Bulletin I27105 rev. A 09/97

International
IOR Rectifier

T..RIA SERIES

MEDIUM POWER PHASE CONTROL THYRISTORS

Power Modules

50 A
70 A
90 A

Features

- Electrically isolated base plate
- Types up to 1600 V_{RRM}
- 3500 V_{RMS} isolating voltage
- Simplified mechanical designs, rapid assembly
- High surge capability
- Large creepage distances
- UL E78996 approved

Description

These series of T-modules are inteded for general purpose applications such as battery chargers, welders and plating equipment, regulated power supplies and temperature and speed control circuits. The semiconductors are electrically isolated from the metal base, allowing common heatsinks and compact assemblies to be built.

Major Ratings and Characteristics

Parameters		T50RIA	T70RIA	T90RIA	Units
$I_{T(AV)}$		50	70	90	A
	@ T_C	70	70	70	°C
$I_{T(RMS)}$		80	110	141	A
I_{TSM}	@ 50Hz	1310	1660	1780	A
	@ 60Hz	1370	1740	1870	A
I^2t	@ 50Hz	8550	13860	15900	A^2s
	@ 60Hz	7800	12650	14500	A^2s
$I^2\sqrt{t}$		85500	138500	159100	$A^2\sqrt{s}$
V_{DRM}/V_{RRM}		100 to 1200			V
T_J		-40 to 125			°C

ELECTRICAL SPECIFICATIONS

Voltage Ratings

Type number	Voltage Code	V_{DRM}/V_{RRM}, maximum repetitive peak reverse voltage V	V_{RSM}, maximum non-repetitive peak reverse voltage V	I_{DRM}/I_{RRM} max. @ 25°C µA
T50RIA T70RIA T90RIA	10	100	150	100
	20	200	300	
	40	400	500	
	60	600	700	
	80	800	900	
	100	1000	1100	
	120	1200	1300	

On-state Conduction

	Parameter	T50RIA	T70RIA	T90RIA	Units	Conditions		
$I_{T(AV)}$	Max. average on-state current	50	70	90	A	180° conduction, half sine wave		
	@ Case temperature	70	70	70	°C			
$I_{T(RMS)}$	Max. RMS on-state current	80	110	141	A			
I_{TSM}	Maximum peak, one-cycle on-state, non-repetitive surge current	1310	1660	1780	A	t = 10ms	No voltage	Sine half wave, Initial $T_J = T_J$ max.
		1370	1740	1870		t = 8.3ms	reapplied	
		1100	1400	1500		t = 10ms	100% V_{RRM}	
		1150	1460	1570		t = 8.3ms	reapplied	
I^2t	Maximum I^2t for fusing	8550	13860	15900	A^2s	t = 10ms	No voltage	
		7800	12650	14500		t = 8.3ms	reapplied	
		6050	9800	11250		t = 10ms	100% V_{RRM}	
		5520	8950	10270		t = 8.3ms	reapplied	
$I^2\sqrt{t}$	Maximum $I^2\sqrt{t}$ for fusing	85500	138500	159100	$A^2\sqrt{s}$	t = 0.1 to 10ms, no voltage reapplied		
$V_{T(TO)1}$	Low level value of threshold voltage	0.97	0.77	0.78	V	(16.7% x π x $I_{T(AV)}$ < I < π x $I_{T(AV)}$), @ T_J max.		
$V_{T(TO)2}$	High level value of threshold voltage	1.13	0.88	0.88		(I > π x $I_{T(AV)}$), @ T_J max.		
r_{t1}	Low level value on-state slope resistance	4.1	3.6	2.9	mΩ	(16.7% x π x $I_{T(AV)}$ < I < π x $I_{T(AV)}$), @ T_J max.		
r_{t2}	High level value on-state slope resistance	3.3	3.2	2.6		(I > π x $I_{T(AV)}$), @ T_J max.		
V_{TM}	Maximum on-state voltage drop	1.60	1.55	1.55	V	$I_{TM} = \pi$ x $I_{T(AV)}$, T_J = 25°C., tp = 400µs square Av. power = $V_{T(TO)}$ x $I_{T(AV)}$ + r_f x $(I_{T(RMS)})^2$		
I_H	Maximum holding current	200			mA	Anode supply = 6V initial I_T = 30A, T_J = 25°C		
I_L	Maximum latching current	400			mA	Anode supply = 6V resistive load = 10Ω gate pulse: 10V, 100µs, T_J = 25°C		

Switching

	Parameter	T50RIA	T70RIA	T90RIA	Units	Conditions
t_{gd}	Typical turn-on time	0.9			µs	T_J = 25°C Vd = 50% V_{DRM}, I_{TM} = 50 A I_g = 500mA, tr <= 0.5, tp >= 6µs
t_{rr}	Typical reverse recovery time	3.0			µs	T_J =125°C, I_{TM} = 50A tp = 300µs di/dt =10A/µs
t_q	Typical turn-off time	110			µs	$T_J = T_J$ max., I_{TM} = 50A, tp = 300µs, -di/dt = 15A/µs, V_r = 100V; linear to 80%V_{DRM}

Blocking

	Parameter	T50RIA	T70RIA	T90RIA	Units	Conditions
I_{RRM} I_{DRM}	Maximum peak reverse and off-state leakage current	15			mA	$T_J = T_J = T_J$ max.
V_{INS}	RMS isolation voltage	3500			V	50Hz, circuit to base, all terminals shorted, $T_J = 25°C$, t = 1s
dv/dt	Critical rate of rise of off-state voltage	500			V/µs	$T_J = T_J$ max., linear to 80% rated V_{DRM} **(1)**

(1) Available with dv/dt = 1000V/µs, to complete code add S90 i.e. T90RIA80S90

Triggering

	Parameter	T50RIA	T70RIA	T90RIA	Units	Conditions	
P_{GM}	Max. peak gate power	10	12	12	W	tp ≤ 5ms, $T_J = T_J$ max.	
$P_{G(AV)}$	Max. average gate power	2.5	3.0	3.0	W	f=50Hz, $T_J = T_J$ max.	
I_{GM}	Max. peak gate current	2.5	3.0	3.0	A	tp ≤ 5ms, $T_J = T_J$ max.	
$-V_{GT}$	Max. peak negative gate voltage	10	10	10	V		
V_{GT}	Max. required DC gate voltage to trigger	4.0	4.0	4.0	V	T_J = - 40°C	Anode supply = 6V, resistive load; Ra = 1Ω
		2.5	2.5	2.5		T_J = 25°C	
		1.5	1.5	1.5		$T_J = T_J$ max.	
I_{GT}	Max. required DC gate current to trigger	250	270	270	mA	T_J = - 40°C	Anode supply = 6V, resistive load; Ra = 1Ω
		100	120	120		T_J = 25°C	
		50	60	60		$T_J = T_J$ max.	
V_{GD}	Max. gate voltage that will not trigger	0.2	0.2	0.2	V	@ $T_J = T_J$ max., rated V_{DRM} applied	
I_{GD}	Max. gate current that will not trigger	5.0	6.0	6.0	mA		
di/dt	Max. rate of rise of turned-on current	200			A/µs	V_D = 0.67 rated V_{DRM}, I_{TM} = 2 x rated di/dt	
		180				I_g = 400mA for T50RIA and I_g = 500mA for	
		160				T70RIA & T90RIA; tr < 0.5µs, tp >= 6µs	
		150				For repetitive value use 40% non-repetitive Per JEDEC std. RS397,5.2.2.6	

Thermal and Mechanical Specifications

	Parameter		T50RIA	T70RIA	T90RIA	Units	Conditions
T_J	Max. junction operating temperature range		-40 to 125			°C	
T_{stg}	Max. storage temperature range		-40 to 150			°C	
R_{thJC}	Max. thermal resistance, junction to case		0.65	0.50	0.38	K/W	DC operation, per junction
R_{thCS}	Max. thermal resistance, case to heatsink		0.2			K/W	Mounting surface smooth, flat and greased
T	Mounting torque ± 10%	to heatsink	1.3 ± 10%			Nm	M3.5 mounting screws **(2)** non lubricated threads
		terminals	3 ± 10%				M5 screw terminals
wt	Approximate weight		54			g	See outline table
	Case style		D-56				T type

(2) A mounting compound is recommended and the torque should be rechecked after a period of 3 hours to allow for the spread of the compound.

ΔR Conduction (per Junction)

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

Devices	Sinusoidal conduction @ T_J max.					Rectangular conduction @ T_J max.					Units
	180°	120°	90°	60°	30°	180°	120°	90°	60°	30°	
T50RIA	0.08	0.10	0.13	0.19	0.31	0.06	0.10	0.14	0.20	0.32	K/W
T70RIA	0.07	0.08	0.10	0.14	0.24	0.05	0.08	0.11	0.15	0.24	
T90RIA	0.05	0.06	0.08	0.12	0.20	0.04	0.06	0.09	0.12	0.20	

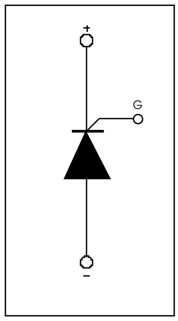
Ordering Information Table

Device Code

T	50	RIA	120
1	2	3	4

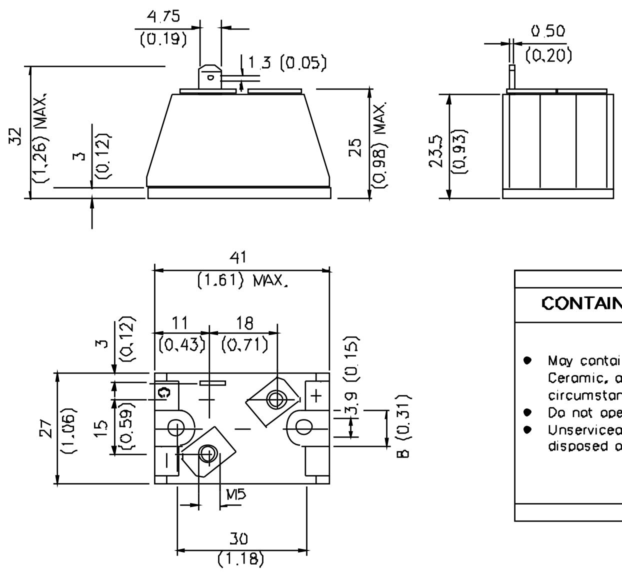
1 - Module type
2 - Current rating
3 - Circuit configuration **
4 - Voltage code : code x 10 = V_{RRM}

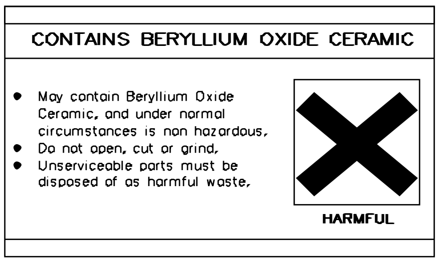
Circuit configuration **



Outline Table

All dimensions in millimeters (inches)





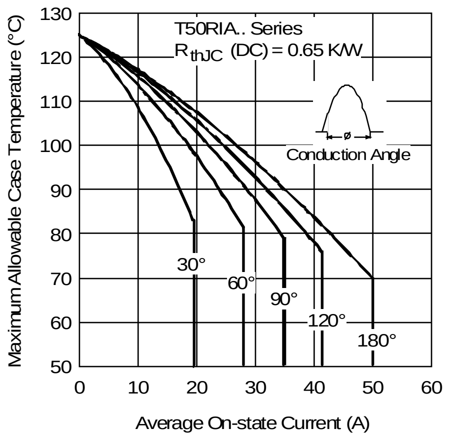


Fig. 1 - Current Ratings Characteristics

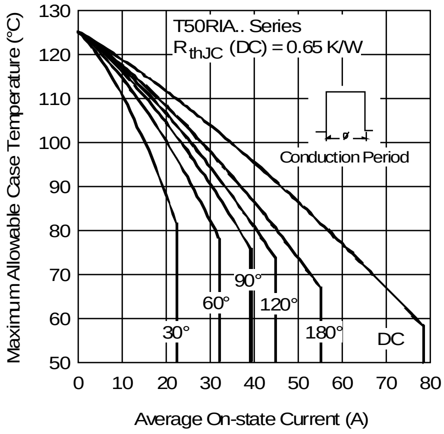


Fig. 2 - Current Ratings Characteristics

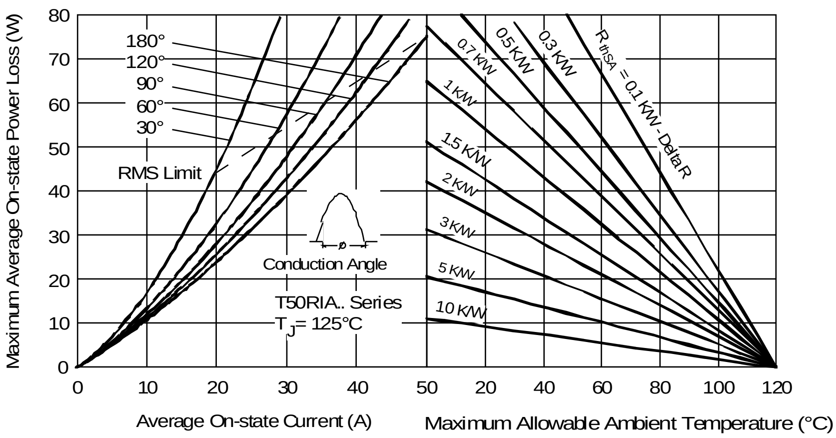


Fig. 3 - On-state Power Loss Characteristics

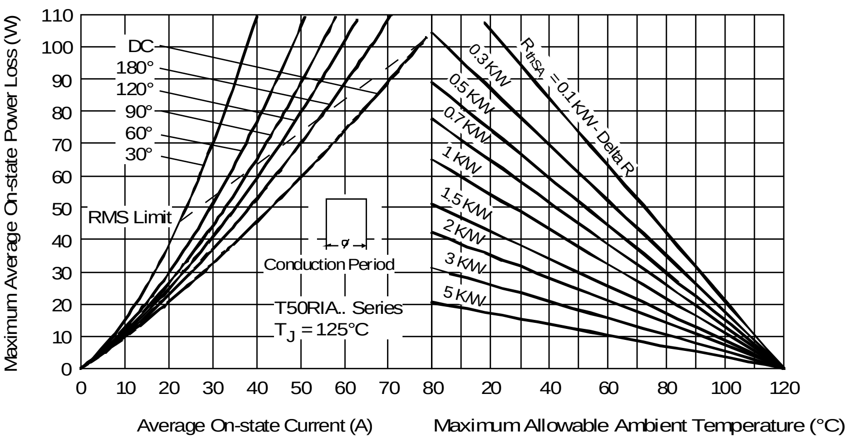


Fig. 4 - On-state Power Loss Characteristics

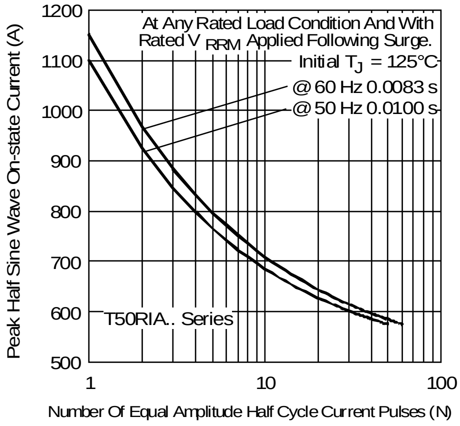


Fig. 5 - Maximum Non-Repetitive Surge Current

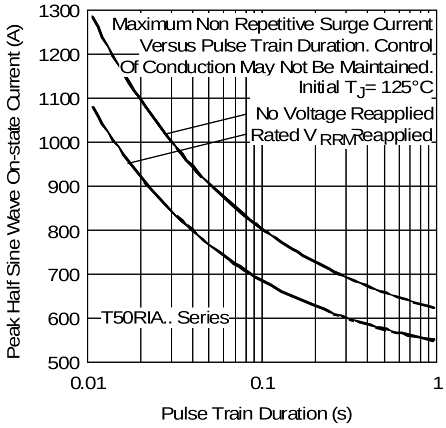


Fig. 6 - Maximum Non-Repetitive Surge Current

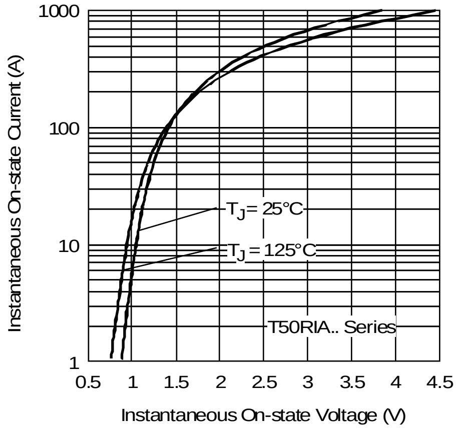


Fig. 10 - On-state Voltage Drop Characteristics

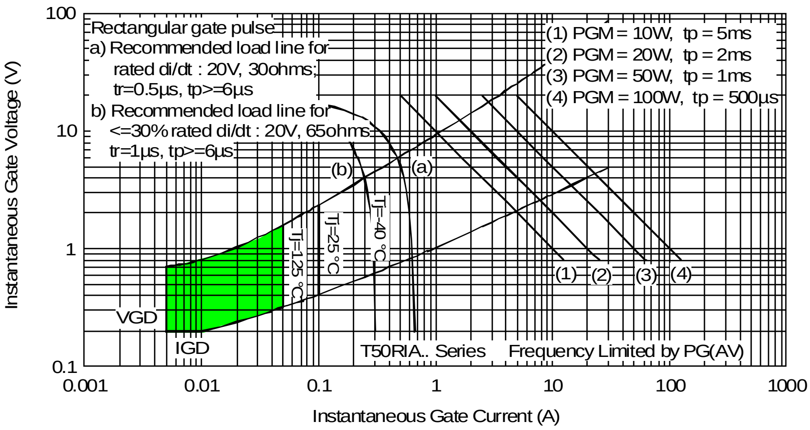


Fig. 9 - Gate Characteristics

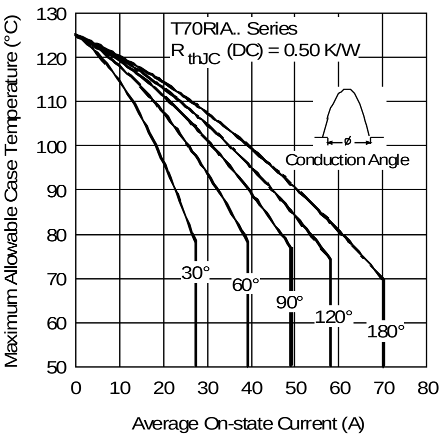


Fig. 12 - Current Ratings Characteristics

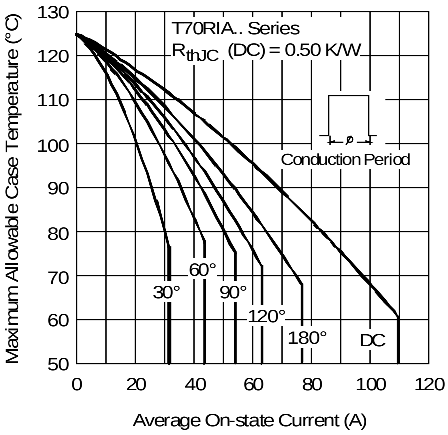


Fig. 13 - Current Ratings Characteristics

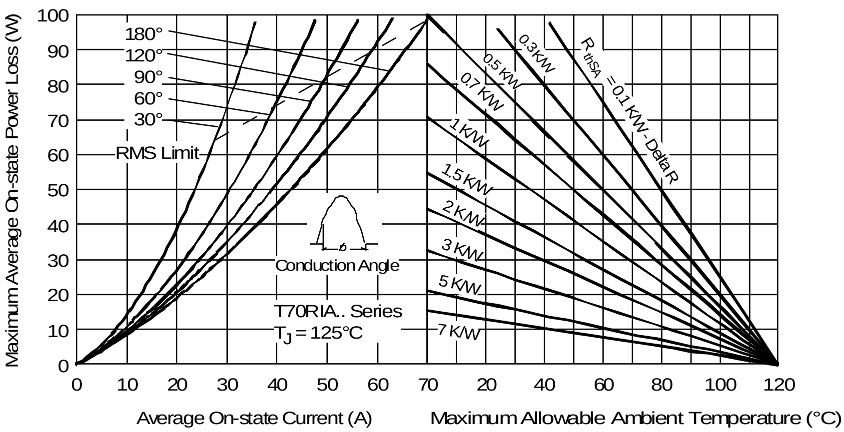


Fig. 18 - On-state Power Loss Characteristics

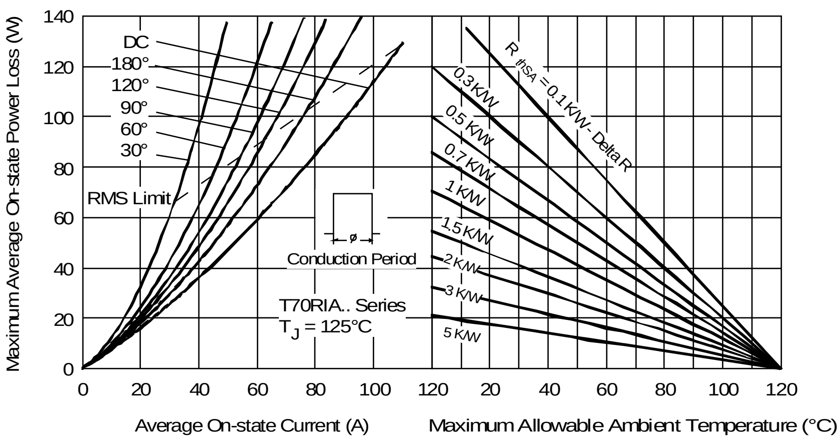


Fig. 15 - On-state Power Loss Characteristics

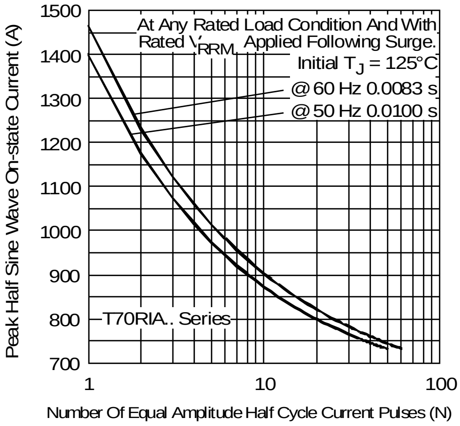


Fig. 16 - Maximum Non-Repetitive Surge Current

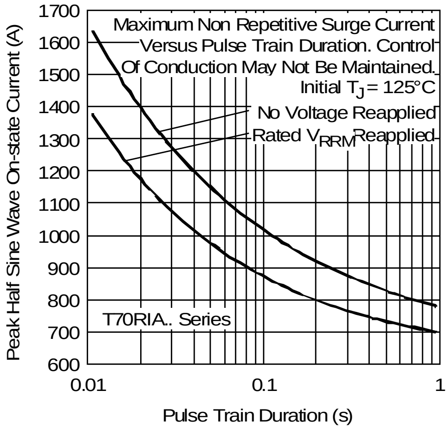


Fig. 17 - Maximum Non-Repetitive Surge Current

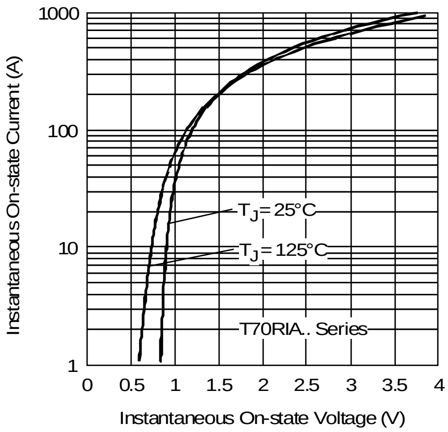


Fig. 10 - On-state Voltage Drop Characteristics

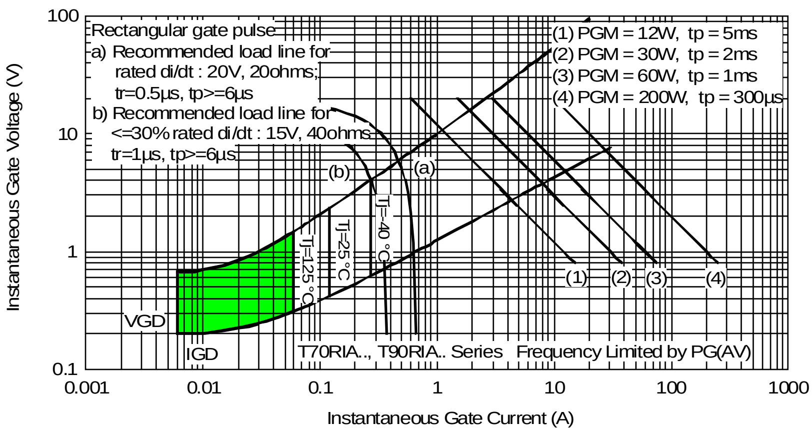


Fig. 19 - Gate Characteristics

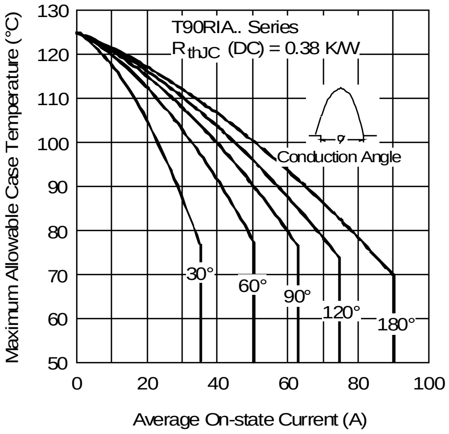


Fig. 23 - Current Ratings Characteristics

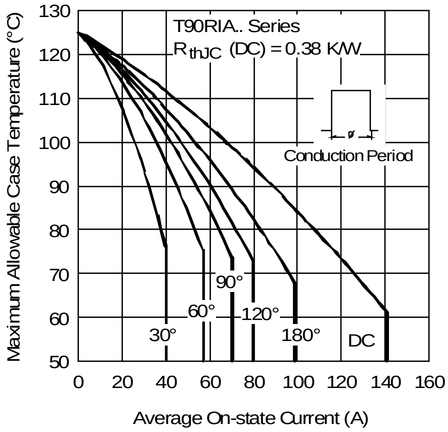


Fig. 24 - Current Ratings Characteristics

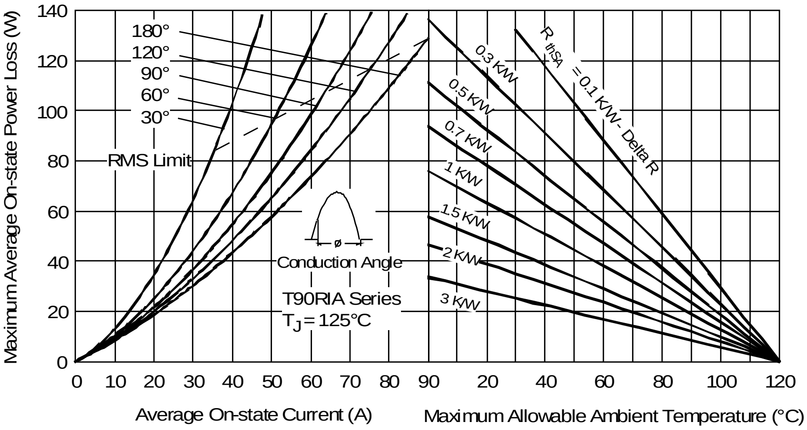


Fig. 29 - On-state Power Loss Characteristics

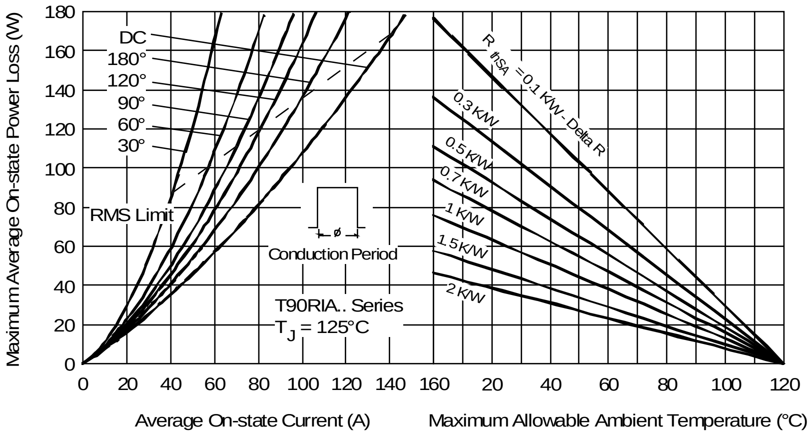


Fig. 29 - On-state Power Loss Characteristics

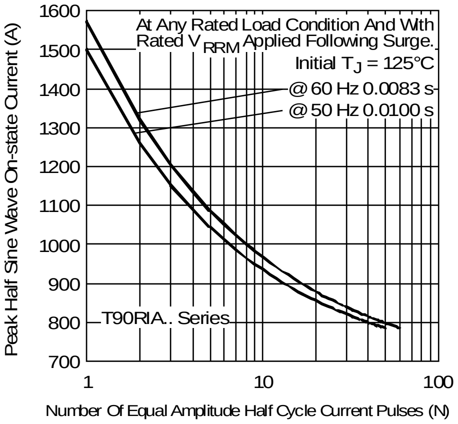


Fig. 27 - Maximum Non-Repetitive Surge Current

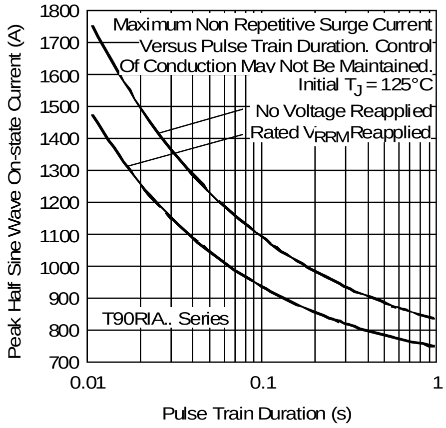


Fig. 28 - Maximum Non-Repetitive Surge Current

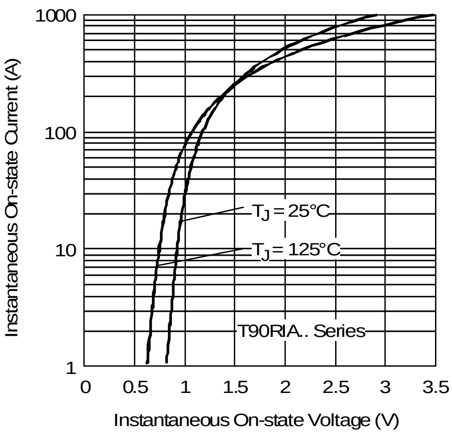


Fig. 21 - On-state Voltage Drop Characteristics

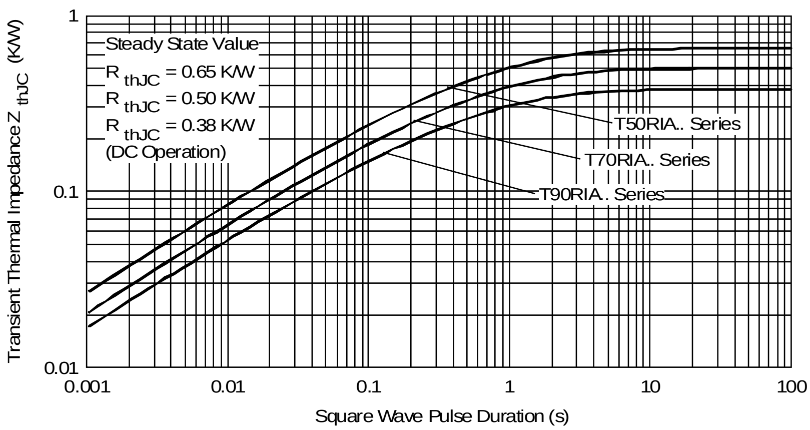


Fig. 34 - Thermal Impedance Z_{thJC} Characteristics