

### INVERTER GRADE THYRISTORS

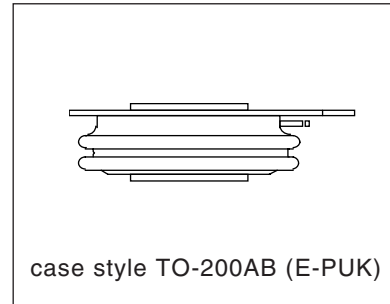
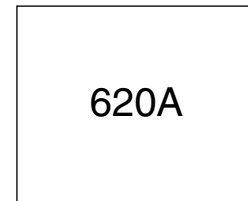
Puk Version

#### Features

- Metal case with ceramic insulator
- International standard case TO-200AB (E-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



#### Major Ratings and Characteristics

Parameters	ST303C..C	Units
$I_{T(AV)}$	620	A
	@ $T_{hs}$	55 °C
$I_{T(RMS)}$	1180	A
	@ $T_{hs}$	25 °C
$I_{TSM}$	@ 50Hz	7950 A
	@ 60Hz	8320 A
$I^2t$	@ 50Hz	316 KA <sup>2</sup> s
	@ 60Hz	289 KA <sup>2</sup> s
$V_{DRM}/V_{RRM}$	400 to 1200	V
$t_q$ range (*)	10 to 30	μs
$T_J$	- 40 to 125	°C

(\*)  $t_q = 10$  to  $20\mu s$  for 400 to 800V devices  
 $t_q = 15$  to  $30\mu s$  for 1000 to 1200V devices

## ST303C..C Series

Bulletin I25172 rev. B 04/00

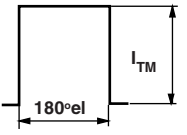
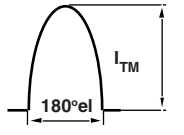
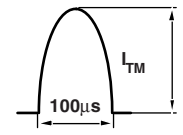
International  
 Rectifier

### 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
ST303C..C	04	400	500	50
	08	800	900	
	10	1000	1100	
	12	1200	1300	

#### Current Carrying Capability

Frequency							Units
50Hz	1314	1130	2070	1940	6930	6270	A
400Hz	1260	1040	2190	1880	3440	2960	
1000Hz	900	700	1900	1590	1850	1540	
2500Hz	340	230	910	710	740	560	
Recovery voltage Vr	50	50	50	50	50	50	
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	10Ω / 0.47µF		10Ω / 0.47µF		10Ω / 0.47µF		

#### On-state Conduction

Parameter	ST303C..C	Units	Conditions		
$I_{T(AV)}$ Max. average on-state current @ Heatsink temperature	620 (230)	A	180° conduction, half sine wave double side (single side) cooled		
	55 (85)	°C			
$I_{T(RMS)}$ Max. RMS on-state current	1180	A	DC @ 25°C heatsink temperature double side cooled		
$I_{TSM}$ Max. peak, one half cycle, non-repetitive surge current	7950			t = 10ms	No voltage
	8320			t = 8.3ms	reapplied
	6690			t = 10ms	100% $V_{RRM}$
	7000	t = 8.3ms	reapplied		
$I^2t$ Maximum $I^2t$ for fusing	316	KA <sup>2</sup> s	Sinusoidal half wave, Initial $T_J = T_J$ max		
	289			t = 10ms	No voltage
	224			t = 8.3ms	reapplied
	204			t = 10ms	100% $V_{RRM}$
			t = 8.3ms	reapplied	
$I^2\sqrt{t}$ Maximum $I^2\sqrt{t}$ for fusing	3160	KA <sup>2</sup> √s	t = 0.1 to 10ms, no voltage reapplied		

On-state Conduction

Parameter	ST303C..C	Units	Conditions
$V_{TM}$ Max. peak on-state voltage	2.16	V	$I_{TM} = 1255A, T_J = T_J \text{ max}, t_p = 10\text{ms sine wave pulse}$
$V_{T(TO)1}$ Low level value of threshold voltage	1.44		$(16.7\% \times \pi \times I_{T(AV)} < I < \pi \times I_{T(AV)}), T_J = T_J \text{ max.}$
$V_{T(TO)2}$ High level value of threshold voltage	1.48		$(I > \pi \times I_{T(AV)}), T_J = T_J \text{ max.}$
$r_{t1}$ Low level value of forward slope resistance	0.57	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	0.56		$(I > \pi \times I_{T(AV)}), T_J = T_J \text{ max.}$
$I_H$ 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	ST303C..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	0.83	$\mu\text{s}$	$T_J = 25^\circ\text{C}, V_{DM} = \text{rated } V_{DRM}, I_{TM} = 50A \text{ DC}, t_p = 1\mu\text{s}$ Resistive load, Gate pulse: 10V, 5 $\Omega$ source
$t_q$ Max. turn-off time (*)	Min 10 Max 30		$T_J = T_J \text{ max}, I_{TM} = 550A, \text{commutating di/dt} = 40A/\mu\text{s}$ $V_R = 50V, t_p = 500\mu\text{s}, \text{dv/dt: see table in device code}$

(\*)  $t_q = 10$  to  $20\mu\text{s}$  for 400 to 800V devices;  $t_q = 15$  to  $30\mu\text{s}$  for 1000 to 1200V devices.

Blocking

Parameter	ST303C..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	50	mA	$T_J = T_J \text{ max, rated } V_{DRM}/V_{RRM} \text{ applied}$

Triggering

Parameter	ST303C..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	

# ST303C..C Series

Bulletin I25172 rev. B 04/00

## Thermal and Mechanical Specification

Parameter	ST303C..C	Units	Conditions
$T_J$ Max. operating temperature range	-40 to 125	°C	
$T_{stg}$ Max. storage temperature range	-40 to 150		
$R_{thJ-hs}$ Max. thermal resistance, junction to heatsink	0.09	K/W	DC operation single side cooled
	0.04		DC operation double side cooled
$R_{thC-hs}$ Max. thermal resistance, case to heatsink	0.020	K/W	DC operation single side cooled
	0.010		DC operation double side cooled
F Mounting force, $\pm 10\%$	9800 (1000)	N (Kg)	
wt Approximate weight	83	g	
Case style	TO - 200AB (E-PUK)		See Outline Table

## $\Delta R_{thJ-hs}$ Conduction

(The following table shows the increment of thermal resistance  $R_{thJ-hs}$  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°	0.010	0.010	0.007	0.007	K/W	$T_J = T_J \text{ max.}$
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	0.037		

## Ordering Information Table

**Device Code**

ST

30

3

C

12

C

H

K

1

①

②

③

④

⑤

⑥

⑦

⑧

⑨

⑩

- 1** - Thyristor
- 2** - Essential part number
- 3** - 3 = Fast turn off
- 4** - C = Ceramic Puk
- 5** - Voltage code: Code x 100 =  $V_{RRM}$  (See Voltage Rating 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 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/ $\mu$ sec (Standard value)
  - L = 1000V/ $\mu$ sec (Special selection)

**dv/dt -  $t_q$  combinations available**

	dv/dt (V/ $\mu$ s)	20	50	100	200	400	
$t_q$ ( $\mu$ s)	10	CN	DN	EN	<b>FN</b> *	HN	
	12	CM	DM	EM	FM	HM	
	up to 800V	15	CL	DL	EL	<b>FL</b> *	HL
		20	CK	DK	EK	<b>FK</b> *	HK
$t_q$ ( $\mu$ s)	15	CL	--	--	--	--	
	18	CP	DP	--	--	--	
	20	CK	DK	EK	<b>FK</b> *	HK	
	only for 1000/1200V	25	CJ	DJ	EJ	<b>FJ</b> *	HJ
		30	--	DH	EH	FH	HH

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

Outline Table

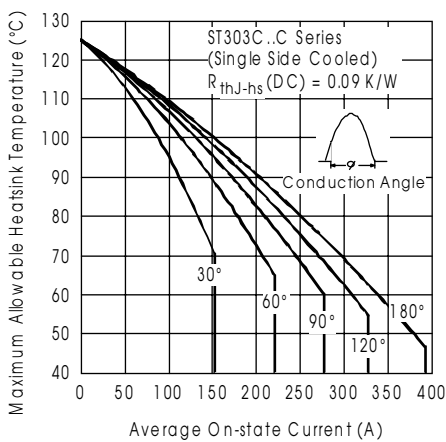
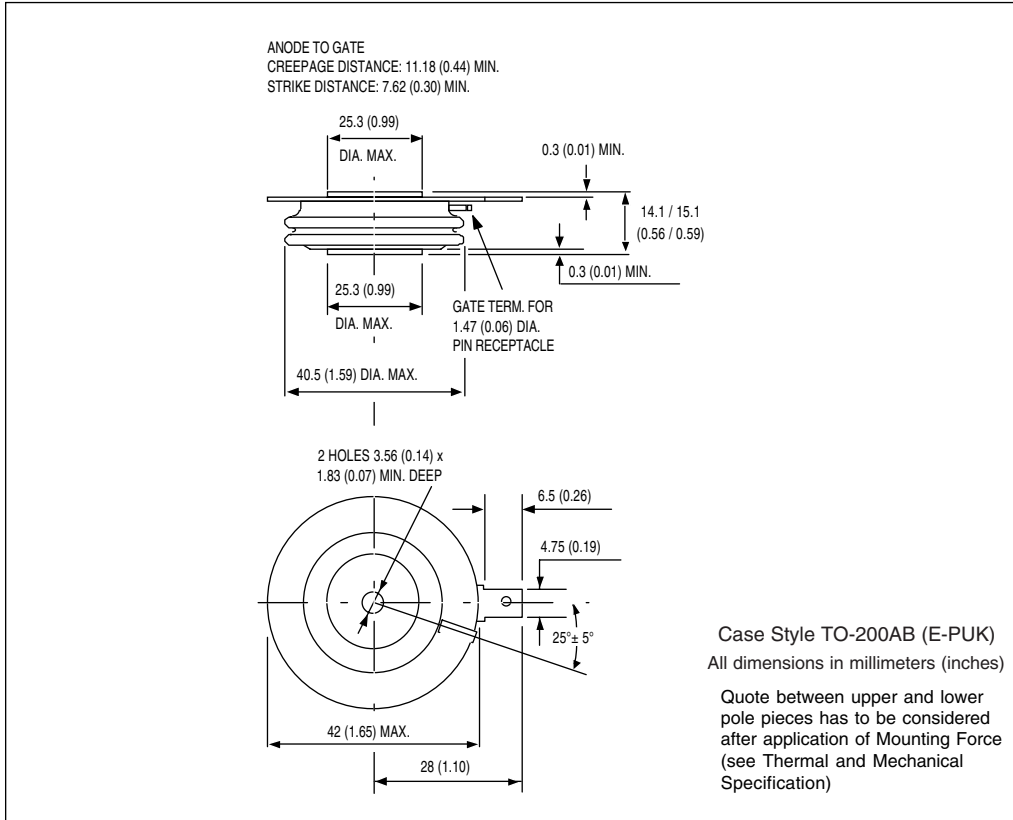


Fig. 1 - Current Ratings Characteristics

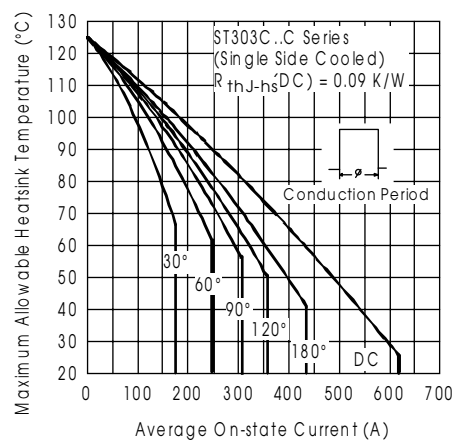


Fig. 2 - Current Ratings Characteristics

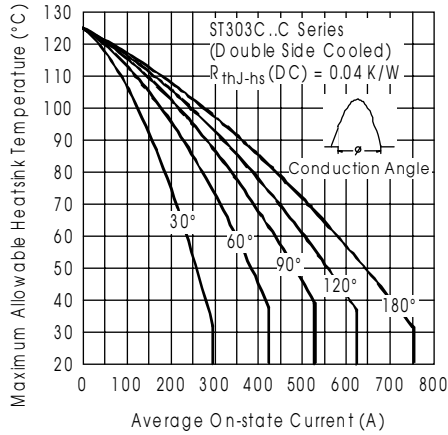


Fig. 3 - Current Ratings Characteristics

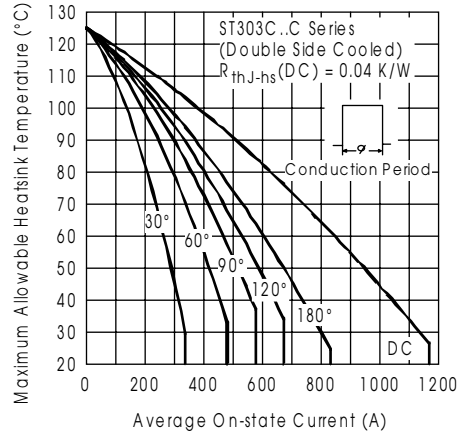


Fig. 4 - Current Ratings Characteristics

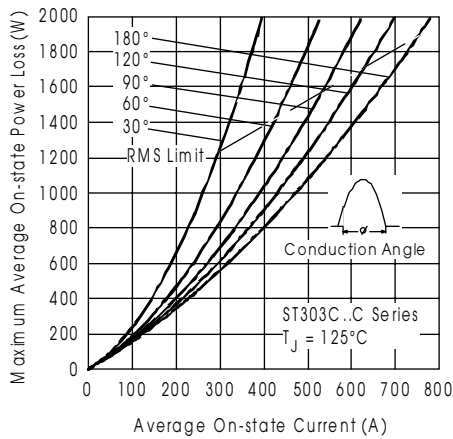


Fig. 5 - On-state Power Loss Characteristics

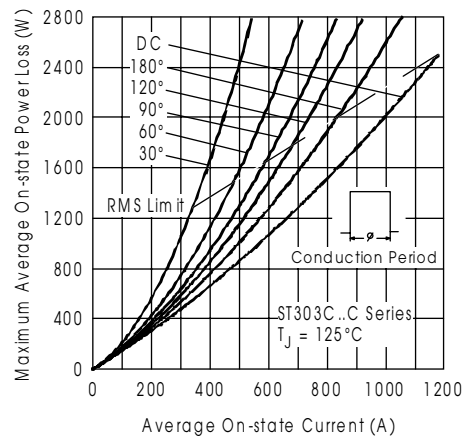


Fig. 6 - On-state Power Loss Characteristics

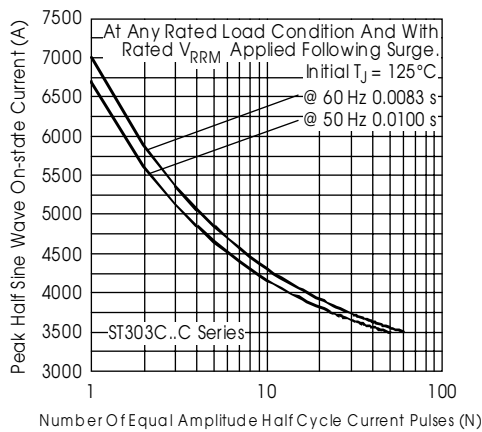


Fig. 7 - Maximum Non-repetitive Surge Current  
Single and Double Side Cooled

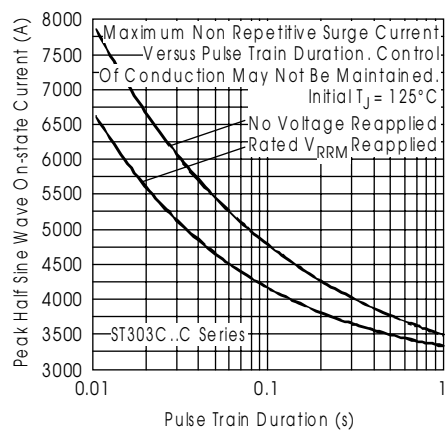


Fig. 8 - Maximum Non-repetitive Surge Current  
Single and Double Side Cooled

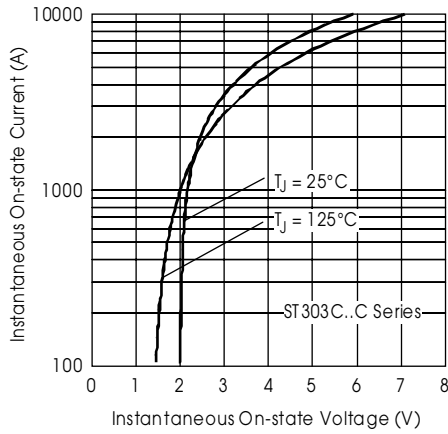


Fig. 9 - On-state Voltage Drop Characteristics

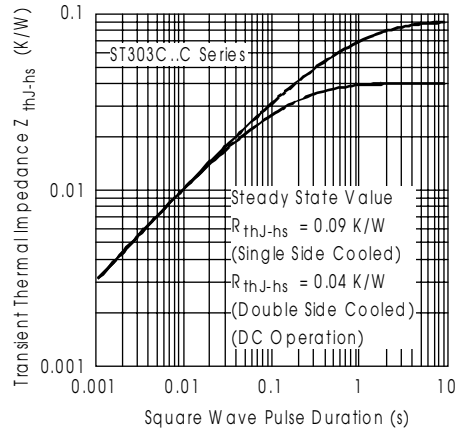


Fig. 10 - Thermal Impedance  $Z_{thJ-hs}$  Characteristics

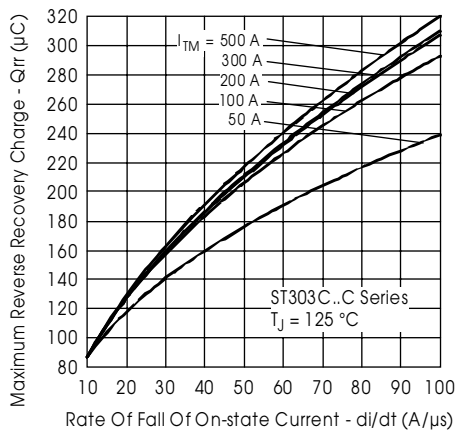


Fig. 11 - Reverse Recovered Charge Characteristics

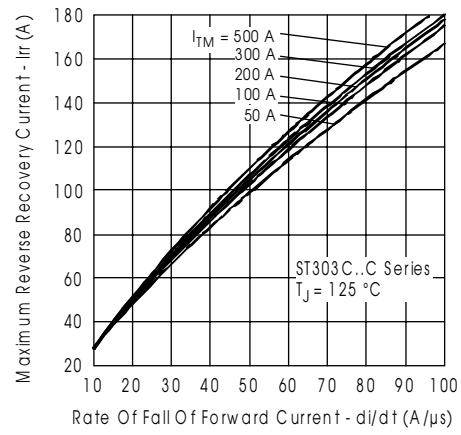


Fig. 12 - Reverse Recovery Current Characteristics

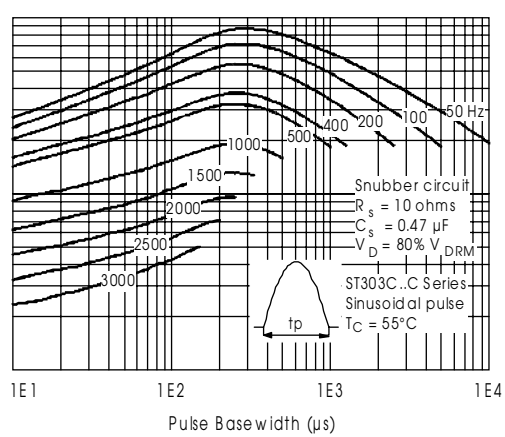
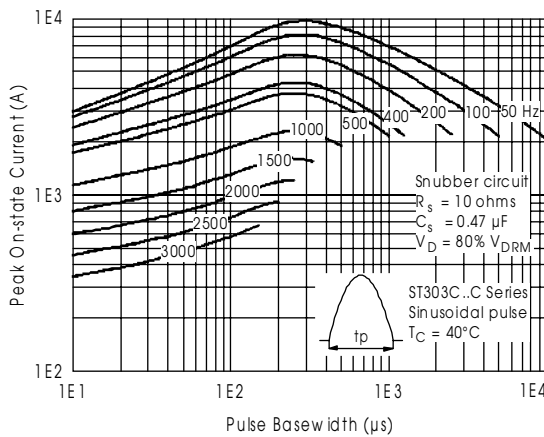


Fig. 13 - Frequency Characteristics

# ST303C..C Series

Bulletin I25172 rev. B 04/00

International  
**IRF** Rectifier

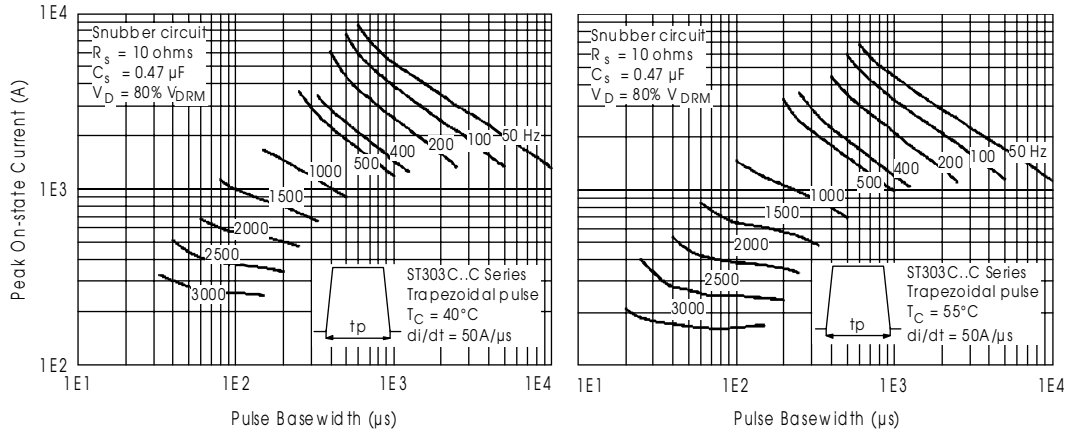


Fig. 14 - Frequency Characteristics

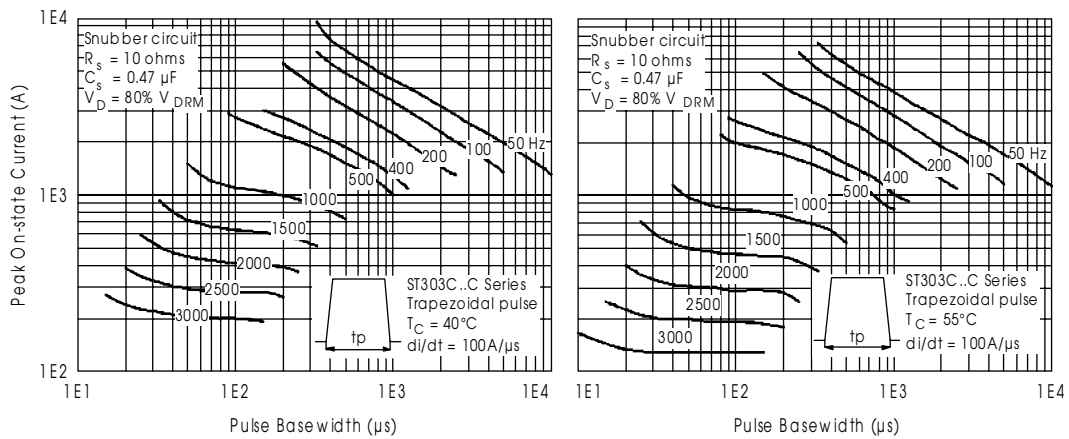


Fig. 15 - Frequency Characteristics

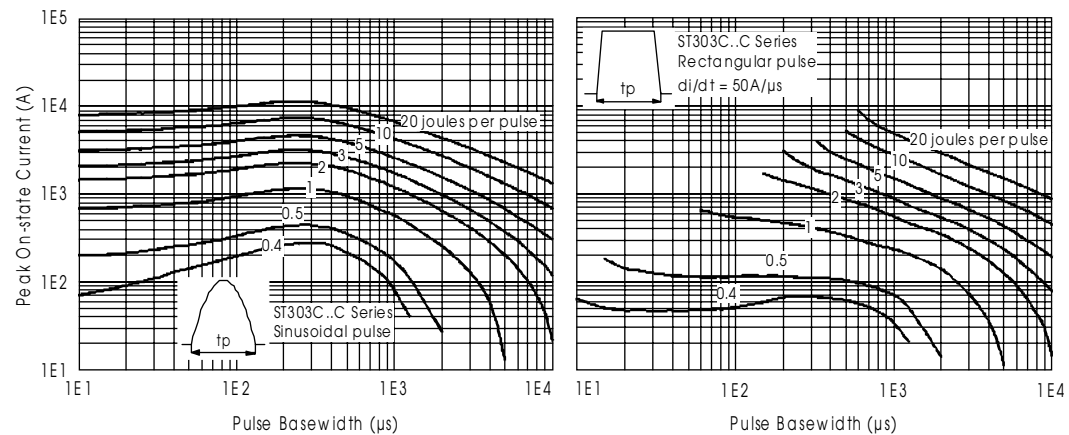


Fig. 16 - Maximum On-state Energy Power Loss Characteristics



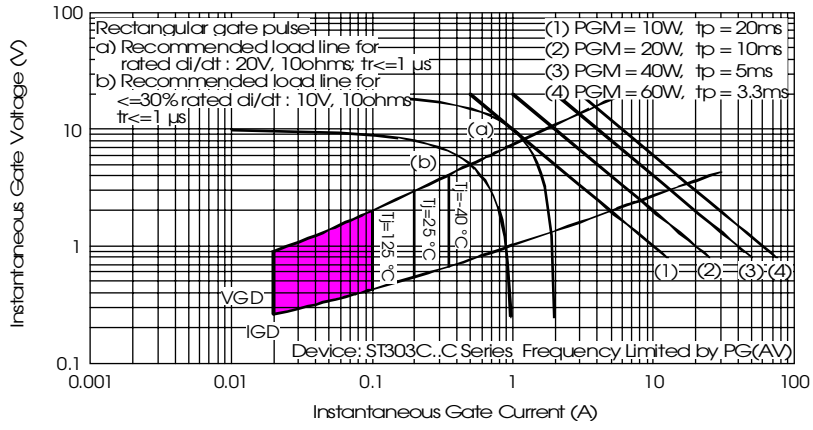


Fig. 17 - Gate Characteristics