International
IOR Rectifier

SERIES MT-K

THREE PHASE CONTROLLED BRIDGE

Power Modules

55A
90A
110A

Features

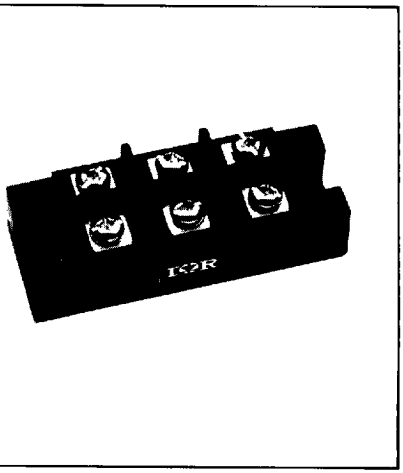
- Package fully compatible with the industry standard INT-A-pak power modules series
- High thermal conductivity package, electrically insulated case
- Outstanding number of power encapsulated components
- Excellent power volume ratio, outline for easy connections to power transistor modules
- 4000 V_{RMS} isolating voltage

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
V_{RRM} range		800 to 1600			V
T_J		-40 to 125			°C



ELECTRICAL SPECIFICATIONS

Voltage Ratings

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

On-state Conduction

	Parameters	53MT 52MT 51MT	93MT 92MT 91MT	113MT 112MT 111MT	Units	Conditions	
I_O	Maximum DC output current	55	90	110	A	120°C Rect Conduction angle	
		85	85	85	°C		
I_{TSM}	Maximum peak one-cycle non-repetitive on-state current Initial $T_J = T_J$ max.	390	950	1130	A	t=10ms	No voltage reapplied
		410	1000	1180	A	t=8.3ms	T_J=125°C
		330	800	950	A	t=10ms	100% V_{RRM} reapplied
		345	840	1000	A	t=8.3ms	T_J=125°C
I^2t	Maximum I^2t for fusing Initial $T_J = T_J$ max.	770	4525	6380	A^2s	t=10ms	No voltage reapplied
		700	4130	5830	A^2s	t=8.3ms	T_J=125°C
		540	3200	4510	A^2s	t=10ms	100% V_{RRM} reapplied
		500	2920	4120	A^2s	t=8.3ms	T_J=125°C
$I^2\sqrt{t}$	Maximum $I^2\sqrt{t}$ for fusing	7700	45250	63800	$A^2\sqrt{s}$	I^2t for time $t_x = I^2\sqrt{t} \times \sqrt{t_x}$; $0.1 \le t_x \le 10ms$, V_{RRM} = 0V	
$V_{F(TO)1}$	Low-level of threshold voltage	1.17	1.09	1.04	V	T_J=125°C, $(16.7\% \times \pi \times I_{(AV)} < I < \pi \times I_{(AV)})$	
$V_{F(TO)2}$	High-level of threshold voltage	1.45	1.27	1.27	V	T_J=125°C, $(\pi \times I_{(AV)} < I < 20 \times \pi \times I_{(AV)})$	
r_{t1}	Low-level on-state slope resist.	12.40	4.10	3.93	mΩ	T_J=125°C, $(16.7\% \times \pi \times I_{(AV)} < I < \pi \times I_{(AV)})$	
r_{t2}	High-level on-state slope resist.	11.04	3.59	3.37	mΩ	T_J=125°C, $(\pi \times I_{(AV)} < I < 20 \times \pi \times I_{(AV)})$	
V_{TM}	Max. on-state voltage drop	2.68	1.65	1.57	V	T_J=25°C, I_{TM}=150A_{pk} Per single Junction tp=400µs	
$di/_{dt}$	Max. non-repetitive rate of rise of turned on current	150			A/µs	T_J=25°C, from 0.67 V_{DRM} $I_{TM} = \pi \times I_{(AV)}$, I_g=500mA, t_r < 0.5µs, t_p > 6µs	
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			mA	T_J=25°C, anode supply=6V	

Blocking

I_{RRM} I_{DRM}	Max. peak leakage current	100	µA	T_J=25°C, per junction at rated V_{RRM}
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 rated V_{DRM} gate open circuit *

* Available with $dv/_{dt}$ = 1000 V/µs

Triggering INTERNATIONAL RECTIFIER 65E D

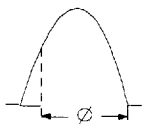
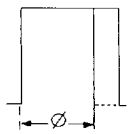
Parameters		53MT 52MT 51MT	93MT 92MT 91MT	113MT 112MT 111MT	Units	Conditions	
P_{GM}	Maximum peak gate power	8	10	10	W	$T_J = T_J$ max.	
$P_{G(AV)}$	Maximum average gate power	2	2 5	2.5	W	$T_J = T_J$ max	
$+I_{GM}$	Maximum peak gate current	1.5	2 5	2.5	A	$T_J = T_J$ max.	
$-V_{GT}$	Max. peak negative gate volt.	10	10	10	V	$T_J = T_J$ max.	
V_{GT}	Maximum required DC gate voltage to trigger	3	4	4	V	T_J = - 40°C	Anode supply = 6V, resistive load
		2	2.5	2.5	V	T_J = 25°C	
		1	1.5	1.5	V	$T_J = T_J$ max.	
I_{GT}	Maximum required DC gate current to trigger	90	250	250	mA	T_J = - 40°C	Anode supply = 12V, resistive load
		60	100	100	mA	T_J = 25°C	
		35	50	50	mA	$T_J = T_J$ max	
V_{GD}	Maximum gate voltage that will not trigger	0.2	0.25	0.25	V	@ $T_J = T_J$ max., rated V_{DRM} applied	
I_{GD}	Maximum gate current that will not trigger	2	6	6	mA	@ $T_J = T_J$ max., rated V_{DRM} applied	

Thermal and Mechanical Specifications

T_J	Max. junction temp. range	-40 to 125			°C		
T_{stg}	Max. storage temp. range	-40 to 125			°C		
R_{thJC}	Max. thermal resistance junction to case	0.179	0.144	0.117	K/W	DC operation per module	
		1.074	0.864	0.702	K/W	DC operation per junction	
		0.194	0.151	0.123	K/W	120° Rect cond. angle per module	
		1.165	0.908	0.739	K/W	120° Rect cond. angle per junction	
R_{thCS}	Max. thermal resistance, case to heatsink	0.033			K/W	Per module. Mounting surface smooth, flat and greased.	
wt	Approximate weight	225			g	A mounting compound is recommended and the tourque should be rechecked after a period of about 3 hours to allow for the spread of the compound. Lubricated threads.	
T	Mounting heatsink	4 to 6			Nm		
	Torque ± 10% terminal	3 to 4			Nm		

ΔR Conduction (per Junction)

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

Parameters		53MT 52MT 51MT	93MT 92MT 91MT	113MT 112MT 111MT	Units	Conditions
	180°	0.072	0.033	0.027	K/W	$T_J = T_J$ max.
	120°	0.085	0.039	0.033	K/W	
	90°	0.108	0.051	0.042	K/W	
	60°	0.152	0.069	0.057	K/W	
	30°	0.233	0.099	0 081	K/W	
	180°	0.055	0.027	0.023	K/W	$T_J = T_J$ max
	120°	0.091	0.044	0.037	K/W	
	90°	0.117	0.055	0.046	K/W	
	60°	0.157	0.071	0.059	K/W	
	30°	0.236	0.100	0.082	K/W	

Ordering Information Table

113 MT 160 K

① ② ③

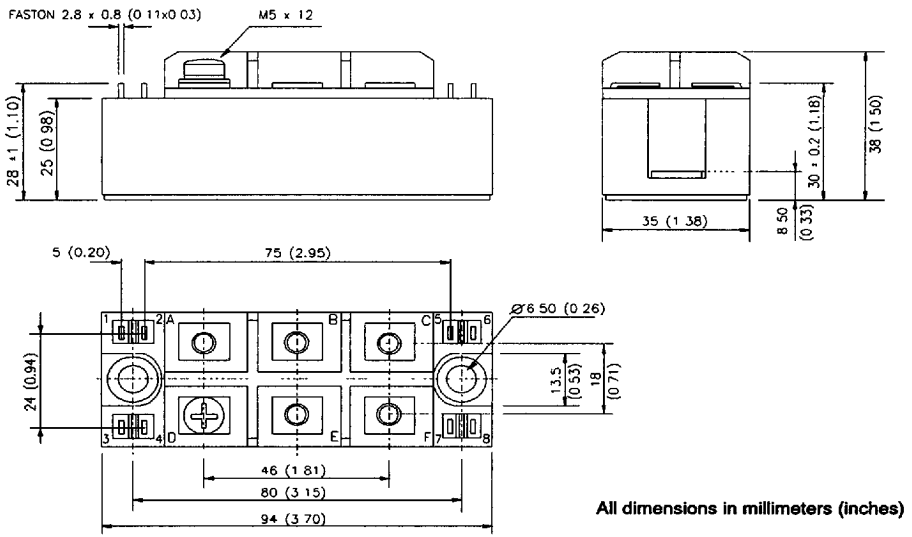
1 - Current rating code:
- --3 MT = three phase controlled bridge
- --2 MT = positive three phase controlled bridge
- --1 MT = negative three phase controlled bridge

53 (52, 51)	= 55 A (Avg)
93 (92, 91)	= 90 A (Avg)
113 (112, 111)	= 110 A (Avg)

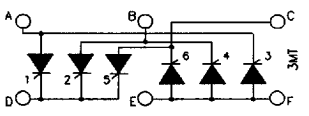
2 - Basic part number

3 - Voltage code (code x 10 = V_{RRM})

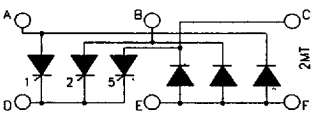
Outline Table



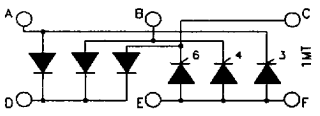
All dimensions in millimeters (inches)



three phase controlled bridge
(53, 93, 113MT..K)



positive three phase controlled bridge
(52, 92, 112MT..K)



negative three phase controlled bridge
(51, 91, 111MT..K)

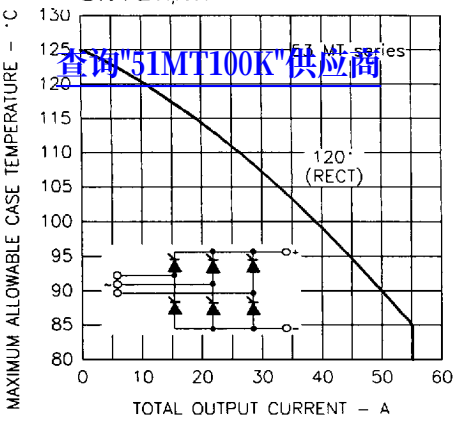


Fig. 1 - Current Ratings Characteristics

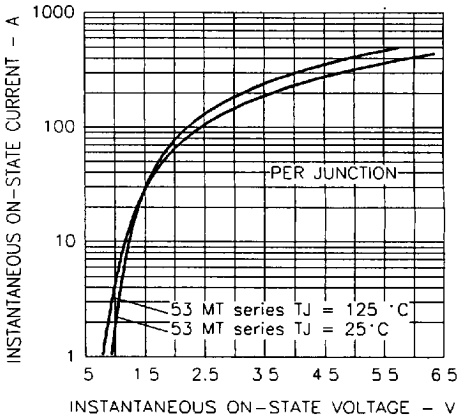


Fig. 2 - Forward Voltage Drop Characteristics

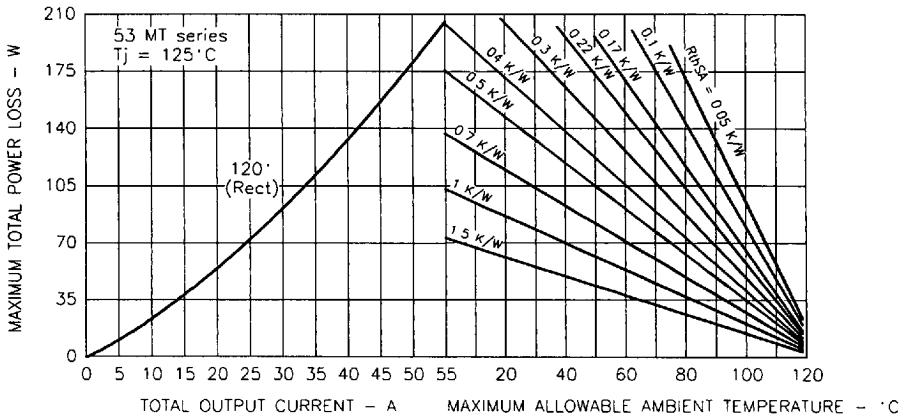


Fig. 3 - Total Power Loss Characteristics

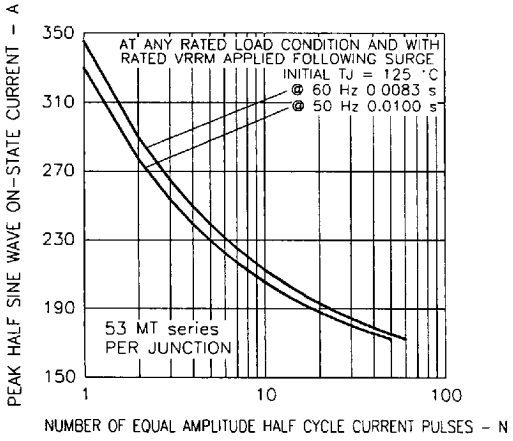


Fig. 4 - Maximum Non-Repetitive Surge Current

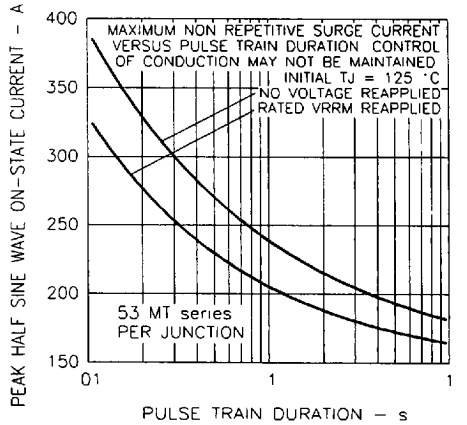


Fig. 5 - Maximum Non-Repetitive Surge Current

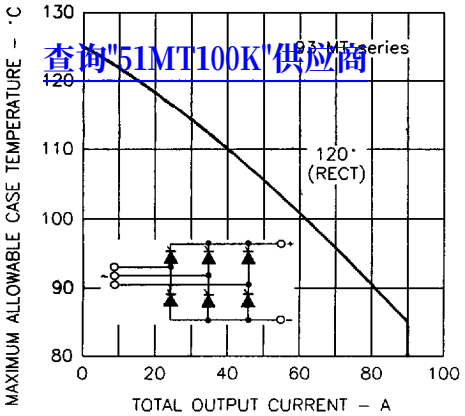


Fig. 6 - Current Ratings Characteristics

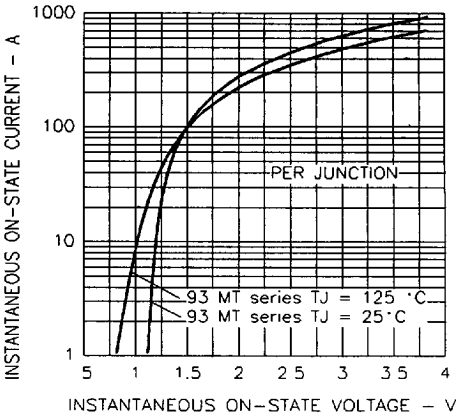


Fig. 7 - Forward Voltage Drop Characteristics

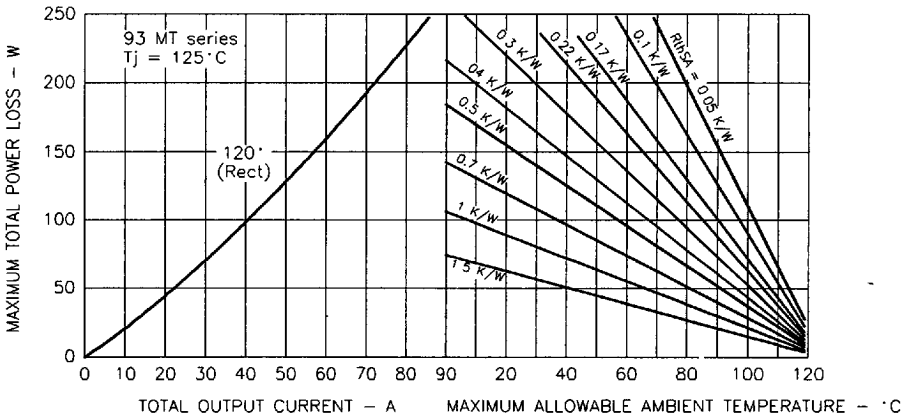


Fig. 8 - Total Power Loss Characteristics

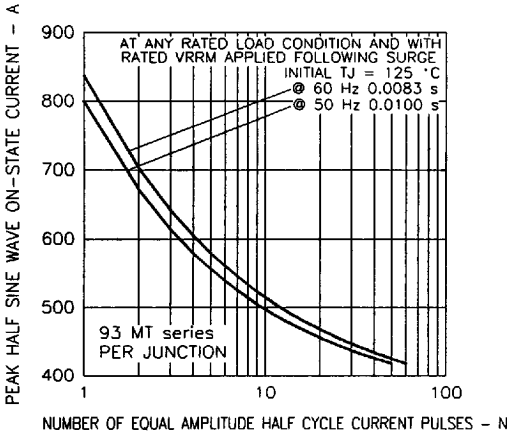


Fig. 9 - Maximum Non-Repetitive Surge Current

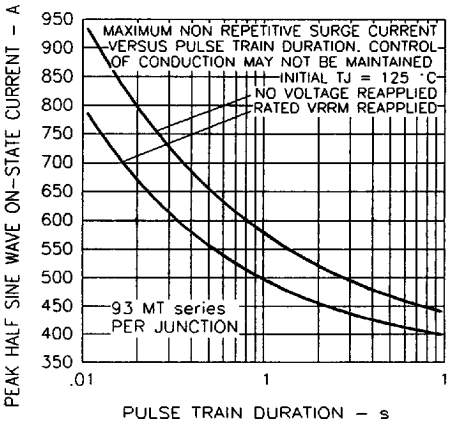


Fig. 10 - Maximum Non-Repetitive Surge Current

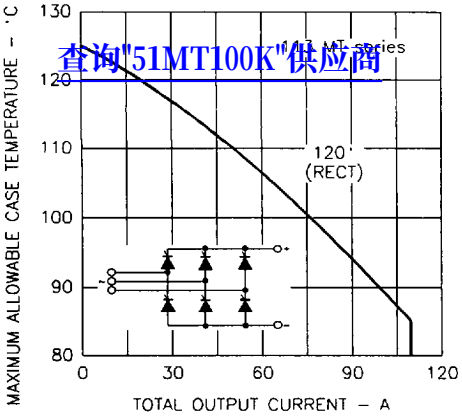


Fig. 11 - Current Ratings Characteristics

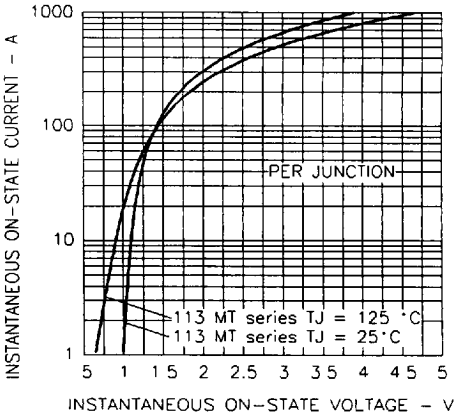


Fig. 12 - Forward Voltage Drop Characteristics

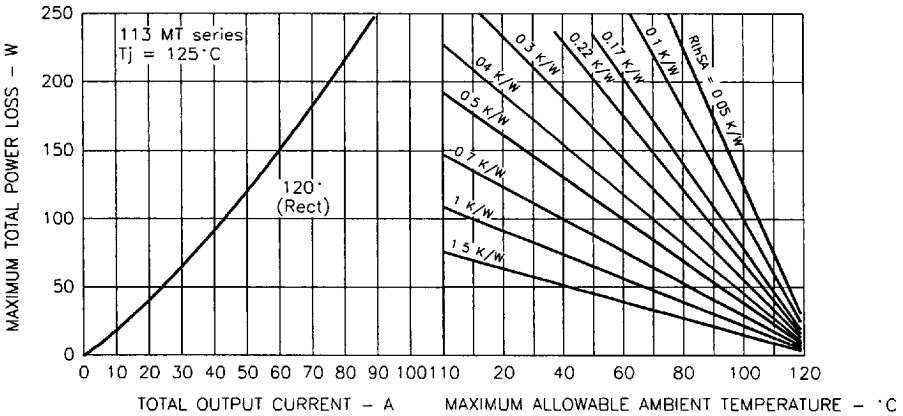


Fig. 13 - Total Power Loss Characteristics

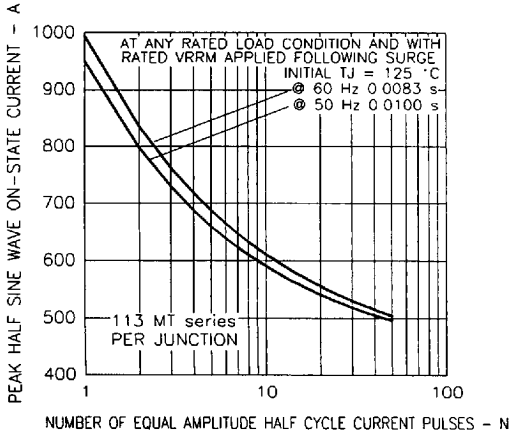


Fig. 14 - Maximum Non-Repetitive Surge Current

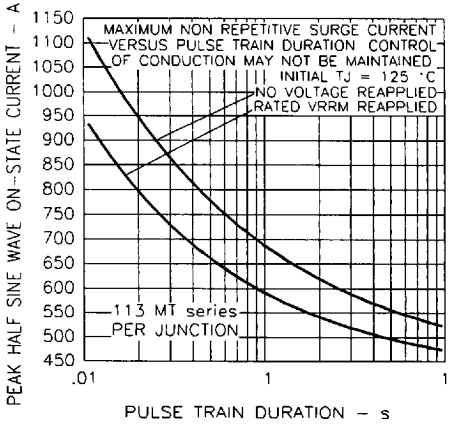


Fig. 15 - Maximum Non-Repetitive Surge Current

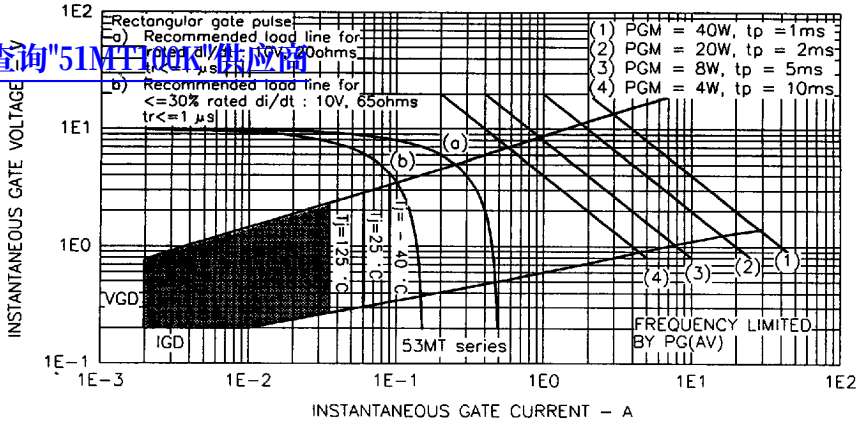


Fig. 17 - Gate Characteristics

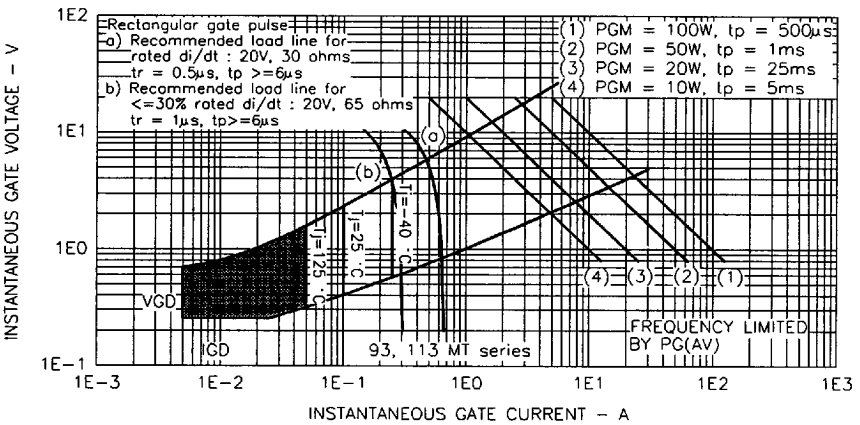


Fig. 18. Gate Characteristics

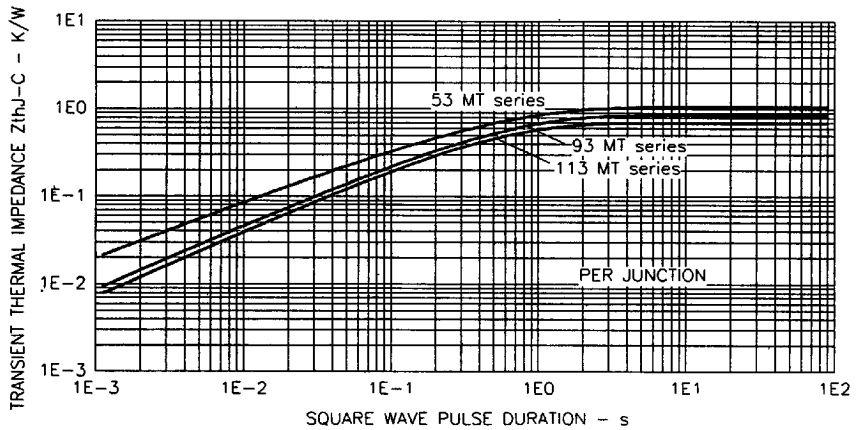


Fig. 19 - Thermal Impedance ZthJC Characteristics