

### Features

- High current and high surge ratings
- Hermetic glass-metal seal up to 1200V

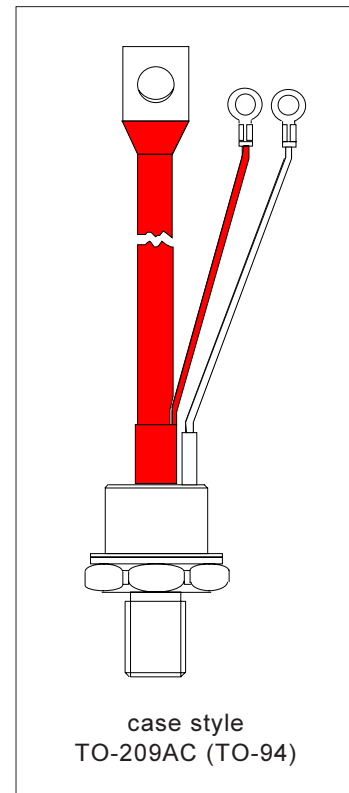
110A

### Typical Applications

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

### Major Ratings and Characteristics

Parameters	110/111RIA	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 <sup>2</sup> s
@ 60Hz	19.8	KA <sup>2</sup> s
$V_{DRM}/V_{RRM}$	800 to 1200	V
$t_q$ typical	110	μs
$T_J$	- 40 to 140	°C



## 110/111RIA Series

Bulletin I25204 rev. B 09/03

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
110/111RIA	80	800	900	20
	120	1200	1300	

#### On-state Conduction

Parameter	110/111RIA	Units	Conditions	
$I_{T(AV)}$ Max. average on-state current @ Case temperature	110	A	180° conduction, half sine wave	
	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		t = 10ms	No voltage reappplied
	2180		t = 8.3ms	reappplied
	1750		t = 10ms	100% $V_{RRM}$ reappplied
1830	t = 8.3ms	reappplied		
$I^2t$ Maximum $I^2t$ for fusing	21.7	KA <sup>2</sup> s	t = 10ms	No voltage reappplied
	19.8		t = 8.3ms	reappplied
	15.3		t = 10ms	100% $V_{RRM}$ reappplied
	14.0		t = 8.3ms	reappplied
$I^2\sqrt{t}$ Maximum $I^2\sqrt{t}$ for fusing	217	KA <sup>2</sup> √s	t = 0.1 to 10ms, no voltage reappplied	
$V_{T(TO)1}$ Low level value of threshold voltage	0.82	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	1.02		( $I > \pi \times I_{T(AV)}$ ), $T_J = T_J$ max.	
$r_{t1}$ Low level value of on-state slope resistance	2.16	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	1.70		( $I > \pi \times I_{T(AV)}$ ), $T_J = T_J$ 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	150	mA	$T_J = 25^\circ C$ , anode supply 6V resistive load	
$I_L$ Typical latching current	400			

#### Switching

Parameter	110/111RIA	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	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	110		$I_{TM} = 50A$ , $T_J = T_J$ max., $di/dt = -5A/\mu s$ , $V_R = 50V$ $dv/dt = 20V/\mu s$ , Gate 0V 25Ω

**Blocking**

Parameter	110/111RIA	Units	Conditions
dv/dt Maximum critical rate of rise of off-state voltage	500	V/ $\mu$ s	$T_J = T_J \text{ max. linear to } 80\% \text{ rated } V_{\text{DRM}}$
$I_{\text{RRM}}$ $I_{\text{DRM}}$ Max. peak reverse and off-state leakage current	20	mA	$T_J = T_J \text{ max, rated } V_{\text{DRM}}/V_{\text{RRM}}$ applied

**Triggering**

Parameter	110/111RIA	Units	Conditions
$P_{\text{GM}}$ Maximum peak gate power	12	W	$T_J = T_J \text{ max, } t_p \leq 5 \text{ ms}$
$P_{\text{G(AV)}}$ Maximum average gate power	3.0		$T_J = T_J \text{ max, } f = 50 \text{ Hz, } d\% = 50$
$I_{\text{GM}}$ Max. peak positive gate current	3.0	A	$T_J = T_J \text{ max, } t_p \leq 5 \text{ ms}$
$+V_{\text{GM}}$ Maximum peak positive gate voltage	20	V	$T_J = T_J \text{ max, } t_p \leq 5 \text{ ms}$
$-V_{\text{GM}}$ Maximum peak negative gate voltage	10		
$I_{\text{GT}}$ 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	120	
$V_{\text{GT}}$ 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	-	
$I_{\text{GD}}$ 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 $V_{\text{DRM}}$ anode-to-cathode applied
$V_{\text{GD}}$ DC gate voltage not to trigger	0.25	V	

**Thermal and Mechanical Specification**

Parameter	110/111RIA	Units	Conditions
$T_J$ Max. operating temperature range	-40 to 140	$^\circ\text{C}$	
$T_{\text{stg}}$ Max. storage temperature range	-40 to 150		
$R_{\text{thJC}}$ Max. thermal resistance, junction to case	0.27	K/W	DC operation
$R_{\text{thCS}}$ 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)		Lubricated threads
	14 (120)		
wt Approximate weight	130	g	
Case style	TO-209AC (TO-94)		See Outline Table

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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°	0.043	0.031	K/W	$T_J = T_J \text{ max.}$
120°	0.052	0.053		$T_J = T_J \text{ max.}$
90°	0.066	0.071		$T_J = T_J \text{ max.}$
60°	0.096	0.101		$T_J = T_J \text{ max.}$
30°	0.167	0.169		$T_J = T_J \text{ max.}$

### Ordering Information Table

**Device Code**

11	1	RIA	120
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)

NOTE: For Metric Device M12 x 1.75 Contact Factory

Outline Table

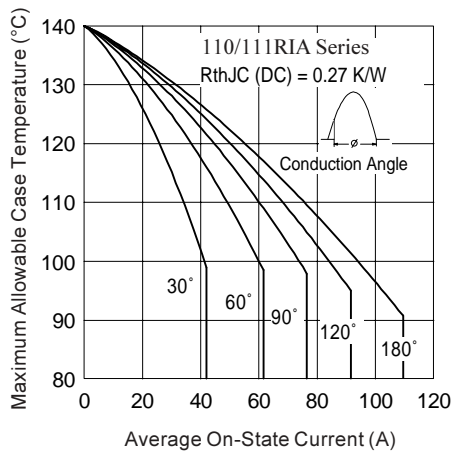
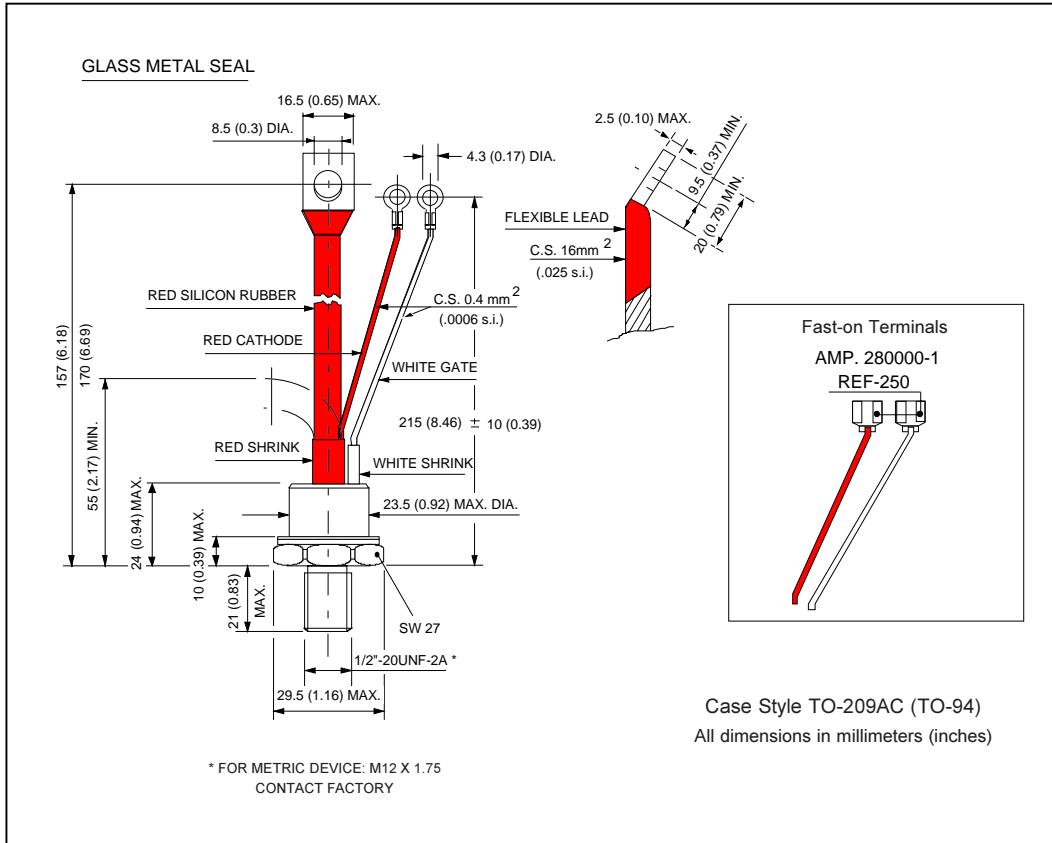


Fig. 1 - Current Ratings Characteristics

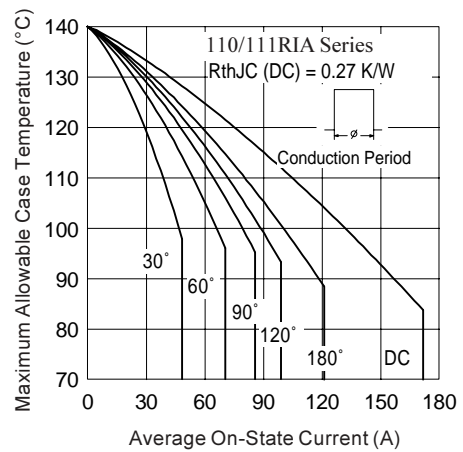


Fig. 2 - Current Ratings Characteristics

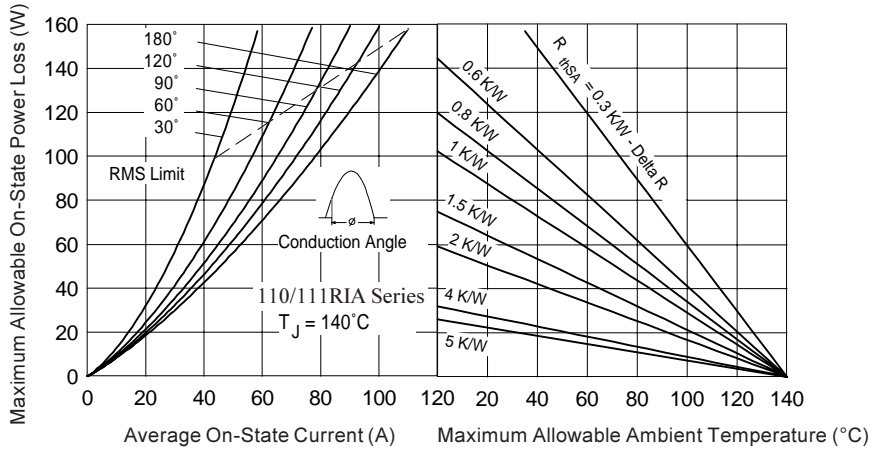


Fig. 3 - On-State Power Loss Characteristics

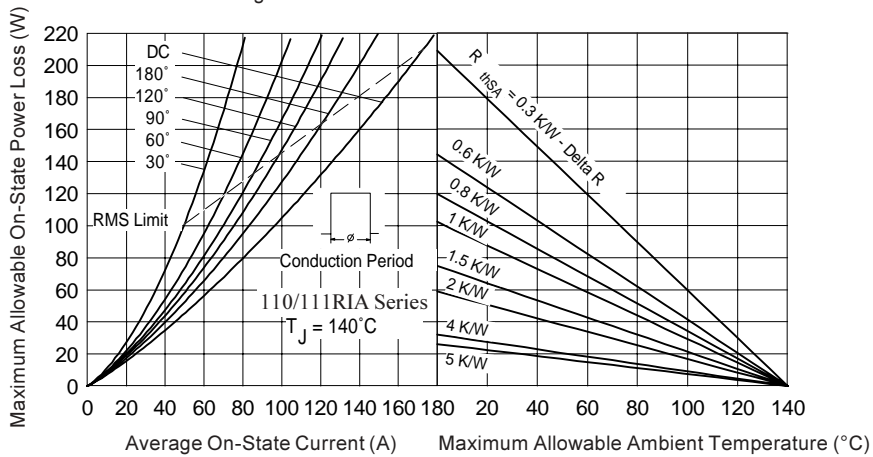


Fig. 4 - On-state Power Loss Characteristics

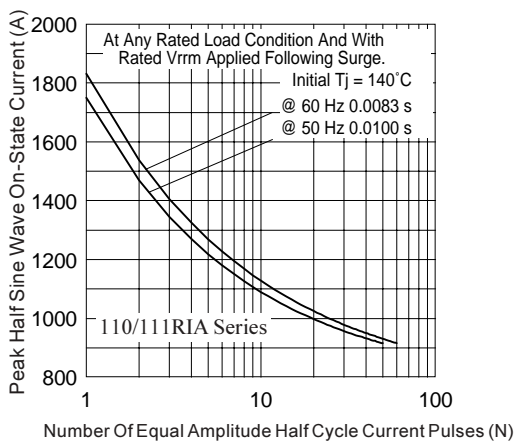


Fig. 5 - Maximum Non-Repetitive Surge Current

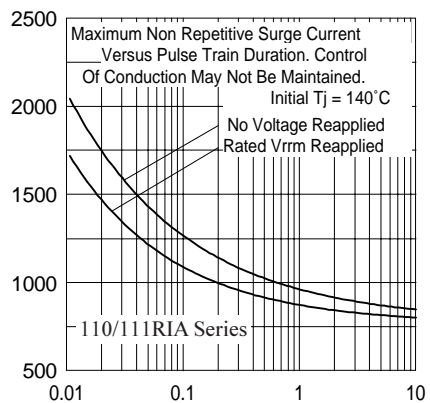


Fig. 6 - Maximum Non-Repetitive Surge Current

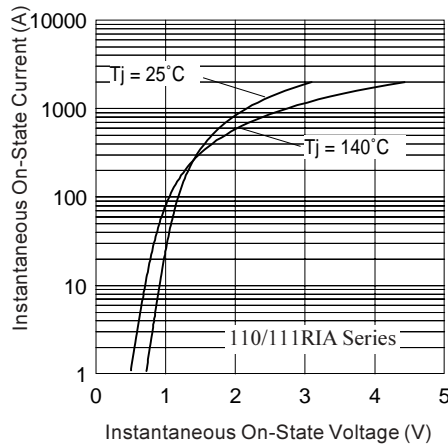


Fig. 7 - On-State Voltage Drop Characteristics

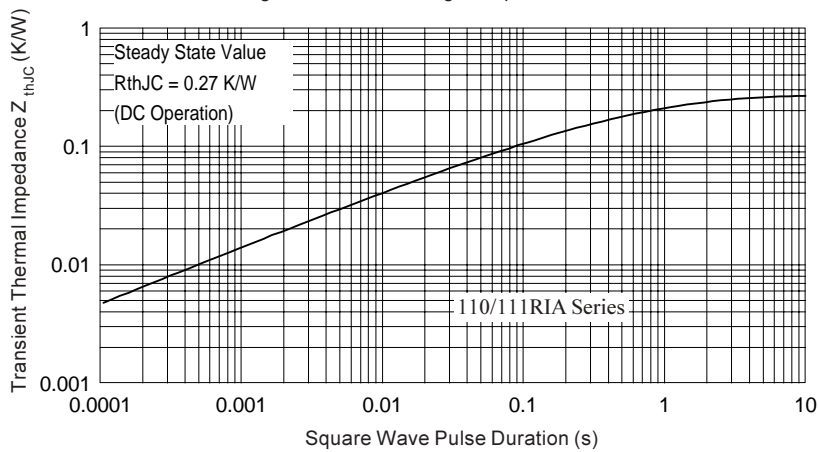


Fig. 8 - Thermal Impedance  $Z_{thJC}$  Characteristic

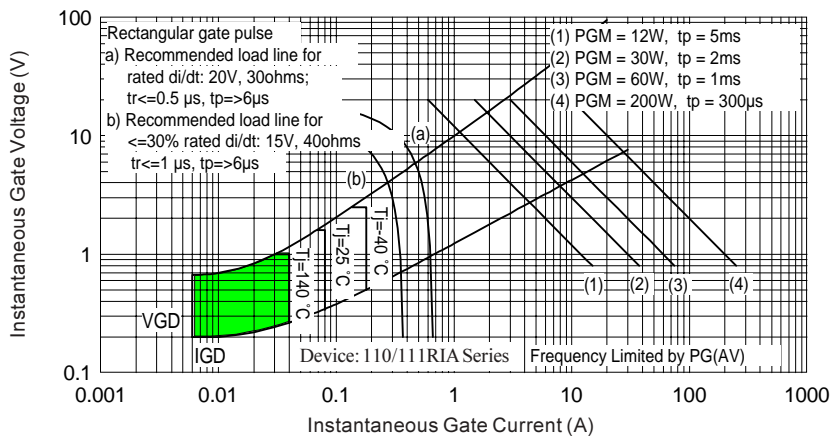


Fig. 9 - Gate Characteristics

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