Bulletin I25152 rev. E 09/03

International
IOR Rectifier

110/111RKI SERIES

PHASE CONTROL THYRISTORS

Stud Version

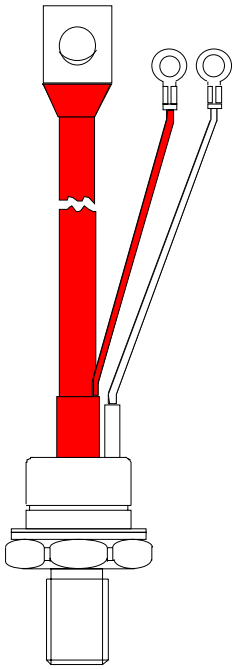
Features

- High current and high surge ratings
- Hermetic ceramic housing

110A

Typical Applications

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



case style
TO-209AC (TO-94)

Major Ratings and Characteristics

Parameters		110/111RKI	Units
$I_{T(AV)}$		110	A
	@ T_C	90	°C
$I_{T(RMS)}$		172	A
I_{TSM}	@ 50Hz	2080	A
	@ 60Hz	2180	A
I^2t	@ 50Hz	21.7	KA^2s
	@ 60Hz	19.8	KA^2s
V_{DRM}/V_{RRM}		400 to 1200	V
t_q	typical	110	µs
T_J		- 40 to 140	°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
110/111RKI	40	400	500	20
	80	800	900	
	120	1200	1300	

On-state Conduction

	Parameter	110/111RKI	Units	Conditions		
$I_{T(AV)}$	Max. average on-state current	110	A	180° conduction, half sine wave		
	@ Case temperature	90	°C			
$I_{T(RMS)}$	Max. RMS on-state current	172	A	DC @ 83°C case temperature		
I_{TSM}	Max. peak, one-cycle non-repetitive surge current	2080	A	t = 10ms	No voltage reapplied	Sinusoidal half wave, Initial $T_J = T_J$ max.
		2180		t = 8.3ms		
		1750		t = 10ms	100% V_{RRM} reapplied	
		1830		t = 8.3ms		
I^2t	Maximum I^2t for fusing	21.7	KA^2s	t = 10ms	No voltage reapplied	
		19.8		t = 8.3ms		
		15.3		t = 10ms	100% V_{RRM} reapplied	
		14.0		t = 8.3ms		
$I^2\sqrt{t}$	Maximum $I^2\sqrt{t}$ for fusing	217	$KA^2\sqrt{s}$	t = 0.1 to 10ms, no voltage reapplied		
$V_{T(TO)1}$	Low level value of threshold voltage	0.82	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	1.02		(I > π x $I_{T(AV)}$), $T_J = T_J$ max.		
r_{t1}	Low level value of on-state slope resistance	2.16	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	1.70		(I > π x $I_{T(AV)}$), $T_J = T_J$ max.		
V_{TM}	Max. on-state voltage	1.57	V	I_{pk} = 350A, $T_J = T_J$ max., t_p = 10ms sine pulse		
I_H	Maximum holding current	200	mA	T_J = 25°C, anode supply 6V resistive load		
I_L	Typical latching current	400				

Switching

	Parameter	110/111RKI	Units	Conditions
di/dt	Max. non-repetitive rate of rise of turned-on current	300	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	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	110		I_{TM} = 50A, $T_J = T_J$ max., di/dt = -5A/µs, V_R = 50V dv/dt = 20V/µs, Gate 0V 25Ω

Blocking

	Parameter	110/111RKI	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	20	mA	$T_J = T_J$ max, rated V_{DRM}/V_{RRM} applied

Triggering

	Parameter	110/111RKI		Units	Conditions	
P_{GM}	Maximum peak gate power	12		W	$T_J = T_J$ max, $t_p \leq 5$ms	
$P_{G(AV)}$	Maximum average gate power	3.0			$T_J = T_J$ 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	10				
		TYP.	MAX.			
I_{GT}	DC gate current required to trigger	180	-	mA	T_J = - 40°C	Max. required gate trigger/ current/ voltage are the lowest value which will trigger all units 12V anode-to-cathode applied
		80	120		T_J = 25°C	
		40	-		T_J = 140°C	
V_{GT}	DC gate voltage required to trigger	2.5	-	V	T_J = - 40°C	
		1.6	2		T_J = 25°C	
		1	-		T_J = 140°C	
I_{GD}	DC gate current not to trigger	6.0		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	110/111RKI	Units	Conditions
T_J	Max. operating temperature range	-40 to 140	°C	
T_{stg}	Max. storage temperature range	-40 to 150		
R_{thJC}	Max. thermal resistance, junction to case	0.27	K/W	DC operation
R_{thCS}	Max. thermal resistance, case to heatsink	0.1		Mounting surface, smooth, flat and greased
T	Mounting torque, ± 10%	15.5 (137)	Nm (lbf-in)	Non lubricated threads
		14 (120)		Lubricated threads
wt	Approximate weight	130	g	
	Case style	TO - 209AC (TO-94)		See Outline Table

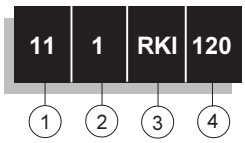
ΔR_{thJC} Conduction

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

Conduction angle	Sinusoidal conduction	Rectangular conduction	Units	Conditions
180°	0.043	0.031	K/W	$T_J = T_J$ max.
120°	0.052	0.053		
90°	0.066	0.071		
60°	0.096	0.101		
30°	0.167	0.169		

Ordering Information Table

Device Code



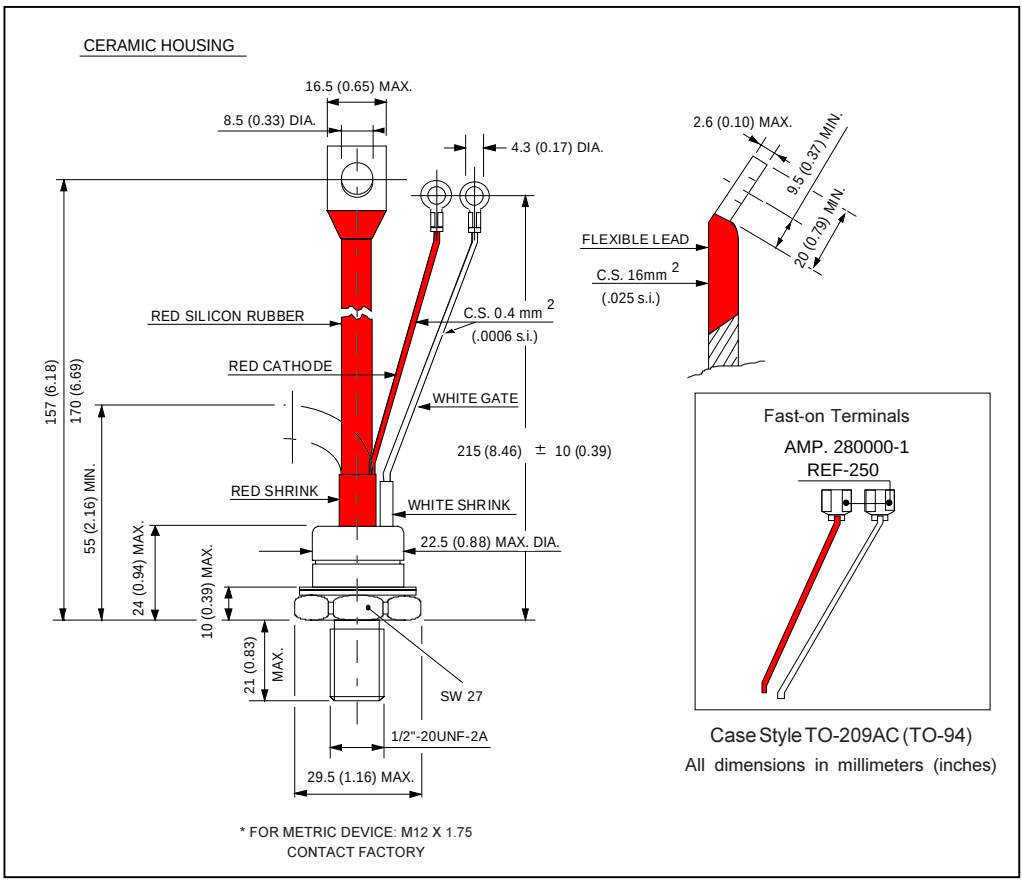
1 - $I_{T(AV)}$ rated average output current (rounded/10)

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



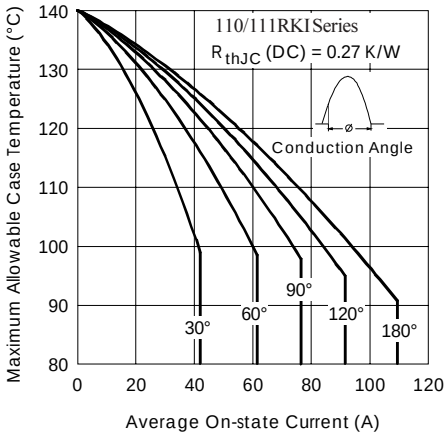


Fig. 1 - Current Ratings Characteristics

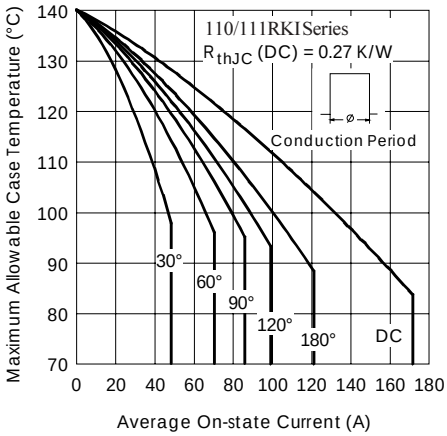


Fig. 2 - Current Ratings Characteristics

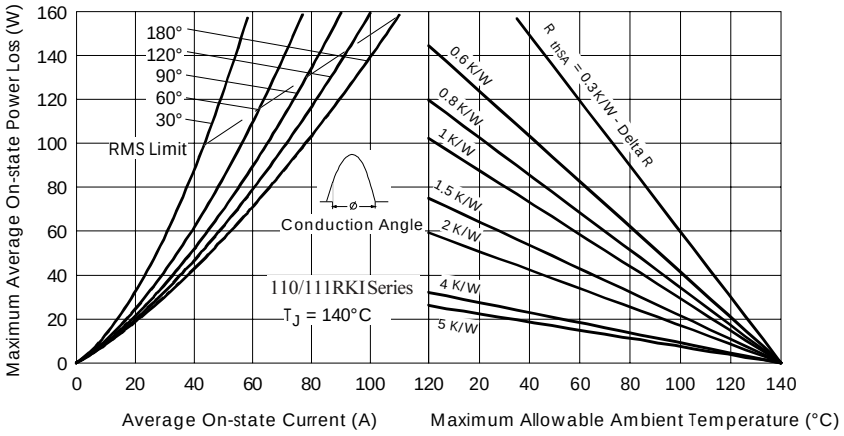


Fig. 3 - On-state Power Loss Characteristics

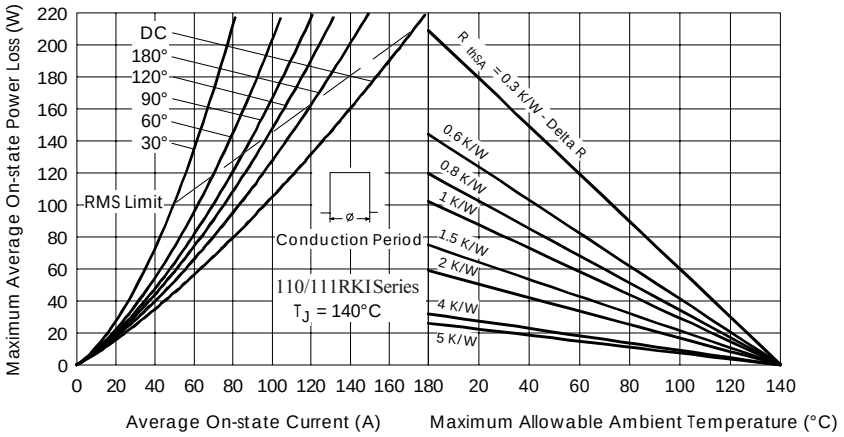


Fig. 4 - On-state Power Loss Characteristics

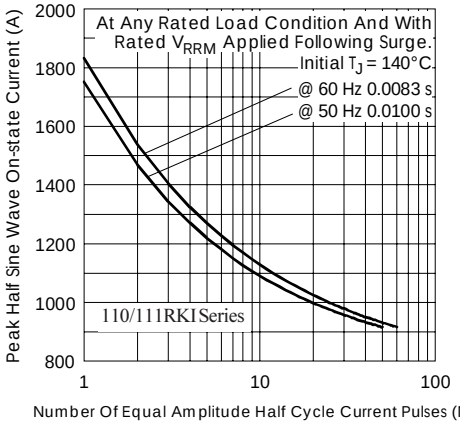


Fig. 5 - Maximum Non-Repetitive Surge Current

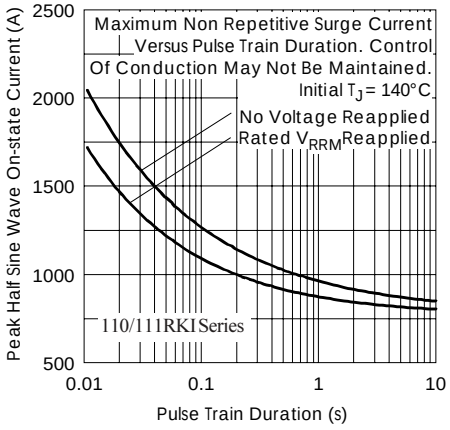


Fig. 6 - Maximum Non-Repetitive Surge Current

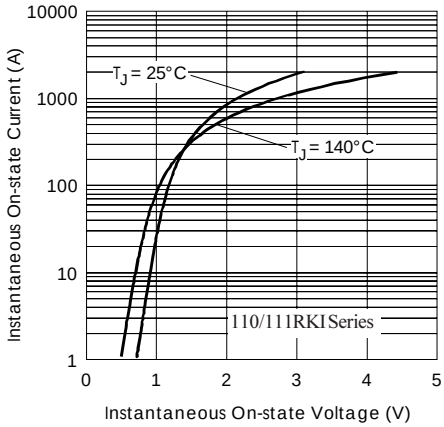


Fig. 7 - On-state Voltage Drop Characteristics

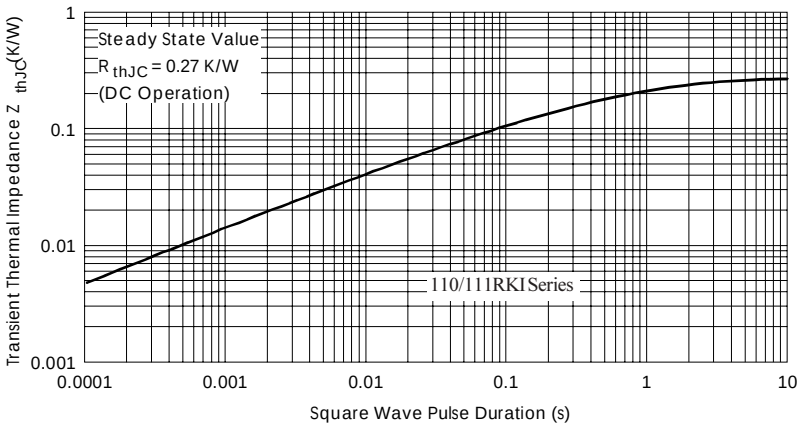


Fig. 8 - Thermal Impedance Z_{thJC} Characteristic

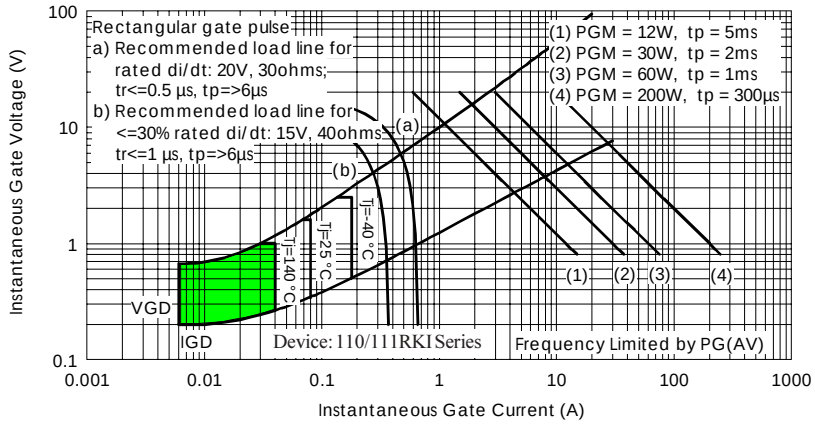


Fig. 9 - Gate Characteristics

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.

IR WORLD HEADQUARTERS: 233 Kansas St., El Segundo, California 90245, USA Tel: (310) 252-7105
TAC Fax: (310) 252-7309
Visit us at www.irf.com for sales contact information. 03 /03