

### PHASE CONTROL THYRISTORS

### Hockey Puk Version

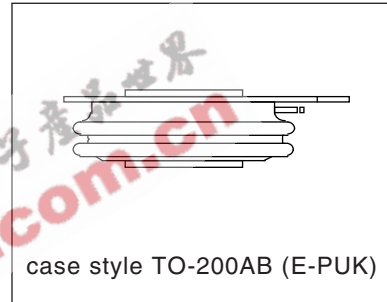
#### Features

- 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

960A

#### 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 <sup>2</sup> s
	@ 60Hz	713 KA <sup>2</sup> s
$V_{DRM}/V_{RRM}$	400 to 600	V
$t_q$ typical	100	μs
$T_J$	- 40 to 150	°C

## ST380CH..C Series

Bulletin I25169 rev. C 04/00

International  
IRF 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. @ $T_J = T_J$ 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 @ Heatsink temperature	960 (440)	A	180° conduction, half sine wave		
	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		t = 10ms	No voltage reappplied	
	13000		t = 8.3ms	reappplied	
	10500		t = 10ms	100% $V_{RRM}$ reappplied	
11000	t = 8.3ms	reappplied	Sinusoidal half wave,		
$I^2t$ Maximum $I^2t$ for fusing	782	KA <sup>2</sup> s	t = 10ms	No voltage reappplied	Initial $T_J = T_J$ max.
	713		t = 8.3ms	reappplied	
	553		t = 10ms	100% $V_{RRM}$ reappplied	
	505		t = 8.3ms	reappplied	
$I^2\sqrt{t}$ Maximum $I^2\sqrt{t}$ for fusing	7820	KA <sup>2</sup> √s	t = 0.1 to 10ms, no voltage reappplied		
$V_{T(TO)1}$ Low level value of threshold voltage	0.85	V	(16.7% x $\pi$ x $I_{T(AV)}$ ) < I < $\pi$ x $I_{T(AV)}$ , $T_J = T_J$ max.		
$V_{T(TO)2}$ High level value of threshold voltage	0.88		(I > $\pi$ 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 $\pi$ x $I_{T(AV)}$ ) < I < $\pi$ x $I_{T(AV)}$ , $T_J = T_J$ max.		
$r_{t2}$ High level value of on-state slope resistance	0.24		(I > $\pi$ 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	$T_J = 25^\circ C$ , 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, $t_r \leq 1\mu s$ $T_J = T_J$ 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	100		$I_{TM} = 550A$ , $T_J = T_J$ max, $di/dt = 40A/\mu s$ , $V_R = 50V$ $dv/dt = 20V/\mu s$ , Gate 0V 100Ω, $t_p = 500\mu s$

**Blocking**

Parameter	ST380CH..C	Units	Conditions
dv/dt Maximum critical rate of rise of off-state voltage	500	V/ $\mu$ s	$T_J = T_J$ 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
$P_{GM}$ 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			
$I_{GM}$ 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			
$I_{GT}$ DC gate current required to trigger	TYP.	MAX.	mA	$T_J = -40^\circ\text{C}$ $T_J = 25^\circ\text{C}$ $T_J = 150^\circ\text{C}$  Max. required gate trigger/ current/ voltage are the lowest value which will trigger all units 12V anode-to-cathode applied
	200	-		
	100	200		
$V_{GT}$ DC gate voltage required to trigger	TYP.	MAX.	V	$T_J = -40^\circ\text{C}$ $T_J = 25^\circ\text{C}$ $T_J = 150^\circ\text{C}$
	2.5	-		
	1.8	3.0		
$I_{GD}$ DC gate current not to trigger	10		mA	$T_J = T_J$ 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
$V_{GD}$ DC gate voltage not to trigger	0.25		V	

**Thermal and Mechanical Specification**

Parameter	ST380CH..C	Units	Conditions
$T_J$ Max. operating temperature range	-40 to 150	$^\circ\text{C}$	
$T_{stg}$ 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	0.02	K/W	DC operation single side cooled
	0.01		DC operation double side cooled
F Mounting force, $\pm 10\%$	9800	N	
	(1000)	(Kg)	
wt Approximate weight	83	g	
Case style	TO - 200AB (E-PUK)		See Outline Table

## ST380CH..C Series

Bulletin I25169 rev. C 04/00

International  
IRF Rectifier

### $\Delta R_{thJ-hs}$ 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	0.011	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	38	0	CH	06	C	1	
①	②	③	④	⑤	⑥	⑦	⑧
<b>1</b>	- Thyristor	<b>2</b>	- Essential part number	<b>3</b>	- 0 = Converter grade	<b>4</b>	- CH = Ceramic Puk, High temperature
<b>5</b>	- Voltage code: Code x 100 = $V_{RRM}$ (See Voltage Rating Table)	<b>6</b>	- C = Puk Case TO-200AB (E-PUK)	<b>7</b>	- 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)
<b>7</b>	- 3 = Fast-on terminals (Gate and Auxiliary Cathode Soldered Leads)	<b>8</b>	- Critical dv/dt: None = 500V/ $\mu$ sec (Standard selection)	L	= 1000V/ $\mu$ sec (Special selection)		

Outline Table

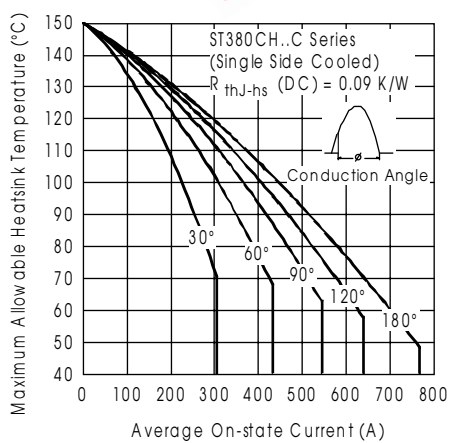
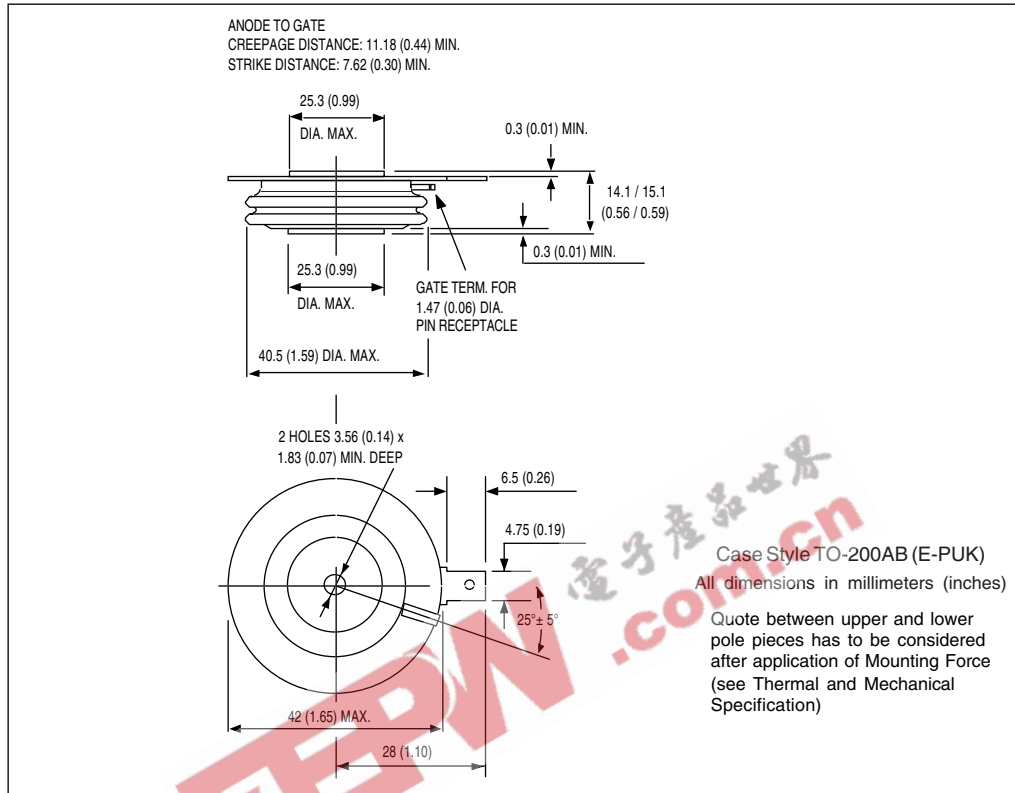


Fig. 1 - Current Ratings Characteristics

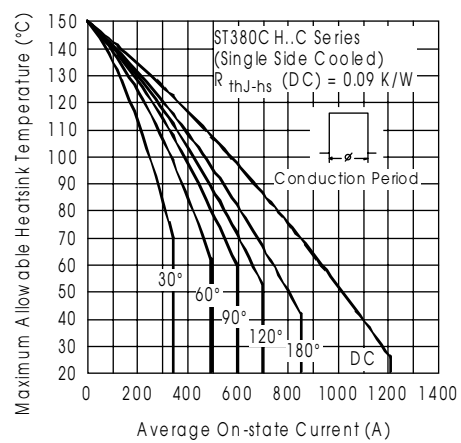


Fig. 2 - Current Ratings Characteristics

# ST380CH..C Series

Bulletin I25169 rev. C 04/00

International  
**IRF** Rectifier

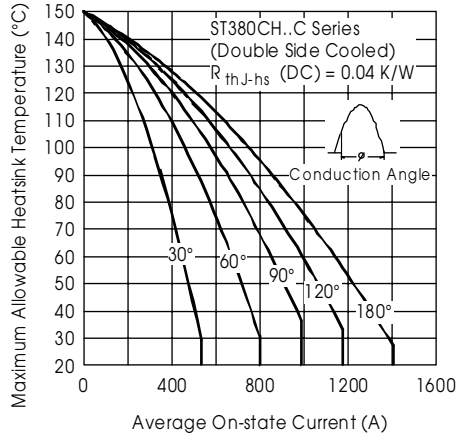


Fig. 3 - Current Ratings Characteristics

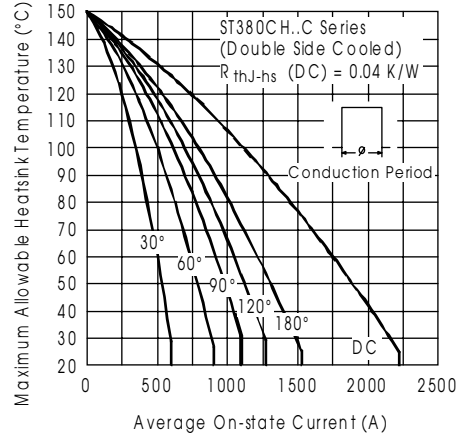


Fig. 4 - Current Ratings Characteristics

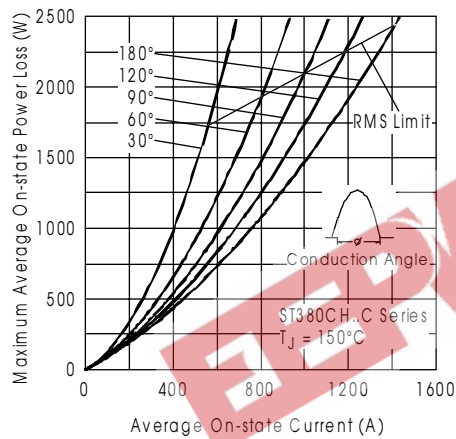


Fig. 5 - On-state Power Loss Characteristics

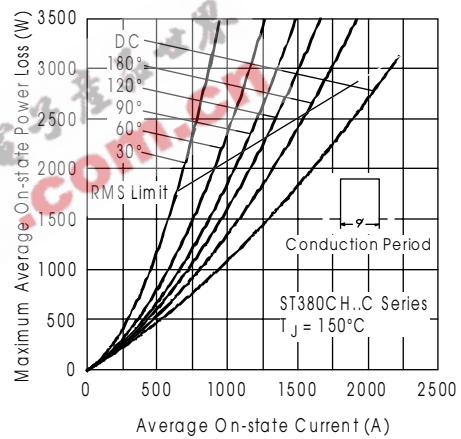


Fig. 6 - On-state Power Loss Characteristics

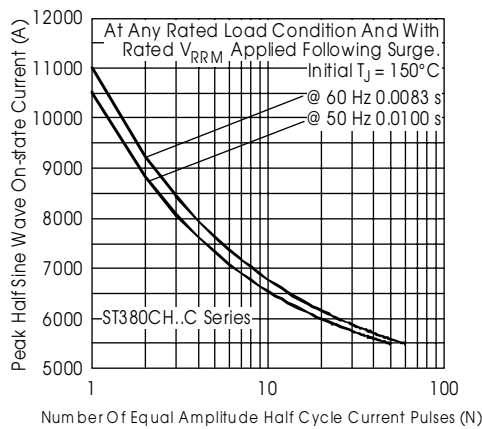


Fig. 7 - Maximum Non-Repetitive Surge Current Single and Double Side Cooled

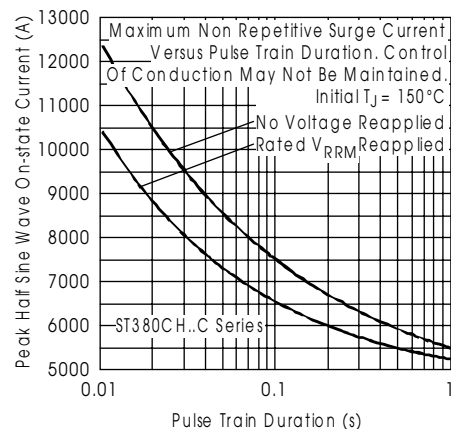


Fig. 8 - Maximum Non-Repetitive Surge Current Single and Double Side Cooled

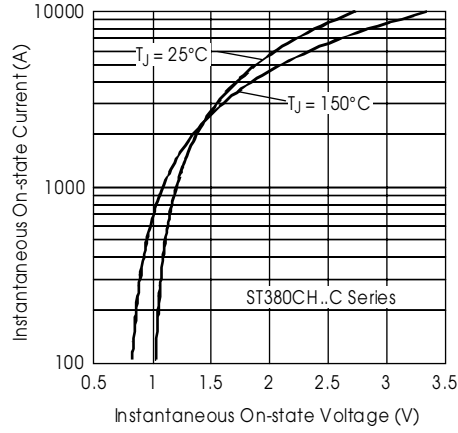


Fig. 9 - On-state Voltage Drop Characteristics

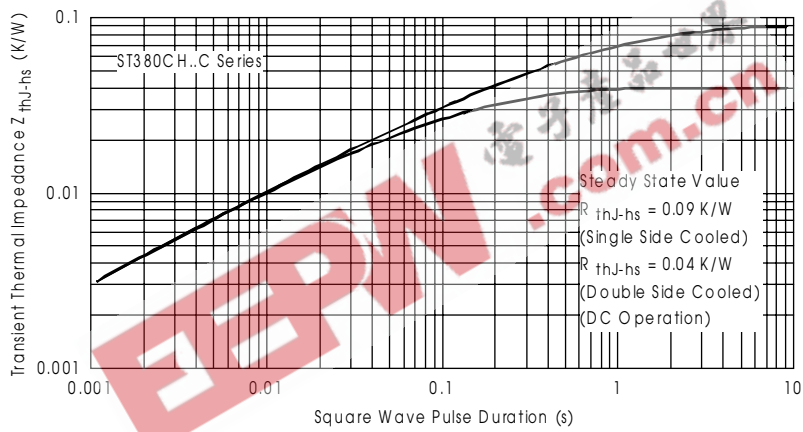


Fig. 10 - Thermal Impedance  $Z_{thJ-hs}$  Characteristics

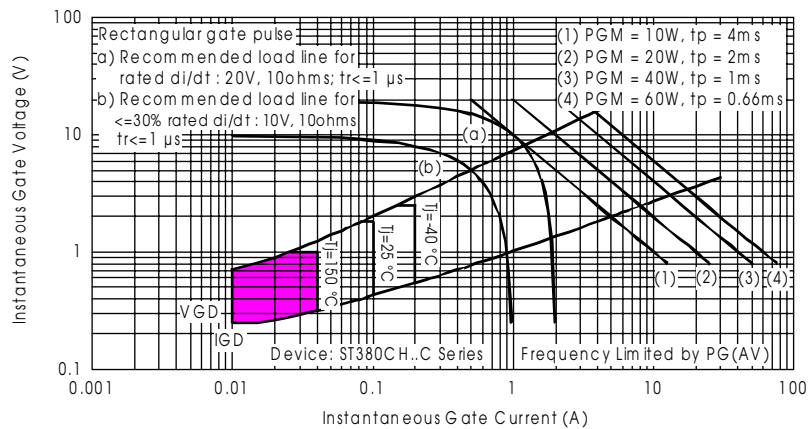


Fig. 11 - Gate Characteristics