Thyristor/Thyristor, 45/60 A (ADD-A-PAK^{TM} Generation 5 Power Modules)

ADD-A-PAK^{TM}

PRODUCT SUMMARY	
$I_{T(AV)}$	45/60 A

MECHANICAL DESCRIPTION

The Generation 5 of ADD-A-PAK^{TM} 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

Pb-free
RoHS COMPLIANT

BENEFITS

- Up to 1600 V
- Full compatible TO-240AA
- High surge capability
- Easy mounting on heatsink
- Al_20_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/V41	VSKU/V56	UNITS
$I_{T(AV)}$	85 °C	45	60	A
$I_{T(RMS)}$		70	95	
I_{TSM}	50 Hz	850	1310	
	60 Hz	890	1370	
I^2t	50 Hz	3.61	8.50	kA^2s
	60 Hz	3.30	7.82	
$I^2\sqrt{t}$		36.1	85.0	$kA^2\sqrt{s}$
V_{RRM}	Range	400 to 1600		V
T_J, T_{Stg}		- 40 to 125		°C

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
VSKU/V41, 56	04	400	500	400	15
	08	800	900	800	
	12	1200	1300	1200	
	16	1600	1700	1600	

ON-STATE CONDUCTION

PARAMETER	SYMBOL	TEST CONDITIONS			VALUES VSKU/V41	VALUES VSKU/V56	UNITS
Maximum average on-state current	$I_{T(AV)}$	180° conduction, half sine wave, T_C = 85 °C			45	60	A
Maximum RMS on-state current	$I_{T(RMS)}$	DC			70	95	A
		T_C			82	80	°C
Maximum peak, one-cycle non-repetitive on-state current	I_{TSM}	t = 10 ms	No voltage reapplied	Sinusoidal half wave, initial $T_J = T_J$ maximum	850	1310	A
		t = 8.3 ms			890	1370	
		t = 10 ms	100 % V_{RRM} reapplied		715	1100	
		t = 8.3 ms			750	1150	
		t = 10 ms	T_J = 25 °C, no voltage reapplied		940	1450	
		t = 8.3 ms			985	1520	
Maximum I^2t for fusing	I^2t	t = 10 ms	No voltage reapplied	Initial $T_J = T_J$ maximum	3.61	8.56	kA^2s
		t = 8.3 ms			3.30	7.82	
		t = 10 ms	100 % V_{RRM} reapplied		2.56	6.05	
		t = 8.3 ms			2.33	5.53	
		t = 10 ms	T_J = 25 °C, no voltage reapplied		4.42	10.05	
		t = 8.3 ms			4.03	9.60	
Maximum $I^2\sqrt{t}$ for fusing	$I^2\sqrt{t}$ (1)	t = 0.1 to 10 ms, no voltage reapplied			36.1	85.6	$kA^2\sqrt{s}$
Maximum value of threshold voltage	$V_{T(TO)}$ (2)	Low level (3)	$T_J = T_J$ maximum		0.88	0.85	V
		High level (4)			0.91	0.88	
Maximum value of on-state slope resistance	r_t (2)	Low level (3)			5.90	3.53	mΩ
		High level (4)			5.74	3.41	
Maximum peak on-state voltage	V_{TM}	$I_{TM} = \pi$ x $I_{T(AV)}$	T_J = 25 °C		1.81	1.54	V
		$I_{FM} = \pi$ x $I_{F(AV)}$					
Maximum non-repetitive rate of rise of turned on current	dI/dt	T_J = 25 °C, from 0.67 V_{DRM}, $I_{TM} = \pi$ x $I_{T(AV)}$, 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		

Notes

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

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

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

(4) $I > \pi$ x I_{AV}

TRIGGERING					
PARAMETER	**SYMBOL**	**TEST CONDITIONS**		**VALUES**	**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		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}			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 °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 °C, linear to 0.67 V_{DRM}, gate open circuit	500	V/µs

Note

(1) Available with dV/dt = 1000 V/µs, to complete code add S90 i.e. VSKU41/16AS90

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 module	R_{thJC}	DC operation	0.23	K/W
Typical thermal resistance, case to heatsink	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.	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°**	
VSKU/V41	0.11	0.13	0.17	0.23	0.34	0.09	0.14	0.18	0.23	0.34	°C/W
VSKU/V56	0.09	0.11	0.13	0.18	0.27	0.07	0.11	0.14	0.19	0.28	

Note

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

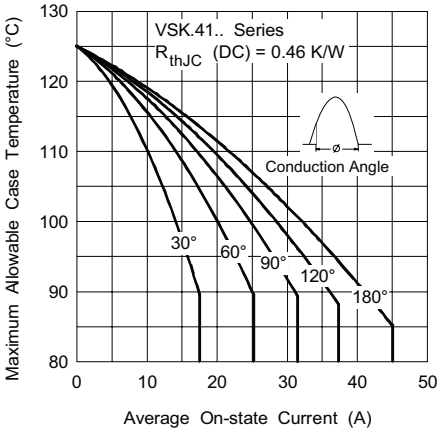


Fig. 1 - Current Ratings Characteristics

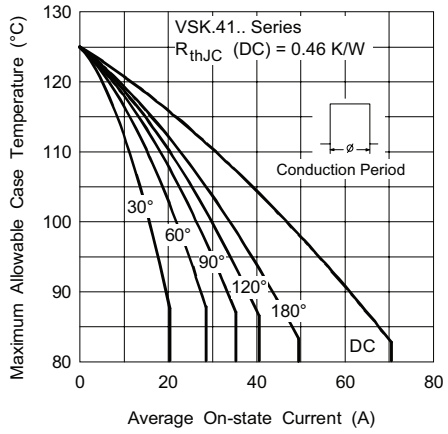


Fig. 2 - Current Ratings Characteristics

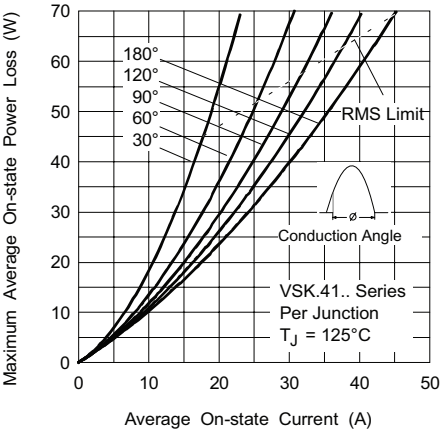


Fig. 3 - On-State Power Loss Characteristics

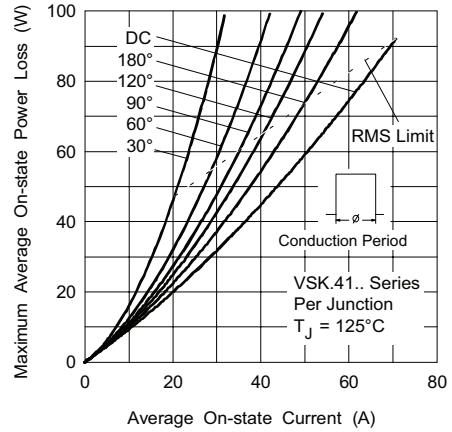


Fig. 4 - On-State Power Loss Characteristics

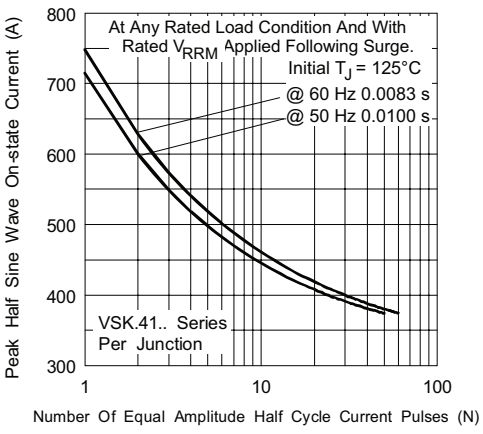


Fig. 5 - Maximum Non-Repetitive Surge Current

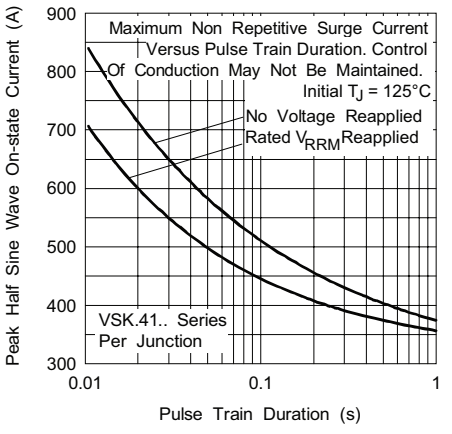


Fig. 6 - Maximum Non-Repetitive Surge Current

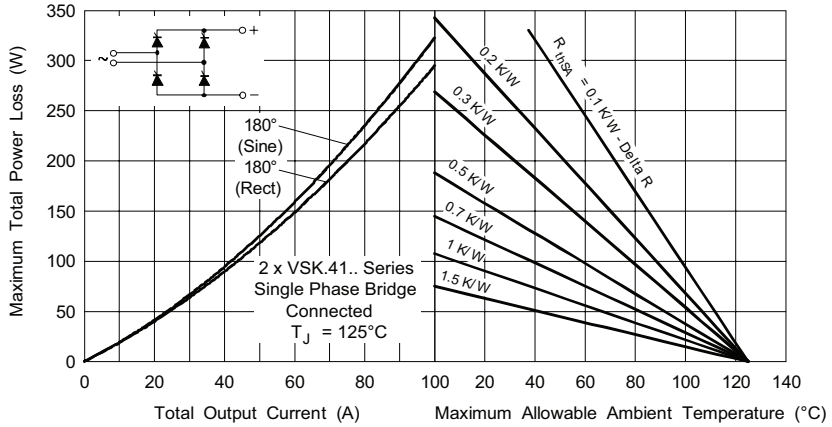


Fig. 7 - On-State Power Loss Characteristics (Single Phase Bridge VSKU and VSKV)

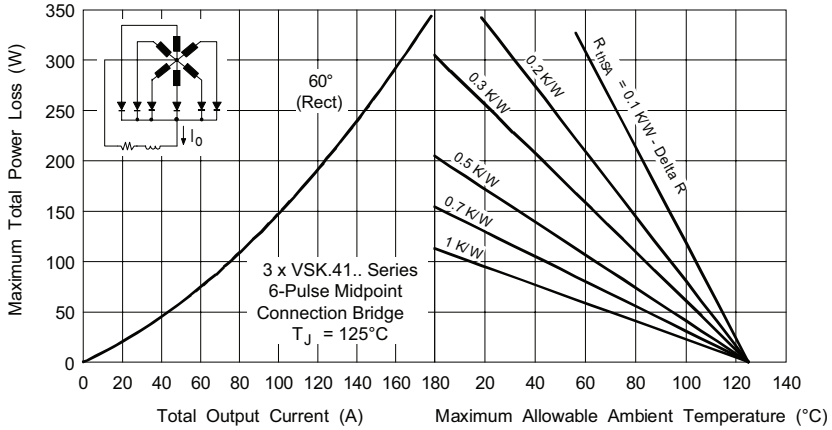


Fig. 8 - On-State Power Loss Characteristics

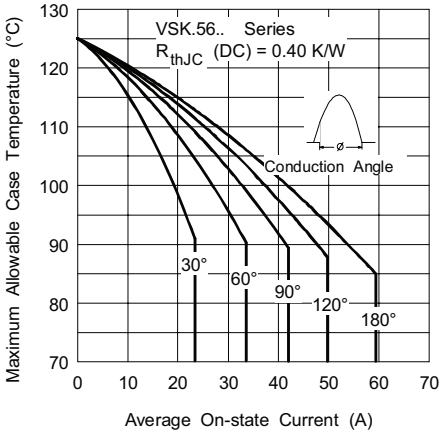


Fig. 9 - Current Ratings Characteristics

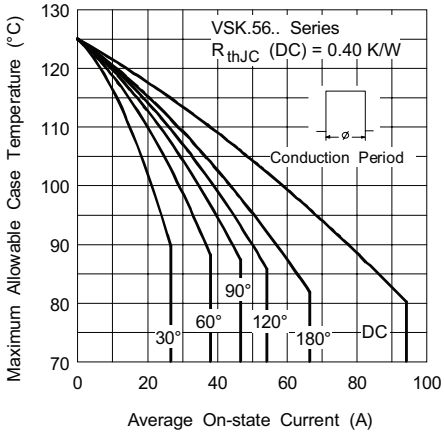


Fig. 10 - Current Ratings Characteristics

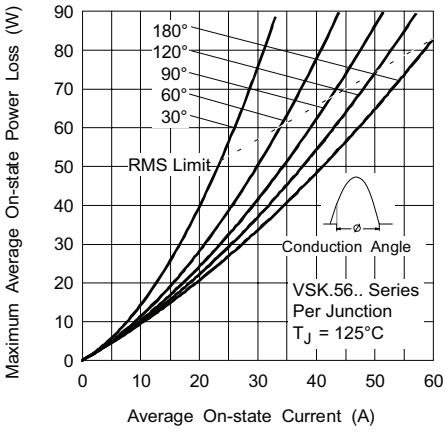


Fig. 11 - On-State Power Loss Characteristics

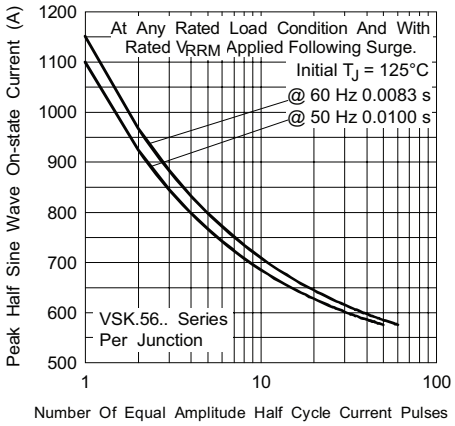


Fig. 13 - Maximum Non-Repetitive Surge Current

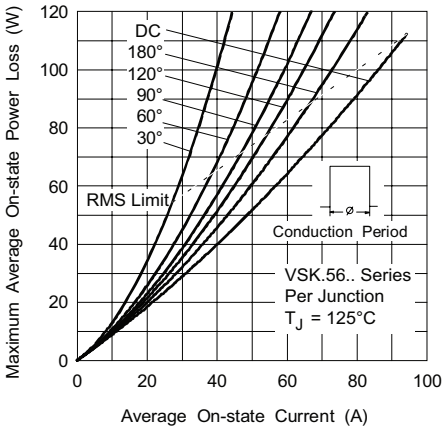


Fig. 12 - On-State Power Loss Characteristics

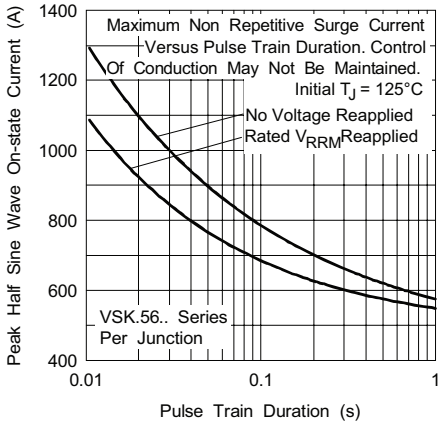


Fig. 14 - Maximum Non-Repetitive Surge Current

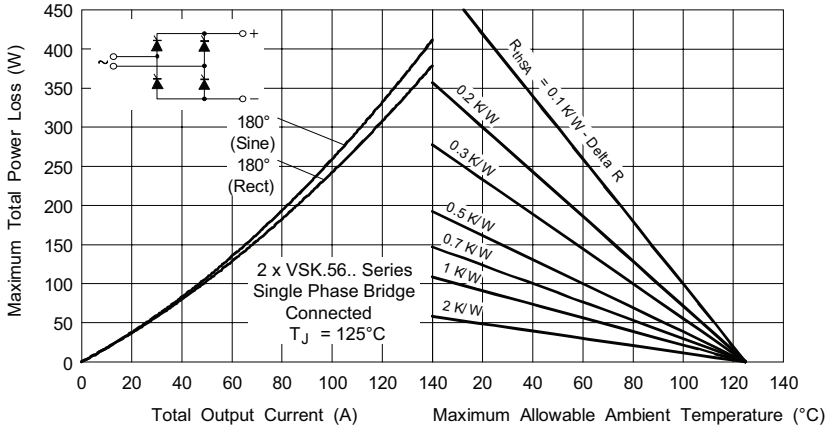


Fig. 15 - On-State Power Loss Characteristics (Single Phase Bridge VSKU and VSKV)

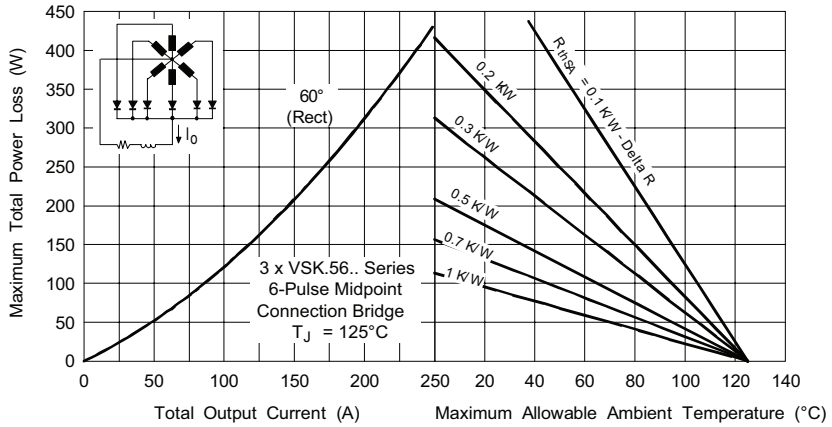


Fig. 16 - On-State Power Loss Characteristics

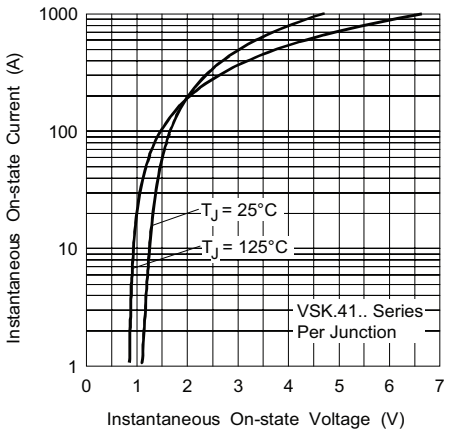


Fig. 17 - On-State Voltage Drop Characteristics

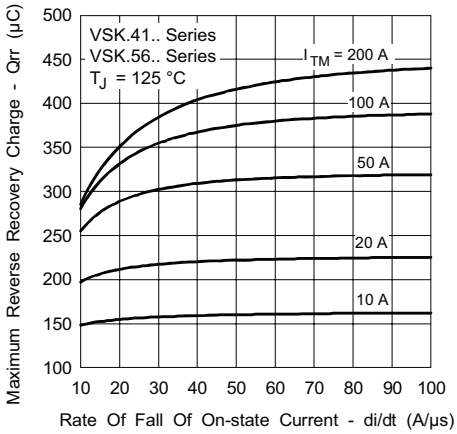


Fig. 19 - Recovery Charge Characteristics

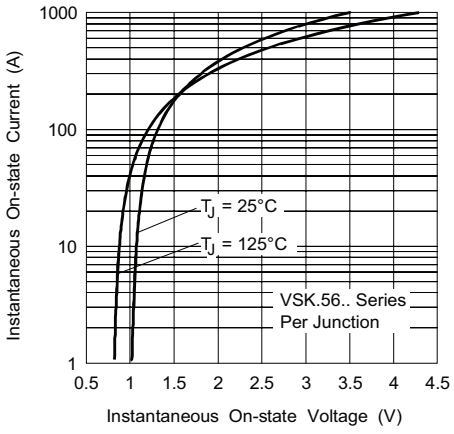


Fig. 18 - On-State Voltage Drop Characteristics

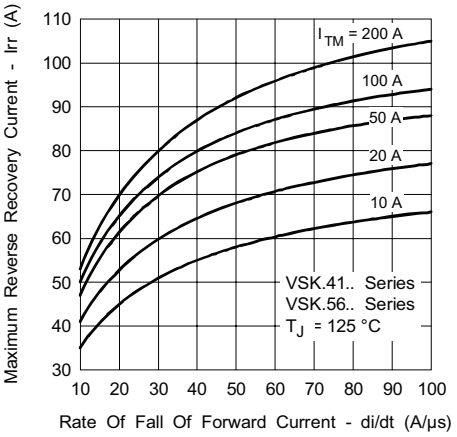


Fig. 20 - Recovery Current Characteristics

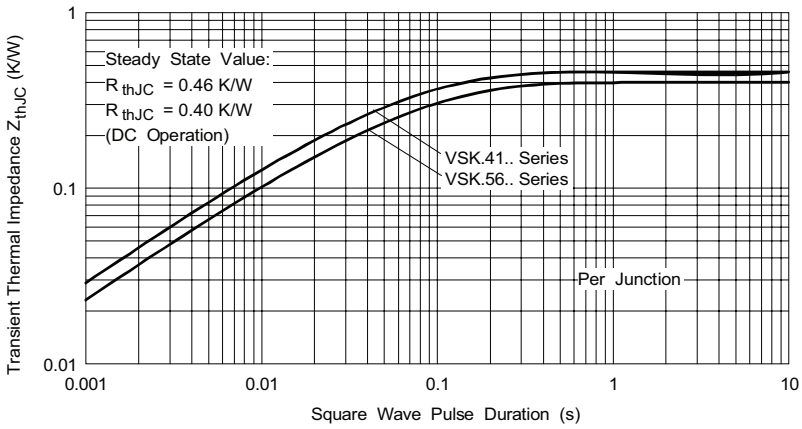


Fig. 21 - Thermal Impedance Z_{thJC} Characteristics

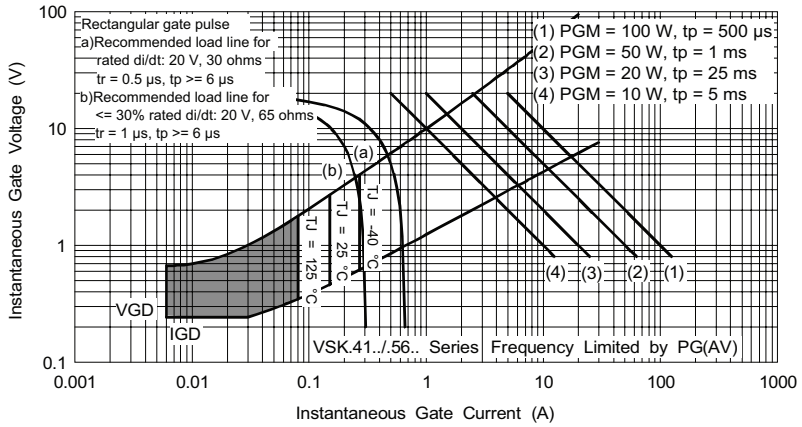


Fig. 22 - Gate Characteristics

ORDERING INFORMATION TABLE

Device code

VSK	U	56	/	16	P
1	2	3		4	5

1 - Module type

2 - Circuit configuration:
- U = Two SCR common cathode
- V = Two SCR common anode

3 - Current code

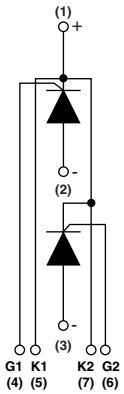
4 - Voltage code (see Voltage Ratings table)

5 - P = Lead (Pb)-free

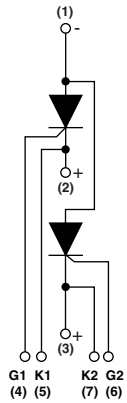
Note
- To order the optional hardware go to www.vishay.com/doc?95172

CIRCUIT CONFIGURATION

VSKU...



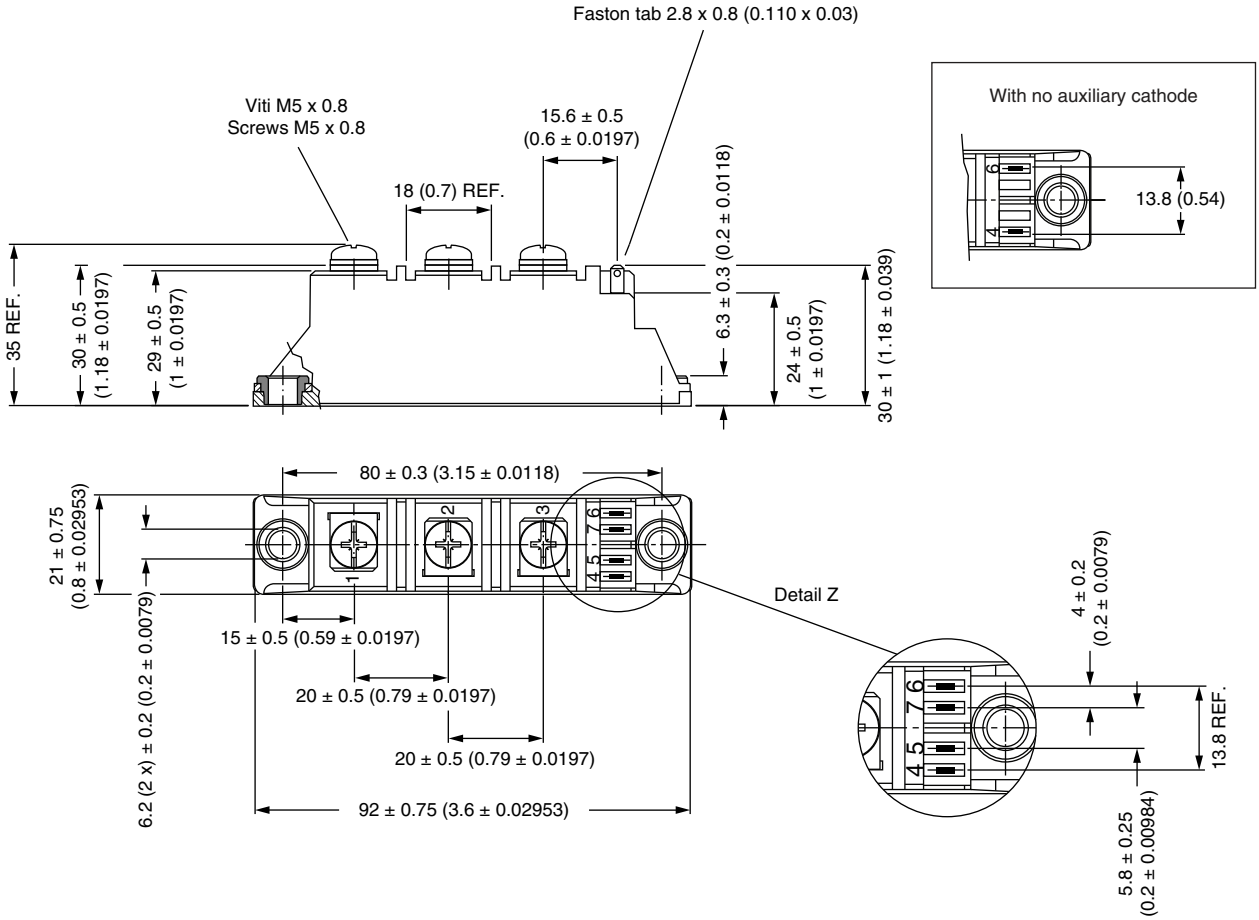
VSKV...



LINKS TO RELATED DOCUMENTS	
Dimensions	http://www.vishay.com/doc?95087

ADD-A-PAK Thyristor

DIMENSIONS in millimeters (inches)



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