

Phase Control Thyristors (Hockey PUK Version), 650 A



B-PUK (TO-200AC)

FEATURES

- Center amplifying gate
- Metal case with ceramic insulator
- International standard case B-PUK (TO-200AC))
- High profile hockey PUK
- Designed and qualified for industrial level
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912



RoHS
COMPLIANT

TYPICAL APPLICATIONS

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

PRIMARY CHARACTERISTICS

$I_{T(AV)}$	650 A
V_{DRM}/V_{RRM}	400 V, 800 V, 1200 V, 1400 V, 1600 V
V_{TM}	1.90 V
I_{GT}	100 mA
T_J	-40 °C to +125 °C
Package	B-PUK (TO-200AC)
Circuit configuration	Single SCR

MAJOR RATINGS AND CHARACTERISTICS

PARAMETER	TEST CONDITIONS	VALUES	UNITS
$I_{T(AV)}$		650	A
	T_{hs}	55	°C
$I_{T(RMS)}$		1230	A
	T_{hs}	25	°C
I_{TSM}	50 Hz	9000	A
	60 Hz	9420	
I^2t	50 Hz	405	kA ² s
	60 Hz	370	
V_{DRM}/V_{RRM}		400 to 1600	V
t_q	Typical	100	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-ST330CL	04	400	500	50
	08	800	900	
	12	1200	1300	
	14	1400	1500	
	16	1600	1700	

**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		650 (314)	A
				55 (75)	°C
Maximum RMS on-state current	$I_{T(RMS)}$	DC at 25 °C heatsink temperature double side cooled		1230	
Maximum peak, one-cycle non-repetitive surge current	I_{TSM}	t = 10 ms	No voltage reapplied	9000	A
		t = 8.3 ms	No voltage reapplied	9420	
		t = 10 ms	100 % V_{RRM} reapplied	7570	
		t = 8.3 ms	100 % V_{RRM} reapplied	7920	
Maximum I^2t for fusing	I^2t	t = 10 ms	No voltage reapplied	405	kA ² s
		t = 8.3 ms	No voltage reapplied	370	
		t = 10 ms	100 % V_{RRM} reapplied	287	
		t = 8.3 ms	100 % V_{RRM} reapplied	262	
Maximum $I^2\sqrt{t}$ for fusing	$I^2\sqrt{t}$	t = 0.1 to 10 ms, no voltage reapplied		4050	kA ² √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		0.93	
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		0.57	mΩ
High level value of on-state slope resistance	r_{t2}	(I $> \pi \times I_{T(AV)}$), $T_J = T_J$ maximum		0.57	
Maximum on-state voltage	V_{TM}	$I_{pk} = 1730$ A, $T_J = T_J$ maximum, $t_p = 10$ ms sine pulse		1.90	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 Ω, $t_r \leq 1$ μs $T_J = T_J$ maximum, anode voltage ≤ 80 % V_{DRM}	1000	A/μs
Typical delay time	t_d	Gate current 1 A, $di_g/dt = 1$ A/μs $V_d = 0.67$ % V_{DRM} , $T_J = 25$ °C	1.0	μs
Typical turn-off time	t_q	$I_{TM} = 550$ A, $T_J = T_J$ maximum, $di/dt = 40$ A/μs, $V_R = 50$ V, $dV/dt = 20$ V/μs, gate 0 V 100 Ω, $t_p = 500$ μs	100	

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/μs
Maximum peak reverse and off-state leakage current	I_{RRM} , I_{DRM}	$T_J = T_J$ maximum, rated V_{DRM}/V_{RRM} applied	50	mA



TRIGGERING							
PARAMETER	SYMBOL	TEST CONDITIONS		VALUES		UNITS	
				Typ.	Max.		
Maximum peak gate power	P _{GM}	T _J = T _J maximum, t _p ≤ 5 ms		10.0		W	
Maximum average gate power	P _{G(AV)}	T _J = T _J maximum, f = 50 Hz, d% = 50		2.0			
Maximum peak positive gate current	I _{GM}	T _J = T _J maximum, t _p ≤ 5 ms		3.0		A	
Maximum peak positive gate voltage	+V _{GM}	T _J = T _J maximum, t _p ≤ 5 ms		20		V	
Maximum peak negative gate voltage	-V _{GM}			5.0			
DC gate current required to trigger	I _{GT}	T _J = -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 _J = 25 °C		100	200		
		T _J = 125 °C		50	-		
DC gate voltage required to trigger	V _{GT}	T _J = -40 °C		2.5	-	V	
		T _J = 25 °C		1.8	3.0		
		T _J = 125 °C		1.1	-		
DC gate current not to trigger	I _{GD}	T _J = T _J maximum		Maximum gate current/voltage not to trigger is the maximum value which will not trigger any unit with rated V _{DRM} anode to cathode applied	10		mA
DC gate voltage not to trigger	V _{GD}				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	0.11	K/W	
		DC operation double side cooled	0.06		
Maximum thermal resistance, case to heatsink	R_{thC-hs}	DC operation single side cooled	0.011		
		DC operation double side cooled	0.005		
Mounting force, ± 10 %			9800 (1000)	N (kg)	
Approximate weight			250	g	
Case style		See dimensions - link at the end of datasheet	B-PUK (TO-200AC)		

ΔR_{thJ-hs} CONDUCTION						
CONDUCTION ANGLE	SINUSOIDAL CONDUCTION		RECTANGULAR CONDUCTION		TEST CONDITIONS	UNITS
	SINGLE SIDE	DOUBLE SIDE	SINGLE SIDE	DOUBLE SIDE		
180°	0.012	0.010	0.008	0.008	$T_J = T_J$ maximum	K/W
120°	0.014	0.015	0.014	0.014		
90°	0.018	0.018	0.019	0.019		
60°	0.026	0.027	0.027	0.028		
30°	0.045	0.046	0.046	0.046		

Note

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

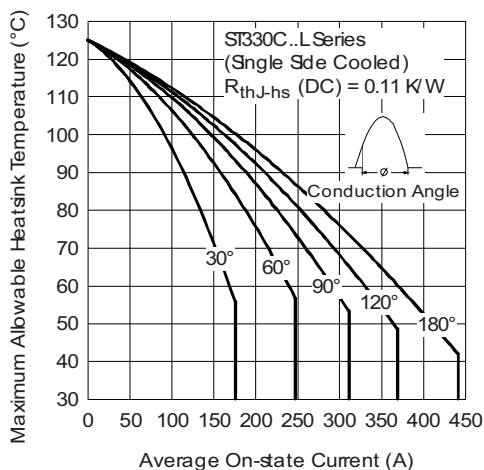


Fig. 1 - Current Ratings Characteristics

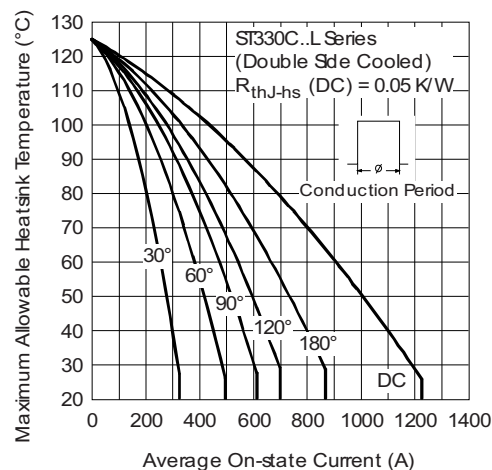


Fig. 4 - Current Ratings Characteristics

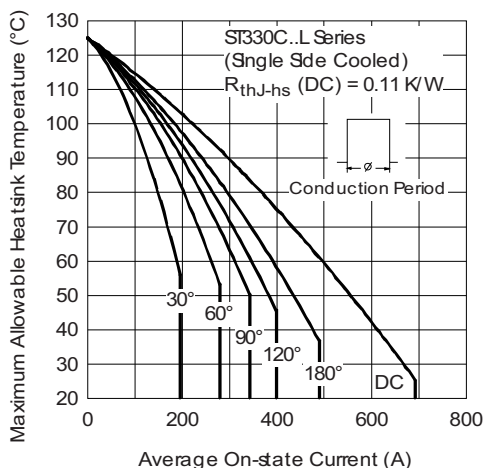


Fig. 2 - Current Ratings Characteristics

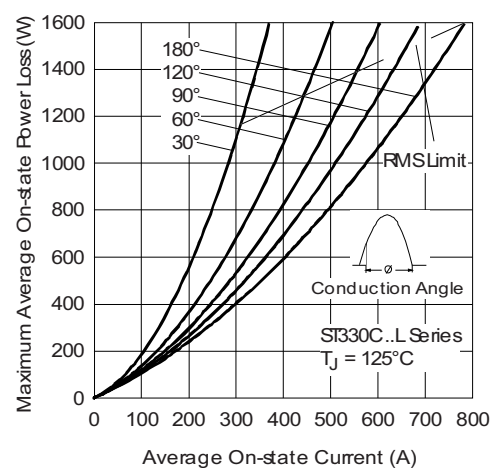


Fig. 5 - On-State Power Loss Characteristics

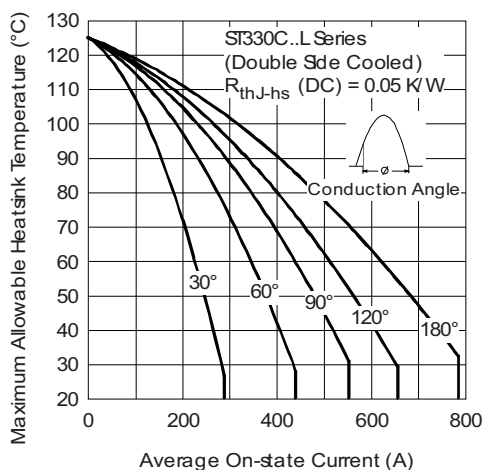


Fig. 3 - Current Ratings Characteristics

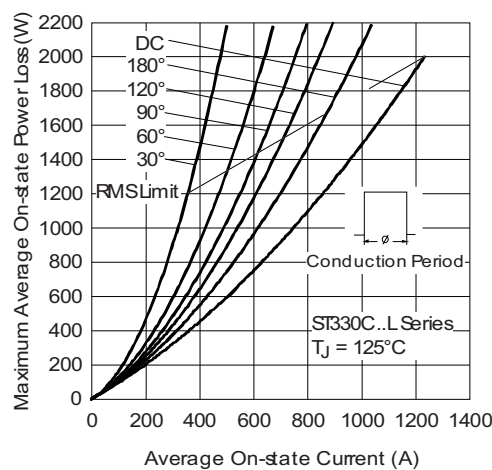


Fig. 6 - On-State Power Loss Characteristics

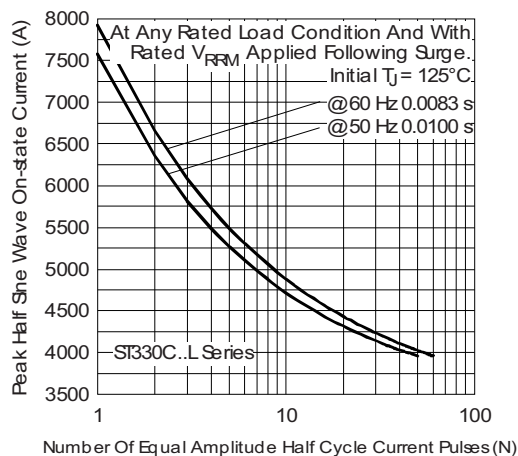


Fig. 7 - Maximum Non-Repetitive Surge Current
Single and Double Side Cooled

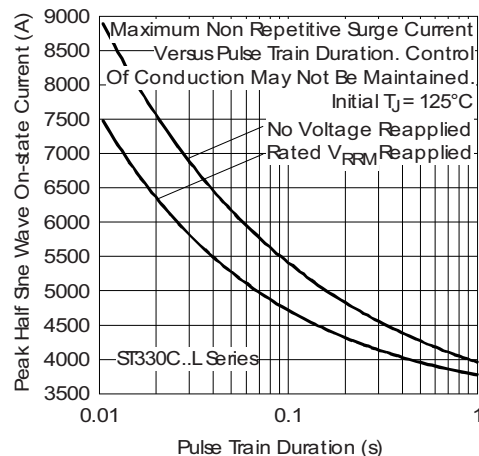


Fig. 8 - Maximum Non-Repetitive Surge Current
Single and Double Side Cooled

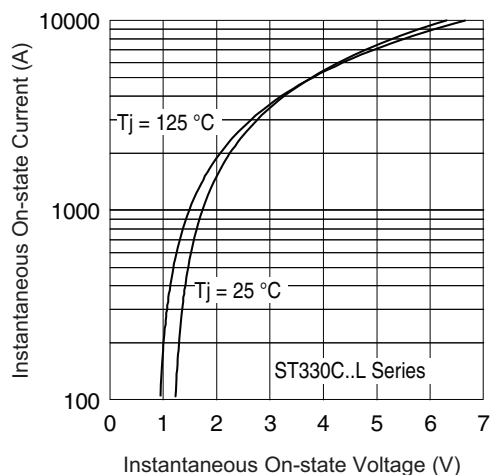


Fig. 9 - On-State Voltage Drop Characteristics

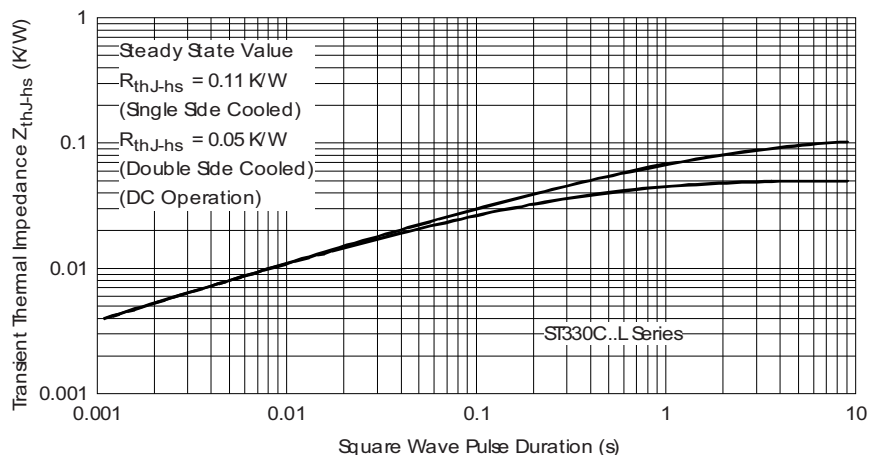


Fig. 10 - Thermal Impedance Z_{thJ-hs} Characteristics

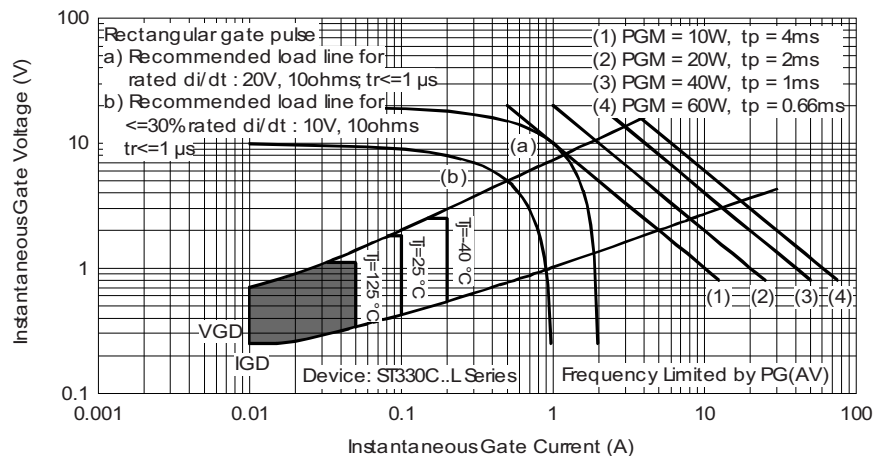


Fig. 11 - Gate Characteristics

ORDERING INFORMATION TABLE

Device code	VS-	ST	33	0	C	16	L	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 x 100 = V_{RRM} (see Voltage Ratings table)
- ⑦ - L = PUK case B-PUK (TO-200AC)
- ⑧ - 0 = eyelet terminals (gate and auxiliary cathode unsoldered leads)
1 = fast-on terminals (gate and auxiliary cathode unsoldered leads)
2 = eyelet terminals (gate and auxiliary cathode soldered leads)
3 = fast-on terminals (gate and auxiliary cathode soldered leads)
- ⑨ - Critical dV/dt : • None = 500 V/ μs (standard selection)
• L = 1000 V/ μs (special selection)

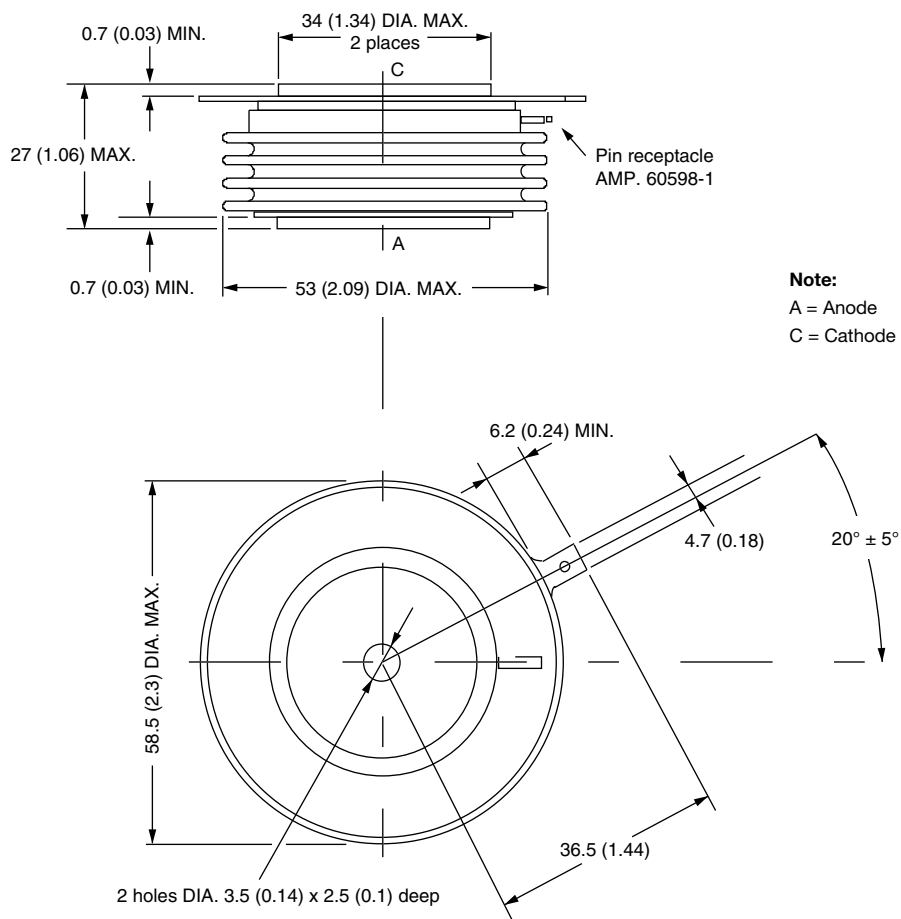
LINKS TO RELATED DOCUMENTS	
Dimensions	www.vishay.com/doc?95076



B-PUK (TO-200AC)

DIMENSIONS in millimeters (inches)

Creepage distance: 36.33 (1.430) minimum
Strike distance: 17.43 (0.686) minimum



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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