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

Pb-free

RoHS COMPLIANT

PRODUCT SUMMARY	
$I_{T(AV)}$	720 A

TYPICAL APPLICATIONS

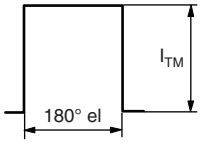
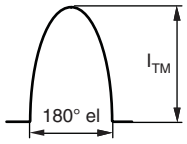
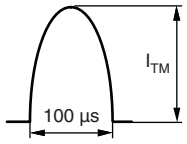
- Inverters
- Choppers
- Induction heating
- All types of force-commutated converters

MAJOR RATINGS AND CHARACTERISTICS			
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^2s
	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

VOLTAGE RATINGS				
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	

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 reapplied	Sinusoidal half wave, initial $T_J = T_J$ maximum	11 000	
		t = 8.3 ms			11 500	
		t = 10 ms	100 % V_{RRM} reapplied		9250	
		t = 8.3 ms			9700	
Maximum I^2t for fusing	I^2t	t = 10 mls	No voltage reapplied		605	kA^2s
		t = 8.3 ms			553	
		t = 10 ms	100 % V_{RRM} reapplied		428	
		t = 8.3 ms			391	
Maximum $I^2\sqrt{t}$ for fusing	$I^2\sqrt{t}$	t = 0.1 to 10 ms, no voltage reapplied			6050	$kA^2\sqrt{s}$
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 % x π x $I_{T(AV)}$ < I < π x $I_{T(AV)}$), $T_J = T_J$ maximum			0.91	
High level value of threshold voltage	$V_{T(TO)2}$	(I > π x $I_{T(AV)}$), $T_J = T_J$ maximum			0.93	
Low level value of forward slope resistance	r_{t1}	(16.7 % x π x $I_{T(AV)}$ < I < π x $I_{T(AV)}$), $T_J = T_J$ maximum			0.58	mΩ
High level value of forward slope resistance	r_{t2}	(I > π x $I_{T(AV)}$), $T_J = T_J$ 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	

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} = Rated V_{DRM} I_{TM} = 2 x dI/dt	1000	A/µs
Typical delay time		t_d	T_J = 25 °C, V_{DM} = Rated V_{DRM}, I_{TM} = 50 A DC, t_p = 1 µs Resistive load, gate pulse: 10 V, 5 Ω source	1.1	µs
Maximum turn-off time	minimum	t_q	$T_J = T_J$ maximum, I_{TM} = 550 A, commutating dI/dt = 40 A/µs V_R = 50 V, t_p = 500 µs, 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/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
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 currrent required to trigger	I_{GT}	T_J = 25 °C, V_A = 12 V, R_a = 6 Ω	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	°C
Maximum storage temperature range	T_{Stg}		- 40 to 150	
Maximum thermal resistance, junction to heatsink	$R_{thJ\text{-}hs}$	DC operation single side cooled	0.09	K/W
		DC operation double side cooled	0.04	
Maximum thermal resistance, case to heatsink	$R_{thC\text{-}hs}$	DC operation single side cooled	0.020	
		DC operation double side cooled	0.010	
Mounting force, ± 10 %			9800 (1000)	N (kg)
Approximate weight			83	g
Case style		See dimensions - link at the end of datasheet	TO-200AB (E-PUK)	

$\Delta R_{thJ\text{-}hs}$ 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	$T_J = T_J$ 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 $R_{thJ\text{-}hs}$ when devices operate at different conduction angles than DC

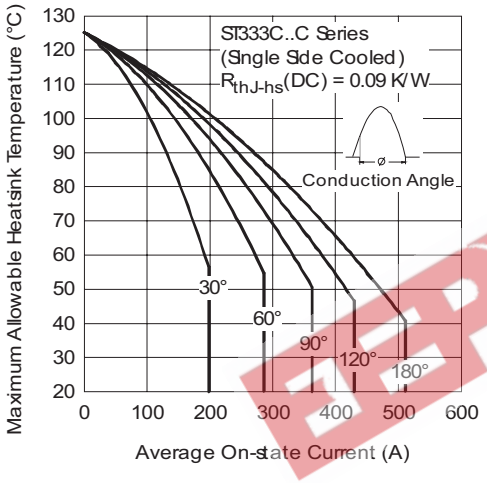


Fig. 1 - Current Ratings Characteristics

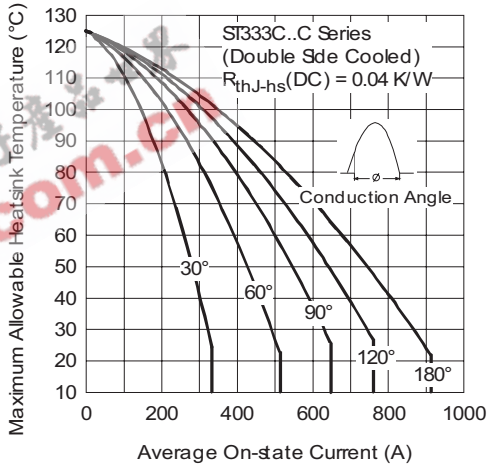


Fig. 3 - Current Ratings Characteristics

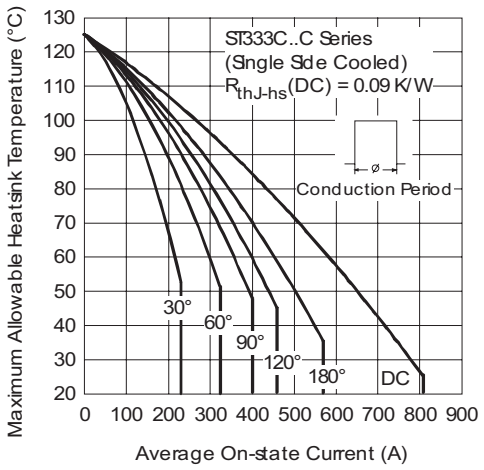


Fig. 2 - Current Ratings Characteristics

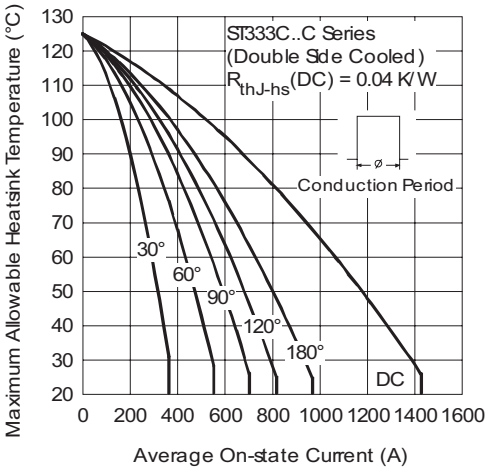


Fig. 4 - Current Ratings Characteristics

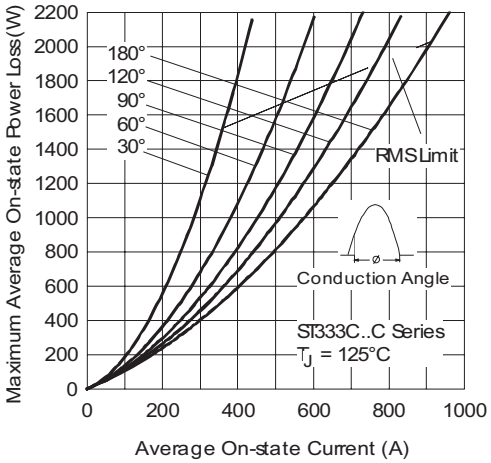


Fig. 5 - On-State Power Loss Characteristics

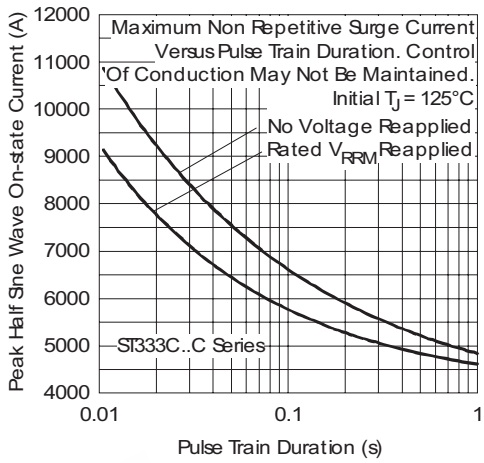


Fig. 8 - Maximum Non-Repetitive Surge Current
Single and Double Side Cooled

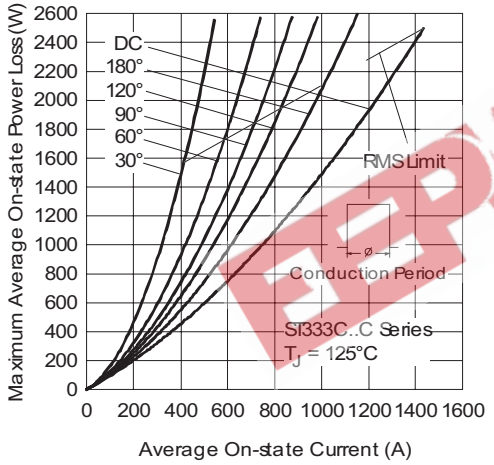


Fig. 6 - On-State Power Loss Characteristics

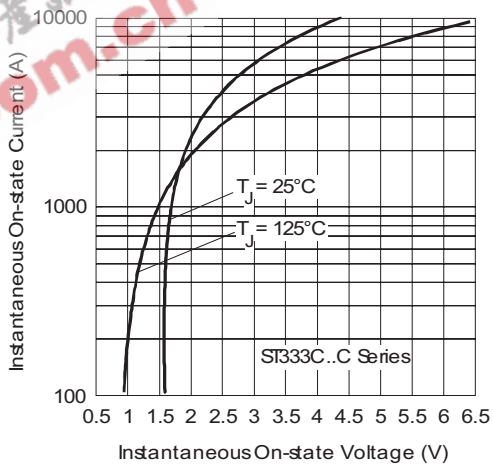


Fig. 9 - On-State Voltage Drop Characteristics

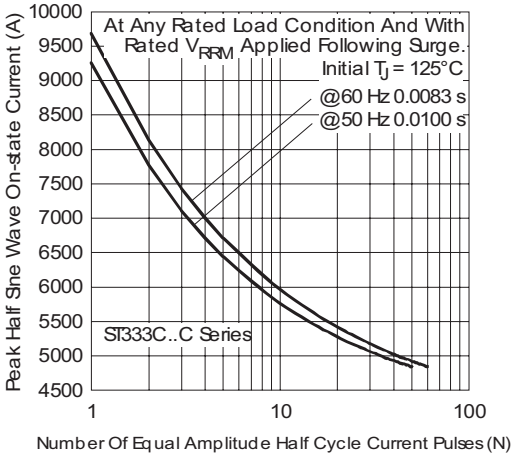


Fig. 7 - Maximum Non-Repetitive Surge Current
Single and Double Side Cooled

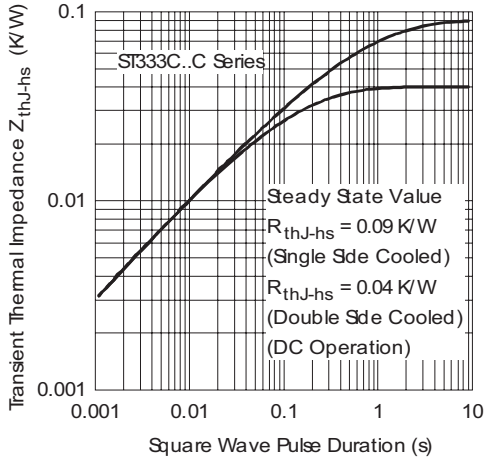


Fig. 10 - Thermal Impedance Z_{thJ-hs} Characteristics

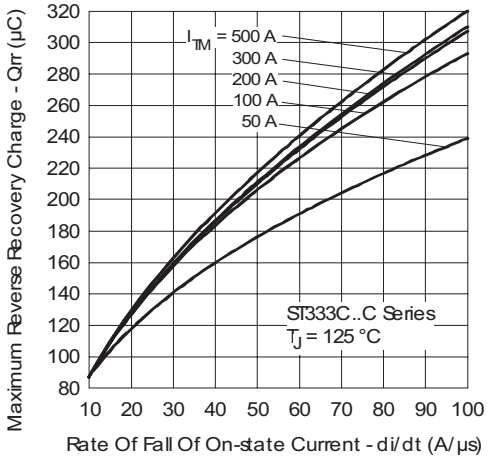


Fig. 11 - Reverse Recovered Charge Characteristics

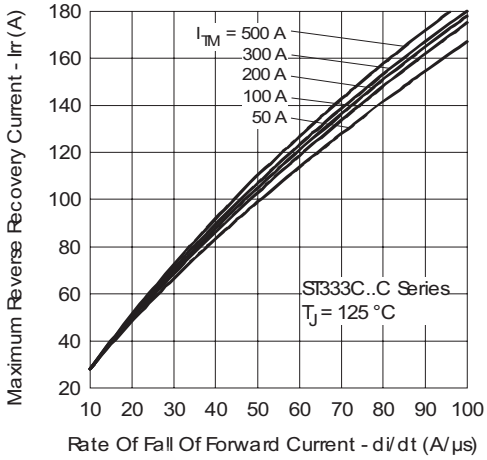


Fig. 12 - Reverse Recovered Current Characteristics

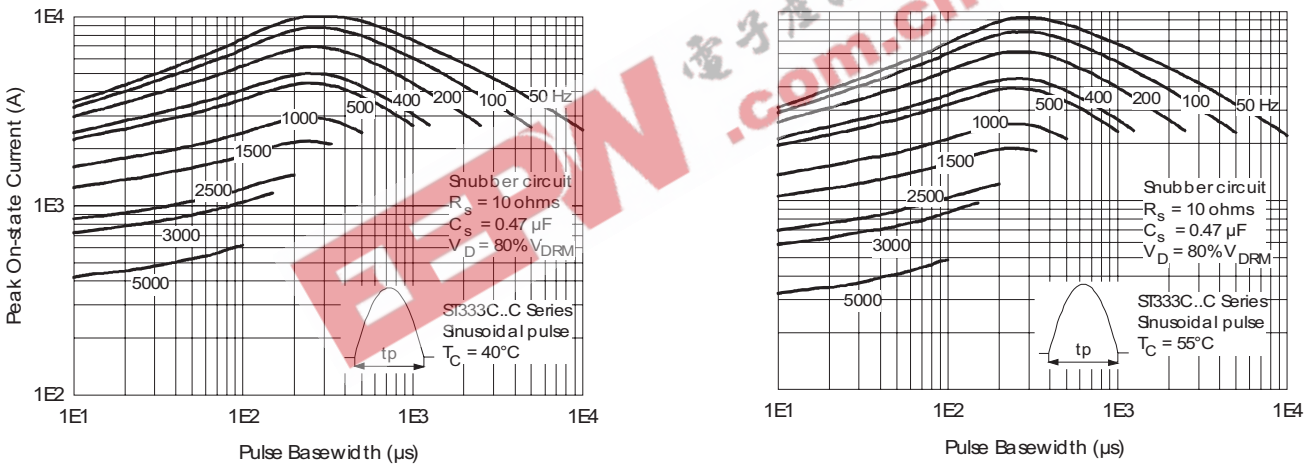


Fig. 13 - Frequency Characteristics

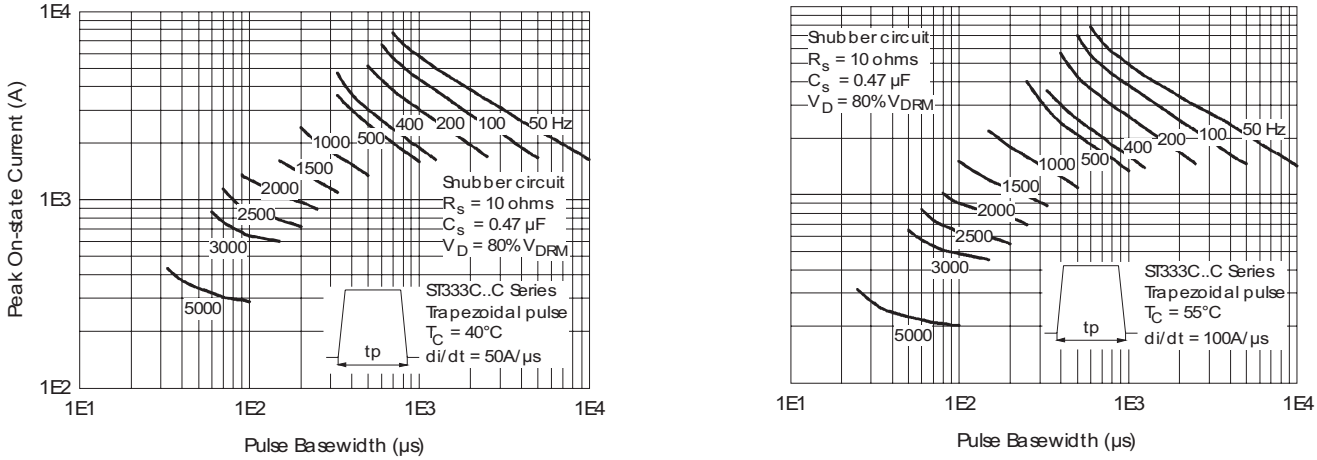


Fig. 14 - Frequency Characteristics

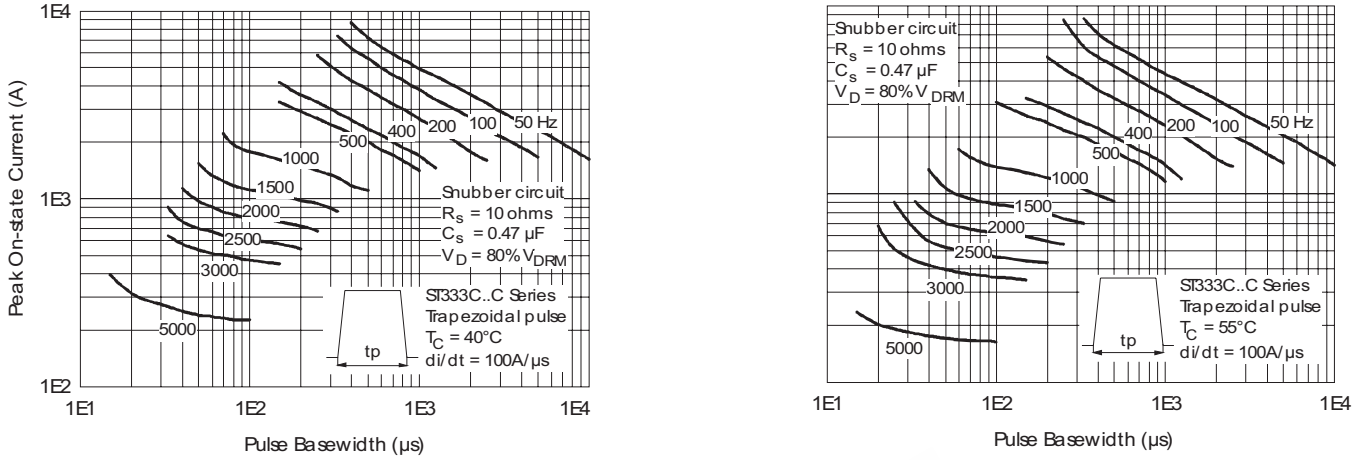


Fig. 15 - Frequency Characteristics

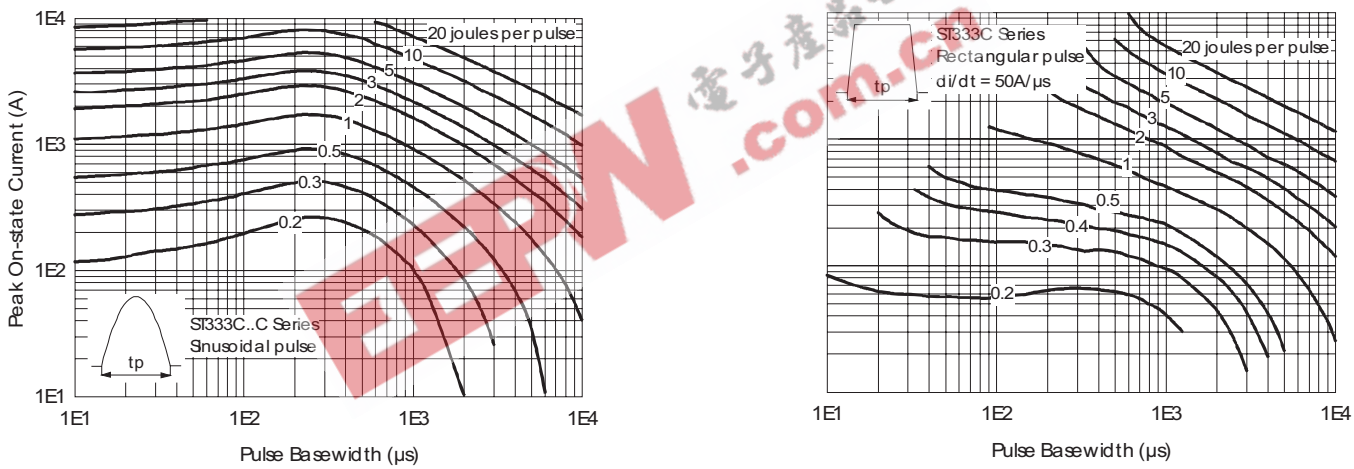


Fig. 16 - Maximum On-State Energy Power Loss Characteristics

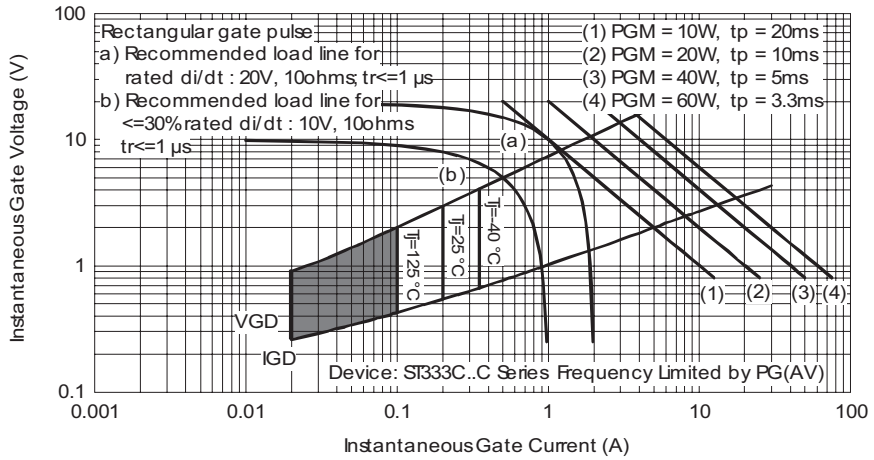


Fig. 17 - Gate Characteristics

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/µs (standard value)
  - L = 1000 V/µs (special selection)
- **11** - P = Lead (Pb)-free

dV/dt - t_q combinations available

dV/dt (V/µs)	20	50	100	**200**	400
10	CN	DN	EN	-	-
12	CM	DM	EM	**FM***	-
15	CL	DL	EL	**FL***	HL
t_q (µs) 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	http://www.vishay.com/doc?95075

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