International
IOR Rectifier

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

DIODES

NEW INT-A-pak™ Power Modules

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 nitrade substrate

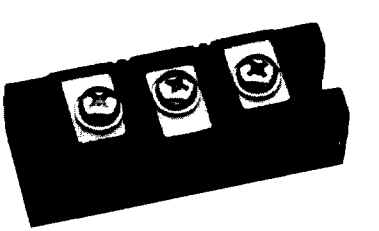
Description

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.).

DATA SHEETS

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^2t	50Hz	80	113	214	kA^2s
	60Hz	73	103	195	kA^2s
$I^2\sqrt{t}$		1130	1130	2140	$kA^2\sqrt{s}$
V_{RRM} range		Up to 2000	Up to 2000	Up to 2400	V
T_J		-40 to 150			°C



ELECTRICAL SPECIFICATIONS

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 m A
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	165	195	230	A	180° conduction, half sine wave		
	@ Case temperature	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	No voltage reapplied	Sinusoidal half wave, initial $T_J = T_J$ max
		4200	4980	6850	A	t = 8.3ms		
		3350	4000	5500	A	t = 10ms	100% V_{RRM} reapplied	
		3500	4200	5750	A	t = 8.3ms		
I^2t	Maximum I^2t for fusing	80	113	214	kA^2s	t = 10ms	No voltage reapplied	Sinusoidal half wave, Initial $T_J = T_J$ max
		73	103	195	kA^2s	t = 8.3ms		
		56	80	151	kA^2s	t = 10ms	100% V_{RRM} reapplied	
		52	73	138	kA^2s	t = 8.3ms		
$I^2\sqrt{t}$	Maximum $I^2\sqrt{t}$ for fusing	798	1130	2140	$kA^2\sqrt{s}$	t = 0.1 to 10ms, no voltage reapplied		
$V_{F(TO)1}$	Low level value of threshold voltage	0.70	0.75	0.79	V	$(16.7\% \times \pi \times I_{F(AV)} < I < \pi \times I_{F(AV)})$ $T_J = T_J$ max.		
$V_{F(TO)2}$	High level value of threshold voltage	0.87	0.86	0.92	V	$(\pi \times I_{F(AV)} < I < 20 \times \pi \times I_{F(AV)})$ $T_J = T_J$ max.		
r_{t1}	Low level forward slope resistance	1.69	0.92	0.64	mΩ	$(16.7\% \times \pi \times I_{F(AV)} < I < \pi \times I_{F(AV)})$ $T_J = T_J$ max.		
r_{t2}	High level forward slope resistance	1.42	0.77	0.49	mΩ	$(\pi \times I_{F(AV)} < I < 20 \times \pi \times I_{F(AV)})$ $T_J = T_J$ max.		
V_{FM}	Maximum forward voltage drop	1.57	1.32	1.26	V	$I_{FM} = \pi \times I_{F(AV)}$, $T_J = T_J$ max., 180° conduction Av. power = $V_{F(TO)} \times I_{F(AV)} + r_f \times (I_{F(RMS)})^2$		

Thermal and Mechanical Specifications

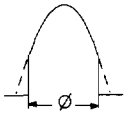
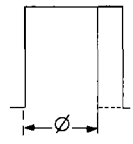
T_J	Junction operating temperature	-40 to 150 °C					
T_{stg}	Storage temperature range	-40 to 150 °C					
R_{thJC}	Maximum thermal resistance junction to case	0.20	0.20	0.17	K/W	IRKD-IRKC-IRKJ	Per junction, DC operation
		0.20	0.20	0.17	K/W	IRKE	
R_{thC-S}	Thermal resistance, case to heatsink	0.035	0.035	0.035	K/W	Mounting surface flat, smooth and greased (per module)	
T	Mounting tourque±10% INT-A-pak to heatsink	4 to 6			Nm	A mounting compound is recommended and the tourque should be rechecked after a period of about 3 hours to allow for the spread of the compound	
	Busbar to INT-A-pak	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°C
V_{INS}	RMS isolation voltage	3000	3000	3000	V	50Hz, circuit to base, all terminals shorted, t = 1s

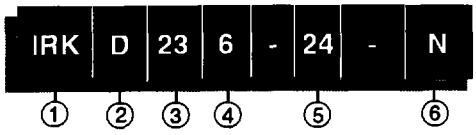
ΔR Conduction (per Junction)

(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	$T_J = T_J$ max.
	120°	0.019	0.019	0.019	K/W	Sinusoidal conduction
	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	$T_J = T_J$ max.
	120°	0.019	0.019	0.020	K/W	Rectangular conduction
	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

Device Code



1 - Module type

2 - Circuit configuration (See Outline Table)

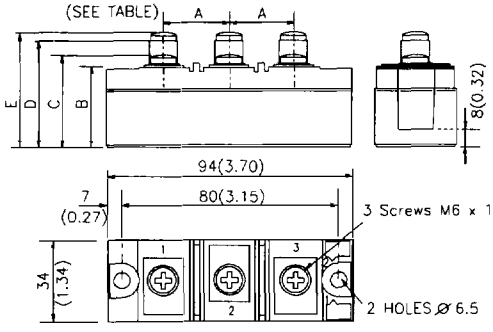
3 - Current rating: IF (AV) x 10 rounded

4 - 5 = option with spacers and longer terminal screws
6 = option with standard terminal screws

5 - Voltage code: Code x 100 = V_{RRM}

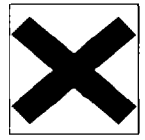
6 - None = Standard devices (beryllium oxide)
N = Aluminium nitrade substrate (contact factory)

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.

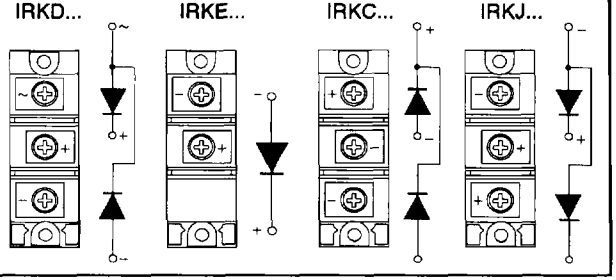


HARMFUL

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

IRKD... IRKE... IRKC... IRKJ...



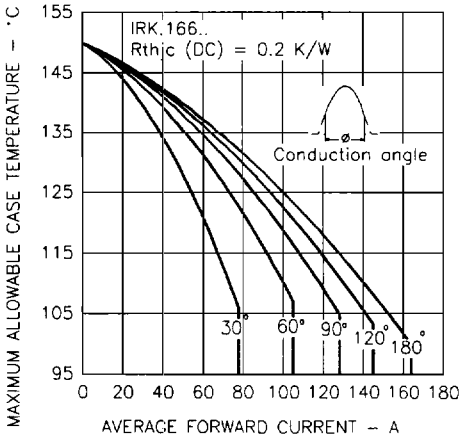


Fig. 1 - Current Ratings Characteristics

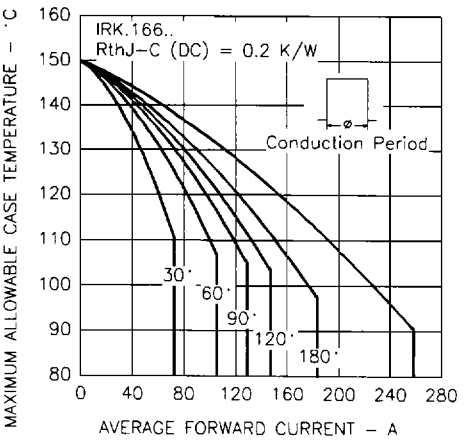


Fig. 2 - Current Ratings Characteristics

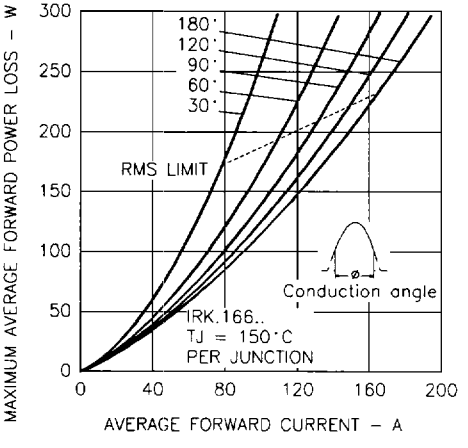


Fig. 3 - Forward Power Loss Characteristics

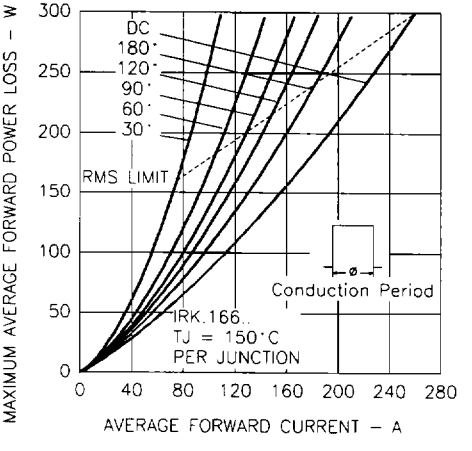


Fig. 4 - Forward Power Loss Characteristics

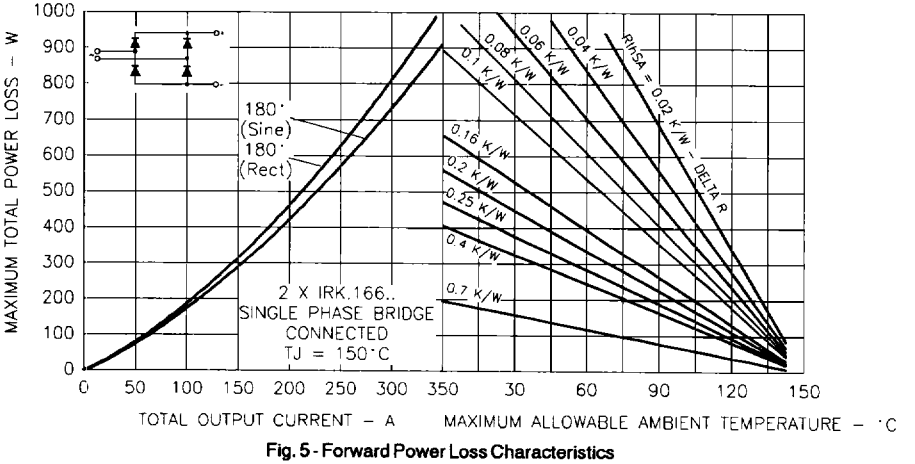


Fig. 5 - Forward Power Loss Characteristics

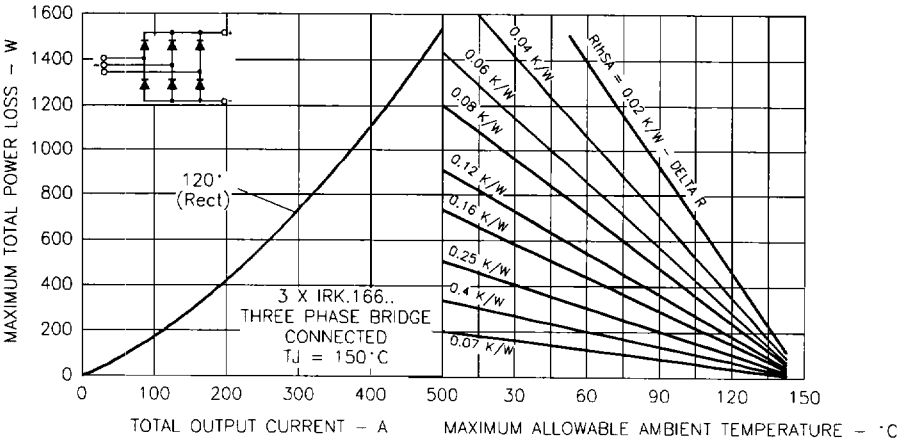


Fig. 6 - Forward Power Loss Characteristics

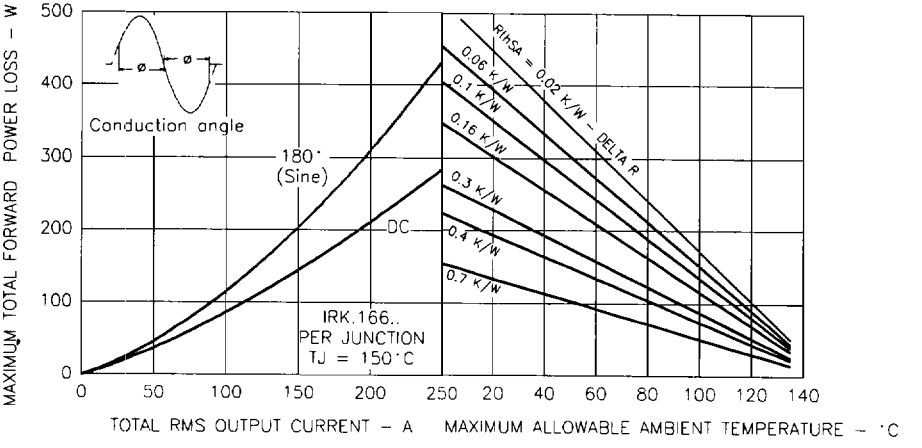


Fig. 7 - Forward Power Loss Characteristics

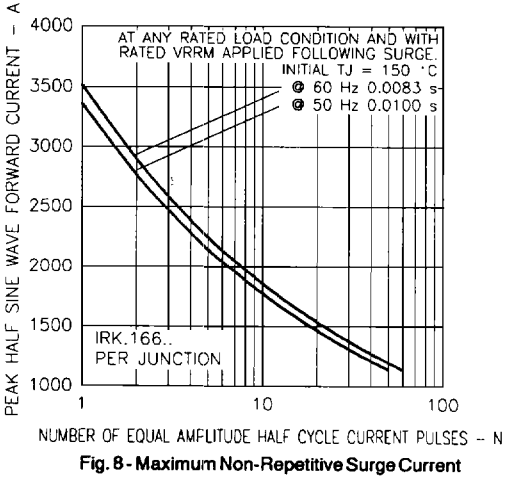


Fig. 8 - Maximum Non-Repetitive Surge Current

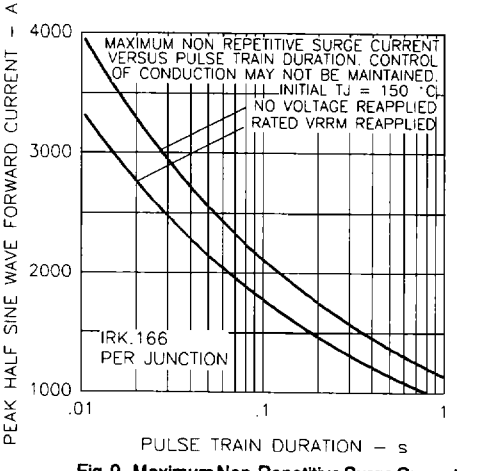


Fig. 9 - Maximum Non-Repetitive Surge Current

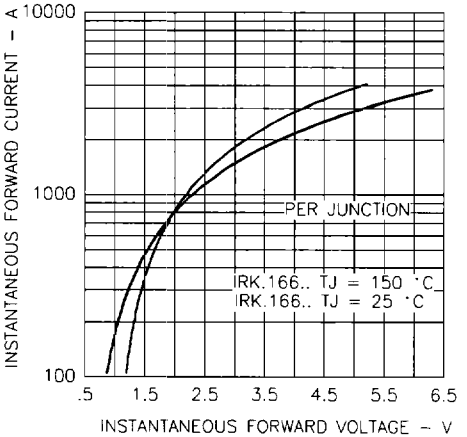


Fig. 10 - Forward Voltage Drop Characteristics

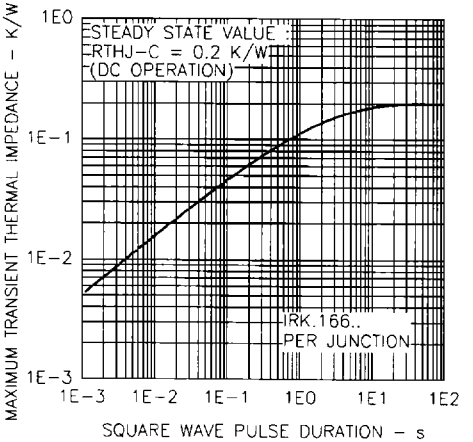


Fig. 11 - Thermal Impedance ZthJC Characteristics

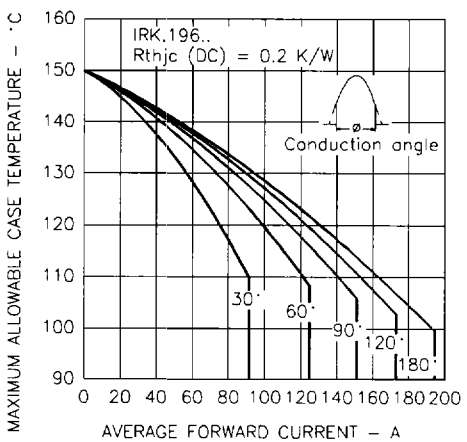


Fig. 12 - Current Ratings Characteristics

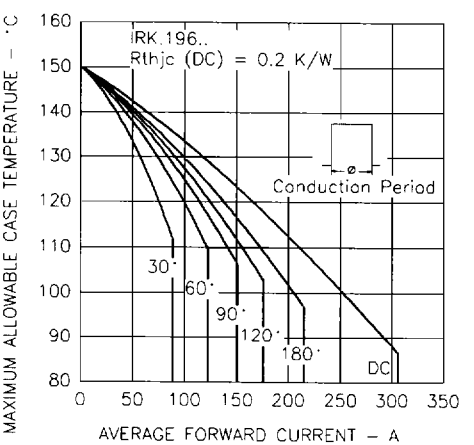


Fig. 13 - Current Ratings Characteristics

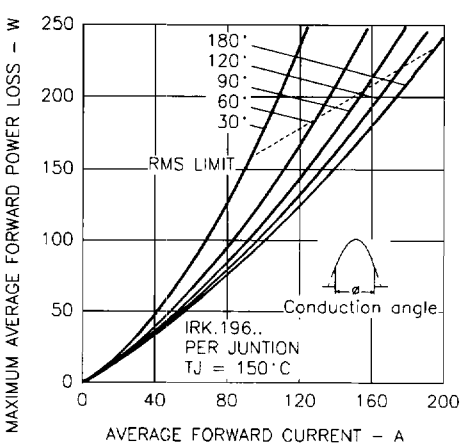


Fig. 14 - Forward Power Loss Characteristics

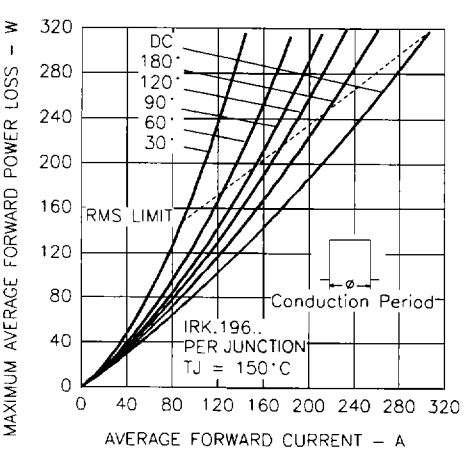


Fig. 15 - Forward Power Loss Characteristics

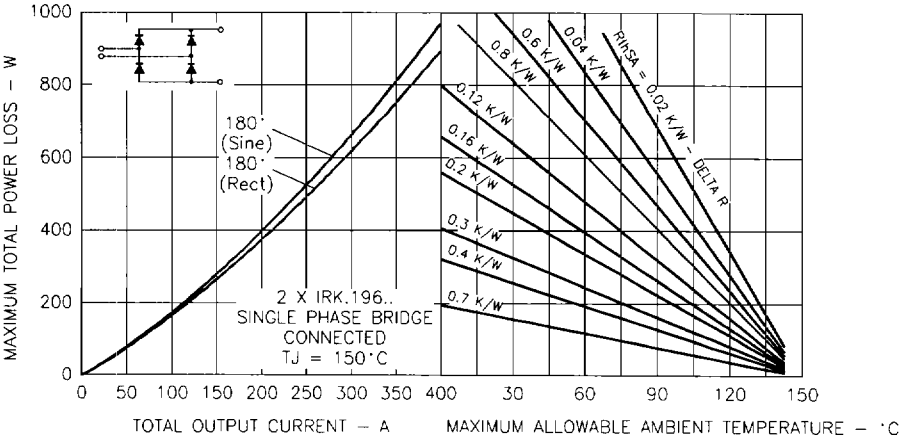


Fig. 16 - Forward Power Loss Characteristics

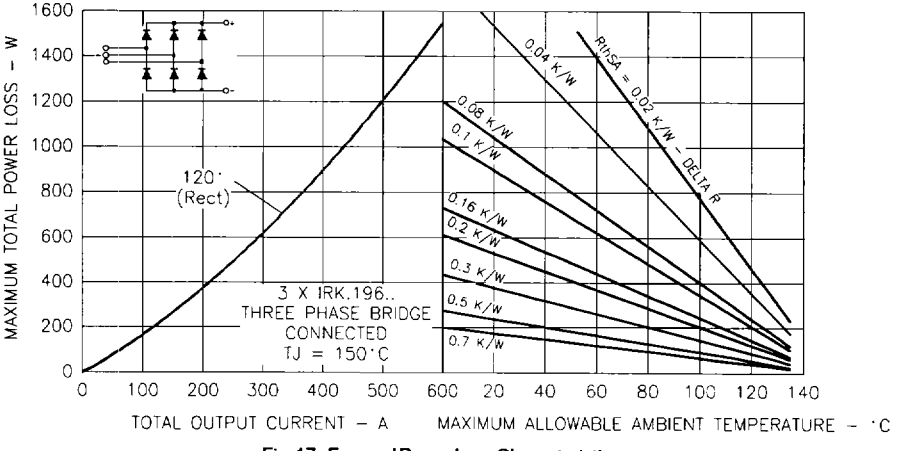


Fig. 17 - Forward Power Loss Characteristics

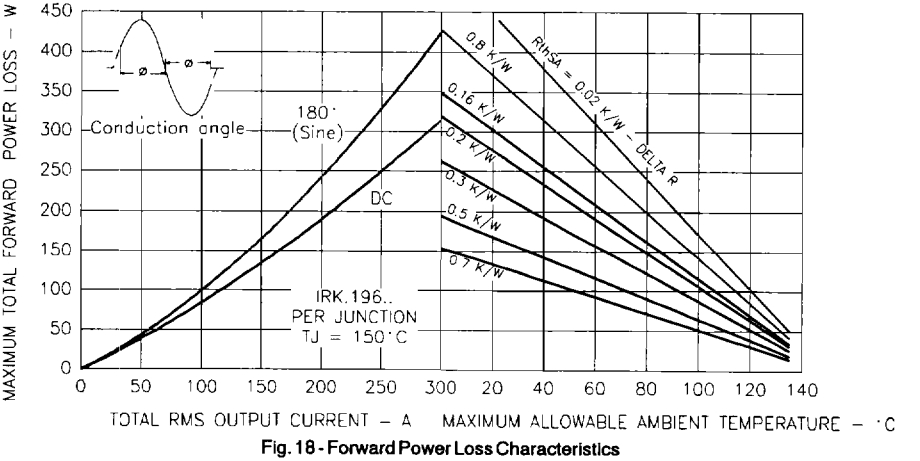


Fig. 18 - Forward Power Loss Characteristics

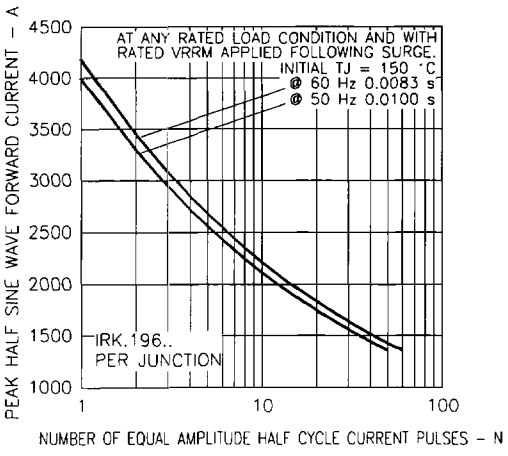


Fig. 19 - Maximum Non-Repetitive Surge Current

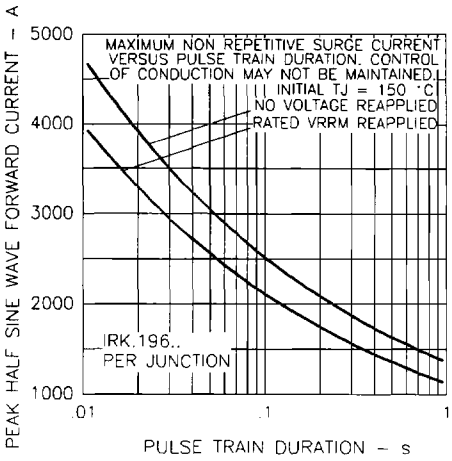


Fig. 20 - Maximum Non-Repetitive Surge Current

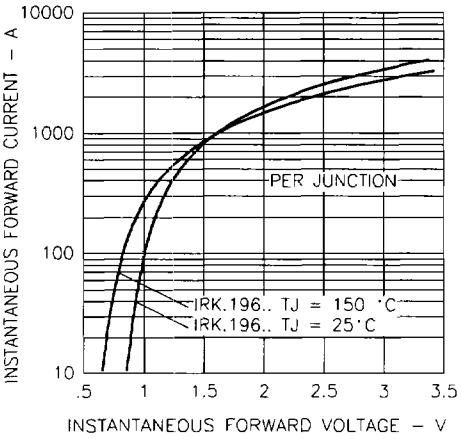


Fig. 21 - Forward Voltage Drop Characteristics

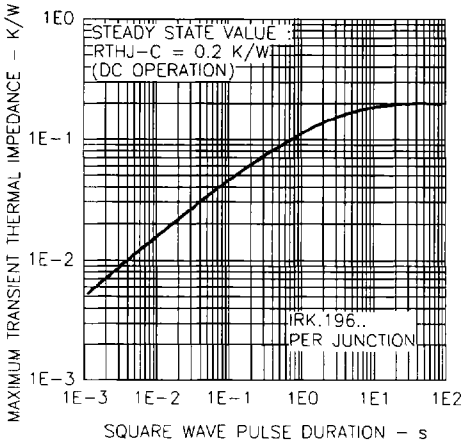


Fig. 22 - Thermal Impedance ZthJC Characteristics

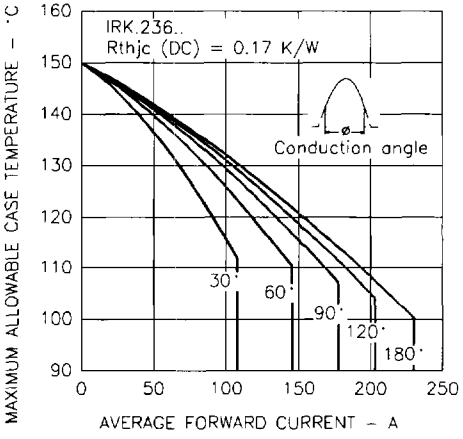


Fig. 23 - Current Ratings Characteristics

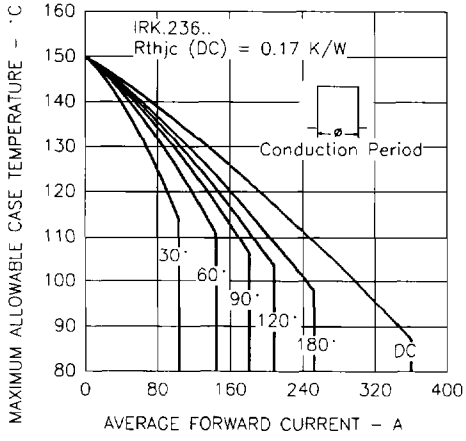


Fig. 24 - Current Ratings Characteristics

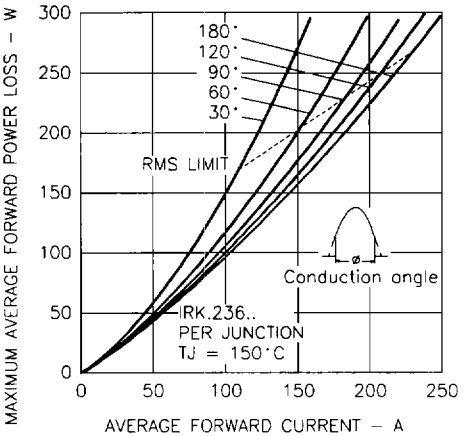


Fig. 25 - Forward Power Loss Characteristics

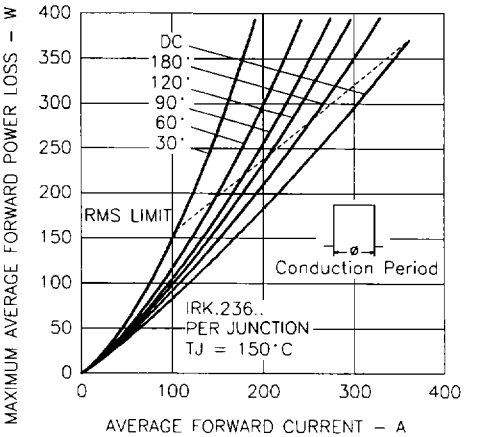


Fig. 26 - Forward Power Loss Characteristics

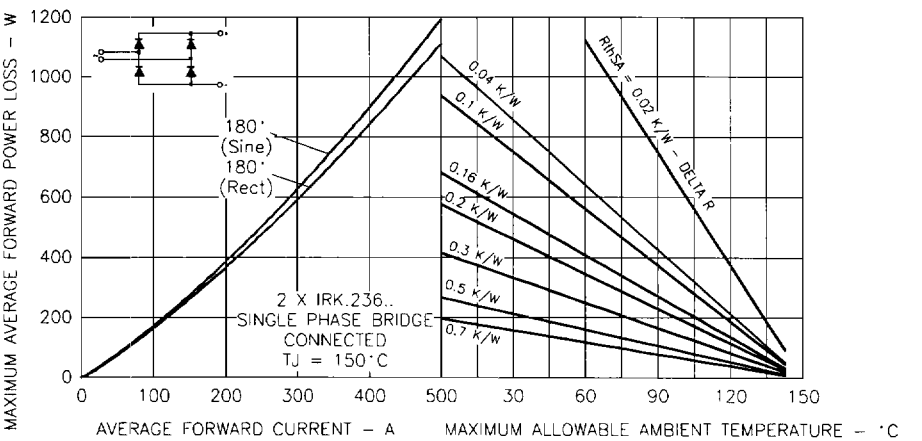


Fig. 27 - Forward Power Loss Characteristics

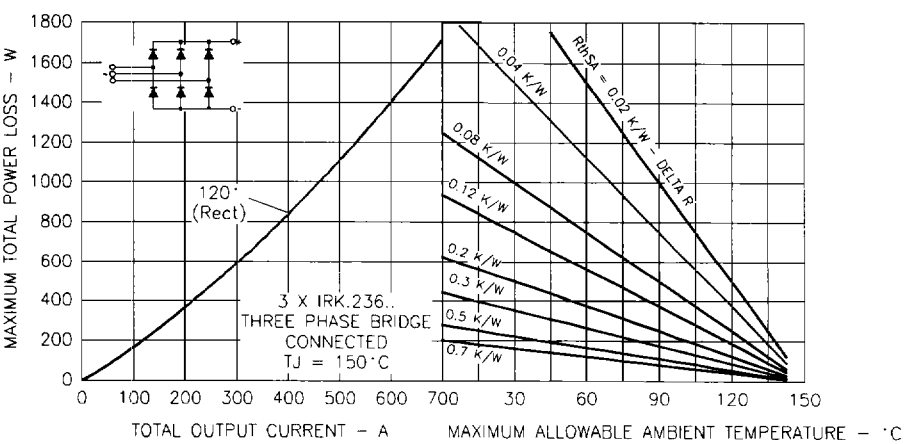


Fig. 28 - Forward Power Loss Characteristics

DATA SHEETS

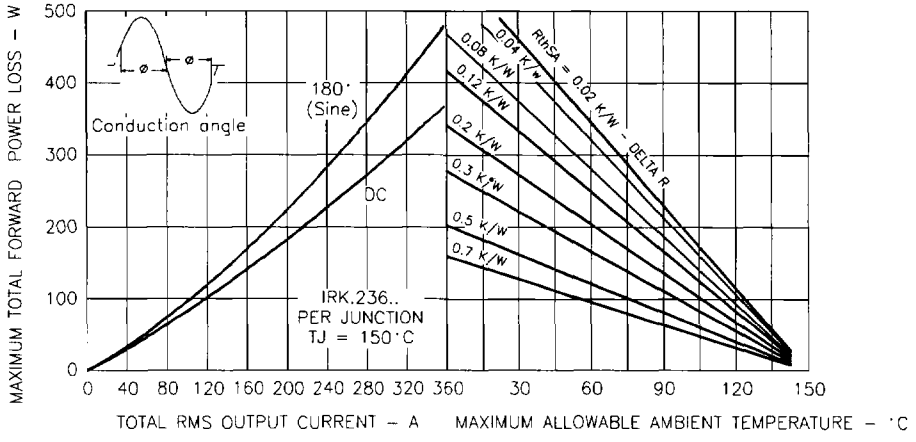


Fig. 29 - Forward Power Loss Characteristics

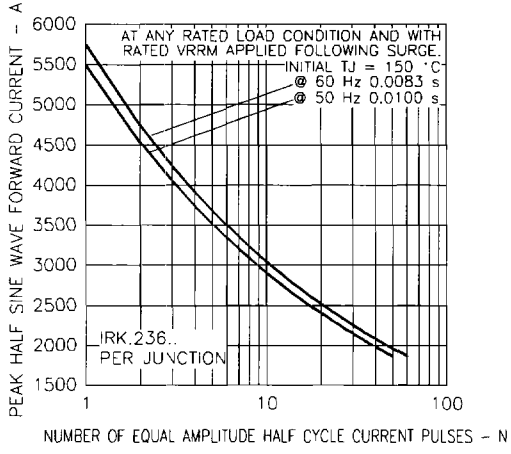


Fig. 30 - Maximum Non-Repetitive Surge Current

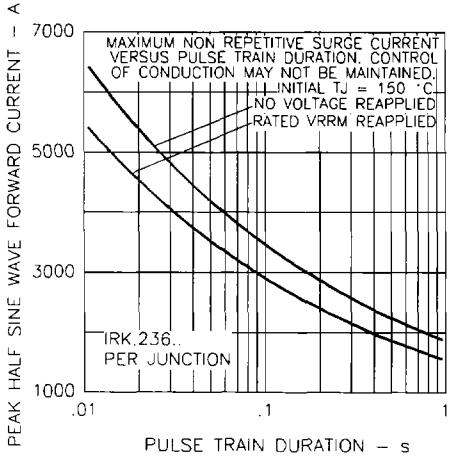


Fig. 31 - Maximum Non-Repetitive Surge Current

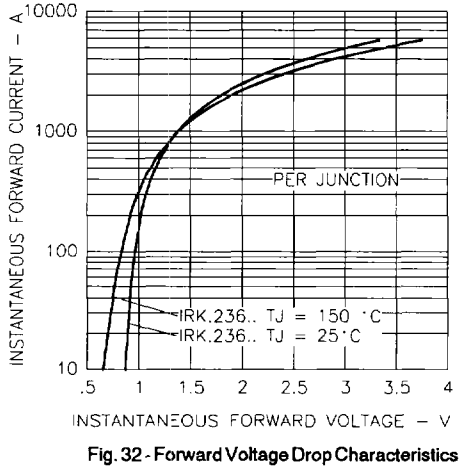


Fig. 32 - Forward Voltage Drop Characteristics

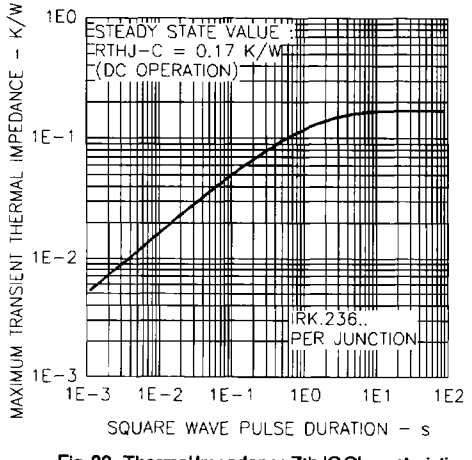


Fig. 33 - Thermal Impedance ZthJC Characteristics