International IOR Rectifier

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

HIGH VOLTAGE 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

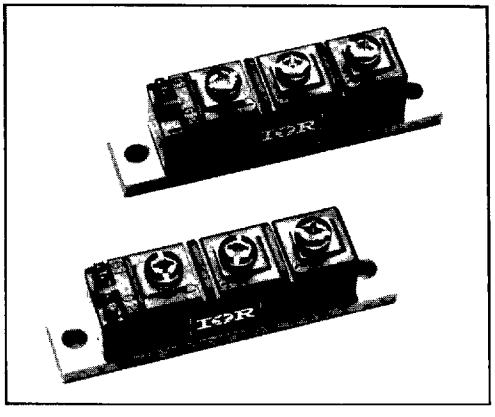
Description

These new IRK series of ADD-A-paks use high voltage 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.

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	535	770	1250	1550	1700	A
I_{FSM}	@ 60Hz	560	810	1310	1610	1785	A
I^2t	@ 50Hz	1430	3000	7800	11950	14550	A^2s
	@ 60Hz	1300	2700	7100	10900	13300	A^2s
$I^2\sqrt{t}$		14300	30000	78000	119500	145500	$A^2\sqrt{s}$
V_{RRM} range		1400 to 1800					V
T_{STG}		-40 to 125					°C
T_J		-40 to 125					°C

(*) As AC switch.

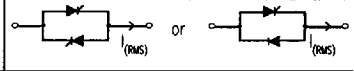


ELECTRICAL SPECIFICATIONS

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-	14	1400	1500	1400	20
	16	1600	1700	1600	20
	18	1800	1900	1800	20

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 (IRK.26, .71) T_C = 80°C (IRK.41, .56, .91)		
$I_{O(RMS)}$	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	535	770	1250	1550	1700	A	t=10ms	No voltage reapplied	Sinusoidal half wave, Initial $T_J = T_J$ max.
		560	810	1310	1610	1785	A	t=8.3ms		
		450	650	1050	1300	1435	A	t=10ms	100% V_{RRM} reapplied	
		470	680	1100	1360	1500	A	t=8.3ms		
		595	865	1360	1695	1830	A	t=10ms	T_J = 25°C, no voltage reapplied	
		622	910	1425	1760	1910	A	t=8.3ms		
I^2t	Max. I^2t for fusing	1430	3000	7800	11950	14550	A^2s	t=10ms	No voltage reapplied	Initial $T_J = T_J$ max.
		1300	2700	7100	10900	13300	A^2s	t=8.3ms		
		1010	2110	5500	8450	10300	A^2s	t=10ms	100% V_{RRM} reapplied	
		920	1930	5000	7700	9400	A^2s	t=8.3ms		
		1780	3750	9000	14300	16750	A^2s	t=10ms	T_J = 25°C, no voltage reapplied	
		1600	3350	8250	13000	19250	A^2s	t=8.3ms		
$I^2\sqrt{t}$	Max. $I^2\sqrt{t}$ for fusing (1)	14300	30000	78000	119500	145500	$A^2\sqrt{s}$	t=0.1 to 10ms, no voltage reapplied		
$V_{T(TO)}$	Max. value of threshold voltage (2)	1.30	1.20	0.90	0.91	0.96	V	Low level (3)		$T_J = T_J$ max (4)
		1.40	1.30	1.00	0.98	1.10	V	High level		
r_t	Max. value of on-state slope resistance (2)	8.5	4.4	4.1	3.2	2.5	mΩ	Low level (3)		$T_J = T_J$ max (4)
		7.5	3.8	3.4	2.9	2.1	mΩ	High level		
V_{TM}	Max. peak on-state or	1.92	1.77	1.55	1.60	1.62	V	$I_{TM} = \pi \times I_{T(AV)}$		T_J = 25°C
V_{FM}	forward voltage	1.92	1.77	1.55	1.60	1.62	V	$I_{FM} = \pi \times I_{F(AV)}$		180° conduction
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 < 0.5 µs, t_p > 6 µs		
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, resistive load		

(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. avg. 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	Anode supply = 6V resistive load
		2.5	2.5	2.5	2.5	2.5	V	T_J = 25°C	
		1.5	1.5	1.5	1.5	1.5	V	T_J = 125°C	
I_{GT}	Max. gate current required to trigger	250	250	250	270	270	mA	T_J = -40°C	Anode supply = 6V resistive load
		100	100	100	120	120	mA	T_J = 25°C	
		50	50	50	60	60	mA	T_J = 125°C	
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}	20	20	20	20	20	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 temp. 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 3 hours to allow for the spread of the compound
	Busbar to ADD-A-pak	3					Nm	
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. IRKT91-18 S90.

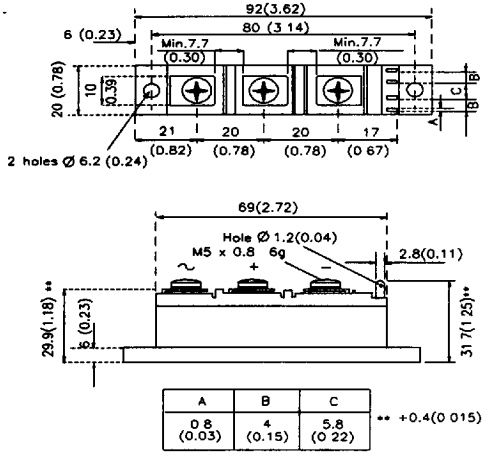
ΔR Conduction (per Junction)

(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	0.033	0.063	0.080	0.110	0.190	0.033	0.065	0.087	0.122	0.196	K/W
IRK.71	0.050	0.080	0.104	0.152	0.252	0.049	0.085	0.113	0.158	0.255	K/W
IRK.56	0.055	0.109	0.138	0.200	0.331	0.066	0.112	0.149	0.208	0.334	K/W
IRK.41	0.070	0.132	0.168	0.229	0.369	0.080	0.137	0.182	0.255	0.410	K/W
IRK.26	0.165	0.182	0.233	0.340	0.563	0.110	0.189	0.252	0.352	0.567	K/W

Outlines Table

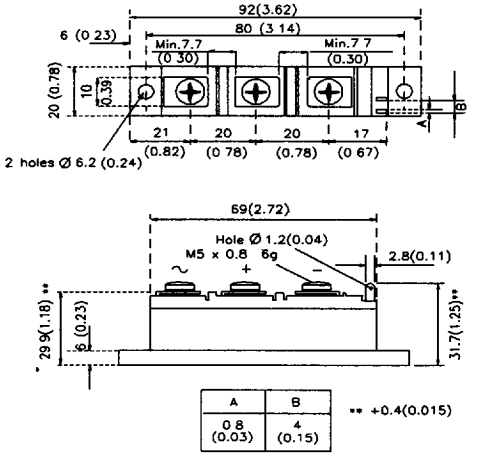
IRKT..-.. (*)



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

** +0.4(0.015)

IRKH..-.. (*)

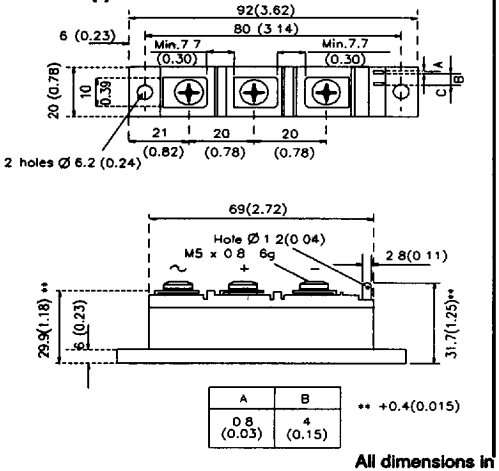


A	B
0.8 (0.03)	4 (0.15)

** +0.4(0.015)

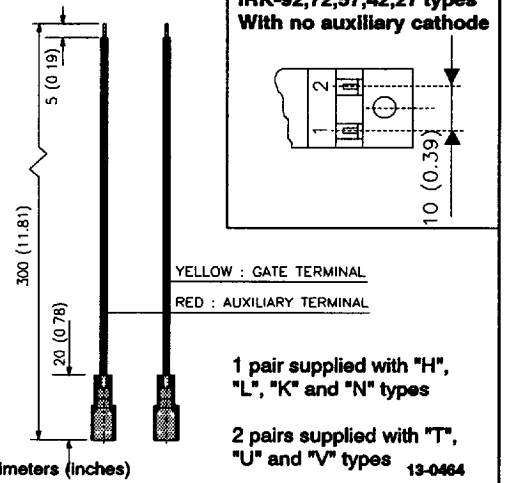
All dimensions in millimeters (inches)

IRKL..-.. (*)



A	B
0.8 (0.03)	4 (0.15)

** +0.4(0.015)



IRK-92,72,57,42,27 types
With no auxiliary cathode

1 pair supplied with "H", "L", "K" and "N" types

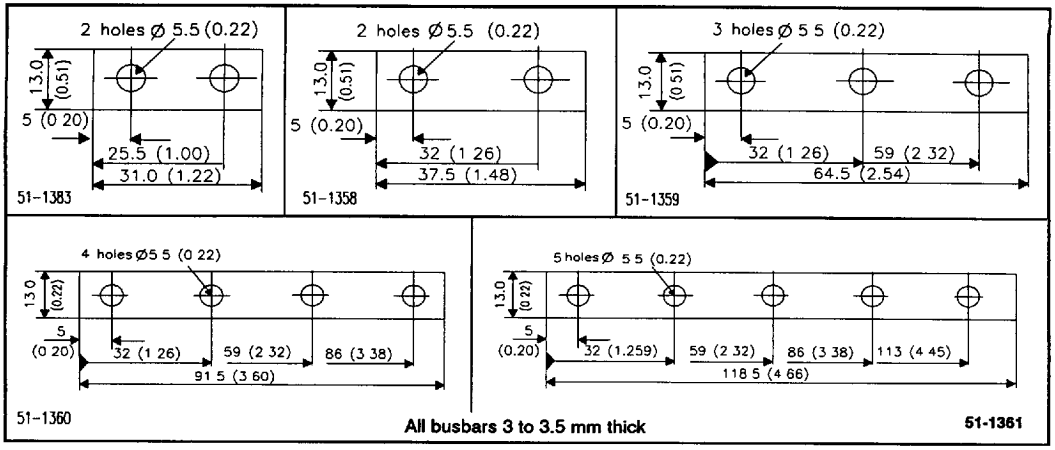
2 pairs supplied with "T", "U" and "V" types

13-0464

All dimensions in millimeters (inches)

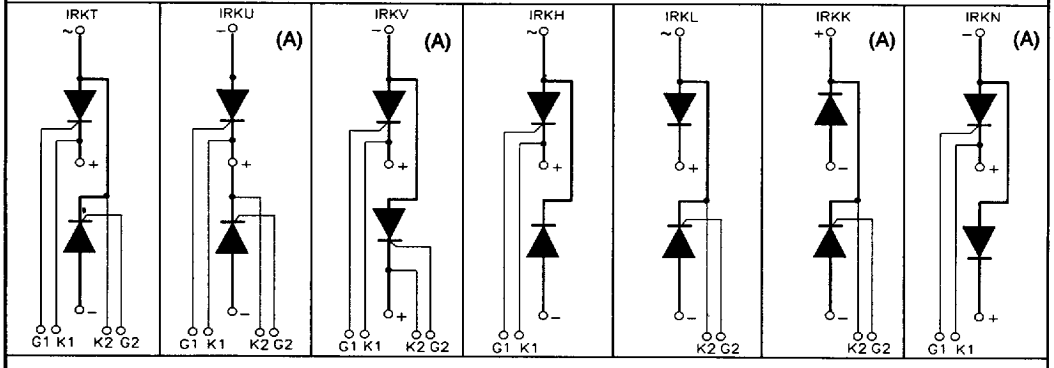
(*) For terminals connections, see Circuit Configurations Table

Busbars Dimensions



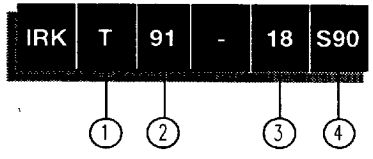
Ordering Information Table

Circuit configurations Table



(A) Available on request only. Contact factory

Device Code



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. : IRKT92-18 etc.

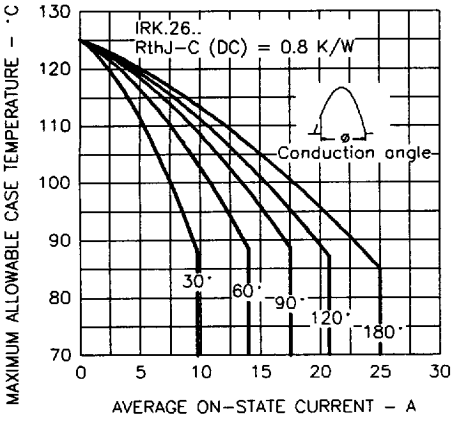


Fig. 1 - Current Ratings Characteristics

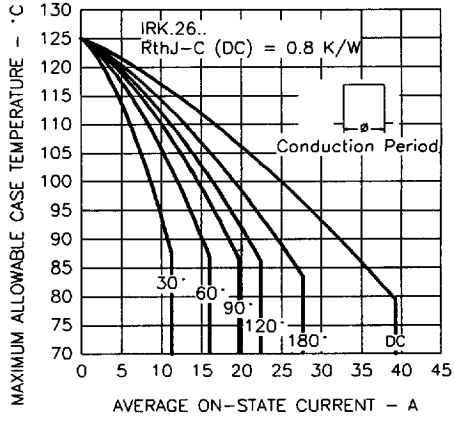


Fig. 2 - Current Ratings Characteristics

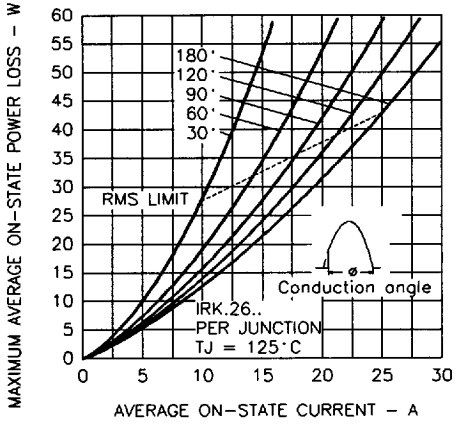


Fig. 3 - On-state Power Loss Characteristics

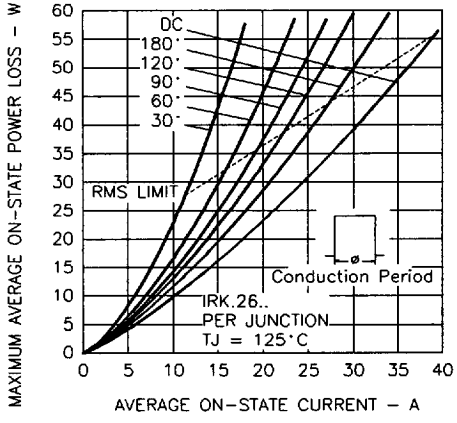


Fig. 4 - On-state Power Loss Characteristics

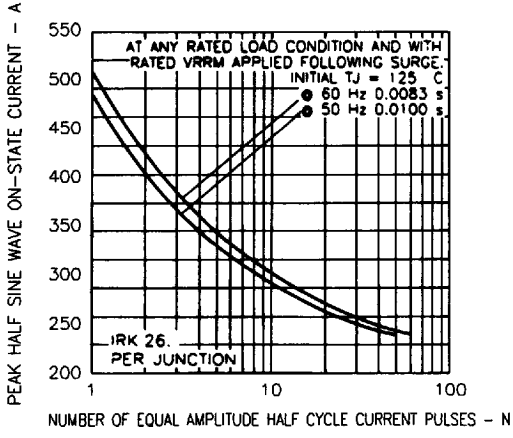


Fig. 5 - Maximum Non-Repetitive Surge Current

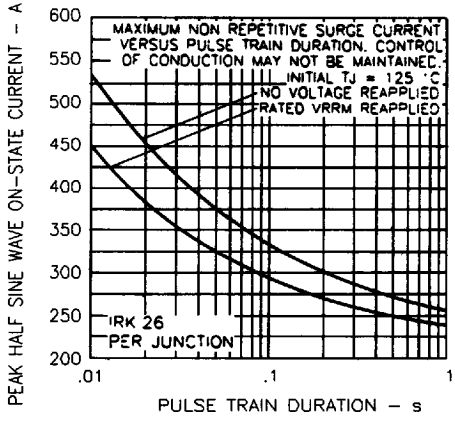


Fig. 6 - Maximum Non-Repetitive Surge Current

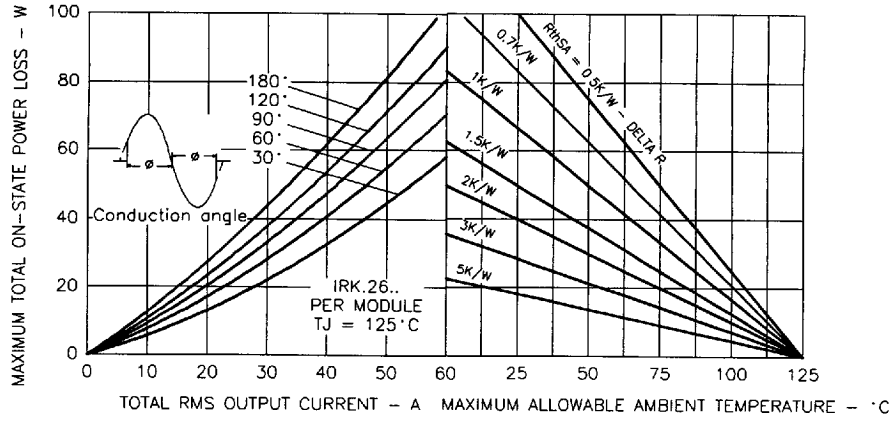


Fig. 7 - On-state Power Loss Characteristics

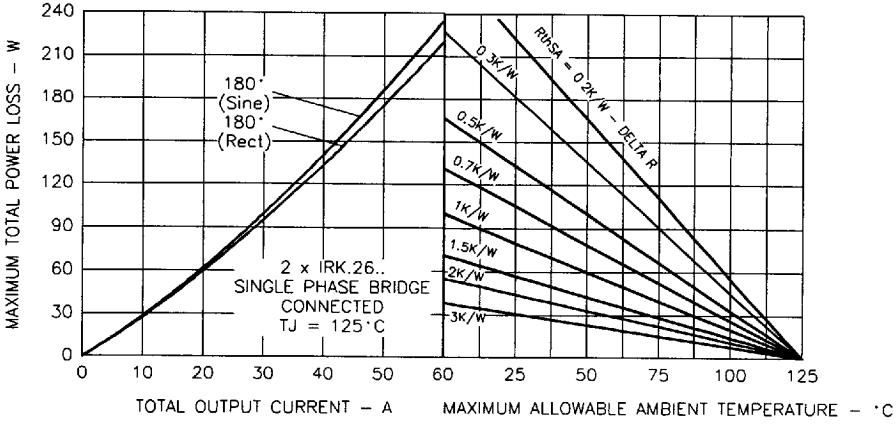


Fig. 8 - On-state Power Loss Characteristics

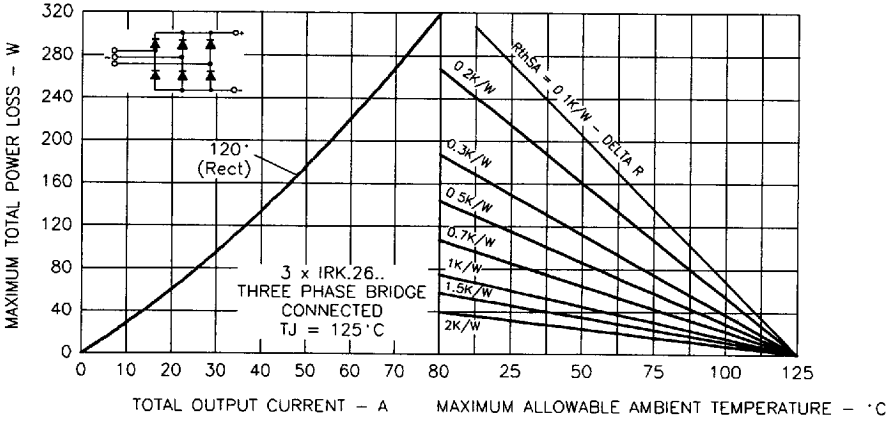


Fig. 9 - On-state Power Loss Characteristics

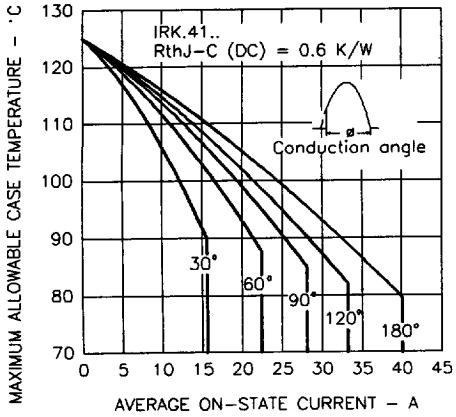


Fig. 10 - Current Ratings Characteristics

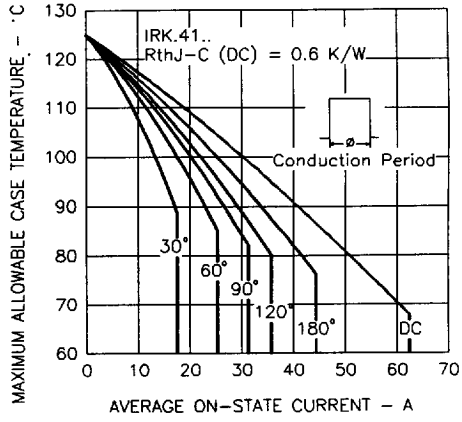


Fig. 11 - Current Ratings Characteristics

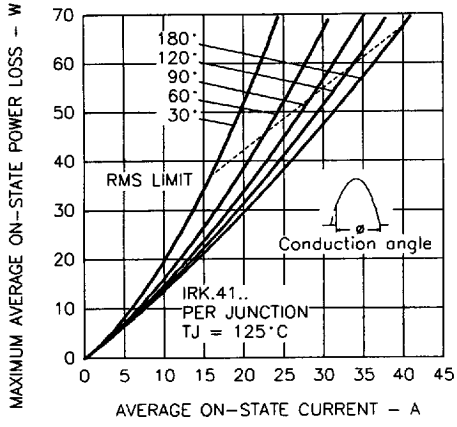


Fig. 12 - On-state Power Loss Characteristics

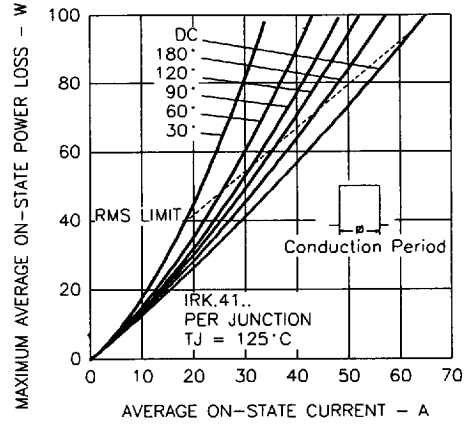


Fig. 13 - On-state Power Loss Characteristics

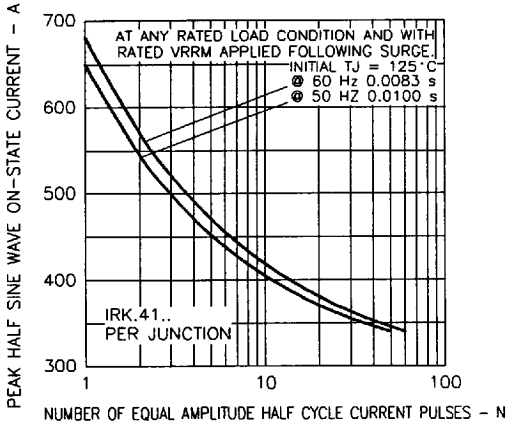


Fig. 14 - Maximum Non-Repetitive Surge Current

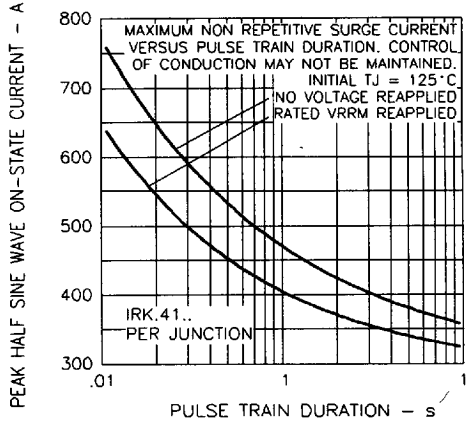


Fig. 15 - Maximum Non-Repetitive Surge Current

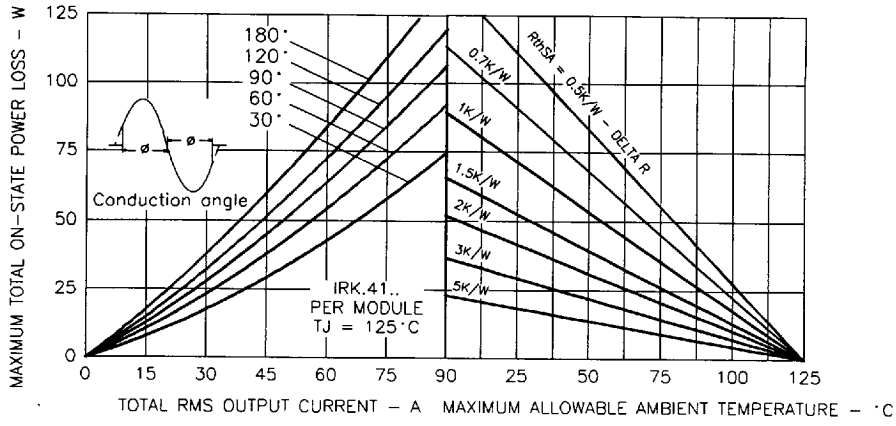


Fig. 16 - On-state Power Loss Characteristics

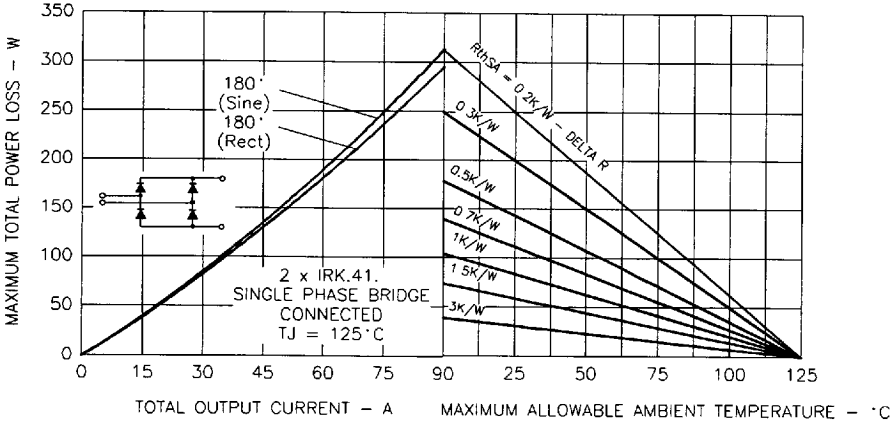


Fig. 17 - On-state Power Loss Characteristics

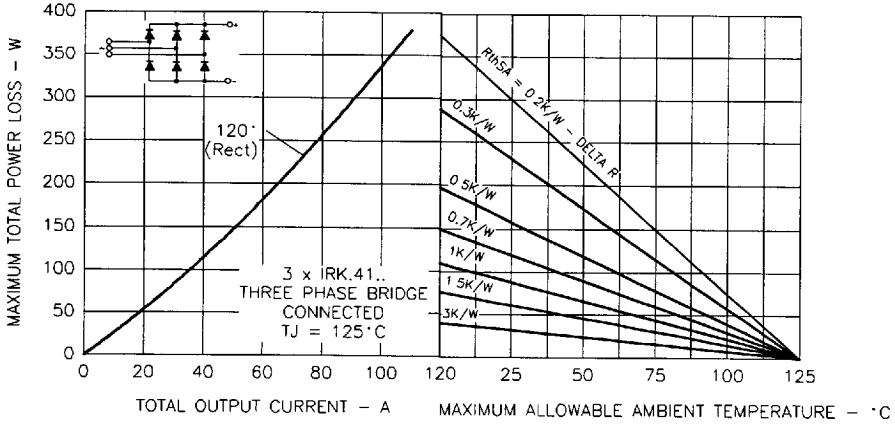


Fig. 18 - On-state Power Loss Characteristics

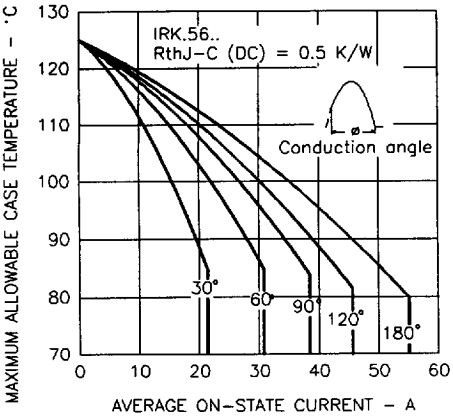


Fig. 19 - Current Ratings Characteristics

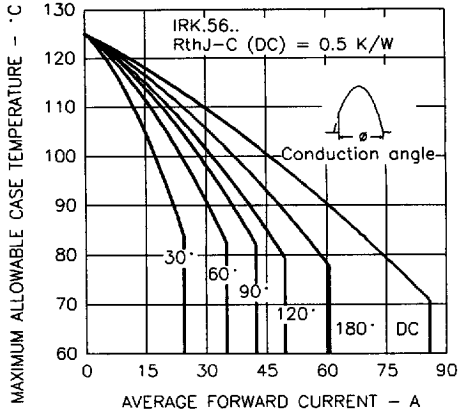


Fig. 20 - Current Ratings Characteristics

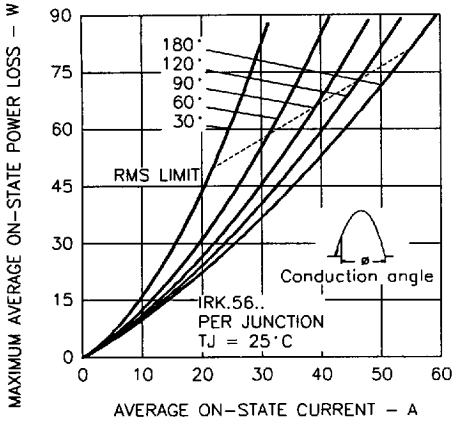


Fig. 21 - On-state Power Loss Characteristics

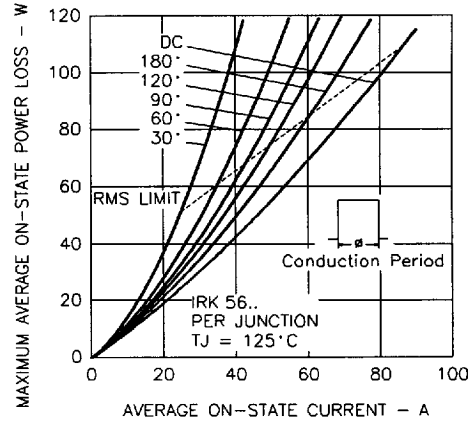


Fig. 22 - On-state Power Loss Characteristics

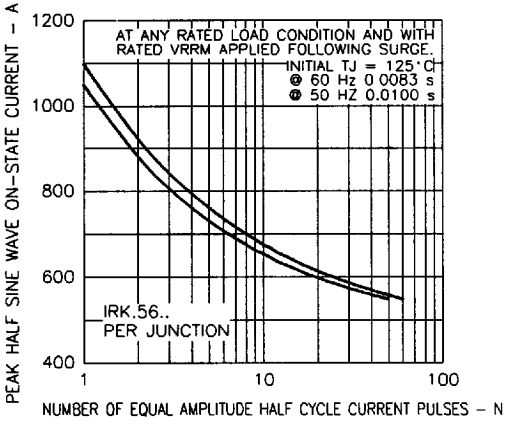


Fig. 23 - Maximum Non-Repetitive Surge Current

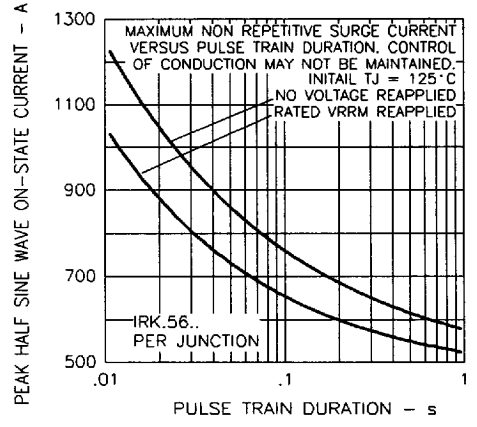


Fig. 24 - Maximum Non-Repetitive Surge Current

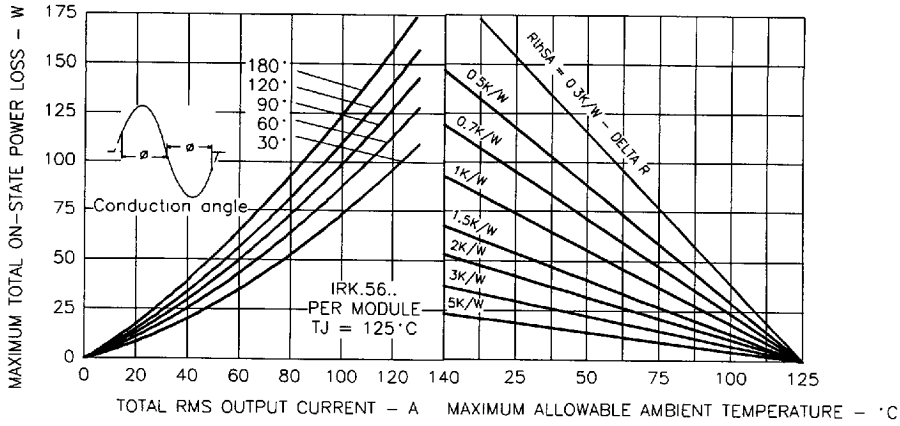


Fig. 25 - On-state Power Loss Characteristics

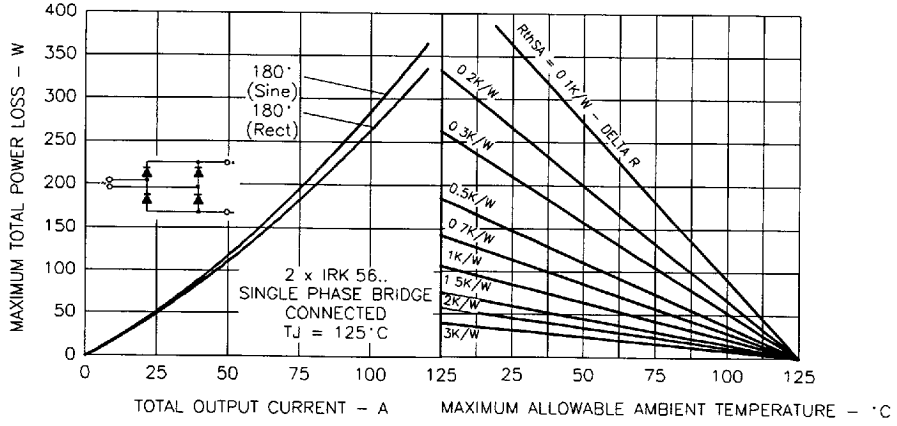


Fig. 26 - On-state Power Loss Characteristics

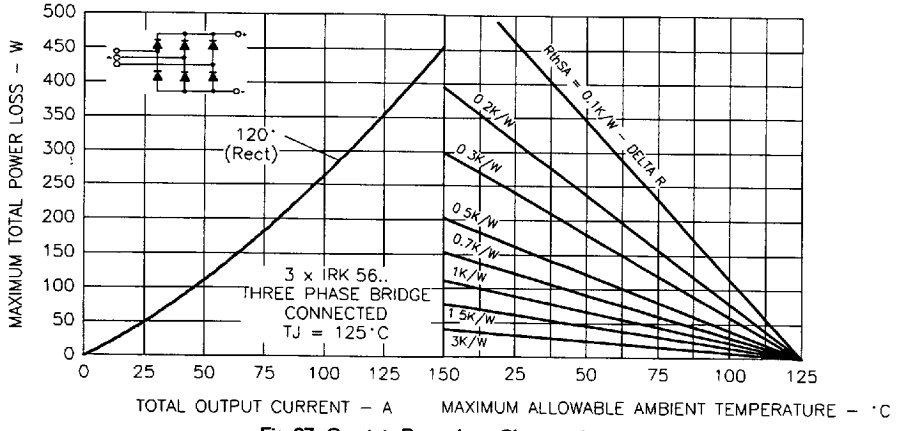


Fig. 27 - On-state Power Loss Characteristics

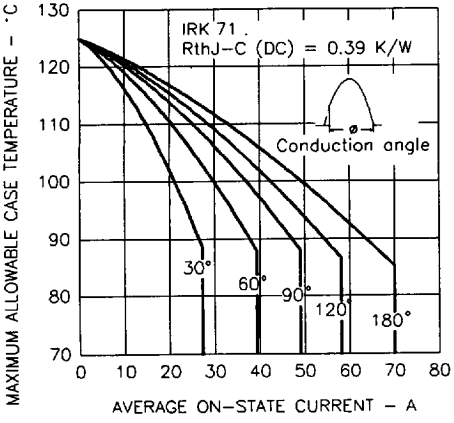


Fig. 28 - Current Ratings Characteristics

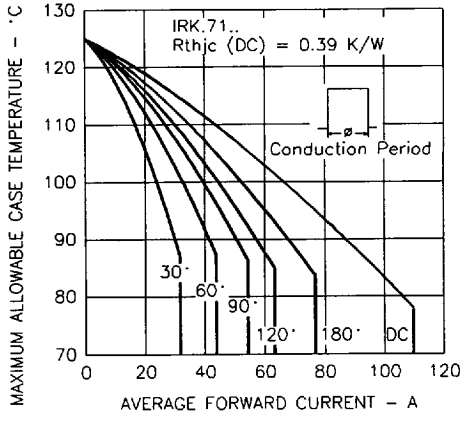


Fig. 29 - Current Ratings Characteristics

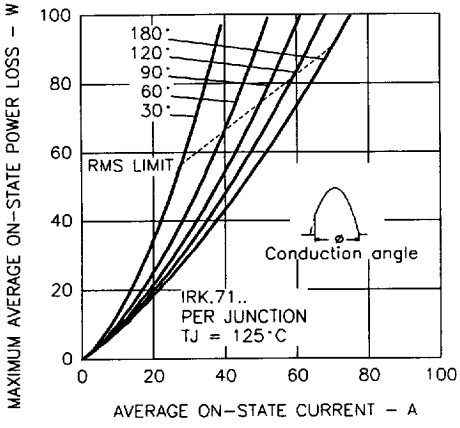


Fig. 30 - On-state Power Loss Characteristics

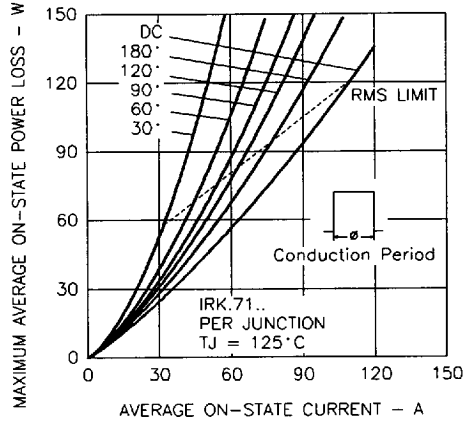


Fig. 31 - On-state Power Loss Characteristics

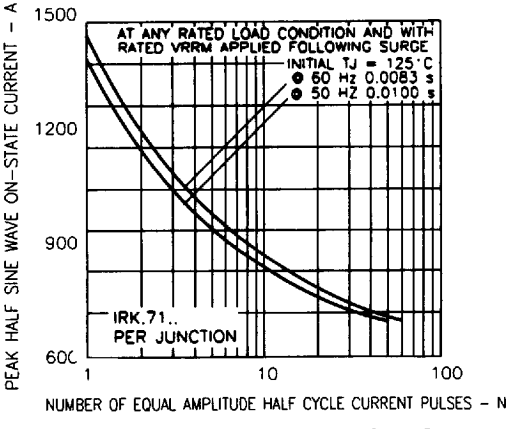


Fig. 32 - Maximum Non-Repetitive Surge Current

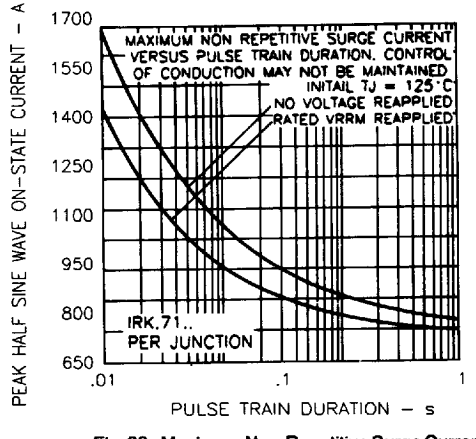


Fig. 33 - Maximum Non-Repetitive Surge Current

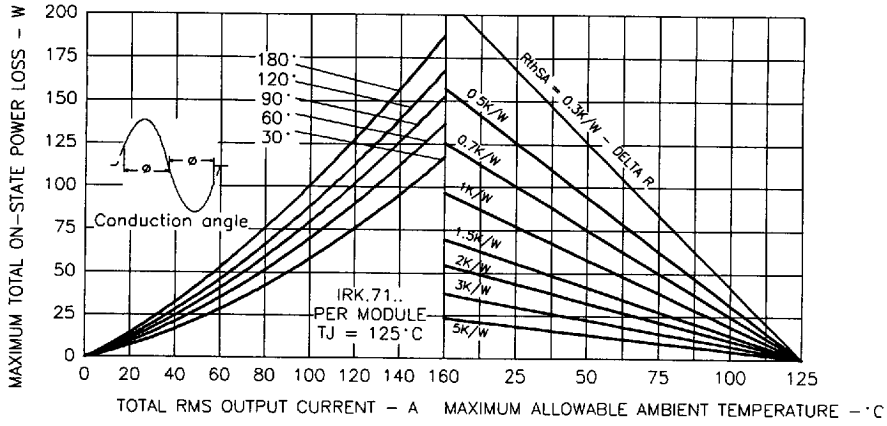


Fig. 34 - On-state Power Loss Characteristics

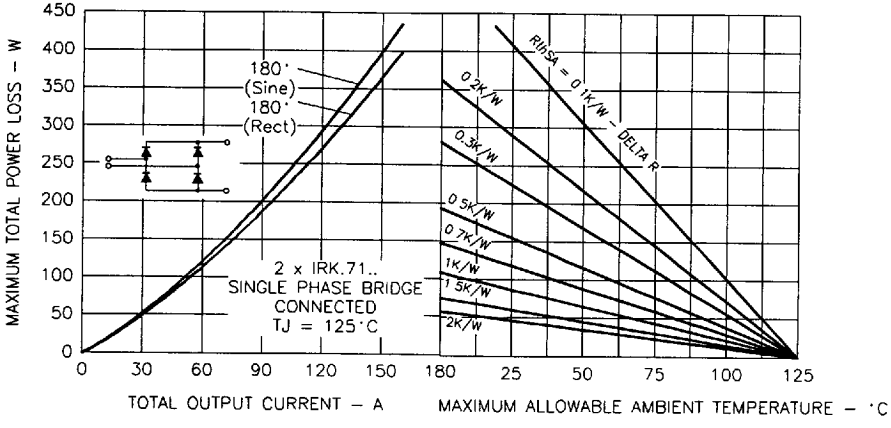


Fig. 35 - On-state Power Loss Characteristics

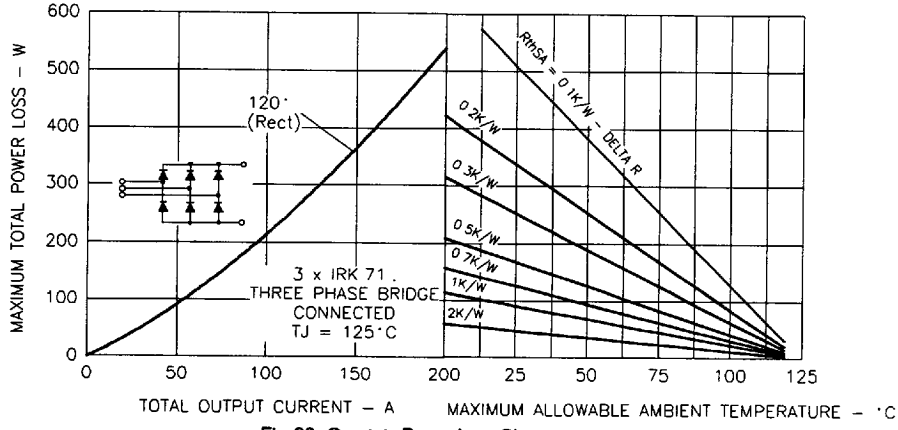


Fig. 36 - On-state Power Loss Characteristics

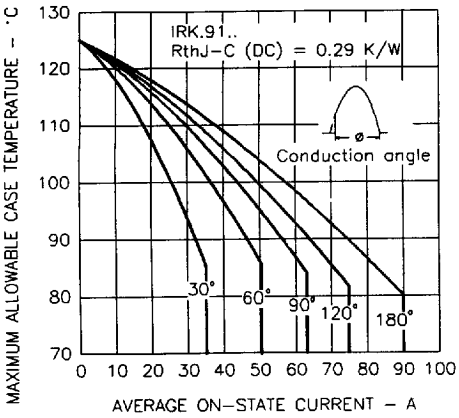


Fig. 37 - Current Ratings Characteristics

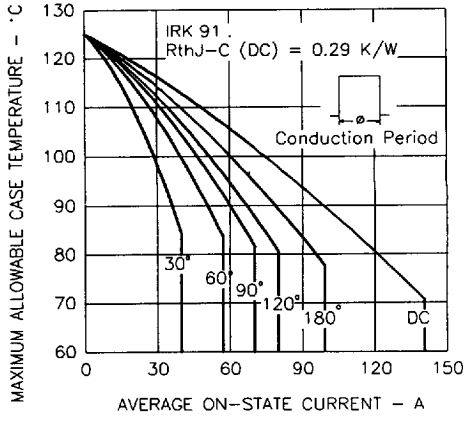


Fig. 38 - Current Ratings Characteristics

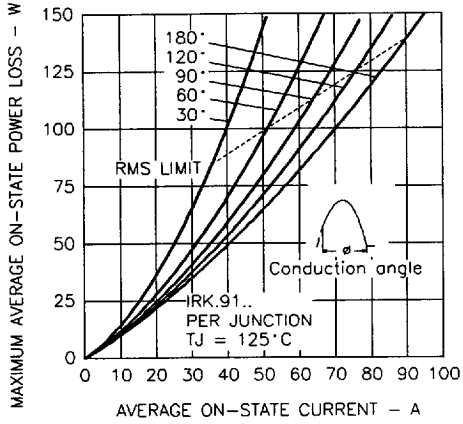


Fig. 39 - On-state Power Loss Characteristics

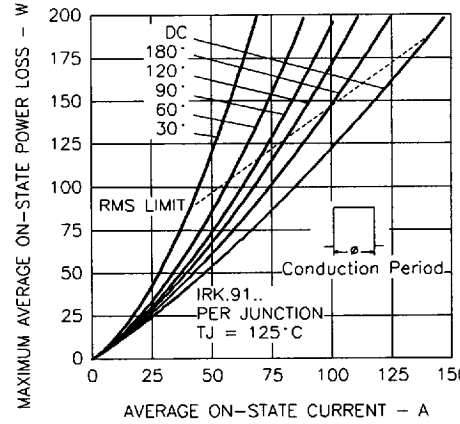


Fig. 40 - On-state Power Loss Characteristics

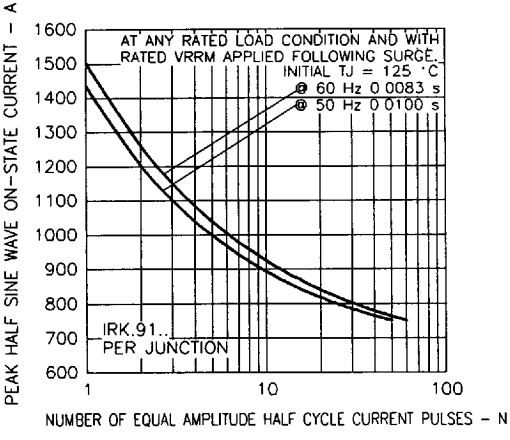


Fig. 41 - Maximum Non-Repetitive Surge Current

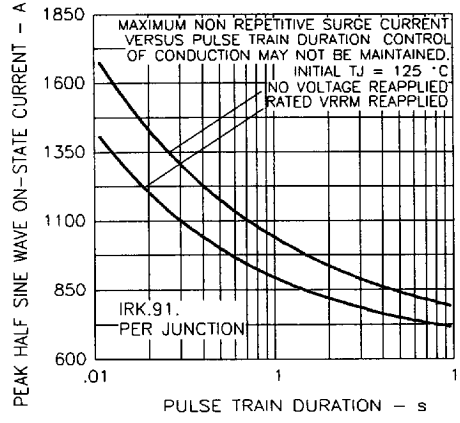


Fig. 42 - Maximum Non-Repetitive Surge Current

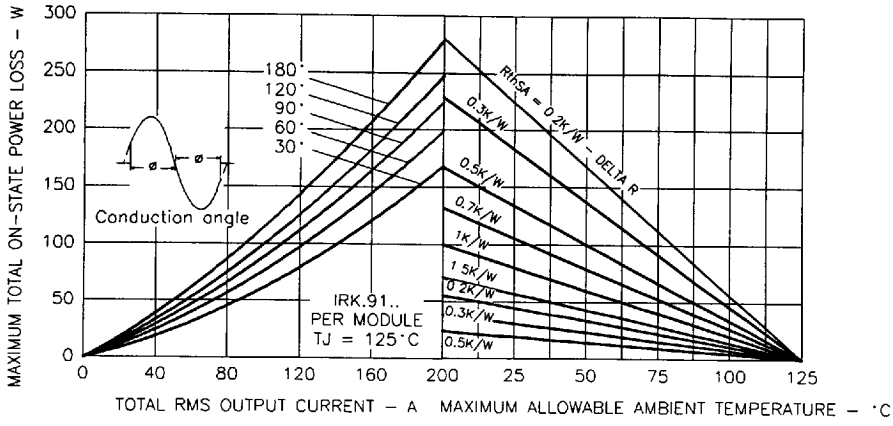


Fig. 43 - On-state Power Loss Characteristics

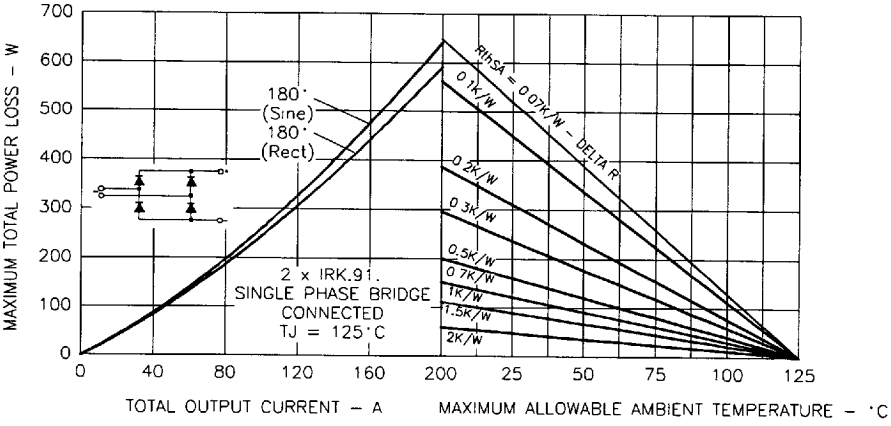


Fig. 44 - On-state Power Loss Characteristics

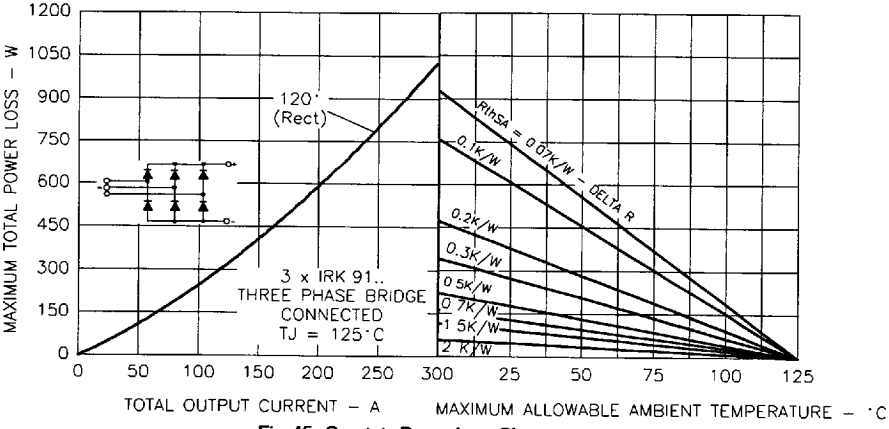


Fig. 45 - On-state Power Loss Characteristics

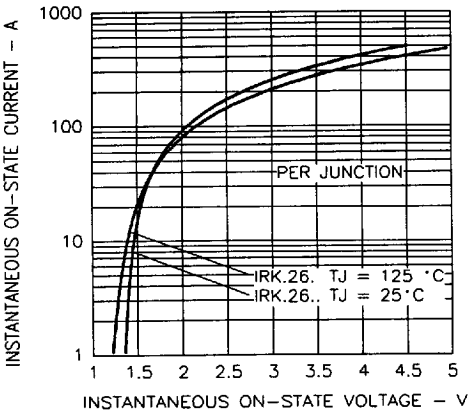


Fig. 46 - On-state Voltage Drop Characteristics

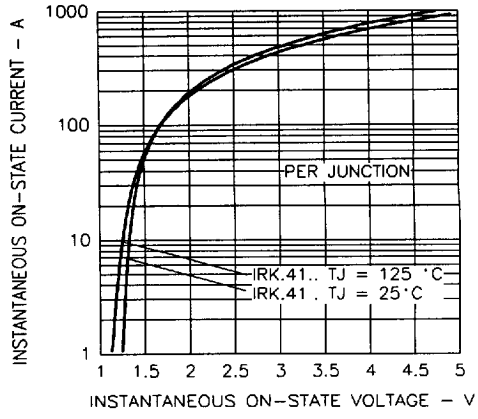


Fig. 47 - On-state Voltage Drop Characteristics

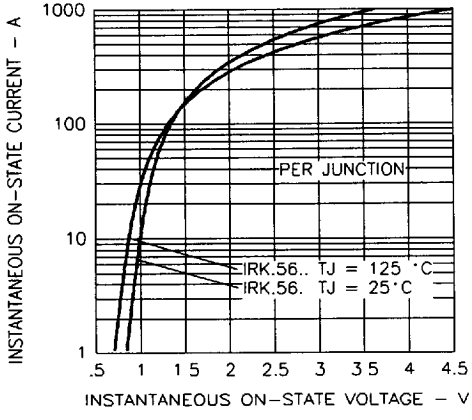


Fig. 48 - On-state Voltage Drop Characteristics

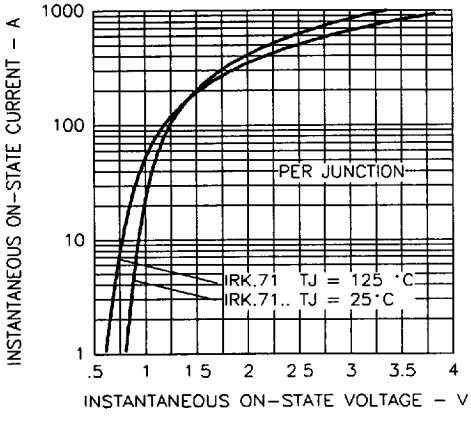


Fig. 49 - On-state Voltage Drop Characteristics

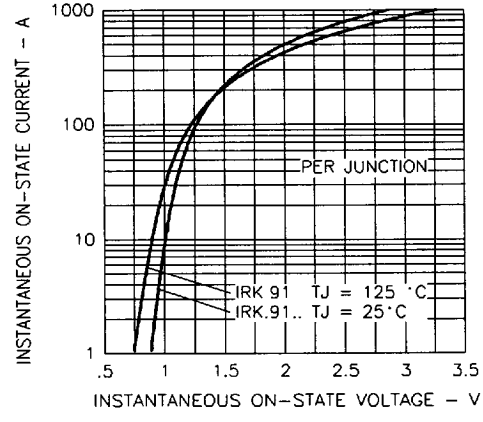


Fig. 50 - On-state Voltage Drop Characteristics

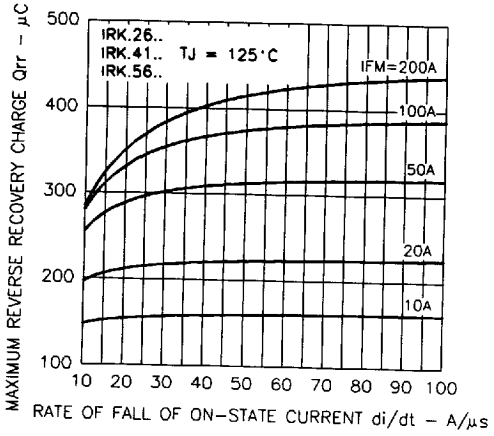


Fig. 51 - Recovery Charge Characteristics

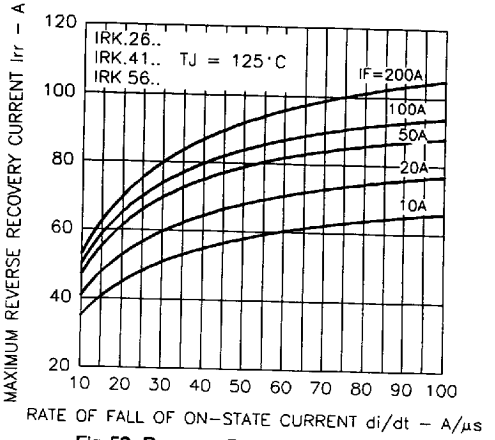


Fig. 52 - Recovery Current Characteristics

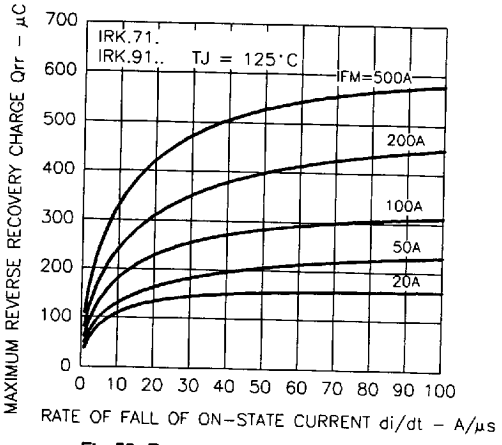


Fig. 53 - Recovery Charge Characteristics

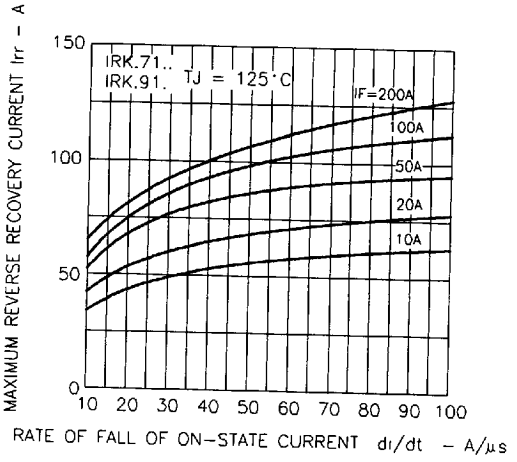


Fig. 54 - Recovery Current Characteristics

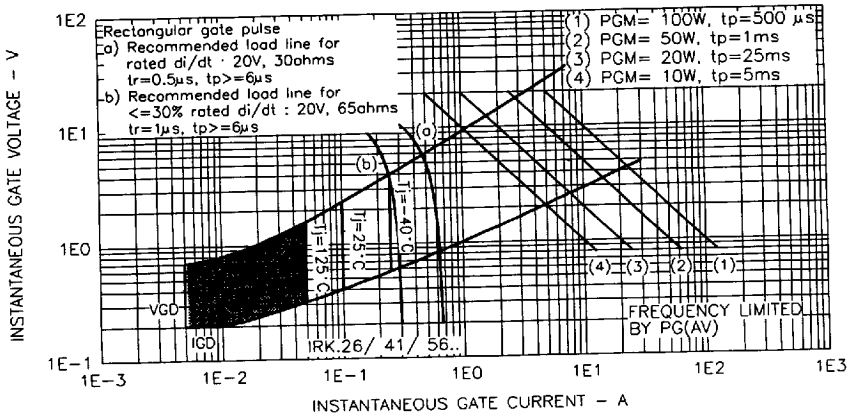


Fig. 55 - Gate Characteristics

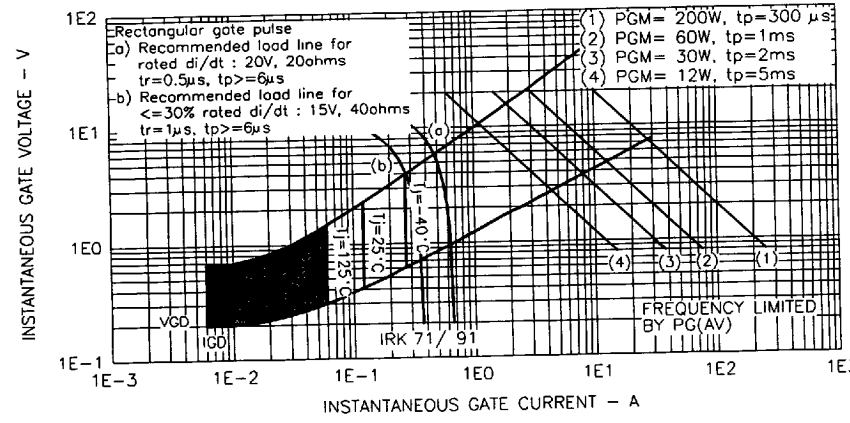


Fig. 56 - Gate Characteristics

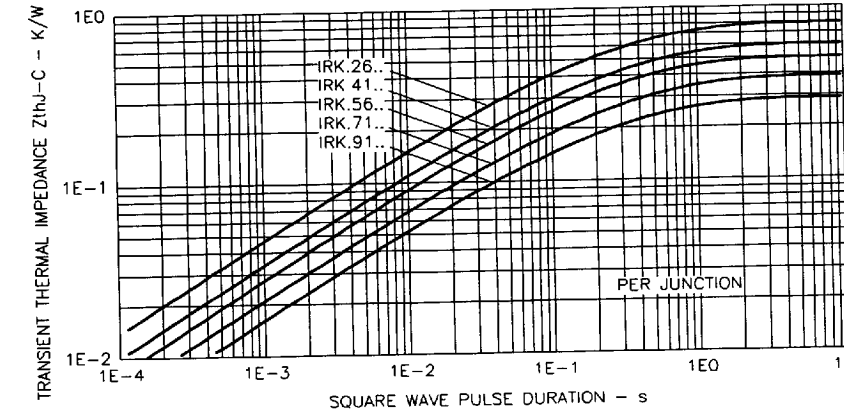


Fig. 57 - Thermal Impedance ZthJC Characteristics