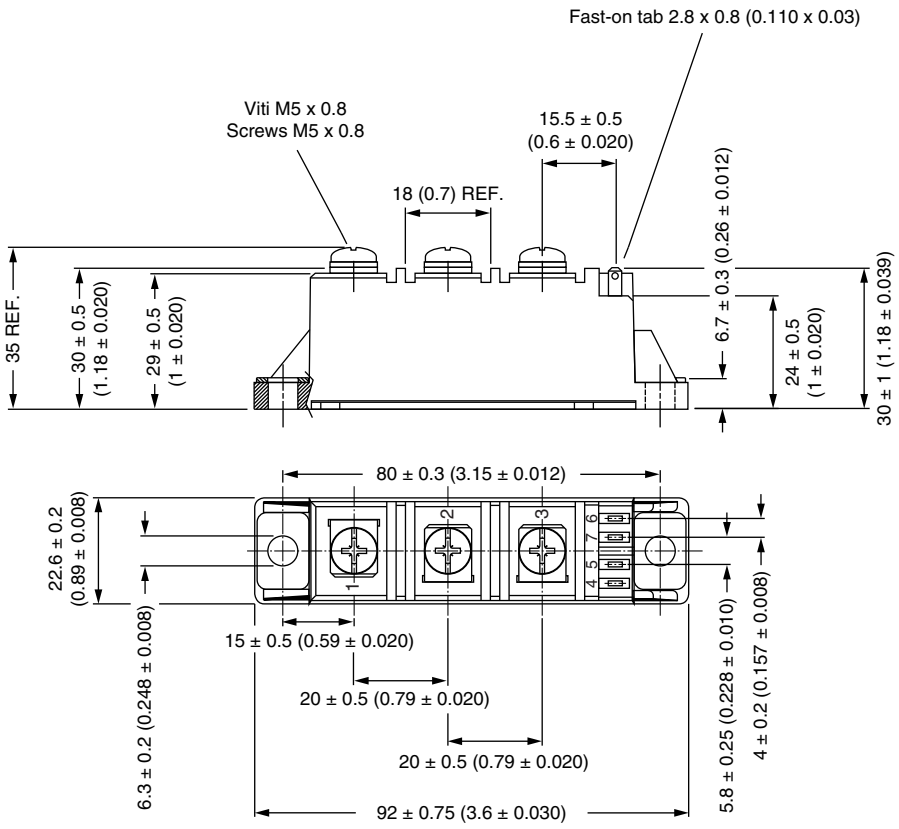
CIRCUIT DESCRIPTION	CIRCUIT CONFIGURATION CODE	CIRCUIT DRAWING
Two SCRs doubler circuit	T	
SCR/diode doubler circuit, positive control	H	
SCR/diode doubler circuit, negative control	L	
SCR/diode common anodes	N	

LINKS TO RELATED DOCUMENTS	
Dimensions	www.vishay.com/doc?95368

For technical questions within your region: DiodesAmericas@vishay.com, DiodesAsia@vishay.com, DiodesEurope@vishay.com
THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

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.

© 2024 VISHAY INTERTECHNOLOGY, INC. ALL RIGHTS RESERVED