

## ST780C..L SERIES

### PHASE CONTROL THYRISTORS

### Hockey Puk Version

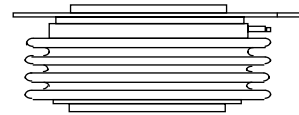
#### Features

- Center amplifying gate
- Metal case with ceramic insulator
- International standard case TO-200AC (B-PUK)

1350A

#### Typical Applications

- DC motor controls
- Controlled DC power supplies
- AC controllers



case style TO-200AC (B-PUK)

#### Major Ratings and Characteristics

Parameters	ST780C..L	Units
$I_{T(AV)}$	1350	A
@ $T_{hs}$	55	°C
$I_{T(RMS)}$	2700	A
@ $T_{hs}$	25	°C
$I_{TSM}$	@ 50Hz	24400 A
	@ 60Hz	25600 A
$I^2t$	@ 50Hz	2986 KA <sup>2</sup> s
	@ 60Hz	2726 KA <sup>2</sup> s
$V_{DRM}/V_{RRM}$	400 to 600	V
$t_q$ typical	150	μs
$T_J$	- 40 to 125	°C

**ST780C..L Series**

Bulletin I25192 rev. C 04/00

International  
**IR** Rectifier**ELECTRICAL SPECIFICATIONS****Voltage Ratings**

Type number	Voltage Code	$V_{DRM}/V_{RRM}$ , max. repetitive peak and off-state voltage V	$V_{RSM}$ , maximum non-repetitive peak voltage V	$I_{DRM}/I_{RRM}$ max. @ $T_J = T_J \text{ max}$ mA
ST780C..L	04	400	500	80
	06	600	700	

**On-state Conduction**

Parameter	ST780C..L	Units	Conditions
$I_{T(AV)}$ Max. average on-state current @ Heatsink temperature	1350 (500)	A	180° conduction, half sine wave
	55 (85)	°C	double side (single side) cooled
$I_{T(RMS)}$ Max. RMS on-state current	2700		DC @ 25°C heatsink temperature double side cooled
$I_{TSM}$ Max. peak, one-cycle non-repetitive surge current	24400	A	t = 10ms No voltage
	25600		t = 8.3ms reappplied
	20550		t = 10ms 100% $V_{RRM}$
	21500		t = 8.3ms reappplied
$I^2t$ Maximum $I^2t$ for fusing	2986	KA <sup>2</sup> s	t = 10ms No voltage
	2726		t = 8.3ms reappplied
	2112		t = 10ms 100% $V_{RRM}$
	1928		t = 8.3ms reappplied
$I^2\sqrt{t}$ Maximum $I^2\sqrt{t}$ for fusing	29860	KA <sup>2</sup> /s	t = 0.1 to 10ms, no voltage reappplied
$V_{T(TO)1}$ Low level value of threshold voltage	0.80	V	$(16.7\% \times \pi \times I_{T(AV)} < I < \pi \times I_{T(AV)})$ , $T_J = T_J \text{ max.}$
$V_{T(TO)2}$ High level value of threshold voltage	0.90		$(I > \pi \times I_{T(AV)})$ , $T_J = T_J \text{ max.}$
$r_{t1}$ Low level value of on-state slope resistance	0.14	mΩ	$(16.7\% \times \pi \times I_{T(AV)} < I < \pi \times I_{T(AV)})$ , $T_J = T_J \text{ max.}$
$r_{t2}$ High level value of on-state slope resistance	0.13		$(I > \pi \times I_{T(AV)})$ , $T_J = T_J \text{ max.}$
$V_{TM}$ Max. on-state voltage	1.31	V	$I_{pk} = 3600A$ , $T_J = T_J \text{ max.}$ , $t_p = 10ms$ sine pulse
$I_H$ Maximum holding current	600	mA	$T_J = 25^\circ C$ , anode supply 12V resistive load
$I_L$ Typical latching current	1000		

**Switching**

Parameter	ST780C..L	Units	Conditions
$di/dt$ Max. non-repetitive rate of rise of turned-on current	1000	A/μs	Gate drive 20V, 20Ω, $t_r \leq 1\mu s$ $T_J = T_J \text{ max.}$ , anode voltage $\leq 80\% V_{DRM}$
$t_d$ Typical delay time	1.0	μs	Gate current 1A, $di_g/dt = 1A/\mu s$ $V_d = 0.67\% V_{DRM}$ , $T_J = 25^\circ C$
$t_q$ Typical turn-off time	150		$I_{TM} = 750A$ , $T_J = T_J \text{ max.}$ , $di/dt = 60A/\mu s$ , $V_R = 50V$ $dv/dt = 20V/\mu s$ , Gate 0V 100Ω, $t_p = 500\mu s$

### Blocking

Parameter	ST780C..L	Units	Conditions
$dv/dt$ Maximum critical rate of rise of off-state voltage	500	V/ $\mu$ s	$T_J = T_J \text{ max.}$ linear to 80% rated $V_{DRM}$
$I_{DRM}$ $I_{RRM}$ Max. peak reverse and off-state leakage current	80	mA	$T_J = T_J \text{ max.}$ rated $V_{DRM}/V_{RRM}$ applied

### Triggering

Parameter	ST780C..L		Units	Conditions
$P_{GM}$ Maximum peak gate power	10.0		W	$T_J = T_J \text{ max.}$ $t_p \leq 5\text{ms}$
$P_{G(AV)}$ Maximum average gate power	2.0			$T_J = T_J \text{ max.}$ $f = 50\text{Hz}$ , $d\% = 50$
$I_{GM}$ Max. peak positive gate current	3.0		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	5.0			
$I_{GT}$ DC gate current required to trigger	TYP.	MAX.	mA	$T_J = -40^\circ\text{C}$ $T_J = 25^\circ\text{C}$ $T_J = 125^\circ\text{C}$ Max. required gate trigger/ current/ voltage are the lowest value which will trigger all units 12V anode-to-cathode applied
	200	-		
	100	200		
	50	-		
$V_{GT}$ DC gate voltage required to trigger	2.5	-	V	$T_J = -40^\circ\text{C}$ $T_J = 25^\circ\text{C}$ $T_J = 125^\circ\text{C}$
	1.8	3.0		
	1.1	-		
$I_{GD}$ DC gate current not to trigger	10		mA	$T_J = T_J \text{ max}$ Max. gate current/voltage not to trigger is the max. value which will not trigger any unit with rated $V_{DRM}$ anode-to-cathode applied
$V_{GD}$ DC gate voltage not to trigger	0.25		V	

### Thermal and Mechanical Specification

Parameter	ST780C..L	Units	Conditions
$T_J$ Max. operating temperature range	-40 to 125	$^\circ\text{C}$	
$T_{stg}$ Max. storage temperature range	-40 to 150		
$R_{thJ-hs}$ Max. thermal resistance, junction to heatsink	0.073 0.031	K/W	DC operation single side cooled DC operation double side cooled
$R_{thC-hs}$ Max. thermal resistance, case to heatsink	0.011 0.006	K/W	DC operation single side cooled DC operation double side cooled
F Mounting force, $\pm 10\%$	14700 (1500)	N (Kg)	
wt Approximate weight	255	g	
Case style	TO - 200AC (B-PUK)		See Outline Table

ST780C..L Series

Bulletin I25192 rev. C 04/00

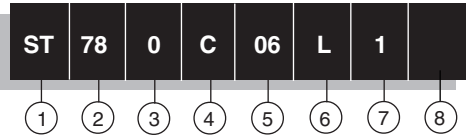
$\Delta R_{thJ-hs}$  Conduction

(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°	0.009	0.009	0.006	0.006	K/W	$T_J = T_{J \text{ max.}}$
120°	0.011	0.011	0.011	0.011		
90°	0.014	0.014	0.015	0.015		
60°	0.020	0.020	0.021	0.021		
30°	0.036	0.036	0.036	0.036		

Ordering Information Table

Device Code



- 1** - Thyristor
- 2** - Essential part number
- 3** - 0 = Converter grade
- 4** - C = Ceramic Puk
- 5** - Voltage code: Code x 100 =  $V_{RRM}$  (See Voltage Rating Table)
- 6** - L = Puk Case TO-200AC (B-PUK)
- 7** - 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)
- 8** - Critical dv/dt: None = 500V/ $\mu$ sec (Standard selection)  
L = 1000V/ $\mu$ sec (Special selection)

Outline Table

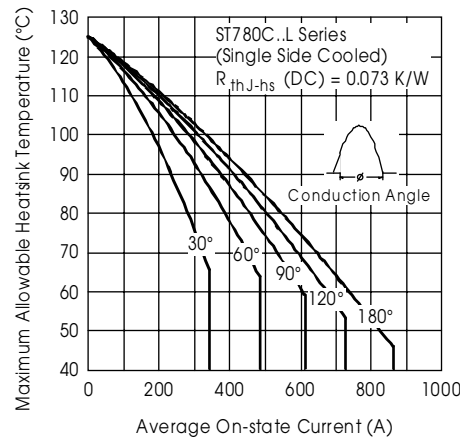
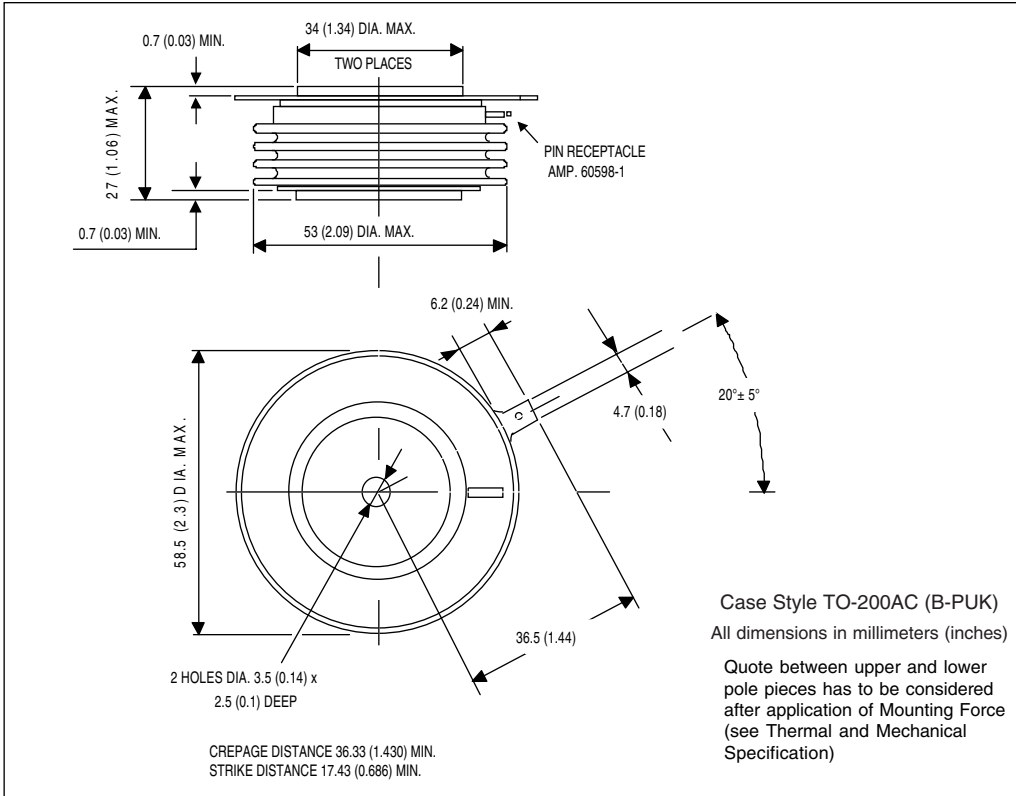


Fig. 1 - Current Ratings Characteristics

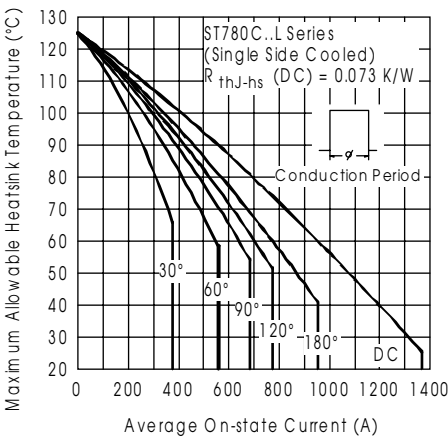


Fig. 2 - Current Ratings Characteristics

## ST780C..L Series

Bulletin I25192 rev. C 04/00

International  
IOR Rectifier

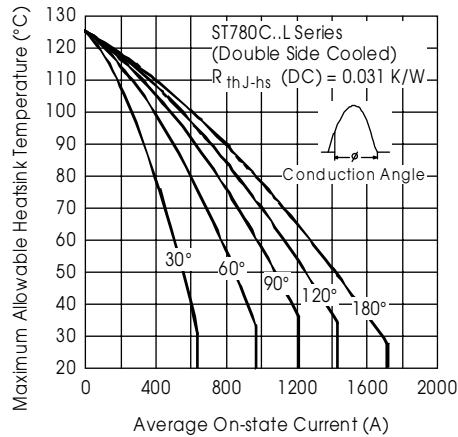


Fig. 3 - Current Ratings Characteristics

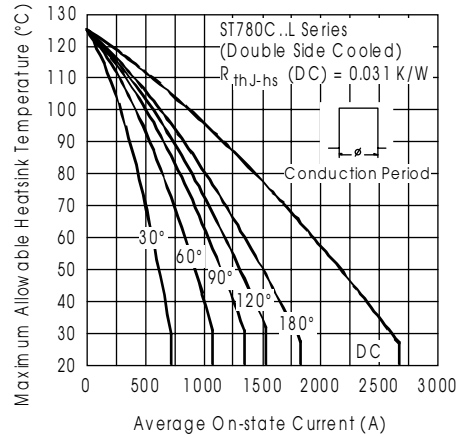


Fig. 4 - Current Ratings Characteristics

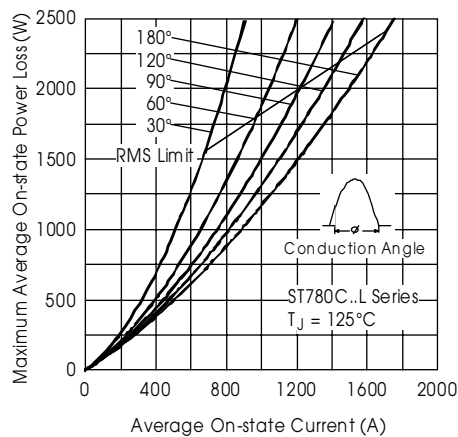


Fig. 5 - On-state Power Loss Characteristics

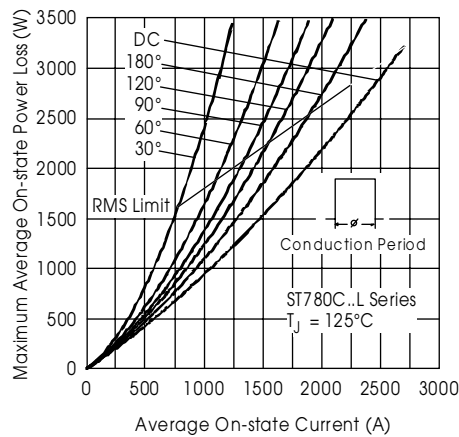


Fig. 6 - On-state Power Loss Characteristics

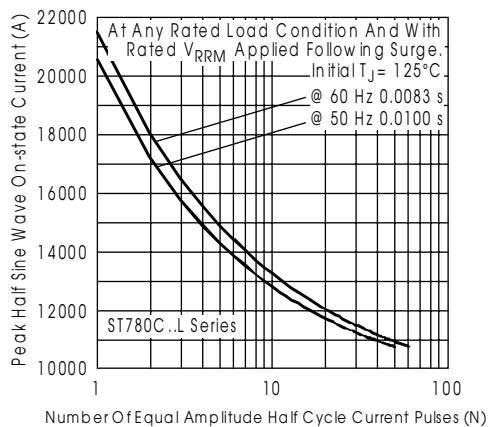


Fig. 7 - Maximum Non-Repetitive Surge Current  
Single and Double Side Cooled

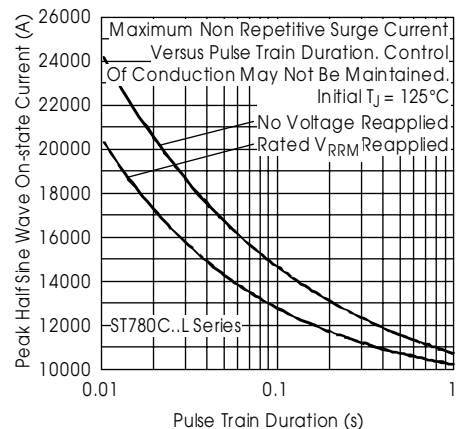


Fig. 8 - Maximum Non-Repetitive Surge Current  
Single and Double Side Cooled

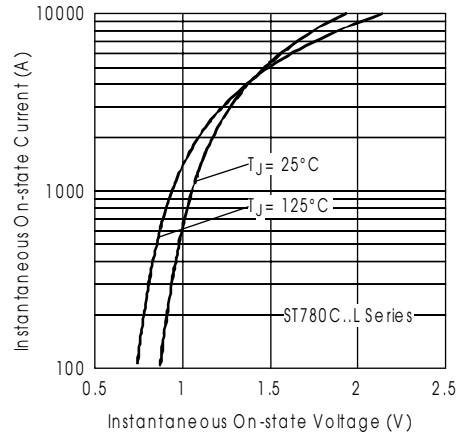


Fig. 9 - On-state Voltage Drop Characteristics

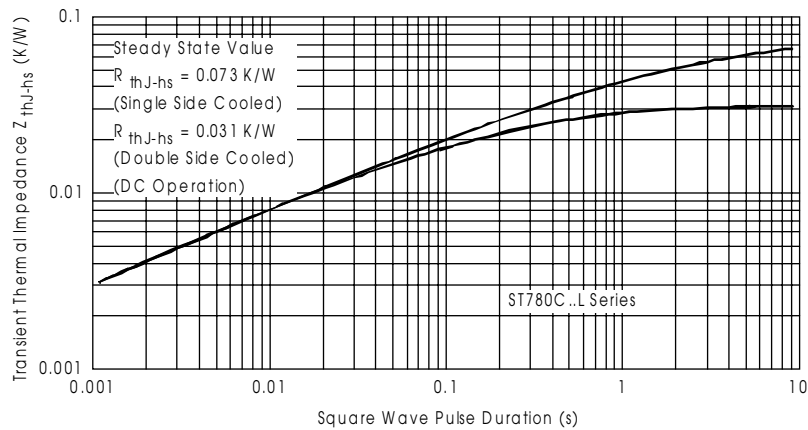


Fig. 10 - Thermal Impedance  $Z_{thJ-hs}$  Characteristics

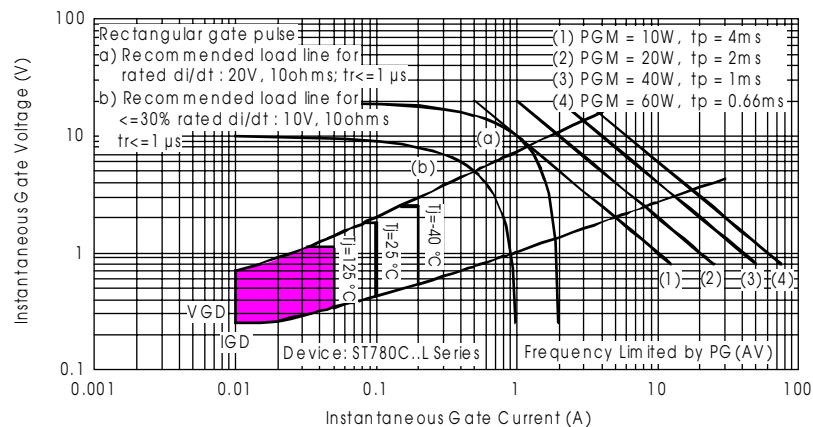


Fig. 11 - Gate Characteristics