



## Inverter Grade Thyristors (Hockey PUK Version), 720 A



TO-200AB (E-PUK)

**FEATURES**

- Metal case with ceramic insulator
- All diffused design
- Center amplifying gate
- Guaranteed high dv/dt
- Guaranteed high di/dt
- International standard case TO-200AB (E-PUK)
- High surge current capability
- Low thermal impedance
- High speed performance
- Lead (Pb)-free
- Designed and qualified for industrial level



**RoHS**  
COMPLIANT

<b>PRODUCT SUMMARY</b>	
$I_{T(AV)}$	720 A

**TYPICAL APPLICATIONS**

- Inverters
- Choppers
- Induction heating
- All types of force-commutated converters

<b>MAJOR RATINGS AND CHARACTERISTICS</b>			
PARAMETER	TEST CONDITIONS	VALUES	UNITS
$I_{T(AV)}$		720	A
	$T_{hs}$	55	°C
$I_{T(RMS)}$		1435	A
	$T_{hs}$	25	°C
$I_{TSM}$	50 Hz	11 000	A
	60 Hz	11 500	
$I^2t$	50 Hz	605	kA <sup>2</sup> s
	60 Hz	553	
$V_{DRM}/V_{RRM}$		400 to 800	V
$t_q$	Range	10 to 30	µs
$T_J$		- 40 to 125	°C

**ELECTRICAL SPECIFICATIONS**

<b>VOLTAGE RATINGS</b>				
TYPE NUMBER	VOLTAGE CODE	$V_{DRM}/V_{RRM}$ , MAXIMUM REPETITIVE PEAK VOLTAGE V	$V_{RSM}$ , MAXIMUM NON-REPETITIVE PEAK VOLTAGE V	$I_{DRM}/I_{RRM}$ MAXIMUM AT $T_J = T_J$ MAXIMUM mA
ST333C..C	04	400	500	50
	08	800	900	

# ST333CPbF Series



Vishay High Power Products Inverter Grade Thyristors  
(Hockey PUK Version), 720 A

CURRENT CARRYING CAPABILITY							
FREQUENCY							UNITS
50 Hz	1630	1420	2520	2260	7610	6820	A
400 Hz	1630	1390	2670	2330	4080	3600	
1000 Hz	1350	1090	2440	2120	2420	2100	
2500 Hz	720	550	1450	1220	1230	1027	
Recovery voltage $V_R$	50		50		50		V
Voltage before turn-on $V_D$	$V_{DRM}$		$V_{DRM}$		$V_{DRM}$		
Rise of on-state current $di/dt$	50		-		-		A/μs
Heatsink temperature	40	55	40	55	40	55	°C
Equivalent values for RC circuit	10/0.47		10/0.47		10/0.47		Ω/μF

ON-STATE CONDUCTION					
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		720 (350)	A
				55 (75)	°C
Maximum RMS on-state current	$I_{T(RMS)}$	DC at 25 °C heatsink temperature double side cooled		1435	A
Maximum peak, one half cycle, non-repetitive surge current	$I_{TSM}$	t = 10 ms	No voltage reappplied	11 000	
		t = 8.3 ms	No voltage reappplied	11 500	
		t = 10 ms	100 % $V_{RRM}$ reappplied	9250	
		t = 8.3 ms	100 % $V_{RRM}$ reappplied	9700	
Maximum $I^2t$ for fusing	$I^2t$	t = 10 mls	No voltage reappplied	605	kA <sup>2</sup> s
		t = 8.3 ms	No voltage reappplied	553	
		t = 10 ms	100 % $V_{RRM}$ reappplied	428	
		t = 8.3 ms	100 % $V_{RRM}$ reappplied	391	
Maximum $I^2\sqrt{t}$ for fusing	$I^2\sqrt{t}$	t = 0.1 to 10 ms, no voltage reappplied		6050	kA <sup>2</sup> √s
Maximum peak on-state voltage	$V_{TM}$	$I_{TM} = 1810$ A, $T_J = T_J$ maximum, $t_p = 10$ ms sine wave pulse		1.96	V
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	
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 forward slope resistance	$r_{t1}$	$(16.7\% \times \pi \times I_{T(AV)} < I < \pi \times I_{T(AV)})$ , $T_J = T_J$ maximum		0.58	mΩ
High level value of forward slope resistance	$r_{t2}$	$(I > \pi \times I_{T(AV)})$ , $T_J = T_J$ maximum		0.58	
Maximum holding current	$I_H$	$T_J = 25$ °C, $I_T > 30$ A		600	mA
Typical latching current	$I_L$	$T_J = 25$ °C, $V_A = 12$ V, $R_a = 6$ Ω, $I_G = 1$ A		1000	



# ST333CPbF Series

Inverter Grade Thyristors Vishay High Power Products  
(Hockey PUK Version), 720 A

SWITCHING				
PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Maximum non-repetitive rate of rise of turned on current	$di/dt$	$T_J = T_J$ maximum, $V_{DRM} = \text{Rated } V_{DRM}$ $I_{TM} = 2 \times di/dt$	1000	A/ $\mu$ s
Typical delay time	$t_d$	$T_J = 25^\circ\text{C}$ , $V_{DM} = \text{Rated } V_{DRM}$ , $I_{TM} = 50$ A DC, $t_p = 1 \mu\text{s}$ Resistive load, gate pulse: 10 V, 5 $\Omega$ source	1.1	$\mu$ s
Maximum turn-off time	minimum	$T_J = T_J$ maximum, $I_{TM} = 550$ A, commutating $di/dt = 40$ A/ $\mu$ s $V_R = 50$ V, $t_p = 500 \mu\text{s}$ , $dV/dt$ : See table in device code	10	
	maximum		30	

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 % $V_{DRM}$ , higher value available on request	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	50	mA

TRIGGERING				
PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Maximum peak gate power	$P_{GM}$	$T_J = T_J$ maximum, $f = 50$ Hz, $d\% = 50$	60	W
Maximum average gate power	$P_{G(AV)}$		10	
Maximum peak positive gate current	$I_{GM}$	$T_J = T_J$ maximum, $t_p \leq 5$ ms	10	A
Maximum peak positive gate voltage	+ $V_{GM}$		20	V
Maximum peak negative gate voltage	- $V_{GM}$		5	
Maximum DC gate current required to trigger	$I_{GT}$	$T_J = 25^\circ\text{C}$ , $V_A = 12$ V, $R_a = 6 \Omega$	200	mA
Maximum DC gate voltage required to trigger	$V_{GT}$		3	V
Maximum DC gate current not to trigger	$I_{GD}$	$T_J = T_J$ maximum, rated $V_{DRM}$ applied	20	mA
Maximum 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	$^\circ\text{C}$
Maximum storage temperature range	$T_{Stg}$		- 40 to 150	
Maximum thermal resistance, junction to heatsink	$R_{thJ-hs}$	DC operation single side cooled	0.09	K/W
		DC operation double side cooled	0.04	
Maximum thermal resistance, case to heatsink	$R_{thC-hs}$	DC operation single side cooled	0.020	
		DC operation double side cooled	0.010	
Mounting force, $\pm 10$ %			9800 (1000)	N (kg)
Approximate weight			83	g
Case style		See dimensions - link at the end of datasheet	TO-200AB (E-PUK)	

# ST333CPbF Series



Vishay High Power Products Inverter Grade Thyristors  
(Hockey PUK Version), 720 A

$\Delta R_{thJ-hs}$ CONDUCTION						
CONDUCTION ANGLE	SINUSOIDAL CONDUCTION		RECTANGULAR CONDUCTION		TEST CONDITIONS	UNITS
	SINGLE SIDE	DOUBLE SIDE	SINGLE SIDE	DOUBLE SIDE		
180°	0.010	0.011	0.007	0.007	$T_J = T_{J \text{ maximum}}$	K/W
120°	0.012	0.012	0.012	0.013		
90°	0.015	0.015	0.016	0.017		
60°	0.022	0.022	0.023	0.023		
30°	0.036	0.036	0.036	0.036		

**Note**

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

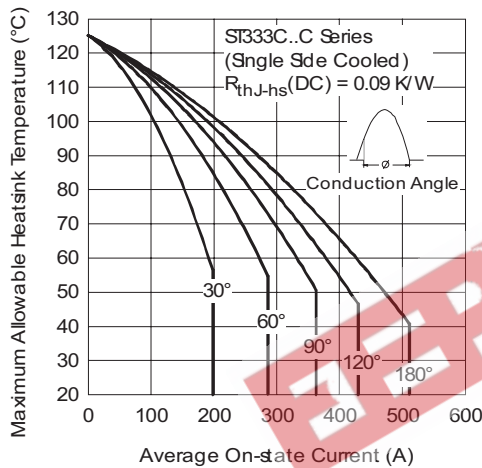


Fig. 1 - Current Ratings Characteristics

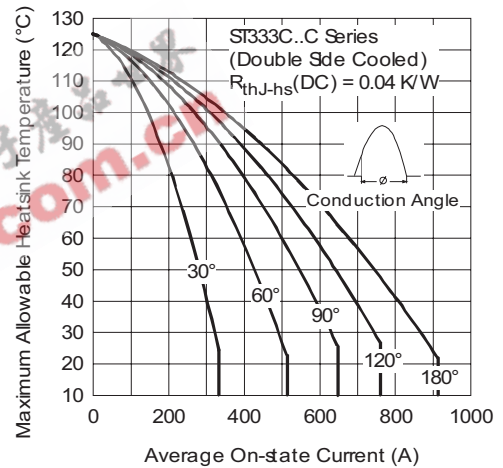


Fig. 3 - Current Ratings Characteristics

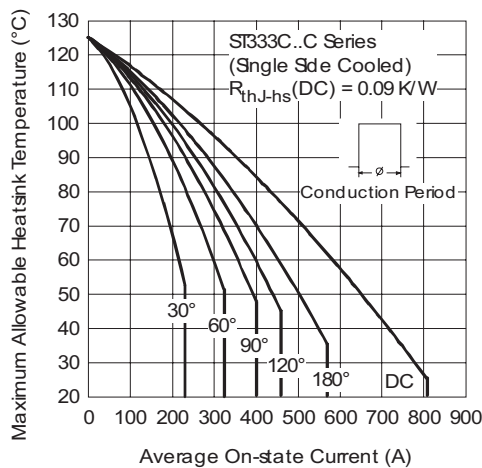


Fig. 2 - Current Ratings Characteristics

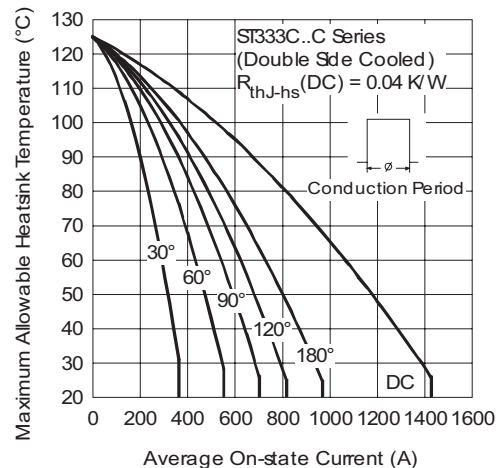


Fig. 4 - Current Ratings Characteristics



# ST333CPbF Series

## Inverter Grade Thyristors Vishay High Power Products (Hockey PUK Version), 720 A

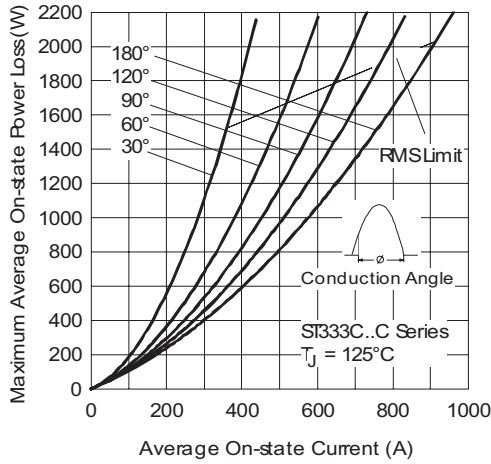


Fig. 5 - On-State Power Loss Characteristics

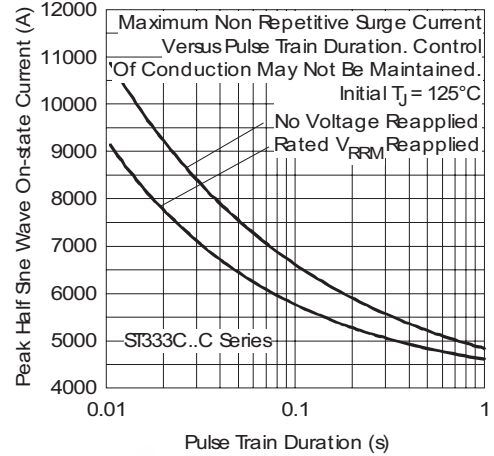


Fig. 8 - Maximum Non-Repetitive Surge Current Single and Double Side Cooled

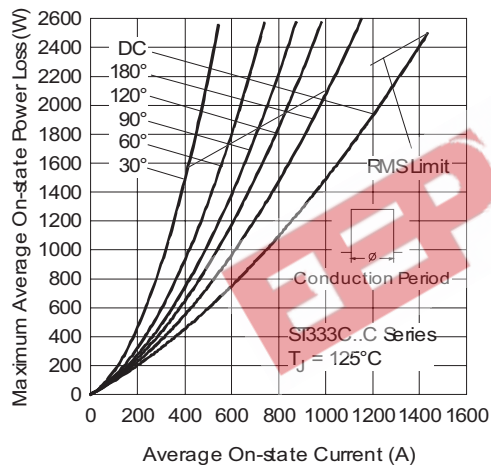


Fig. 6 - On-State Power Loss Characteristics

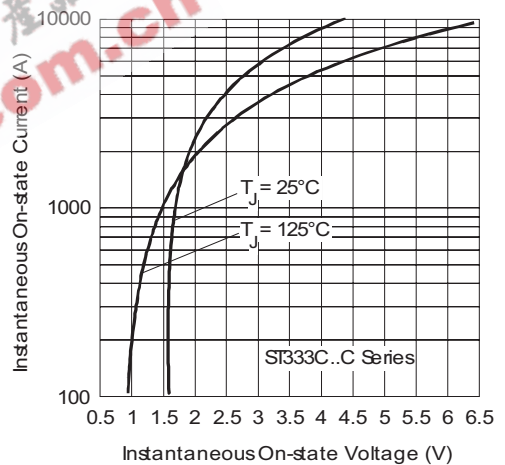


Fig. 9 - On-State Voltage Drop Characteristics

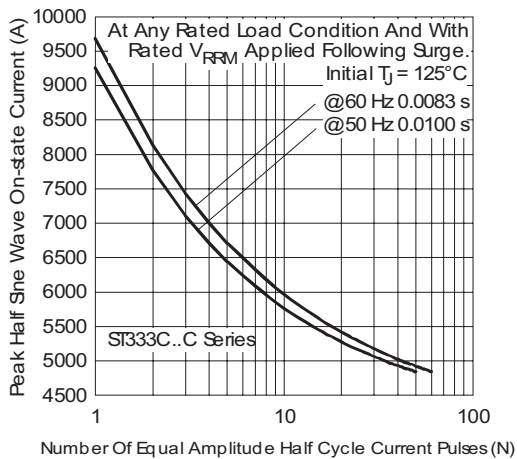


Fig. 7 - Maximum Non-Repetitive Surge Current Single and Double Side Cooled

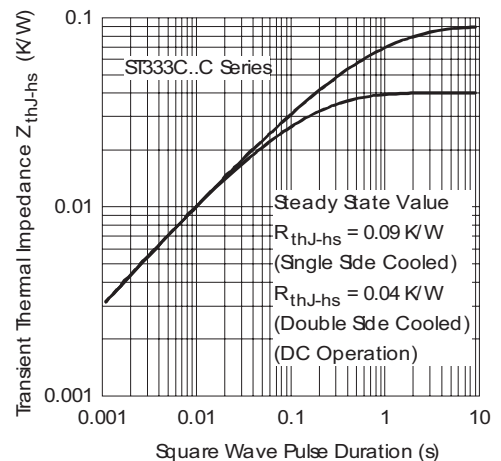


Fig. 10 - Thermal Impedance  $Z_{thJ-hs}$  Characteristics

# ST333CPbF Series



Vishay High Power Products Inverter Grade Thyristors  
(Hockey PUK Version), 720 A

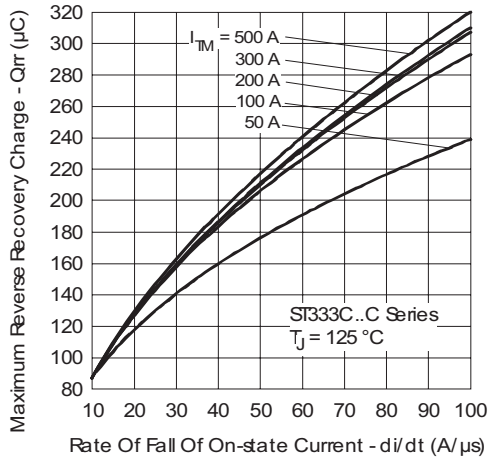


Fig. 11 - Reverse Recovered Charge Characteristics

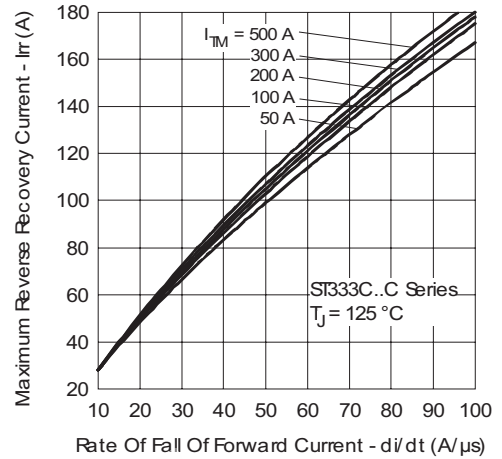


Fig. 12 - Reverse Recovered Current Characteristics

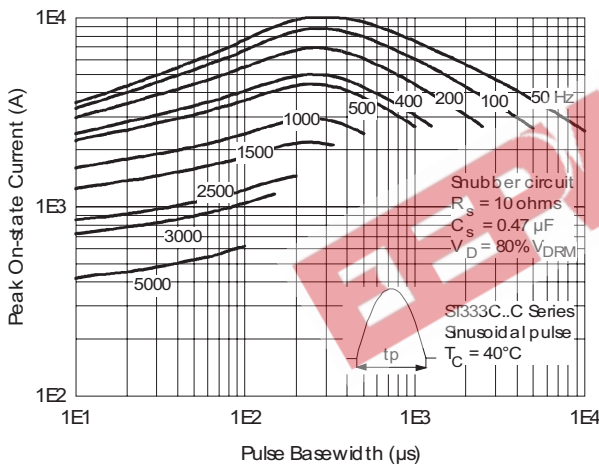


Fig. 13 - Frequency Characteristics

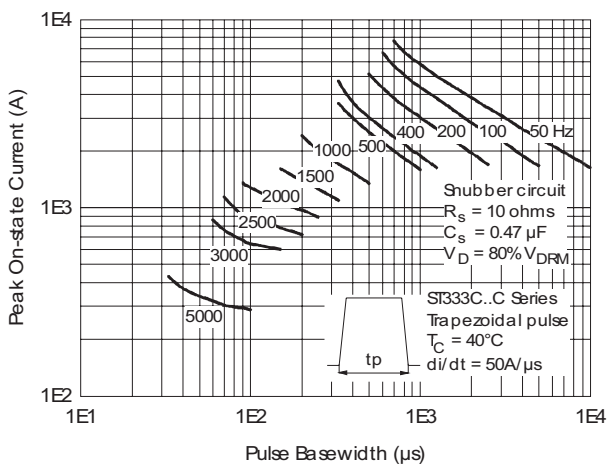
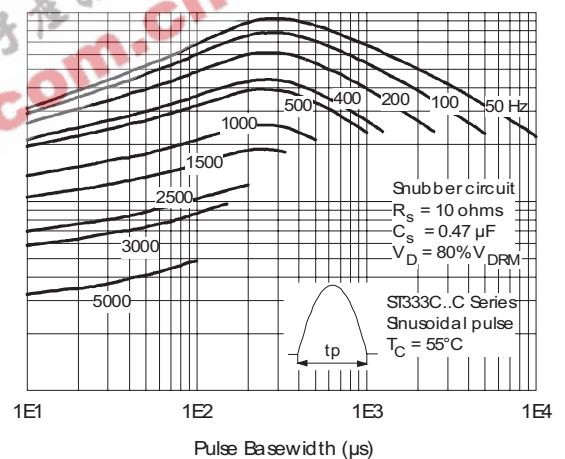
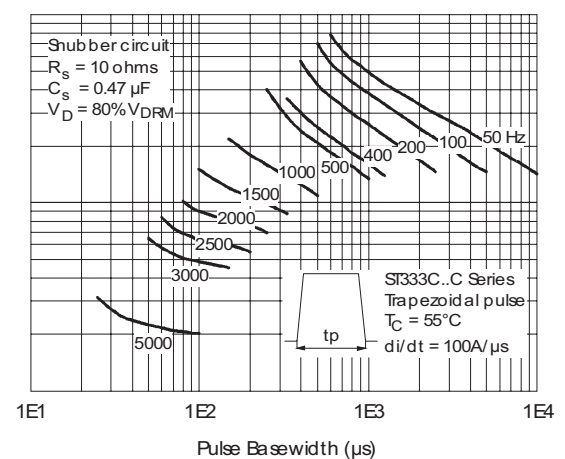


Fig. 14 - Frequency Characteristics





# ST333CPbF Series

Inverter Grade Thyristors Vishay High Power Products  
(Hockey PUK Version), 720 A

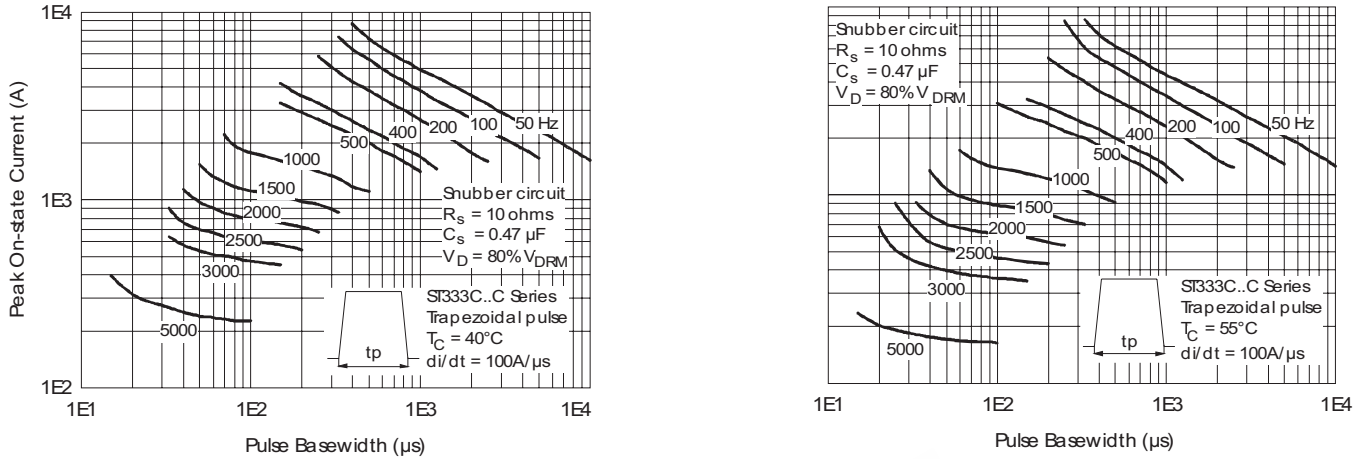


Fig. 15 - Frequency Characteristics

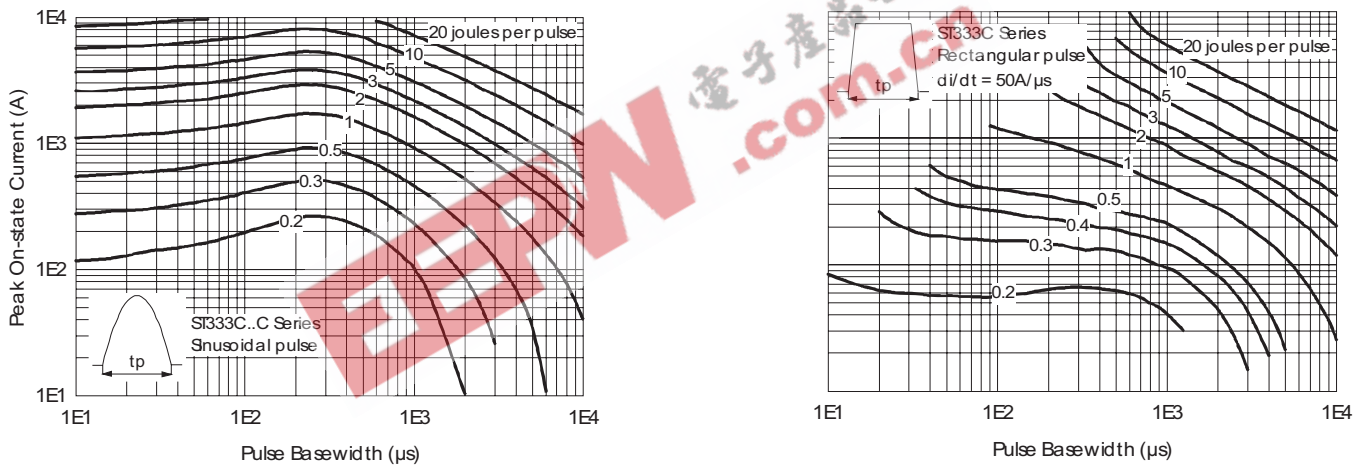


Fig. 16 - Maximum On-State Energy Power Loss Characteristics

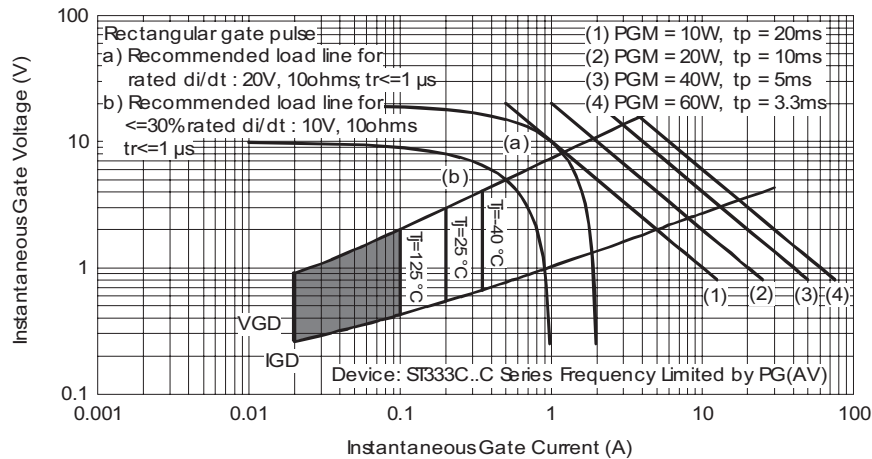


Fig. 17 - Gate Characteristics

# ST333CPbF Series



Vishay High Power Products Inverter Grade Thyristors  
(Hockey PUK Version), 720 A

## ORDERING INFORMATION TABLE

Device code	ST	33	3	C	08	C	H	K	1	-	P
	1	2	3	4	5	6	7	8	9	10	11

- 1** - Thyristor
- 2** - Essential part number
- 3** - 3 = Fast turn-off
- 4** - C = Ceramic PUK
- 5** - Voltage code x 100 =  $V_{RRM}$   
(see Voltage Ratings table)
- 6** - C = Puk case TO-200AB (E-PUK)
- 7** - Reapplied dV/dt code (for  $t_q$  test condition)
- 8** -  $t_q$  code
- 9** - 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)
- 10** - Critical dV/dt:
  - None = 500 V/ $\mu$ s (standard value)
  - L = 1000 V/ $\mu$ s (special selection)
- 11** - P = Lead (Pb)-free

dV/dt - $t_q$ combinations available					
dV/dt (V/ $\mu$ s)	20	50	100	200	400
10	CN	DN	EN	-	-
12	CM	DM	EM	<b>FM*</b>	-
15	CL	DL	EL	<b>FL*</b>	HL
18	CP	DP	EP	FP	HP
20	CK	DK	EK	FK	HK
25	-	-	-	FJ	HJ
30	-	-	-	-	HH

\* Standard part number.  
All other types available only on request.

LINKS TO RELATED DOCUMENTS	
Dimensions	<a href="http://www.vishay.com/doc?95075">http://www.vishay.com/doc?95075</a>





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