

Bulletin I25153 rev. D 09/03

# International IOR Rectifier

## 180/181RKI SERIES

PHASE CONTROL THYRISTORS

Stud Version

### Features

- Hermetic glass-metal seal
- International standard case TO-209AB (TO-93)

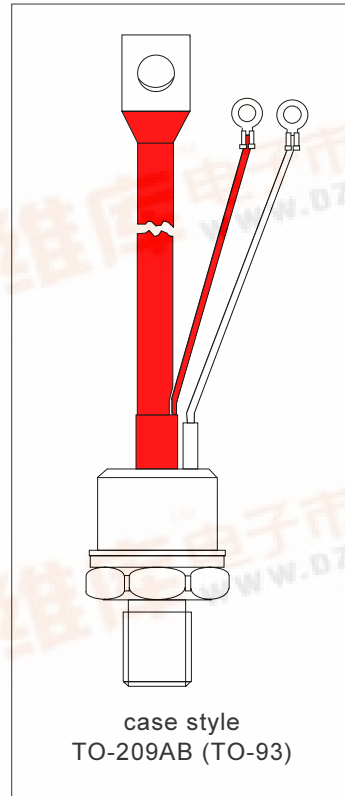


### Typical Applications

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

### Major Ratings and Characteristics

Parameters	180/181RKI	Units
$I_{T(AV)}$	180	A
@ $T_C$	80	°C
$I_{T(RMS)}$	285	A
$I_{TSM}$ @ 50Hz	3800	A
@ 60Hz	4000	A
$I^2t$ @ 50Hz	72	KA <sup>2</sup> s
@ 60Hz	66	KA <sup>2</sup> s
$V_{DRM}/V_{RRM}$	400 to 1000	V
$t_q$ typical	100	μs
$T_J$	- 40 to 125	°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
180/181RKI	40	400	500	30
	80	800	900	
	100	1000	1100	

**On-state Conduction**

Parameter	180/181RKI	Units	Conditions	
$I_{T(AV)}$ Max. average on-state current @ Case temperature	180	A	180° conduction, half sine wave	
	80	°C		
$I_{T(RMS)}$ Max. RMS on-state current	285	A	DC @ 79°C case temperature	
$I_{TSM}$ Max. peak, one-cycle non-repetitive surge current	3800		t = 10ms	No voltage reappplied
	4000		t = 8.3ms	100% $V_{RRM}$
	3500		t = 10ms	reappplied
	3660	t = 8.3ms	reappplied	
$I^2t$ Maximum $I^2t$ for fusing	72	KA <sup>2</sup> s	t = 10ms	No voltage reappplied
	66		t = 8.3ms	reappplied
	61		t = 10ms	100% $V_{RRM}$
	56		t = 8.3ms	reappplied
$I^2\sqrt{t}$ Maximum $I^2\sqrt{t}$ for fusing	720	KA <sup>2</sup> √s	t = 0.1 to 10ms, no voltage reappplied	
$V_{T(TO)1}$ Low level value of threshold voltage	0.83	V	$(16.7\% \times \pi \times I_{T(AV)} < I < \pi \times I_{T(AV)})$ , $T_J = T_J$ max.	
$V_{T(TO)2}$ High level value of threshold voltage	0.89		$(I > \pi \times I_{T(AV)})$ , $T_J = T_J$ max.	
$r_{t1}$ Low level value of on-state slope resistance	0.92	mΩ	$(16.7\% \times \pi \times I_{T(AV)} < I < \pi \times I_{T(AV)})$ , $T_J = T_J$ max.	
$r_{t2}$ High level value of on-state slope resistance	0.81		$(I > \pi \times I_{T(AV)})$ , $T_J = T_J$ max.	
$V_{TM}$ Max. on-state voltage	1.35	V	$I_{pk} = 570A$ , $T_J = T_J$ 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	180/181RKI	Units	Conditions
$di/dt$ Max. non-repetitive rate of rise of turned-on current	300	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		$I_{TM} = 50A$ , $T_J = T_J$ max, $di/dt = 10A/\mu s$ , $V_R = 100V$ $dv/dt = 20V/\mu s$

Blocking

Parameter	180/181RKI	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	30	mA	$T_J = T_J$ max, rated $V_{DRM}/V_{RRM}$ applied

Triggering

Parameter	180/181RKI	Units	Conditions
$P_{GM}$ Maximum peak gate power	10	W	$T_J = T_J$ max, $t_p \leq 5$ ms
$P_{G(AV)}$ Maximum average gate power	2.0		$T_J = T_J$ max, $f = 50$ Hz, $d\% = 50$
$I_{GM}$ 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		
$I_{GT}$ DC gate current required to trigger	TYP.	MAX.	$T_J = -40^\circ\text{C}$ $T_J = 25^\circ\text{C}$ $T_J = 125^\circ\text{C}$ Max. required gate trigger/ current/ voltage are the lowest value which will trigger all units 12V anode-to-cathode applied
	130	-	
	65	150	
$V_{GT}$ DC gate voltage required to trigger	2.0	-	$T_J = -40^\circ\text{C}$ $T_J = 25^\circ\text{C}$ $T_J = 125^\circ\text{C}$
	1.2	2.5	
	0.9	-	
$I_{GD}$ 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	180/181RKI	Units	Conditions
$T_J$ Max. operating temperature range	-40 to 125	°C	
$T_{stg}$ Max. storage temperature range	-40 to 150		
$R_{thJC}$ Max. thermal resistance, junction to case	0.15	K/W	DC operation
$R_{thCS}$ Max. thermal resistance, case to heatsink	0.04		Mounting surface, smooth, flat and greased
T Mounting torque, $\pm 10\%$	31	Nm (lbf-in)	Non lubricated threads
	(275)		
	24.5		Lubricated threads
wt Approximate weight	280	g	
Case style	TO-209AB (TO-93)		See Outline Table

# 180/181RKI Series

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## $\Delta R_{thJC}$ Conduction

(The following table shows the increment of thermal resistance  $R_{thJC}$  when devices operate at different conduction angles than DC)

Conduction angle	Sinusoidal conduction	Rectangular conduction	Units	Conditions
180°	0.050	0.032	K/W	$T_J = T_{J \text{ max.}}$
120°	0.063	0.059		
90°	0.080	0.082		
60°	0.118	0.124		
30°	0.225	0.228		

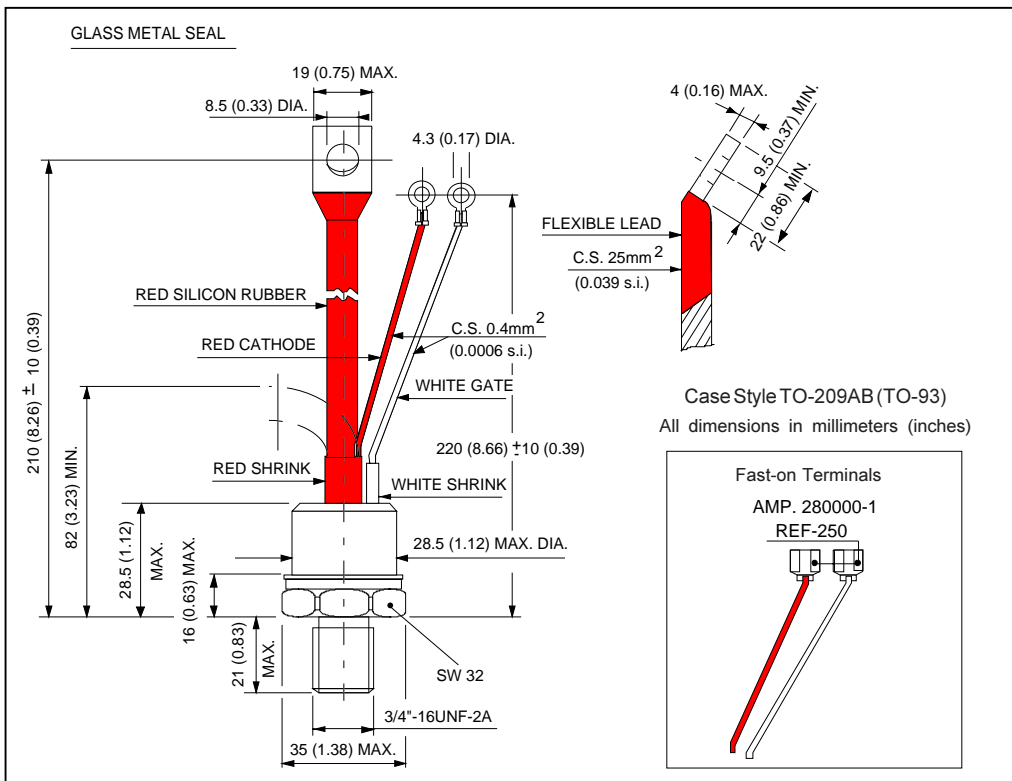
## Ordering Information Table

**Device Code**  

18	1	RKI	100
1	2	3	4

- 1** -  $I_{T(AV)}$  rated average output current (rounded/10)
- 2** - 0 = Eyelet terminals (Gate and Auxiliary Cathode Leads)  
1 = Fast - on terminals (Gate and Auxiliary Cathode Leads)
- 3** - Thyristor
- 4** - Voltage code: Code x 10 =  $V_{RRM}$  (See Voltage Rating Table)

## Outline Table



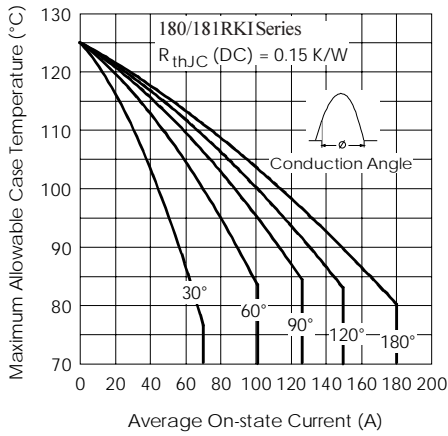


Fig. 1 - Current Ratings Characteristics

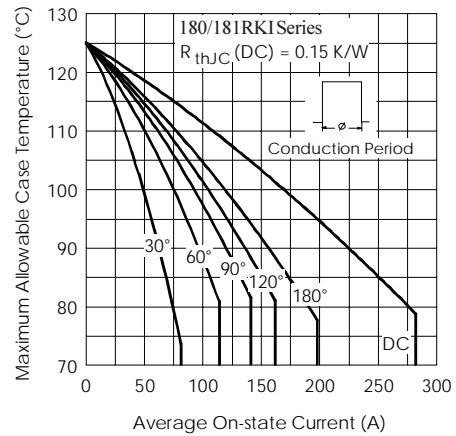


Fig. 2 - Current Ratings Characteristics

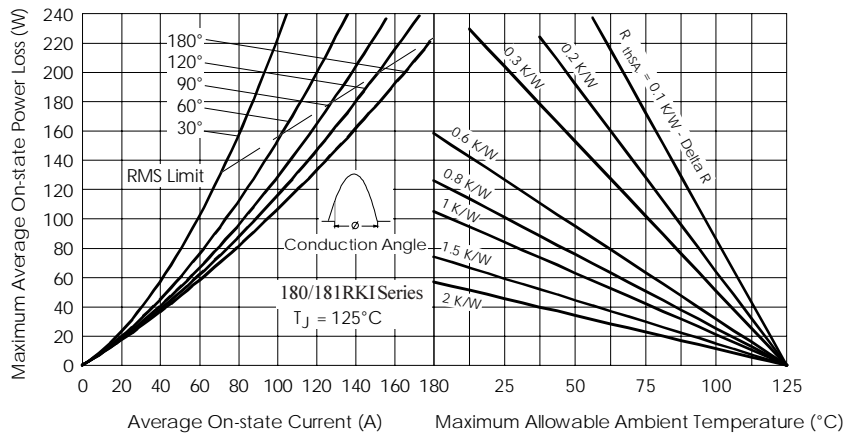


Fig. 3 - On-state Power Loss Characteristics

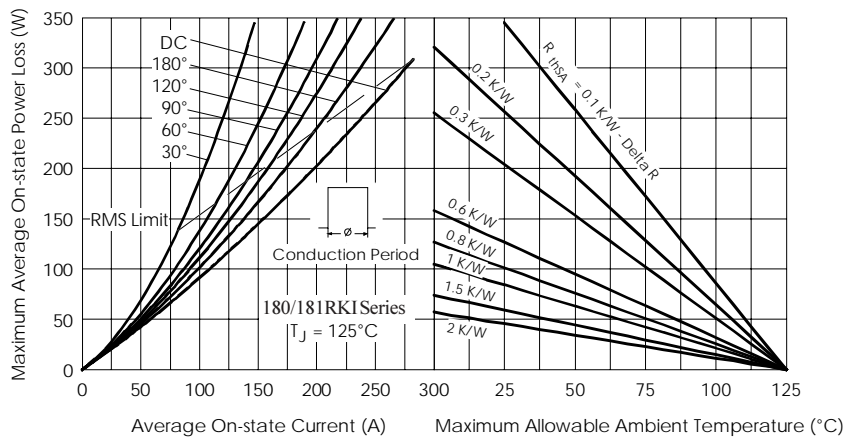


Fig. 4 - On-state Power Loss Characteristics

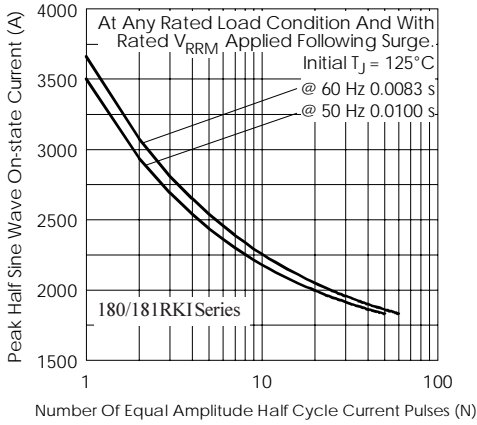


Fig. 5 - Maximum Non-Repetitive Surge Current

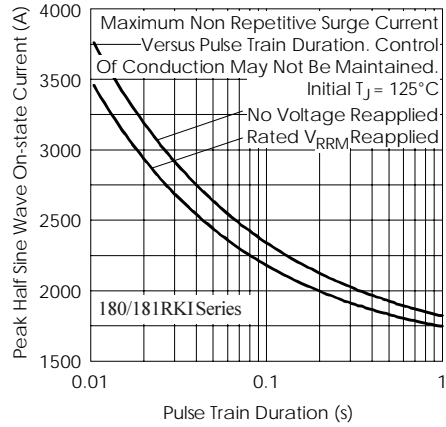


Fig. 6 - Maximum Non-Repetitive Surge Current

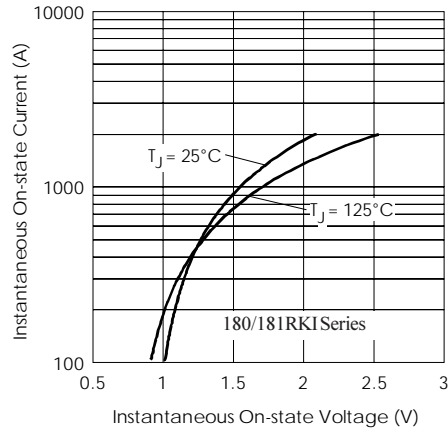


Fig. 7 - On-state Voltage Drop Characteristics

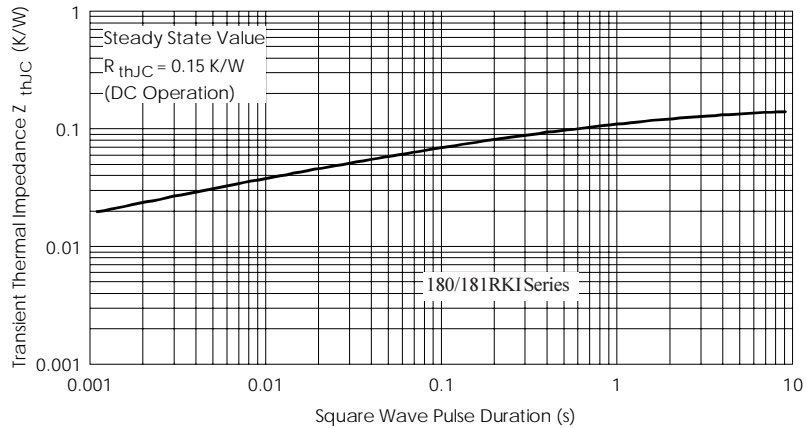


Fig. 8 - Thermal Impedance  $Z_{thJC}$  Characteristic

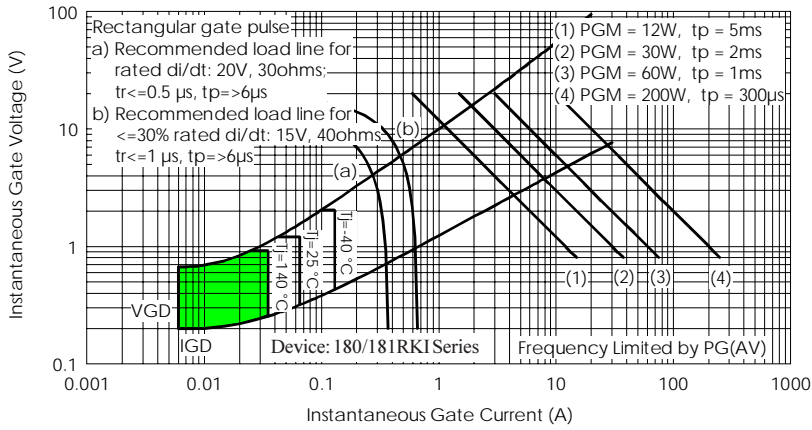


Fig. 9 - Gate Characteristics

Data and specifications subject to change without notice.  
 This product has been designed and qualified for Industrial Level.  
 Qualification Standards can be found on IR's Web site.