

### INVERTER GRADE THYRISTORS

### Hockey Puk Version

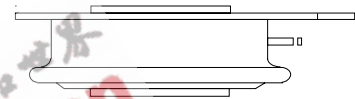
#### Features

- Metal case with ceramic insulator
- International standard case TO-200AB (A-PUK)
- All diffused design
- Center amplifying gate
- Guaranteed high dV/dt
- Guaranteed high dI/dt
- High surge current capability
- Low thermal impedance
- High speed performance

#### Typical Applications

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

330A



case style TO-200AB (A-PUK)

### Major Ratings and Characteristics

Parameters	ST173C..C	Units
$I_{T(AV)}$	330	A
@ $T_{hs}$	55	°C
$I_{T(RMS)}$	610	A
@ $T_{hs}$	25	°C
$I_{TSM}$	@ 50Hz	4680
	@ 60Hz	4900
$I^2t$	@ 50Hz	110
	@ 60Hz	100
$V_{DRM}/V_{RRM}$	1000 to 1200	V
$t_q$ range	15 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	$I_{DRM}/I_{RRM}$ max. @ $T_J = T_{J\ max}$ . mA
ST173C..C	10	1000	1100	40
	12	1200	1300	

**Current Carrying Capability**

Frequency							Units
50Hz	760	660	1200	1030	5570	4920	A
400Hz	730	590	1260	1080	2800	2460	
1000Hz	600	490	1200	1030	1620	1390	
2500Hz	350	270	850	720	800	680	
Recovery voltage Vr	50	50	50	50	50	50	V
Voltage before turn-on Vd	$V_{DRM}$		$V_{DRM}$		$V_{DRM}$		
Rise of on-state current di/dt	50	50	-	-	-	-	A/µs
Heatsink temperature	40	55	40	55	40	55	°C
Equivalent values for RC circuit	47Ω / 0.22µF		47Ω / 0.22µF		47Ω / 0.22µF		

**On-state Conduction**

Parameter	ST173C..C	Units	Conditions	
$I_{T(AV)}$ Max. average on-state current @ Heatsink temperature	330 (120)	A	180° conduction, half sine wave double side (single side) cooled	
	55 (85)	°C		
$I_{T(RMS)}$ Max. RMS on-state current	610		DC @ 25°C heatsink temperature double side cooled	
$I_{TSM}$ Max. peak, one half cycle, non-repetitive surge current	4680	A	t = 10ms	No voltage
	4900		t = 8.3ms	reapplied
	3940		t = 10ms	100% $V_{RRM}$
$I^2t$ Maximum $I^2t$ for fusing	4120	KA <sup>2</sup> s	t = 8.3ms	reapplied
	110		t = 10ms	No voltage
	100		t = 8.3ms	reapplied
	77		t = 10ms	100% $V_{RRM}$
	71		t = 8.3ms	reapplied

$I^2\sqrt{t}$  Maximum  $I^2\sqrt{t}$  for fusing 1100 KA<sup>2</sup>/s t = 0.1 to 10ms, no voltage reapplied

### On-state Conduction

Parameter	ST173C..C	Units	Conditions
$V_{TM}$ Max. peak on-state voltage	2.07	V	$I_{TM} = 600A, T_J = T_J \text{ max}, t_p = 10\text{ms sine wave pulse}$
$V_{T(TO)1}$ Low level value of threshold voltage	1.55		$(16.7\% \times \pi \times I_{T(AV)} < I < \pi \times I_{T(AV)}), T_J = T_J \text{ max.}$
$V_{T(TO)2}$ High level value of threshold voltage	1.61		$(I > \pi \times I_{T(AV)}), T_J = T_J \text{ max.}$
$r_{t1}$ Low level value of forward slope resistance	0.87	m $\Omega$	$(16.7\% \times \pi \times I_{T(AV)} < I < \pi \times I_{T(AV)}), T_J = T_J \text{ max.}$
$r_{t2}$ High level value of forward slope resistance	0.77		$(I > \pi \times I_{T(AV)}), T_J = T_J \text{ max.}$
$I_H$ Maximum holding current	600	mA	$T_J = 25^\circ\text{C}, I_T > 30A$
$I_L$ Typical latching current	1000		$T_J = 25^\circ\text{C}, V_A = 12V, R_a = 6\Omega, I_G = 1A$

### Switching

Parameter	ST173C..C	Units	Conditions
di/dt Max. non-repetitive rate of rise of turned-on current	1000	A/ $\mu\text{s}$	$T_J = T_J \text{ max}, V_{DRM} = \text{rated } V_{DRM}$ $I_{TM} = 2 \times \text{di/dt}$
$t_d$ Typical delay time	1.1	$\mu\text{s}$	$T_J = 25^\circ\text{C}, V_{DM} = \text{rated } V_{DRM}, I_{TM} = 50A \text{ DC}, t_p = 1\mu\text{s}$ Resistive load, Gate pulse: 10V, 5 $\Omega$ source
$t_q$ Max. turn-off time	Min 15 Max 30		$T_J = T_J \text{ max}, I_{TM} = 300A, \text{commutating di/dt} = 20A/\mu\text{s}$ $V_R = 50V, t_p = 500\mu\text{s}, \text{dv/dt: see table in device code}$

### Blocking

Parameter	ST173C..C	Units	Conditions
dv/dt Maximum critical rate of rise of off-state voltage	500	V/ $\mu\text{s}$	$T_J = T_J \text{ max. linear to } 80\% V_{DRM}, \text{higher value available on request}$
$I_{RRM}$ $I_{DRM}$ Max. peak reverse and off-state leakage current	40	mA	$T_J = T_J \text{ max, rated } V_{DRM}/V_{RRM} \text{ applied}$

### Triggering

Parameter	ST173C..C	Units	Conditions
$P_{GM}$ Maximum peak gate power	60	W	$T_J = T_J \text{ max, } f = 50\text{Hz, } d\% = 50$
$P_{G(AV)}$ Maximum average gate power	10		
$I_{GM}$ Max. peak positive gate current	10	A	$T_J = T_J \text{ max, } t_p \leq 5\text{ms}$
$+V_{GM}$ Maximum peak positive gate voltage	20	V	$T_J = T_J \text{ max, } t_p \leq 5\text{ms}$
$-V_{GM}$ Maximum peak negative gate voltage	5		
$I_{GT}$ Max. DC gate current required to trigger	200	mA	$T_J = 25^\circ\text{C}, V_A = 12V, R_a = 6\Omega$
$V_{GT}$ Max. DC gate voltage required to trigger	3	V	
$I_{GD}$ Max. DC gate current not to trigger	20	mA	$T_J = T_J \text{ max, rated } V_{DRM} \text{ applied}$
$V_{GD}$ Max. DC gate voltage not to trigger	0.25	V	

**Thermal and Mechanical Specification**

Parameter	ST173C..C	Units	Conditions
T <sub>J</sub> Max. operating temperature range	-40 to 125	°C	
T <sub>stg</sub> Max. storage temperature range	-40 to 150		
R <sub>thJ-hs</sub> Max. thermal resistance, junction to heatsink	0.17 0.08	K/W	DC operation single side cooled DC operation double side cooled
R <sub>thC-hs</sub> Max. thermal resistance, case to heatsink	0.033 0.017		K/W
F Mounting force, ± 10%	4900 (500)	N (Kg)	
wt Approximate weight	50	g	
Case style	TO-200AB (A-PUK)		See Outline Table

**ΔR<sub>thJ-hs</sub> Conduction**

(The following table shows the increment of thermal resistance R<sub>thJ-hs</sub> when devices operate at different conduction angles than DC)

Conduction angle	Sinusoidal conduction		Rectangular conduction		Units	Conditions
	Single Side	Double Side	Single Side	Double Side		
180°	0.015	0.016	0.011	0.011	K/W	T <sub>J</sub> = T <sub>J</sub> max.
120°	0.018	0.019	0.019	0.019		
90°	0.024	0.024	0.026	0.026		
60°	0.035	0.035	0.036	0.037		
30°	0.060	0.060	0.060	0.061		

**Ordering Information Table**

**Device Code**

ST	17	3	C	12	C	H	K	1	3	P
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(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
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- 1** - Thyristor
- 2** - Essential part number
- 3** - 3 = Fast turn off
- 4** - C = Ceramic Puk
- 5** - Voltage code: Code x 100 = V<sub>RRM</sub> (See Voltage Rating Table)
- 6** - C = Puk Case TO-200AB (A-PUK)
- 7** - Reapplied dv/dt code (for t<sub>q</sub> test condition)
- 8** - t<sub>q</sub> code
- 9** - 0 = Eyelet term. (Gate and Aux. Cathode Unsoldered Leads)  
 1 = Fast-on term. (Gate and Aux. Cathode Unsoldered Leads)  
 2 = Eyelet term. (Gate and Aux. Cathode Soldered Leads)  
 3 = Fast-on term. (Gate and Aux. Cathode Soldered Leads)
- 10** - Critical dv/dt:  
 None = 500V/μsec (Standard value)  
 L = 1000V/μsec (Special selection)
- 11** - P = Lead Free

dv/dt - t <sub>q</sub> combinations available					
dv/dt (V/μs)	20	50	100	200	400
15	CL	--	--	--	--
18	CP	DP	EP	<b>FP</b> *	--
20	CK	DK	EK	<b>FK</b> *	HK
25	CJ	DJ	EJ	FJ	HJ
30	--	DH	EH	FH	HH

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

Outline Table

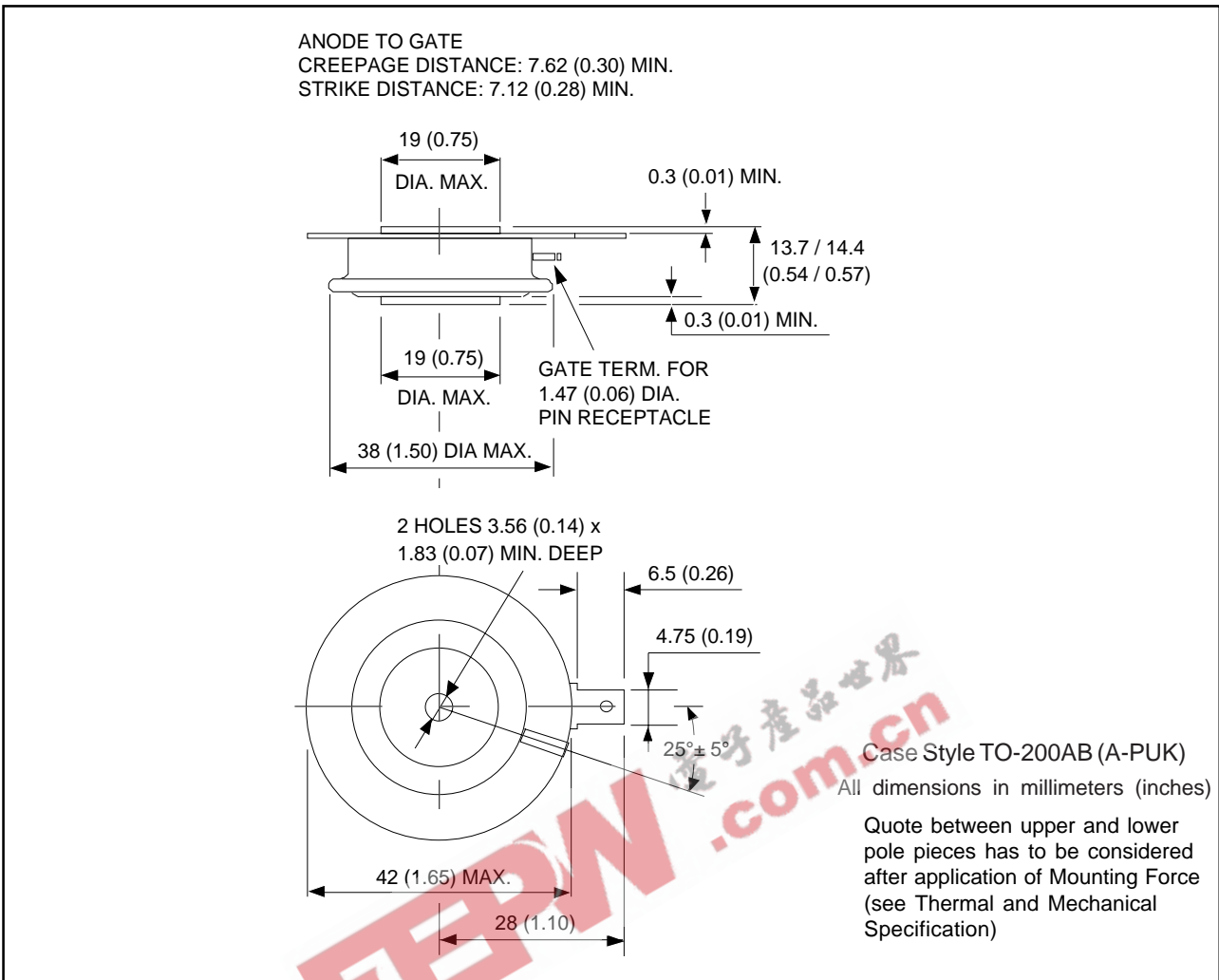


Fig. 1 - Current Ratings Characteristics



Fig. 2 - Current Ratings Characteristics

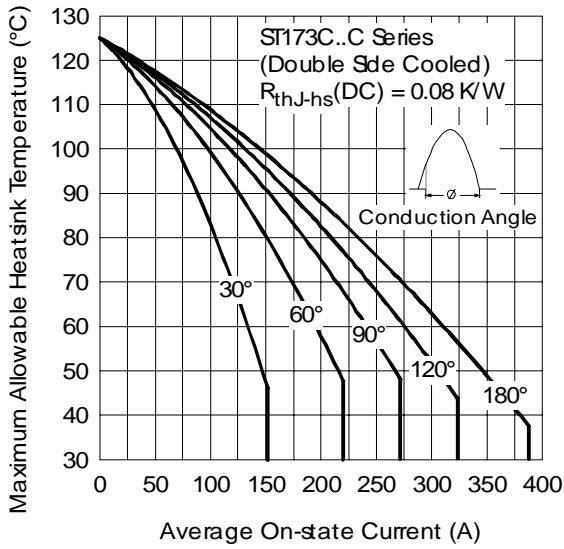


Fig. 3 - Current Ratings Characteristics

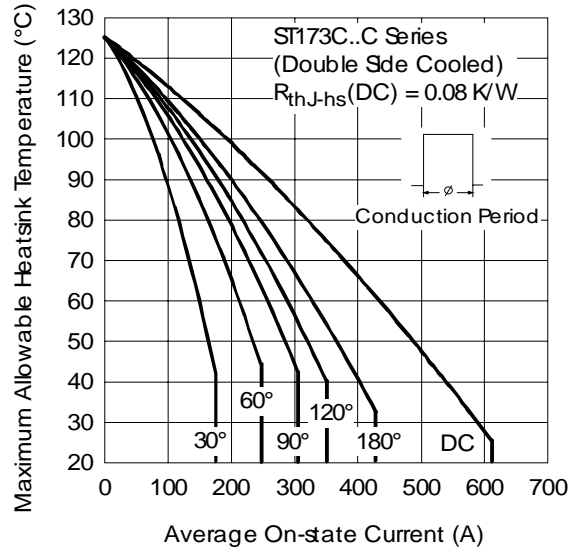


Fig. 4 - Current Ratings Characteristics

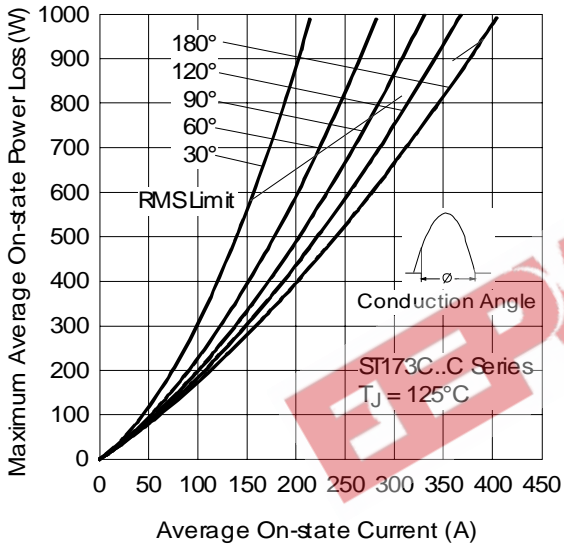


Fig. 5 - On-state Power Loss Characteristics

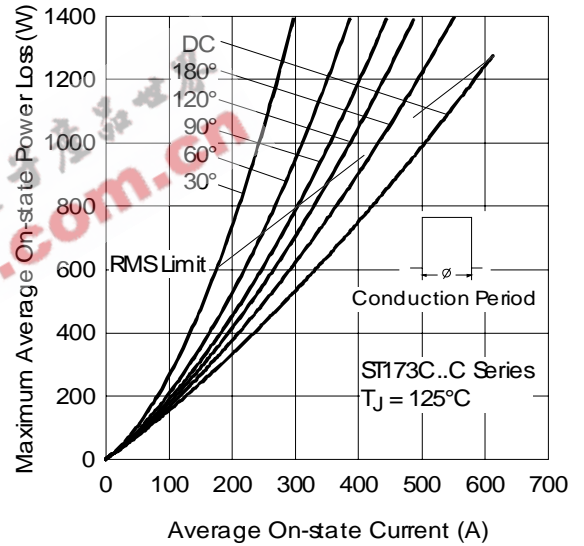


Fig. 6 - On-state Power Loss Characteristics



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

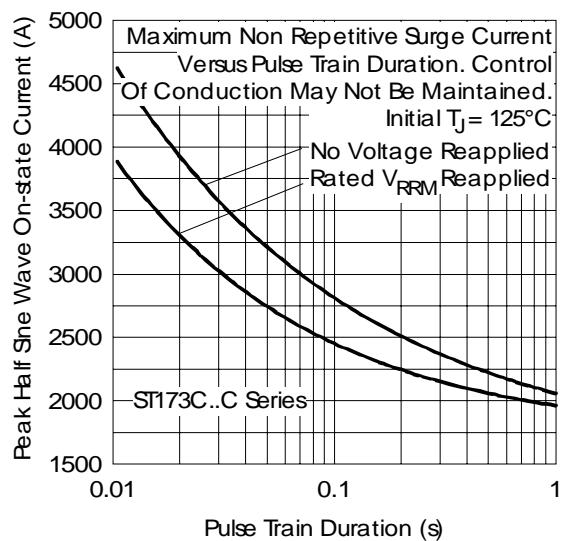


Fig. 8 - Maximum Non-repetitive Surge Current Single and Double Side Cooled



Fig. 9 - On-state Voltage Drop Characteristics

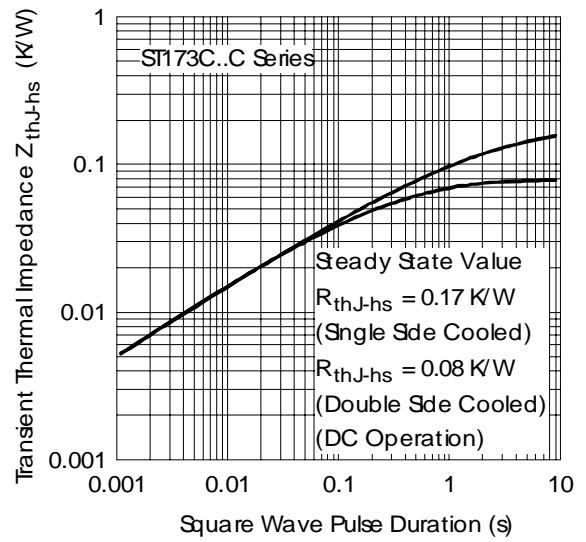


Fig. 10 - Thermal Impedance  $Z_{thJ-hs}$  Characteristics



Fig. 11 - Reverse Recovered Charge Characteristics

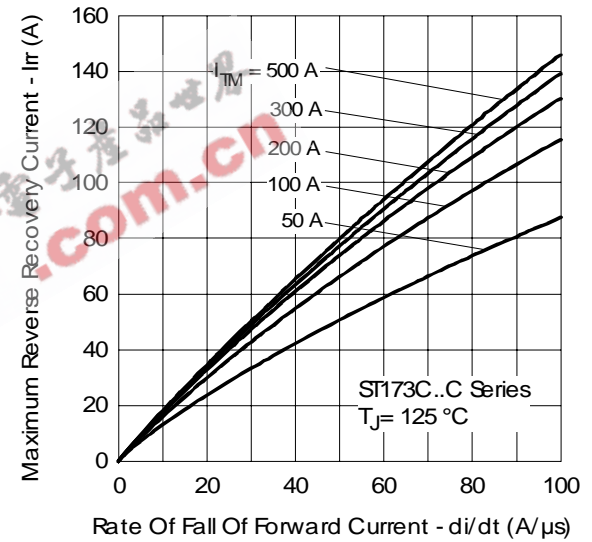


Fig. 12 - Reverse Recovery Current Characteristics

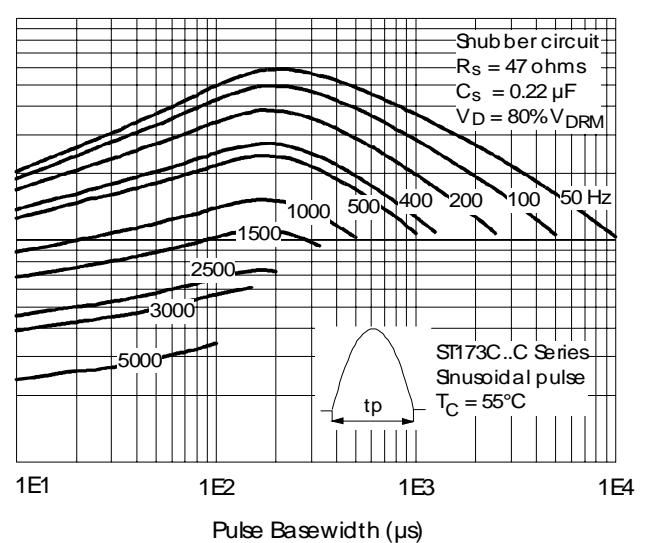


Fig. 13 - Frequency Characteristics

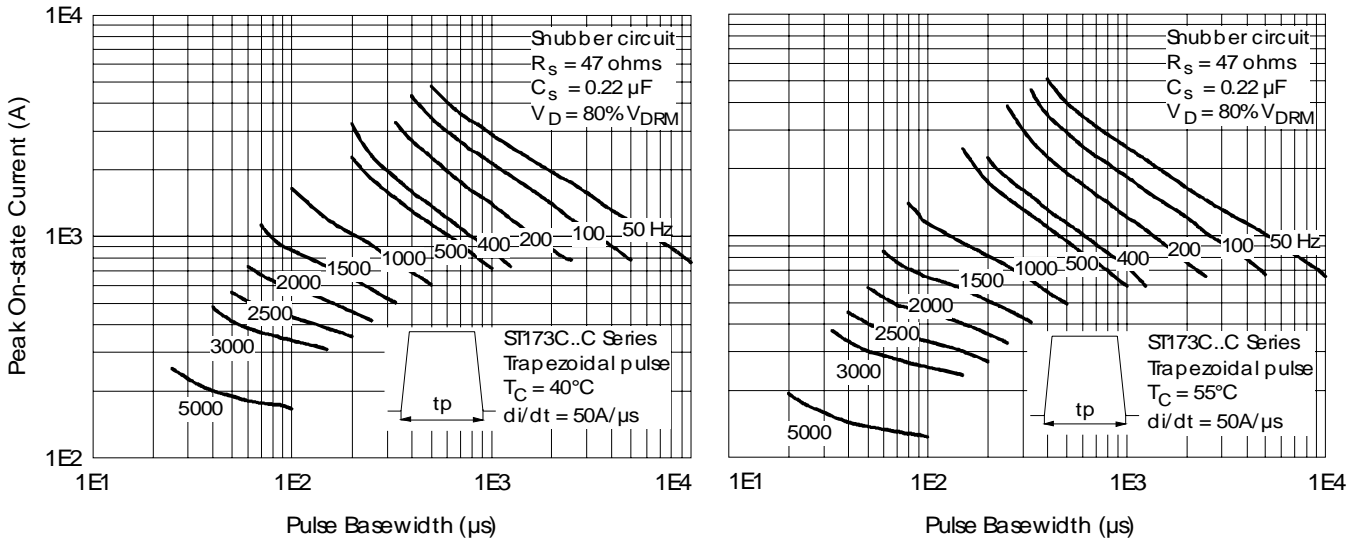


Fig. 14 - Frequency Characteristics

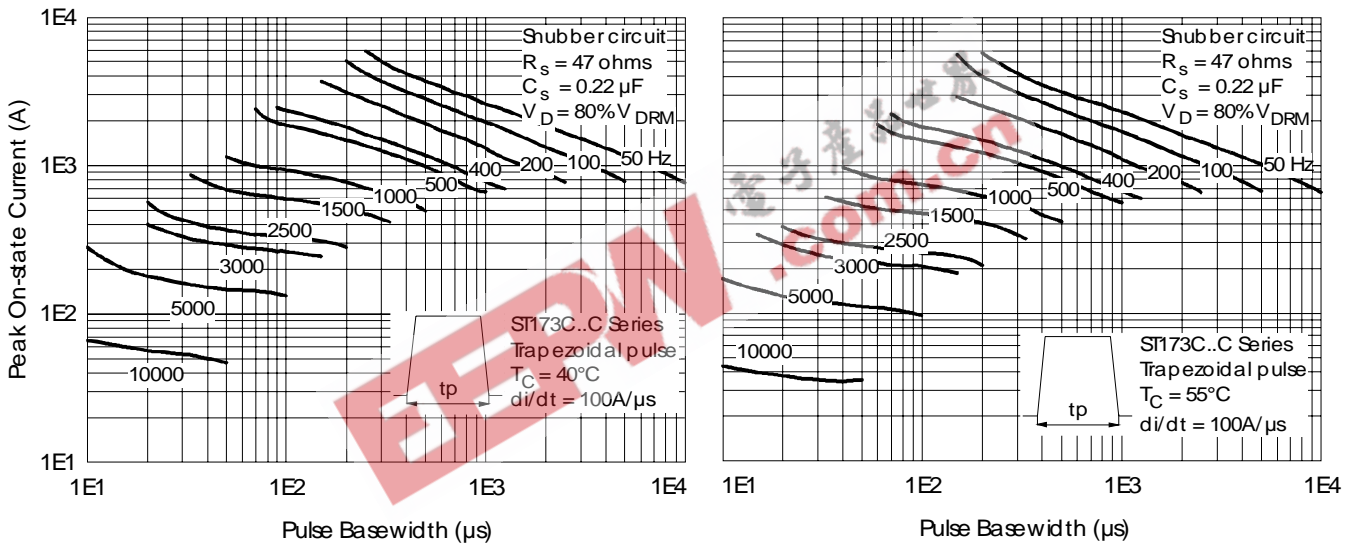


Fig. 15 - Frequency Characteristics

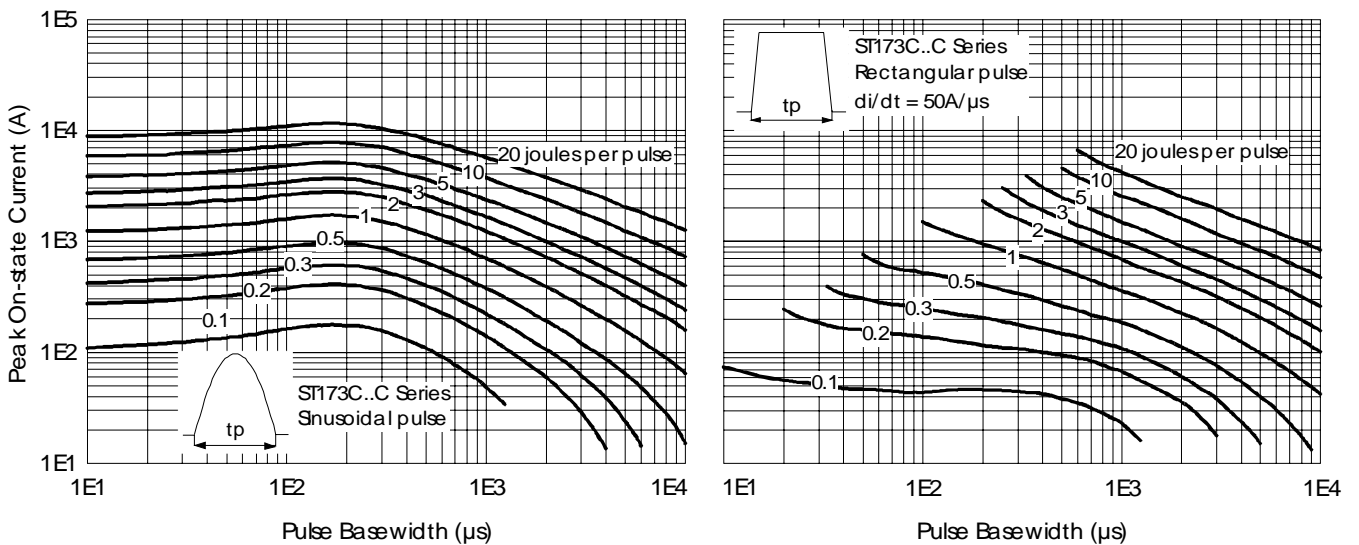


Fig. 16 - Maximum On-state Energy Power Loss Characteristics



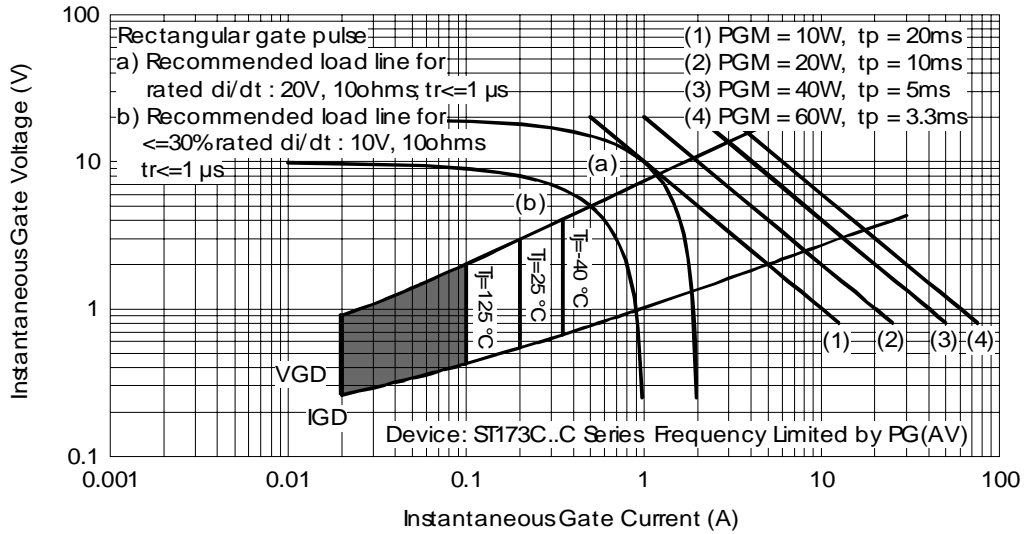


Fig. 17 - Gate Characteristics

Data and specifications subject to change without notice.  
 This product has been designed and qualified for Industrial Level and Lead-Free.  
 Qualification Standards can be found on IR's Web site.