Bulletin I27219 03/06

International
IOR Rectifier

MT..KPbF SERIES

THREE PHASE CONTROLLED BRIDGE **Power Modules**

55 A
90 A
110 A

Features

- Package fully compatible with the industry standard INT-A-pak power modules series
- High thermal conductivity package, electrically insulated case
- Excellent power volume ratio
- 4000 V_{RMS} isolating voltage
- UL E78996 approved
- TOTALLY LEAD-FREE

Description

A range of extremely compact, encapsulated three phase controlled bridge rectifiers offering efficient and reliable operation. They are intended for use in general purpose and heavy duty applications.

Major Ratings and Characteristics

Parameters		53MT.K 52MT.K 51MT.K	93MT.K 92MT.K 91MT.K	113MT.K 112MT.K 111MT.K	Units
I_O		55	90	110	A
	@ T_C	85	85	85	°C
I_{FSM}	@ 50Hz	390	950	1130	A
	@ 60Hz	410	1000	1180	A
I^2t	@ 50Hz	770	4525	6380	A^2s
	@ 60Hz	700	4130	5830	A^2s
$I^2\sqrt{t}$		7700	45250	63800	$A^2\sqrt{s}$
V_{RRM}	range	800 to 1600			V
T_{STG}	range	-40 to 125			°C
T_J	range	-40 to 125			°C

ELECTRICAL SPECIFICATIONS

Voltage Ratings

Type number	Voltage Code	V_{RRM}, maximum repetitive peak reverse voltage V	V_{RSM}, maximum non-repetitive peak reverse voltage V	V_{DRM}, max. repetitive peak off-state voltage gate open circuit V	I_{RRM}/I_{DRM} max. @ T_J = 125°C mA
53/52/51MT..K	80	800	900	800	10
	100	1000	1100	1000	
	120	1200	1300	1200	
	140	1400	1500	1400	
	160	1600	1700	1600	
93/92/91MT..K 113/112/111MT..K	80	800	900	800	20
	100	1000	1100	1000	
	120	1200	1300	1200	
	140	1400	1500	1400	
	160	1600	1700	1600	

Forward Conduction

	Parameter	53MT.K 52MT.K 51MT.K	93MT.K 92MT.K 91MT.K	113MT.K 112MT.K 111MT.K	Units	Conditions		
I_O	Maximum DC output current	55	90	110	A	120° Rect conduction angle		
	@ Case temperature	85	85	85	°C			
I_{TSM}	Maximum peak, one-cycle	390	950	1130	A	t = 10ms	No voltage	Initial $T_J = T_J$ max.
	forward, non-repetitive	410	1000	1180		t = 8.3ms	reapplied	
	on state surge current	330	800	950		t = 10ms	100% V_{RRM}	
		345	840	1000		t = 8.3ms	reapplied	
I^2t	Maximum I^2t for fusing	770	4525	6380	A^2s	t = 10ms	No voltage	
		700	4130	5830		t = 8.3ms	reapplied	
		540	3200	4510		t = 10ms	100% V_{RRM}	
		500	2920	4120		t = 8.3ms	reapplied	
$I^2\sqrt{t}$	Maximum $I^2\sqrt{t}$ for fusing	7700	45250	63800	$A^2\sqrt{s}$	t = 0.1 to 10ms, no voltage reapplied		
$V_{T(TO)1}$	Low level value of threshold voltage	1.17	1.09	1.04	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	1.45	1.27	1.27		(I > π x $I_{T(AV)}$), @ T_J max.		
r_{t1}	Low level value on-state slope resistance	12.40	4.10	3.93	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	11.04	3.59	3.37		(I > π x $I_{T(AV)}$), @ T_J max.		
V_{TM}	Maximum on-state voltage drop	2.68	1.65	1.57	V	I_{pk} = 150A, T_J = 25°C t_p = 400µs single junction		
di/dt	Max. non-repetitive rate of rise of turned on current	150			A/µs	T_J = 25°C, from 0.67 V_{DRM}, I_{TM} = π x $I_{T(AV)}$, I_g = 500mA, t_r < 0.5 µs, t_p > 6 µs		
I_H	Max. holding current	200			mA	T_J = 25°C, anode supply = 6V, resistive load, gate open circuit		
I_L	Max. latching current	400				T_J = 25°C, anode supply = 6V, resistive load		

Blocking

	Parameter	53MT.K 52MT.K 51MT.K	93MT.K 92MT.K 91MT.K	113MT.K 112MT.K 111MT.K	Units	Conditions
V_{INS}	RMS isolation voltage	4000			V	T_J = 25°C all terminal shorted f = 50Hz, t = 1s
dv/dt	Max. critical rate of rise of off-state voltage (*)	500			V/µs	T_J = T_J max., linear to 0.67 V_{DRM}, gate open circuit

(*) Available with dv/dt = 1000V/ms, to complete code add S90 i.e. 113MT160KBS90.

Triggering

	Parameter	53MT.K 52MT.K 51MT.K	93MT.K 92MT.K 91MT.K	113MT.K 112MT.K 111MT.K	Units	Conditions	
P_{GM}	Max. peak gate power	10			W	T_J = T_J max.	
$P_{G(AV)}$	Max. average gate power	2.5					
I_{GM}	Max. peak gate current	2.5			A		
$-V_{GT}$	Max. peak negative gate voltage	10			V		
V_{GT}	Max. required DC gate voltage to trigger	4.0			V	T_J = -40°C	
		2.5				T_J = 25°C	Anode supply = 6V, resistive load
		1.7				T_J = 125°C	
I_{GT}	Max. required DC gate current to trigger	270			mA	T_J = -40°C	
		150				T_J = 25°C	Anode supply = 6V, resistive load
		80				T_J = 125°C	
V_{GD}	Max. gate voltage that will not trigger	0.25			V	@ T_J = T_J max., rated V_{DRM} applied	
I_{GD}	Max. gate current that will not trigger	6			mA		

Thermal and Mechanical Specifications

	Parameter		53MT.K 52MT.K 51MT.K	93MT.K 92MT.K 91MT.K	113MT.K 112MT.K 111MT.K	Units	Conditions
T_J	Max. junction 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		0.18	0.14	0.12	K/W	DC operation per module
			1.07	0.86	0.70		DC operation per junction
			0.19	0.15	0.12		120° Rect conduction angle per module
			1.17	0.91	0.74		120° Rect conduction angle per junction
R_{thCS}	Max. thermal resistance, case to heatsink		0.03			K/W	Per module Mounting surface smooth, flat an greased
T	Mounting torque ± 10%	to heatsink	4 to 6			Nm	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. Lubricated threads.
		to terminal	3 to 4				
wt	Approximate weight		225			g	

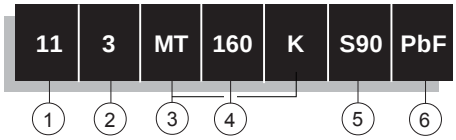
ΔR Conduction (per Junction)

(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°	
53/52/51MT.K	0.072	0.085	0.108	0.152	0.233	0.055	0.091	0.117	0.157	0.236	K/W
93/92/91MT.K	0.033	0.039	0.051	0.069	0.099	0.027	0.044	0.055	0.071	0.100	
113/112/111MT.K	0.027	0.033	0.042	0.057	0.081	0.023	0.037	0.046	0.059	0.082	

Ordering Information Table

Device Code



1 - Current rating code: 5 = 55 A (Avg)
9 = 90 A (Avg)
11 = 110 A (Avg)

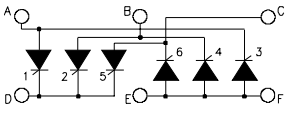
2 - Circuit configuration code: 3 = Full-controlled bridge
2 = Positive half-controlled bridge
1 = Negative half-controlled bridge

3 - Essential part number

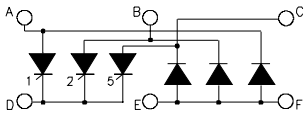
4 - Voltage code: Code x 10 = V_{RRM} (See Voltage Ratings Table)

5 - Critical dv/dt: None = 500V/μs (Standard value)
S90 = 1000V/μs (Special selection)

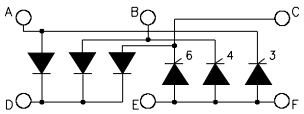
6 - PbF = Lead-Free



full-controlled bridge
(53, 93, 113MT..K)



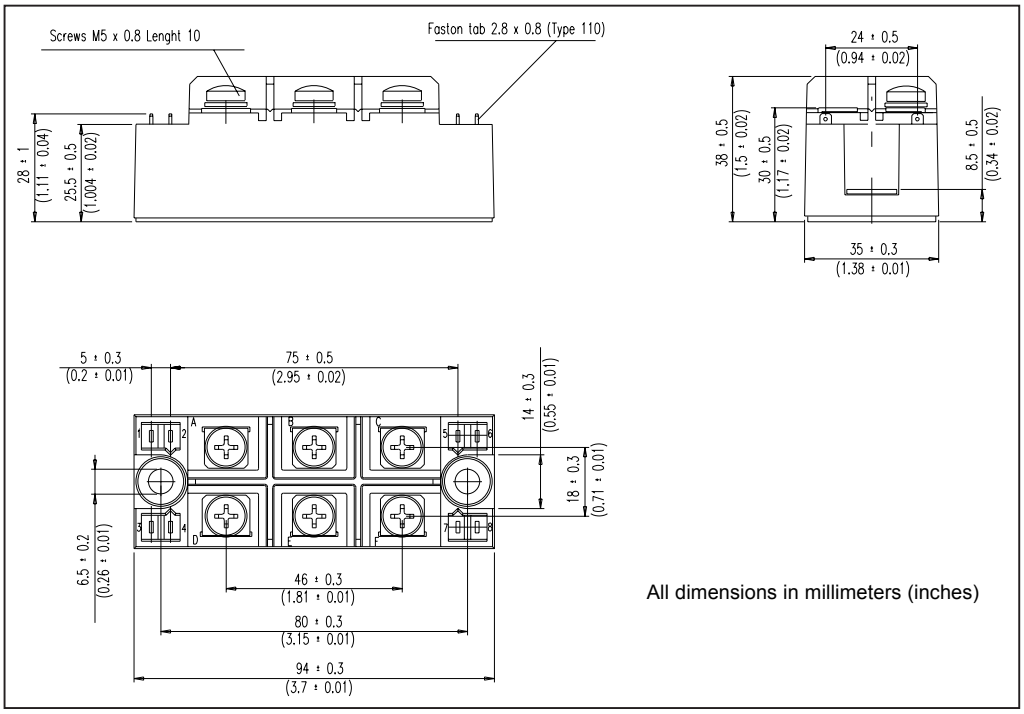
positive half-controlled bridge
(52, 92, 112MT..K)



negative half-controlled bridge
(51, 91, 111MT..K)

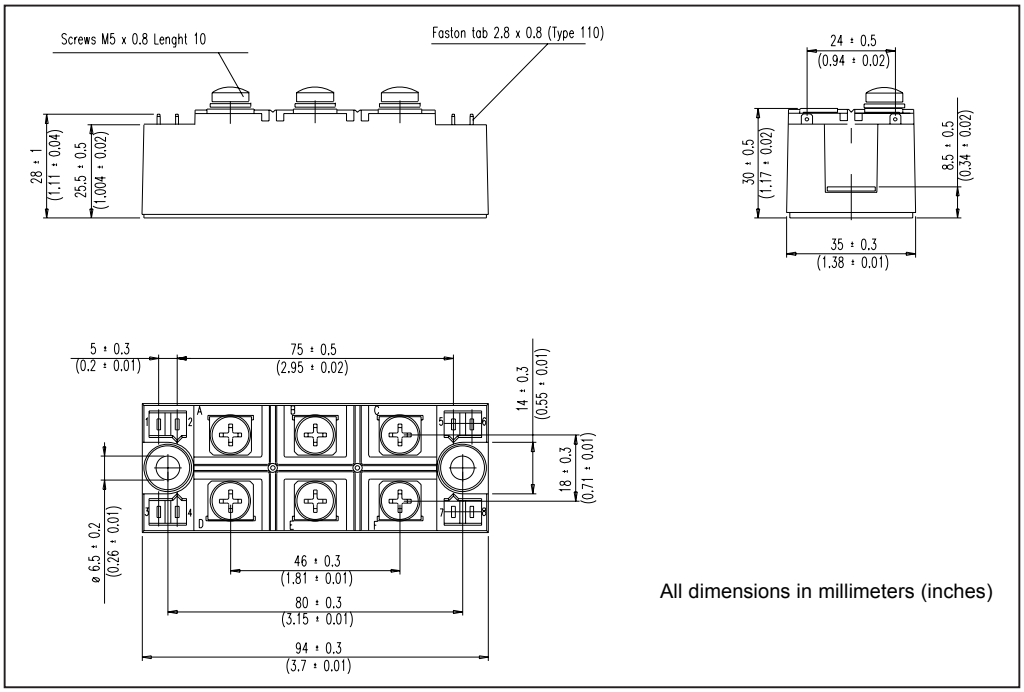
NOTE: To order the Optional Hardware see Bulletin I27900

Outline Table (with optional barriers)



All dimensions in millimeters (inches)

Outline Table (without optional barriers)



All dimensions in millimeters (inches)

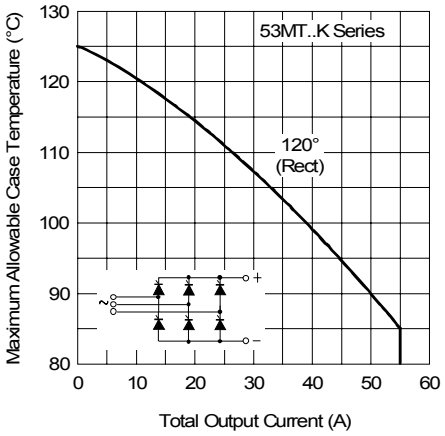


Fig. 1 - Current Ratings Characteristic

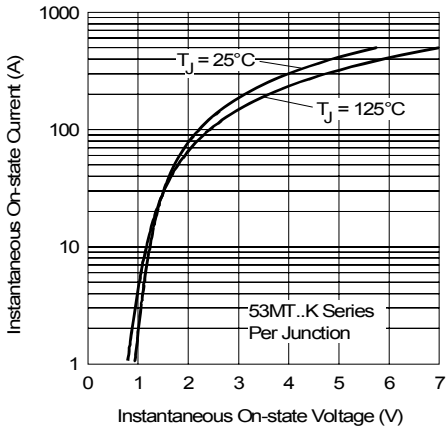


Fig. 2 - Forward Voltage Drop Characteristics

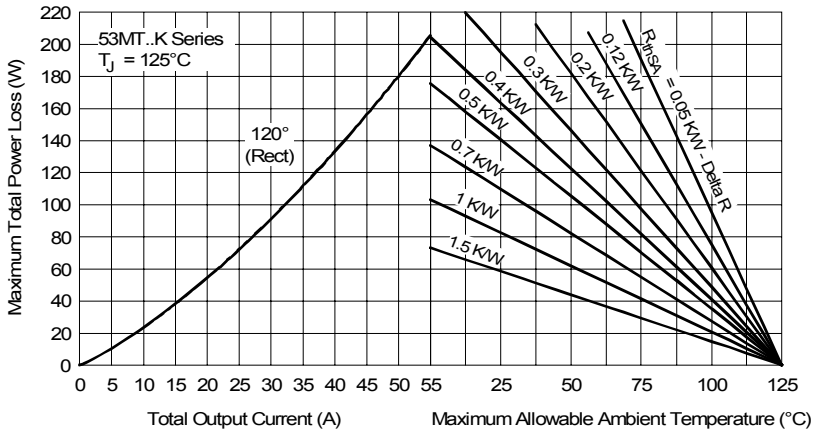


Fig. 3 - Total Power Loss Characteristics

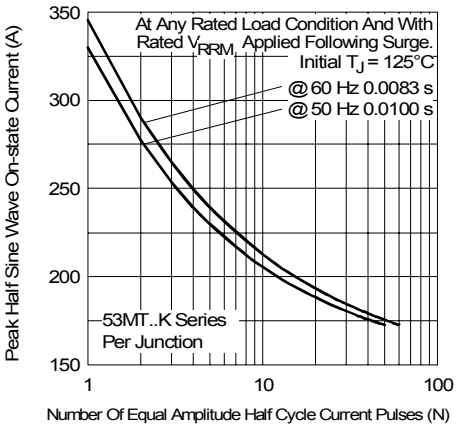


Fig. 4 - Maximum Non-Repetitive Surge Current

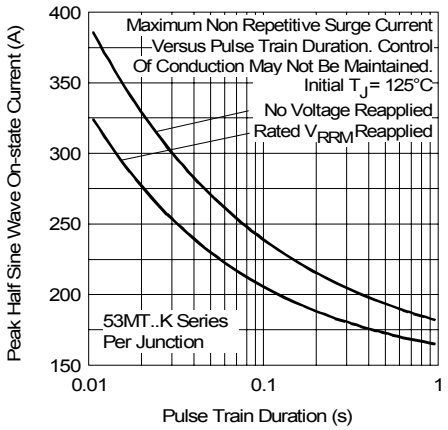


Fig. 5 - Maximum Non-Repetitive Surge Current

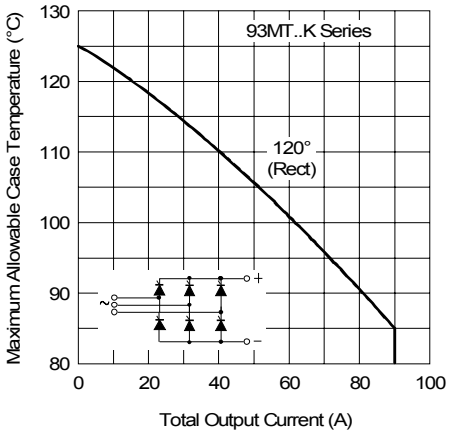


Fig. 6 - Current Ratings Characteristic

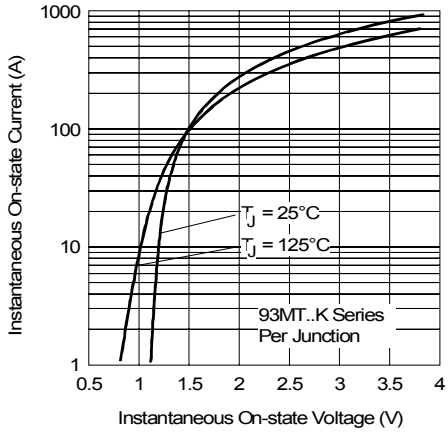


Fig. 7 - Forward Voltage Drop Characteristics

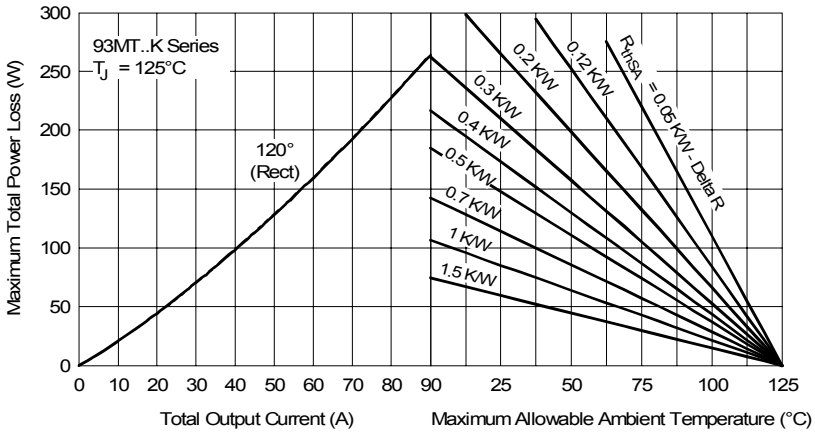


Fig. 8 - Total Power Loss Characteristics

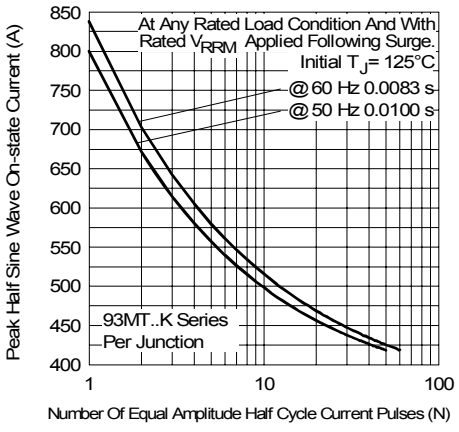


Fig. 9 - Maximum Non-Repetitive Surge Current

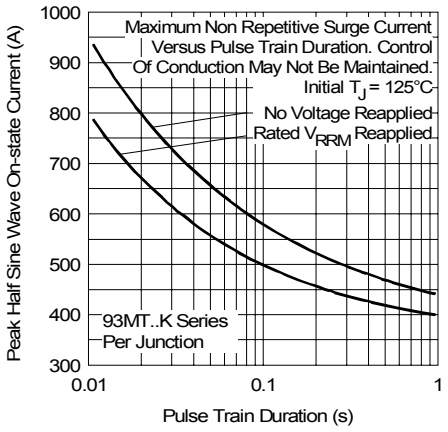


Fig. 10 - Maximum Non-Repetitive Surge Current

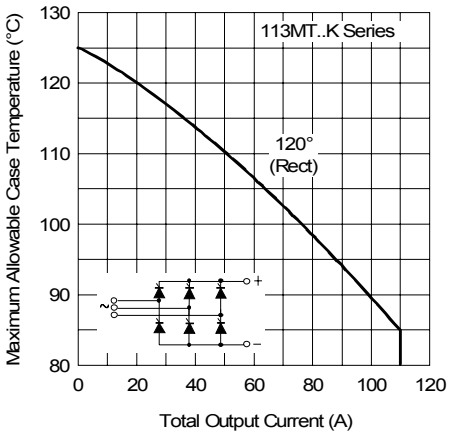


Fig. 11 - Current Ratings Characteristic

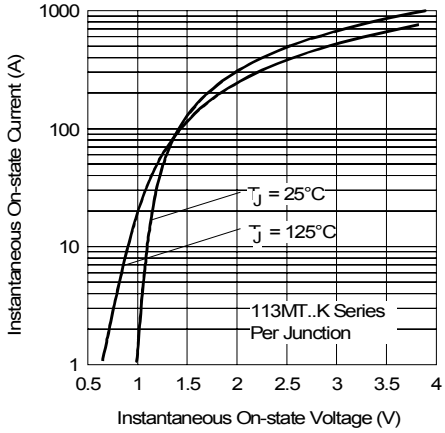


Fig. 12 - Forward Voltage Drop Characteristics

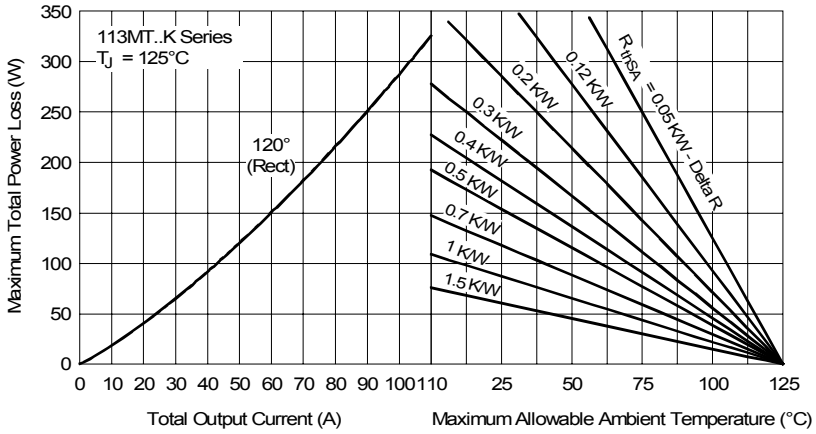


Fig. 13 - Total Power Loss Characteristics

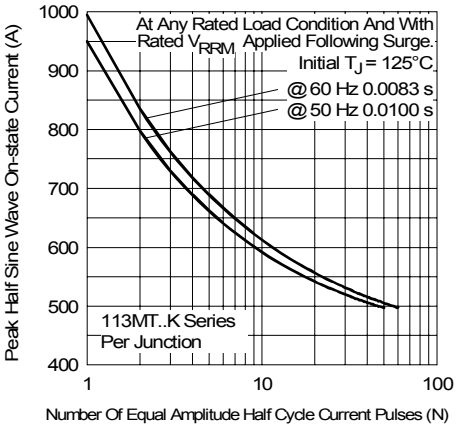


Fig. 14 - Maximum Non-Repetitive Surge Current

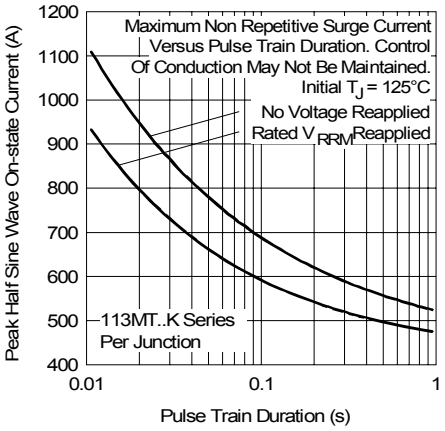


Fig. 15 - Maximum Non-Repetitive Surge Current

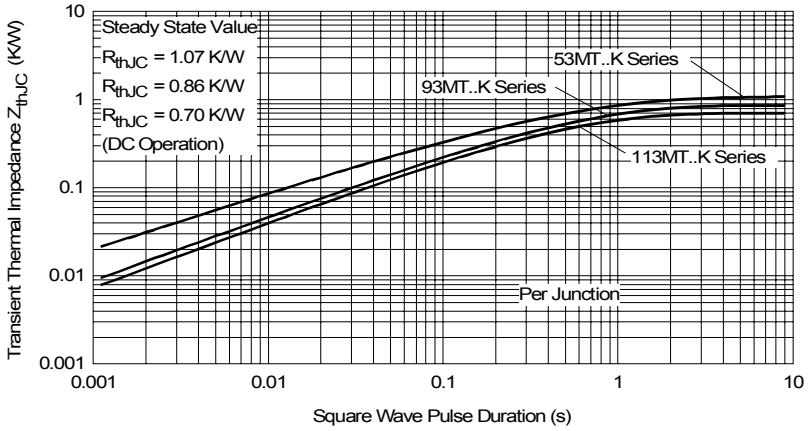


Fig. 16 - Thermal Impedance Z_{thJC} Characteristics

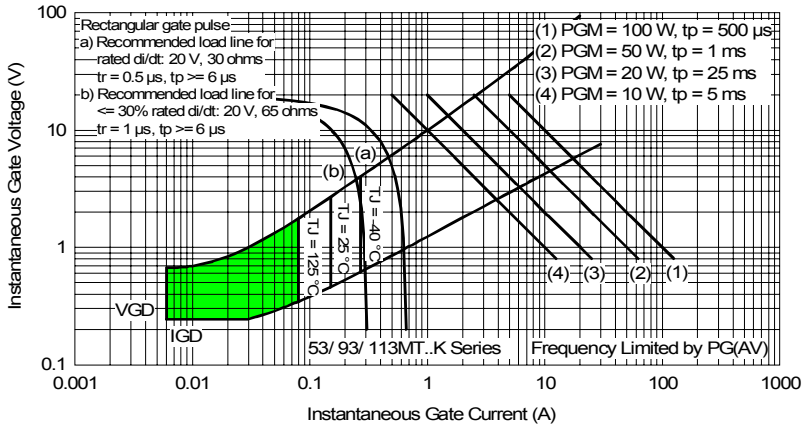


Fig. 17 - Gate Characteristics

Data and specifications subject to change without notice.
This product has been designed and qualified for Industrial Level and Lead-Free.
Qualification Standards can be found on IR's Web site.

International
IOR Rectifier

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