

International IR Rectifier

SERIES IRK.136, .142, .162

**THYRISTOR/DIODE and
THYRISTOR/THYRISTOR**

NEW INT-A-pak Power Modules

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 

135 A
140 A
160 A

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 ² s
	@ 60Hz	47	92.5	108	KA ² s
$I^2\sqrt{t}$	515.5	1013	1190	KA ² √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 mA
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 @ Case temperature	135	140	160	A	180° conduction, half sine wave	
	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 on-state, non-repetitive surge current	3200	4500	4870	A	t = 10ms No voltage	Sine half wave, Initial $T_J = T_{J \text{ max.}}$
	3360	4712	5100		t = 8.3ms reappplied	
	2700	3785	4100		t = 10ms 100% V_{RRM}	
	2800	3963	4300		t = 8.3ms reappplied	
I^2t Maximum I^2t for fusing	51.5	102	119	KA ² s	t = 10ms No voltage	
	47	92.5	108		t = 8.3ms reappplied	
	36.5	71.6	84		t = 10ms 100% V_{RRM}	
	33.3	65.4	76.7		t = 8.3ms reappplied	
$I^2\sqrt{t}$ Maximum $I^2\sqrt{t}$ for fusing	515.5	1013	1190	KA ² √s	t = 0.1 to 10ms, no voltage reappplied	
$V_{T(TO)1}$ Low level value of threshold voltage	0.86	0.83	0.8	V	$(16.7\% \times \pi \times I_{T(AV)}) < I < \pi \times I_{T(AV)}$, @ $T_{J \text{ max.}}$	
$V_{T(TO)2}$ High level value of threshold voltage	1.05	1	0.98		$(I > \pi \times I_{T(AV)})$, @ $T_{J \text{ max.}}$	
$r_{\theta 1}$ Low level value on-state slope resistance	2.02	1.78	1.67	mΩ	$(16.7\% \times \pi \times I_{T(AV)}) < I < \pi \times I_{T(AV)}$, @ $T_{J \text{ max.}}$	
$r_{\theta 2}$ High level value on-state slope resistance	1.65	1.43	1.38		$(I > \pi \times I_{T(AV)})$, @ $T_{J \text{ max.}}$	
V_{TM} Maximum forward voltage drop	1.57	1.55	1.54	V	$I_{TM} = \pi \times I_{T(AV)}$, $T_J = 25^\circ\text{C}$, 180° conduction	
I_H Maximum holding current	200			mA	Anode supply = 6V initial $I_r = 30A$, $T_J = 25^\circ\text{C}$	
I_L Maximum latching current	400			mA	Anode supply = 6V resistive load = 1Ω Gate pulse: 10V, 100μs, $T_J = 25^\circ\text{C}$	

Switching

t_{gd} Typical delay time	1	μs	$T_J = 25^\circ\text{C}$	Gate Current=1A $dI_g/dt=1A/\mu s$
t_{gr} Typical rise time	2		$T_J = 25^\circ\text{C}$	$V_d=0,67\% V_{DRM}$
t_q Typical turn-off time	50 - 200		$I_{TM} = 300A$; $-dI/dt = 15A/\mu s$; $T_J = T_{J \text{ max}}$ $V_r = 50V$; $dV/dt = 20V/\mu s$; Gate 0V, 100Ω	

Blocking

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

Triggering

Parameter	IRK.136	IRK.142	IRK.162	Units	Conditions
P_{GM}	12			W	$t_p \leq 5\text{ms}$, $T_J = T_{J\text{max.}}$
$P_{G(AV)}$	3			W	$f = 50\text{Hz}$, $T_J = T_{J\text{max.}}$
I_{GM}	3			A	$t_p \leq 5\text{ms}$, $T_J = T_{J\text{max.}}$
$-V_{GT}$	10			V	
V_{GT}	Max. required DC gate voltage to trigger	4		V	$T_J = -40^\circ\text{C}$
		2.5			$T_J = 25^\circ\text{C}$
		1.7			$T_J = T_{J\text{max.}}$
I_{GT}	Max. required DC gate current to trigger	270		mA	$T_J = -40^\circ\text{C}$
		150			$T_J = 25^\circ\text{C}$
		80			$T_J = T_{J\text{max.}}$
V_{GD}	Max. gate voltage that will not trigger	0.3		V	@ $T_J = T_{J\text{max.}}$, 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	@ $T_J = T_{J\text{max.}}$, $I_{TM} = 400\text{A}$ rated V_{DRM} applied

Thermal and Mechanical Specifications

Parameter	IRK.136	IRK.142	IRK.162	Units	Conditions
T_J	-40 to 125			$^\circ\text{C}$	
T_{stg}	-40 to 150			$^\circ\text{C}$	
R_{thJC}	0.18	0.18	0.16	K/W	DC operation, per junction
R_{thCS}	0.05			K/W	Mounting surface smooth, flat and greased Per module
T	Mounting 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.
	torque $\pm 10\%$ busbar to IAP	4 to 6			
wt	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 @ $T_J\text{max.}$					Rectangular conduction @ $T_J\text{max.}$					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	

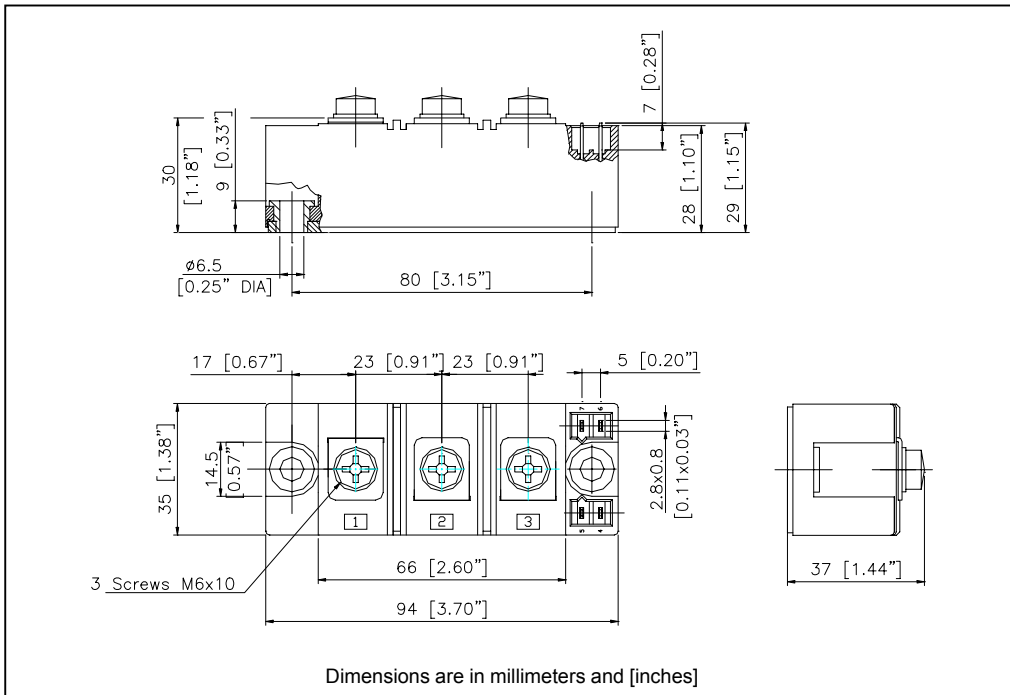
IRK.136, .142, .162 Series

Bulletin I27117 rev. C 03/02

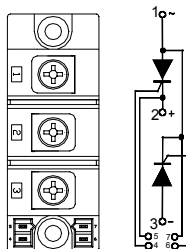
Ordering Information Table

Device Code				
1	2	3	4	
IRK	T	162	/	16
1	- Module Type			
2	- Circuit Configuration			
3	- Current Rating: $I_{T(AV)}$			
4	- Voltage Code: Code x 100 = V_{RRM}			

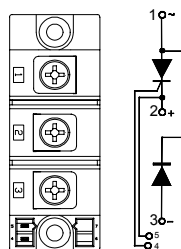
Outline Table



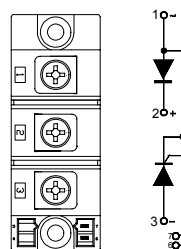
IRKT



IRKH



IRKL



NOTE: To order the Optional Hardware see Bulletin I27900

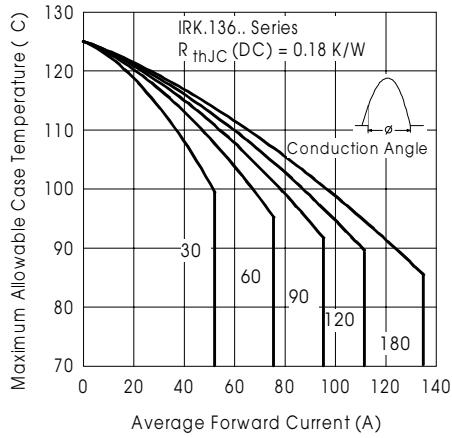


Fig. 1 - Current Ratings Characteristics

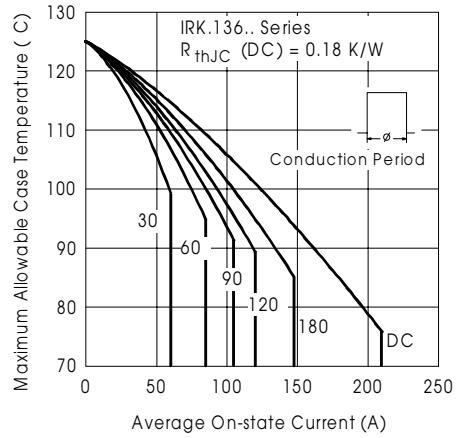


Fig. 2 - Current Ratings Characteristics

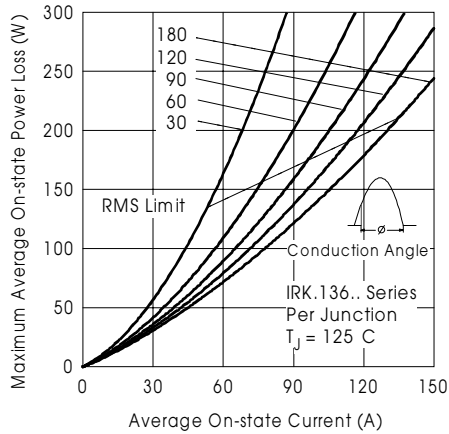


Fig. 3 - On-State Power Loss Characteristics

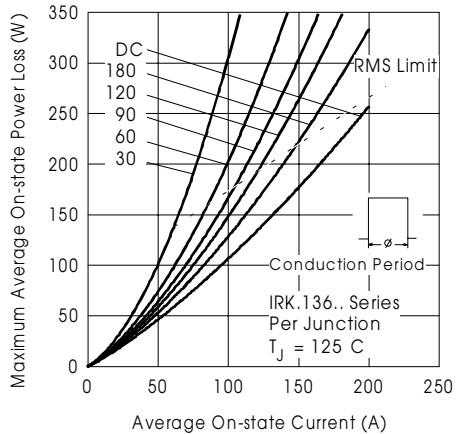


Fig. 4 - On-State Power Loss Characteristics

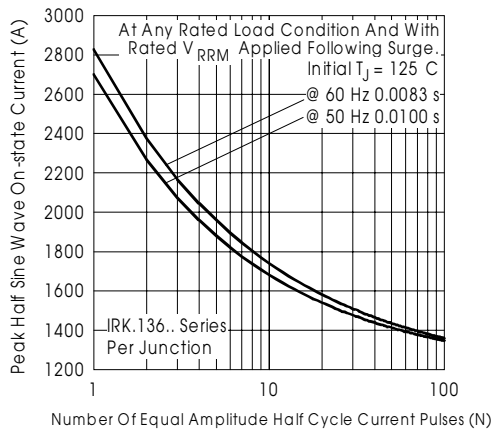


Fig. 5 - Maximum Non-Repetitive Surge Current

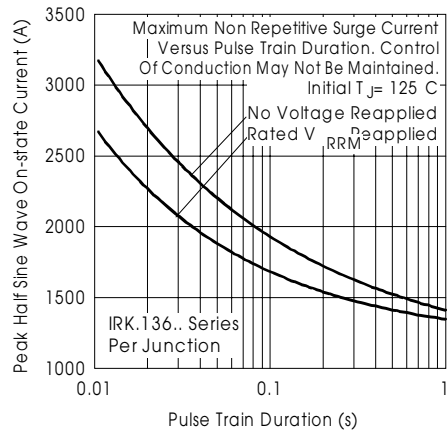


Fig. 6 - Maximum Non-Repetitive Surge Current

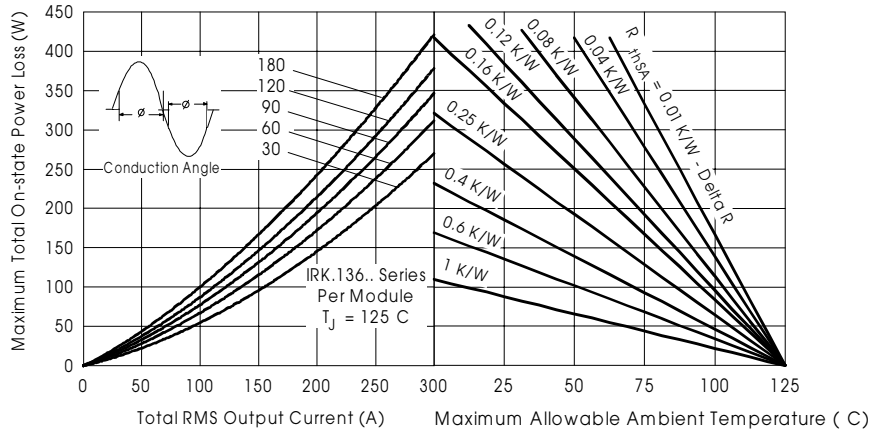


Fig.7 - On State Power Loss Characteristics

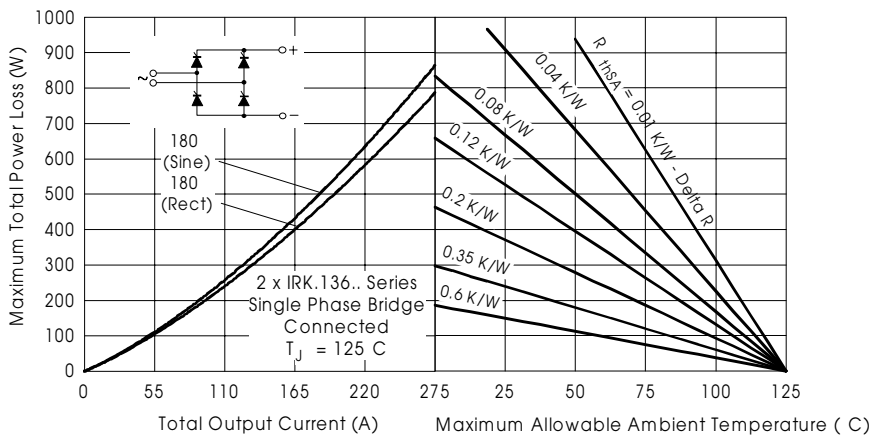


Fig.8 - On State Power Loss Characteristics

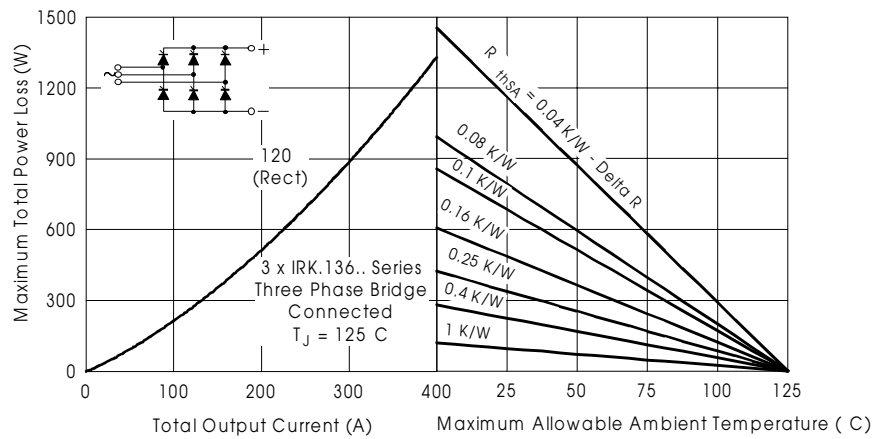


Fig.9 - On State Power Loss Characteristics

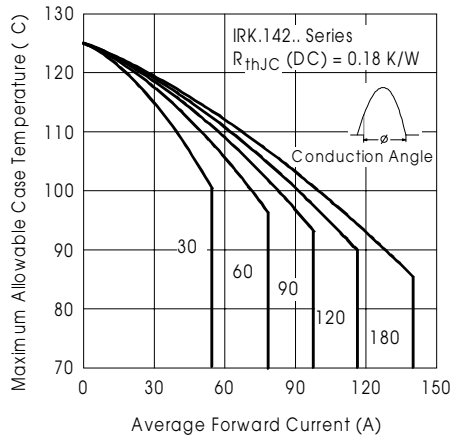


Fig. 10 - Current Ratings Characteristics

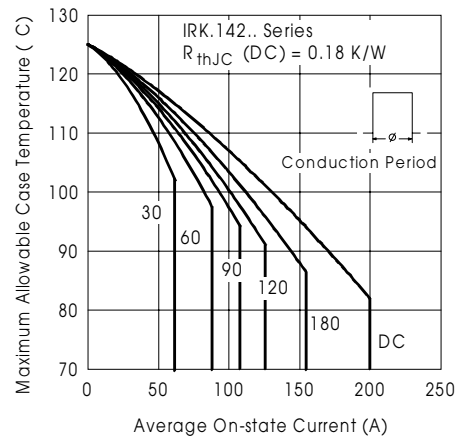


Fig. 11 - Current Ratings Characteristics

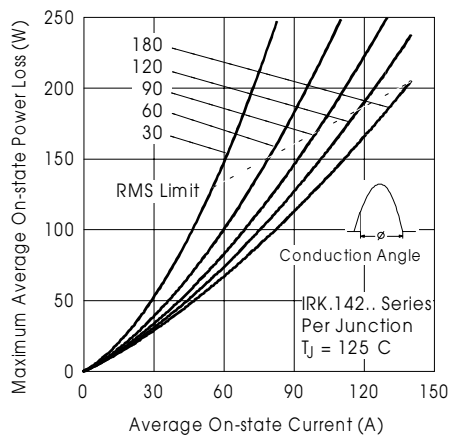


Fig. 12 - On-State Power Loss Characteristics

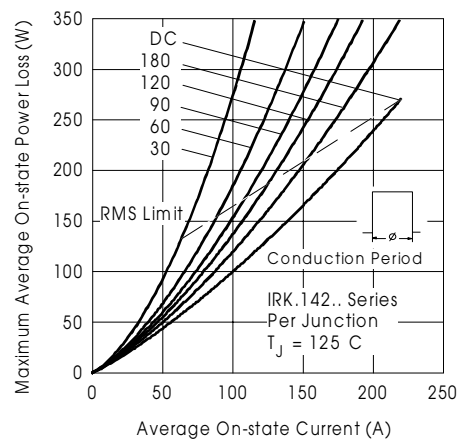


Fig. 13 - On-State Power Loss Characteristics

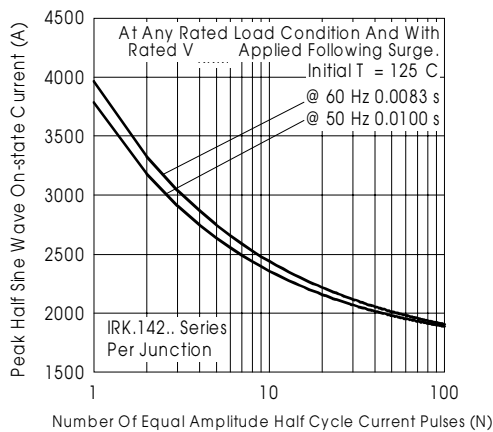


Fig. 14 - Maximum Non-Repetitive Surge Current

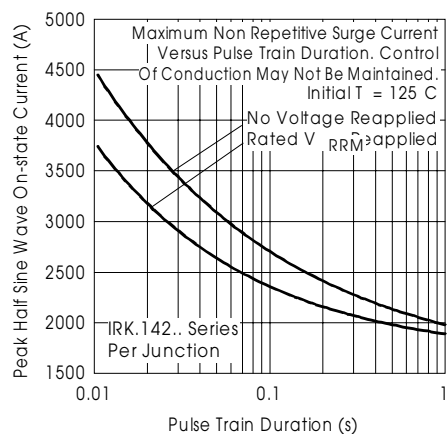


Fig. 15 - Maximum Non-Repetitive Surge Current

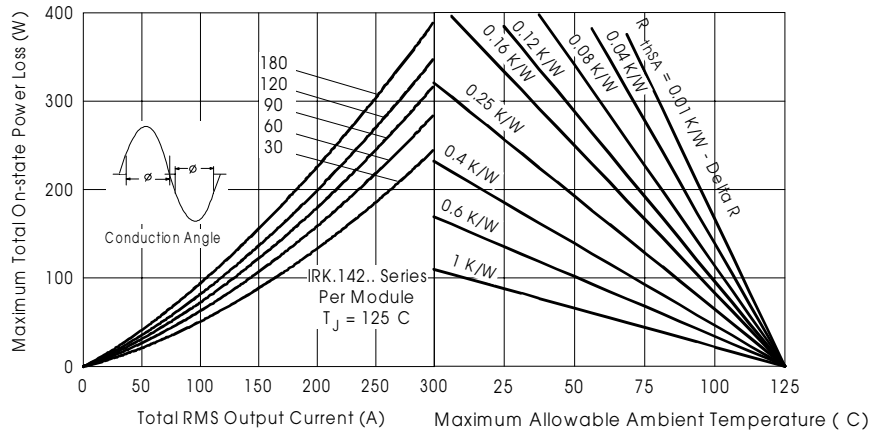


Fig.16 - On State Power Loss Characteristics

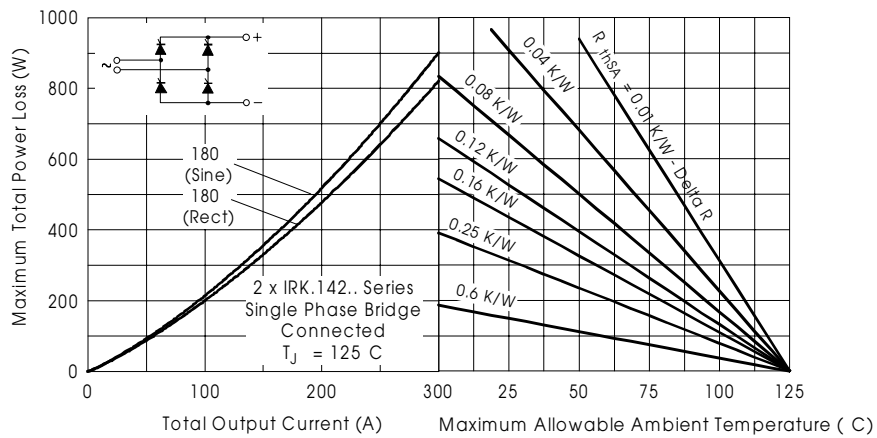


Fig.17 - On State Power Loss Characteristics

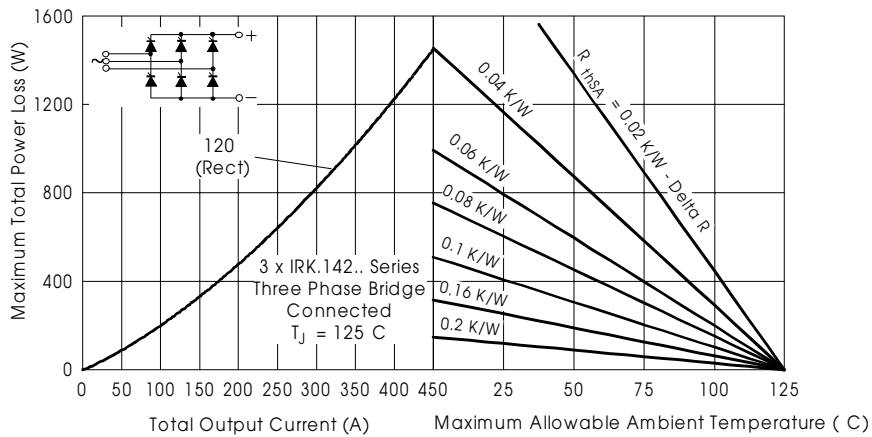


Fig.18 - On State Power Loss Characteristics

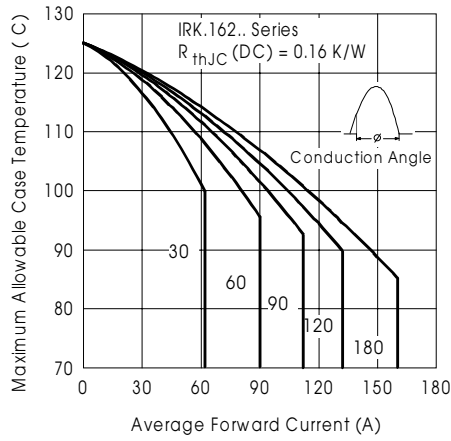


Fig. 19 - Current Ratings Characteristics

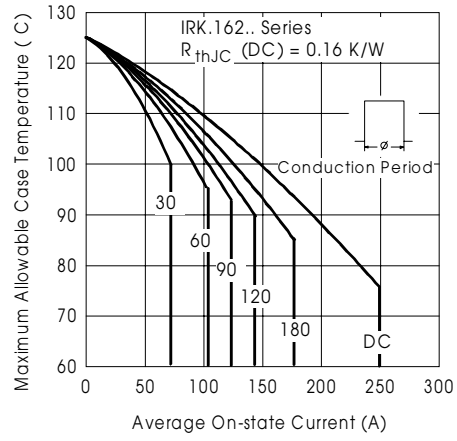


Fig. 20 - Current Ratings Characteristics

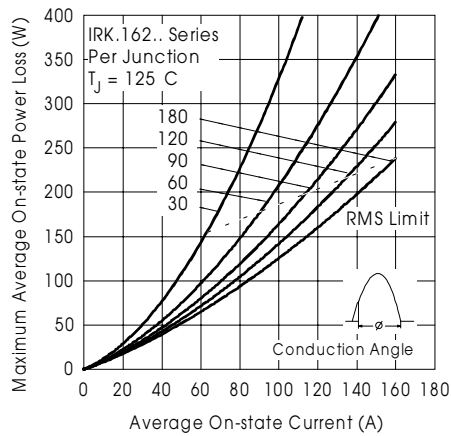


Fig. 21 - On-State Power Loss Characteristics

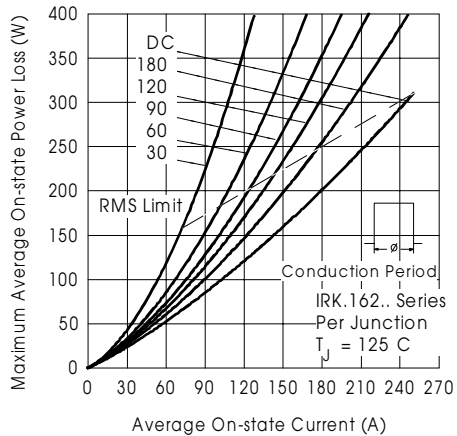


Fig. 22 - On-State Power Loss Characteristics

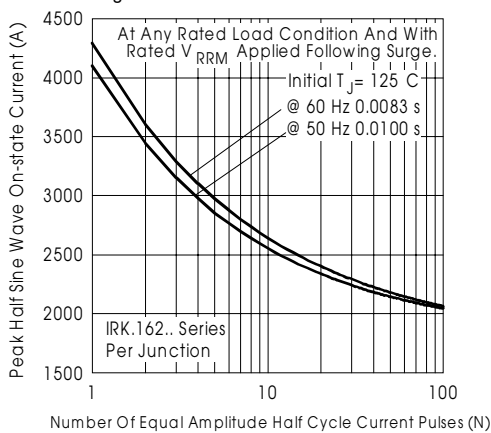


Fig. 23 - Maximum Non-Repetitive Surge Current

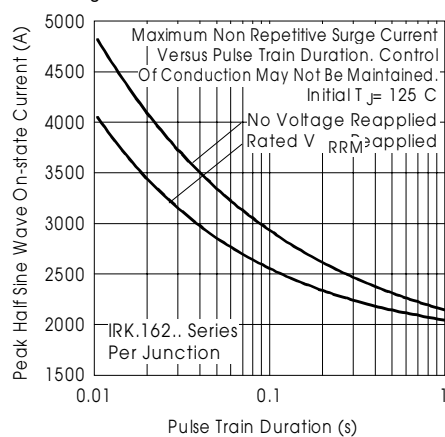


Fig. 24 - Maximum Non-Repetitive Surge Current

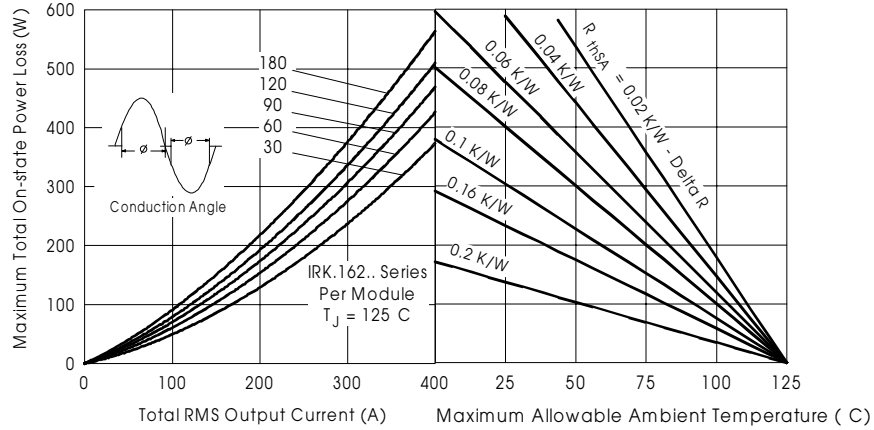


Fig.25 - On State Power Loss Characteristics

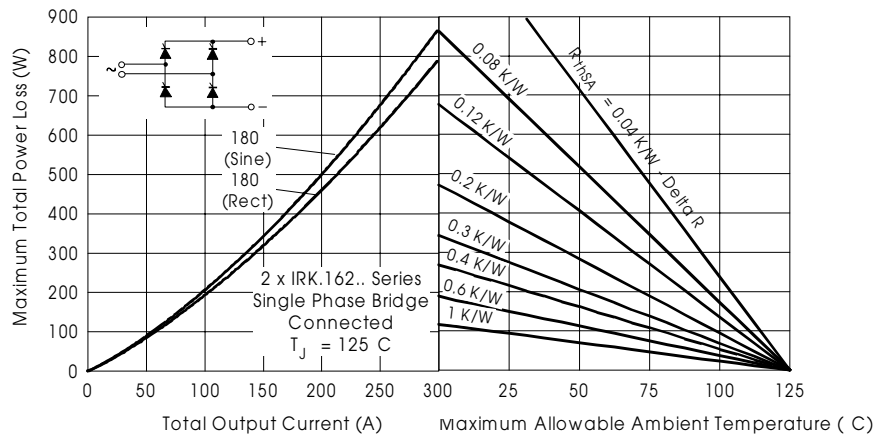


Fig.26 - On State Power Loss Characteristics

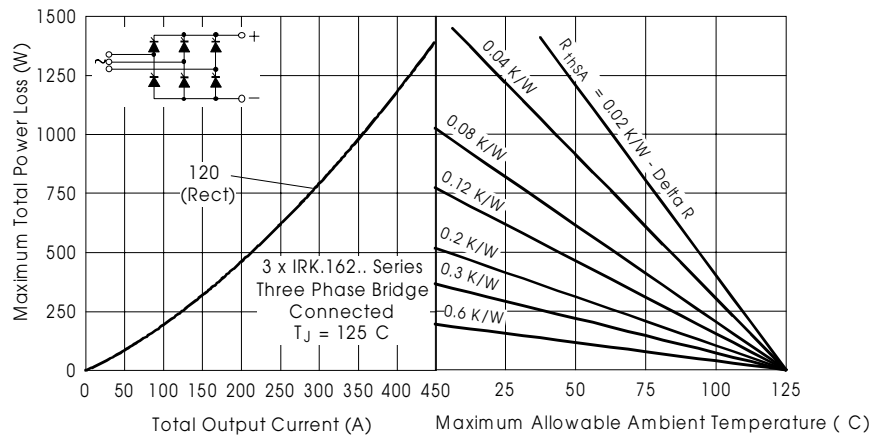


Fig.27 - On State Power Loss Characteristics

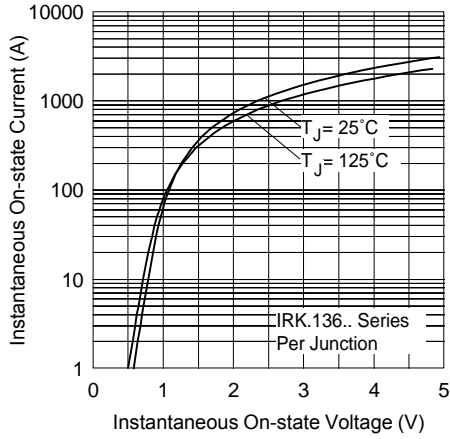


Fig.28 - On State Voltage Drop Characteristics

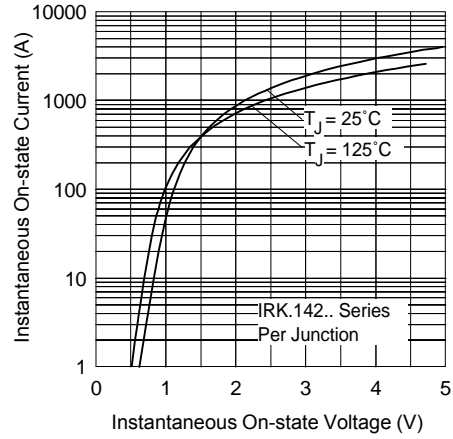


Fig.29 - On State Voltage Drop Characteristics

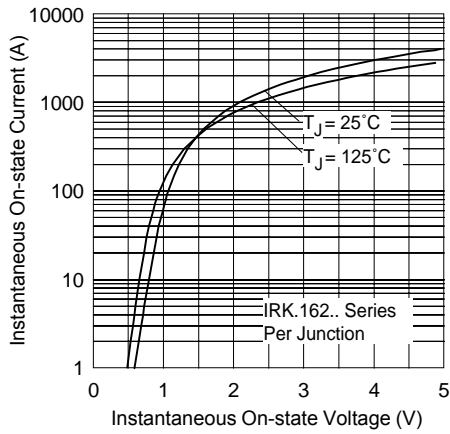


Fig.30 - On State Voltage Drop Characteristics

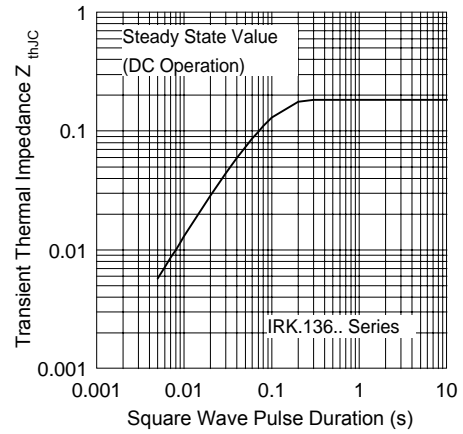


Fig.31 - Thermal Impedance ZthJC Characteristics

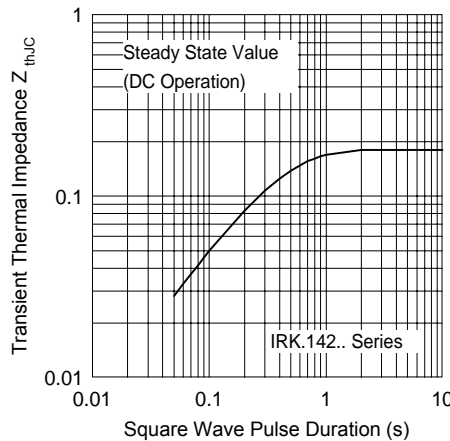


Fig.32 - Thermal Impedance ZthJC Characteristics

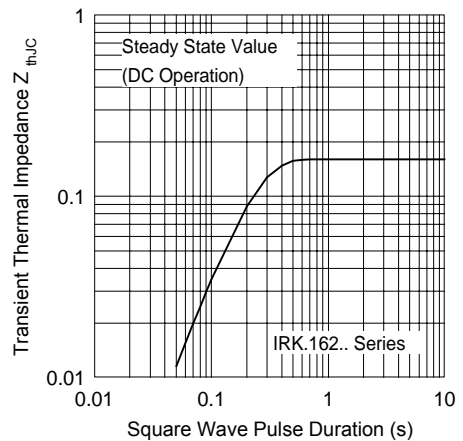


Fig.33 - Thermal Impedance ZthJC Characteristics

IRK.136, .142, .162 Series

Bulletin I27117 rev. C 03/02

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IR Rectifier

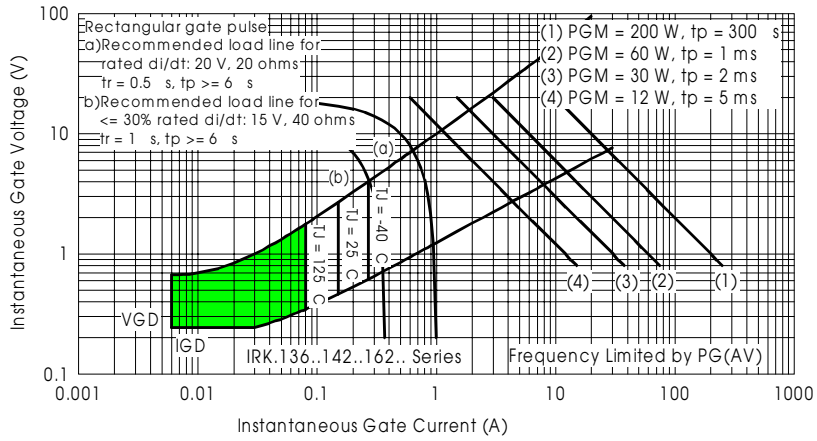


Fig. 34 - Gate Characteristics

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
IR Rectifier

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