International IOR Rectifier

SERIES IRK.26, .41, .56, .71, .91

THYRISTOR/ DIODE and THYRISTOR/ THYRISTOR

ADD-A-pak™ Power Modules

25A - 40A
55A - 70A
90A

Features

- Electrically isolated base plate
- 3500 V_{RMS} isolating voltage
- Standard JEDEC package
- Simplified mechanical designs, rapid assembly
- Auxiliary cathode terminals for wiring convenience
- High surge capability
- Wide choice of circuit configurations
- Large creepage distances
- UL E 78996 approved

Description

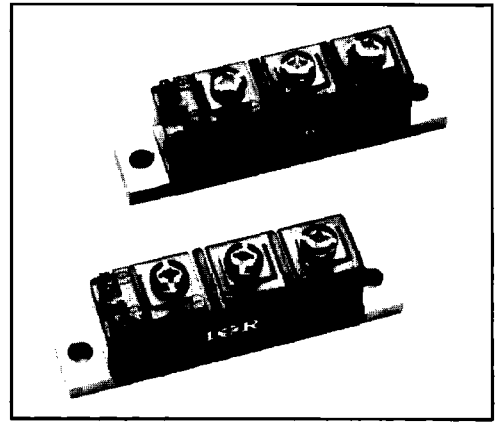
These IRK series of ADD-A-paks use power diodes and thyristors in a variety of circuit configurations. The semiconductor chips are electrically isolated from the metal base, allowing common heatsinks and compact assemblies to be built. They can be interconnected to form single phase or three phase bridges or AC controllers. These modules are intended for general purpose high voltage applications such as high voltage regulated power supplies, lighting circuits, and temperature and motor speed control circuits.

DATA SHEETS

Major Ratings and Characteristics

Parameters		IRK.26	IRK.41	IRK.56	IRK.71	IRK.91	Units
$I_{T(AV)}$ or $I_{F(AV)}$ @ 85°C		25	40	55	70	90	A
$I_{O(RMS)}$ (*)		55.5	89	122	155	200	A
I_{TSM}	@ 50Hz	595	850	1310	1665	1785	A
I_{FSM}	@ 60Hz	625	890	1370	1740	1870	A
I^2t	@ 50Hz	1.77	3.61	8.50	13.86	15.91	KA^2s
	@ 60Hz	1.62	3.30	7.82	12.56	14.52	KA^2s
$I^2\sqrt{t}$		17.7	36.1	85.6	138.6	159.1	$KA^2\sqrt{s}$
V_{RRM} range		400 to 1200					V
T_{STG}		-40 to 125					°C
T_J		-40 to 125					°C

(*) As AC switch.

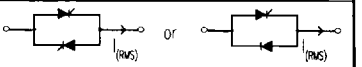


ELECTRICAL SPECIFICATIONS

Voltage Ratings

Type number	Voltage code Code	V_{RRM}, maximum repetitive peak reverse voltage	V_{RSM}, maximum non-repetitive peak reverse voltage	V_{DRM}, max. repetitive peak off-state voltage, gate open circuit	I_{RRM} I_{DRM} 125°C
	-	V	V	V	mA
IRK.26-/ 41-/ 56-/ 71-/ 91-	04	400	500	400	15
	06	600	700	600	15
	08	800	900	800	15
	10	1000	1100	1000	15
	12	1200	1300	1200	15

On-state Conduction

Parameters		IRK.26	IRK.41	IRK.56	IRK.71	IRK.91	Units	Conditions		
$I_{T(AV)}$	Max. average on-state current (Thyristors)	25	40	55	70	90	A	180° conduction, half sine wave,		
$I_{F(AV)}$	Maximum average forward current (Diodes)	25	40	55	70	90	A	T_c = 85°C		
$I_{O(RMS)}$	Max. continuous RMS on-state current. As AC switch	55.5	89	122	155	200	A			
I_{TSM} or I_{FSM}	Max. peak, one cycle non-repetitive on-state or forward current	595	850	1310	1665	1785	A	t=10ms	No voltage reapplied	Sinusoidalhalfwave, Initial T_J = T_J max.
		625	890	1370	1740	1870	A	t=8.3ms		
		500	715	1100	1400	1500	A	t=10ms	100% V_{RRM} reapplied	
		525	750	1150	1470	1570	A	t=8.3ms		
		660	940	1450	1850	2000	A	t=10ms	T_J = 25°C, no voltage reapplied	
		690	985	1520	1940	2100	A	t=8.3ms		
I^2t	Max. I^2t for fusing	1.77	3.61	8.50	13.86	15.91	KA^2s	t=10ms	No voltage reapplied	Initial T_J = T_J max.
		1.62	3.30	7.82	12.56	14.52	KA^2s	t=8.3ms		
		1.25	2.56	6.05	9.80	11.25	KA^2s	t=10ms	100% V_{RRM} reapplied	
		1.15	2.33	5.53	8.96	10.27	KA^2s	t=8.3ms		
		2.18	4.42	10.5	17.1	20.0	KA^2s	t=10ms	T_J = 25°C, no voltage reapplied	
		1.98	4.03	9.60	15.6	18.3	KA^2s	t=8.3ms		
$I^2\sqrt{t}$	Max. $I^2\sqrt{t}$ for fusing (1)	17.7	36.1	85.6	138.6	159.1	$KA^2\sqrt{s}$	t=0.1 to 10ms, no voltage reapplied		
$V_{T(TO)}$	Max. value of threshold voltage (2)	0.91	0.90	0.81	0.76	0.78	V	Low level (3)		T_J = T_J max (4)
		1.22	1.22	0.85	0.91	1.03	V	High level		
r_t	Max. value of on-state slope resistance (2)	12.4	6.58	3.35	2.98	2.78	mΩ	Low level (3)		T_J = T_J max (4)
		9.1	4.46	3.16	2.40	2.05	mΩ	High level		
V_{TM}	Max. peak on-state or forward voltage	1.90	1.75	1.40	1.55	1.55	V	$I_{TM} = \pi \times I_{T(AV)}$		T_J = 25°C 180° conduction
V_{FM}		1.90	1.75	1.40	1.55	1.55	V	$I_{FM} = \pi \times I_{F(AV)}$		
di/dt	Max. non-repetitive rate of rise of turned on current	150	150	150	150	150	A/µs	T_J = 25°C, from 0.67 V_{DRM}, $I_{TM} = \pi \times I_{T(AV)}$, I_g = 500mA, t_r<0.5µs, t_p>6µs		
I_H	Max. holding current	200	200	200	200	200	mA	T_J = 25°C, anode supply = 6V, resistive load, gate open circuit		
I_L	Max. latching current	400	400	400	400	400	mA	T_J = 25°C, anode supply = 6V,		

(1) I^2t for time $t_x = I^2\sqrt{t} \times \sqrt{t_x}$. (2) Average power = $V_{T(TO)} \times I_{T(AV)} + r_t \times (I_{T(RMS)})^2$

(3) 16.7% x π x I_{AV} < I < π x I_{AV} (4) π x I_{AV} < I < 20 x π x I_{AV}

Triggering

	Parameters	IRK.26	IRK.41	IRK.56	IRK.71	IRK.91	Units	Conditions	
P_{GM}	Max. peak gate power	10	10	10	12	12	W		
$P_{G(AV)}$	Max. average gate power	2.5	2.5	2.5	3.0	3.0	W		
I_{GM}	Max. peak gate current	2.5	2.5	2.5	3.0	3.0	A		
$-V_{GM}$	Max. peak negative gate voltage	10	10	10	10	10	V		
V_{GT}	Max. gate voltage required to trigger	4.0	4.0	4.0	4.0	4.0	V	T_J = -40°C	
		2.5	2.5	2.5	2.5	2.5	V	T_J = 25°C	Anode supply = 6V
		1.5	1.5	1.5	1.5	1.5	V	T_J = 125°C	resistive load
I_{GT}	Max. gate current required to trigger	250	250	250	270	270	mA	T_J = -40°C	
		100	100	100	120	120	mA	T_J = 25°C	Anode supply = 6V
		50	50	50	60	60	mA	T_J = 125°C	resistive load
V_{GD}	Max. gate voltage that will not trigger	0.25	0.25	0.25	0.25	0.25	V	T_J = 125°C, rated V_{DRM} applied	
I_{GD}	Max. gate current that will not trigger	6.0	6.0	6.0	6.0	6.0	mA	T_J = 125°C, rated V_{DRM} applied	

Blocking

I_{RRM} I_{DRM}	Max. peak reverse and off-state leakage current at V_{RRM}, V_{DRM}	15	15	15	15	15	mA	T_J = 125 °C, gate open circuit
V_{INS}	RMS isolation voltage	3500	3500	3500	3500	3500	V	50 Hz, circuit to base, all terminal shorted, t = 1s
dv/dt	Max. critical rate of rise of off-state voltage (5)	500	500	500	500	500	V/µs	T_J = 125°C, linear to 0.67 V_{DRM}, gate open circuit

Thermal and Mechanical Specifications

	Parameters	IRK.26	IRK.41	IRK.56	IRK.71	IRK.91	Units	Conditions
T_J	Junction operating temperature range	- 40 to 125					°C	
T_{stg}	Storage temper. range	- 40 to 125					°C	
R_{thJC}	Max. internal thermal resistance, junction to case	0.400	0.300	0.250	0.195	0.145	K/W	Per module, D.C. operation
R_{thCS}	Max. thermal resistance case to heatsink	0.1					K/W	Mounting surface flat, smooth and greased (per module)
T	Mounting torque ±10% ADD-A-pak to heatsink	5					Nm	A mounting compound is recommended and the torque should be rechecked after a period of
	Busbar to ADD-A-pak	3					Nm	3 hours to allow for the spread of the compound
wt	Approximate weight	140 5					g oz	
	Case style	TO-240AA					JEDEC	

(5) Available with dv/dt = 1000V/µs, to complete code add S90 i.e. IRKT91-12 S90.

DATA SHEETS

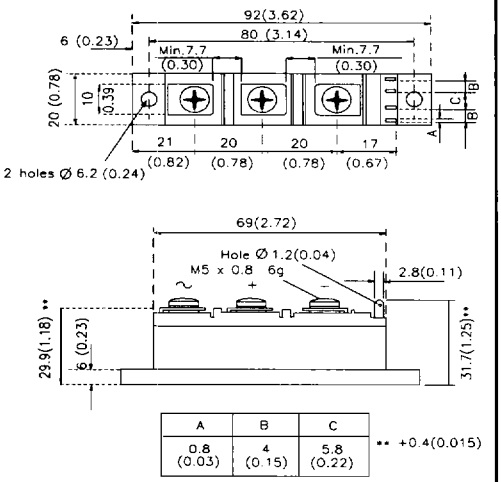
ΔR Conduction (per Junction)

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

Devices	Sine half wave conduction					Rect. wave conduction					Units
	180°	120°	90°	60°	30°	180°	120°	90°	60°	30°	
IRK.91	0.03	0.06	0.09	0.14	0.24	0.02	0.06	0.08	0.13	0.20	K/W
IRK.71	0.05	0.09	0.12	0.18	0.27	0.035	0.06	0.09	0.13	0.20	K/W
IRK.56	0.07	0.13	0.17	0.26	0.41	0.05	0.10	0.14	0.21	0.31	K/W
IRK.41	0.06	0.10	0.16	0.26	0.45	0.04	0.08	0.14	0.23	0.39	K/W
IRK.26	0.11	0.17	0.22	0.33	0.52	0.08	0.11	0.16	0.22	0.36	K/W

Outlines Table

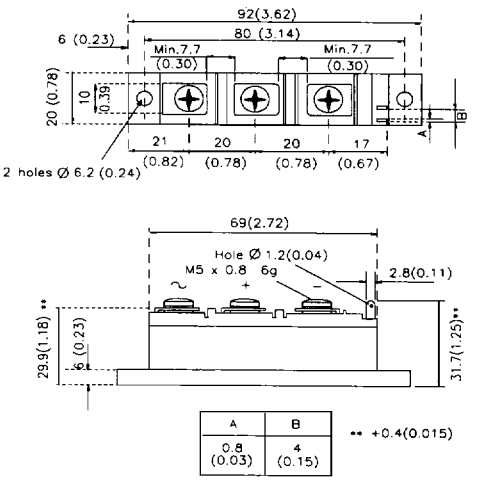
IRKT..-.. (*)



A	B	C
0.8 (0.03)	4 (0.15)	5.8 (0.22)

** +0.4(0.015)

IRKH..-.. (*)

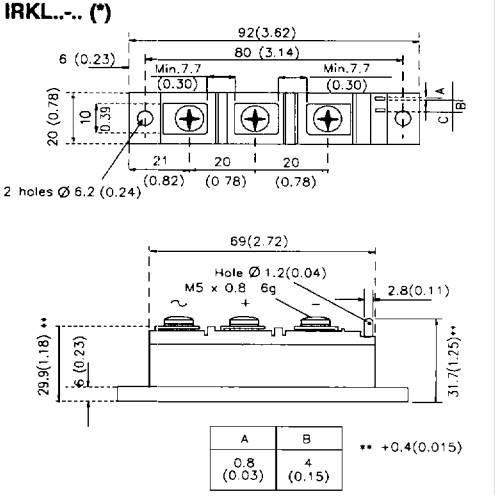


A	B
0.8 (0.03)	4 (0.15)

** +0.4(0.015)

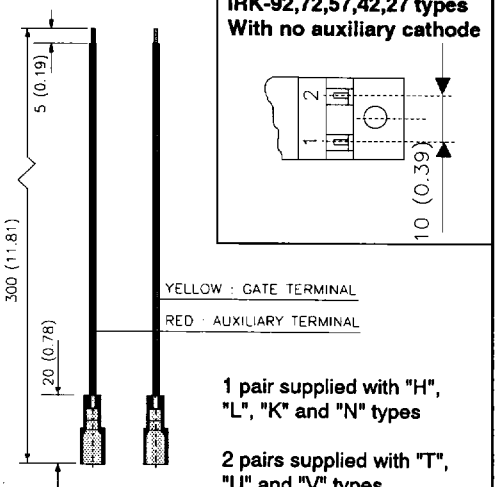
All dimensions in millimeters (inches)

IRKL..-.. (*)



A	B
0.8 (0.03)	4 (0.15)

** +0.4(0.015)

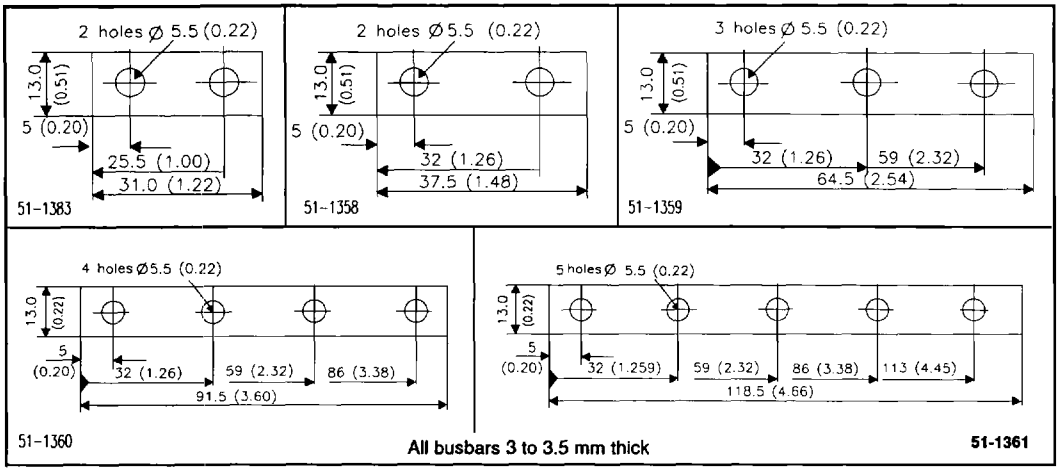


All dimensions in millimeters (inches)

13-0464

(*) For terminals connections, see Circuit configurations Table

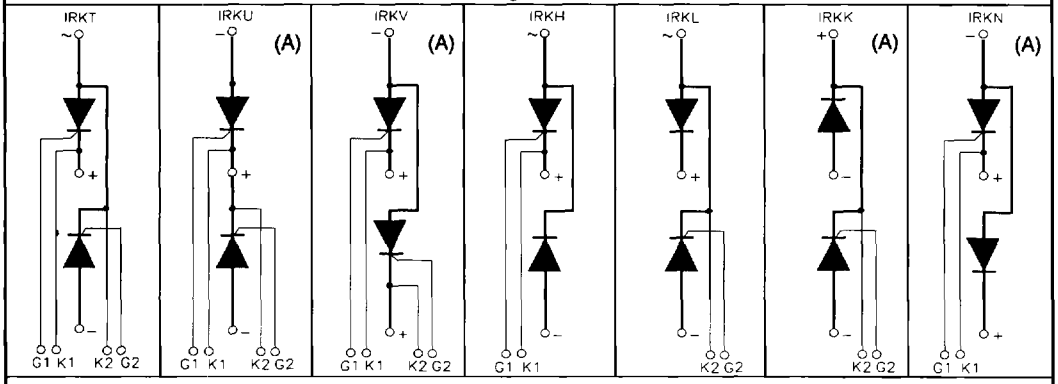
Busbars Dimensions



All busbars 3 to 3.5 mm thick

Ordering Information Table

Circuit configurations Table



Device Code

IRK	T	91	-	12	S90
	①	②		③	④

(A) Available on request only. Contact factory

1 - Circuit code (See Circuit Configuration Table)

2 - Current rating * *

3 - Voltage code (See Voltage Ratings Table)

4 - dv/dt code: S90 = dv/dt 1000 V/µs
No letter = dv/dt 500 V/µs

** Available with no auxiliary cathode.
To specify change: 26 to 27
41 to 42
56 to 57
71 to 72
91 to 92
e.g. : IRKT92-12 etc.

DATA SHEETS

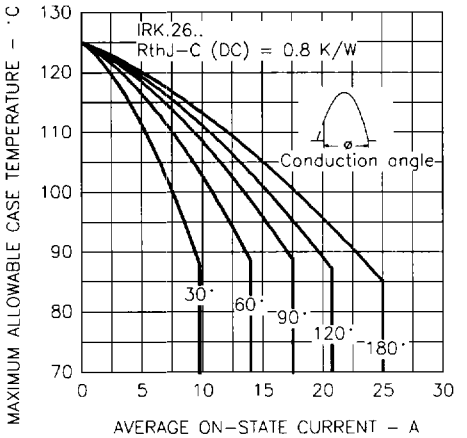


Fig. 1 - Current Ratings Characteristics

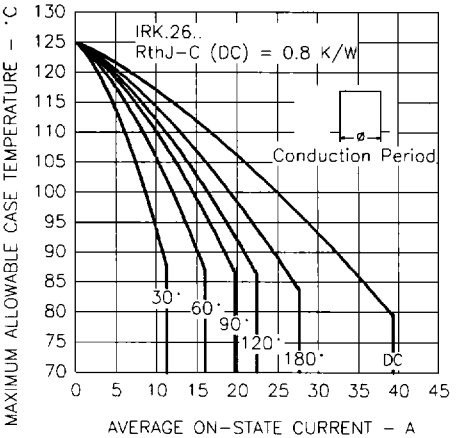


Fig. 2 - Current Ratings Characteristics

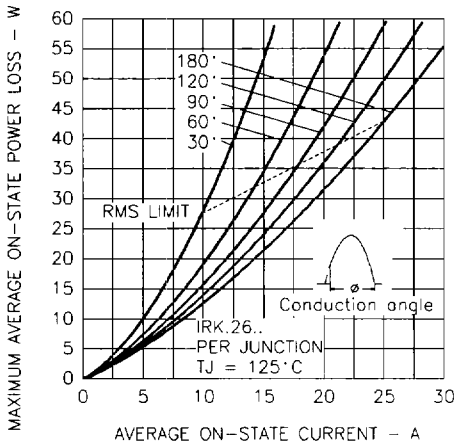


Fig. 3 - On-state Power Loss Characteristics

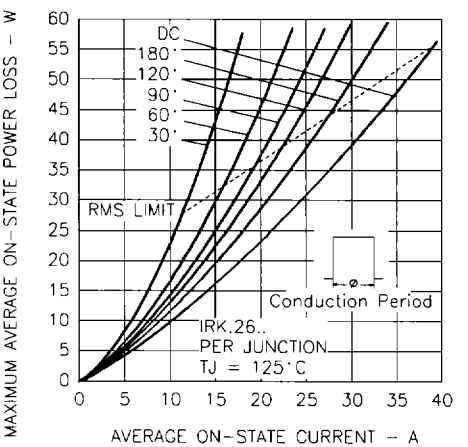


Fig. 4 - On-state Power Loss Characteristics

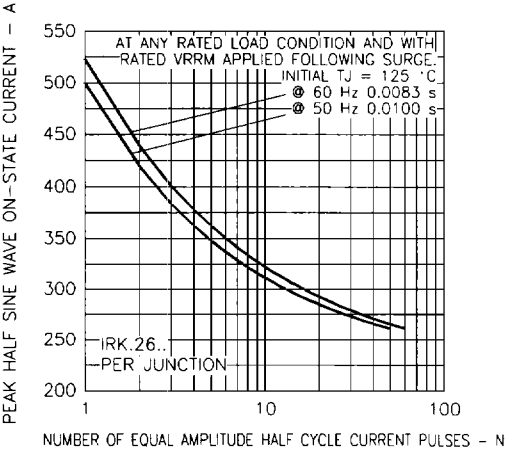


Fig. 5 - Maximum Non-Repetitive Surge Current

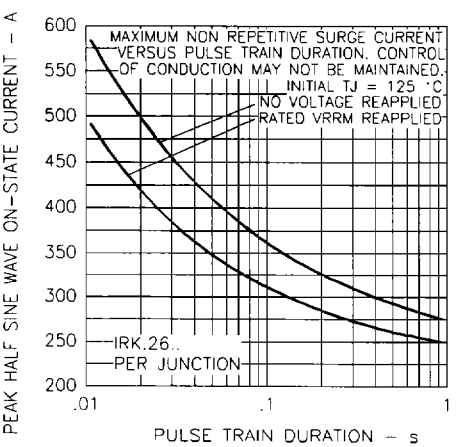


Fig. 6 - Maximum Non-Repetitive Surge Current

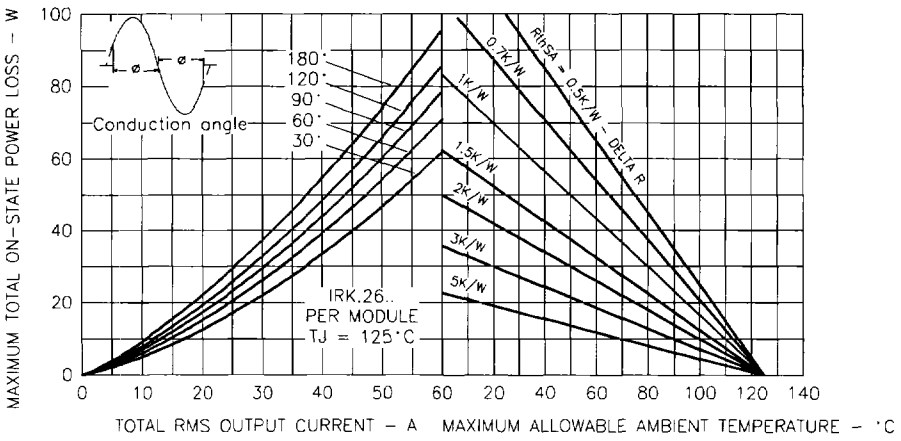


Fig. 7 - On-state Power Loss Characteristics

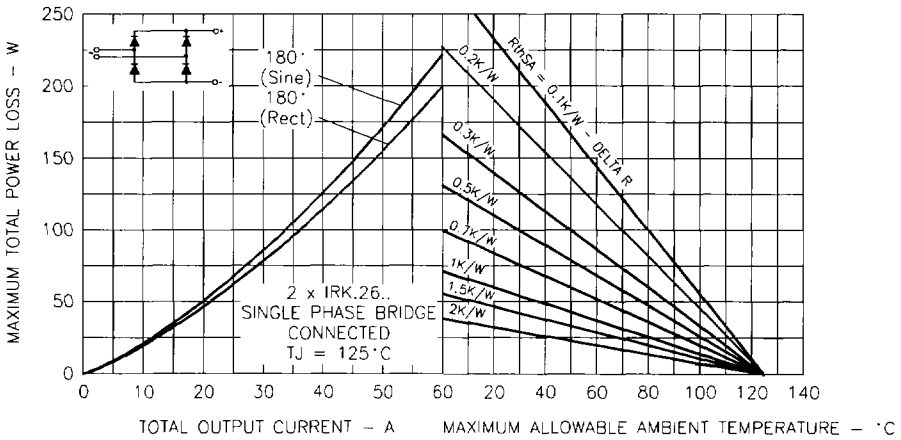


Fig. 8 - On-state Power Loss Characteristics

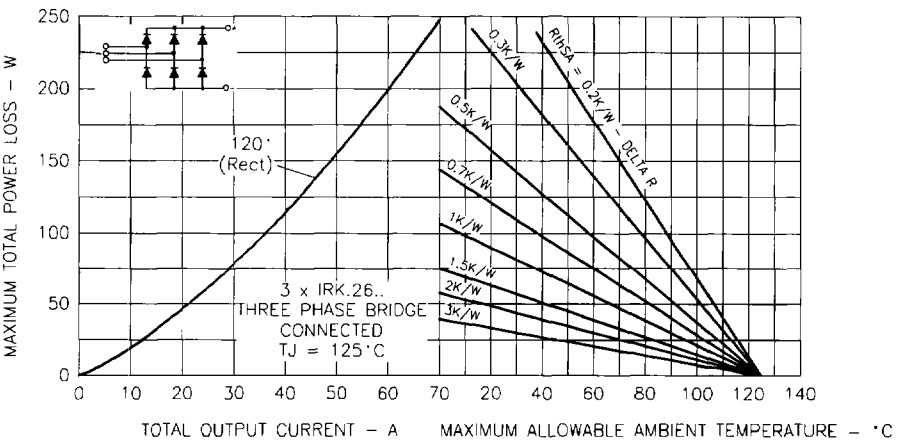


Fig. 9 - On-state Power Loss Characteristics

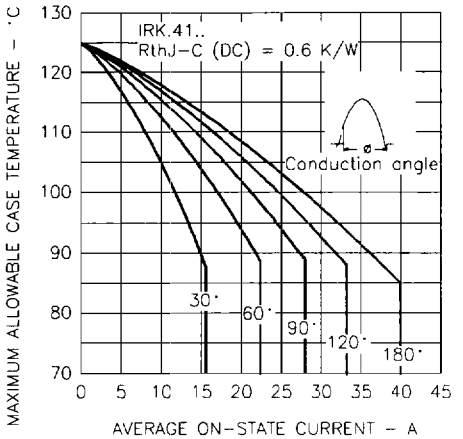


Fig. 10 - Current Ratings Characteristics

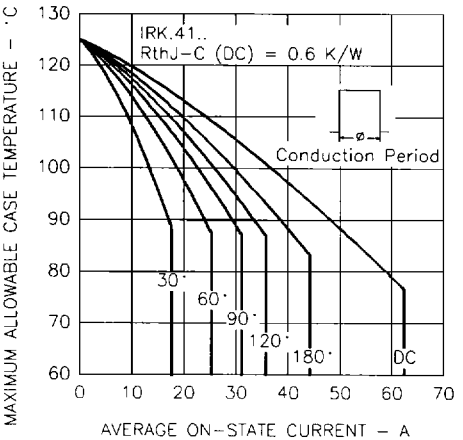


Fig. 11 - Current Ratings Characteristics

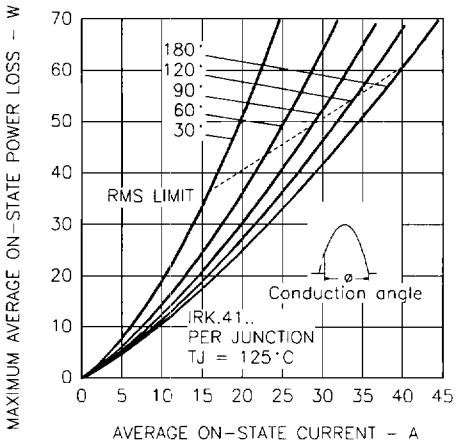


Fig. 12 - On-state Power Loss Characteristics

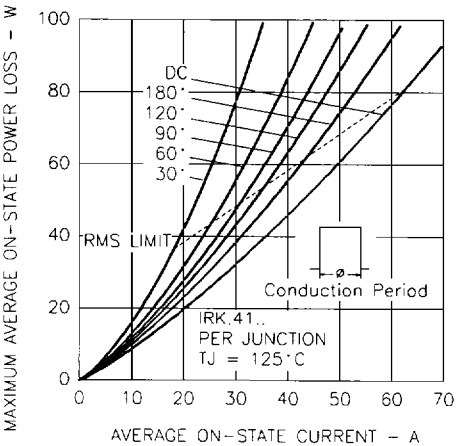


Fig. 13 - On-state Power Loss Characteristics

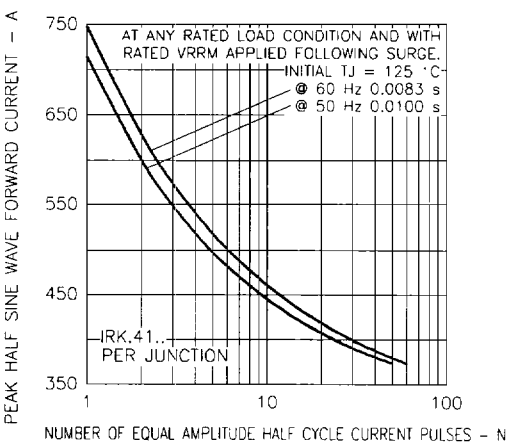


Fig. 14 - Maximum Non-Repetitive Surge Current

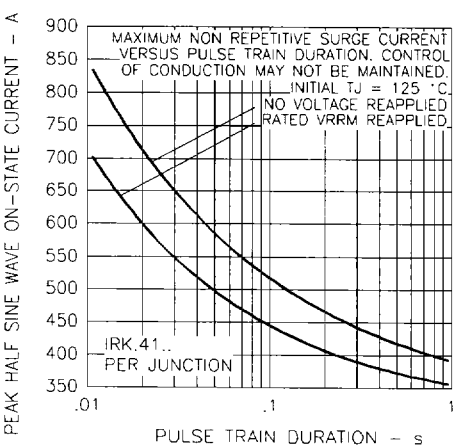


Fig. 15 - Maximum Non-Repetitive Surge Current

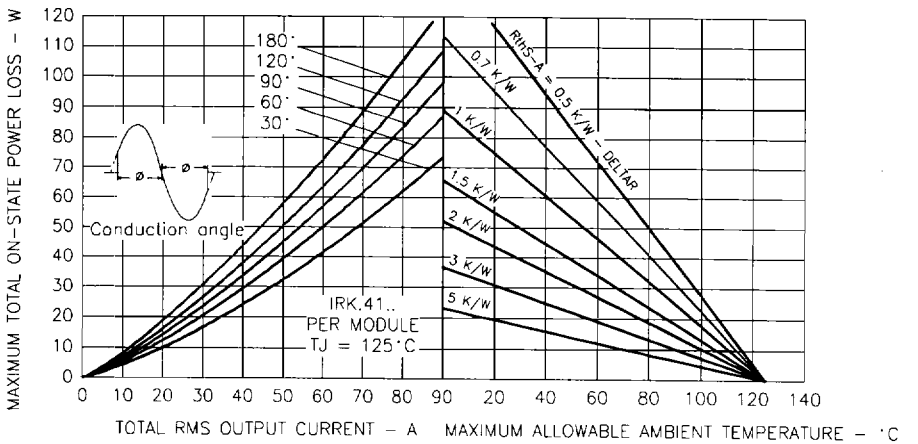


Fig. 16 - On-state Power Loss Characteristics

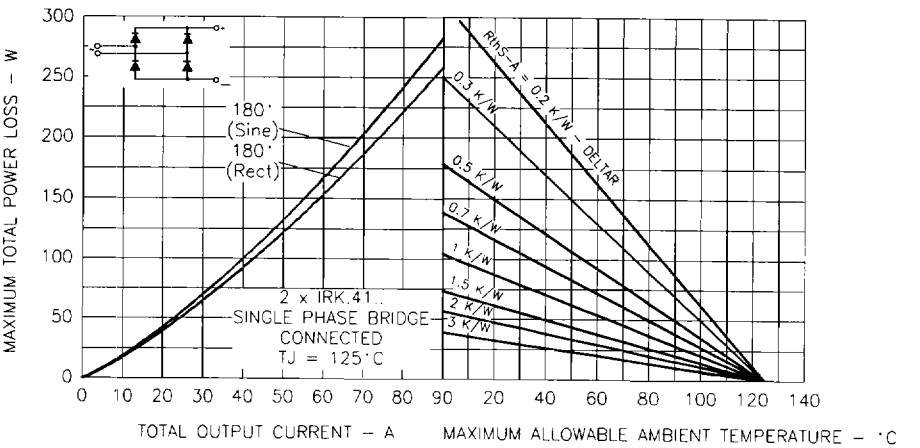


Fig. 17 - On-state Power Loss Characteristics

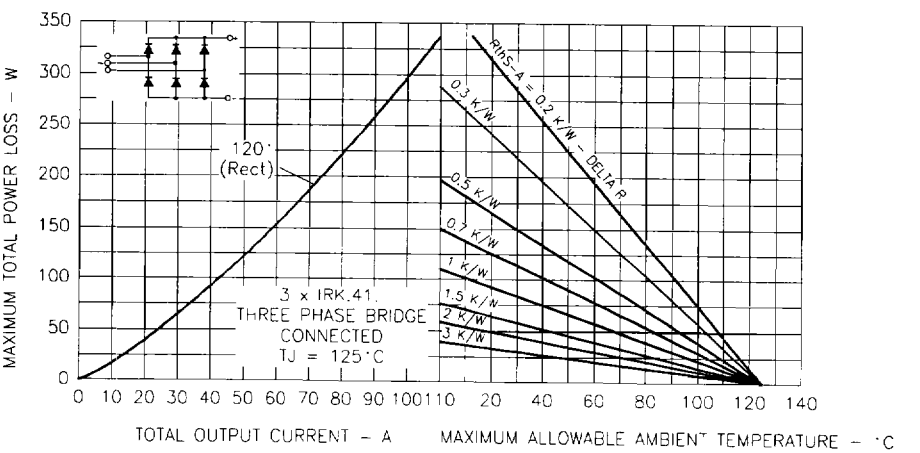


Fig. 18 - On-state Power Loss Characteristics

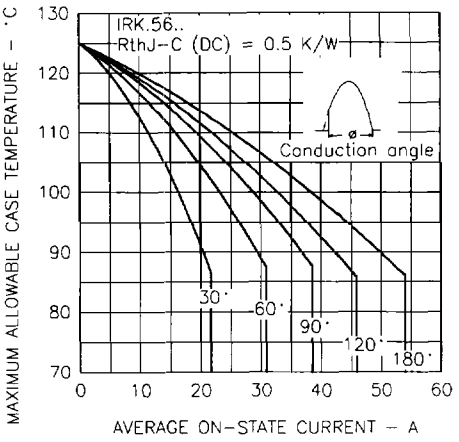


Fig. 19 - Current Ratings Characteristics

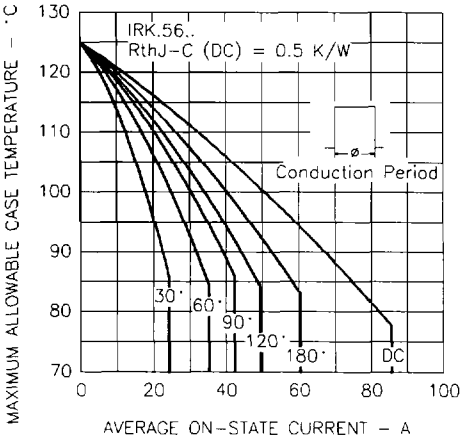


Fig. 20 - Current Ratings Characteristics

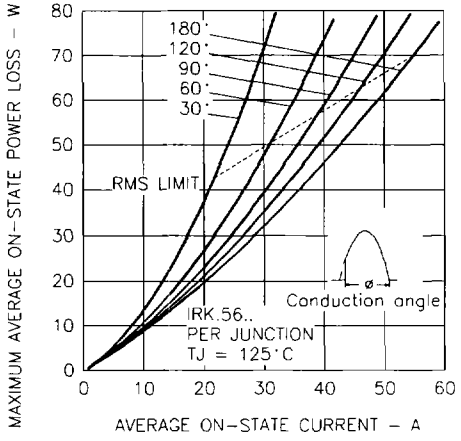


Fig. 21 - On-state Power Loss Characteristics

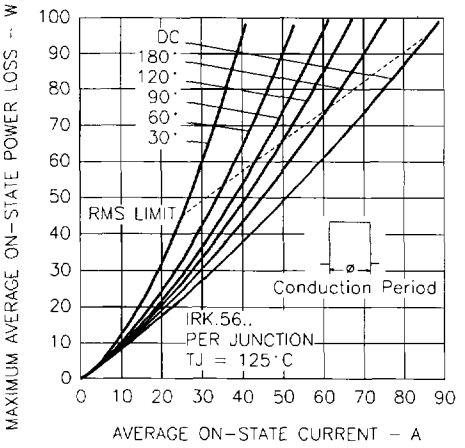


Fig. 22 - On-state Power Loss Characteristics

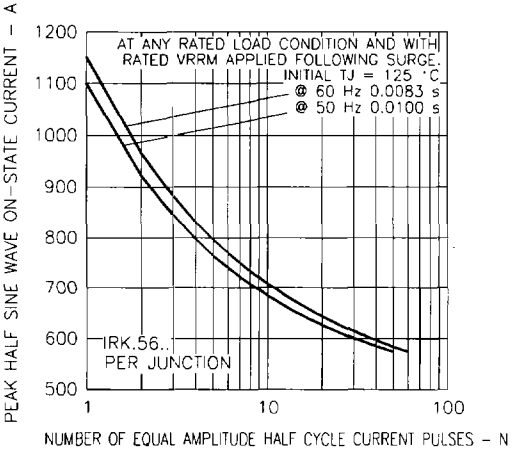


Fig. 23 - Maximum Non-Repetitive Surge Current

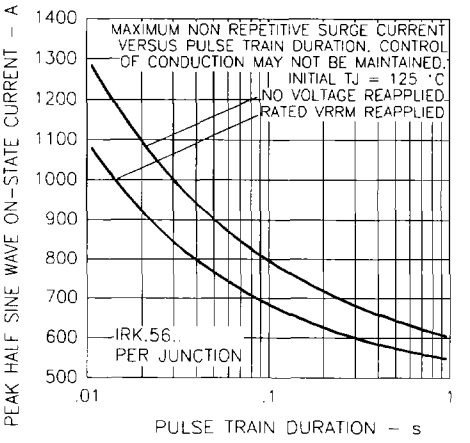


Fig. 24 - Maximum Non-Repetitive Surge Current

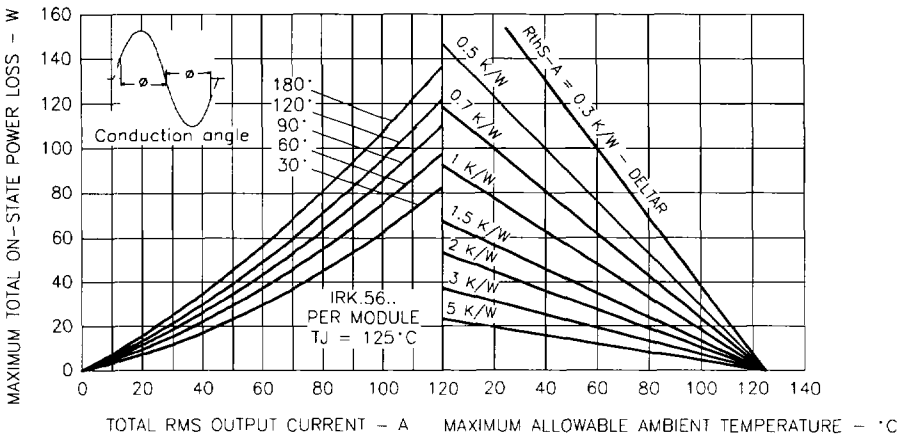


Fig. 25 - On-state Power Loss Characteristics

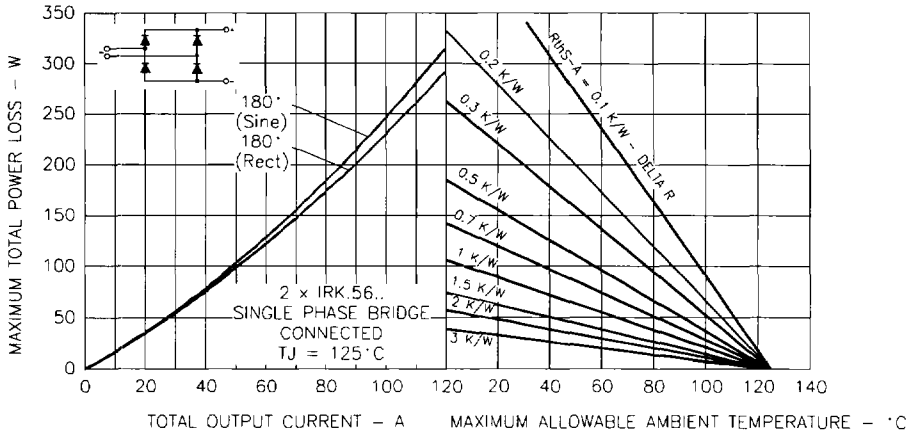


Fig. 26 - On-state Power Loss Characteristics

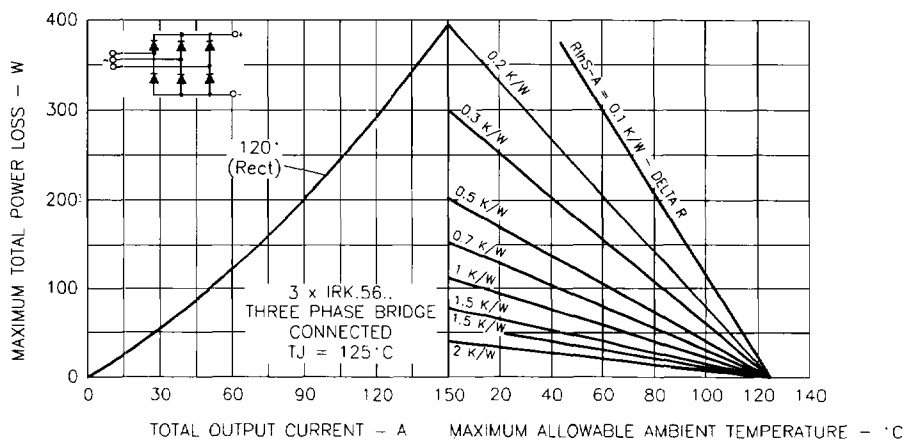


Fig. 27 - On-state Power Loss Characteristics

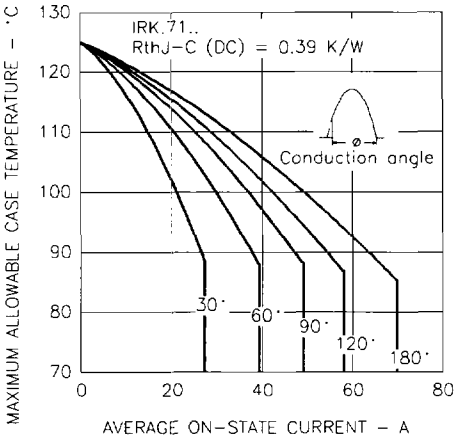


Fig. 28 - Current Ratings Characteristics

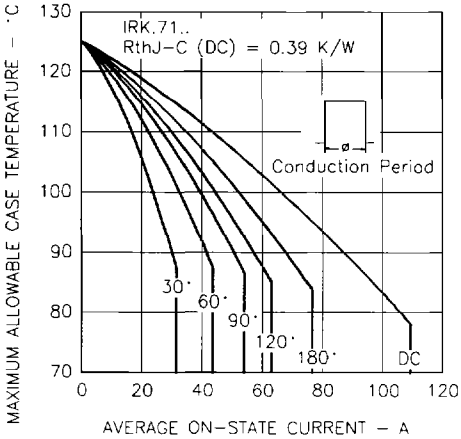


Fig. 29 - Current Ratings Characteristics

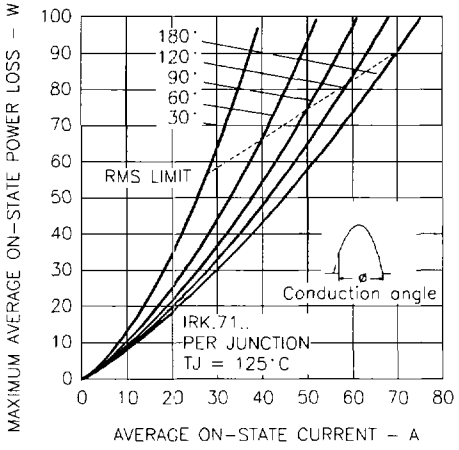


Fig. 30 - On-state Power Loss Characteristics

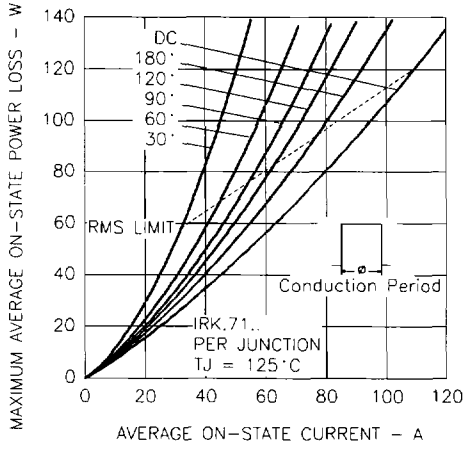


Fig. 31 - On-state Power Loss Characteristics

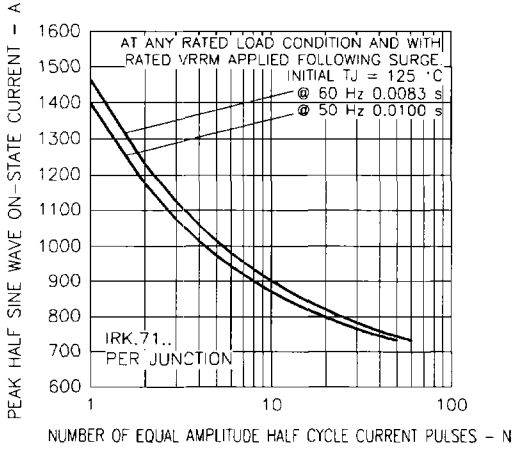


Fig. 32 - Maximum Non-Repetitive Surge Current

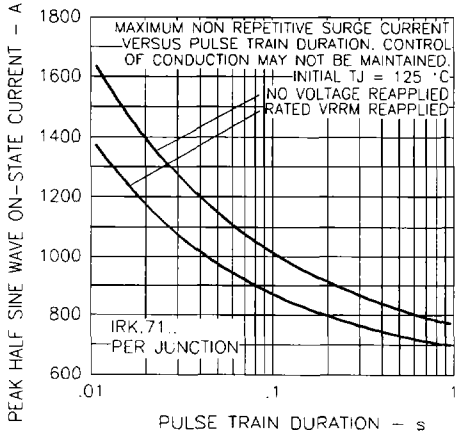


Fig. 33 - Maximum Non-Repetitive Surge Current

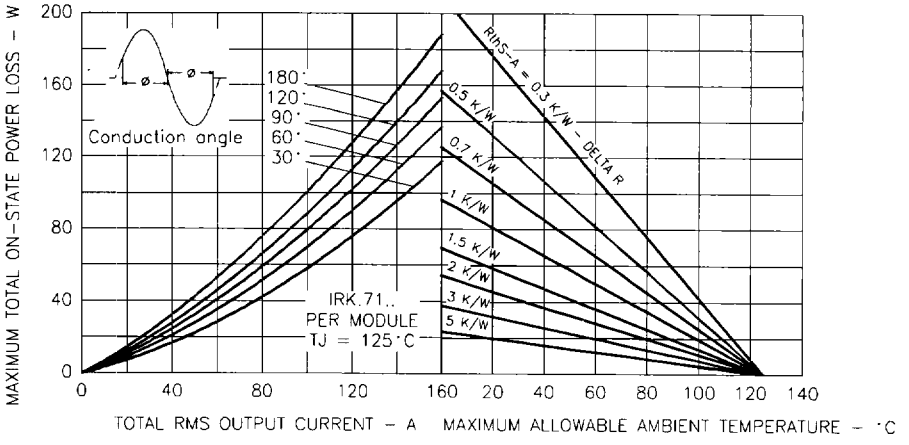


Fig. 34 - On-state Power Loss Characteristics

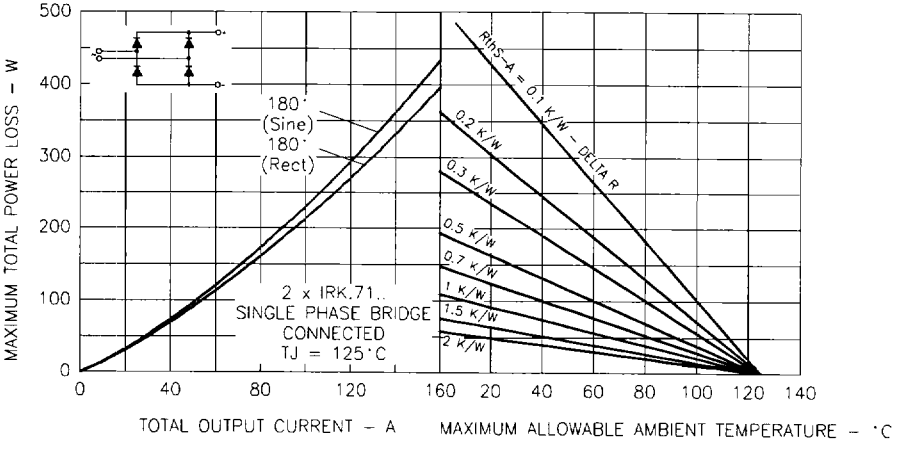


Fig. 35 - On-state Power Loss Characteristics

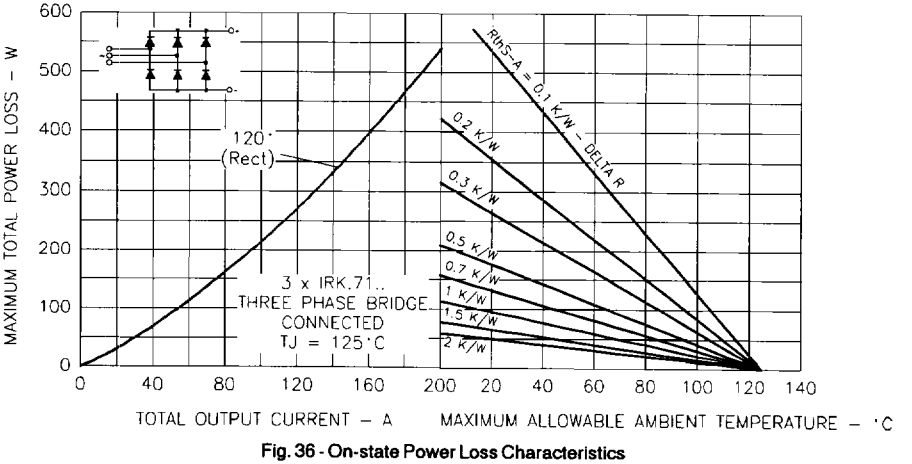


Fig. 36 - On-state Power Loss Characteristics

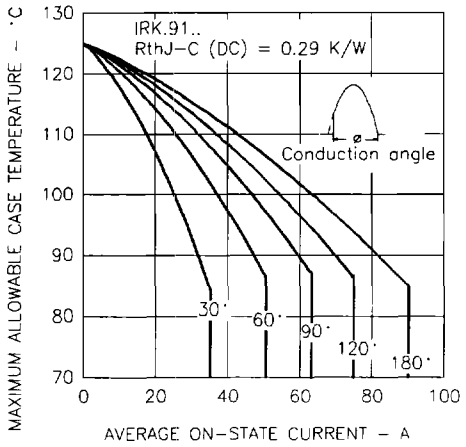


Fig. 37 - Current Ratings Characteristics

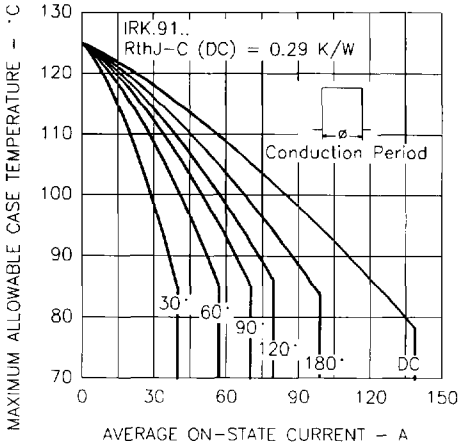


Fig. 38 - Current Ratings Characteristics

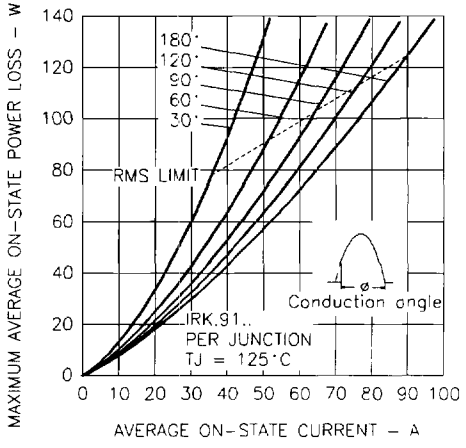


Fig. 39 - On-state Power Loss Characteristics

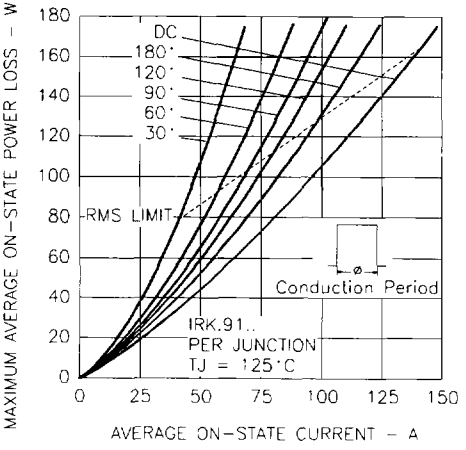


Fig. 40 - On-state Power Loss Characteristics

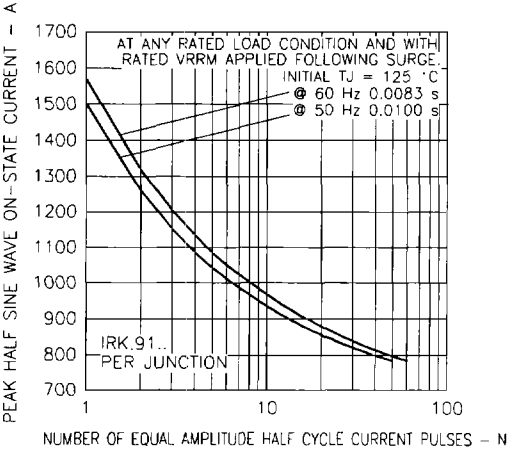


Fig. 41 - Maximum Non-Repetitive Surge Current

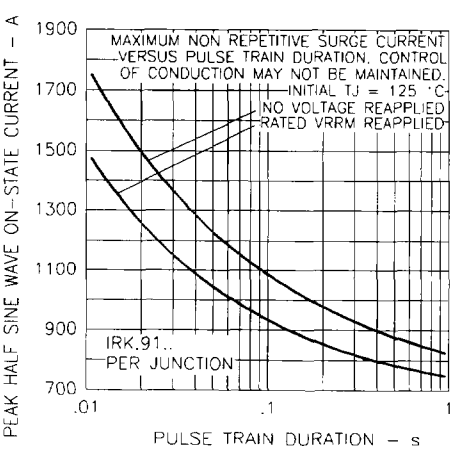


Fig. 42 - Maximum Non-Repetitive Surge Current

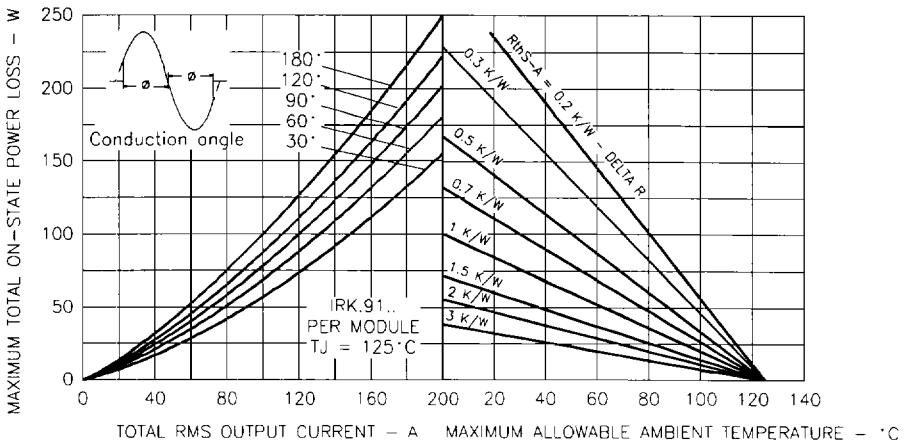


Fig. 43 - On-state Power Loss Characteristics

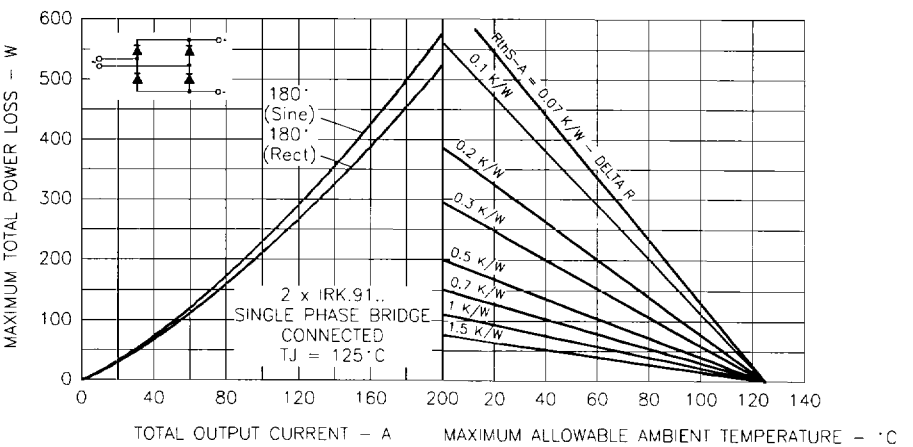


Fig. 44 - On-state Power Loss Characteristics

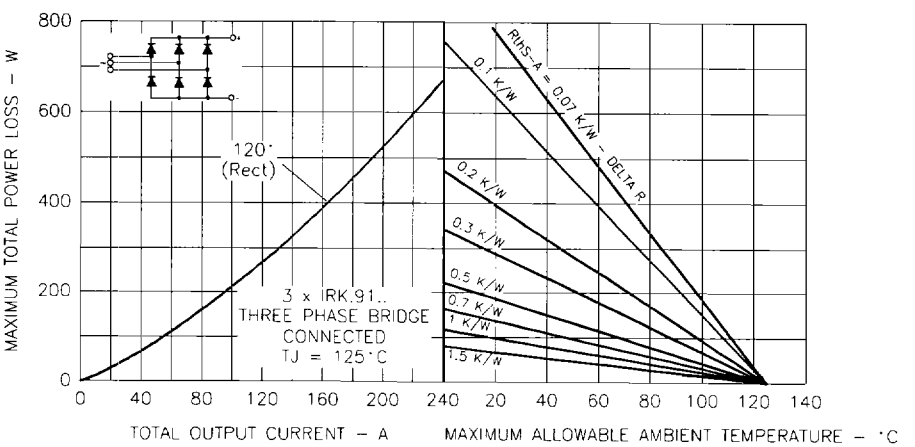


Fig. 45 - On-state Power Loss Characteristics

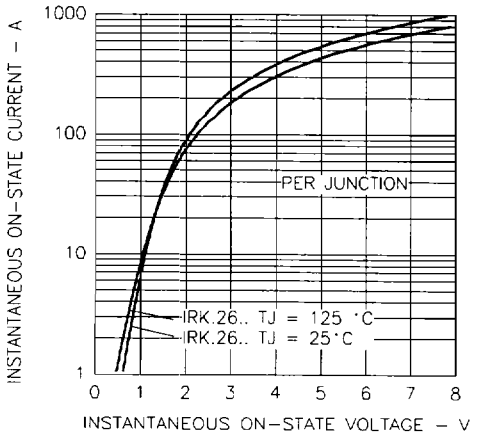


Fig. 46 - On-state Voltage Drop Characteristics

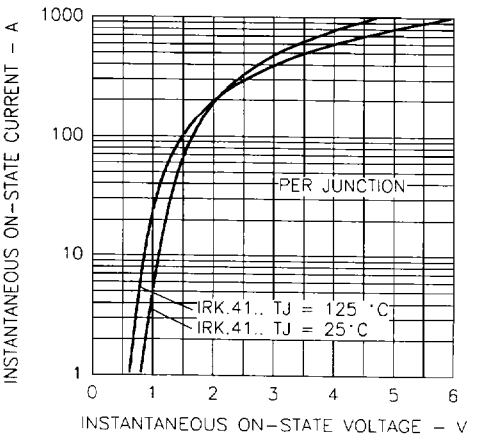


Fig. 47 - On-state Voltage Drop Characteristics

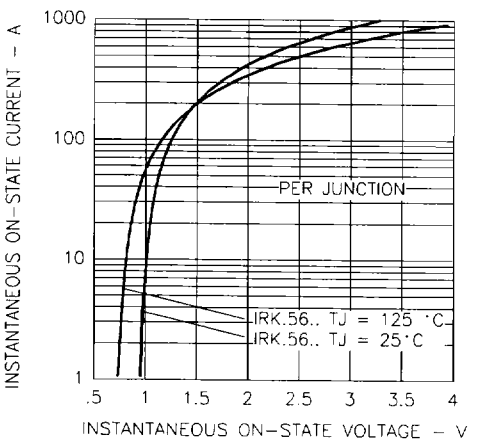


Fig. 48 - On-state Voltage Drop Characteristics

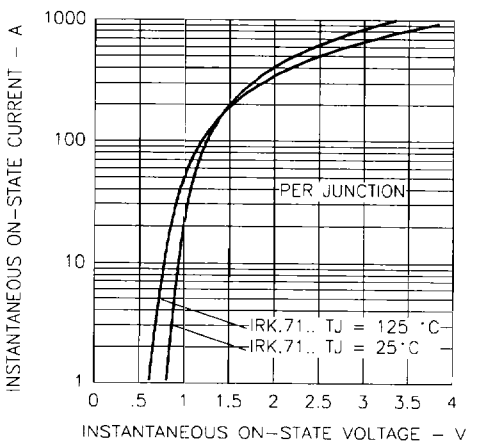


Fig. 49 - On-state Voltage Drop Characteristics

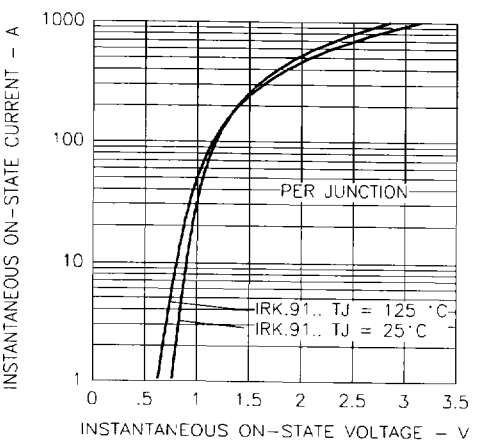


Fig. 50 - On-state Voltage Drop Characteristics

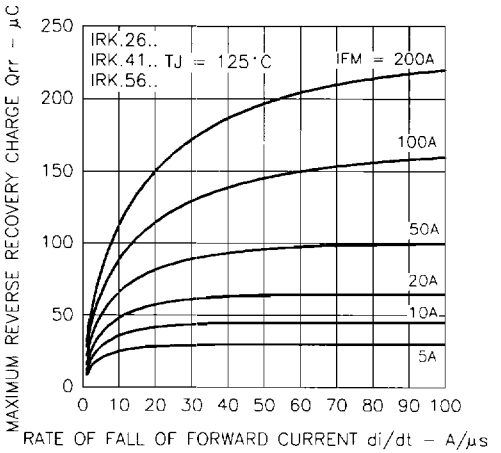


Fig. 51 - Recovery Charge Characteristics

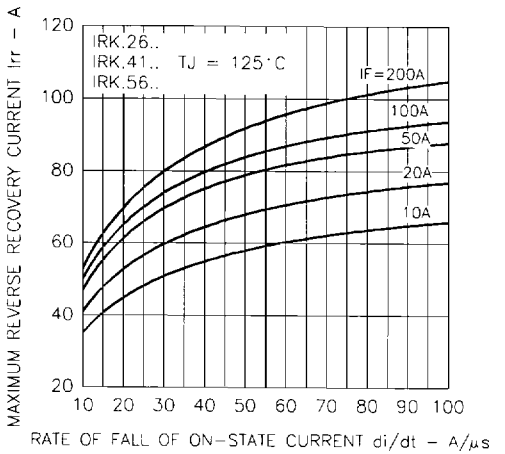


Fig. 52 - Recovery Current Characteristics

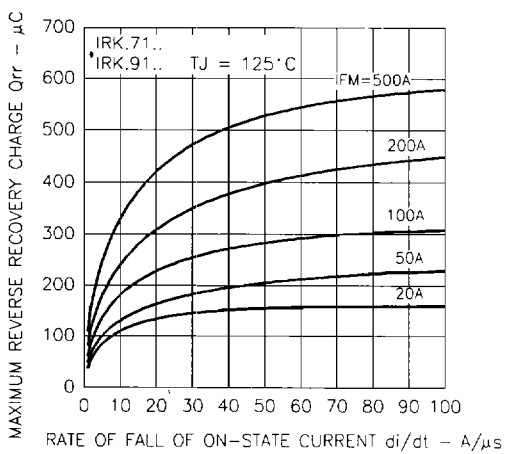


Fig. 53 - Recovery Charge Characteristics

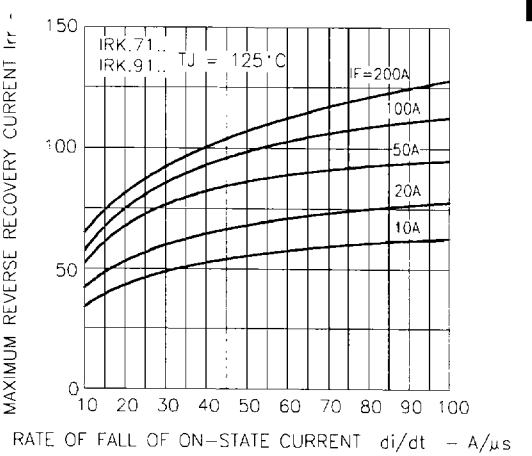


Fig. 54 - Recovery Current Characteristics

DATA SHEETS

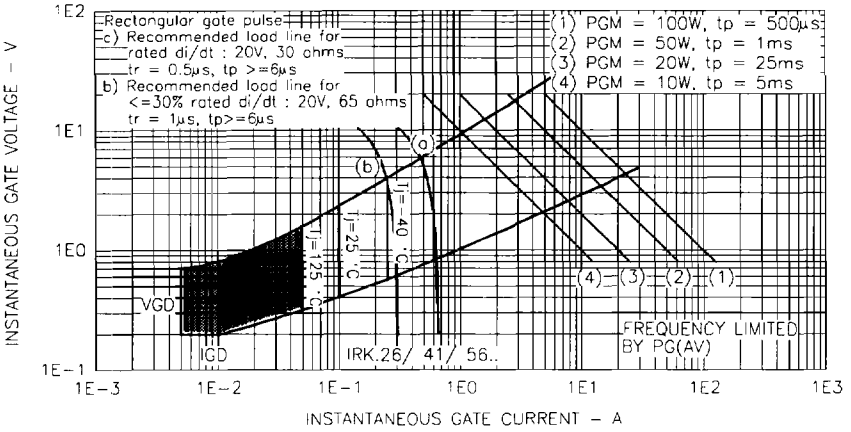


Fig. 55 - Gate Characteristics

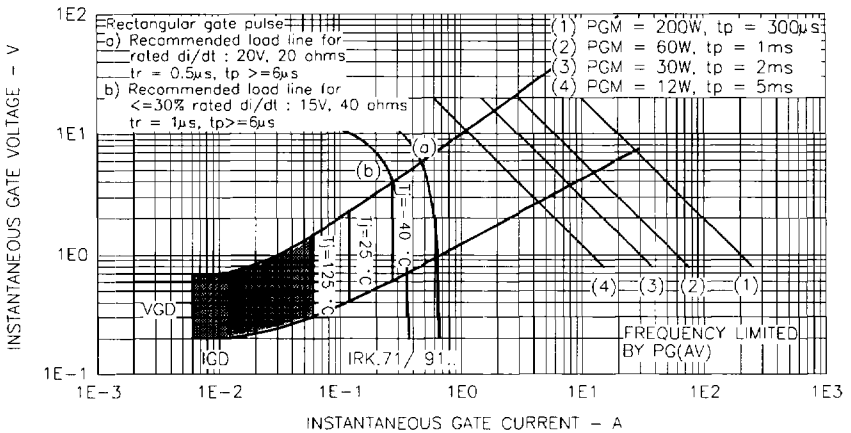


Fig. 56 - Gate Characteristics

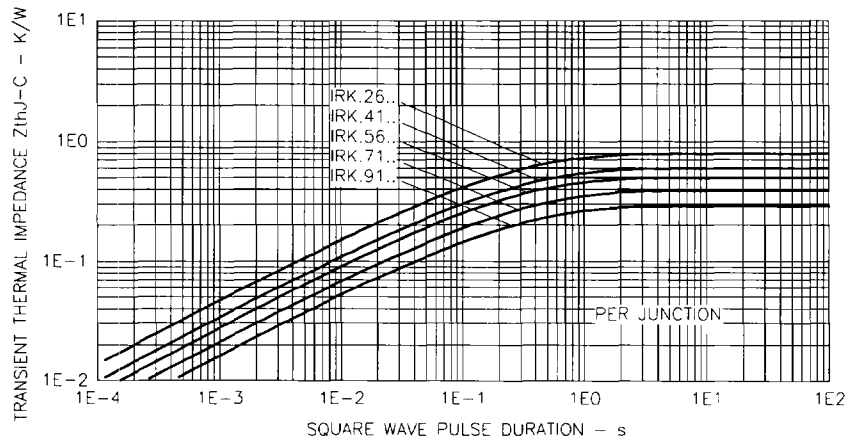


Fig. 57 - Thermal Impedance ZthJC Characteristics