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***DISCRETE POWER DIODES and THYRISTORS***  
***DATA BOOK***

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## INVERTER GRADE THYRISTORS

## Hockey Puk Version

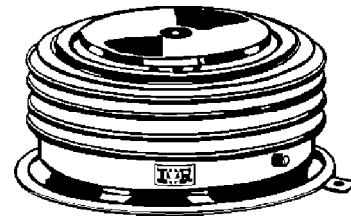
### Features

- Metal case with ceramic insulator
- International standard case TO-200AC (B-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

515A



case style TO-200AC (B-PUK)

### Major Ratings and Characteristics

Parameters	ST303C..L	Units	
$I_{T(AV)}$	515	A	
@ $T_{hs}$	55	°C	
$I_{T(RMS)}$	995	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	

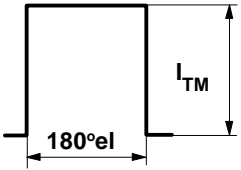
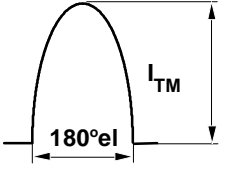
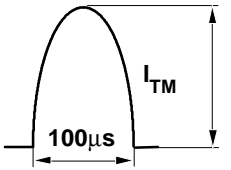
(\*)  $t_q = 10$  to  $20\mu s$  for 400 to 800V devices  
 $t_q = 15$  to  $30\mu s$  for 1000 to 1200V devices

**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..L	04	400	500	50
	08	800	900	
	10	1000	1100	
	12	1200	1300	

Current Carrying Capability

Frequency				Units			
50Hz	1130	950	1800	1540	5660	4990	A
400Hz	1010	820	1850	1570	2830	2420	
1000Hz	680	530	1560	1300	1490	1220	
2500Hz	230	140	690	510	540	390	
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	10Ω / 0.47µF		10Ω / 0.47µF		10Ω / 0.47µF		

On-state Conduction

Parameter	ST303C..L	Units	Conditions	
$I_{T(AV)}$ Max. average on-state current @ Heatsink temperature	515 (190)	A	180° conduction, half sine wave double side (single side) cooled	
	55 (85)	°C		
$I_{T(RMS)}$ Max. RMS on-state current	995	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 reappplied
	8320		t = 8.3ms	reappplied
	6690		t = 10ms	100% $V_{RRM}$
$I^2t$ Maximum $I^2t$ for fusing	7000	t = 8.3ms	reappplied	
	316	t = 10ms	No voltage reappplied	
		t = 8.3ms	reappplied	
		t = 10ms	100% $V_{RRM}$	
289	t = 8.3ms	reappplied		
224	KA <sup>2</sup> s	t = 10ms	reappplied	
204		t = 8.3ms	reappplied	
$I^2\sqrt{t}$ Maximum $I^2\sqrt{t}$ for fusing	3160	KA <sup>2</sup> √s	t = 0.1 to 10ms, no voltage reappplied	

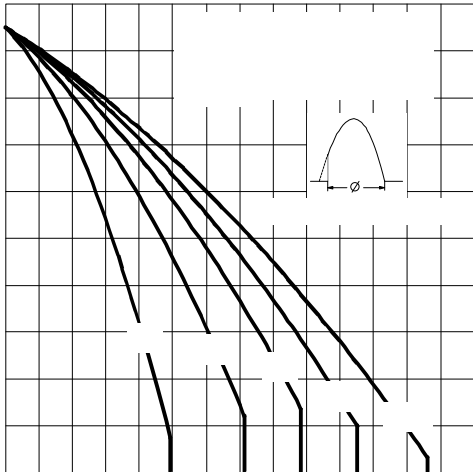


Fig. 3 - Current Ratings Characteristics

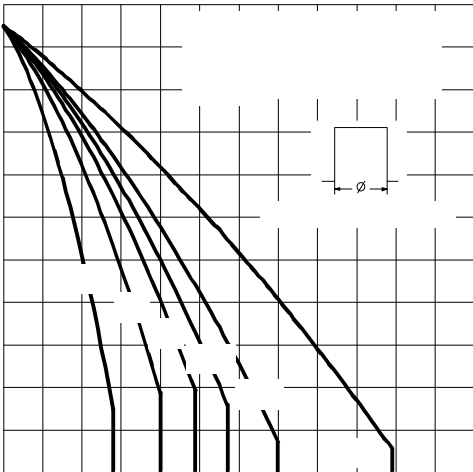


Fig. 4 - Current Ratings Characteristics

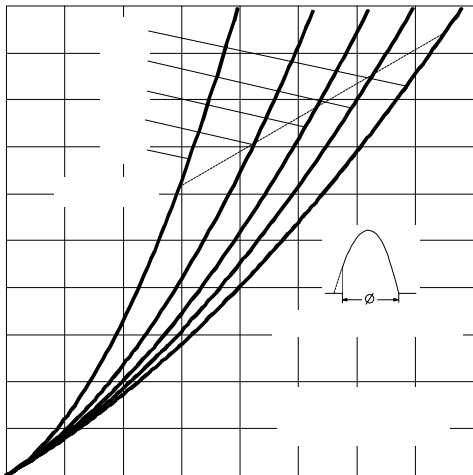


Fig. 5 - On-state Power Loss Characteristics

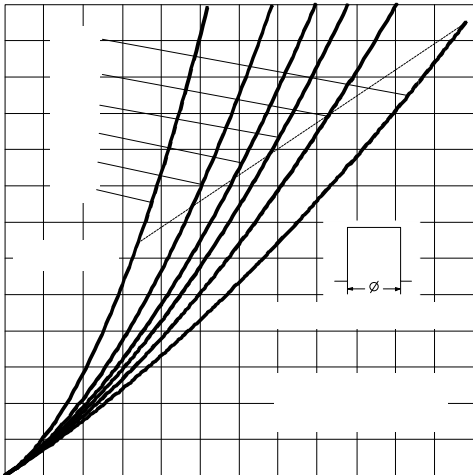


Fig. 6 - On-state Power Loss Characteristics

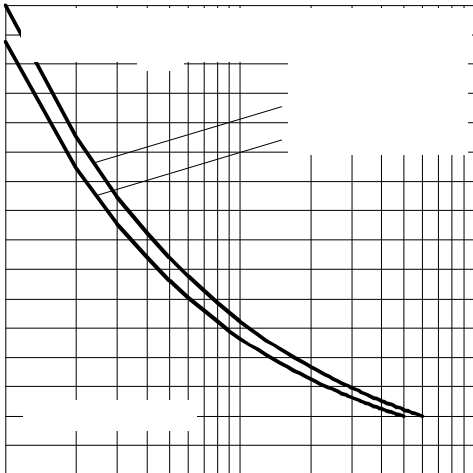


Fig. 7 - Maximum Non-repetitive Surge Current

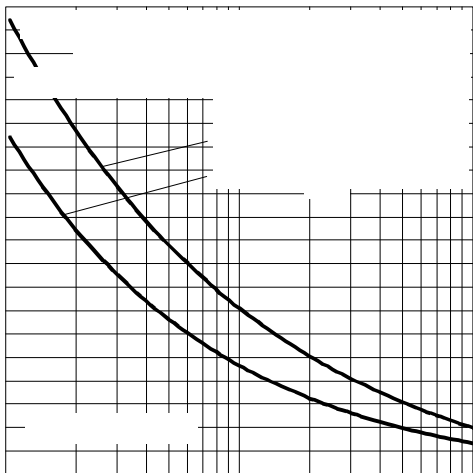


Fig. 8 - Maximum Non-repetitive Surge Current

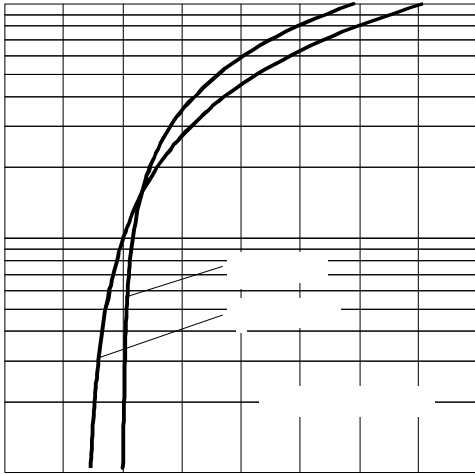


Fig. 9 - On-state Voltage Drop Characteristics

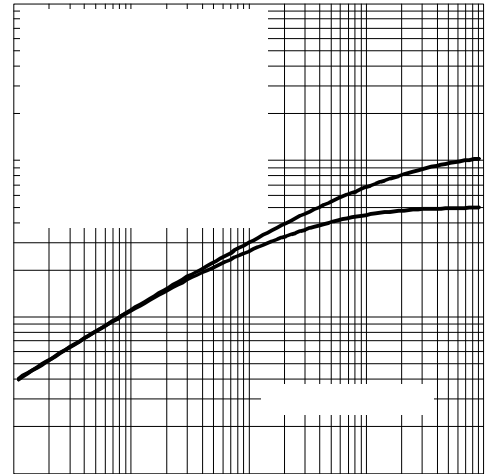


Fig. 10 - Thermal Impedance  $Z_{thJ-hs}$  Characteristics

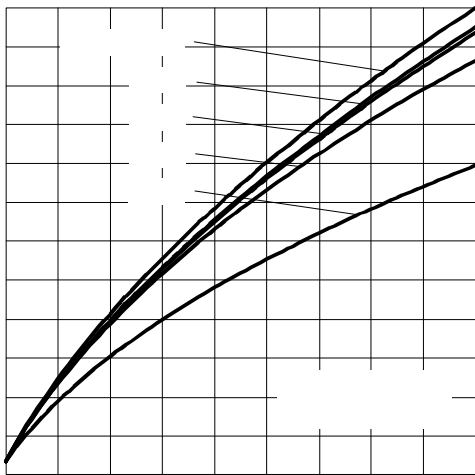


Fig. 11 - Reverse Recovered Charge Characteristics

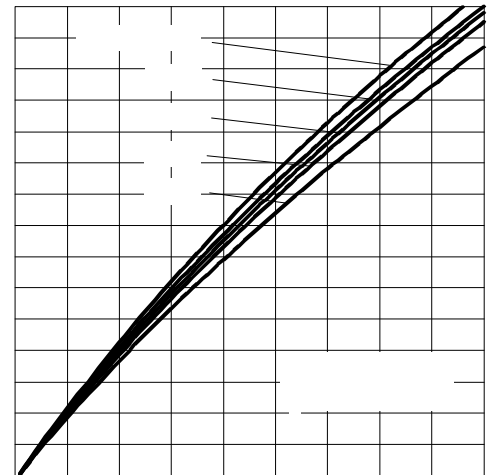


Fig. 12 - Reverse Recovery Current Characteristics

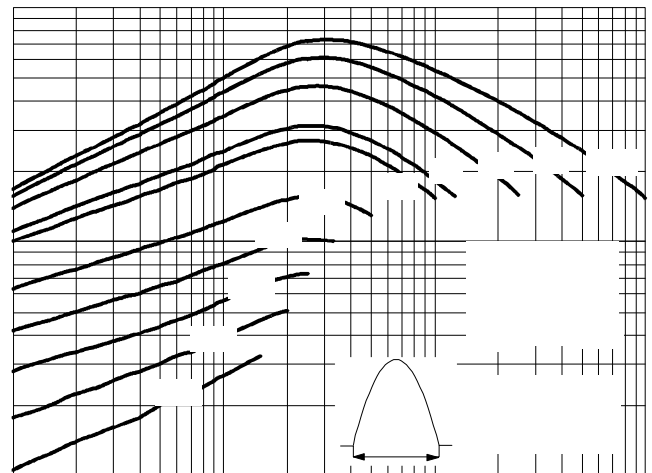
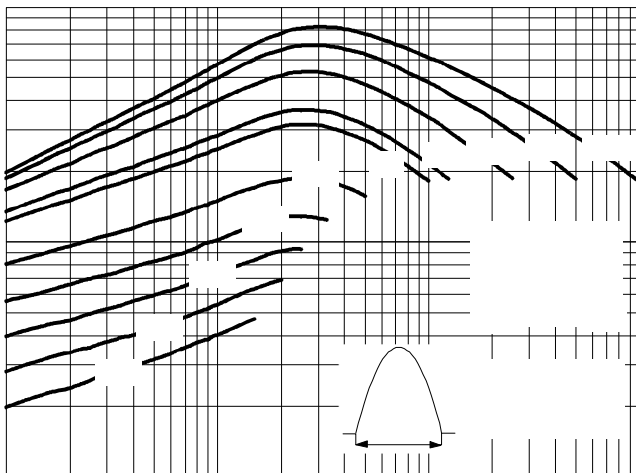


Fig. 13 - Frequency Characteristics

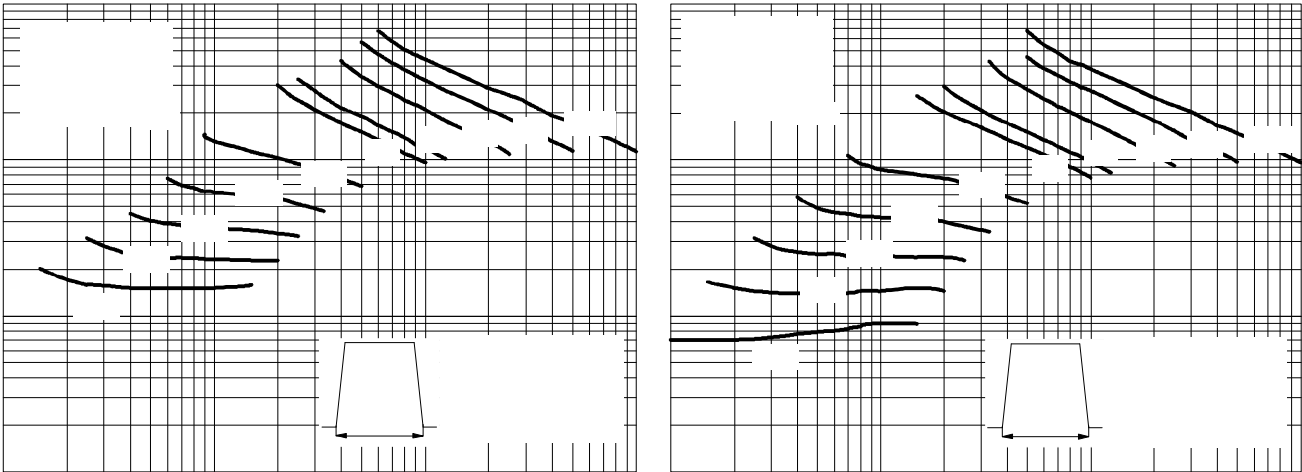


Fig. 14 - Frequency Characteristics

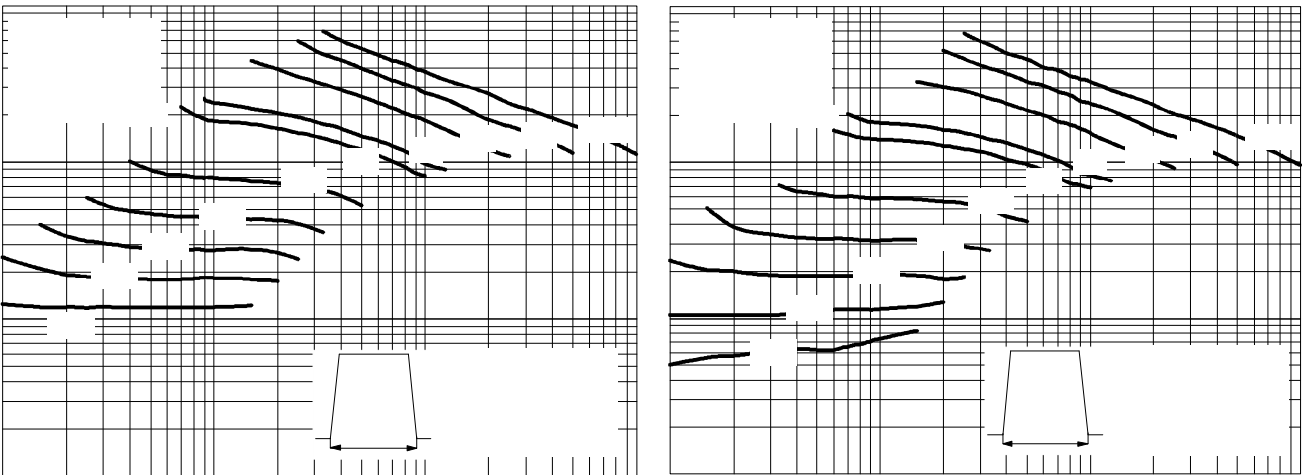


Fig. 15 - Frequency Characteristics

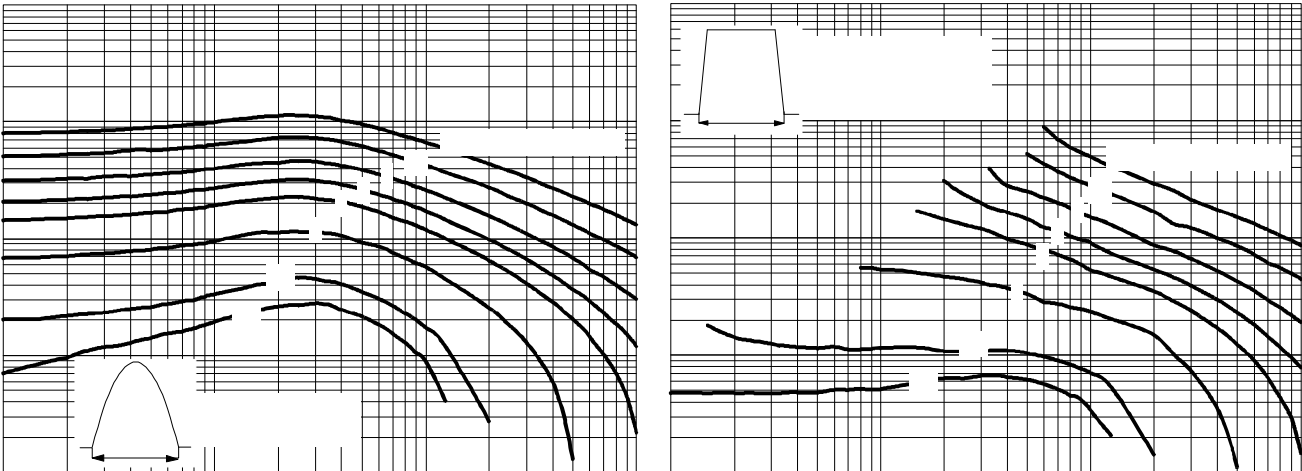


Fig. 16 - Maximum On-state Energy Power Loss Characteristics

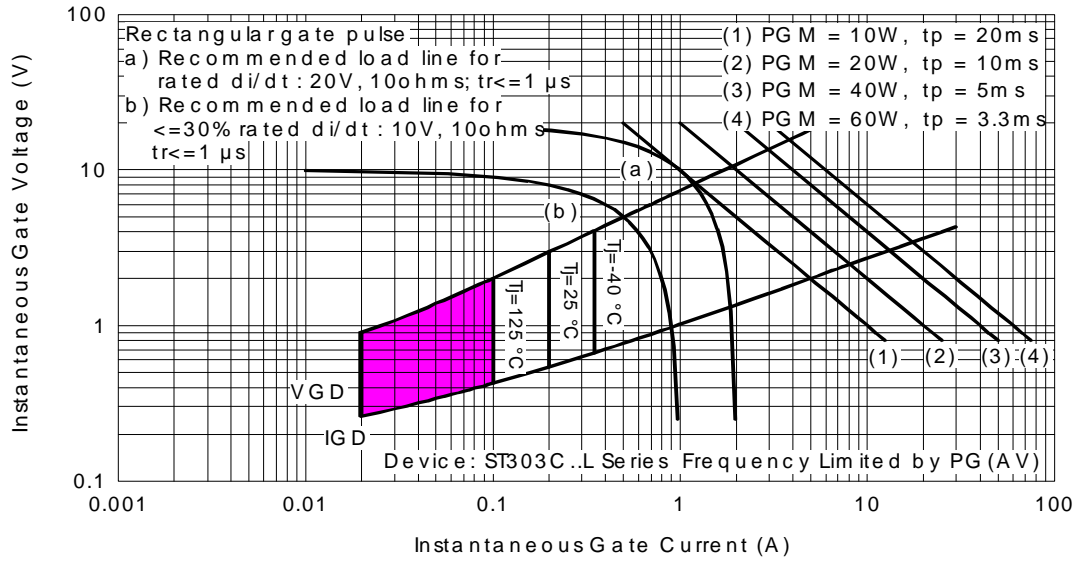


Fig. 17 - Gate Characteristics

## On-state Conduction

Parameter	ST303C..L	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 atching current	1000		$T_J = 25^\circ\text{C}$ , $V_A = 12V$ , $R_a = 6\Omega$ , $I_G = 1A$

## Switching

Parameter	ST303C..L	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	$\mu\text{s}$	$T_J = 25^\circ\text{C}$ , $V_{DM} = \text{rated } V_{DRM}$ , $I_{TM} = 50A$ 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		$T_J = T_J \text{ max}$ , $I_{TM} = 550A$ , commutating di/dt = 40A/ $\mu\text{s}$ $V_R = 50V$ , $t_p = 500\mu\text{s}$ , 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..L	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% $V_{DRM}$ , 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 $V_{DRM}/V_{RRM}$ applied

## Triggering

Parameter	ST303C..L	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 $V_{DRM}$ applied
$V_{GD}$ Max. DC gate voltage not to trigger	0.25	V	



# ST303C..L Series

## Thermal and Mechanical Specification

Parameter	ST303C..L	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	0.11 0.05	K/W	DC operation single side cooled DC operation double side cooled
R <sub>thC-hs</sub> Max. thermal resistance, case to heatsink	0.011 0.005		K/W
F Mounting force, ± 10%	9800 (1000)	N (Kg)	
wt Approximate weight	250	g	
Case style	TO - 200AC (B-PUK)		See Outline Table

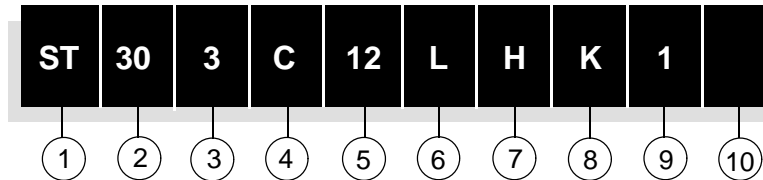
## ΔR<sub>thJ-hs</sub> Conduction

(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°	0.012	0.010	0.008	0.008	K/W	T <sub>J</sub> = T <sub>J</sub> max.
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		

## Ordering Information Table

### Device Code



- 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** - L = Puk Case TO-200AC (B-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)

dv/dt - t <sub>q</sub> combinations available							
dv/dt (V/μs)		20	50	100	200	400	
t <sub>q</sub> (μs)	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 <sub>q</sub> (μs)	15	CL	--	--	--	--	
	18	CP	DP	--	--	--	
	only for 1000/1200V	20	CK	DK	EK	<b>FK</b> *	HK
		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

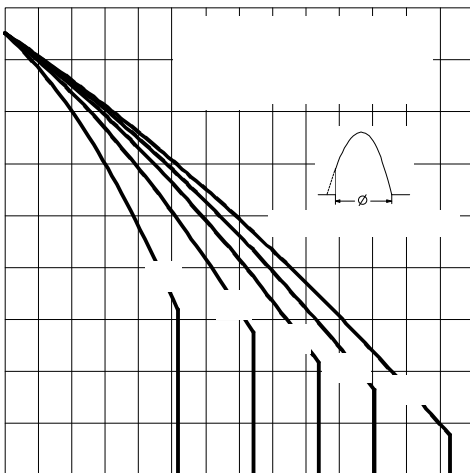
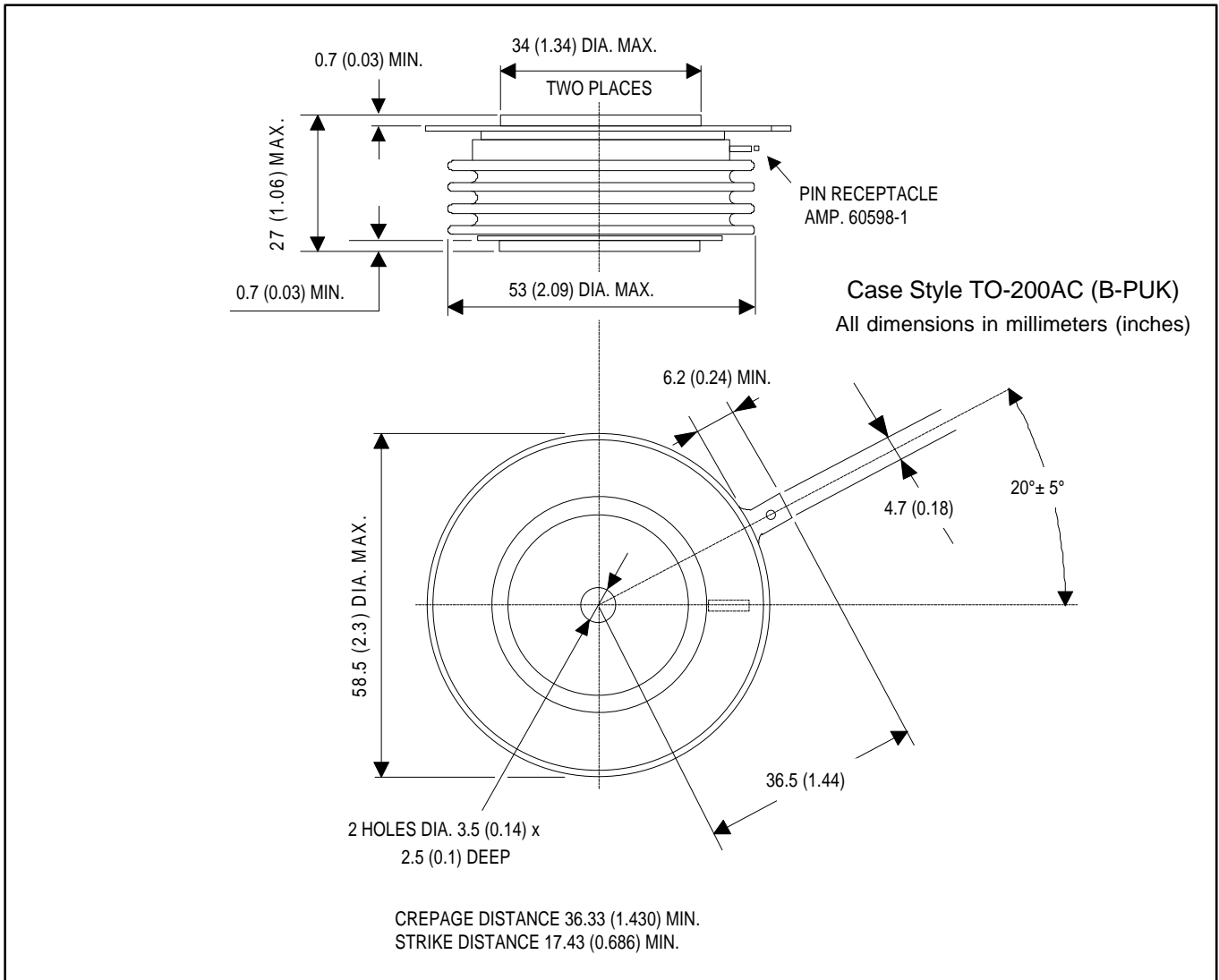


Fig. 1 - Current Ratings Characteristics

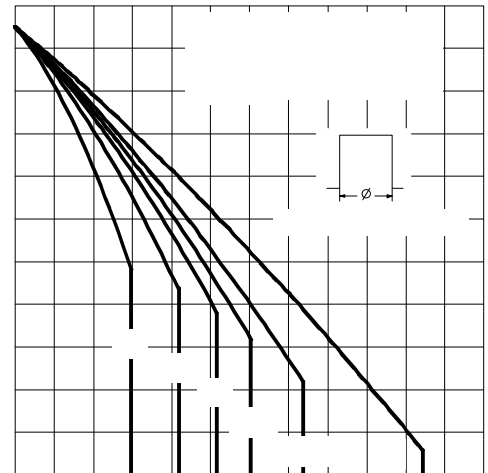


Fig. 2 - Current Ratings Characteristics