

MEDIUM POWER THYRISTORS

Stud Version

Features

- High current rating
- Excellent dynamic characteristics
- $dv/dt = 1000V/\mu s$ option
- Superior surge capabilities
- Standard package
- Metric threads version available
- Types up to $1600V V_{DRM}/V_{RRM}$
- Available to CECC 50000

50A

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 ² s
@ 60Hz	9.30	6.58	KA ² s
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)

50RIA Series

ELECTRICAL SPECIFICATIONS

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 $20A/\mu s$

(2) For voltage pulses with $t_p \leq 5ms$

On-state Conduction

Parameter		50RIA		Units	Conditions			
		10 to 120	140 to 160					
I _{T(AV)}	Max. average on-state current @ Case temperature	50	50	A	180° sinusoidal conduction			
		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	Sinusoidal half wave, Initial T _J = T _J max.	
		1490	1257		t = 8.3ms	reapplied		
		1200	1010		t = 10ms	100% V _{RRM}		
		1255	1057		t = 8.3ms	reapplied		
I ² t	Maximum I ² t for fusing	10.18	7.21	KA ² s	t = 10ms	No voltage		
		9.30	6.58		t = 8.3ms	reapplied		
		7.20	5.10		t = 10ms	100% V _{RRM}		
		6.56	4.65		t = 8.3ms	reapplied		
I ² √t	Maximum I ² √t for fusing	101.8	72.1	KA ² √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% × π × I _{T(AV)} < I < π × I _{T(AV)}), T _J = T _J max.			
V _{T(TO)2}	High level value of threshold voltage	1.08	1.17		(π × I _{T(AV)} < I < 20 × π × 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% × π × I _{T(AV)} < I < π × I _{T(AV)}), T _J = T _J max.			
r _{t2}	High level value of on-state slope resistance	3.34	3.97		(π × I _{T(AV)} < I < 20 × π × 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 $V_{\text{DRM}} \leq 600\text{V}$ $V_{\text{DRM}} \leq 1600\text{V}$	200 100	A/ μs	$T_{\text{C}} = 125^{\circ}\text{C}$, $V_{\text{DM}} = \text{rated } V_{\text{DRM}}$ Gate pulse = 20V, 15 Ω , $t_{\text{p}} = 6\mu\text{s}$, $t_{\text{r}} = 0.1\mu\text{s}$ max. $I_{\text{TM}} = (2 \times \text{rated di/dt}) \text{ A}$
t_{d} Typical delay time	0.9	μs	$T_{\text{C}} = 25^{\circ}\text{C}$ $V_{\text{DM}} = \text{rated } V_{\text{DRM}}$ $I_{\text{TM}} = 10\text{A}$ dc resistive circuit Gate pulse = 10V, 15 Ω source, $t_{\text{p}} = 20\mu\text{s}$
t_{q} Typical turn-off time	110		$T_{\text{C}} = 125^{\circ}\text{C}$, $I_{\text{TM}} = 50\text{A}$, reapplied $dv/dt = 20\text{V}/\mu\text{s}$ $di/dt = -10\text{A}/\mu\text{s}$, $V_{\text{R}} = 50\text{V}$

Blocking

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

(*) Available with $dv/dt = 1000\text{V}/\mu\text{s}$, to complete code add S90 i.e. 50RIA160S90.

Triggering

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

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

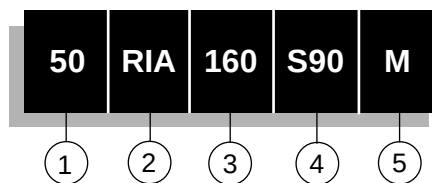
ΔR_{thJC} Conduction

(The following table shows the increment of thermal resistance 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	$T_j = T_j \text{ max.}$
120°	0.094	0.098		
90°	0.120	0.130		
60°	0.176	0.183		
30°	0.294	0.296		

Ordering Information Table

Device Code



- 1** - Current code
- 2** - Essential part number
- 3** - Voltage code: Code x 10 = V_{RRM} (See Voltage Rating Table)
- 4** - Critical dv/dt: None = 500V/ μ s (Standard value)
S90 = 1000V/ μ s (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

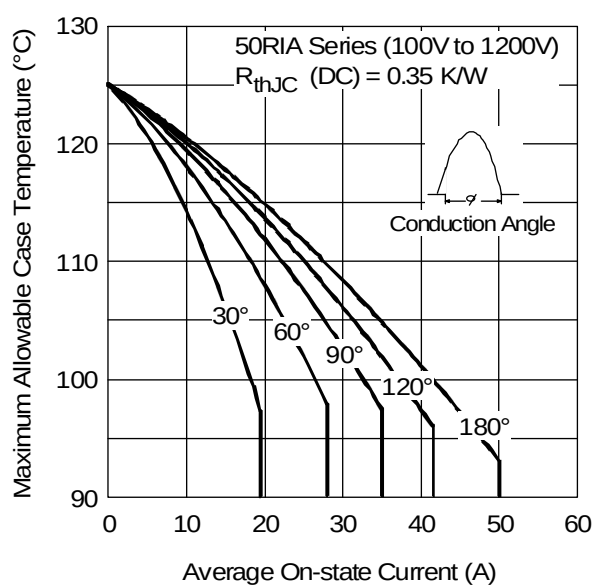
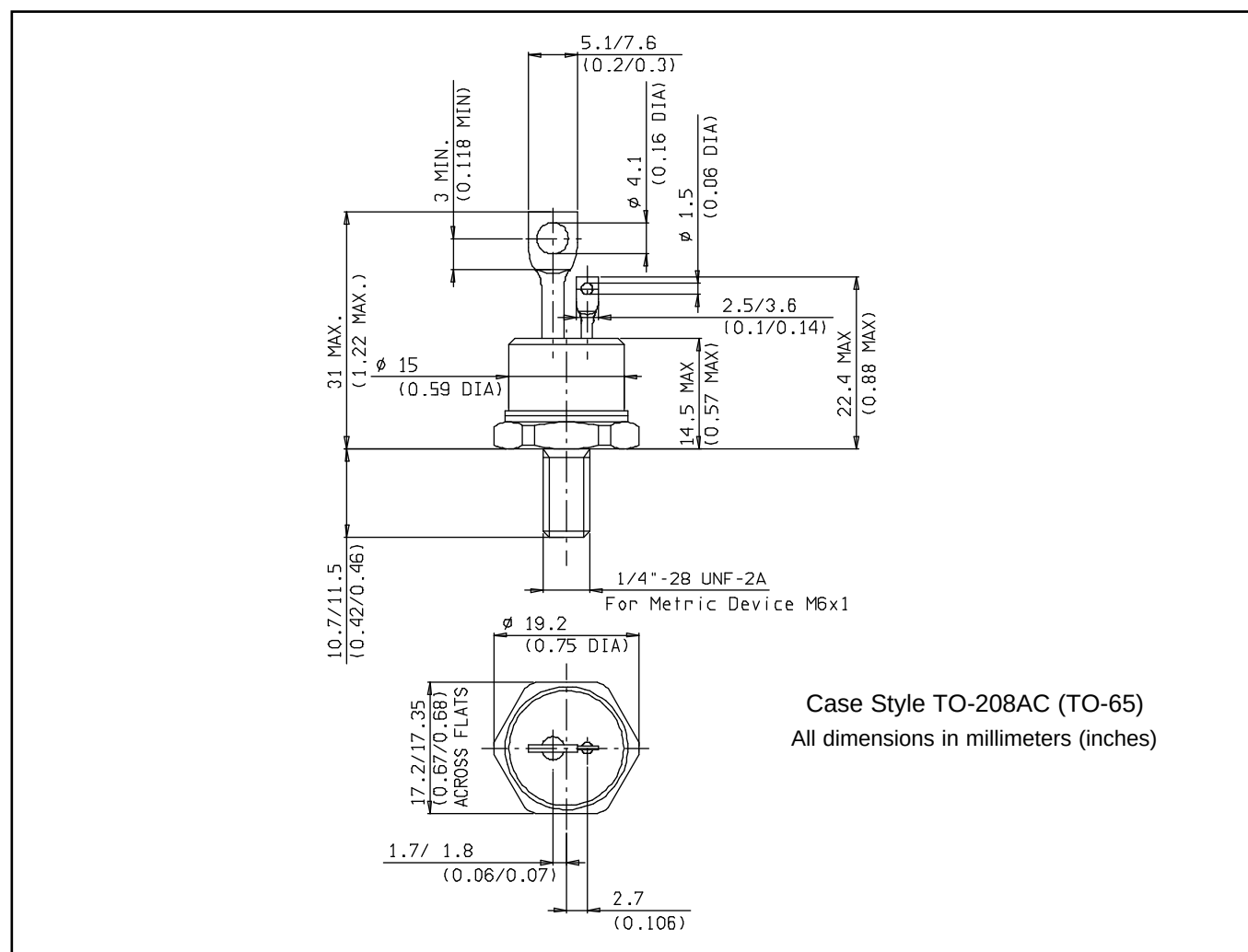


Fig. 1 - Current Ratings Characteristic

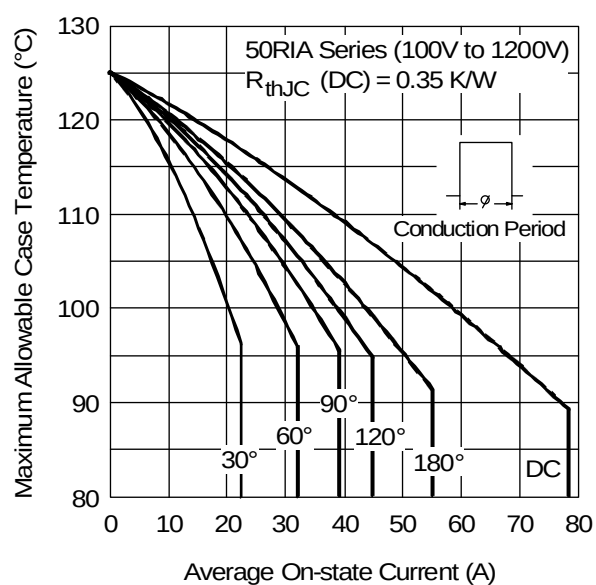


Fig. 2 - Current Ratings Characteristic

50RIA Series

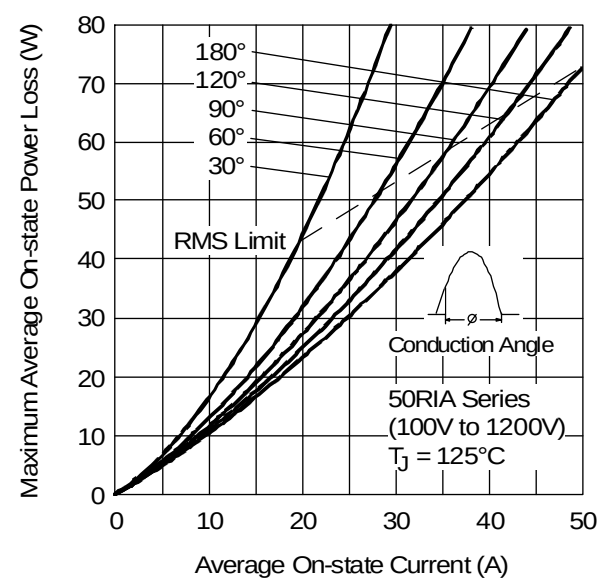


Fig. 3 - On-state Power Loss Characteristics

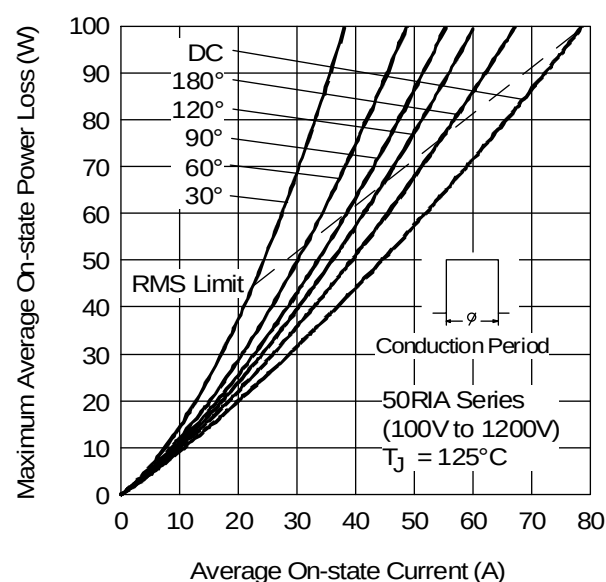


Fig. 4 - On-state Power Loss Characteristics

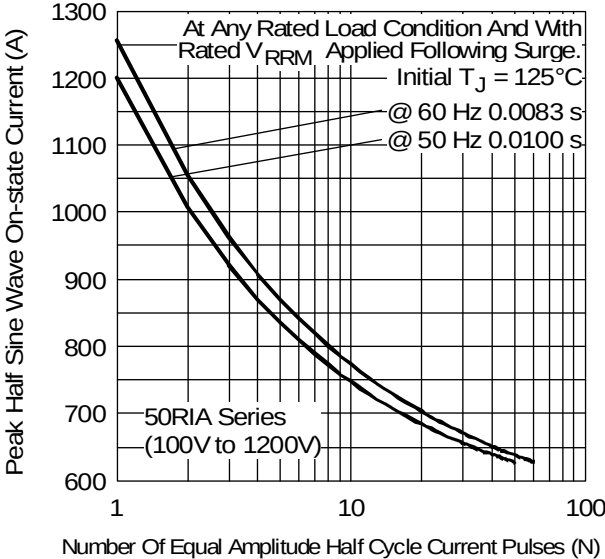


Fig. 5 - Maximum Non-Repetitive Surge Current

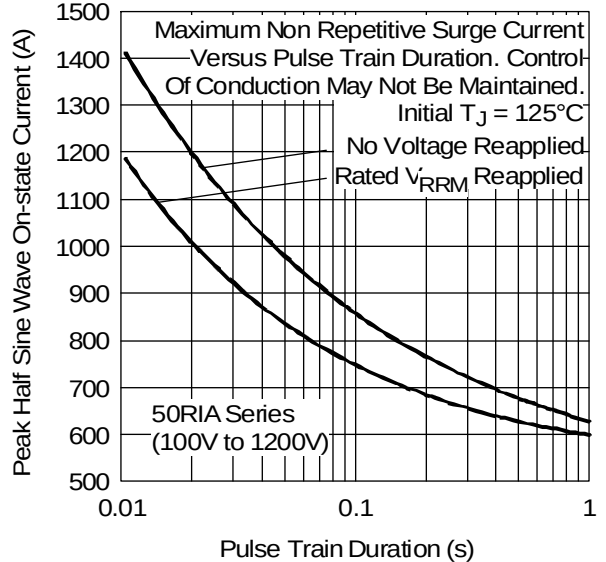


Fig. 6 - Maximum Non-Repetitive Surge Current

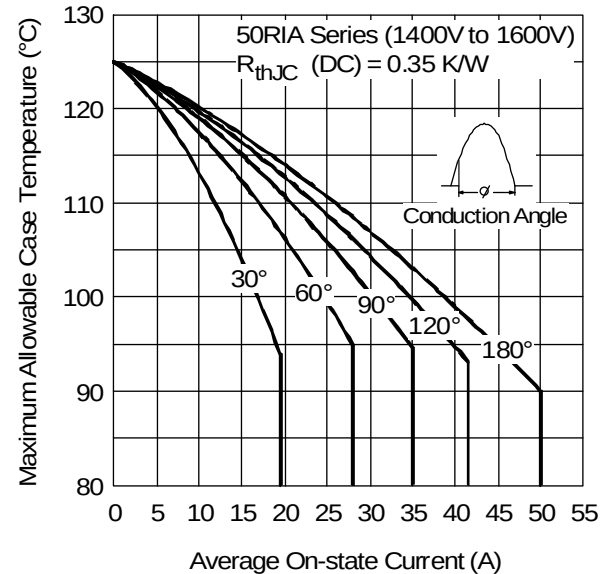


Fig. 7 - Current Ratings Characteristics

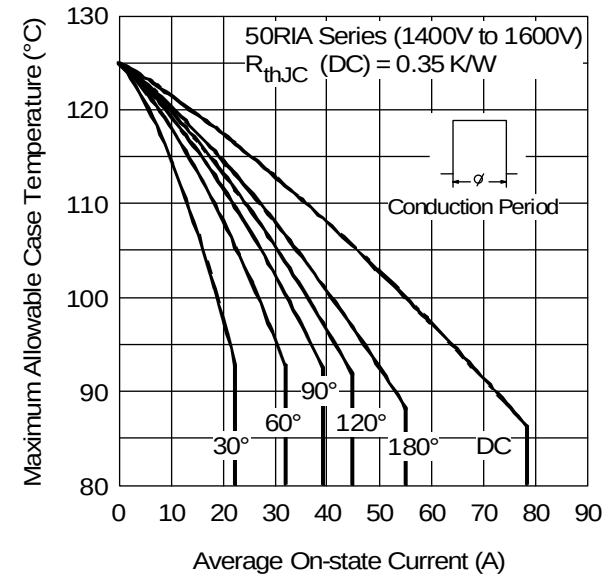


Fig. 8 - Current Ratings Characteristics

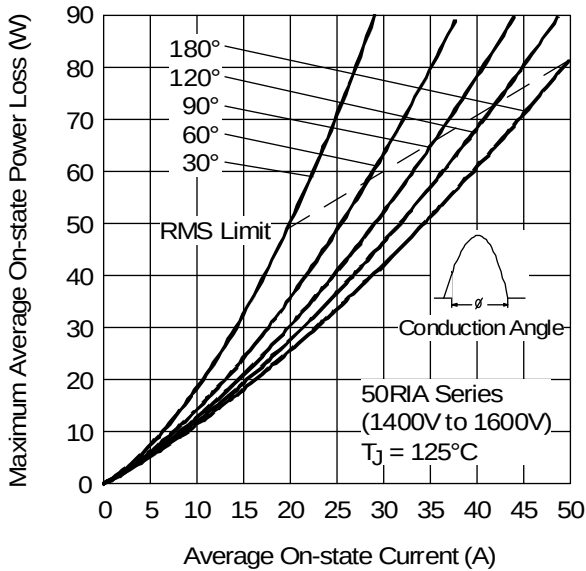


Fig. 9 - On-state Power Loss Characteristics

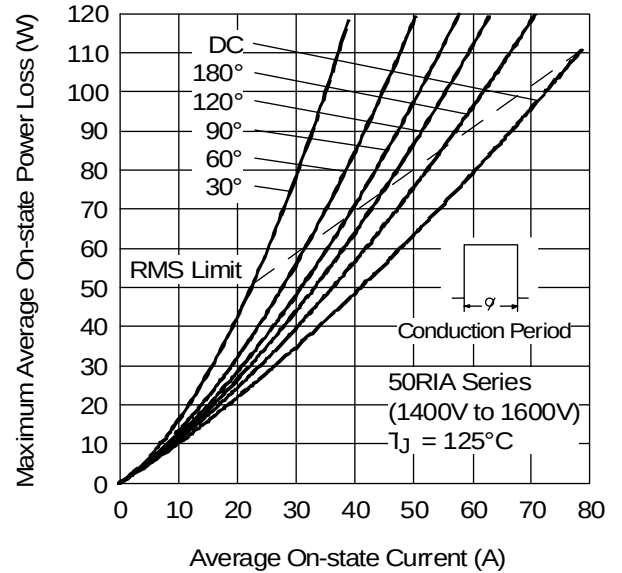


Fig. 10 - On-state Power Loss Characteristics

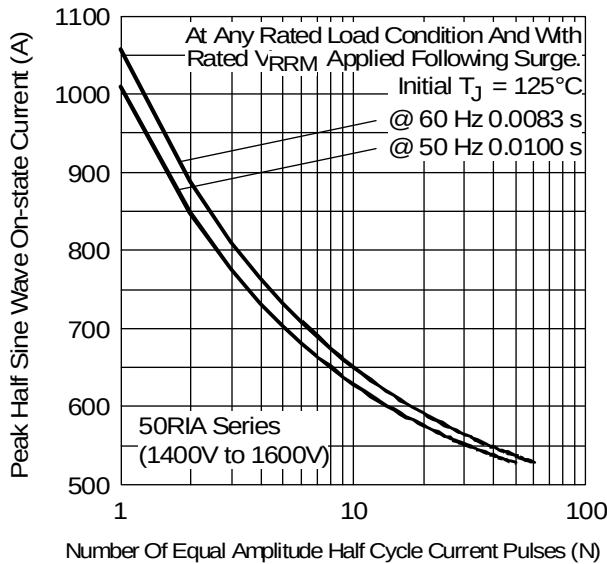


Fig. 11 - Maximum Non-Repetitive Surge Current

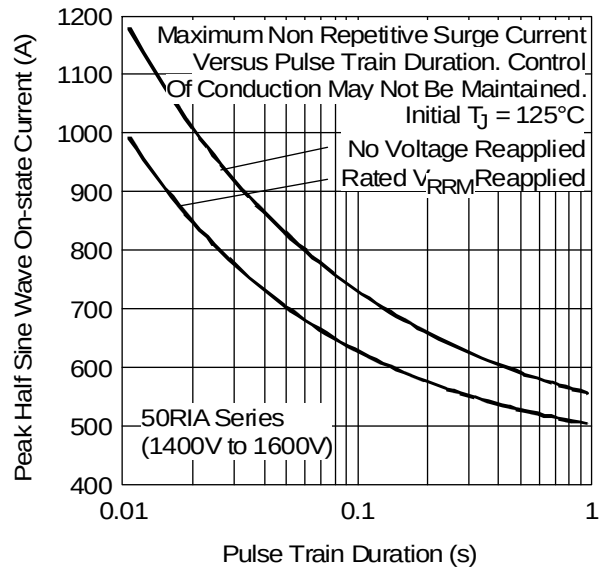


Fig. 12 - Maximum Non-Repetitive Surge Current

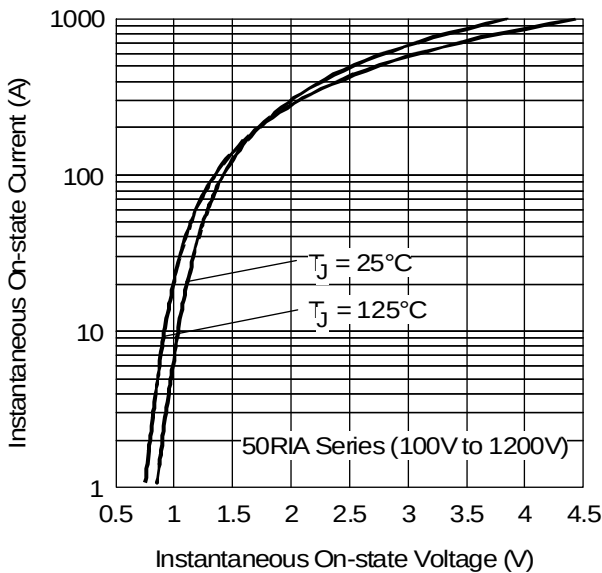


Fig. 13 - Forward Voltage Drop Characteristics

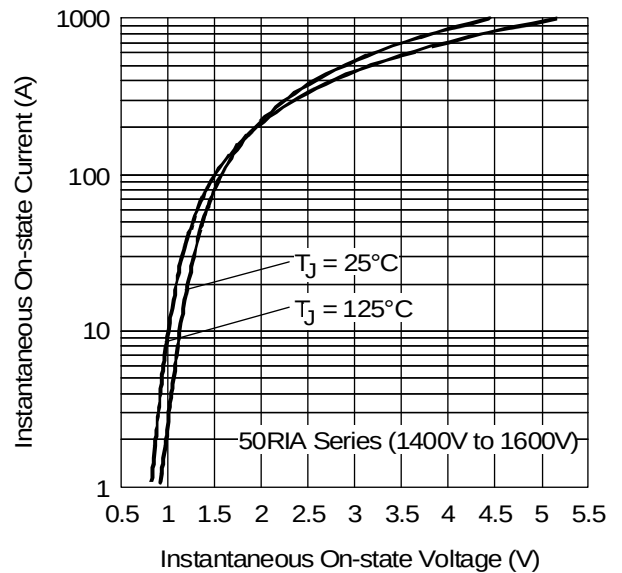


Fig. 14 - Forward Voltage Drop Characteristics

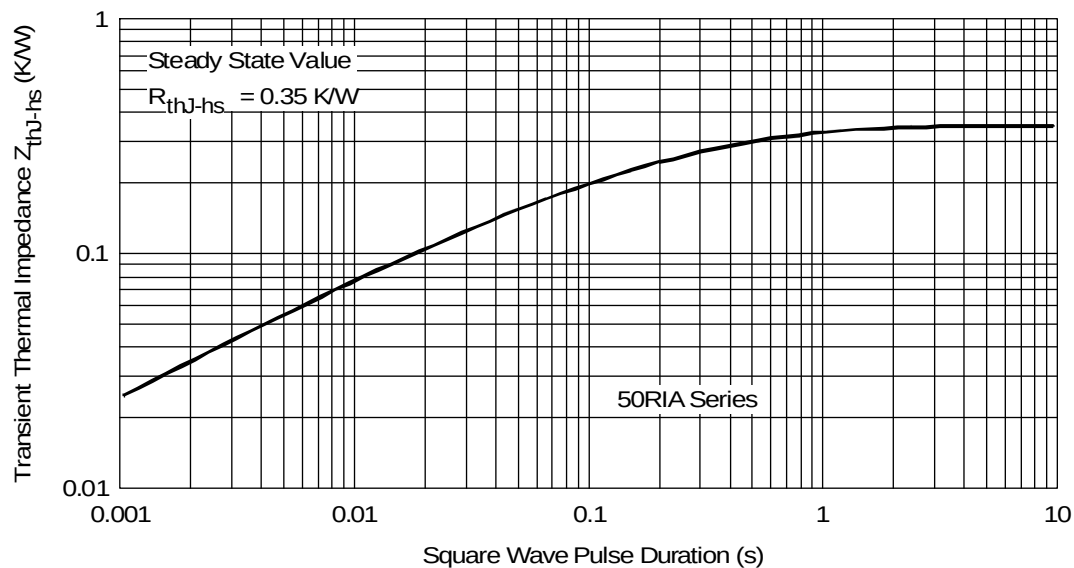


Fig. 15 - Thermal Impedance Z_{thJC} Characteristics

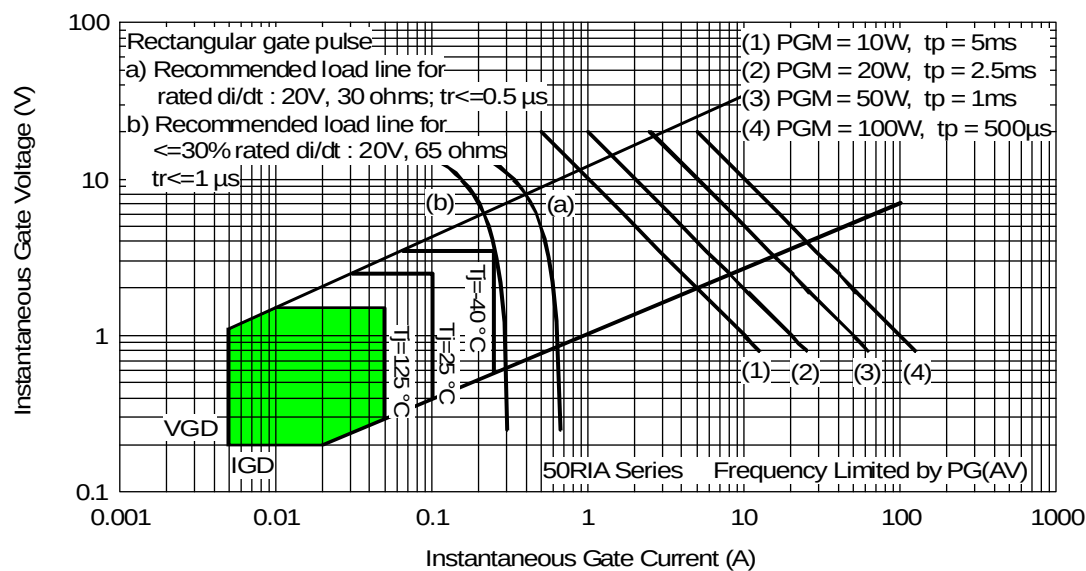


Fig. 16 - Gate Characteristics