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	
	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	Sine half wave,
I^2t	Maximum I^2t for fusing	51.5	102	119	KA^2s	t = 10ms	No voltage	Initial $T_J = T_J$ max.
		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.
	Mounting torque ± 10% — 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	
IRK.162	0.0030	0.0031	0.0032	0.0033	0.0034	0.0029	0.0036	0.0039	0.0041	0.0040	

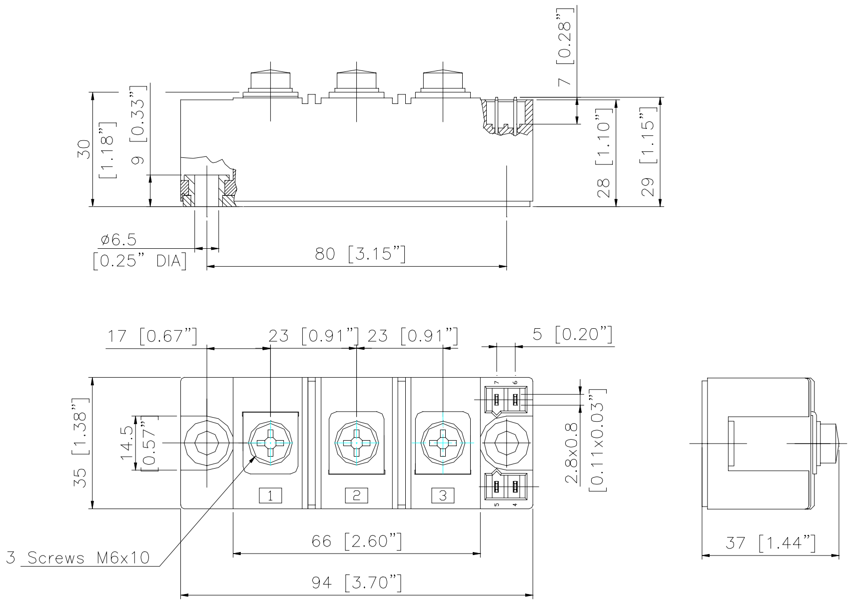
Ordering Information Table

Device Code

IRK	T	162	/	16
1	2	3		4

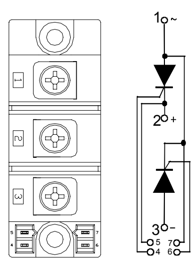
1 - Module Type
2 - Circuit Configuration
3 - Current Rating: $I_{T(AV)}$
4 - Voltage Code: Code x 100 = V_{RRM}

Outline Table

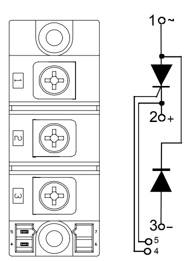


Dimensions are in millimeters and [inches]

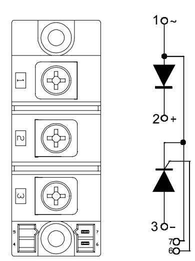
IRKT



IRKH



IRKL



NOTE: To order the Optional Hardware see Bulletin I27900

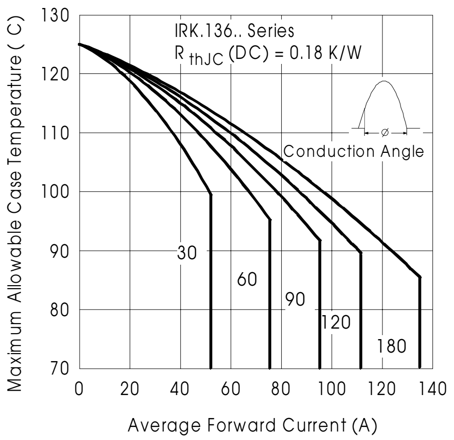


Fig. 1 - Current Ratings Characteristics

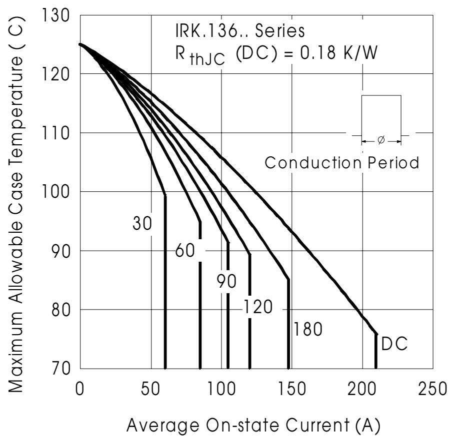


Fig. 2 - Current Ratings Characteristics

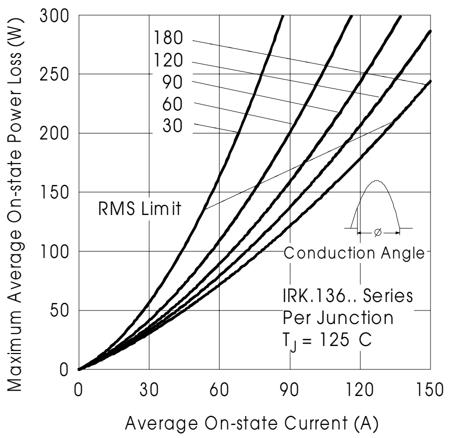


Fig. 3 - On-State Power Loss Characteristics

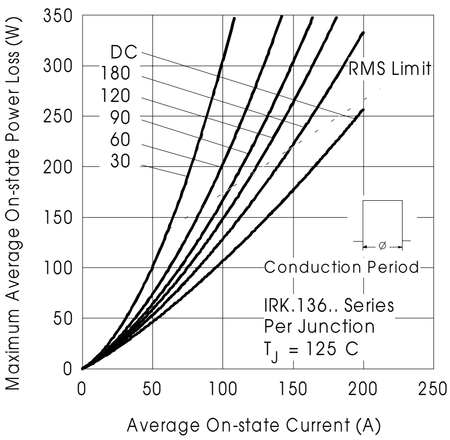


Fig. 4 - On-State Power Loss Characteristics

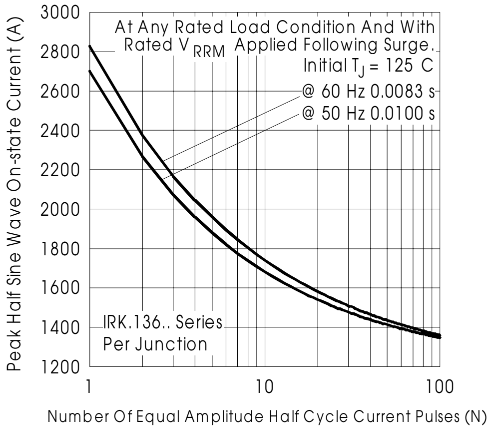


Fig.5 - Maximum Non-Repetitive Surge Current

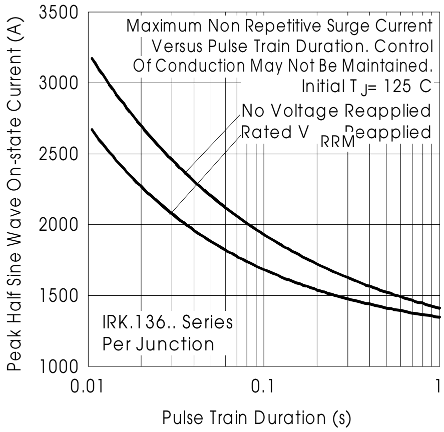


Fig. 6 - Maximum Non-Repetitive Surge Current

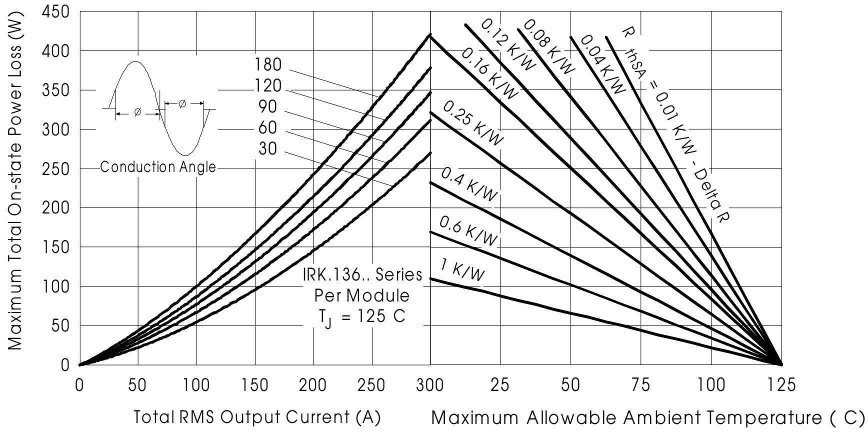


Fig.7 - On State Power Loss Characteristics

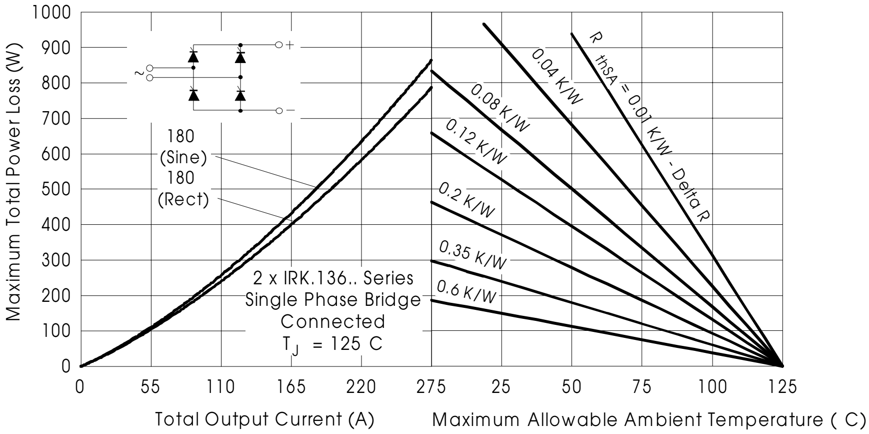


Fig.8 - On State Power Loss Characteristics

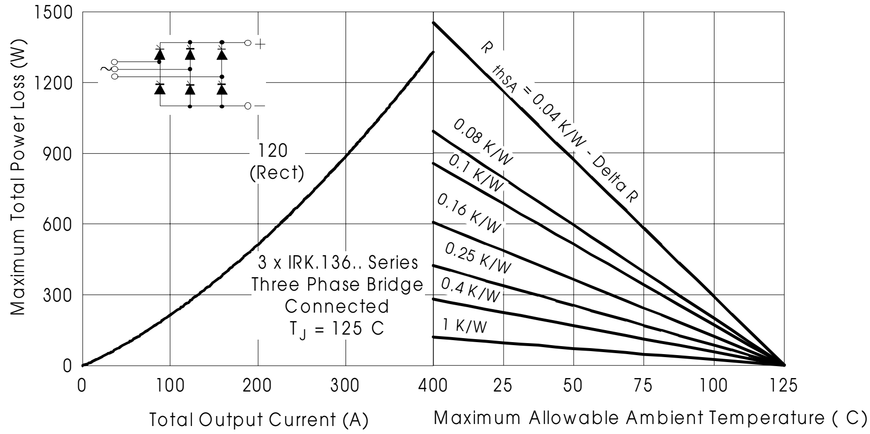


Fig.9- On State Power Loss Characteristics

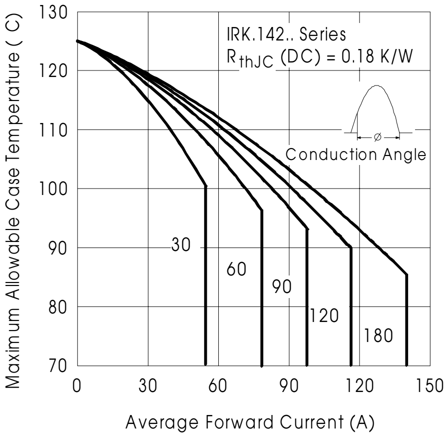


Fig. 10 - Current Ratings Characteristics

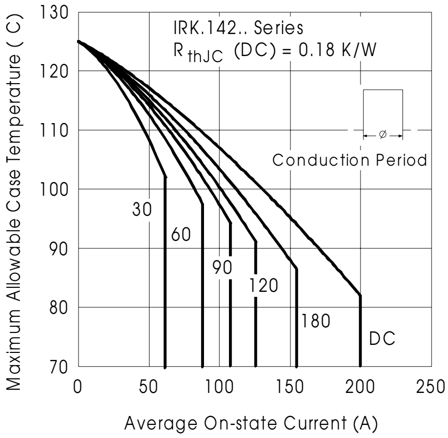


Fig. 11 - Current Ratings Characteristics

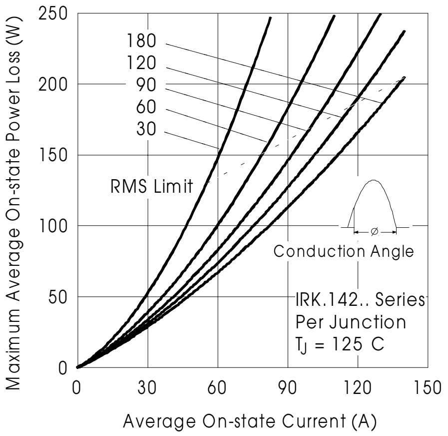


Fig. 12 - On-State Power Loss Characteristics

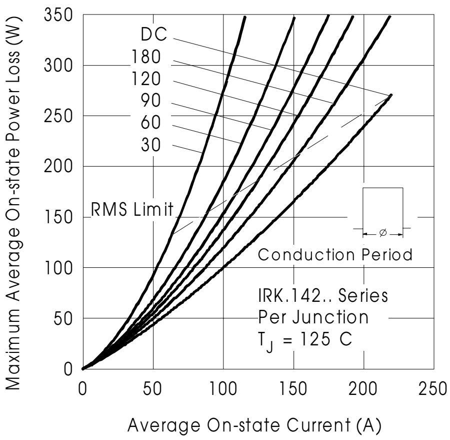


Fig. 13 - On-State Power Loss Characteristics

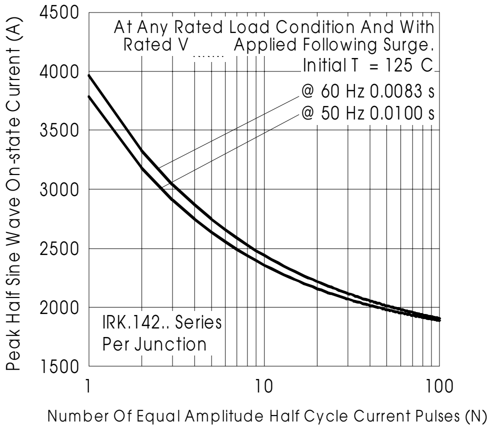


Fig.14 - Maximum Non-Repetitive Surge Current

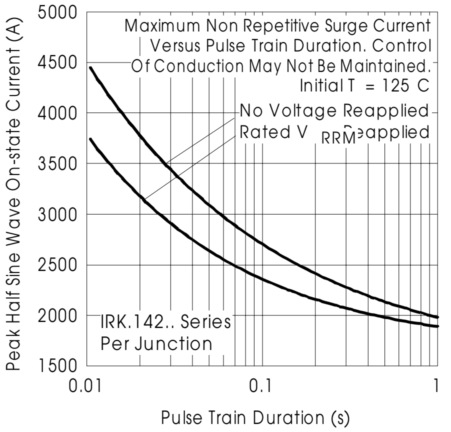


Fig. 15 - Maximum Non-Repetitive Surge Current

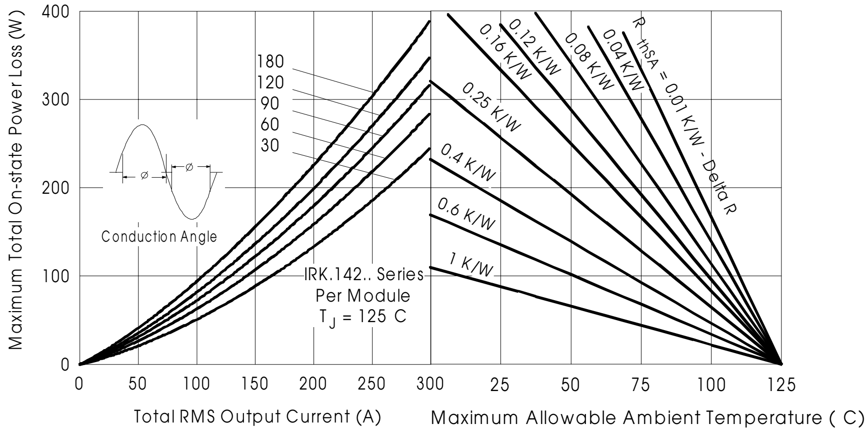


Fig.16 - On State Power Loss Characteristics

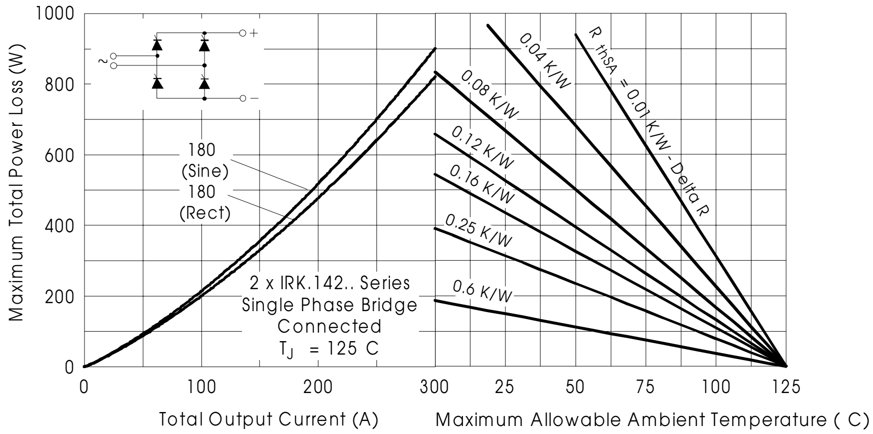


Fig.17 - On State Power Loss Characteristics

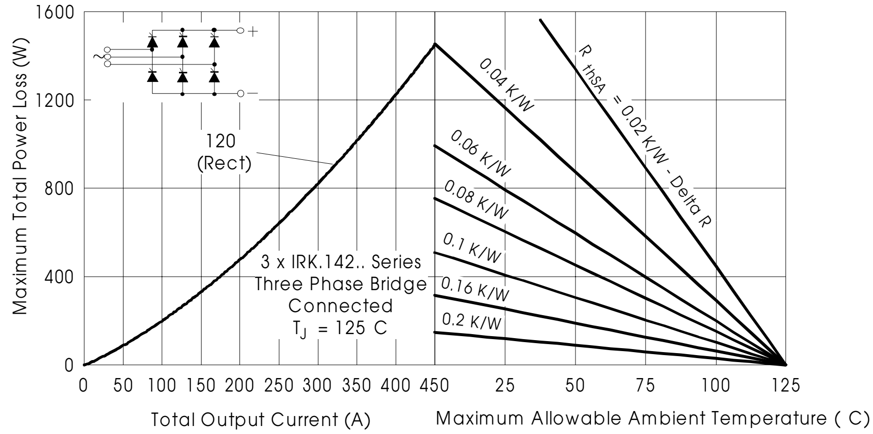


Fig.18- On State Power Loss Characteristics

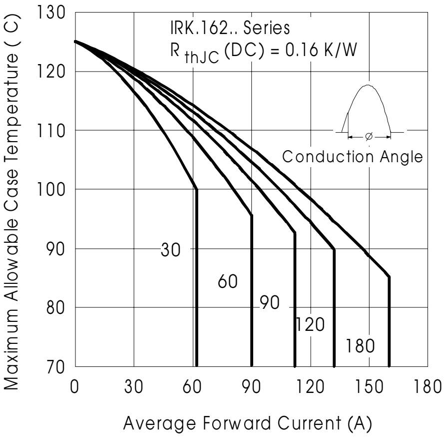


Fig. 19 - Current Ratings Characteristics

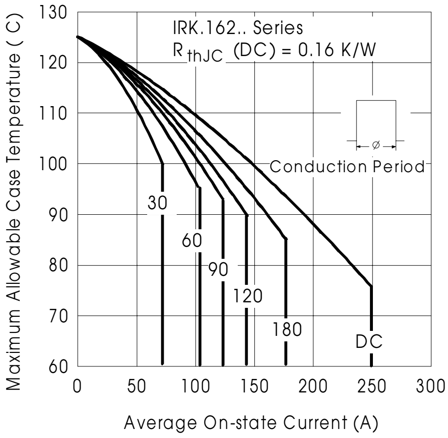


Fig. 20 - Current Ratings Characteristics

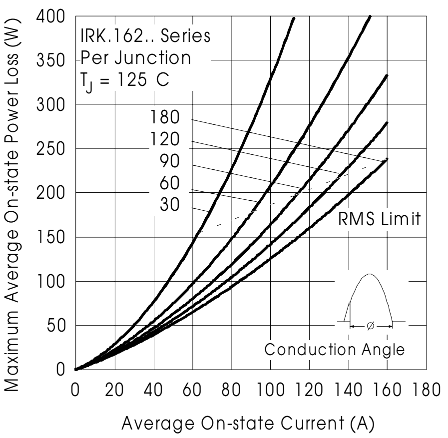


Fig. 21 - On-State Power Loss Characteristics

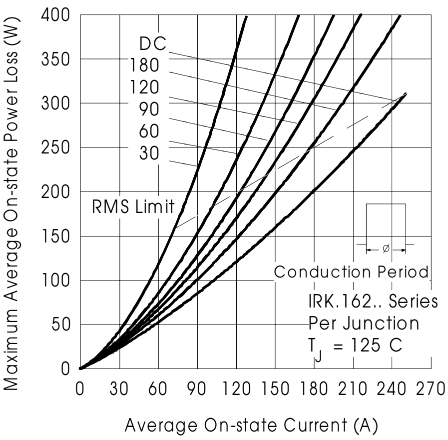


Fig. 22 - On-State Power Loss Characteristics

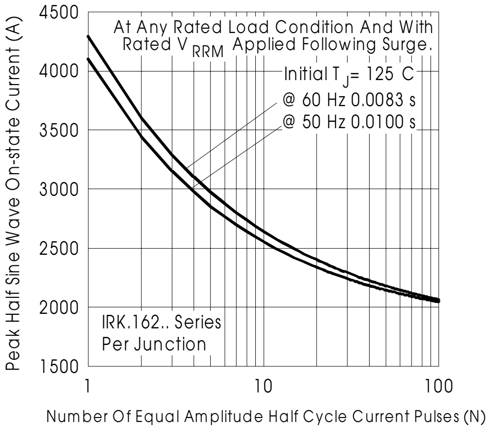


Fig.23 - Maximum Non-Repetitive Surge Current

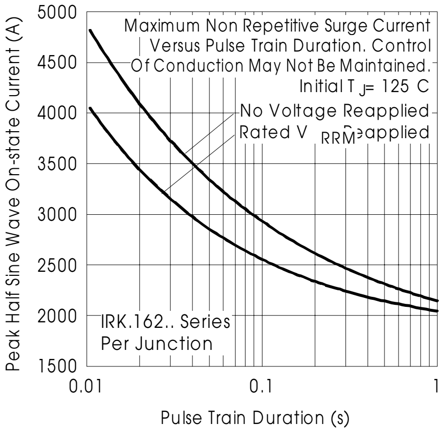


Fig. 24 - Maximum Non-Repetitive Surge Current

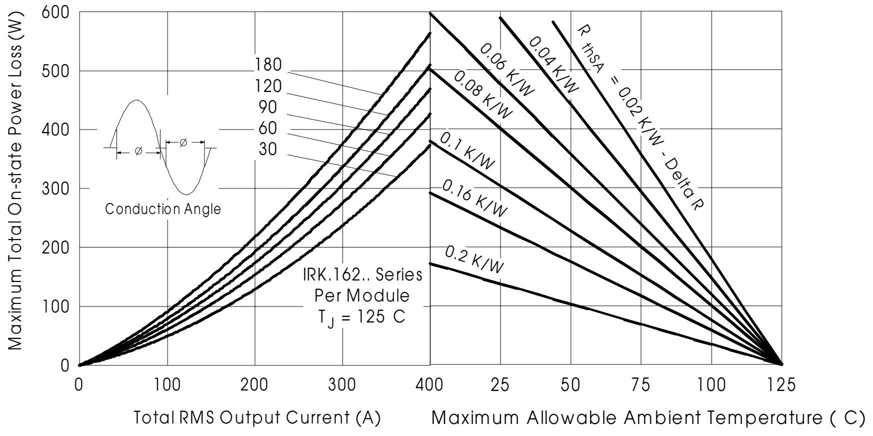


Fig.25 - On State Power Loss Characteristics

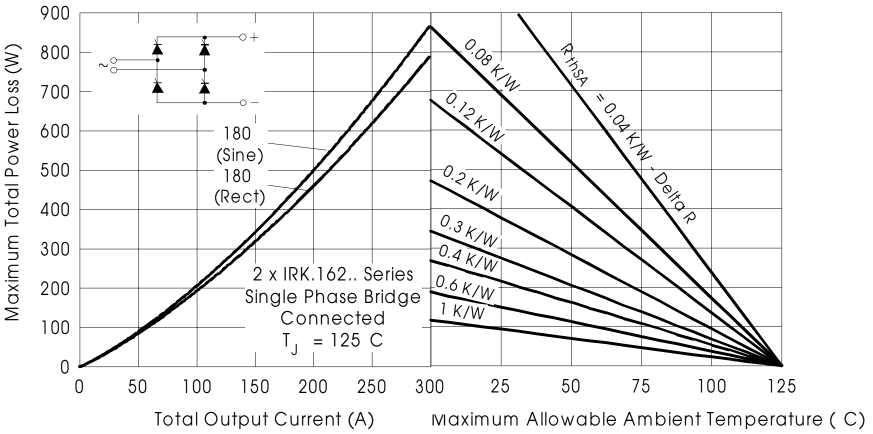


Fig.26 - On State Power Loss Characteristics

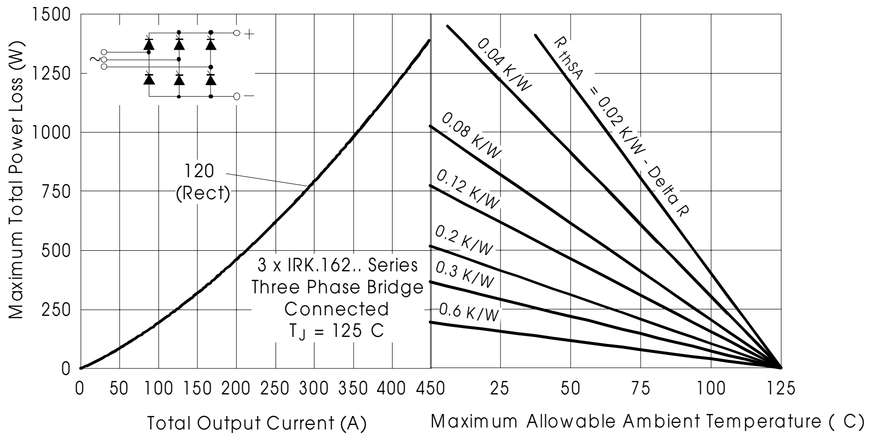


Fig.27- On State Power Loss Characteristics

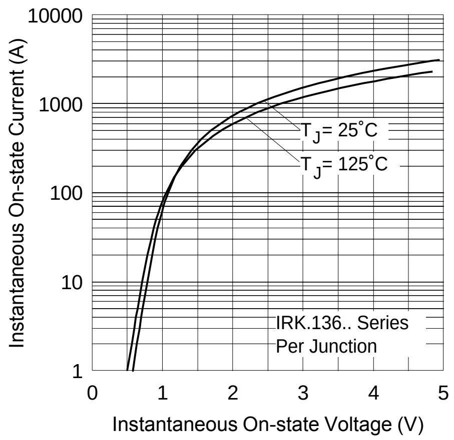


Fig.28 - On State Voltage Drop Characteristics

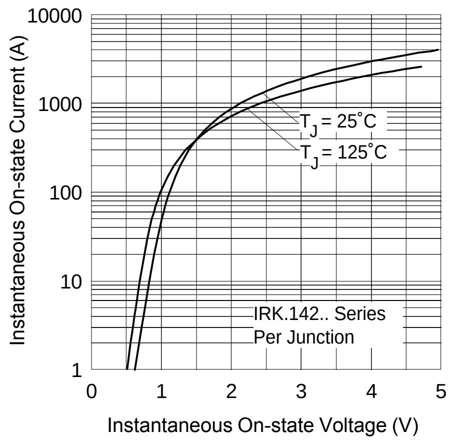


Fig.29 - On State Voltage Drop Characteristics

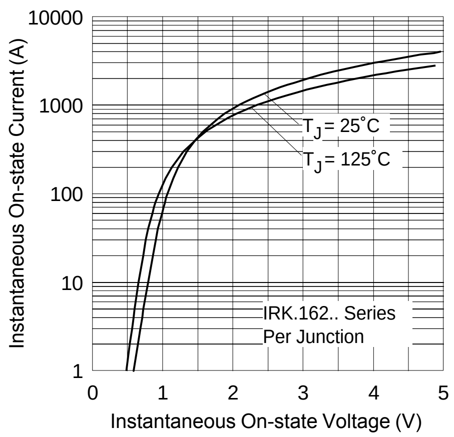


Fig.30 - On State Voltage Drop Characteristics

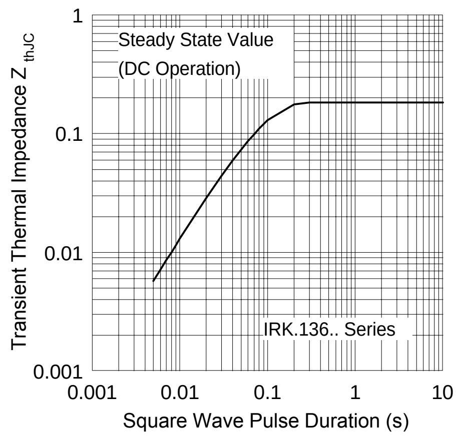


Fig.31 - Thermal Impedance ZthJC Characteristics

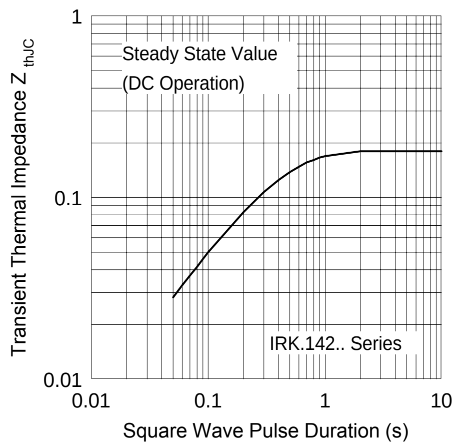


Fig.32 - Thermal Impedance ZthJC Characteristics

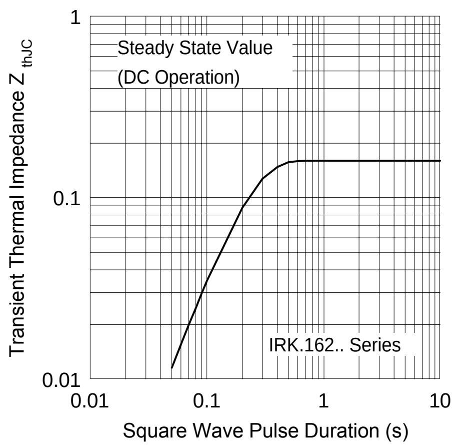


Fig.33 - Thermal Impedance ZthJC Characteristics

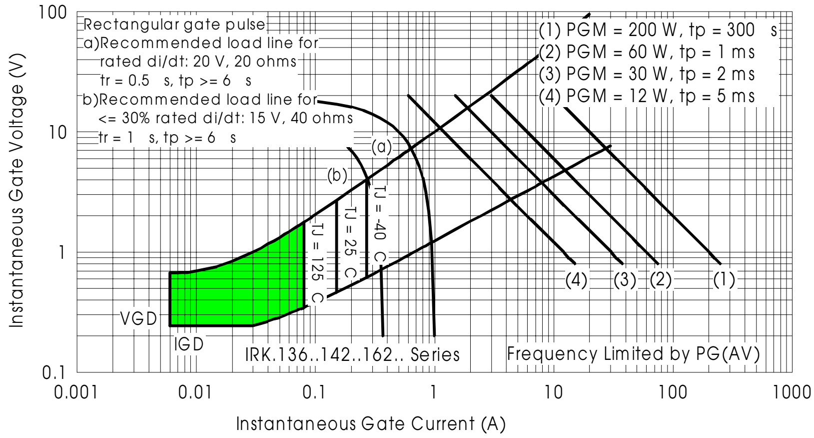


Fig. 34 - Gate Characteristics

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03/02

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