



## Phase Control Thyristors (Hockey PUK Version), 1650 A



K-PUK (A-24)

### FEATURES

- Center amplifying gate
- Metal case with ceramic insulator
- International standard case K-PUK (A-24)
- High profile hockey PUK
- 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

### TYPICAL APPLICATIONS

- DC motor controls
- Controlled DC power supplies
- AC controllers

### PRIMARY CHARACTERISTICS

$I_{T(AV)}$	1650 A
$V_{DRM}/V_{RRM}$	1200 V, 1400 V, 1600 V, 1800 V, 2000 V
$V_{TM}$	1.73 V
$I_{GT}$	100 mA
$T_J$	-40 °C to +125 °C
Package	K-PUK (A-24)
Circuit configuration	Single SCR

### MAJOR RATINGS AND CHARACTERISTICS

PARAMETER	TEST CONDITIONS	VALUES	UNITS
$I_{T(AV)}$		1650	A
	$T_{hs}$	55	°C
$I_{T(RMS)}$		3080	A
	$T_{hs}$	25	°C
$I_{TSM}$	50 Hz	30 500	A
	60 Hz	32 000	
$I^2t$	50 Hz	4651	kA <sup>2</sup> s
	60 Hz	4250	
$V_{DRM}/V_{RRM}$		1200 to 2000	V
$t_q$	Typical	200	μs
$T_J$		-40 to +125	°C

### ELECTRICAL SPECIFICATIONS

#### VOLTAGE RATINGS

TYPE NUMBER	VOLTAGE CODE	$V_{DRM}/V_{RRM}$ , MAXIMUM REPETITIVE PEAK AND OFF-STATE VOLTAGE V	$V_{RSM}$ , MAXIMUM NON-REPETITIVE PEAK VOLTAGE V	$I_{DRM}/I_{RRM}$ MAXIMUM AT $T_J = T_J$ MAXIMUM mA
VS-ST1200C..K	12	1200	1300	100
	14	1400	1500	
	16	1600	1700	
	18	1800	1900	
	20	2000	2100	

**ABSOLUTE MAXIMUM RATINGS**

PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Maximum average on-state current at heatsink temperature	$I_{T(AV)}$	180° conduction, half sine wave double side (single side) cooled	1650 (700)	A
Maximum RMS on-state current	$I_{T(RMS)}$	DC at 25 °C heatsink temperature double side cooled	55 (85)	°C
Maximum peak, one-cycle non-repetitive surge current	$I_{TSM}$	<div> <div> <div>t = 10 ms</div> <div>No voltage reapplied</div> </div> <div> <div>t = 8.3 ms</div> <div>100 % <math>V_{RRM}</math> reapplied</div> </div> </div>	30 500	A
			32 000	
			25 700	
			26 900	
Maximum $I^2t$ for fusing	$I^2t$	<div> <div> <div>t = 10 ms</div> <div>No voltage reapplied</div> </div> <div> <div>t = 8.3 ms</div> <div>100 % <math>V_{RRM}</math> reapplied</div> </div> </div>	4651	$kA^2s$
			4250	
			3300	
			3000	
Maximum $I^2\sqrt{t}$ for fusing	$I^2\sqrt{t}$	t = 0.1 ms to 10 ms, no voltage reapplied	46 510	$kA^2\sqrt{s}$
Low level value of threshold voltage	$V_{T(TO)1}$	$(16.7 \% \times \pi \times I_{T(AV)} < I < \pi \times I_{T(AV)})$ , $T_J = T_J$ maximum	0.91	V
High level value of threshold voltage	$V_{T(TO)2}$	$(I > \pi \times I_{T(AV)})$ , $T_J = T_J$ maximum	1.01	
Low level value of on-state slope resistance	$r_{t1}$	$(16.7 \% \times \pi \times I_{T(AV)} < I < \pi \times I_{T(AV)})$ , $T_J = T_J$ maximum	0.21	$m\Omega$
High level value of on-state slope resistance	$r_{t2}$	$(I > \pi \times I_{T(AV)})$ , $T_J = T_J$ maximum	0.19	
Maximum on-state voltage	$V_{TM}$	$I_{pk} = 4000$ A, $T_J = T_J$ maximum, $t_p = 10$ ms sine pulse	1.73	V
Maximum holding current	$I_H$	$T_J = 25$ °C, anode supply 12 V resistive load	600	mA
Typical latching current	$I_L$		1000	

**SWITCHING**

PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Maximum non-repetitive rate of rise of turned-on current	$di/dt$	Gate drive 20 V, 20 $\Omega$ , $t_r \leq 1$ $\mu s$ $T_J = T_J$ maximum, anode voltage $\leq 80 \% V_{DRM}$	1000	A/ $\mu s$
Typical delay time	$t_d$	Gate current 1 A, $di_g/dt = 1$ A/ $\mu s$ $V_d = 0.67 \% V_{DRM}$ , $T_J = 25$ °C	1.9	$\mu s$
Typical turn-off time	$t_q$	$I_{TM} = 550$ A, $T_J = T_J$ maximum, $di/dt = 40$ A/ $\mu s$ , $V_R = 50$ V, $dV/dt = 20$ V/ $\mu s$ , gate 0 V 100 $\Omega$ , $t_p = 500$ $\mu s$	200	

**BLOCKING**

PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Maximum critical rate of rise of off-state voltage	$dV/dt$	$T_J = T_J$ maximum linear to 80 % rated $V_{DRM}$	500	V/ $\mu s$
Maximum peak reverse and off-state leakage current	$I_{RRM}$ , $I_{DRM}$	$T_J = T_J$ maximum, rated $V_{DRM}/V_{RRM}$ applied	100	mA

**TRIGGERING**

PARAMETER	SYMBOL	TEST CONDITIONS		VALUES		UNITS
				TYP.	MAX.	
Maximum peak gate power	P <sub>GM</sub>	T <sub>J</sub> = T <sub>J</sub> maximum, t <sub>p</sub> ≤ 5 ms		16		W
Maximum average gate power	P <sub>G(AV)</sub>	T <sub>J</sub> = T <sub>J</sub> maximum, f = 50 Hz, d% = 50		3		
Maximum peak positive gate current	I <sub>GM</sub>	T <sub>J</sub> = T <sub>J</sub> maximum, t <sub>p</sub> ≤ 5 ms		3.0		A
Maximum peak positive gate voltage	+ V <sub>GM</sub>			20		V
Maximum peak negative gate voltage	- V <sub>GM</sub>			5.0		
DC gate current required to trigger	I <sub>GT</sub>	T <sub>J</sub> = -40 °C	Maximum required gate trigger/ current/voltage are the lowest value which will trigger all units 12 V anode to cathode applied	200	-	mA
		T <sub>J</sub> = 25 °C		100	200	
		T <sub>J</sub> = 125 °C		50	-	
DC gate voltage required to trigger	V <sub>GT</sub>	T <sub>J</sub> = -40 °C		1.4	-	V
		T <sub>J</sub> = 25 °C		1.1	3.0	
		T <sub>J</sub> = 125 °C		0.9	-	
DC gate current not to trigger	I <sub>GD</sub>	T <sub>J</sub> = T <sub>J</sub> maximum	Maximum gate current/voltage not to trigger is the maximum value which will not trigger any unit with rated V <sub>DRM</sub> anode to cathode applied	10		mA
DC gate voltage not to trigger	V <sub>GD</sub>			0.25		V

**THERMAL AND MECHANICAL SPECIFICATIONS**

PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Maximum operating junction temperature range	$T_J$		-40 to 125	°C
Maximum storage temperature range	$T_{Stg}$		-40 to 150	
Maximum thermal resistance, junction to heatsink	$R_{thJ-hs}$	DC operation single side cooled	0.042	K/W
		DC operation double side cooled	0.021	
Maximum thermal resistance, case to heatsink	$R_{thC-hs}$	DC operation single side cooled	0.006	
		DC operation double side cooled	0.003	
Mounting force, $\pm 10$ %			24 500 (2500)	N (kg)
Approximate weight			425	g
Case style		See dimensions - link at the end of datasheet	K-PUK (A-24)	

 **$\Delta R_{thJC}$  CONDUCTION**

CONDUCTION ANGLE	SINUSOIDAL CONDUCTION		RECTANGULAR CONDUCTION		TEST CONDITIONS	UNITS
	SINGLE SIDE	DOUBLE SIDE	SINGLE SIDE	DOUBLE SIDE		
180°	0.003	0.003	0.002	0.002	$T_J = T_J$ maximum	K/W
120°	0.004	0.004	0.004	0.004		
90°	0.005	0.005	0.005	0.005		
60°	0.007	0.007	0.007	0.007		
30°	0.012	0.012	0.012	0.012		

**Note**

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

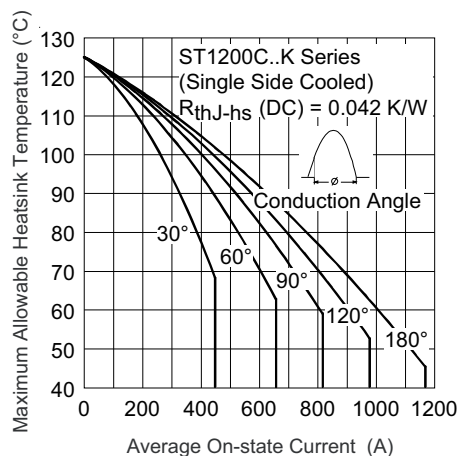


Fig. 1 - Current Ratings Characteristics

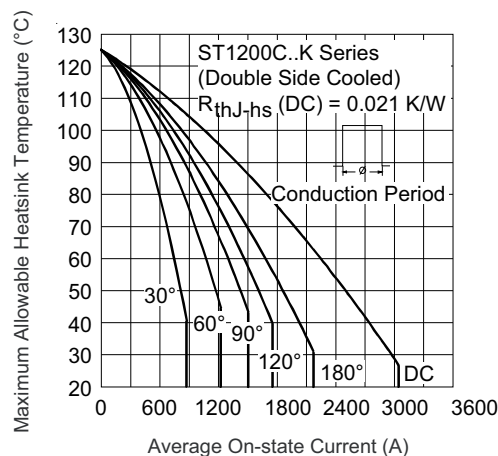


Fig. 4 - Current Ratings Characteristics

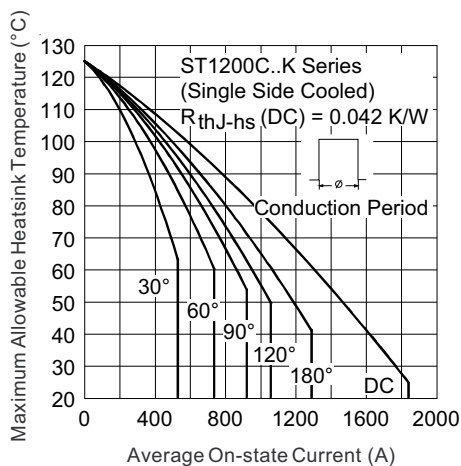


Fig. 2 - Current Ratings Characteristics

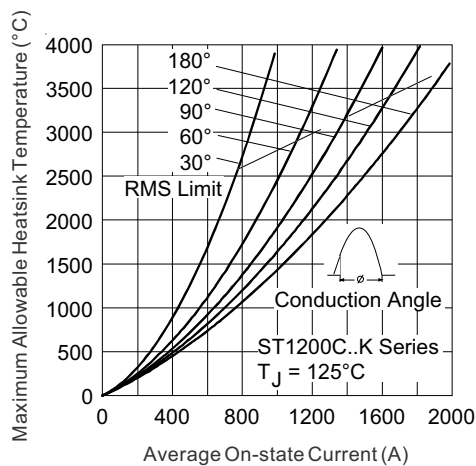


Fig. 5 - On-State Power Loss Characteristics

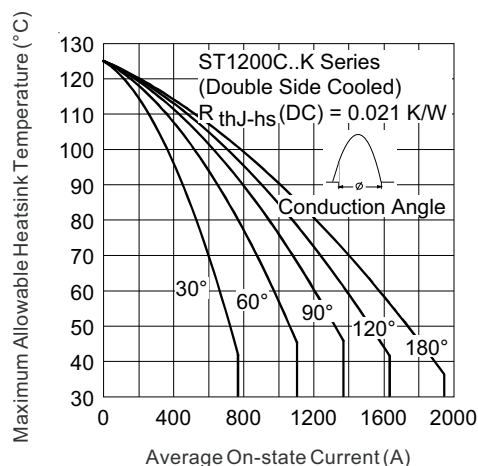


Fig. 3 - Current Ratings Characteristics

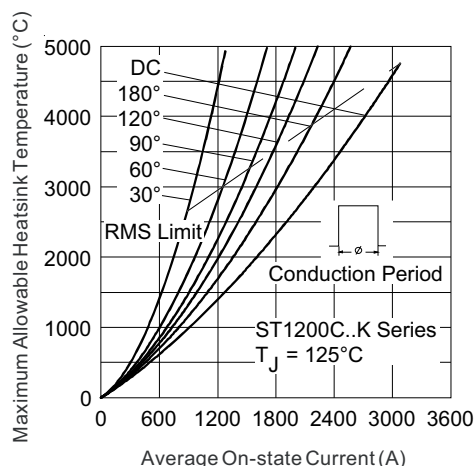


Fig. 6 - On-State Power Loss Characteristics

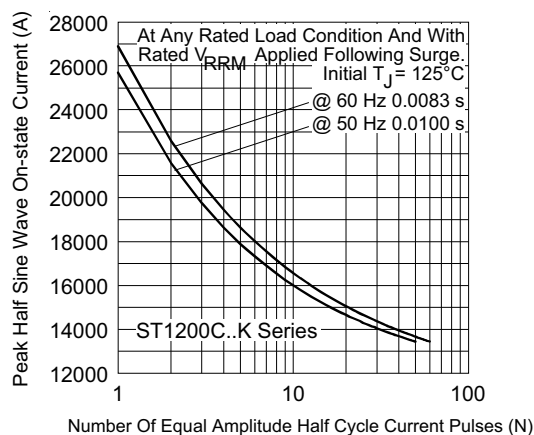


Fig. 7 - Maximum Non-Repetitive Surge Current Single and Double Side Cooled

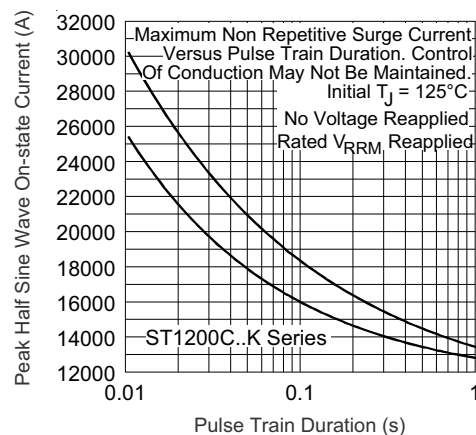


Fig. 8 - Maximum Non-Repetitive Surge Current Single and Double Side Cooled

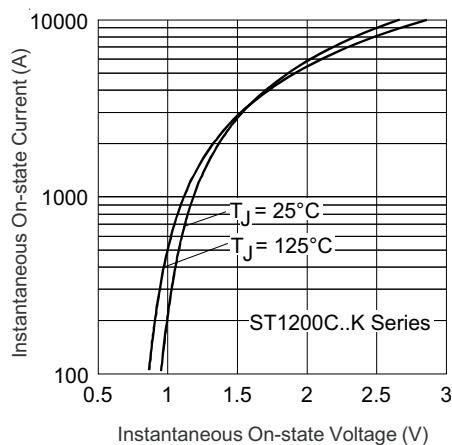
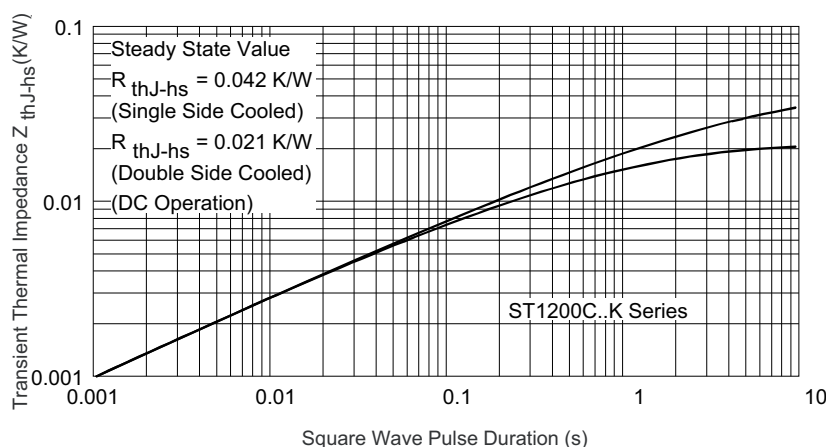


Fig. 9 - On-State Voltage Drop Characteristics

Fig. 10 - Thermal Impedance  $Z_{thJ-hs}$  Characteristics

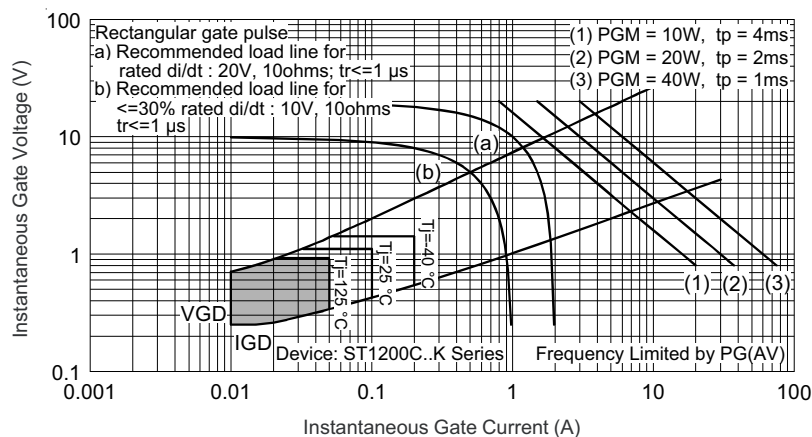


Fig. 11 - Gate Characteristics

## ORDERING INFORMATION TABLE

Device code	VS-	ST	120	0	C	20	K	1	-
	1	2	3	4	5	6	7	8	9
1	Vishay Semiconductors product								
2	Thyristor								
3	Essential part number								
4	0 = converter grade								
5	C = ceramic PUK								
6	Voltage code: code x 100 = V <sub>RRM</sub> (see Voltage Ratings table)								
7	K = PUK case K-PUK (A-24)								
8	0 = eyelet terminals (gate and auxiliary cathode unsoldered leads)								
	1 = fast-on terminals (gate and auxiliary cathode unsoldered leads)								
9	Critical dV/dt: • None = 500 V/μs (standard selection)								
	• L = 1000 V/μs (special selection)								

## LINKS TO RELATED DOCUMENTS

Dimensions

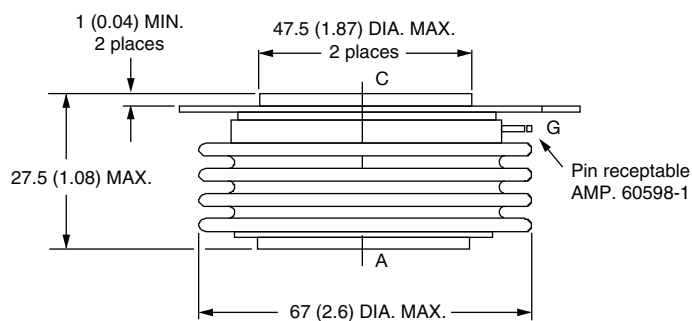
[www.vishay.com/doc?95081](http://www.vishay.com/doc?95081)



## K-PUK (A-24)

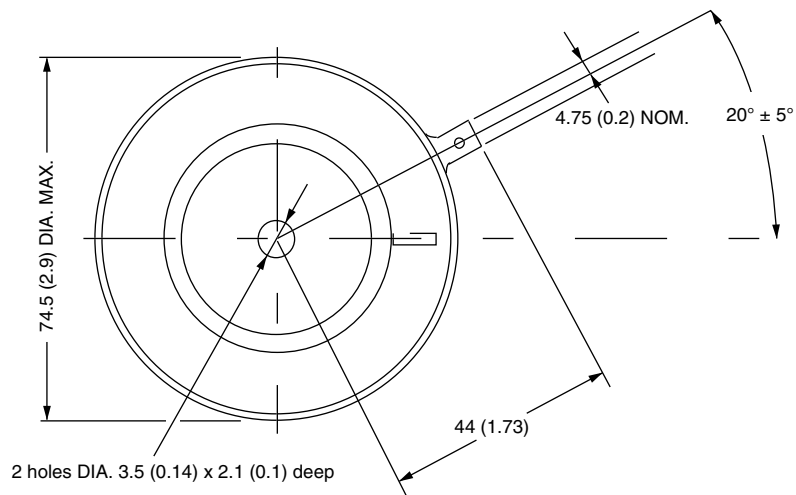
### DIMENSIONS in millimeters (inches)

Creepage distance: 28.88 (1.137) minimum  
Strike distance: 17.99 (0.708) minimum



#### Note:

A = Anode  
C = Cathode  
G = Gate



Quote between upper and lower pole pieces has to be considered after application of mounting force (see thermal and mechanical specification)



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