Bulletin I25169 rev. C 04/00

International
IOR Rectifier

ST380CH..C SERIES

PHASE CONTROL THYRISTORS **Hockey Puk Version**

960A

Features

- Center amplifying gate
- Metal case with ceramic insulator
- International standard case TO-200AB (E-PUK)
- Low profile hockey-puk to increase current-carrying capability
- Extended temperature range

Typical Applications

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

case style TO-200AB (E-PUK)

Major Ratings and Characteristics

Parameters		ST380CH..C	Units
$I_{T(AV)}$		960	A
	@ T_{hs}	80	°C
$I_{T(RMS)}$		2220	A
	@ T_{hs}	25	°C
I_{TSM}	@ 50Hz	12500	A
	@ 60Hz	13000	A
I^2t	@ 50Hz	782	KA^2s
	@ 60Hz	713	KA^2s
V_{DRM}/V_{RRM}		400 to 600	V
t_q	typical	100	µs
T_J		- 40 to 150	°C

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. @ $T_J = T_J$ max mA
ST380CH..C	04	400	500	100
	06	600	700	

On-state Conduction

	Parameter	ST380CH..C	Units	Conditions
$I_{T(AV)}$	Max. average on-state current	960 (440)	A	180° conduction, half sine wave
	@ Heatsink temperature	80 (110)	°C	double side (single side) cooled
$I_{T(RMS)}$	Max. RMS on-state current	2220	A	DC @ 25°C heatsink temperature double side cooled
I_{TSM}	Max. peak, one-cycle non-repetitive surge current	12500	A	t = 10ms No voltage reapplied; Sinusoidal half wave, Initial $T_J = T_J$ max.
		13000		t = 8.3ms No voltage reapplied
		10500		t = 10ms 100% V_{RRM} reapplied
		11000		t = 8.3ms 100% V_{RRM} reapplied
I^2t	Maximum I^2t for fusing	782	KA^2s	t = 10ms No voltage reapplied
		713		t = 8.3ms No voltage reapplied
		553		t = 10ms 100% V_{RRM} reapplied
		505		t = 8.3ms 100% V_{RRM} reapplied
$I^2\sqrt{t}$	Maximum $I^2\sqrt{t}$ for fusing	7820	$KA^2\sqrt{s}$	t = 0.1 to 10ms, no voltage reapplied
$V_{T(TO)1}$	Low level value of threshold voltage	0.85	V	(16.7% x π x $I_{T(AV)}$ < I < π x $I_{T(AV)}$), $T_J = T_J$ max.
$V_{T(TO)2}$	High level value of threshold voltage	0.88		(I > π x $I_{T(AV)}$), $T_J = T_J$ max.
r_{t1}	Low level value of on-state slope resistance	0.25	mΩ	(16.7% x π x $I_{T(AV)}$ < I < π x $I_{T(AV)}$), $T_J = T_J$ max.
r_{t2}	High level value of on-state slope resistance	0.24		(I > π x $I_{T(AV)}$), $T_J = T_J$ max.
V_{TM}	Max. on-state voltage	1.58	V	I_{pk}= 2900A, $T_J = T_J$ max, t_p = 10ms sine pulse
I_H	Maximum holding current	600	mA	T_J = 25° C, anode supply 12V resistive load
I_L	Typical latching current	1000		

Switching

	Parameter	ST380CH..C	Units	Conditions
di/dt	Max. non-repetitive rate of rise of turned-on current	1000	A/µs	Gate drive 20V, 20Ω, $t_r \leq$ 1µs $T_J = T_J$ max, anode voltage ≤ 80% V_{DRM}
t_d	Typical delay time	1.0	µs	Gate current 1A, di_g/dt = 1A/µs V_d = 0.67% V_{DRM}, T_J = 25°C
t_q	Typical turn-off time	100		I_{TM} = 550A, $T_J = T_J$ max, di/dt = 40A/µs, V_R = 50V dv/dt = 20V/µs, Gate 0V 100Ω, t_p = 500µs

Blocking

	Parameter	ST380CH..C	Units	Conditions
dv/dt	Maximum critical rate of rise of off-state voltage	500	V/µs	$T_J = T_J$ max. linear to 80% rated V_{DRM}
I_{RRM} I_{DRM}	Max. peak reverse and off-state leakage current	100	mA	$T_J = T_J$ max, rated V_{DRM}/V_{RRM} applied

Triggering

	Parameter	ST380CH..C		Units	Conditions
		TYP.	MAX.		
P_{GM}	Maximum peak gate power	10.0		W	$T_J = T_J$ max, $t_p \leq 5$ms
$P_{G(AV)}$	Maximum average gate power	2.0		W	$T_J = T_J$ max, f = 50Hz, d% = 50
I_{GM}	Max. peak positive gate current	3.0		A	$T_J = T_J$ max, $t_p \leq 5$ms
$+V_{GM}$	Maximum peak positive gate voltage	20		V	$T_J = T_J$ max, $t_p \leq 5$ms
$-V_{GM}$	Maximum peak negative gate voltage	5.0		V	$T_J = T_J$ max, $t_p \leq 5$ms
I_{GT}	DC gate current required to trigger	200	-	mA	T_J = - 40°C
		100	200	mA	T_J = 25°C
		40	-	mA	T_J = 150°C
V_{GT}	DC gate voltage required to trigger	2.5	-	V	T_J = - 40°C
		1.8	3.0	V	T_J = 25°C
		1.0	-	V	T_J = 150°C
					Max. required gate trigger/ current/ voltage are the lowest value which will trigger all units 12V anode-to-cathode applied
I_{GD}	DC gate current not to trigger	10		mA	$T_J = T_J$ max
V_{GD}	DC gate voltage not to trigger	0.25		V	$T_J = T_J$ 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

Thermal and Mechanical Specification

	Parameter	ST380CH..C	Units	Conditions
T_J	Max. operating temperature range	-40 to 150	°C	
T_{stg}	Max. storage temperature range	-40 to 150	°C	
R_{thJ-hs}	Max. thermal resistance, junction to heatsink	0.09	K/W	DC operation single side cooled
		0.04	K/W	DC operation double side cooled
R_{thC-hs}	Max. thermal resistance, case to heatsink	0.02	K/W	DC operation single side cooled
		0.01	K/W	DC operation double side cooled
F	Mounting force, ± 10%	9800 (1000)	N (Kg)	
wt	Approximate weight	83	g	
	Case style	TO - 200AB (E-PUK)		See Outline Table

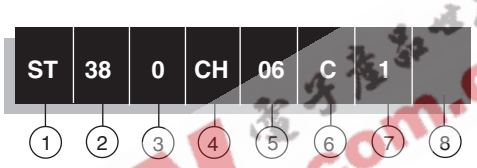
$\Delta R_{thJ\text{-}hs}$ Conduction

(The following table shows the increment of thermal resistence $R_{thJ\text{-}hs}$ 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	0.011	0.007	0.007	K/W	$T_J = T_J$ 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



1 - Thyristor

2 - Essential part number

3 - 0 = Converter grade

4 - CH = Ceramic Puk, High temperature

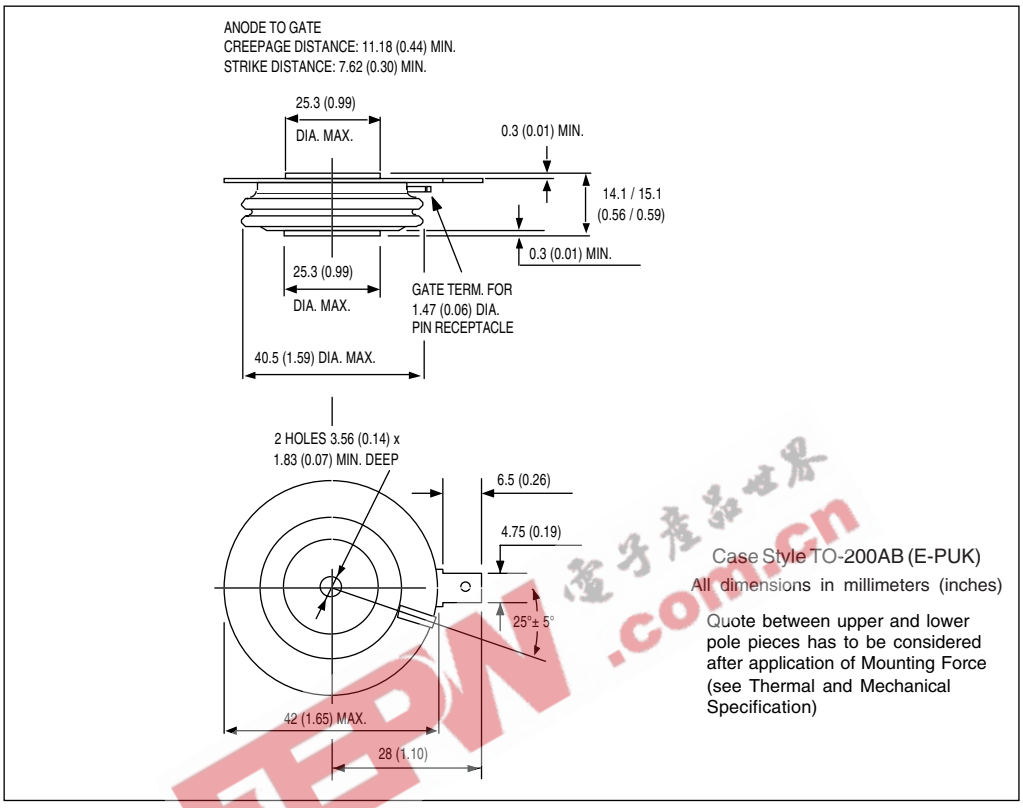
5 - Voltage code: Code x 100 = V_{RRM} (See Voltage Rating Table)

6 - C = Puk Case TO-200AB (E-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/µsec (Standard selection)
L = 1000V/µsec (Special selection)

Outline Table



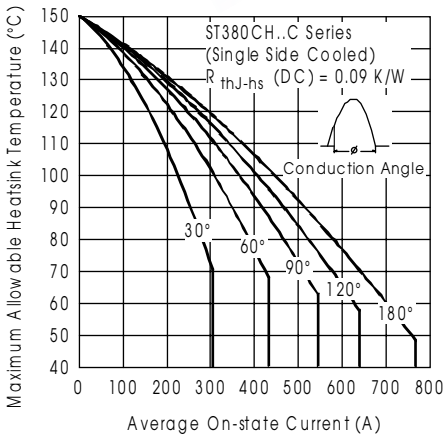


Fig. 1 - Current Ratings Characteristics

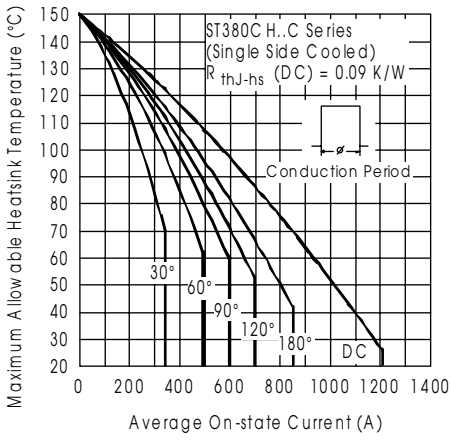


Fig. 2 - Current Ratings Characteristics

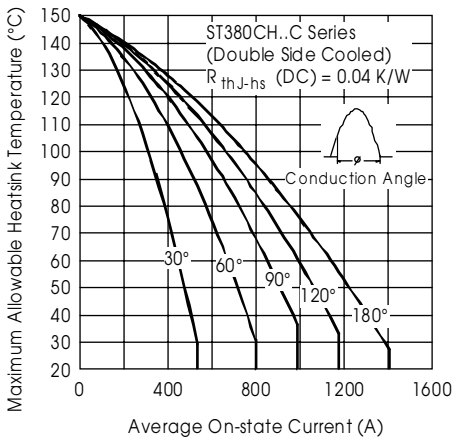


Fig. 3 - Current Ratings Characteristics

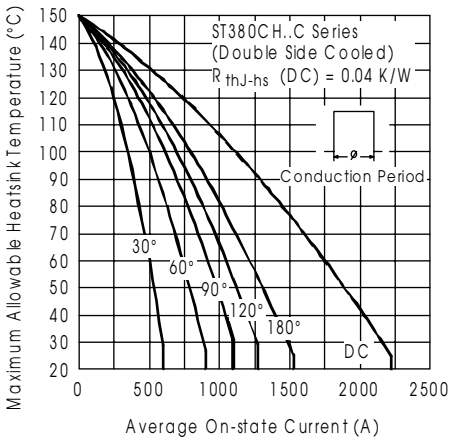


Fig. 4 - Current Ratings Characteristics

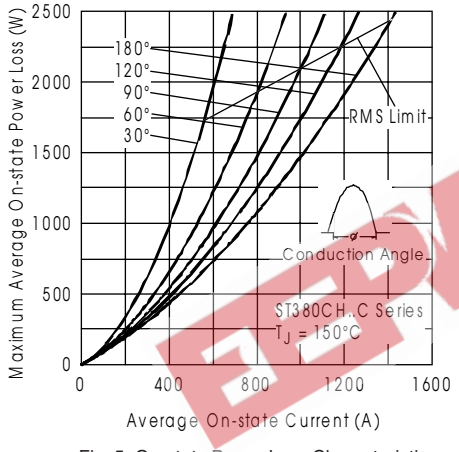


Fig. 5- On-state Power Loss Characteristics

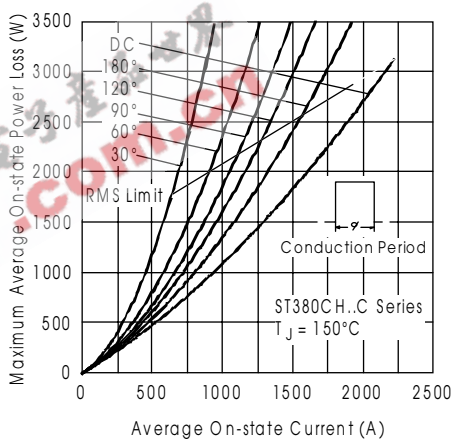


Fig. 6- On-state Power Loss Characteristics

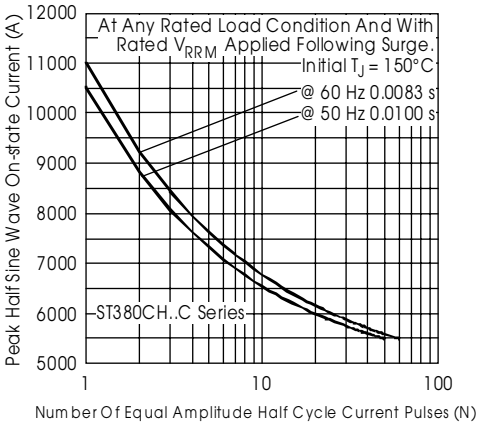


Fig. 7 - Maximum Non-Repetitive Surge Current
Single and Double Side Cooled

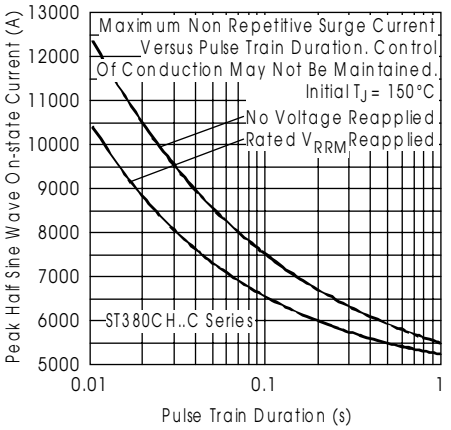


Fig. 8 - Maximum Non-Repetitive Surge Current
Single and Double Side Cooled

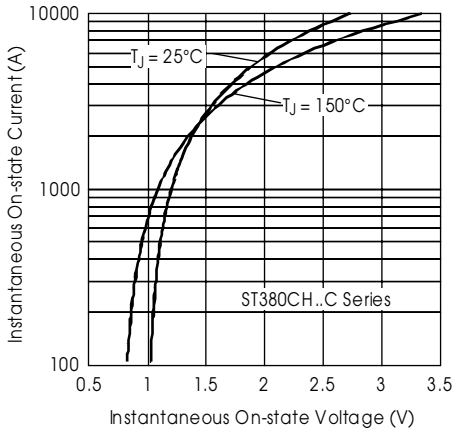


Fig. 9 - On-state Voltage Drop Characteristics

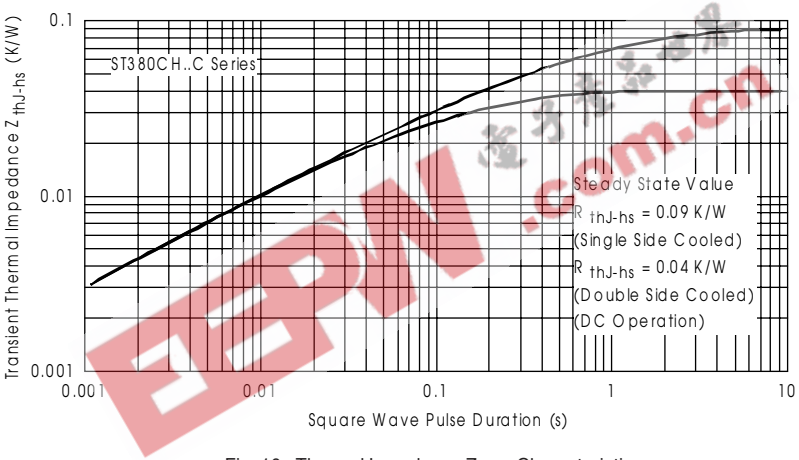


Fig. 10 - Thermal Impedance Z_{thJ-hs} Characteristics

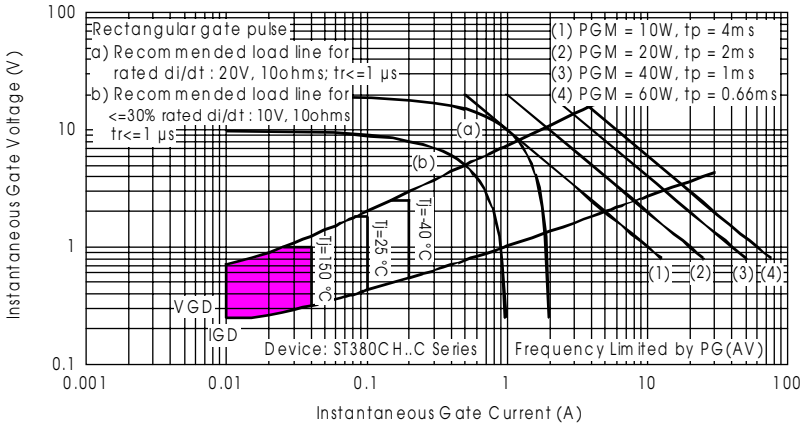


Fig. 11 - Gate Characteristics