Bulletin I2401 rev. A 07/00

International
IOR Rectifier

50RIA SERIES

MEDIUM POWER THYRISTORS **Stud Version**

50 A

Features

- High current rating
- Excellent dynamic characteristics
- dv/dt = 1000V/µs option
- Superior surge capabilities
- Standard package
- Metric threads version available
- Types up to 1600V V_{DRM}/ V_{RRM}

Typical Applications

- Phase control applications in converters
- Lighting circuits
- Battery charges
- Regulated power supplies and temperature and speed control circuit
- Can be supplied to meet stringent military, aerospace and other high-reliability requirements

Major Ratings and Characteristics

Parameters		50RIA		Units
		10 to 120	140 to 160	
$I_{T(AV)}$		50	50	A
	@ T_C	94	90	°C
$I_{T(RMS)}$		80	80	A
I_{TSM}	@ 50Hz	1430	1200	A
	@ 60Hz	1490	1257	A
I^2t	@ 50Hz	10.18	7.21	KA^2s
	@ 60Hz	9.30	6.58	KA^2s
V_{DRM}/V_{RRM}		100 to 1200	1400 to 1600	V
t_q	typical	110		µs
T_J		- 40 to 125		°C

Case Style
TO-208AC (TO-65)

E E TRI A SPE I I ATIO S

Voltage Ratings

Type number	Voltage Code	V_{DRM}/V_{RRM}, max. repetitive peak and off-state voltage (1) V	V_{RSM}, maximum non-repetitive peak voltage (2) V	I_{DRM}/I_{RRM} max. @ $T_J = T_J$ max. mA
50RIA	10	100	150	15
	20	200	300	
	40	400	500	
	60	600	700	
	80	800	900	
	100	1000	1100	
	120	1200	1300	
	140	1400	1500	
	160	1600	1700	

(1) Units may be broken over non-repetitively in the off-state direction without damage, if dI/dt does not exceed 20A/µs
(2) For voltage pulses with $t_p \leq 5$ms

On-state Conduction

Parameter		50RIA 10 to 120	50RIA 140 to 160	Units	Conditions		
$I_{T(AV)}$	Max. average on-state current	50	50	A	180° sinusoidal conduction		
	@ Case temperature	94	90	°C			
$I_{T(RMS)}$	Max. RMS on-state current	80	80	A			
I_{TSM}	Max. peak, one-cycle non-repetitive surge current	1430	1200	A	t = 10ms	No voltage reapplied	Sinusoidal half wave, Initial $T_J = T_J$ max.
		1490	1257		t = 8.3ms		
		1200	1010		t = 10ms	100% V_{RRM} reapplied	
		1255	1057		t = 8.3ms		
I^2t	Maximum I^2t for fusing	10.18	7.21	KA^2s	t = 10ms	No voltage reapplied	
		9.30	6.58		t = 8.3ms		
		7.20	5.10		t = 10ms	100% V_{RRM} reapplied	
		6.56	4.65		t = 8.3ms		
$I^2\sqrt{t}$	Maximum $I^2\sqrt{t}$ for fusing	101.8	72.1	$KA^2\sqrt{s}$	t = 0.1 to 10ms, no voltage reapplied, $T_J = T_J$ max.		
$V_{T(TO)1}$	Low level value of threshold voltage	0.94	1.02	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	1.08	1.17		(π x $I_{T(AV)}$ < I < 20 x π x $I_{T(AV)}$), $T_J = T_J$ max.		
r_{t1}	Low level value of on-state slope resistance	4.08	4.78	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	3.34	3.97		(π x $I_{T(AV)}$ < I < 20 x π x $I_{T(AV)}$), $T_J = T_J$ max.		
V_{TM}	Max. on-state voltage	1.60	1.78	V	I_{pk}= 157 A, T_J = 25°C		
I_H	Maximum holding current	200		mA	T_J = 25°C. Anode supply 22V, resistive load, Initial I_T = 2A		
I_L	Latching current	400			Anode supply 6V, resistive load		

Switching

	Parameter	50RIA	Units	Conditions
di/dt	Max. rate of rise of turned-on current $V_{DRM} \leq 600V$	200	A/µs	T_C = 125°C, V_{DM} = rated V_{DRM} Gate pulse = 20V, 15Ω, t_p = 6µs, t_r = 0.1µs max. I_{TM} = (2x rated di/dt) A
	$V_{DRM} \leq 1600V$	100		
t_d	Typical delay time	0.9	µs	T_C = 25°C V_{DM} = rated V_{DRM} I_{TM} = 10A dc resistive circuit Gate pulse = 10V, 15Ω source, t_p = 20µs
t_q	Typical turn-off time	110		T_C = 125°C, I_{TM} = 50A, reapplied dv/dt = 20V/µs dir/dt = -10A/µs, V_R=50V

Blocking

	Parameter	50RIA	Units	Conditions
dv/dt	Max. critical rate of rise of off-state voltage	200	V/µs	T_J = T_J max. linear to 100% rated V_{DRM}
		500 (*)		T_J = T_J max. linear to 67% rated V_{DRM}

(*) Available with dv/dt = 1000V/µs, to complete code add S90 i.e. 50RIA160S90.

Triggering

	Parameter	50RIA	Units	Conditions	
P_{GM}	Maximum peak gate power	10	W	T_J = T_J max, $t_p \leq$ 5ms	
$P_{G(AV)}$	Maximum average gate power	2.5			
I_{GM}	Max. peak positive gate current	2.5	A		
$+V_{GM}$	Maximum peak positive gate voltage	20	V		
$-V_{GM}$	Maximum peak negative gate voltage	10			
I_{GT}	DC gate current required to trigger	250	mA	T_J = - 40°C	Max. required gate trigger current/voltage are the lowest value which will trigger all units 6V anode-to-cathode applied
		100		T_J = 25°C	
		50		T_J = 125°C	
V_{GT}	DC gate voltage required to trigger	3.5	V	T_J = - 40°C	
		2.5		T_J = 25°C	
I_{GD}	DC gate current not to trigger	5.0	mA	T_J = T_J max V_{DRM} = rated voltage	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	0.2	V	T_J = T_J max	

Thermal and Mechanical Specification

	Parameter		50RIA	Units	Conditions
T_J	Max. operating temperature range		- 40 to 125	°C	
T_{stg}	Max. storage temperature range		- 40 to 125	°C	
R_{thJC}	Max. thermal resistance, junction to case		0.35	K/W	DC operation
R_{thCS}	Max. thermal resistance, case to heatsink		0.25	K/W	Mounting surface, smooth, flat and greased
T	Mounting torque	Min.	2.8 (25)	Nm	Non-lubricated threads
		Max.	3.4 (30)	(lbf-in)	
wt	Approximate weight		28 (1.0)	g (oz)	
	Case style		TO-208AC (TO-65)		See Outline Table

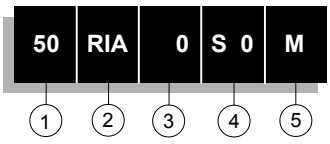
ΔR_{thJC} Conduction

(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°	0.078	0.057	K/W	$T_J = T_J$ max.
120°	0.094	0.098		
90°	0.120	0.130		
60°	0.176	0.183		
30°	0.294	0.296		

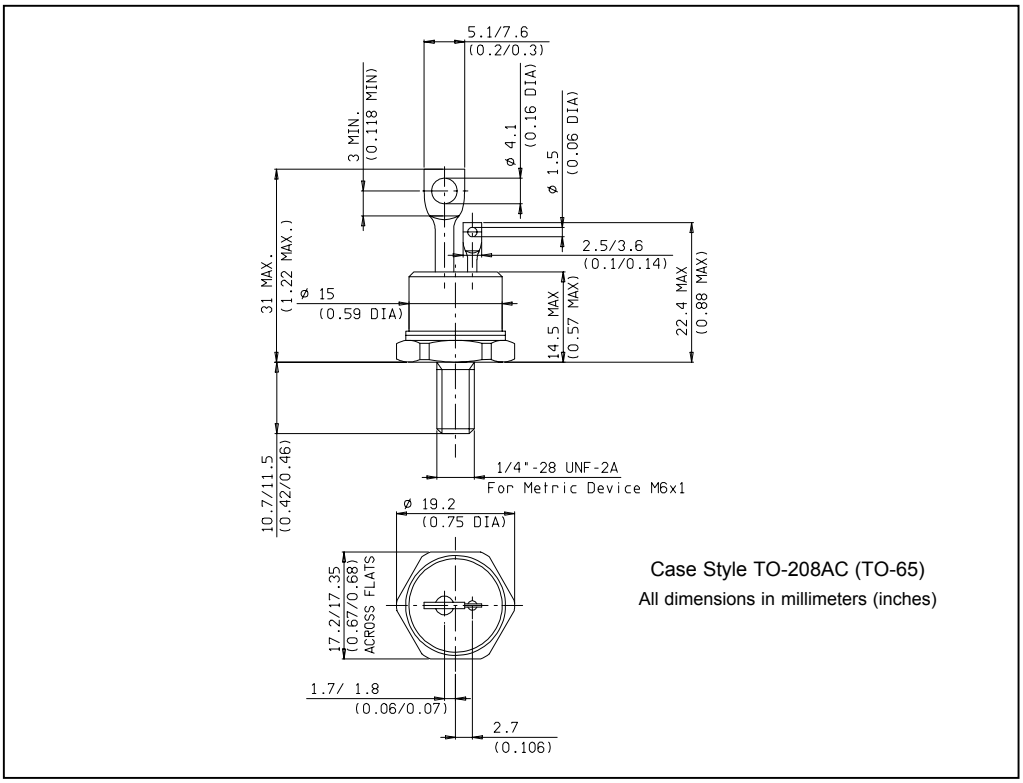
Ordering Information Table

De i e ode



- ■ - Current code
- ■ - Essential part number
- ■ - Voltage code: Code x 10 = V_{RRM} (See Voltage Rating Table)
- ■ - Critical dv/dt: None = 500V/µs (Standard value)
  S90 = 1000V/µs (Special selection)
- **5** - None = Stud base TO-208AC (TO-65) 1/4" 28UNF-2A
  M = Stud base TO-208AC (TO-65) M6 X 1

Outline Table



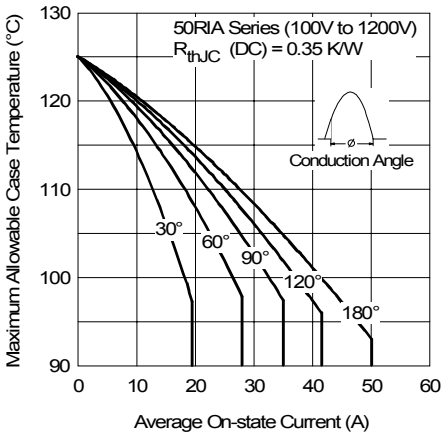


Fig. 1 - Current Ratings Characteristic

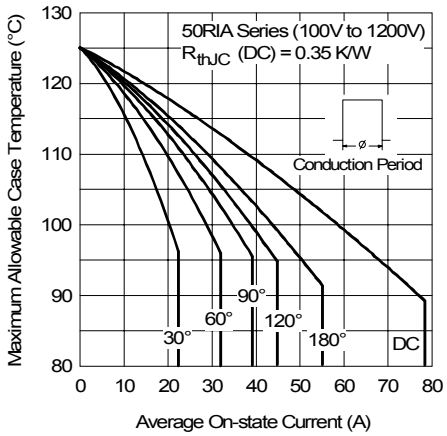


Fig. 2 - Current Ratings Characteristic

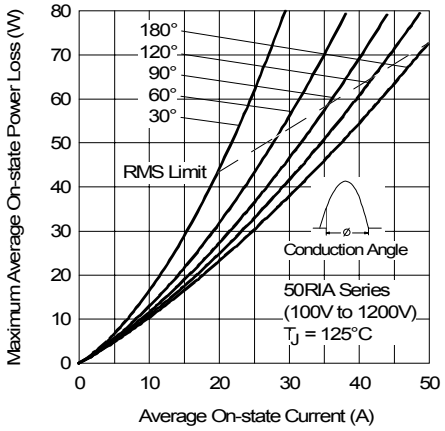


Fig. 3 - On-state Power Loss Characteristics

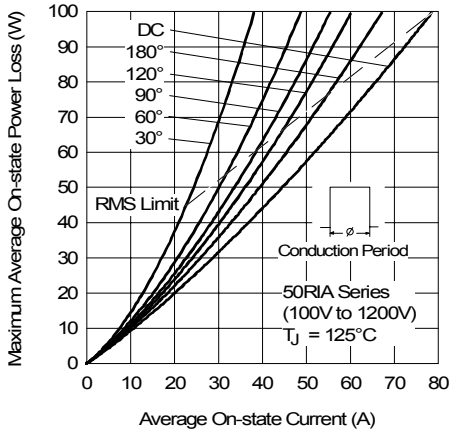


Fig. 4 - On-state Power Loss Characteristics

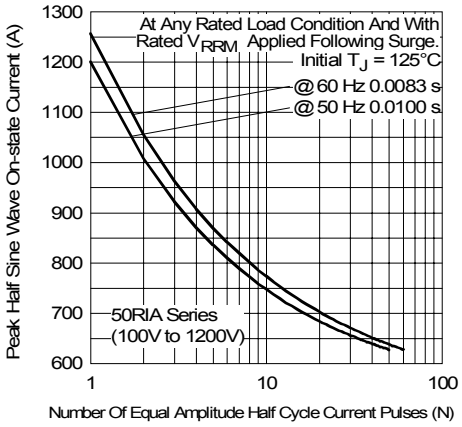


Fig. 5 - Maximum Non-Repetitive Surge Current

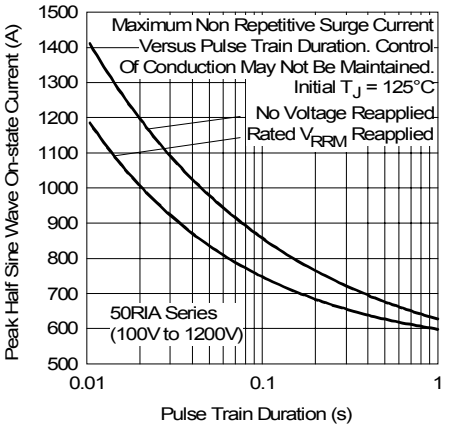


Fig. 6 - Maximum Non-Repetitive Surge Current

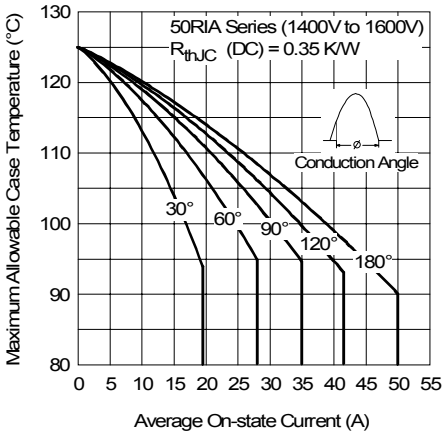


Fig. 7 - Current Ratings Characteristics

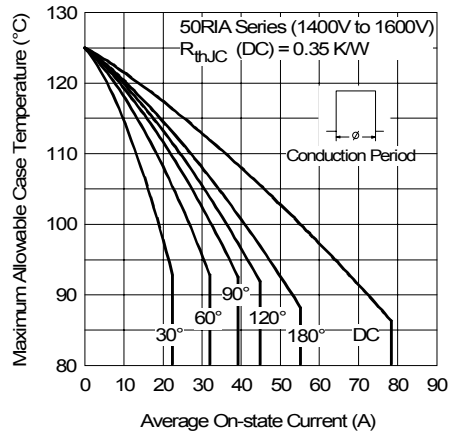


Fig. 8 - Current Ratings Characteristics

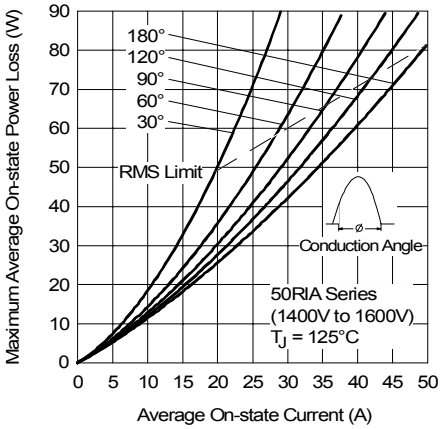


Fig. 9 - On-state Power Loss Characteristics

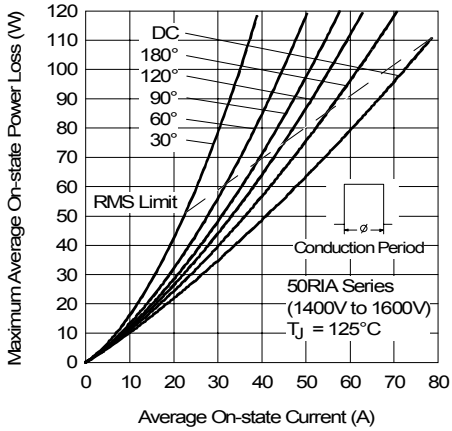


Fig. 10 - On-state Power Loss Characteristics

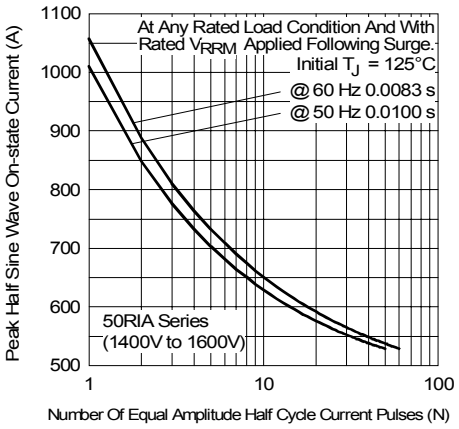


Fig. 11 - Maximum Non-Repetitive Surge Current

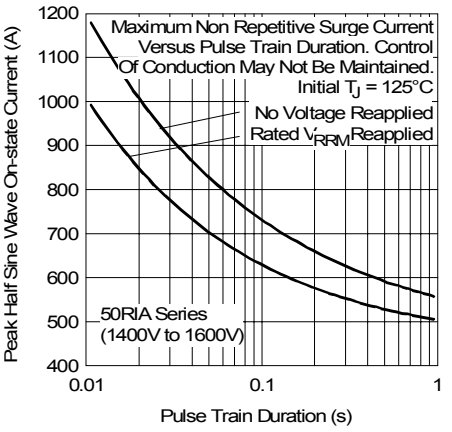


Fig. 12 - Maximum Non-Repetitive Surge Current

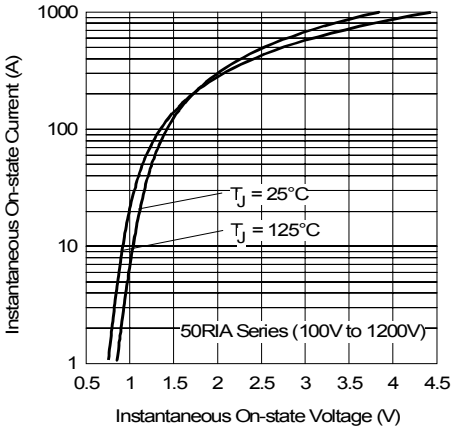


Fig. 13 - Forward Voltage Drop Characteristics

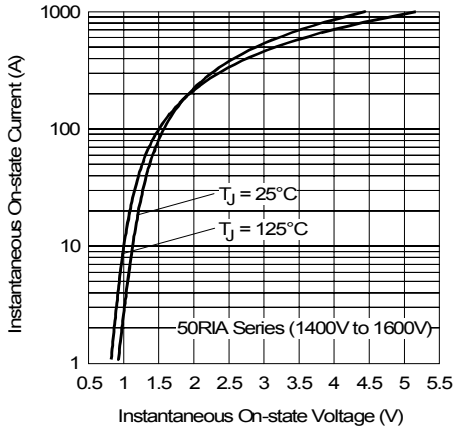


Fig. 14 - Forward Voltage Drop Characteristics

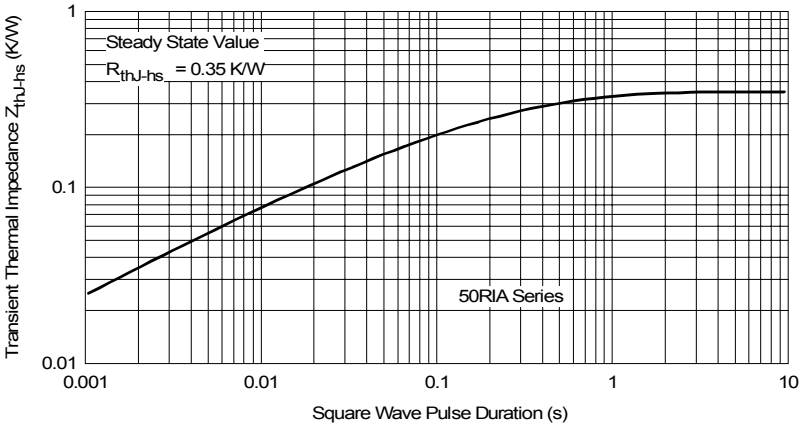


Fig. 15 - Thermal Impedance Z_{thJC} Characteristics

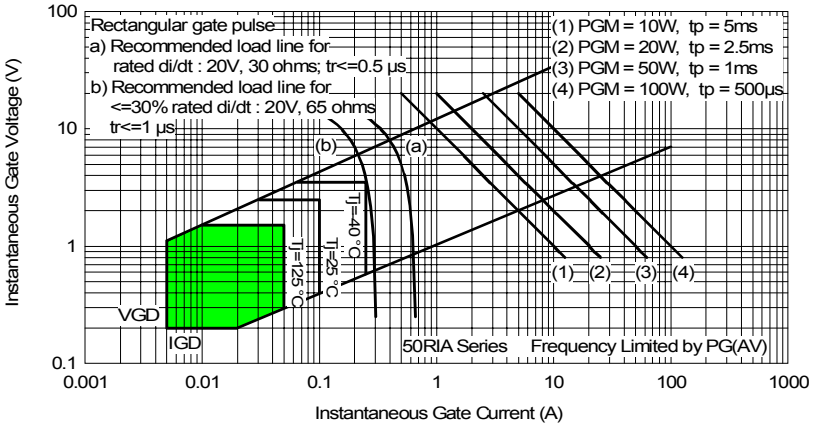


Fig. 16 - Gate Characteristics