

International Rectifier

SERIES IRK.165, .166, .195, .196, .235, .236

DIODES

NEW INT-A-pak™ Power Modules

INTERNATIONAL RECTIFIER 65E D

165A
195A
230A

Features

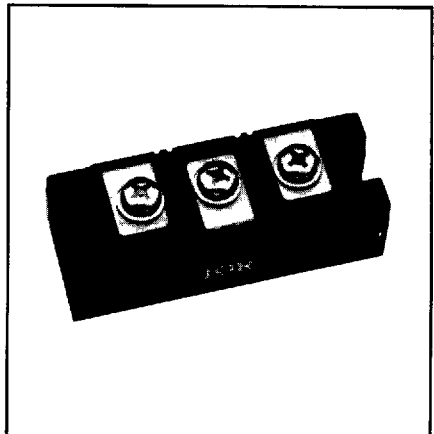
- High voltage
- Electrically isolated base plate
- 3000 V_{RMS} isolating voltage
- Industrial standard package
- Simplified mechanical designs, rapid assembly
- High surge capability
- Large creepage distances
- Beryllium oxide substrate
- Also available with aluminum nitride substrate

Description

This new IRK series of INT-A-paks uses high voltage power diodes in two basic configurations. The semiconductors are electrically isolated from the metal base, allowing common heatsinks and compact assemblies to be built. They can be interconnected to form single phase or three phase bridges and the single diode module can be used in conjunction with the thyristor modules as a freewheel diode. These modules are intended for general purpose applications such as battery chargers, welders and plating equipment and where high voltage and high current are required (motor drives, etc.).

Major Ratings and Characteristics

Parameters	IRK.165... IRK.166...	IRK.195... IRK.196...	IRK.235... IRK.236...	Units	
I _{F(AV)} @ T _C = 100°C	165	195	230	A	
I _{F(RMS)}	260	305	360	A	
I _{FSM}	50Hz	4000	4750	6540	A
	60Hz	4200	4980	6850	A
I ² t	50Hz	80	113	214	kA ² s
	60Hz	73	103	195	kA ² s
I ² /t	1130	1130	2140	kA ² /s	
V _{RRM} range	Up to 2000	Up to 2000	Up to 2400	V	
T _J	-40 to 150			°C	



ELECTRICAL SPECIFICATIONS

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B5E D

Voltage Ratings

Type number	Voltage Code	V_{RRM} , Maximum repetitive peak reverse voltage V	V_{RSM} , Maximum non-repetitive peak reverse voltage V	I_{RRM} Max @ 150°C mA
IRK.165- / IRK.166- IRK.195- / IRK.196- IRK.235- / IRK.236-	04	400	500	50
	06	600	700	50
	08	800	900	50
	10	1000	1100	50
	12	1200	1300	50
	14	1400	1500	50
	16	1600	1700	50
	18	1800	1900	50
	20	2000	2100	50
IRK.235- / IRK.236-	22	2200	2300	50
	24	2400	2500	50

Forward Conduction

Parameters	IRK.165 IRK.166	IRK.195 IRK.196	IRK.235 IRK.236	Units	Conditions	
$I_{F(AV)}$ Maximum average forward current @ Case temperature	165	195	230	A	180° conduction, half sine wave	
	100	100	100	°C		
$I_{F(RMS)}$ Maximum RMS forward current	260	305	360	A	as AC switch	
I_{FSM} Maximum peak, one-cycle forward, non-repetitive surge current	4000	4750	6540	A	t = 10ms	Sinusoidal half wave, initial $T_J = T_J \text{ max}$
	4200	4980	6850	A	t = 8.3ms	
	3350	4000	5500	A	t = 10ms	
	3500	4200	5750	A	t = 8.3ms	
I^2t Maximum I^2t for fusing	80	113	214	kA ² s	t = 10ms	Sinusoidal half wave, initial $T_J = T_J \text{ max}$
	73	103	195	kA ² s	t = 8.3ms	
	56	80	151	kA ² s	t = 10ms	
	52	73	138	kA ² s	t = 8.3ms	
I^2/t Maximum I^2/t for fusing	798	1130	2140	kA ² /s	t = 0.1 to 10ms, no voltage reapplied	
$V_{F(TO1)}$ Low level value of threshold voltage	0.70	0.75	0.79	V	$(16.7\% \times \pi \times I_{F(AV)} < 1 < \pi \times I_{F(AV)}) T_J = T_J \text{ max.}$	
$V_{F(TO2)}$ High level value of threshold voltage	0.87	0.86	0.92	V	$(\pi \times I_{F(AV)} < 1 < 20 \times \pi \times I_{F(AV)}) T_J = T_J \text{ max.}$	
$r_{\theta 1}$ Low level forward slope resistance	1.69	0.92	0.64	mΩ	$(16.7\% \times \pi \times I_{F(AV)} < 1 < \pi \times I_{F(AV)}) T_J = T_J \text{ max.}$	
$r_{\theta 2}$ High level forward slope resistance	1.42	0.77	0.49	mΩ	$(\pi \times I_{F(AV)} < 1 < 20 \times \pi \times I_{F(AV)}) T_J = T_J \text{ max.}$	
V_{FM} Maximum forward voltage drop	1.57	1.32	1.26	V	$I_{FM} = \pi \times I_{F(AV)}, T_J = T_J \text{ max., } 180^\circ \text{ conduction}$ Av. power = $V_{F(TO)} \times I_{F(AV)} + r_f \times (I_{F(RMS)})^2$	

Thermal and Mechanical Specifications

T_J Junction operating temperature	-40 to 150 °C				
T_{stg} Storage temperature range	-40 to 150 °C				
$R_{\theta JC}$ Maximum thermal resistance junction to case	0.20	0.20	0.17	K/W	Per junction, DC operation
	0.20	0.20	0.17	K/W	
$R_{\theta CS}$ Thermal resistance, case to heatsink	0.035	0.035	0.035	K/W	Mounting surface flat, smooth and greased (per module)
T Mounting INT-A-pak to heatsink torque: ±10% Busbar to INT-A-pak	4 to 6			Nm	A mounting compound is recommended and the torque should be rechecked after a period of about 3 hours to allow for the spread of the compound
	4 to 6			Nm	
wt Approximate weight	500			g	
	17.8			oz	
Case style	INT-A-pak				

Blocking

I_{RRM} Max. peak reverse leakage current	35	35	35	mA	$T_J = 150^\circ\text{C}$
V_{INS} RMS isolation voltage	3000	3000	3000	V	50Hz, circuit to base, all terminals shorted, t = 1s

ΔR Conduction (per Junction)

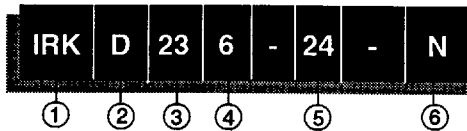
(The following table shows the increment of thermal resistance R_{thJC} when devices operate at different conduction angles than DC)

Conduction angle		IRK.165 IRK.166	IRK.195 IRK.196	IRK.235 IRK.236	Units	Conditions
	180°	0.016	0.016	0.016	K/W	$T_j = T_j \text{ max.}$ Sinusoidal conduction
	120°	0.019	0.019	0.019	K/W	
	90°	0.024	0.024	0.025	K/W	
	60°	0.035	0.035	0.036	K/W	
	30°	0.060	0.060	0.060	K/W	
	180°	0.011	0.011	0.012	K/W	$T_j = T_j \text{ max.}$ Rectangular conduction
	120°	0.019	0.019	0.020	K/W	
	90°	0.026	0.026	0.027	K/W	
	60°	0.037	0.037	0.037	K/W	
	30°	0.060	0.060	0.060	K/W	

Ordering Information Table

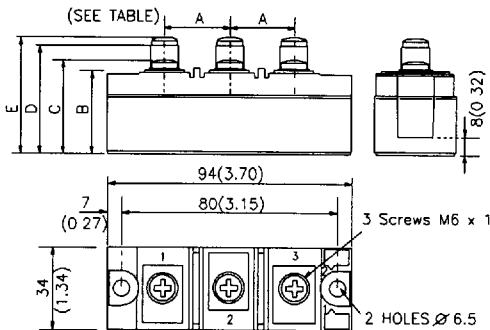
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Device Code



- 1** - Module type
- 2** - Circuit configuration (See Outline Table)
- 3** - Current rating: IF (AV) x 10 rounded
- 4** - 5 = option with spacers and longer terminal screws
6 = option with standard terminal screws
- 5** - Voltage code: Code x 100 = V_{ARM}
- 6** - None = Standard devices (beryllium oxide)
N = Aluminium nitride substrate (contact factory)

Outline Table



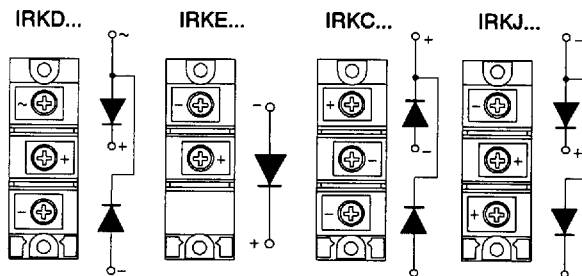
CONTAINS BERYLLIUM OXIDE CERAMIC

- May contain Beryllium Oxide Ceramic, and under normal circumstances is non hazardous.
- Do not open, cut or grind
- Unserviceable parts must be disposed of as harmful waste

HARMFUL

For all types:	A	B	C	D	E
IRK 5	25(0.98)	---	---	41(1.61)	47(1.85)
IRK 6	23(0.91)	30(1.18)	36(1.42)	---	---

- All dimensions in millimeters (inches)
- Dimensions are nominal
- Full engineering drawings are available on request
- UL identification number for cathode wire: UL 1385
- UL identification number for package: UL 94V0



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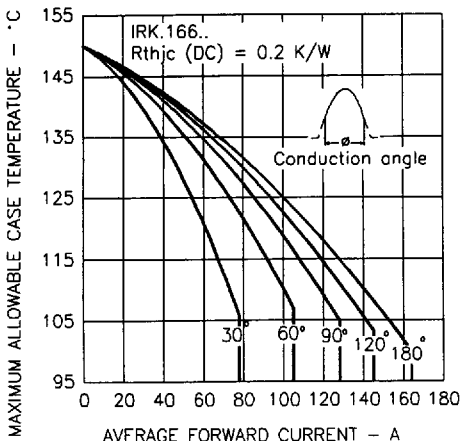


Fig. 1 - Current Ratings Characteristics

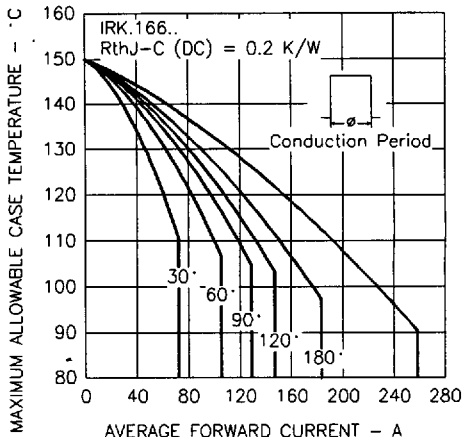


Fig. 2 - Current Ratings Characteristics

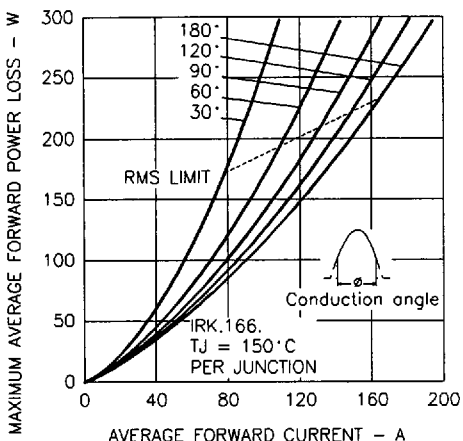


Fig. 3 - Forward Power Loss Characteristics

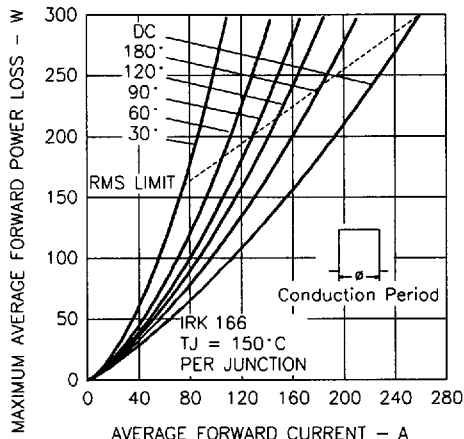


Fig. 4 - Forward Power Loss Characteristics

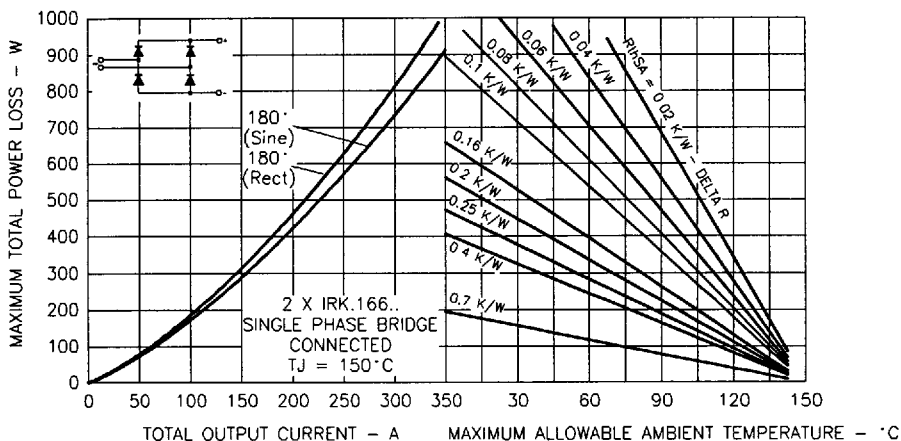


Fig. 5 - Forward Power Loss Characteristics

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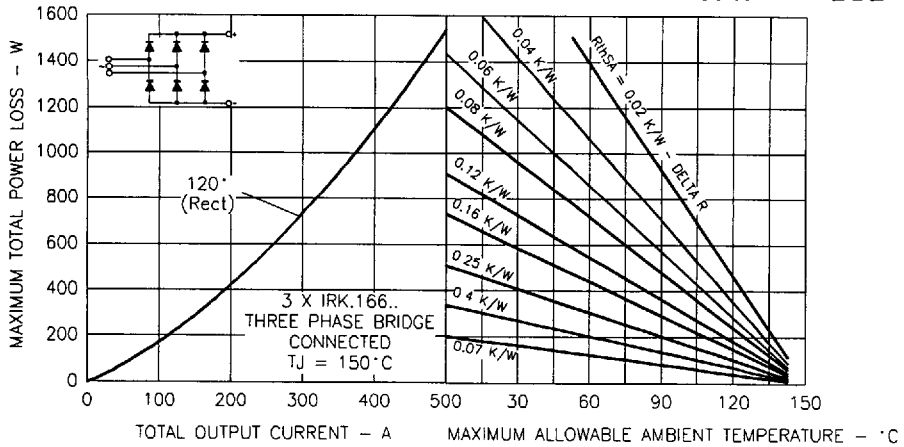


Fig. 6 - Forward Power Loss Characteristics

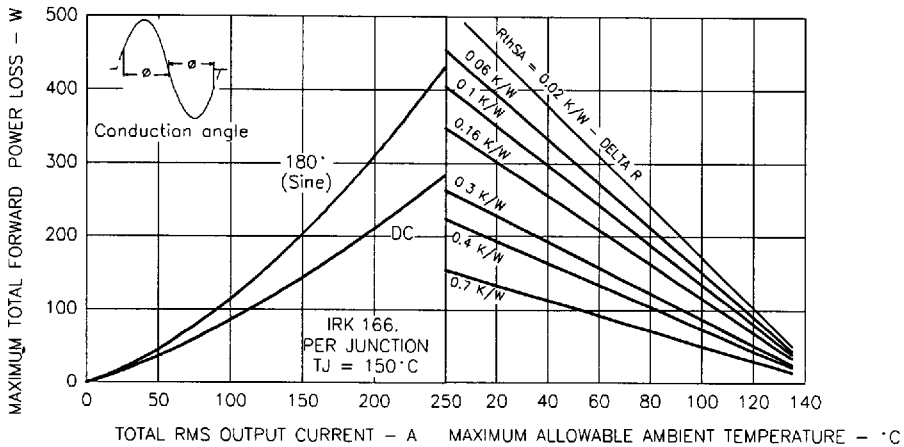


Fig. 7 - Forward Power Loss Characteristics

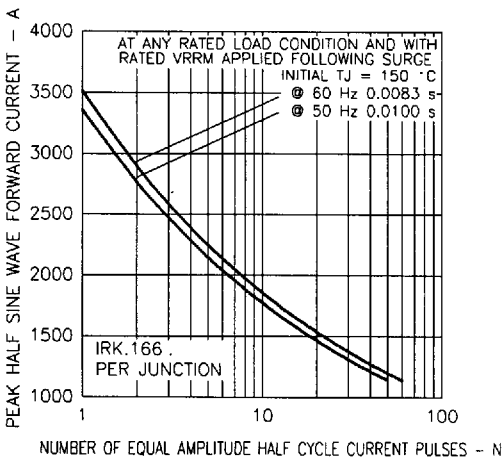


Fig. 8 - Maximum Non-Repetitive Surge Current

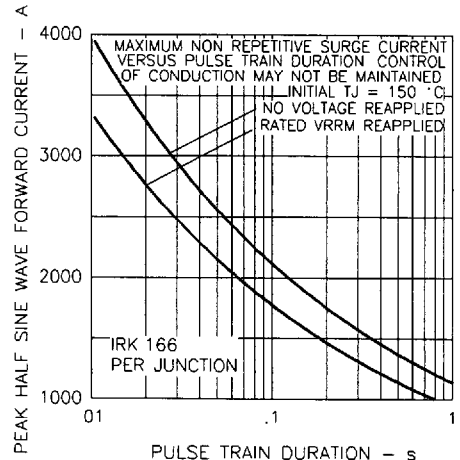


Fig. 9 - Maximum Non-Repetitive Surge Current

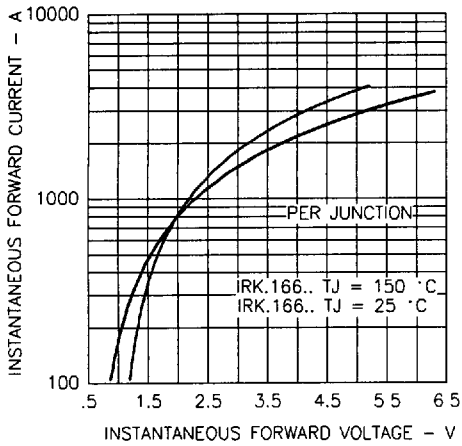


Fig. 10 - Forward Voltage Drop Characteristics

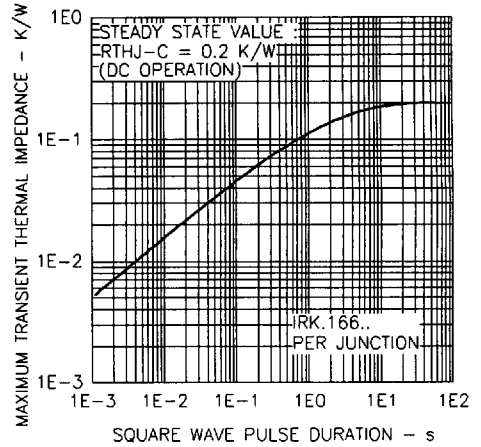


Fig. 11 - Thermal Impedance Z_{thJC} Characteristics

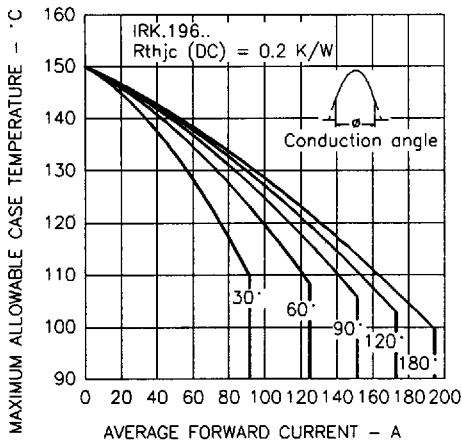


Fig. 12 - Current Ratings Characteristics

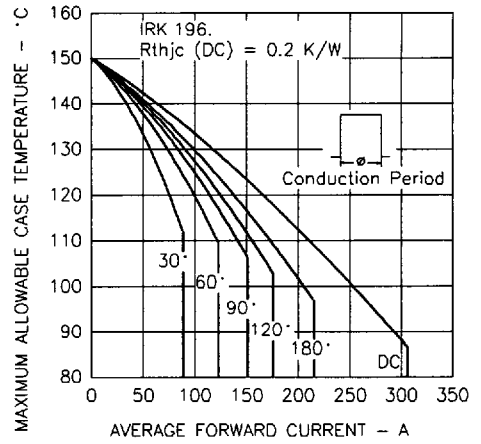


Fig. 13 - Current Ratings Characteristics

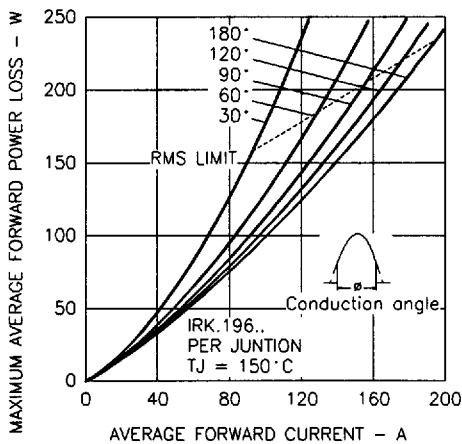


Fig. 14 - Forward Power Loss Characteristics

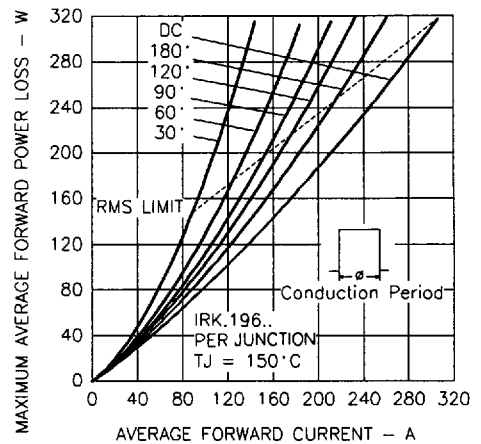


Fig. 15 - Forward Power Loss Characteristics

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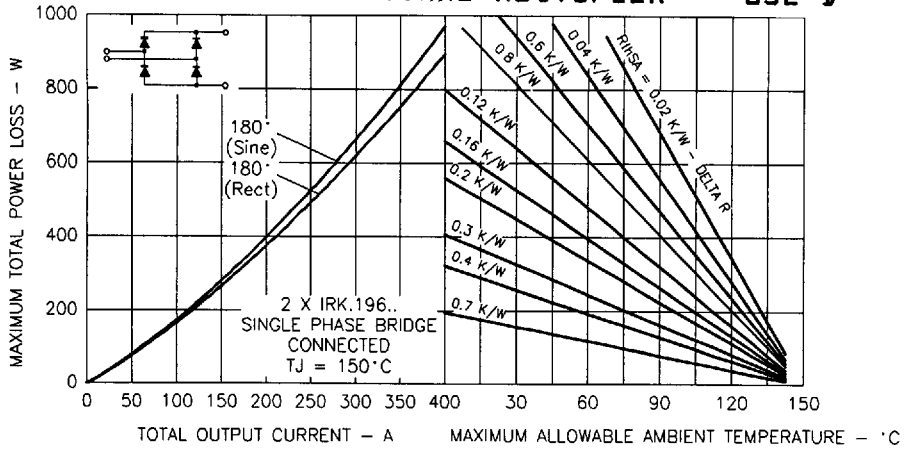


Fig. 16 - Forward Power Loss Characteristics

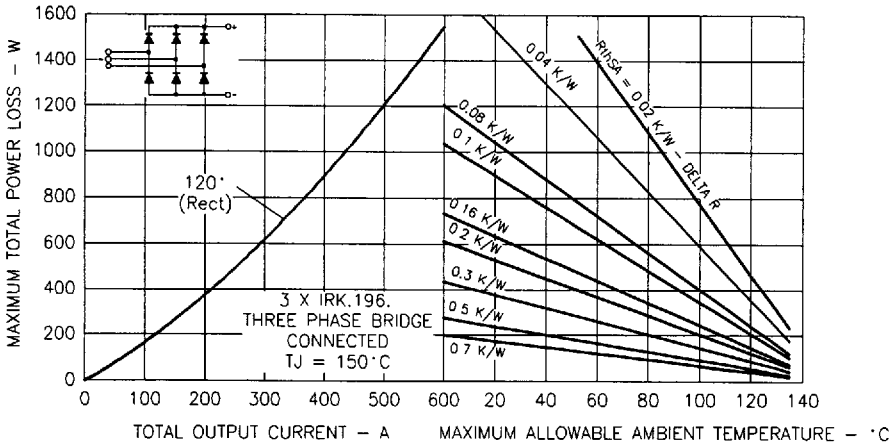


Fig. 17 - Forward Power Loss Characteristics

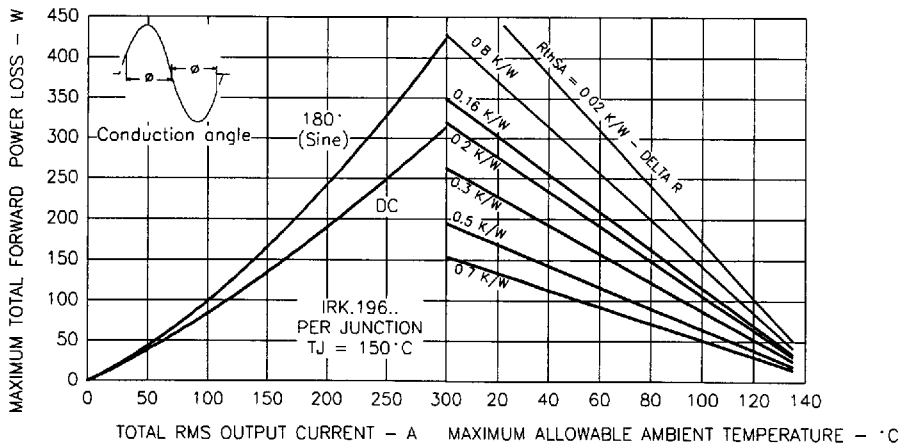


Fig. 18 - Forward Power Loss Characteristics

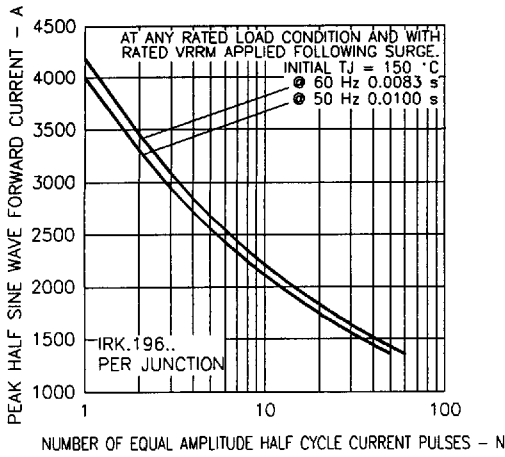


Fig. 19 - Maximum Non-Repetitive Surge Current

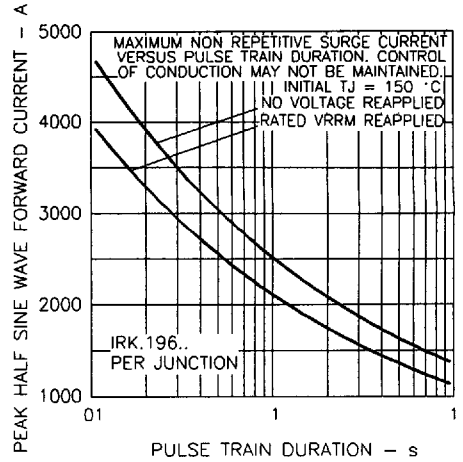


Fig. 20 - Maximum Non-Repetitive Surge Current

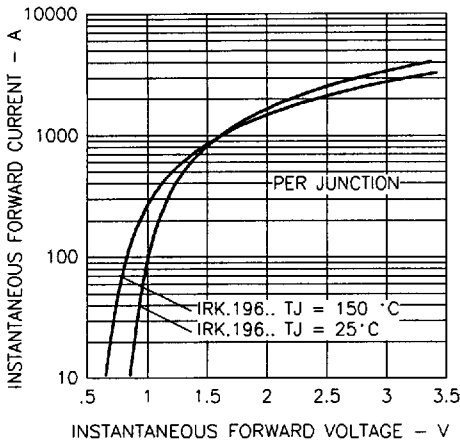


Fig. 21 - Forward Voltage Drop Characteristics

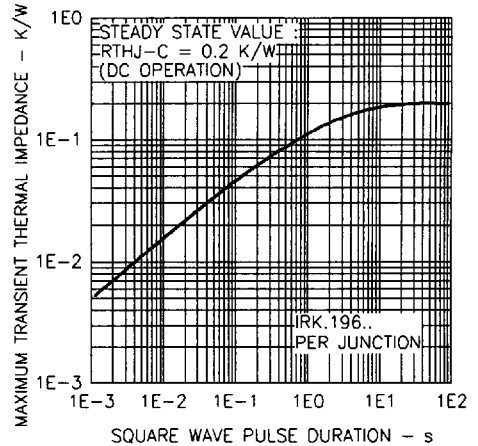


Fig. 22 - Thermal Impedance Z_{thJC} Characteristics

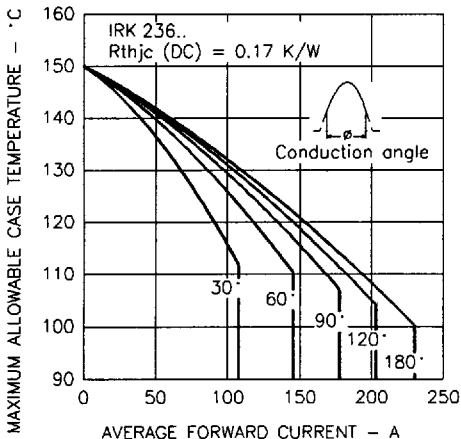


Fig. 23 - Current Ratings Characteristics

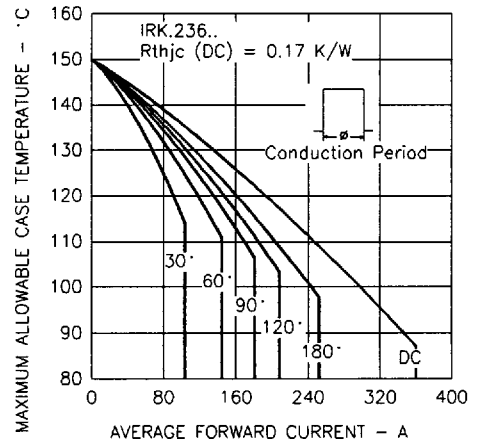


Fig. 24 - Current Ratings Characteristics

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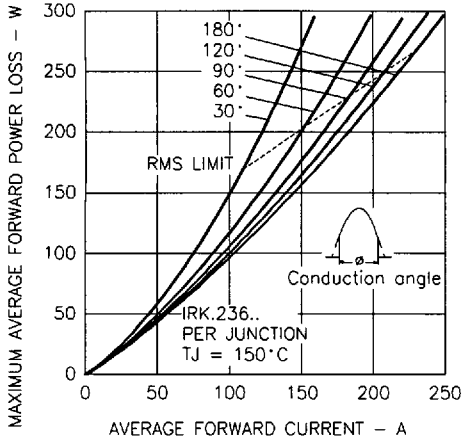


Fig. 25 - Forward Power Loss Characteristics

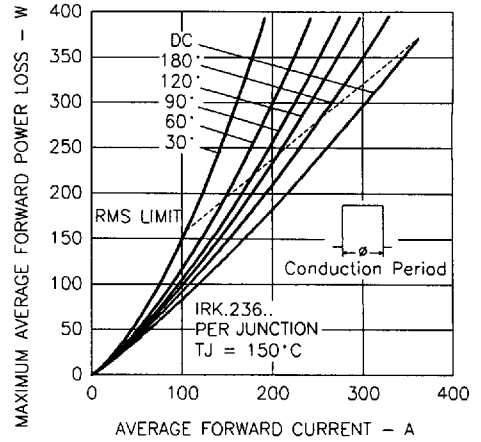


Fig. 26 - Forward Power Loss Characteristics

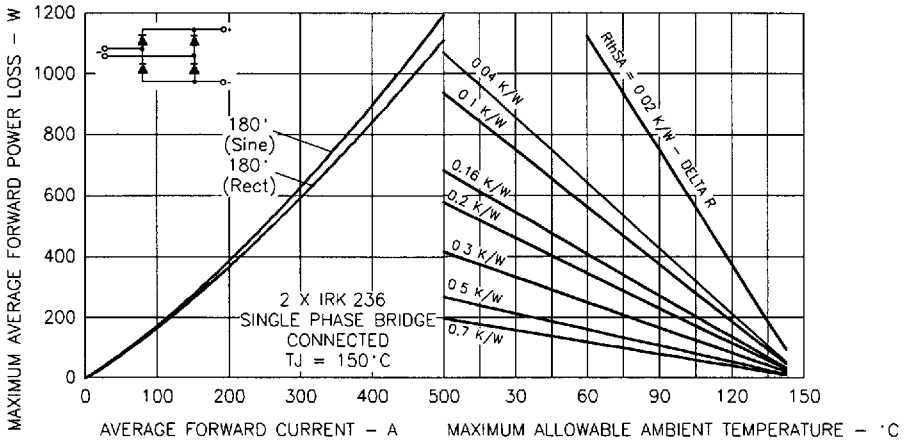


Fig. 27 - Forward Power Loss Characteristics

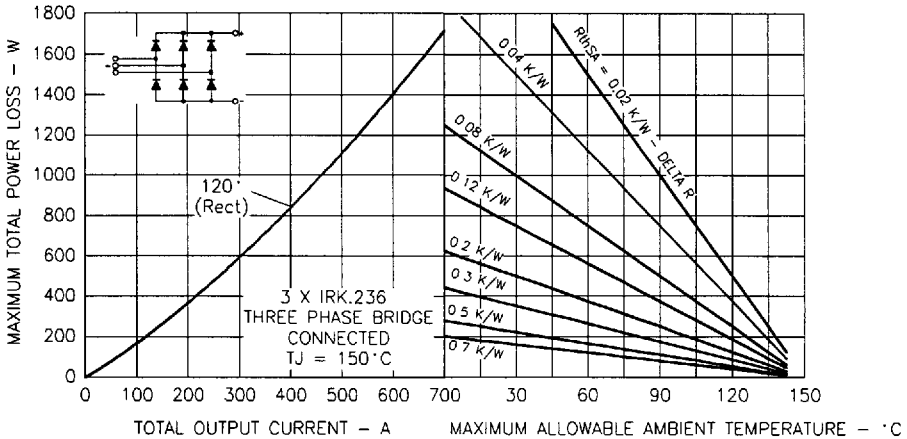


Fig. 28 - Forward Power Loss Characteristics

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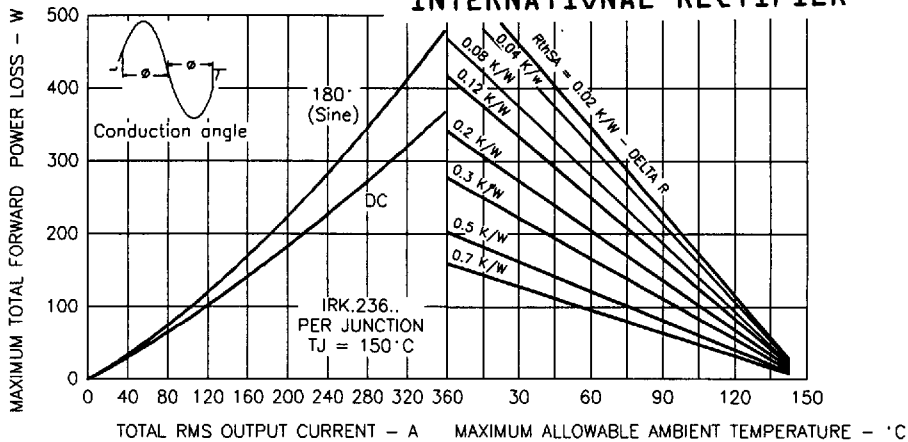


Fig. 29 - Forward Power Loss Characteristics

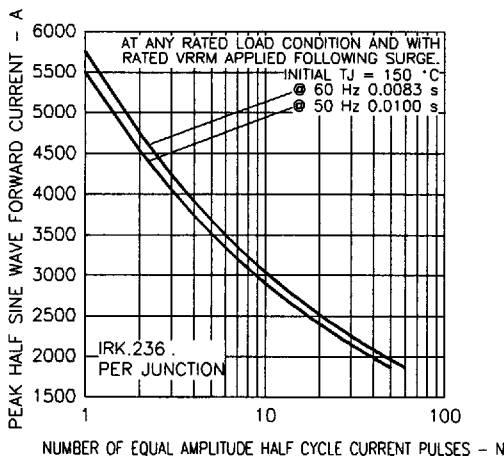


Fig. 30 - Maximum Non-Repetitive Surge Current

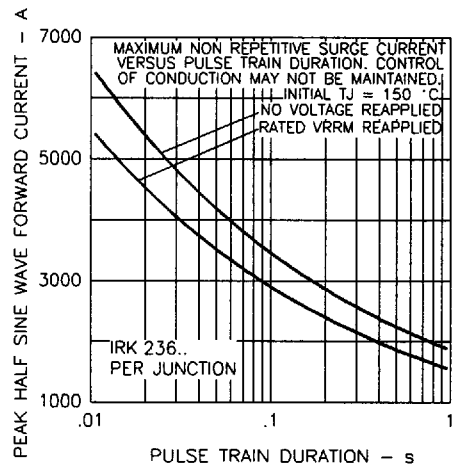


Fig. 31 - Maximum Non-Repetitive Surge Current

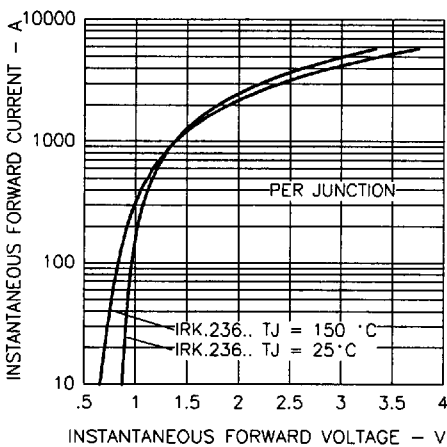


Fig. 32 - Forward Voltage Drop Characteristics

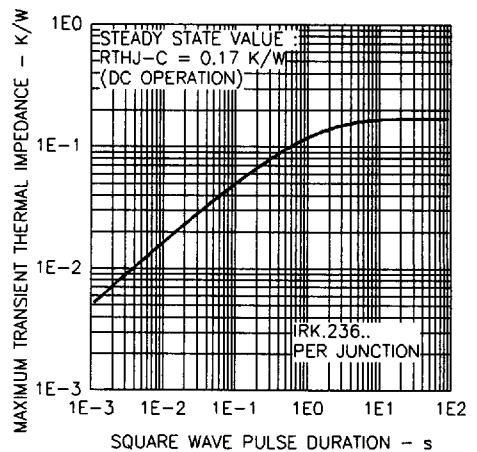


Fig. 33 - Thermal Impedance Z_{thJC} Characteristics