

International Rectifier

111RKI SERIES

PHASE CONTROL THYRISTORS

Stud Version

Features

- High current and high surge ratings
- $dv/dt = 1000V/\mu s$ option
- Ceramic housing
- Threaded studs UNF 1/2 - 20UNF2A
- Types up to 1200V V_{RRM}/V_{DRM}
- $di/dt = 300A/\mu s$

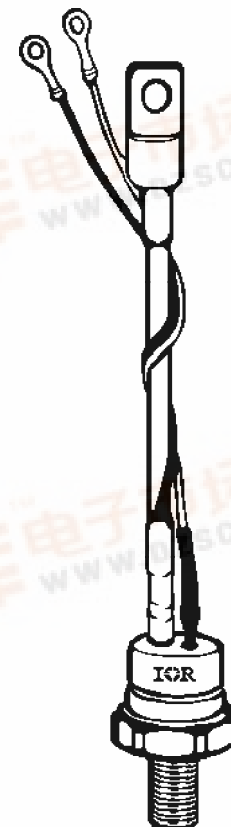
110A

Typical Applications

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

Major Ratings and Characteristics

Parameters	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 ² s
@ 60Hz	19.8	KA ² s
V_{DRM}/V_{RRM}	400 to 1200	V
t_q typical	110	μs
T_J	- 40 to 140	°C



case style
TO-209AC (TO-94)

111RKI Series

ELECTRICAL SPECIFICATIONS

Voltage Ratings

Type number	Voltage Code	$V_{\text{DRM}}/V_{\text{RRM}}$, max. repetitive peak and off-state voltage V	V_{RSM} , maximum non-repetitive peak voltage V	$I_{\text{DRM}}/I_{\text{RRM}}$ max. @ $T_J = T_J \text{ max.}$ mA
111RKI	40	400	500	20
	80	800	900	
	120	1200	1300	

On-state Conduction

Parameter	111RKI	Units	Conditions
$I_{\text{T(AV)}}$ Max. average on-state current @ Case temperature	110	A	180° conduction, half sine wave
	90	°C	
$I_{\text{T(RMS)}}$ Max. RMS on-state current	172	A	DC @ 83°C case temperature
I_{TSM} Max. peak, one-cycle non-repetitive surge current	2080		t = 10ms No voltage t = 8.3ms reapplied t = 10ms 100% V_{RRM} t = 8.3ms reapplied Sinusoidal half wave, Initial $T_J = T_J \text{ max.}$
	2180		
	1750		
	1830		
I^2t Maximum I^2t for fusing	21.7	KA^2s	t = 10ms No voltage t = 8.3ms reapplied t = 10ms 100% V_{RRM} t = 8.3ms reapplied
	19.8		
	15.3		
	14.0		
$I^2\sqrt{t}$ Maximum $I^2\sqrt{t}$ for fusing	217	$\text{KA}^2\sqrt{\text{s}}$	t = 0.1 to 10ms, no voltage reapplied
$V_{\text{T(TO)1}}$ Low level value of threshold voltage	0.82	V	$(16.7\% \times \pi \times I_{\text{T(AV)}} < I < \pi \times I_{\text{T(AV)}}), T_J = T_J \text{ max.}$
$V_{\text{T(TO)2}}$ High level value of threshold voltage	1.02		$(I > \pi \times I_{\text{T(AV)}}), T_J = T_J \text{ max.}$
r_{t1} Low level value of on-state slope resistance	2.16	$\text{m}\Omega$	$(16.7\% \times \pi \times I_{\text{T(AV)}} < I < \pi \times I_{\text{T(AV)}}), T_J = T_J \text{ max.}$
r_{t2} High level value of on-state slope resistance	1.70		$(I > \pi \times I_{\text{T(AV)}}), T_J = T_J \text{ max.}$
V_{TM} Max. on-state voltage	1.57	V	$I_{\text{pk}} = 350\text{A}, T_J = T_J \text{ max.}, t_p = 10\text{ms}$ sine pulse
I_{H} Maximum holding current	150	mA	$T_J = 25^\circ\text{C}$, anode supply 6V resistive load
I_{L} Typical latching current	400		

Switching

Parameter	111RKI	Units	Conditions
di/dt Max. non-repetitive rate of rise of turned-on current	300	A/ μs	Gate drive 20V, 20 Ω , $t_r \leq 1\mu\text{s}$ $T_J = T_J \text{ max.}$, anode voltage $\leq 80\% V_{\text{DRM}}$
t_d Typical delay time	1	μs	Gate current 1A, $di_g/dt = 1\text{A}/\mu\text{s}$ $V_d = 0.67\% V_{\text{DRM}}, T_J = 25^\circ\text{C}$
t_q Typical turn-off time	110		$I_{\text{TM}} = 50\text{A}, T_J = T_J \text{ max.}, di/dt = -5\text{A}/\mu\text{s}, V_R = 50\text{V}$ $dv/dt = 20\text{V}/\mu\text{s}$, Gate 0V 25 Ω

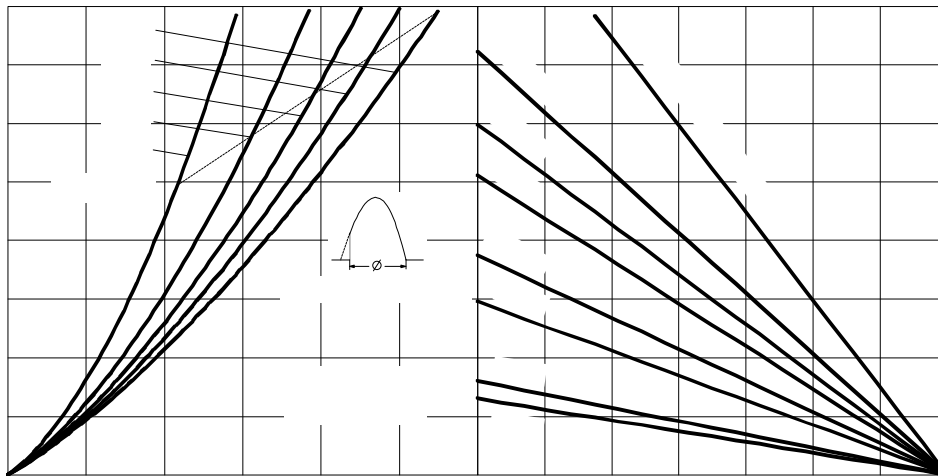


Fig. 3 - On-state Power Loss Characteristics

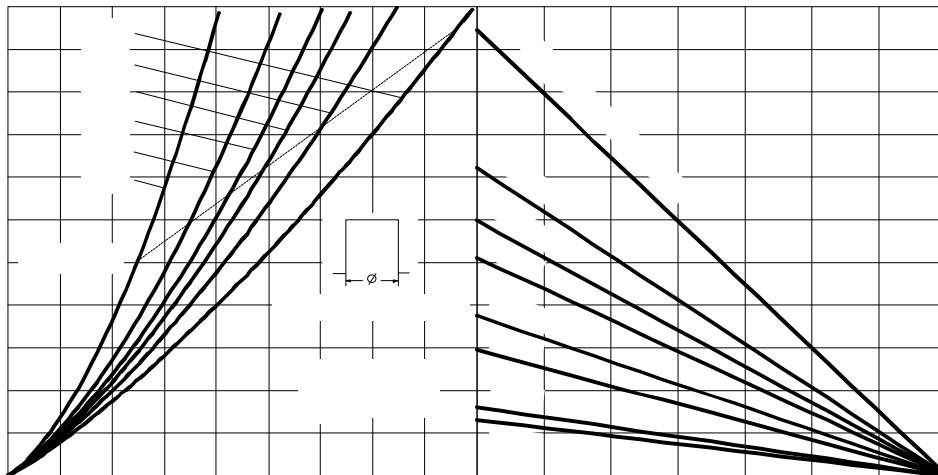
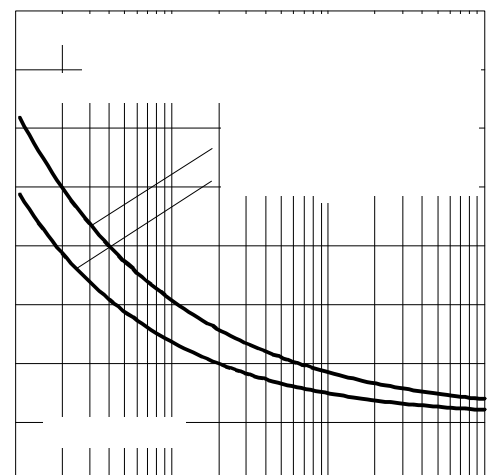
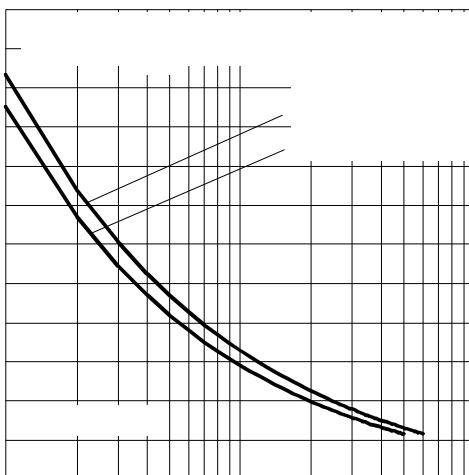


Fig. 4 - On-state Power Loss Characteristics



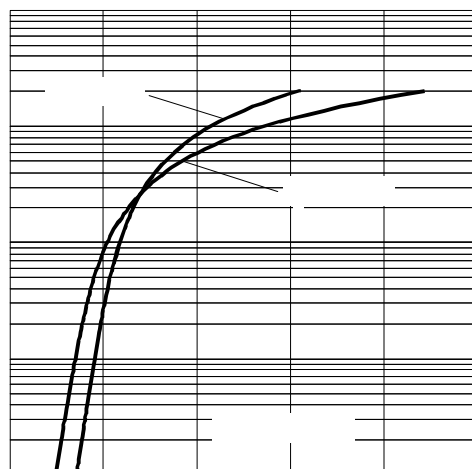


Fig. 7 - On-state Voltage Drop Characteristics

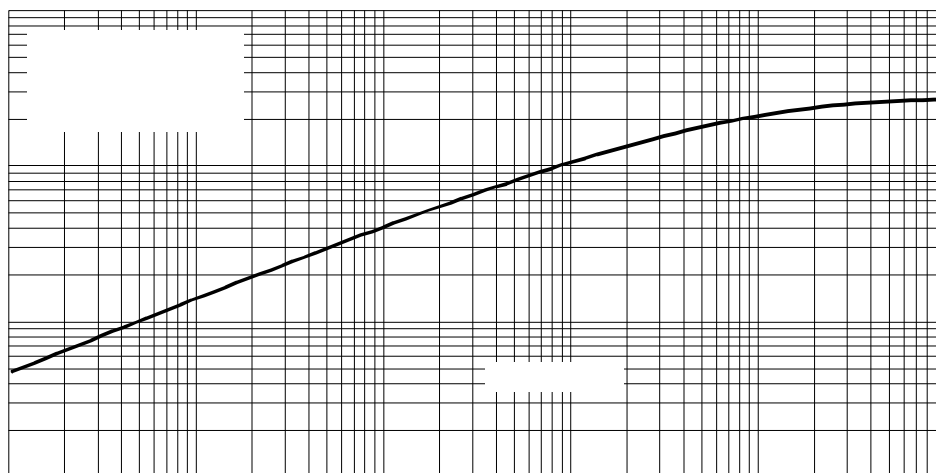
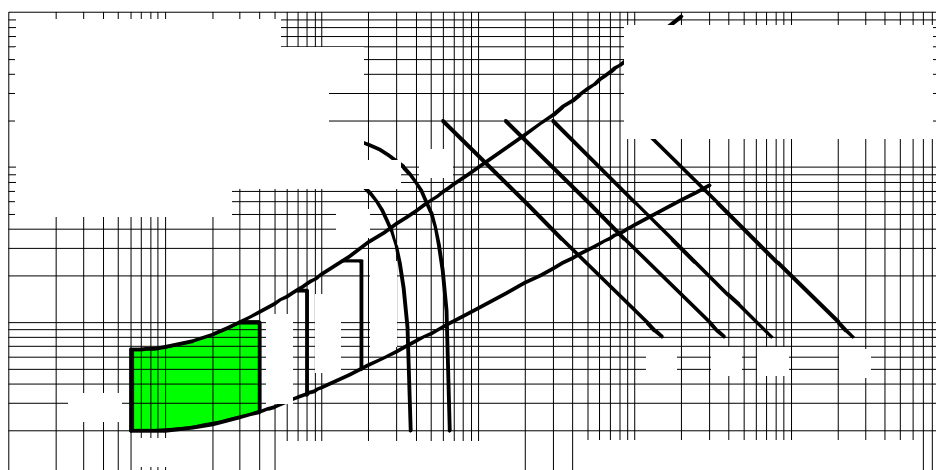


Fig. 8 - Thermal Impedance Z_{thJC} Characteristic



Blocking

Parameter	111RKI	Units	Conditions
dv/dt Maximum critical rate of rise of off-state voltage	500	V/ μ s	$T_J = T_J \text{ max.}$ linear to 80% rated V_{DRM}
I_{RRM} I_{DRM} Max. peak reverse and off-state leakage current	20	mA	$T_J = T_J \text{ max.}$ rated V_{DRM}/V_{RRM} applied

Triggering

Parameter	111RKI	Units	Conditions
P_{GM} Maximum peak gate power	12	W	$T_J = T_J \text{ max.}$ $t_p \leq 5\text{ms}$
$P_{G(AV)}$ Maximum average gate power	3.0		$T_J = T_J \text{ max.}$ $f = 50\text{Hz}$, $d\% = 50$
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	10		
I_{GT} DC gate current required to trigger	TYP.	MAX.	$T_J = -40^\circ\text{C}$ $T_J = 25^\circ\text{C}$ $T_J = 140^\circ\text{C}$ Max. required gate trigger/ current/ voltage are the lowest value which will trigger all units 12V anode-to-cathode applied
	180	-	
	80	100	
	40	-	
V_{GT} DC gate voltage required to trigger	2.5	-	$T_J = -40^\circ\text{C}$ $T_J = 25^\circ\text{C}$ $T_J = 140^\circ\text{C}$
	1.6	2	
	1	-	
I_{GD} DC gate current not to trigger	6.0	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	111RKI	Units	Conditions
T_J Max. operating temperature range	-40 to 140	$^\circ\text{C}$	
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, $\pm 10\%$	15.5	Nm (lbf-in)	Non lubricated threads
	(137)		
	14 (120)		Lubricated threads
wt Approximate weight	130	g	
Case style	TO - 209AC (TO-94)		See Outline Table

111RKI Series

ΔR_{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°	0.043	0.031	K/W	$T_J = T_{J \text{ max.}}$
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

11

1

RKI

120

1

2

3

4

5

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)
2 = Flag terminals (For Cathode and Gate Terminals)

3

-

Thyristor

4

-

Voltage code: Code x 10 = V_{RRM} (See Voltage Rating Table)

5

-

Critical dv/dt: None = 500V/ μ sec
S90 = 1000V/ μ sec

Outline Table

CERAMIC HOUSING
FLAG TERMINAL

22.5 DIA.
(0.89) MAX.

1.5 (0.06) DIA.

10 (0.39)

24 (0.94) MAX.

10 (0.39) MAX.

21 (0.83) MAX.

1/2"-20UNF-2A

SW 27

16.5 (0.65)

2.4 (0.09)

5.2 (0.20) DIA.

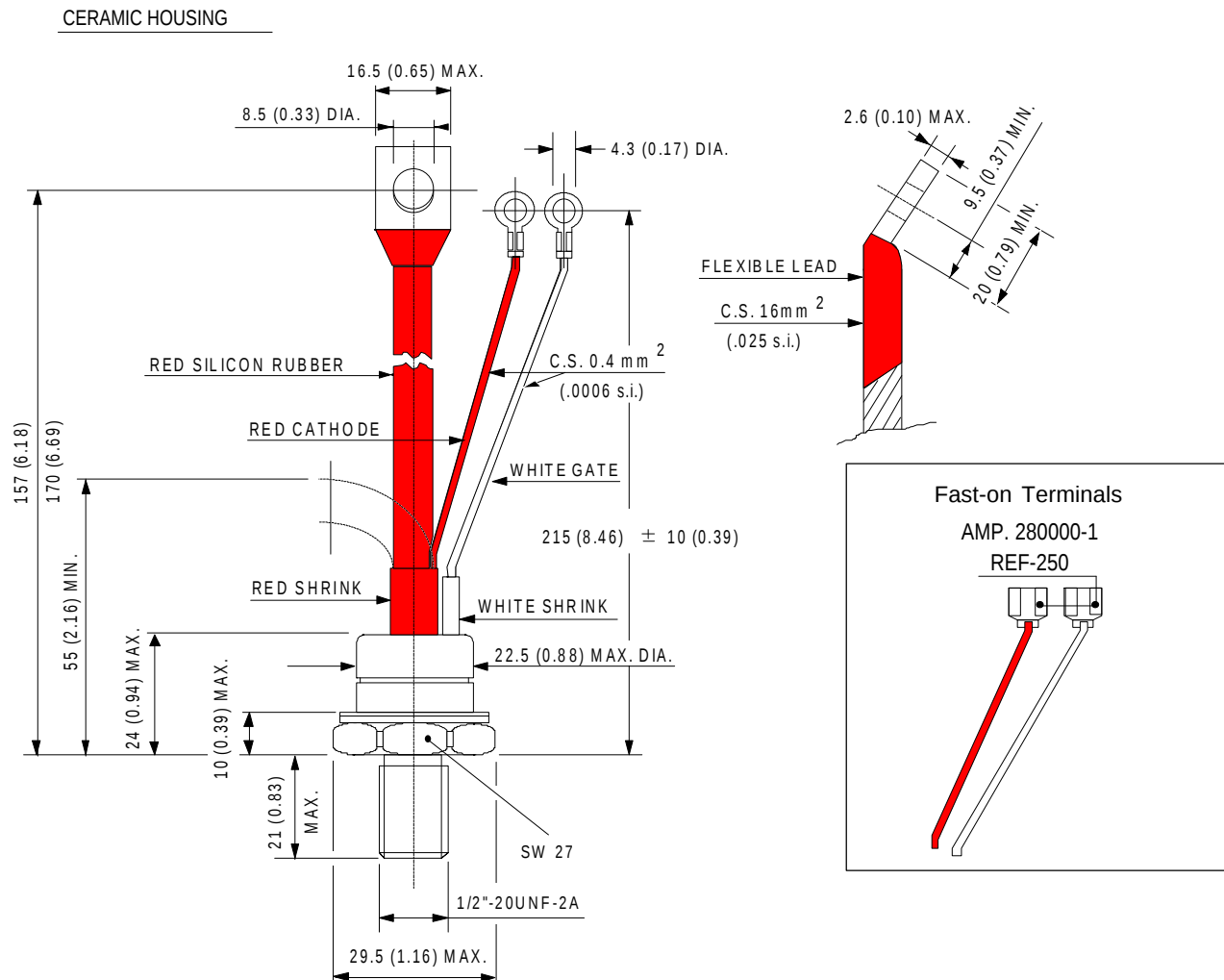
10 (0.39)

7.5 (0.30)

Case Style TO-208AD (TO-83)

All dimensions in millimeters (inches)

Outline Table



Case Style TO-209AC (TO-94)
All dimensions in millimeters (inches)

