International
IOR Rectifier

IRK.71, .91 SERIES

THYRISTOR/ DIODE and THYRISTOR/ THYRISTOR

ADD-A-pak™ GEN V Power Modules

Features

- High Voltage
- Industrial Standard Package
- Thick Al metal die and double stick bonding
- Thick copper baseplate
- UL E78996 approved
- 3500V_{RMS} isolating voltage

Benefits

- Up to 1600V
- Full compatible TO-240AA
- High Surge capability
- Easy Mounting on heatsink
- Al_2O_3 DBC insulator
- Heatsink grounded

75 A
95 A

Mechanical Description

The Generation V of Add-A-pak module combine the excellent thermal performance obtained by the usage of Direct Bonded Copper substrate with superior mechanical ruggedness, thanks to the insertion of a solid Copper baseplate at the bottom side of the device. The Cu baseplate allow an easier mounting on the majority of heatsink with increased tolerance of surface roughness and improve thermal spread.
The Generation V of AAP module is manufactured without hard mold, eliminating in this way any possible direct stress on the leads.

The electrical terminals are secured against axial pull-out: they are fixed to the module housing via a click-stop feature already tested and proved as reliable on other IR modules.

Electrical Description

These modules are intended for general purpose high voltage applications such as high voltage regulated power supplies, lighting circuits, temperature and motor speed control circuits, UPS and battery charger.

Major Ratings and Characteristics

Parameters	IRK.71	IRK.91	Units
$I_{T(AV)}$ or $I_{F(AV)}$ @ 85°C	75	95	A
$I_{O(RMS)}$ (*)	165	210	A
I_{TSM} @ 50Hz	1665	1785	A
I_{FSM} @ 60Hz	1740	1870	A
I^2t @ 50Hz	13.86	15.91	KA^2s
@ 60Hz	12.56	14.52	KA^2s
$I^2\sqrt{t}$	138.6	159.1	$KA^2\sqrt{s}$
V_{RRM} range	400 to 1600		V
T_{STG}	- 40 to 125		°C
T_J	- 40 to 125		°C

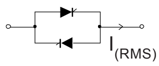
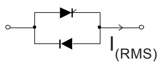
(*) As AC switch.

ELECTRICAL SPECIFICATIONS

Voltage Ratings

Type number	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
	-	V	V	V	mA
IRK.71/ .91	04	400	500	400	15
	06	600	700	600	
	08	800	900	800	
	10	1000	1100	1000	
	12	1200	1300	1200	
	14	1400	1500	1400	
	16	1600	1700	1600	

On-state Conduction

	Parameters	IRK.71	IRK.91	Units	Conditions	
$I_{T(AV)}$ / $I_{F(AV)}$	Max. average on-state current (Thyristors) / Max. average forward current (Diodes)	75	95	A	180° conduction, half sine wave, $T_C = 85°C$	
$I_{O(RMS)}$	Max. continuous RMS on-state current. As AC switch	165	210	A	 or 	
I_{TSM} or I_{FSM}	Max. peak, one cycle non-repetitive on-state or forward current	1665	1785	A	t=10ms No voltage	Sinusoidal half wave, Initial $T_J = T_J$ max.
		1740	1870		t=8.3ms reapplied	
		1400	1500		t=10ms 100% V_{RRM}	
		1470	1570		t=8.3ms reapplied	
		1850	2000		t=10ms $T_J = 25°C$,	
		1940	2100		t=8.3ms no voltage reapplied	
I^2t	Max. I^2t for fusing	13.86	15.91	KA^2s	t=10ms No voltage	Initial $T_J = T_J$ max.
		12.56	14.52		t=8.3ms reapplied	
		9.80	11.25		t=10ms 100% V_{RRM}	
		8.96	10.27		t=8.3ms reapplied	
		17.11	20.00		t=10ms $T_J = 25°C$,	
		15.60	18.30		t= 8.3ms no voltage reapplied	
$I^2\sqrt{t}$	Max. $I^2\sqrt{t}$ for fusing (1)	138.6	159.1	$KA^2\sqrt{s}$	t=0.1 to 10ms, no voltage reapplied, $T_J = T_J$ max	
$V_{T(TO)}$	Max. value of threshold voltage (2)	0.82	0.80	V	Low level (3)	$T_J = T_J$ max
		0.85	0.85		High level (4)	
r_t	Max. value of on-state slope resistance (2)	3.00	2.40	mΩ	Low level (3)	$T_J = T_J$ max
		2.90	2.25		High level (4)	
V_{TM} / V_{FM}	Max. peak on-state or forward voltage	1.59	1.58	V	$I_{TM} = \pi \times I_{T(AV)}$ / $I_{FM} = \pi \times I_{F(AV)}$	$T_J = 25°C$
di/dt	Max. non-repetitive rate of rise of turned on current	150		A/μs	$T_J = 25°C$, from 0.67 V_{DRM}, $I_{TM} = \pi \times I_{T(AV)}$, $I_g = 500mA$, $t_r < 0.5$ μs, $t_p > 6$ μs	
I_H	Max. holding current	250		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, resistive load	

(1) I^2t for time $t_x = I^2\sqrt{t} \times \sqrt{t_x}$ (2) Average power = $V_{T(TO)} \times I_{T(AV)} + r_t \times (I_{T(RMS)})^2$ (3) 16.7% x π x $I_{AV} < I < \pi \times I_{AV}$
(4) $I > \pi \times I_{AV}$

Triggering

	Parameters	IRK.71	IRK.91	Units	Conditions	
P_{GM}	Max. peak gate power	12	12	W		
$P_{G(AV)}$	Max. average gate power	3.0	3.0	W		
I_{GM}	Max. peak gate current	3.0	3.0	A		
$-V_{GM}$	Max. peak negative gate voltage	10		V		
V_{GT}	Max. gate voltage required to trigger	4.0		V	T_J = - 40°C	Anode supply = 6V resistive load
		2.5			T_J = 25°C	
		1.7			T_J = 125°C	
I_{GT}	Max. gate current required to trigger	270		mA	T_J = - 40°C	Anode supply = 6V resistive load
		150			T_J = 25°C	
		80			T_J = 125°C	
V_{GD}	Max. gate voltage that will not trigger	0.25		V	T_J = 125°C, rated V_{DRM} applied	
I_{GD}	Max. gate current that will not trigger	6		mA	T_J = 125°C, rated V_{DRM} applied	

Blocking

	Parameters	IRK.71	IRK.91	Units	Conditions
I_{RRM} I_{DRM}	Max. peak reverse and off-state leakage current at V_{RRM}, V_{DRM}	15		mA	T_J = 125 °C, gate open circuit
V_{INS}	RMS isolation voltage	2500 (1 min) 3500 (1 sec)		V	50 Hz, circuit to base, all terminals shorted
dv/dt	Max. critical rate of rise of off-state voltage (5)	500		V/µs	T_J = 125°C, linear to 0.67 V_{DRM}, gate open circuit

(5) Available with dv/dt = 1000V/µs, to complete code add S90 i.e. IRKT91/16AS90.

Thermal and Mechanical Specifications

	Parameters	IRK.71	IRK.91	Units	Conditions
T_J	Junction operating temperature range	- 40 to 125		°C	
T_{stg}	Storage temp. range	- 40 to 125		°C	
R_{thJC}	Max. internal thermal resistance, junction to case	0.165	0.135	K/W	Per module, DC operation
R_{thCS}	Typical thermal resistance case to heatsink	0.1		K/W	Mounting surface flat, smooth and greased
T	Mounting torque ± 10% to heatsink	5		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
	busbar	3		Nm	
wt	Approximate weight	110 (4)		gr (oz)	
	Case style	TO-240AA		JEDEC	

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	Sine half wave conduction					Rect. wave conduction					Units
	180°	120°	90°	60°	30°	180°	120°	90°	60°	30°	
IRK.71	0.06	0.07	0.09	0.12	0.18	0.04	0.08	0.10	0.13	0.18	°C/W
IRK.91	0.04	0.05	0.06	0.08	0.12	0.03	0.05	0.06	0.08	0.12	°C/W

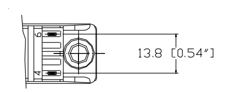
Ordering Information Table

Device Code

IRK	T	91	/	16	A	S90
1	2	3		4	5	6

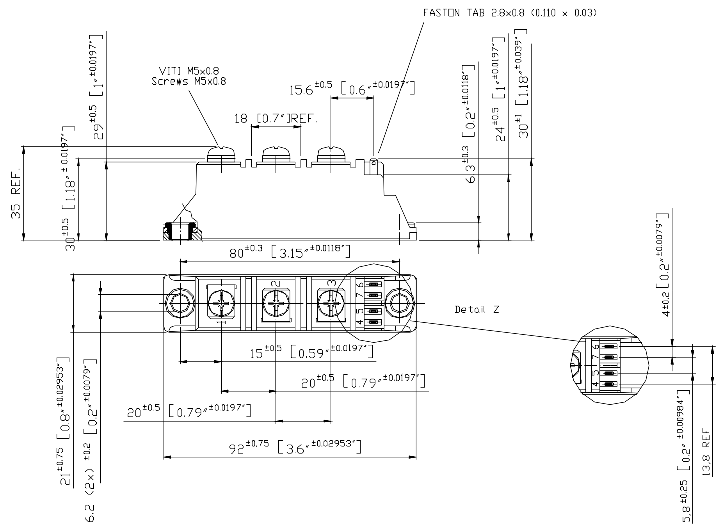
- **1** - Module type
- **2** - Circuit configuration (See Circuit Configuration table below)
- **3** - Current code * *
- **4** - Voltage code (See Voltage Ratings table)
- **5** - A : Gen V
- **6** - dv/dt code: S90 = dv/dt 1000 V/μs
  No letter = dv/dt 500 Vμs

IRK.92 types
With no auxiliary cathode



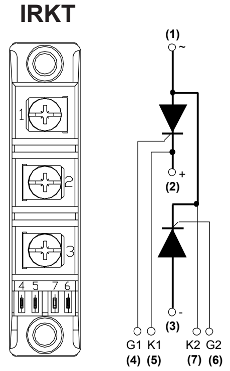
* * Available with no auxiliary cathode.
To specify change: 71 to 72
91 to 92
e.g. : IRKT92/16A etc.

Outline Table

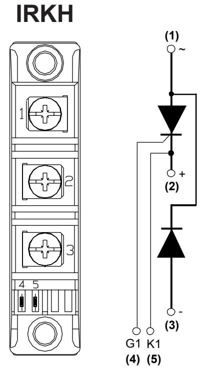


Dimensions are in millimeters and [inches]

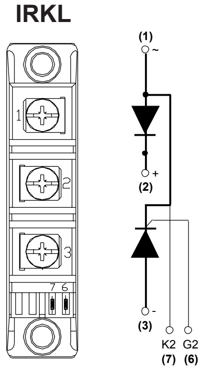
IRKT



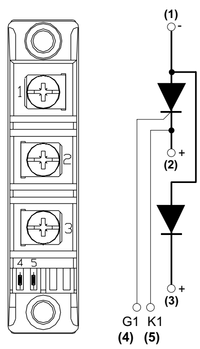
IRKH



IRKL



IRKN



NOTE: To order the Optional Hardware see Bulletin I27900

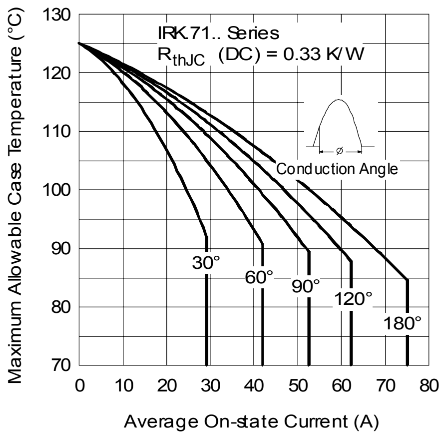


Fig. 1 - Current Ratings Characteristics

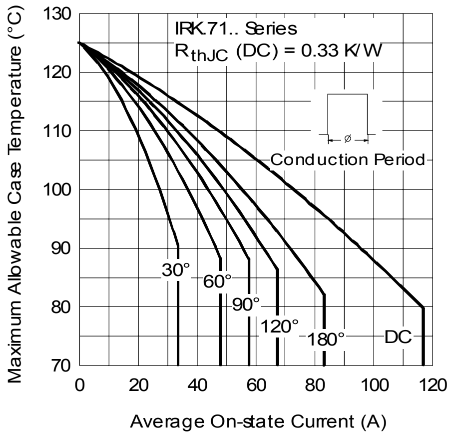


Fig. 2 - Current Ratings Characteristics

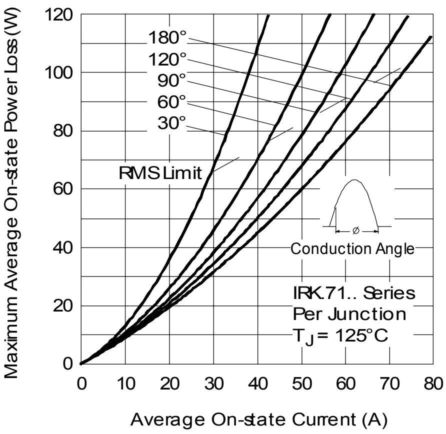


Fig. 3 - On-state Power Loss Characteristics

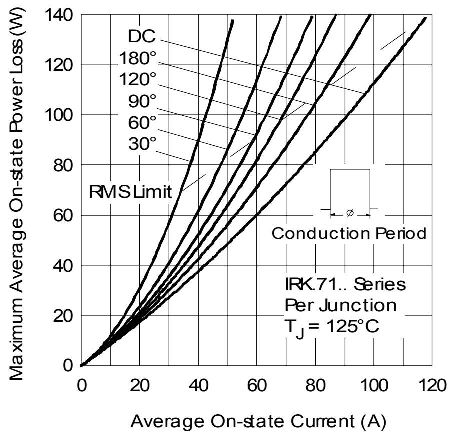


Fig. 4 - On-state Power Loss Characteristics

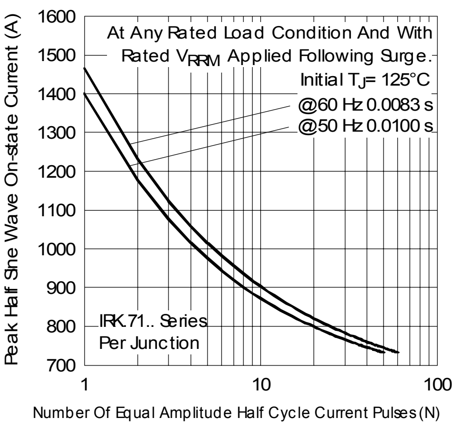


Fig. 5 - Maximum Non-Repetitive Surge Current

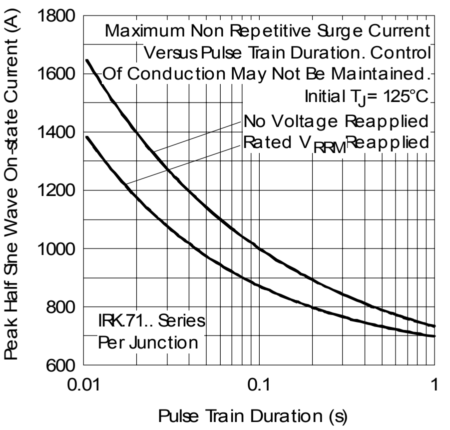


Fig. 6 - Maximum Non-Repetitive Surge Current

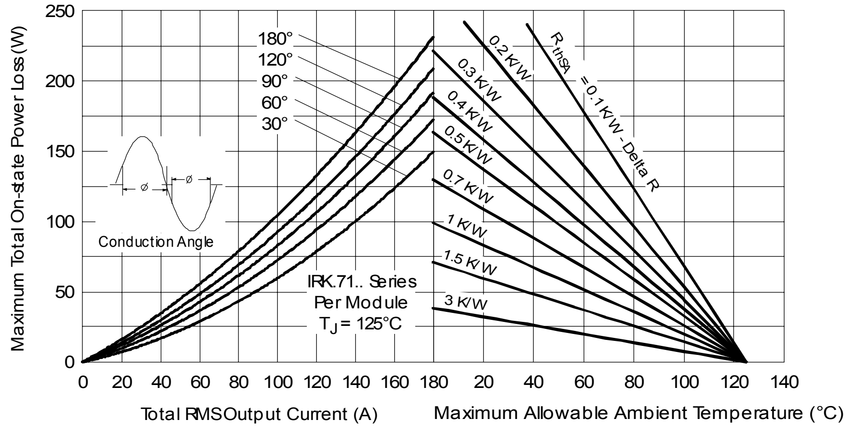


Fig. 7 - On-state Power Loss Characteristics

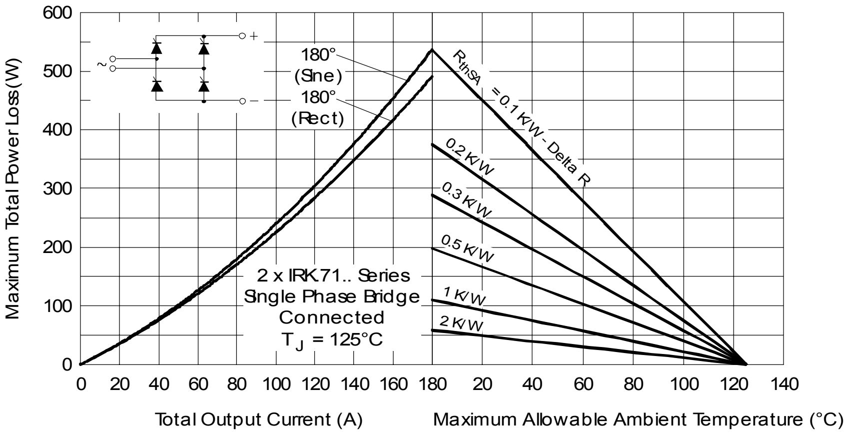


Fig. 8 - On-state Power Loss Characteristics

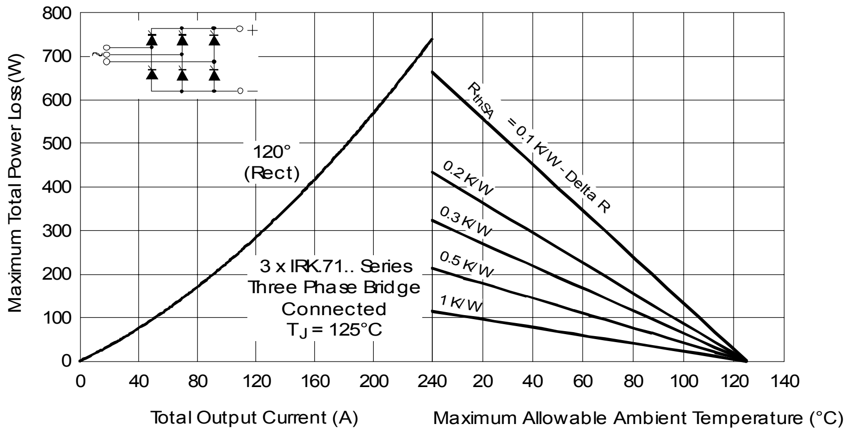


Fig. 9 - On-state Power Loss Characteristics

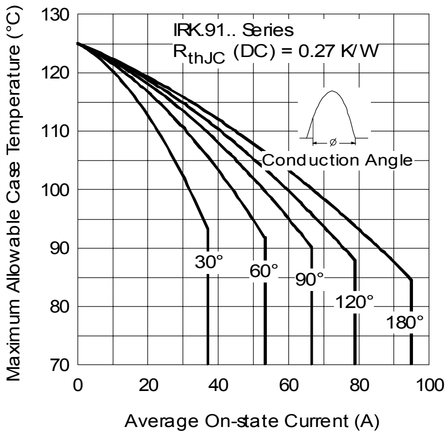


Fig. 10 - Current Ratings Characteristics

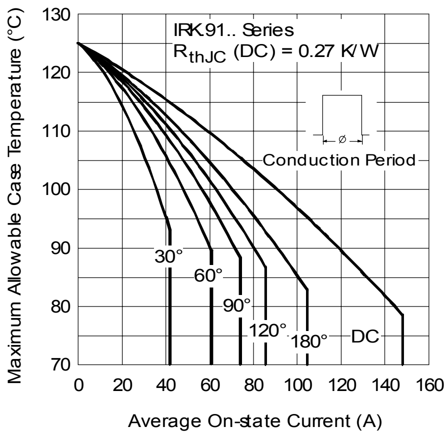


Fig. 11 - Current Ratings Characteristics

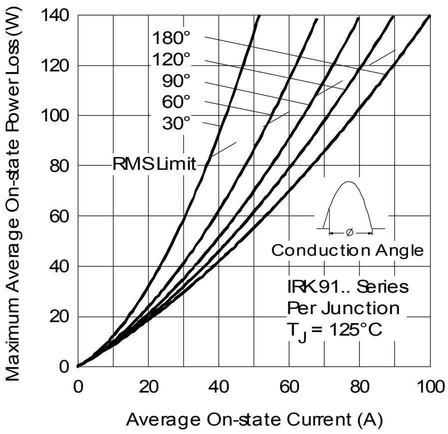


Fig. 12 - On-state Power Loss Characteristics

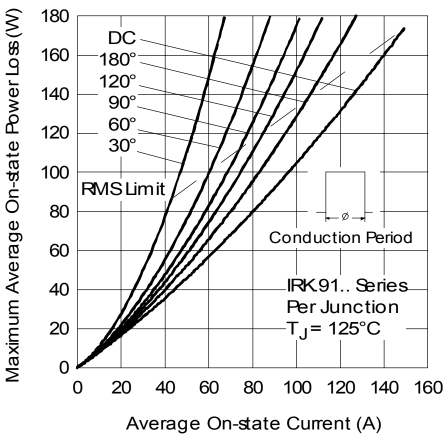


Fig. 13 - On-state Power Loss Characteristics

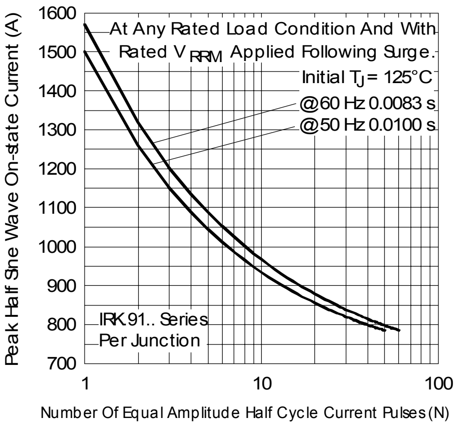


Fig. 14 - Maximum Non-Repetitive Surge Current

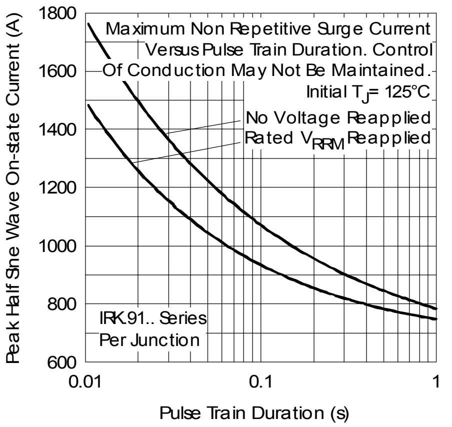


Fig. 15 - Maximum Non-Repetitive Surge Current

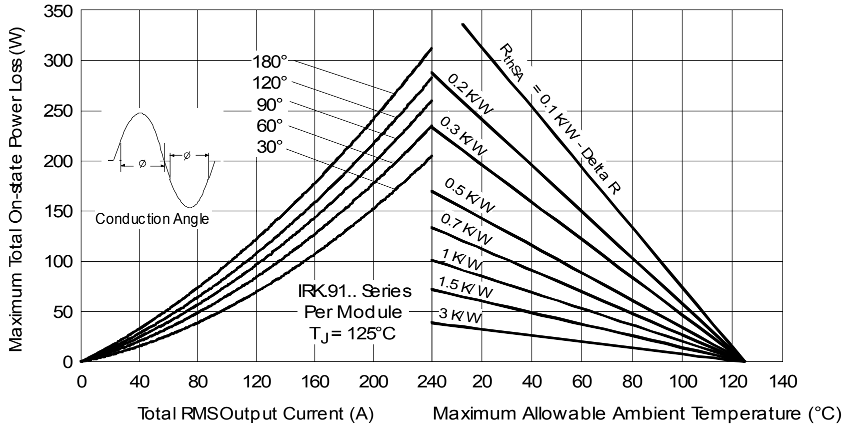


Fig. 16 - On-state Power Loss Characteristics

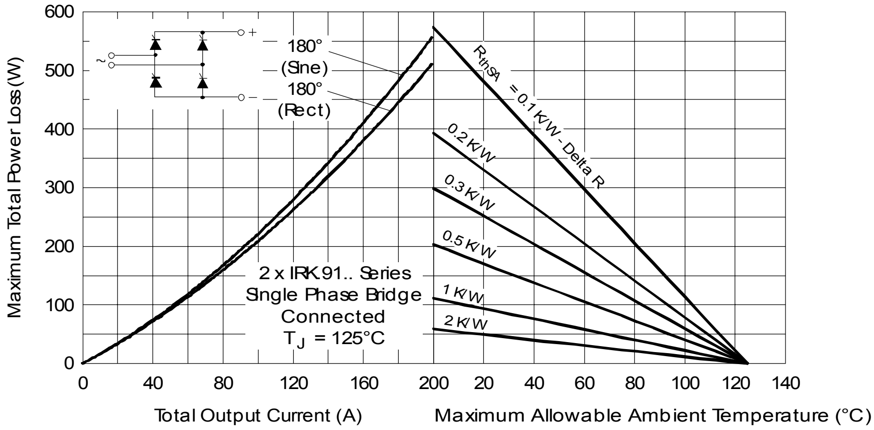


Fig. 17 - On-state Power Loss Characteristics

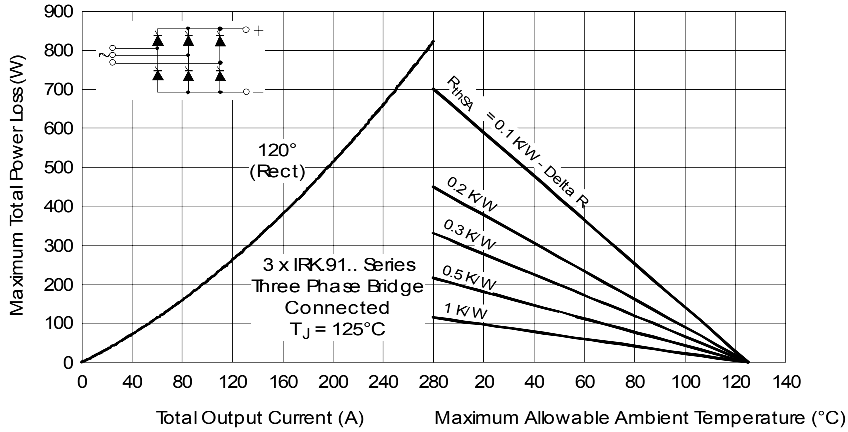


Fig. 18 - On-state Power Loss Characteristics

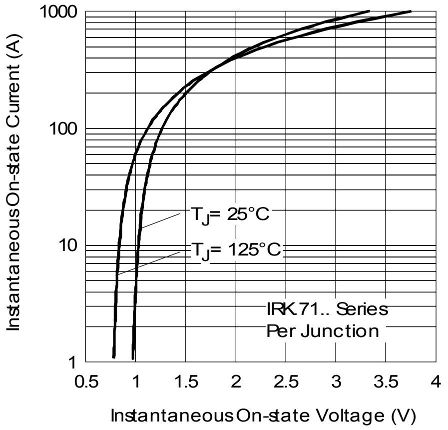


Fig. 19 - On-state Voltage Drop Characteristics

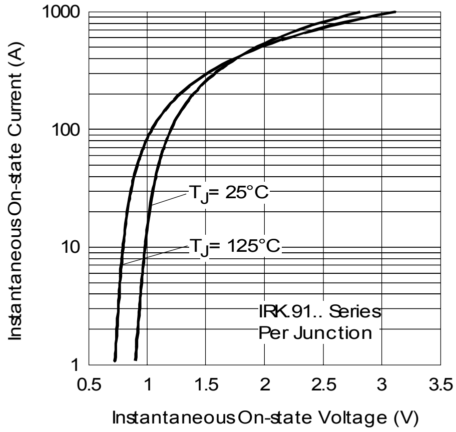


Fig. 20 - On-state Voltage Drop Characteristics

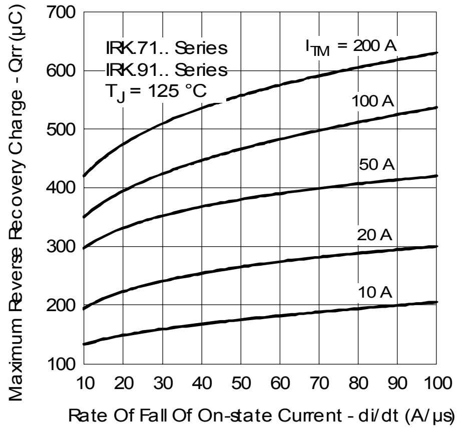


Fig. 21 - Recovery Charge Characteristics

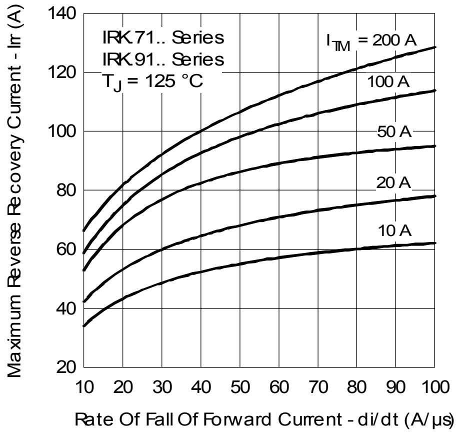


Fig. 22 - Recovery Current Characteristics

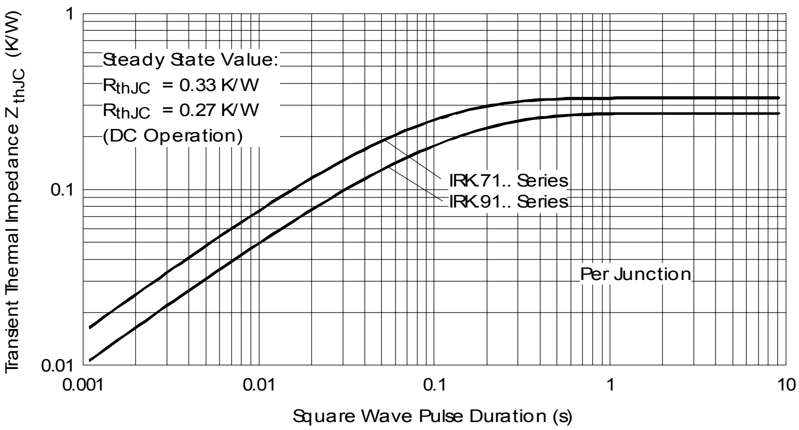


Fig. 23 - Thermal Impedance Z_{thJC} Characteristics

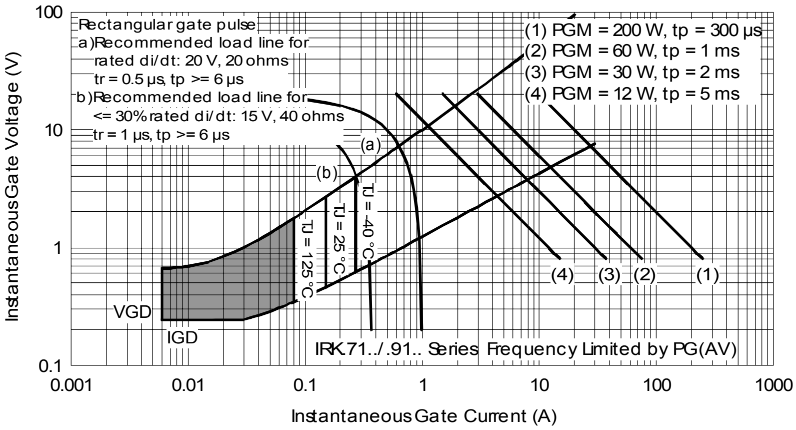


Fig. 24 - Gate Characteristics

International IOR Rectifier

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09/04

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