Bulletin I27117 rev. C 03/02

International Rectifier

SERIES IRK.136, .142, .162

THYRISTOR/DIODE and THYRISTOR/THYRISTOR

NEW INT-A-pak Power Modules

135 A
140 A
160 A

Features

- High Voltage
- Electrically Isolated by DBC Ceramic (Al_2O_3)
- 3500 V_{RMS} Isolating Voltage
- Industrial Standard Package
- High Surge Capability
- Glass Passivated Chips
- Modules uses High Voltage Power thyristor/diodes in three Basic Configurations
- Simple Mounting
- UL E78996 approved

Applications

- DC Motor Control and Drives
- Battery Charges
- Welders
- Power Converters
- Lighting Control
- Heat and Temperature Control

Major Ratings and Characteristics

Parameters	IRK.136..	IRK.142..	IRK.162..	Units
$I_{T(AV)}$	135	140	160	A
@ T_C	85	85	85	°C
$I_{T(RMS)}$	300	310	355	A
I_{TSM} @50Hz	3200	4500	4870	A
@60Hz	3360	4712	5100	A
I^2t @50Hz	51.5	102	119	KA^2s
@60Hz	47	92.5	108	KA^2s
$I^2\sqrt{t}$	515.5	1013	1190	$KA^2\sqrt{s}$
V_{RRM}	400 to 1600			V
T_J range	-40 to 125			°C

CASE STYLE NEW INT-A-PAK

Electrical Specifications

Voltage Ratings

Type number	Voltage Code	V_{RRM}/V_{DRM} , Maximum repetitive peak reverse voltage V	V_{RSM}/V_{DSM}, Maximum non-repetitive peak reverse voltage V	I_{RRM} / I_{DRM} @ 125°C m A
IRK.136	04	400	500	50
IRK.142	08	800	900	
IRK.162	12	1200	1300	
	14	1400	1500	
	16	1600	1700	

Forward Conduction

	Parameter	IRK.136	IRK.142	IRK.162	Units	Conditions		
$I_{T(AV)}$	Max. average on-state current	135	140	160	A	180° conduction, half sine wave		
	@ Case temperature	85	85	85	°C			
$I_{T(RMS)}$	Max. RMS on-state current	300	310	355	A	as AC switch		
I_{TSM}	Maximum peak, one-cycle	3200	4500	4870	A	t = 10ms	No voltage	Sine half wave, Initial $T_J = T_J$ max.
	on-state, non-repetitive	3360	4712	5100		t = 8.3ms	reapplied	
	surge current	2700	3785	4100		t = 10ms	100% V_{RRM}	
		2800	3963	4300		t = 8.3ms	reapplied	
I^2t	Maximum I^2t for fusing	51.5	102	119	KA^2s	t = 10ms	No voltage	
		47	92.5	108		t = 8.3ms	reapplied	
		36.5	71.6	84		t = 10ms	100% V_{RRM}	
		33.3	65.4	76.7		t = 8.3ms	reapplied	
$I^2\sqrt{t}$	Maximum $I^2\sqrt{t}$ for fusing	515.5	1013	1190	$KA^2\sqrt{s}$	t = 0.1 to 10ms, no voltage reapplied		
$V_{T(TO)1}$	Low level value of threshold voltage	0.86	0.83	0.8	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	1.05	1	0.98		(I > π x $I_{T(AV)}$), @ T_J max.		
r_{t1}	Low level value on-state slope resistance	2.02	1.78	1.67	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	1.65	1.43	1.38		(I > π x $I_{T(AV)}$), @ T_J max.		
V_{TM}	Maximum forward voltage drop	1.57	1.55	1.54	V	I_{TM} = π x $I_{T(AV)}$, T_J = 25°C, 180°conduction		
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 = 1Ω Gate pulse: 10V, 100μs, T_J = 25°C		

Switching

t_{gd}	Typical delay time	1	μs	T_J = 25°C	Gate Current=1A dIg/dt=1A/μs
t_{gr}	Typical rise time	2		T_J = 25°C	Vd=0,67% V_{DRM}
t_q	Typical turn-off time	50 - 200		I_{TM} = 300 A; -dI/dt = 15 A/μs; $T_J = T_J$ max V_r = 50 V; dV/dt = 20 V/μs; Gate 0 V, 100Ω	

Blocking

I_{RRM} I_{DRM}	Maximum peak reverse and off-state leakage current	50	mA	T_J = 125°C
V_{INS}	RMS isolation voltage	3500	V	50Hz, circuit to base, all terminals shorted, t = 1s
dV/dt	critical rate of rise of off-state voltage	1000	V/µs	T_J = T_J max., exponential to 67% rated V_{DRM}

Triggering

	Parameter	IRK.136	IRK.142	IRK.162	Units	Conditions	
P_{GM}	Max. peak gate power	12			W	tp ≤ 5ms, T_J = T_J max.	
$P_{G(AV)}$	Max. average gate power	3			W	f=50Hz, T_J = T_J max.	
I_{GM}	Max. peak gate current	3			A	tp ≤ 5ms, T_J = T_J max.	
$-V_{GT}$	Max. peak negative gate voltage	10			V		
V_{GT}	Max. required DC gate voltage to trigger	4			V	T_J = - 40°C	Anode supply = 6V, resistive load; Ra = 1Ω
		2.5				T_J = 25°C	
		1.7				T_J = T_J max.	
I_{GT}	Max. required DC gate current to trigger	270			mA	T_J = - 40°C	Anode supply = 6V, resistive load; Ra = 1Ω
		150				T_J = 25°C	
		80				T_J = T_J max.	
V_{GD}	Max. gate voltage that will not trigger	0.3			V	@ T_J = T_J max., rated V_{DRM} applied	
I_{GD}	Max. gate current that will not trigger	10			mA		
$di/_{dt}$	Max. rate of rise of turned-on current	300			A/µs	@ T_J = T_J max., I_{TM} = 400A rated V_{DRM} applied	

Thermal and Mechanical Specifications

	Parameter		IRK.136	IRK.142	IRK.162	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		0.18	0.18	0.16	K/W	DC operation, per junction
R_{thCS}	Max. thermal resistance, case to heatsink		0.05			K/W	Mounting surface smooth, flat and greased Per module
T	Mounting torque ± 10%	IAP 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.
		busbar to IAP	4 to 6				
wt	Approximate weight		200 (7.1)			g(oz)	
	Case Style		New Int-A-Pak				

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°	
IRK.136	0.007	0.01	0.013	0.0155	0.017	0.009	0.012	0.014	0.015	0.017	K/W
IRK.142	0.0019	0.0019	0.0020	0.0020	0.0021	0.0018	0.0022	0.0023	0.0023	0.0020	K/W
IRK.162	0.0030	0.0031	0.0032	0.0033	0.0034	0.0029	0.0036	0.0039	0.0041	0.0040	K/W

Ordering Information Table

Device Code

IRK	T	162	/	16
1	2	3		4

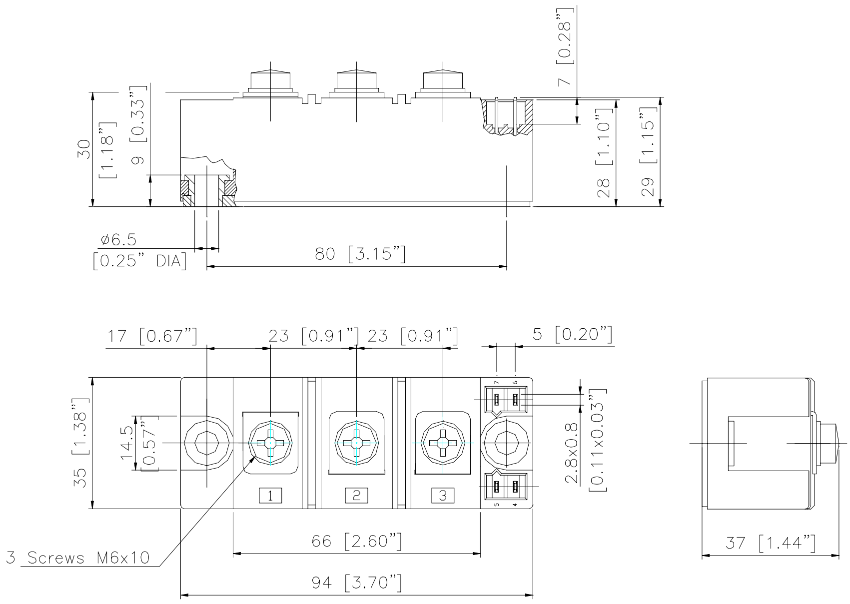
1 - Module Type

2 - Circuit Configuration

3 - Current Rating: $I_{T(AV)}$

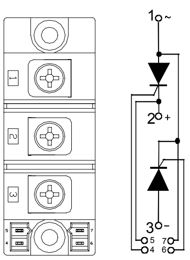
4 - Voltage Code: Code x 100 = V_{RRM}

Outline Table

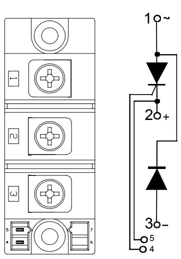


Dimensions are in millimeters and [inches]

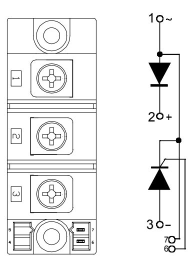
IRKT



IRKH



IRKL



NOTE: To order the Optional Hardware see Bulletin I27900

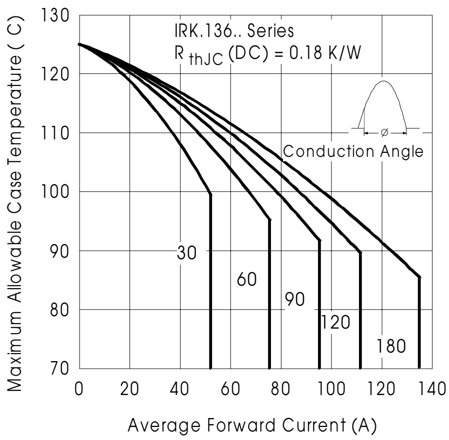


Fig. 1 - Current Ratings Characteristics

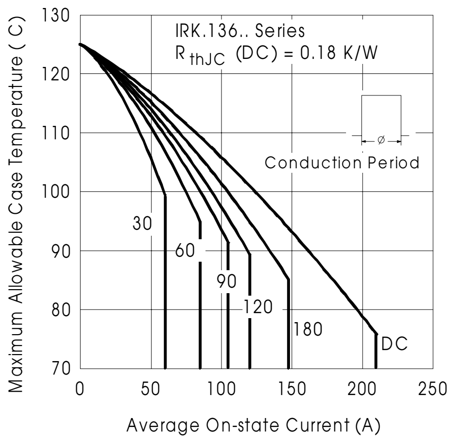


Fig. 2 - Current Ratings Characteristics

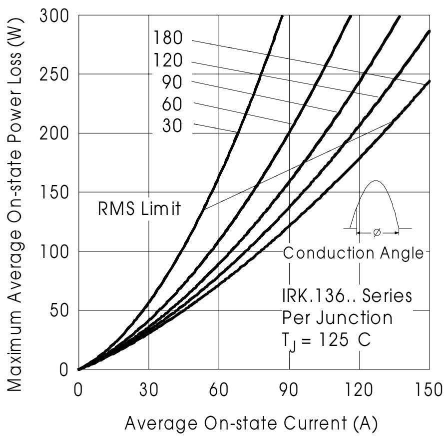


Fig. 3 - On-State Power Loss Characteristics

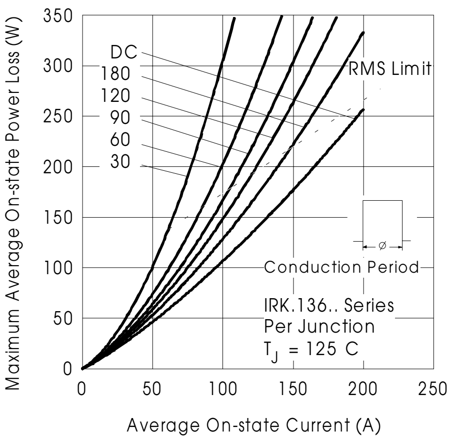


Fig. 4 - On-State Power Loss Characteristics

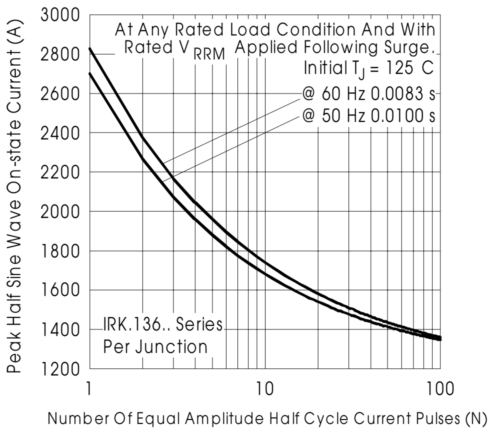


Fig.5 - Maximum Non-Repetitive Surge Current

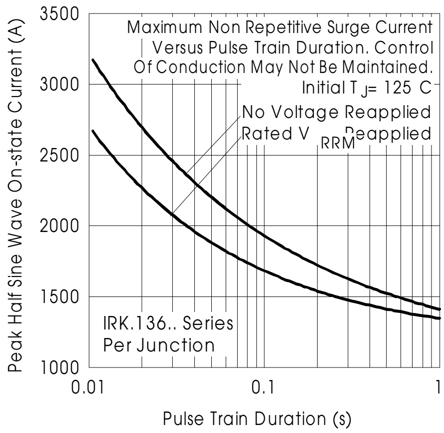


Fig. 6 - Maximum Non-Repetitive Surge Current

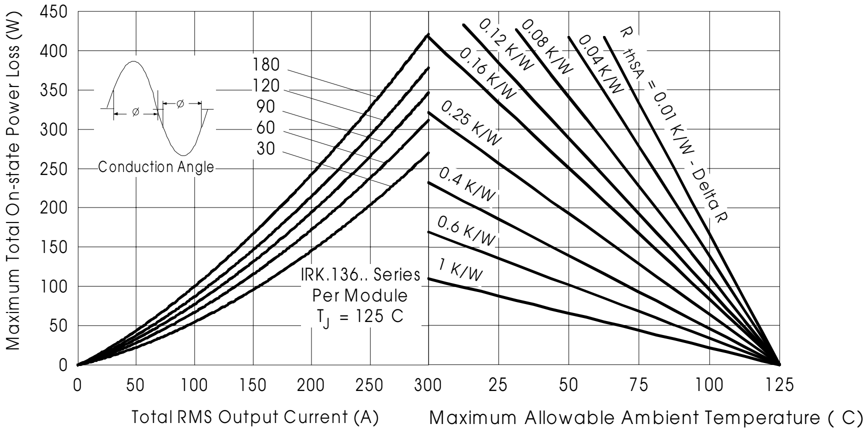


Fig.7 - On State Power Loss Characteristics

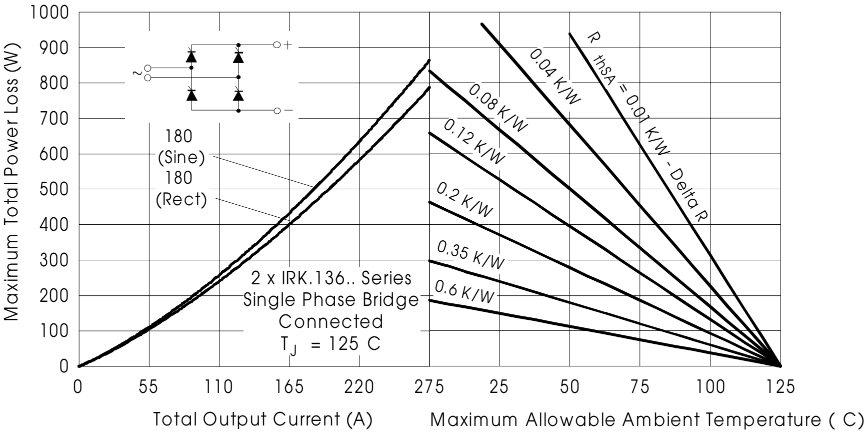


Fig.8 - On State Power Loss Characteristics

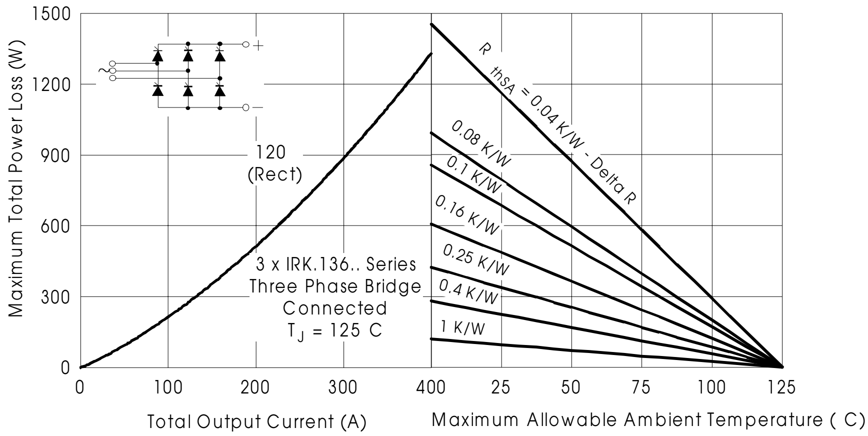


Fig.9- On State Power Loss Characteristics

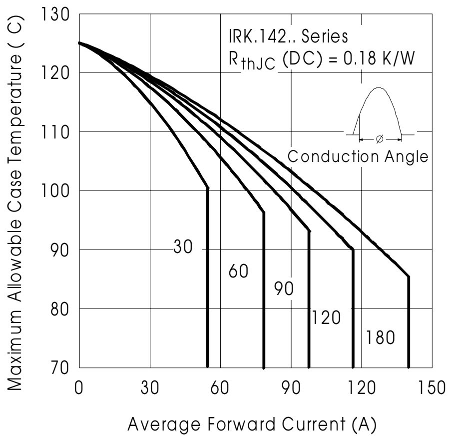


Fig. 10 - Current Ratings Characteristics

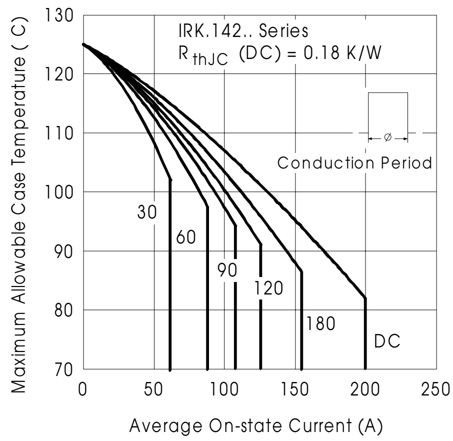


Fig. 11 - Current Ratings Characteristics

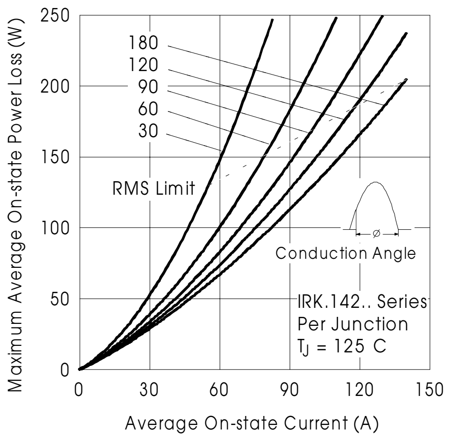


Fig. 12 - On-State Power Loss Characteristics

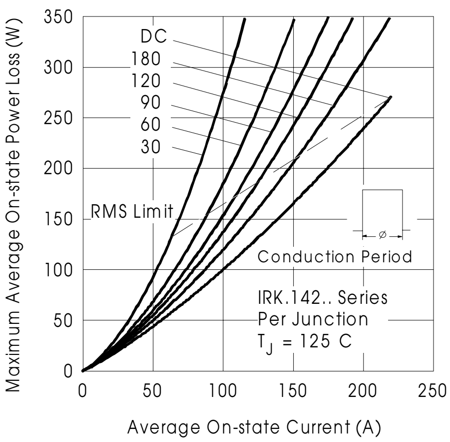


Fig. 13 - On-State Power Loss Characteristics

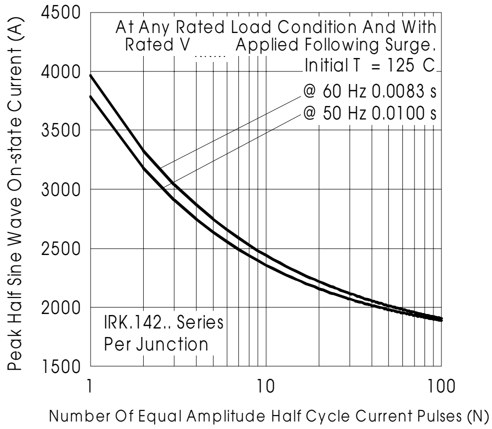


Fig.14 - Maximum Non-Repetitive Surge Current

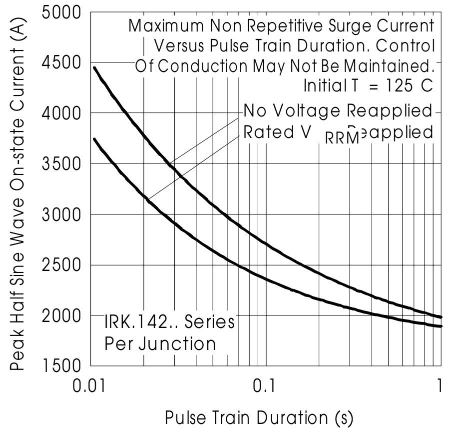


Fig. 15 - Maximum Non-Repetitive Surge Current

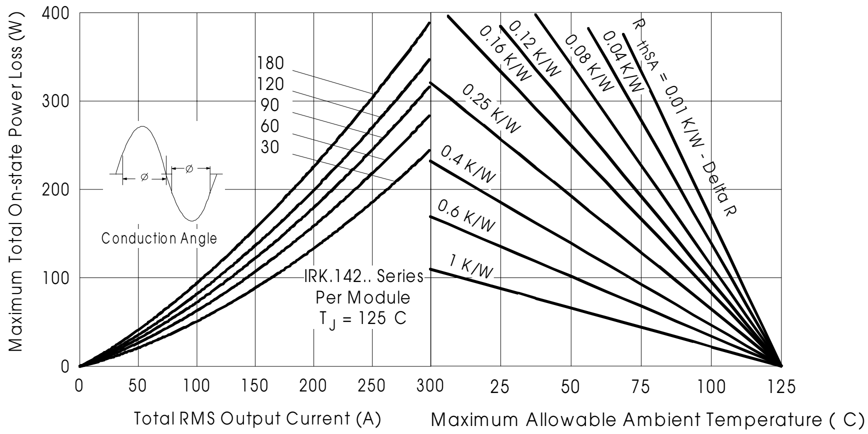


Fig.16 - On State Power Loss Characteristics

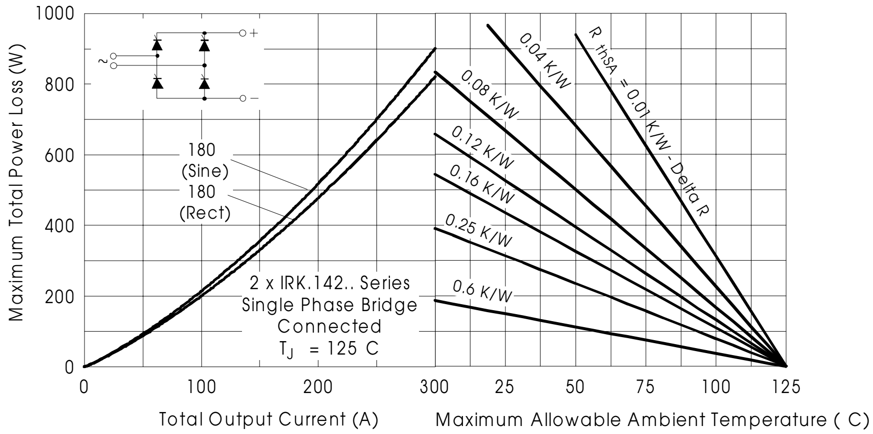


Fig.17 - On State Power Loss Characteristics

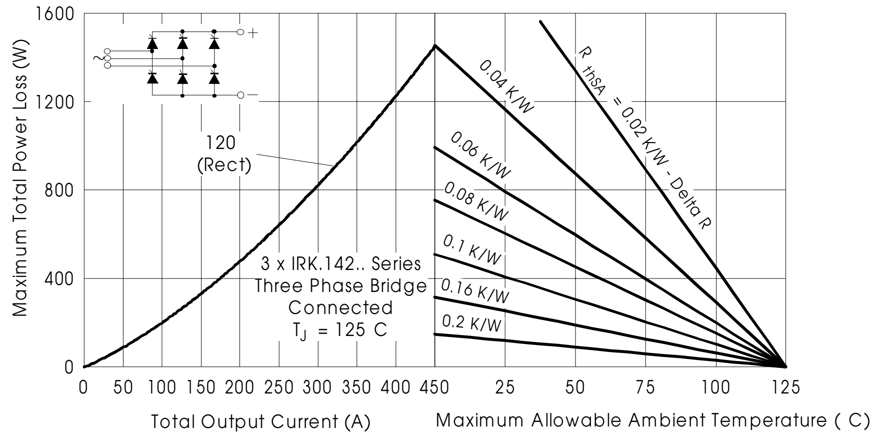


Fig.18- On State Power Loss Characteristics

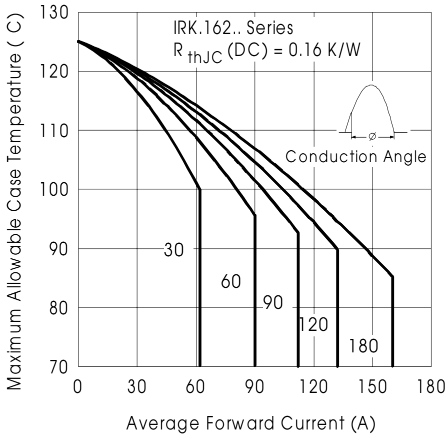


Fig. 19 - Current Ratings Characteristics

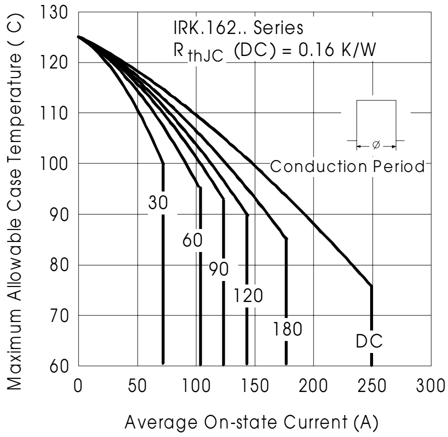


Fig. 20 - Current Ratings Characteristics

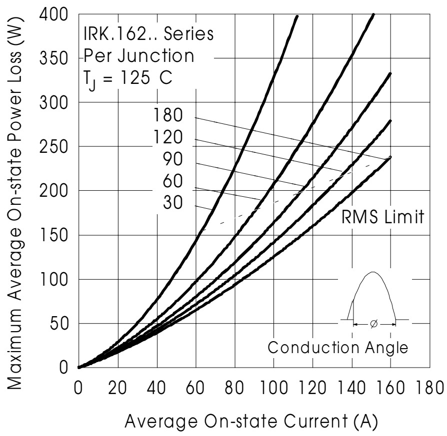


Fig. 21 - On-State Power Loss Characteristics

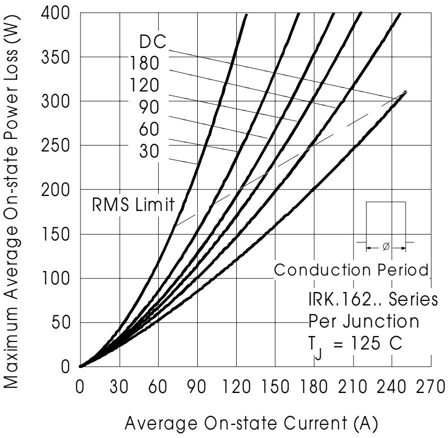


Fig. 22 - On-State Power Loss Characteristics

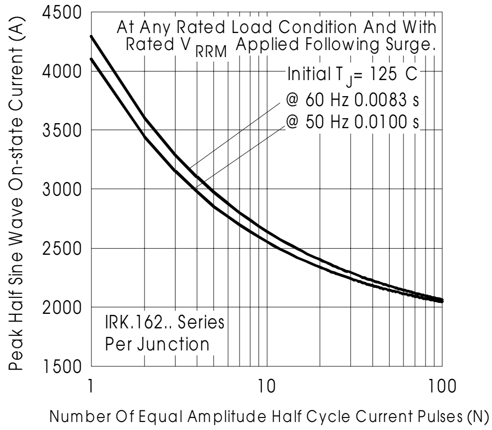


Fig.23 - Maximum Non-Repetitive Surge Current

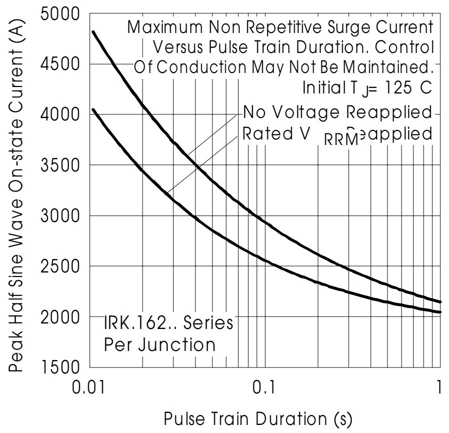


Fig. 24 - Maximum Non-Repetitive Surge Current

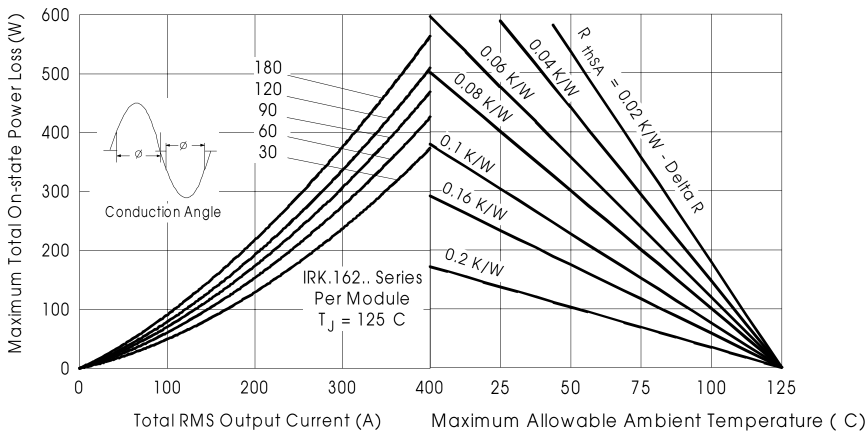


Fig.25 - On State Power Loss Characteristics

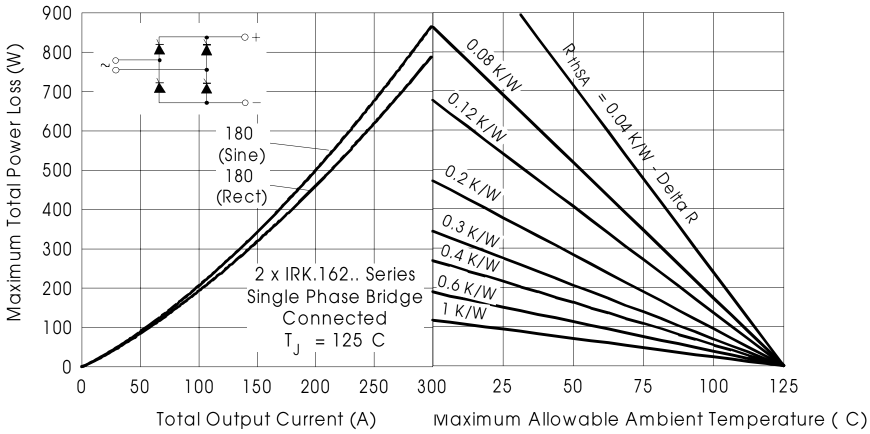


Fig.26 - On State Power Loss Characteristics

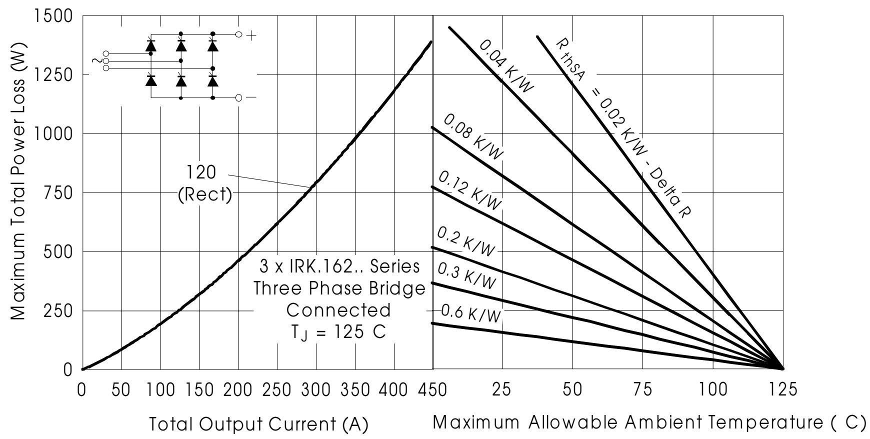


Fig.27- On State Power Loss Characteristics

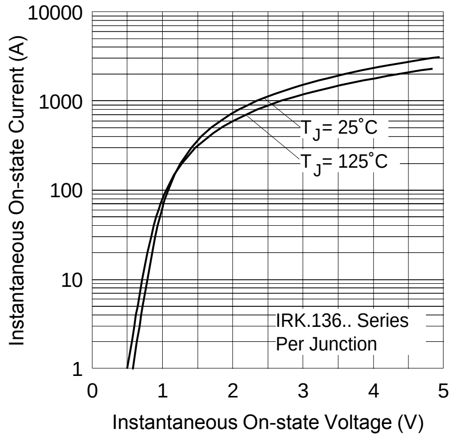


Fig.28 - On State Voltage Drop Characteristics

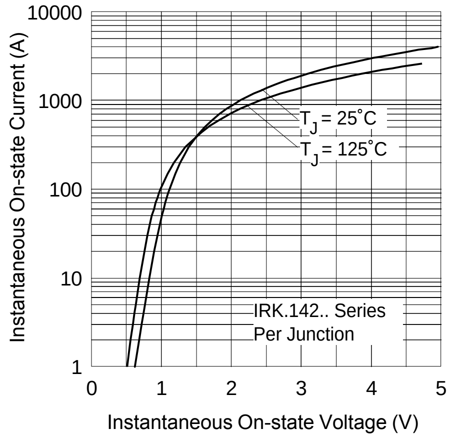


Fig.29 - On State Voltage Drop Characteristics

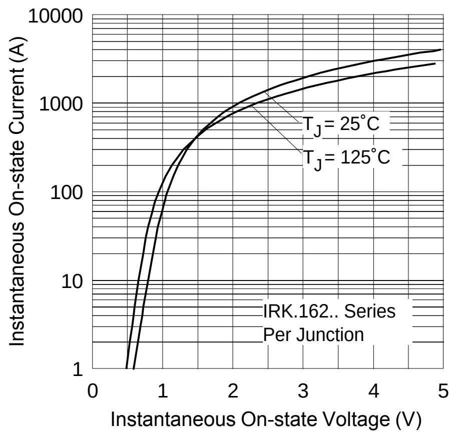


Fig.30 - On State Voltage Drop Characteristics

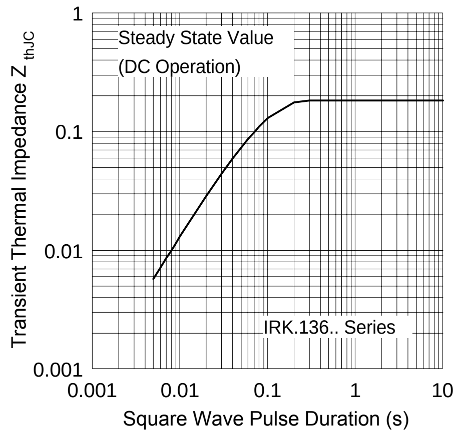


Fig.31 - Thermal Impedance ZthJC Characteristics

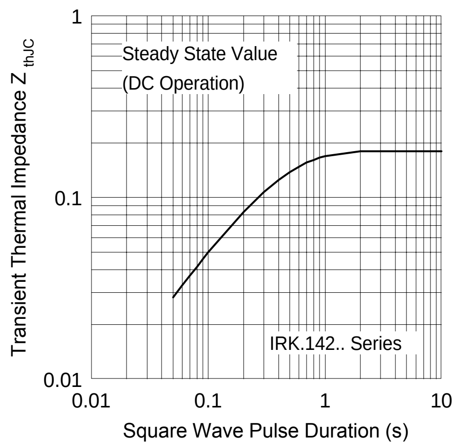


Fig.32 - Thermal Impedance ZthJC Characteristics

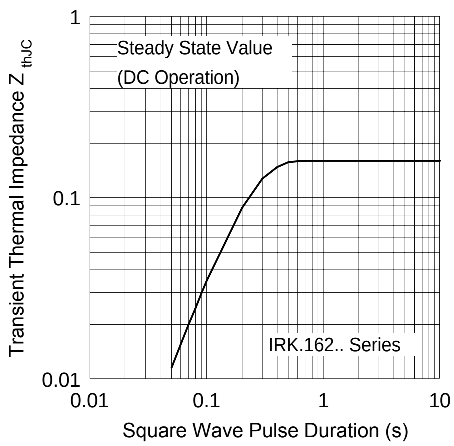


Fig.33 - Thermal Impedance ZthJC Characteristics

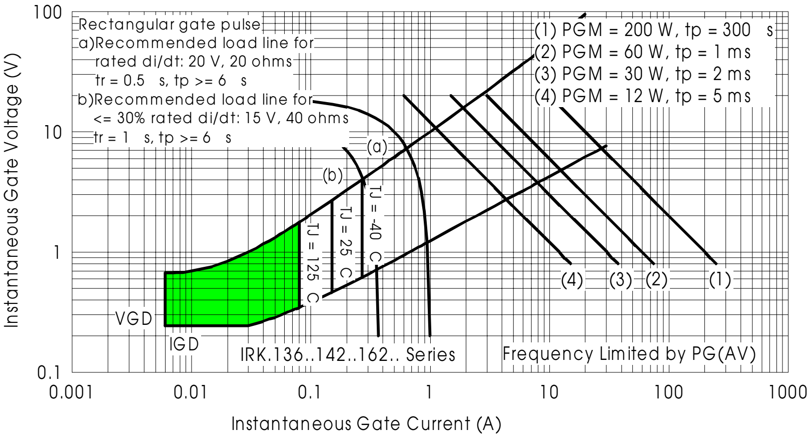


Fig. 34 - Gate Characteristics

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

International IOR Rectifier

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